

| SHEET | ADDRESS             | LOT              | PERMANENT LAND ACQUISITION (ha) |
|-------|---------------------|------------------|---------------------------------|
| 2     | 139 CARRINGTON ROAD | SECT 1 SO 573867 | 0.0065                          |
| 3     | 119 CARRINGTON ROAD | LOT 9            | 0.1482                          |
| 4     | 99 CARRINGTON ROAD  | LOT 6            | 0.2188                          |
| 5     | 1 CARRINGTON ROAD   | LOT 6            | 0.0953                          |
| 6     | 1 CARRINGTON ROAD   | LOT 6            | 0.0360                          |
| 7     | 1 CARRINGTON ROAD   | LOT 1            | 0.0947                          |
| TOTAL | -                   | -                | 0.5995 ha                       |

NOTES:  
1. AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.  
2. LOT NUMBER REFERS TO LT 580984.

LEGEND:  

PERMANENT LAND ACQUISITION

EXISTING EASEMENTS

CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984

EXISTING PROPERTY BOUNDARIES

28.2m UNITARY SETBACK LINE



AREA 1

| KEY         | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS    | LOT DESCRIPTION(S) | EXISTING LAND AREA<br>(ALL PARCELS)<br>(ha) | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) | REMAINING LAND AREA<br>(ALL PARCELS)<br>(ha) |
|-------------|----------------------------|---------------------|--------------------|---|--|--|
| <div></div> | PERMANENT LAND ACQUISITION | 139 CARRINGTON ROAD | SECT 1 SO 573867   | 13.4385                                     | 0.0065                                 | 13.4320                                      |

- NOTES:
1.

AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
2.

LOT NUMBER REFERS TO LT 580984.

LEGEND:

PERMANENT LAND ACQUISITION

CARRINGTON SUBDIVISION STAGE 1  
BOUNDARIES LT 580984

EXISTING PROPERTY BOUNDARIES

28.2m UNITARY SETBACK LINE



AREA 1

DETAIL

NOT TO SCALE


1

SHEET 1





DRAFT

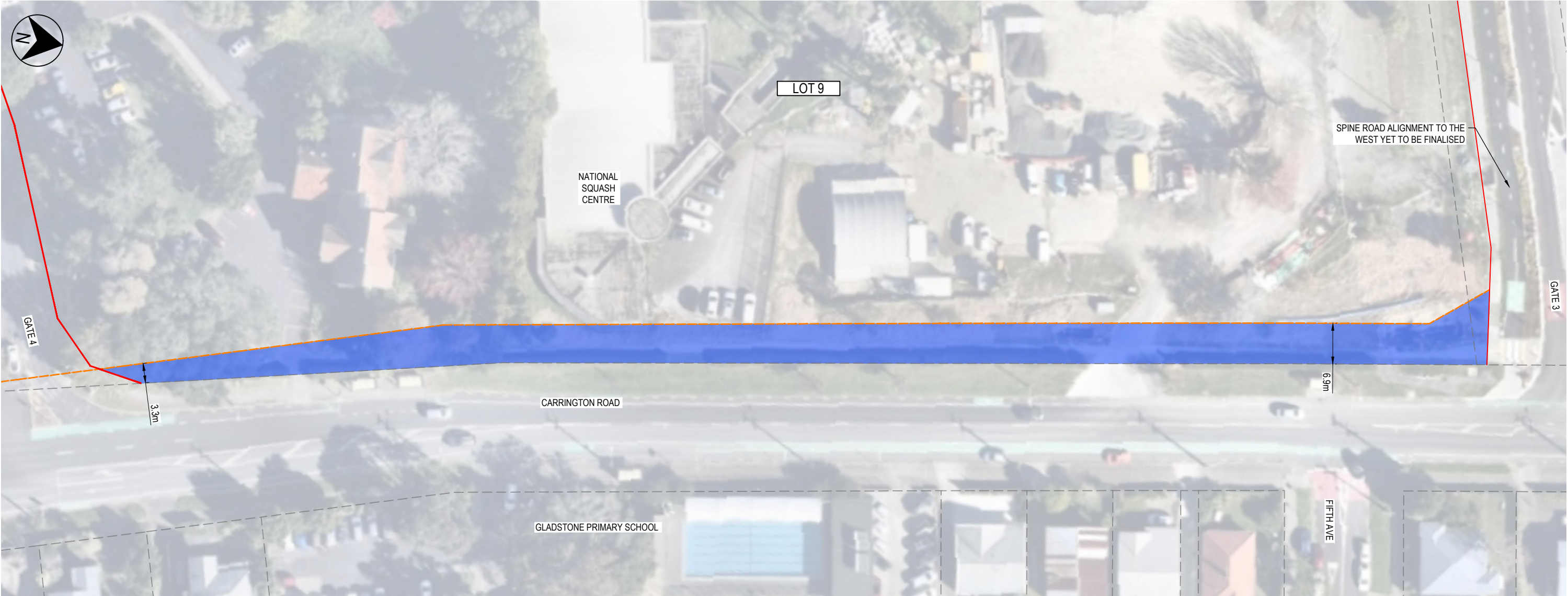
NOT FOR CONSTRUCTION

AREA 2

| KEY   | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS    | LOT DESCRIPTION(S)    | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) |
|---|----------------------------|---------------------|-----------------------|--|
|  | PERMANENT LAND ACQUISITION | 119 CARRINGTON ROAD | LOT 9<br>(SEE NOTE 2) | 0.1482                                 |

- NOTES:**
- AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
  - LOT NUMBER REFERS TO LT 580984.

- LEGEND:**
-  PERMANENT LAND ACQUISITION
  -  CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984
  -  EXISTING PROPERTY BOUNDARIES
  -  28.2m UNITARY SETBACK LINE



AREA 2

DETAIL

NOT TO SCALE

2

SHEET 1


**DRAFT**

NOT FOR CONSTRUCTION

AUCKLAND TRANSPORT

CARRINGTON ROAD IMPROVEMENTS

DATE: 18/03/2025

 LAND REQUIREMENT PLAN


NORTH OF WOODWARD ROAD

119 CARRINGTON ROAD




SHEET 3 - REVISION F



AREA 3

| KEY   | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS   | LOT DESCRIPTION(S)    | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) |
|---|----------------------------|--------------------|-----------------------|--|
|  | PERMANENT LAND ACQUISITION | 99 CARRINGTON ROAD | LOT 6<br>(SEE NOTE 2) | 0.2188                                 |

- NOTES:**
- AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
  - LOT NUMBER REFERS TO LT 580984.

- LEGEND:**
-  PERMANENT LAND ACQUISITION
  -  CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984
  -  EXISTING PROPERTY BOUNDARIES
  -  28.2m UNITARY SETBACK LINE




AREA 3  
DETAIL  
NOT TO SCALE

3  
SHEET 1


**DRAFT**  
NOT FOR CONSTRUCTION

AUCKLAND TRANSPORT  
CARRINGTON ROAD IMPROVEMENTS  
DATE: 18/03/2025

 LAND REQUIREMENT PLAN  
NORTH OF WOODWARD ROAD  
99 CARRINGTON ROAD  
SHEET 4 - REVISION F



AREA 4

| KEY   | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS  | LOT DESCRIPTION(S)    | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) |
|---|----------------------------|-------------------|-----------------------|--|
|  | PERMANENT LAND ACQUISITION | 1 CARRINGTON ROAD | LOT 6<br>(SEE NOTE 2) | 0.0953                                 |

- NOTES:
- AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
  - LOT NUMBER REFERS TO LT 580984.

- LEGEND:
-  PERMANENT LAND ACQUISITION
  -  CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984
  -  EXISTING PROPERTY BOUNDARIES
  -  28.2m UNITARY SETBACK LINE




AREA 4  
DETAIL  
NOT TO SCALE

4  
SHEET 1


DRAFT  
NOT FOR CONSTRUCTION

AUCKLAND TRANSPORT  
CARRINGTON ROAD IMPROVEMENTS  
DATE: 18/03/2025




 LAND REQUIREMENT PLAN  
NORTH OF WOODWARD ROAD  
1 CARRINGTON ROAD  
SHEET 5 - REVISION F



AREA 5

| KEY   | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS  | LOT DESCRIPTION(S)    | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) |
|---|----------------------------|-------------------|-----------------------|--|
|  | PERMANENT LAND ACQUISITION | 1 CARRINGTON ROAD | LOT 6<br>(SEE NOTE 2) | 0.0360                                 |

- NOTES:
- AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
  - LOT NUMBER REFERS TO LT 580984.

- LEGEND:
-  PERMANENT LAND ACQUISITION
  -  CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984
  -  EXISTING PROPERTY BOUNDARIES
  -  28.2m UNITARY SETBACK LINE



AREA 5  
DETAIL  
NOT TO SCALE

5  
SHEET 1

AUCKLAND TRANSPORT  
CARRINGTON ROAD IMPROVEMENTS  
DATE: 18/03/2025



**DRAFT**  
NOT FOR CONSTRUCTION

LAND REQUIREMENT PLAN  
NORTH OF WOODWARD ROAD  
1 CARRINGTON ROAD  
SHEET 6 - REVISION F



AREA 6

| KEY         | TYPE OF LAND REQUIREMENT   | PROPERTY ADDRESS  | LOT DESCRIPTION(S)    | EXISTING LAND AREA<br>(ALL PARCELS)<br>(ha) | AREA AFFECTED<br>(ALL PARCELS)<br>(ha) | REMAINING LAND AREA<br>(ALL PARCELS)<br>(ha) |
|-------------|----------------------------|-------------------|-----------------------|---|--|--|
| <div></div> | PERMANENT LAND ACQUISITION | 1 CARRINGTON ROAD | LOT 1<br>(SEE NOTE 2) | 0.7551                                      | 0.0947                                 | 0.6604                                       |

- NOTES:**
- AREAS REFERRED TO ARE INDICATIVE AND REMAIN SUBJECT TO SURVEY.
  - LOT NUMBER REFERS TO LT 580984.

- LEGEND:**
- PERMANENT LAND ACQUISITION
  - CARRINGTON SUBDIVISION STAGE 1 BOUNDARIES LT 580984
  - EXISTING PROPERTY BOUNDARIES
  - 28.2m UNITARY SETBACK LINE



AREA 6  
DETAIL  
NOT TO SCALE

6  
SHEET 1

**DRAFT**  
NOT FOR CONSTRUCTION

AUCKLAND TRANSPORT  
CARRINGTON ROAD IMPROVEMENTS  
DATE: 18/03/2025

LAND REQUIREMENT PLAN  
NORTH OF WOODWARD ROAD  
1 CARRINGTON ROAD  
SHEET 7 - REVISION F



EXISTING RETAINED AND REMOVED TREES

For additional data refer to Arborconnect Arboricultural Assessment

EXISTING TREES

REMOVED = 70

- Includes Carrington Rd (35), Road Widening Area (12), Segar Ave (14) & the Carrington Development gates (9)
- 49 Street Tree removals subject to AC Tree Owner Approval (839.5 m2 canopy loss in existing road reserve)
- 32 Trees require resource consent for removal

RETAINED = 30 (1,206m2 OF CANOPY)

Within future corridor extent and Segar Ave - does not include other side roads.  
Works within root zones of two retained trees require resource consent.

PROPOSED TREES

PROPOSED = 180 (AT PRELIMINARY DESIGN)

Includes Segar Ave and all gates. AC Urban Ngahere team recommended 1x 45L tree to replace 10m2 of removed street tree canopy cover. Proposed trees 96 more than the required minimum street tree replacement number of 84.

PROPOSED COMBINED CANOPY COVERAGE = 2,946 m2

Retained tree canopy area (1,206m2) combined with an estimated canopy area for proposed trees at 10 years maturity & approx. 8m height (1,740m2). Net gain of 450m2 canopy area.  
Estimated average project canopy coverage in berm areas 13.75% (21,432 m2), and 5.6% including carriageway areas (52,632m2)

LEGEND

RETAINED

REMOVED

TRANSPLANTED

DEAD (EXCLUDED)

| Tree / Group Number | Botanical name                              | Species           | Height | Canopy Spread | Condition | Location                                    |
|---------------------|---|-------------------|--------|---------------|-----------|---|
| 1                   | <i>Alectryon excelsus</i>                   | Titoki            | 5      | 7             | Good      | O/S 28 Carrington Rd on Sutherland Rd       |
| 15                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6      | 5.2           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 16                  | <i>Vitex lucens</i>                         | Pūriri            | 3.5    | 2.2           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 17                  | <i>Vitex lucens</i>                         | Pūriri            | 3.3    | 2.6           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 18                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6.8    | 6.8           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 19                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6      | 6.8           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 20                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6.4    | 6.6           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 21                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 9.8    | 7             | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 22                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 10.8   | 9.2           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 23                  | <i>Tristaniopsis laurina</i>                | Water gum         | 5.3    | 5             | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 24                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 9.2    | 7.2           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 25                  | <i>Tristaniopsis laurina</i>                | Water gum         | 4.2    | 6.4           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 26                  | <i>Vitex lucens</i>                         | Pūriri            | 3      | 1.6           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 27                  | <i>Vitex lucens</i>                         | Pūriri            | 3.2    | 1.7           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 28                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 9.4    | 7.2           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 29                  | <i>Beilschmiedia tarairi</i>                | Taiaire           | 3.2    | 0.8           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 30                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 12     | 8.8           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 31                  | <i>Vitex lucens</i>                         | Pūriri            | 9.2    | 6.2           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 32                  | <i>Vitex lucens</i>                         | Pūriri            | 8.6    | 7.8           | Fair      | O/S 56 Carrington Rd on Segar Ave           |
| 33                  | <i>Vitex lucens</i>                         | Pūriri            | 2.9    | 1.8           | Poor      | O/S 56 Carrington Rd on Segar Ave           |
| 34                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 10.6   | 7.4           | Good      | O/S 56 Carrington Rd on Segar Ave           |
| 35                  | <i>Rhopalostylis sapida</i>                 | Nikau             | 4.6    | 2.8           | Good      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 36                  | <i>Pittosporum crassifolium</i>             | Karo              | 4.6    | 5.2           | Fair      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 37                  | <i>Vitex lucens</i>                         | Pūriri            | 4.6    | 3.4           | Fair      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 38                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 8.2    | 7.6           | Good      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 39                  | <i>Corynocarpus laevigatus</i>              | Karaka            | 1.5    | 1.4           | Poor      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 40                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 9.2    | 6             | Poor      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 41                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 9      | 7.8           | Poor      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 42                  | <i>Tristaniopsis laurina</i>                | Water gum         | 64     | 6.2           | Fair      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 43                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6.8    | 8.8           | Good      | O/S 5 - 27 Sutherland Rd on Segar Ave       |
| 44                  | <i>Vitex lucens</i>                         | Pūriri            | 3.2    | 1.2           | Dead      | O/S 18 Rawalpindi St on Segar Ave           |
| 46                  | <i>Tristaniopsis laurina</i>                | Water gum         | 8      | 12            | Fair      | O/S 78 Carrington Rd on Segar Ave           |
| 50                  | <i>Prunus campanulata</i>                   | Taiwan cherry     | 4.2    | 1.8           | Fair      | O/S 86 Carrington Rd                        |
| 51                  | <i>Vitex lucens</i>                         | Pūriri            | 3.4    | 2.8           | Good      | O/S 86 Carrington Rd on Tasman Ave          |
| 53                  | <i>Melia azedarach</i>                      | Melia             | 6.2    | 16            | Fair      | O/S 98 Carrington Rd on Fontenoy St         |
| 54                  | <i>Melia azedarach</i>                      | Melia             | 6      | 11            | Good      | O/S 100 Carrington Rd on Fontenoy St        |
| 57                  | <i>Tristaniopsis laurina</i>                | Water gum         | 6.8    | 8             | Fair      | O/S 112 Carrington Rd on Fifth Ave          |
| 58                  | <i>Prunus spp.</i>                          | Flowering cherry  | 5.4    | 5.2           | Fair      | O/S 4-8 Seadview Rd on Carrington Rd (Glad) |
| 61                  | <i>Prunus yedoensis 'Awanui'</i>            | Awanui cherry     | 4      | 6.8           | Poor      | O/S 172 Carrington Rd                       |
| 64                  | <i>Alectryon excelsus</i>                   | Titoki            | 4.3    | 6.2           | Good      | O/S 210 Carrington Rd on Counsel Toe        |
| 66                  | <i>Alectryon excelsus</i>                   | Titoki            | 2.3    | 0.8           | Poor      | O/S 214 Carrington Rd                       |
| 73                  | <i>Alectryon excelsus</i>                   | Titoki            | 4.6    | 7.2           | Fair      | O/S 131 Carrington Rd on Woodward Rd        |
| 75                  | <i>Washingtonia robusta</i>                 | Washingtonia      | 7.5    | 3.8           | Good      | O/S 131 Carrington Rd                       |
| 77                  | <i>Metrosideros excelsa</i>                 | Pōhutukawa        | 11.2   | 16.4          | Good      | O/S 131 Carrington Rd                       |
| 78                  | <i>Prunus spp.</i>                          | Flowering cherry  | 3.2    | 3.8           | Fair      | O/S 131 Carrington Rd                       |
| 79                  | <i>Prunus spp.</i>                          | Flowering cherry  | 3.5    | 3             | Poor      | O/S 131 Carrington Rd                       |
| 80                  | <i>Prunus spp.</i>                          | Flowering cherry  | 3      | 2             | Poor      | O/S 131 Carrington Rd                       |
| 81                  | <i>Prunus spp.</i>                          | Flowering cherry  | 4.2    | 7.4           | Fair      | O/S 131 Carrington Rd                       |
| 82                  | <i>Prunus spp.</i>                          | Flowering cherry  | 7.4    | 11.2          | Fair      | O/S 139 Carrington Rd                       |
| 83                  | <i>Syzygium smithii</i>                     | Acmena            | 8.2    | 12.8          | Fair      | O/S 139 Carrington Rd                       |
| 84                  | <i>Syzygium smithii</i>                     | Acmena            | 9.8    | 13.8          | Poor      | O/S 139 Carrington Rd                       |
| 85                  | <i>Pittosporum tenuifolium 'Variegatum'</i> | Variegated Kohuhu | 6.5    | 7.6           | Poor      | O/S 139 Carrington Rd                       |

| Tree / Group Number | Botanical name                               | Species             | Height | Canopy Spread | Condition    | Location                              |
|---------------------|--|---------------------|--------|---------------|--------------|---------------------------------------|
| 86                  | <i>Griselinia littoralis</i>                 | Kāpuka (Griselinia) | 4.8    | 11.6          | Fair         | O/S 139 Carrington Rd                 |
| 87                  | <i>Pittosporum tenuifolium 'Variegatum'</i>  | Variegated Kohuhu   | 6.5    | 7.6           | Fair         | O/S 139 Carrington Rd                 |
| 90                  | <i>Pittosporum eugenioides</i>               | Tarata              | 7      | 6.9           | Fair         | 131 Carrington Rd                     |
| 92                  | <i>Cordyline australis</i>                   | Cabbage tree        | 7.8    | 3             | Good         | O/S 131 Carrington Rd                 |
| 94                  | <i>Gordonia axillaris</i>                    | Gordonia            | 4.8    | 5             | Good         | 131 Carrington Rd                     |
| 95                  | <i>Liquidambar spp.</i>                      | Liquidambar         | 15.2   | 13            | Fair         | 131 Carrington Rd                     |
| 97                  | <i>Agathis robusta</i>                       | Queensland kauri    | 12.2   | 5             | Fair         | 131 Carrington Rd                     |
| 98                  | <i>Agathis robusta</i>                       | Queensland kauri    | 12     | 4.2           | Fair         | 131 Carrington Rd                     |
| 99                  | <i>Metrosideros excelsa</i>                  | Pōhutukawa          | 7.2    | 6.7           | Fair         | 131 Carrington Rd                     |
| 100                 | <i>Metrosideros excelsa</i>                  | Pōhutukawa          | 7      | 7.6           | Fair         | 131 Carrington Rd                     |
| 101                 | <i>Quercus ilex</i>                          | Holm oak            | 3      | 1.9           | Poor         | O/S 131 Carrington Rd                 |
| 102                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.6    | 7.4           | Fair         | O/S 131 Carrington Rd                 |
| 103                 | <i>Prunus spp.</i>                           | Flowering cherry    | 5.1    | 6             | Poor         | O/S 131 Carrington Rd                 |
| 104                 | <i>Prunus spp.</i>                           | Flowering cherry    | 5.2    | 5.8           | Fair         | O/S 131 Carrington Rd                 |
| 131                 |  | Cedar               | 12     | 16            | Dead         | 131 Carrington Rd                     |
| 132                 | <i>Corynocarpus laevigatus</i>               | Karaka              | 7      | 6             | Poor         | 131 Carrington Rd                     |
| 105                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.8    | 4.8           | Fair         | O/S 99 Carrington Rd                  |
| 106                 | <i>Prunus yedoensis 'Awanui'</i>             | Awanui              | 4.4    | 6.4           | Fair         | O/S 99 Carrington Rd                  |
| 107                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.2    | 4             | Poor         | O/S 99 Carrington Rd                  |
| 108                 | <i>Sequoia sempervirens</i>                  | Redwood             | 2.4    | 1.6           | Fair         | O/S 99 Carrington Rd                  |
| 109                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.8    | 4.8           | Fair         | O/S 1 Carrington Rd                   |
| 110                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.8    | 5             | Poor         | O/S 1 Carrington Rd                   |
| 111                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.1    | 5.2           | Poor         | O/S 1 Carrington Rd                   |
| 112                 | <i>Prunus spp.</i>                           | Flowering cherry    | 3.7    | 2.2           | Poor         | O/S 1 Carrington Rd                   |
| 113                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4      | 6.2           | Fair         | O/S 1 Carrington Rd                   |
| 114 / TP4           | <i>Knightia excelsa</i>                      | Rewarewa            | 3      | 1.2           | Good         | O/S 1 Carrington Rd                   |
| 115                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.4    | 7.8           | Fair         | O/S 1 Carrington Rd                   |
| 116                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.6    | 6             | Fair         | O/S 1 Carrington Rd                   |
| 117                 | <i>Prunus spp.</i>                           | Flowering cherry    | 5      | 9.6           | Fair         | O/S 1 Carrington Rd                   |
| 118                 | <i>Ginkgo biloba</i>                         | Ginkgo              | 11.8   | 9             | Fair         | 1 Carrington Rd                       |
| 119                 | <i>Prunus spp.</i>                           | Flowering cherry    | 3.3    | 5.2           | Poor         | O/S 1 Carrington Rd                   |
| 120                 | <i>Prunus spp.</i>                           | Flowering cherry    | 4.2    | 6.8           | Fair         | O/S 1 Carrington Rd                   |
| 121                 | <i>Camellia japonica</i>                     | Camellia            | 40     | 9.8           | Good         | 1 Carrington Rd                       |
| 122                 | <i>Vitex lucens</i>                          | Pūriri              | 13.4   | 13            | Fair         | 1 Carrington Rd                       |
| 123                 | <i>Corynocarpus laevigatus</i>               | Karaka              | 8.8    | 12            | Good         | 1 Carrington Rd                       |
| 124                 | <i>Trachycarpus fortunei</i>                 | Windmill palm       | 8.9    | 2.5           | Good         | 1 Carrington Rd                       |
| 125                 | <i>Camellia japonica</i>                     | Camellia            | 5.8    | 12            | Good         | 1 Carrington Rd                       |
| 126                 | <i>Vitex lucens</i>                          | Pūriri              | 12.6   | 21            | Good         | 1 Carrington Rd                       |
| 127                 | <i>Duranta erecta</i>                        | Sky flower          | 5.2    | 10            | Poor         | 1 Carrington Rd                       |
| 128                 | <i>Ginkgo biloba</i>                         | Ginkgo              | 10.4   | 11            | Good         | 1 Carrington Rd                       |
| 129                 | <i>Cupressus sempervirens 'Swane's Gold'</i> | Swanns golden       | 7.8    | 1.6           | Fair         | 1 Carrington Rd                       |
| 130                 | <i>Prunus spp.</i>                           | Flowering cherry    | 5      | 6.2           | Fair         | O/S 1 Carrington Rd                   |
| TP1                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 3 / Farm Road Intersection Mouth |
| TP2                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 3 / Farm Road Intersection Mouth |
| TP3                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 3 / Farm Road Intersection Mouth |
| TP5                 | <i>Knightia excelsa</i>                      | Rewarewa            | 2.2    | 1             | New Planting | Gate 1 Intersection Mouth             |
| TP6                 | <i>Knightia excelsa</i>                      | Rewarewa            | 2.2    | 1             | New Planting | Gate 1 Intersection Mouth             |
| TP7                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 1 Intersection Mouth             |
| TP8                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 1 Intersection Mouth             |
| TP9                 | <i>Cordyline australis</i>                   | Cabbage tree        | 1.2    | 1             | New Planting | Gate 1 Intersection Mouth             |

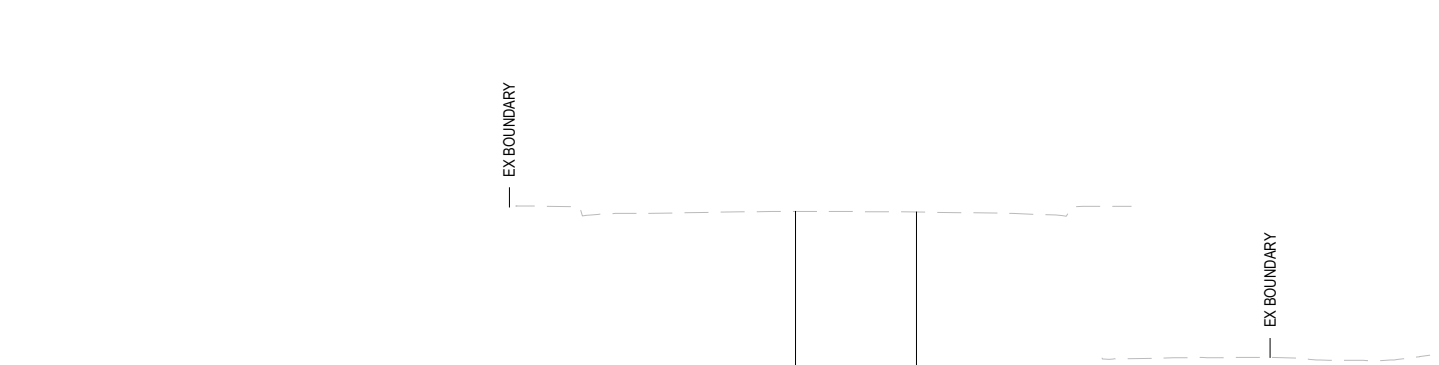


NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



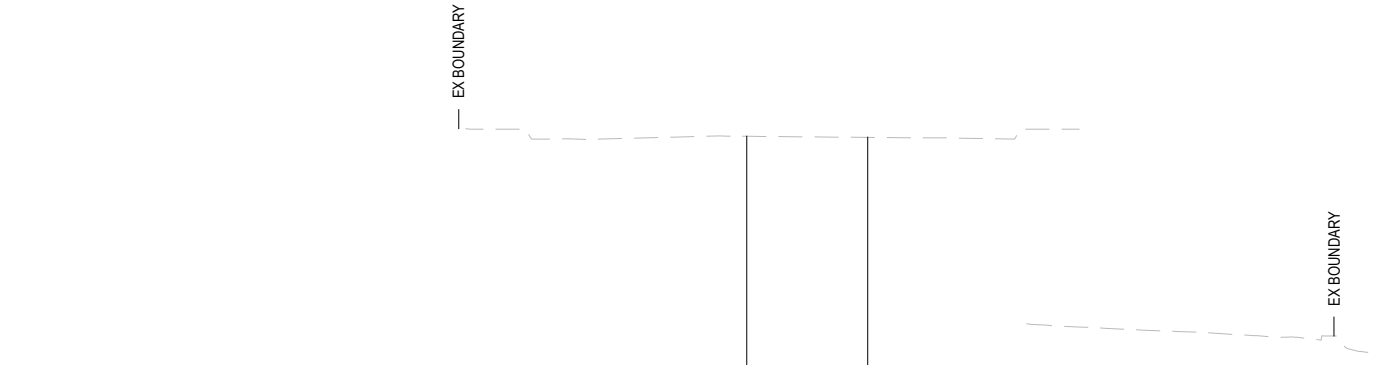
|                 |  |          |          |
|-----------------|--|----------|----------|
| FEATURE CODES   |  | CL       | LA       |
| CUT/FILL        |  | 0.000 -  | 0.000 -  |
| DESIGN LEVELS   |  | 50.723 - | 50.707 - |
| EXISTING LEVELS |  | 50.723 - | 50.707 - |
| OFFSETS         |  | 0.000 -  | 3.200 -  |

CH: 20.00



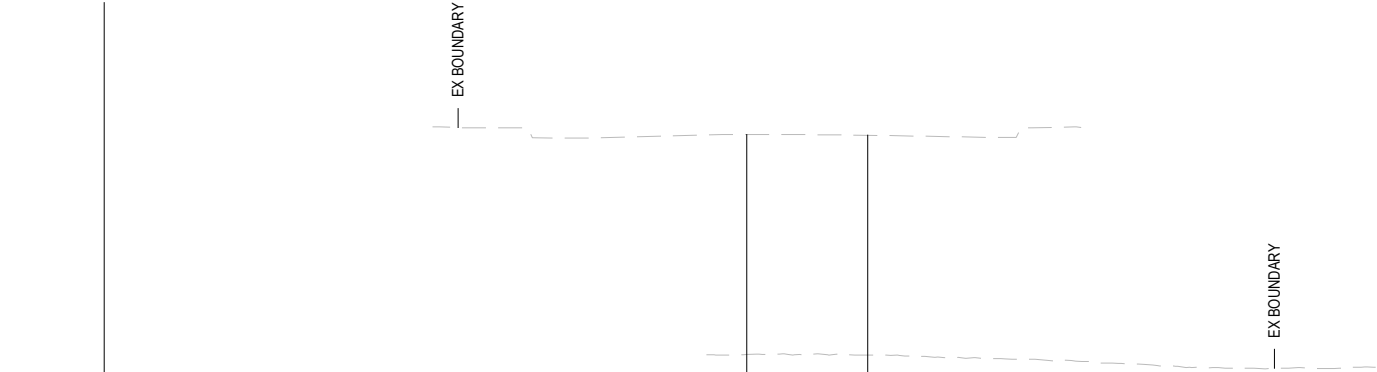
|                 |  |          |
|-----------------|--|----------|
| FEATURE CODES   |  | CL       |
| CUT/FILL        |  | 0.000 -  |
| DESIGN LEVELS   |  | 49.845 - |
| EXISTING LEVELS |  | 49.845 - |
| OFFSETS         |  | 0.000 -  |

CH: 0.00



|                 |  |          |          |
|-----------------|--|----------|----------|
| FEATURE CODES   |  | CL       | LA       |
| CUT/FILL        |  | 0.000 -  | 0.000 -  |
| DESIGN LEVELS   |  | 50.712 - | 50.684 - |
| EXISTING LEVELS |  | 50.712 - | 50.684 - |
| OFFSETS         |  | 0.000 -  | 3.200 -  |

CH: 60.00



|                 |  |          |          |
|-----------------|--|----------|----------|
| FEATURE CODES   |  | CL       | LA       |
| CUT/FILL        |  | 0.000 -  | 0.000 -  |
| DESIGN LEVELS   |  | 51.049 - | 51.029 - |
| EXISTING LEVELS |  | 51.049 - | 51.029 - |
| OFFSETS         |  | 0.000 -  | 3.200 -  |

CH: 40.00

PRELIMINARY  
NOT FOR CONSTRUCTION

|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design Drawn                                 | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Design Verifier                              |         |          |                            |
| 1:200               | Dwg Check                                    |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |

 Boffa Miskell

Client:



Project:

CARRINGTON ROAD  
IMPROVEMENTS PROJECT

Title:

DETAILED CROSS SECTIONS  
SHEET 1

Discipline

CIVIL ENGINEERING

Drawing No.

3230635-CA-0551

Rev.

A

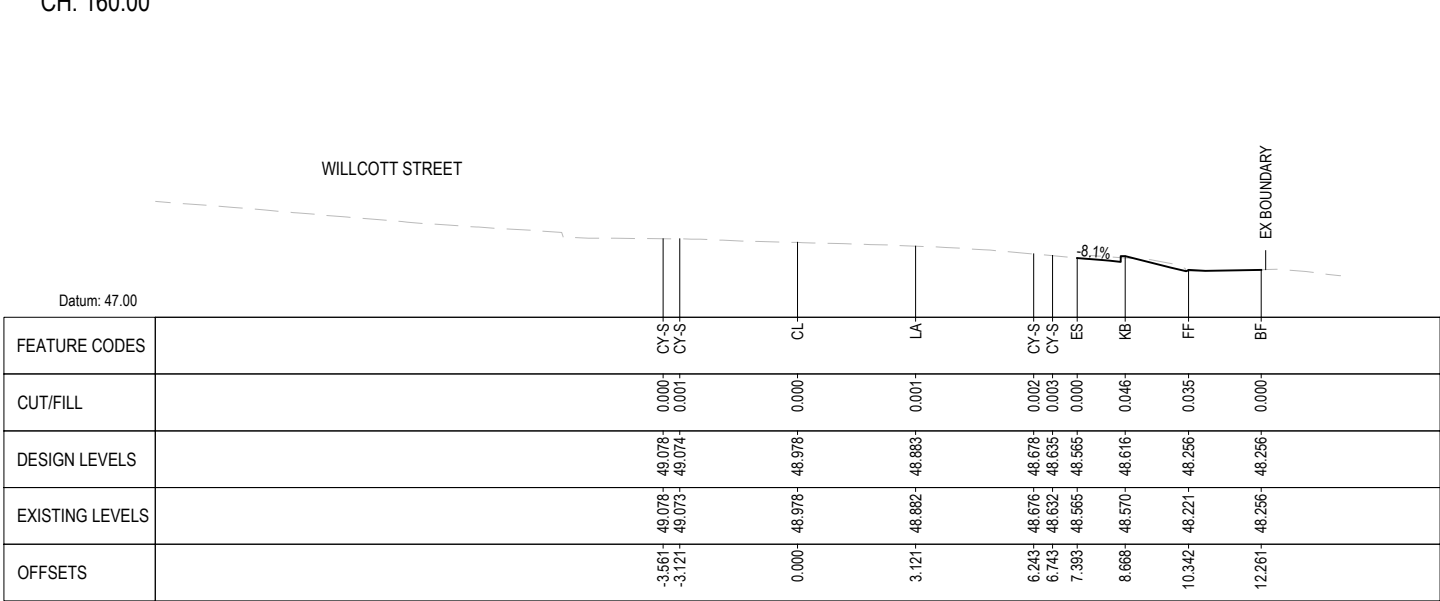
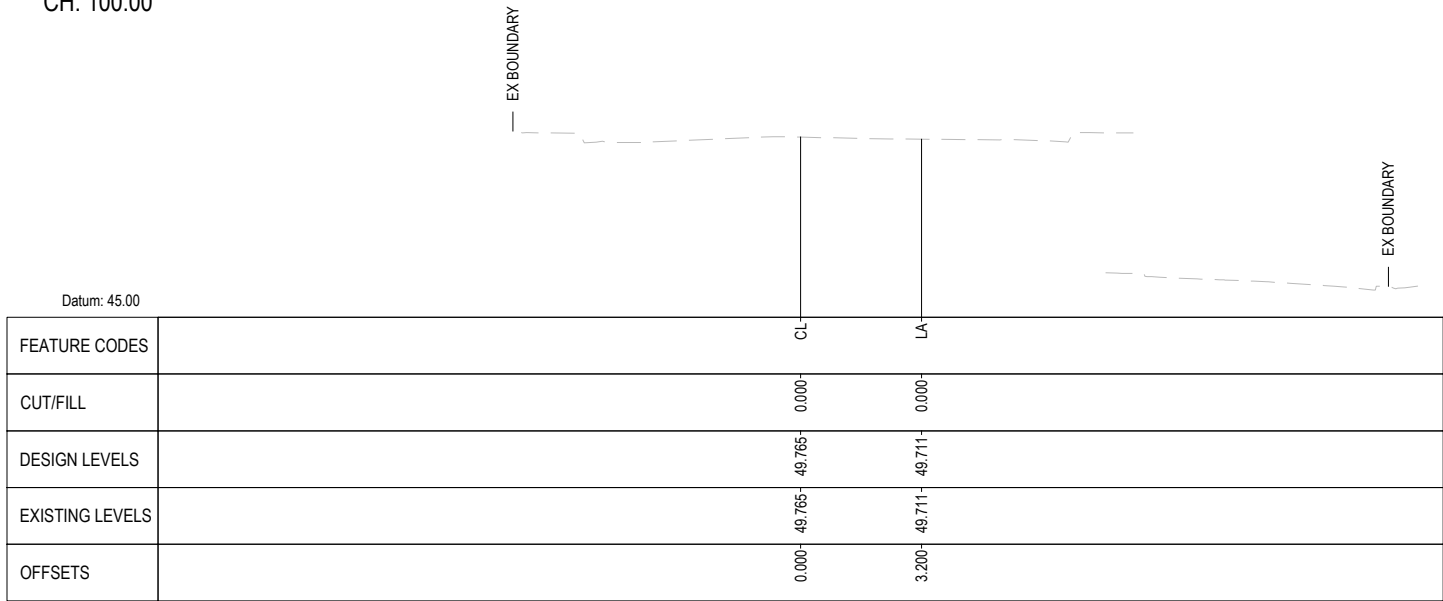
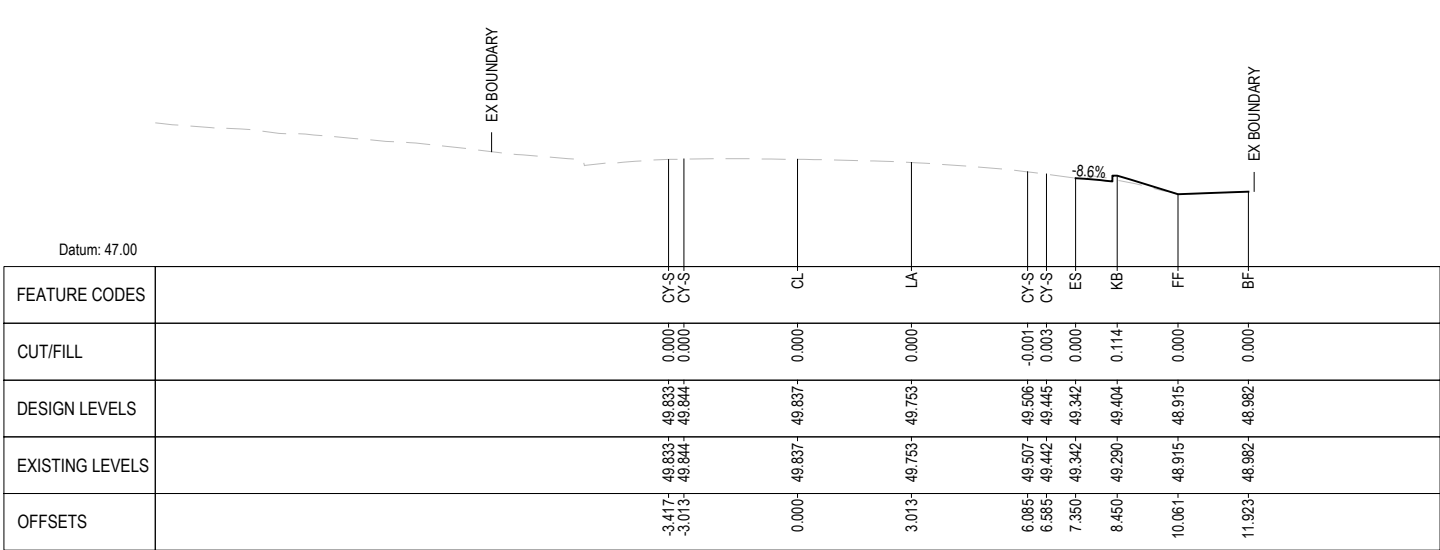
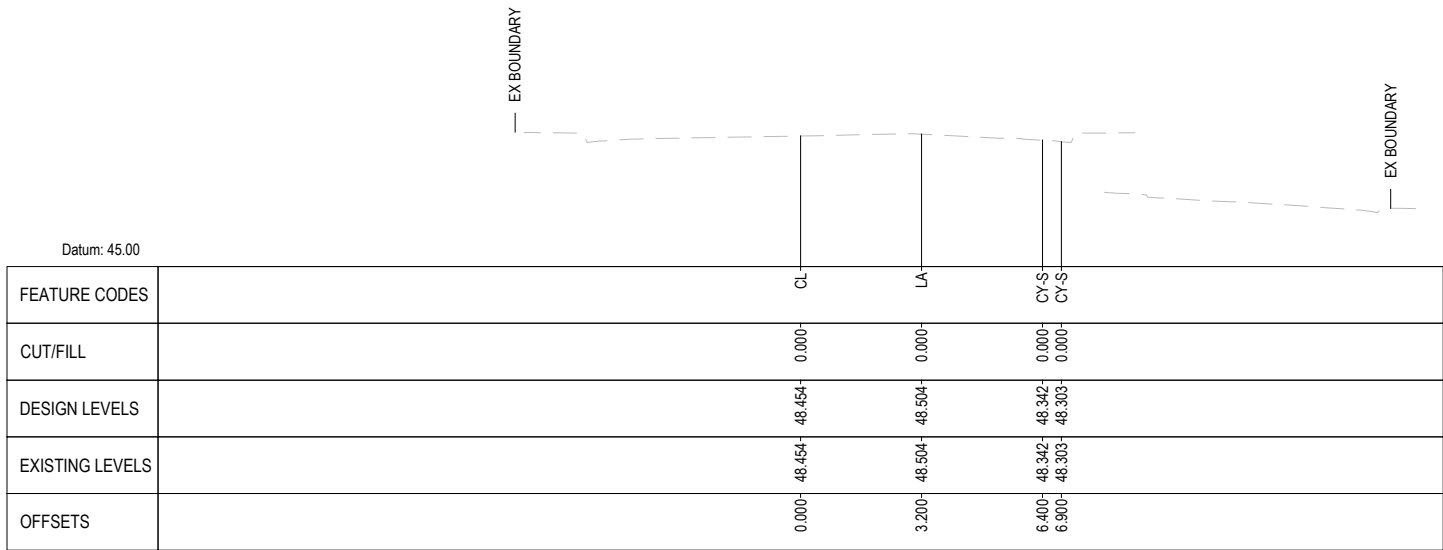
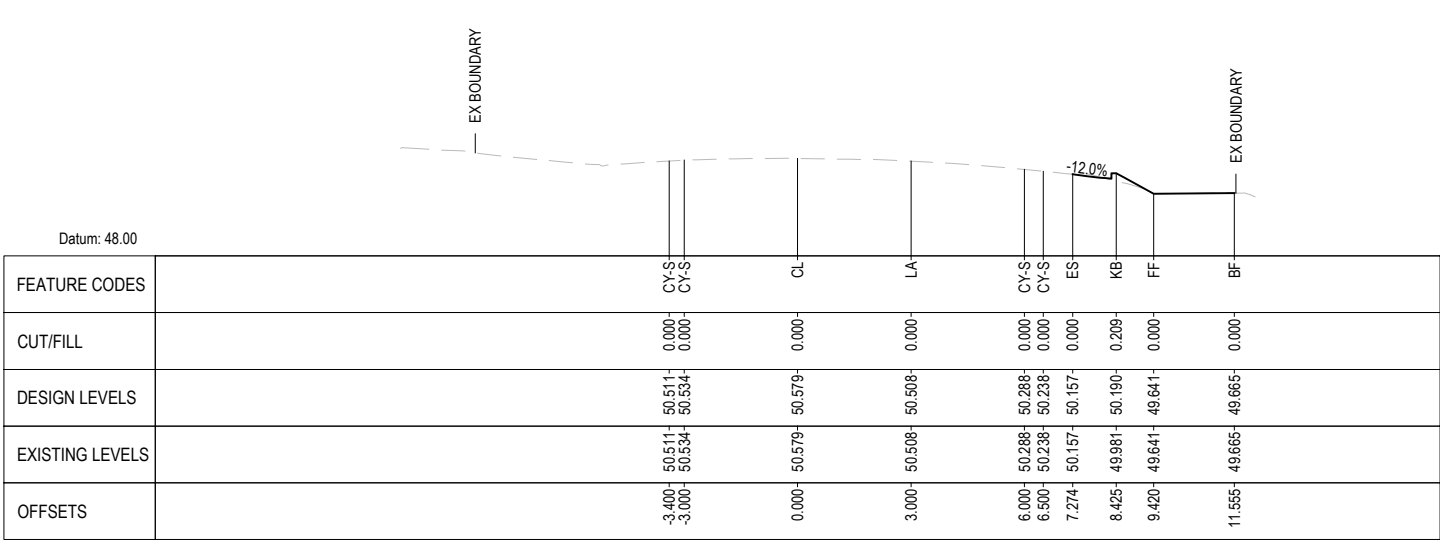


NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design                                       | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Design Verifier                              |         |          |                            |
| 1:200               | Dwg Check                                    |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|         |                                      |
|---------|--------------------------------------|
| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

|                                 |                   |
|---------------------------------|-------------------|
| Title:                          | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 2 | CIVIL ENGINEERING |
| Drawing No.                     | Rev.              |
| 3230635-CA-0552                 | A                 |

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

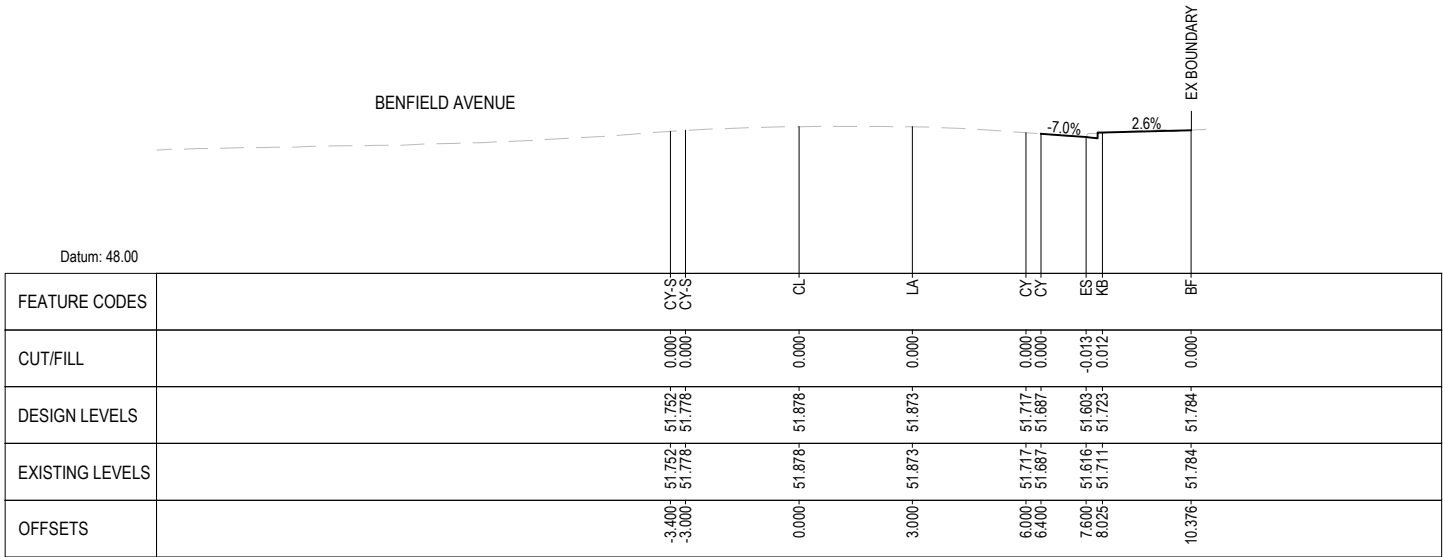


NOTES

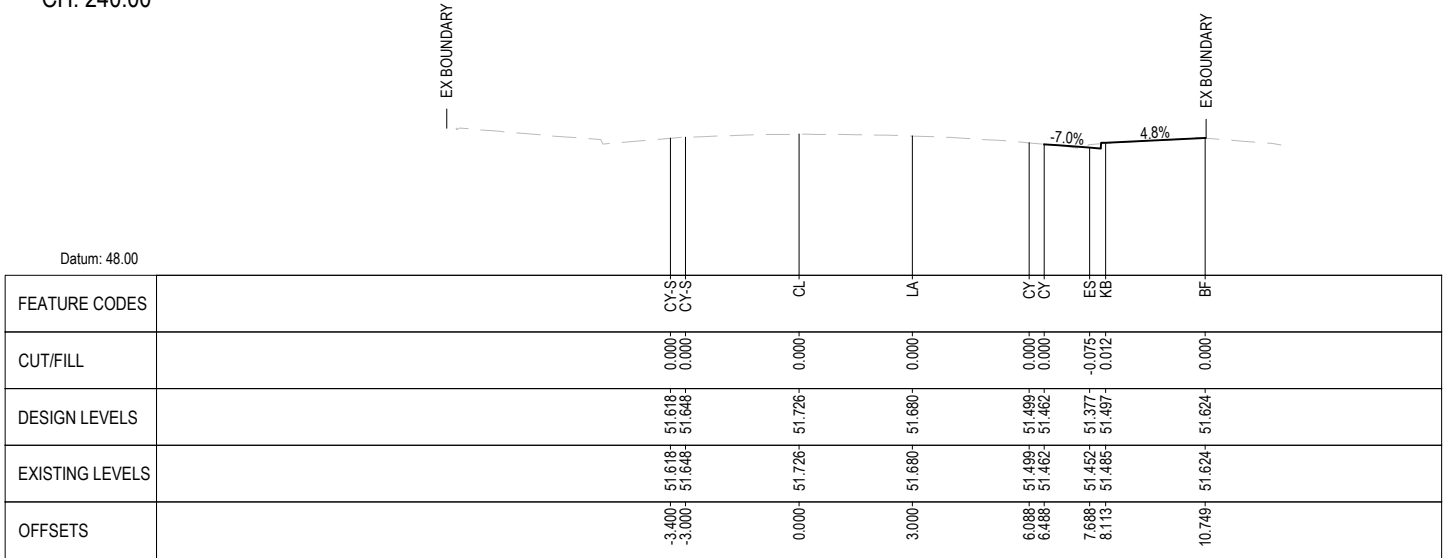
1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

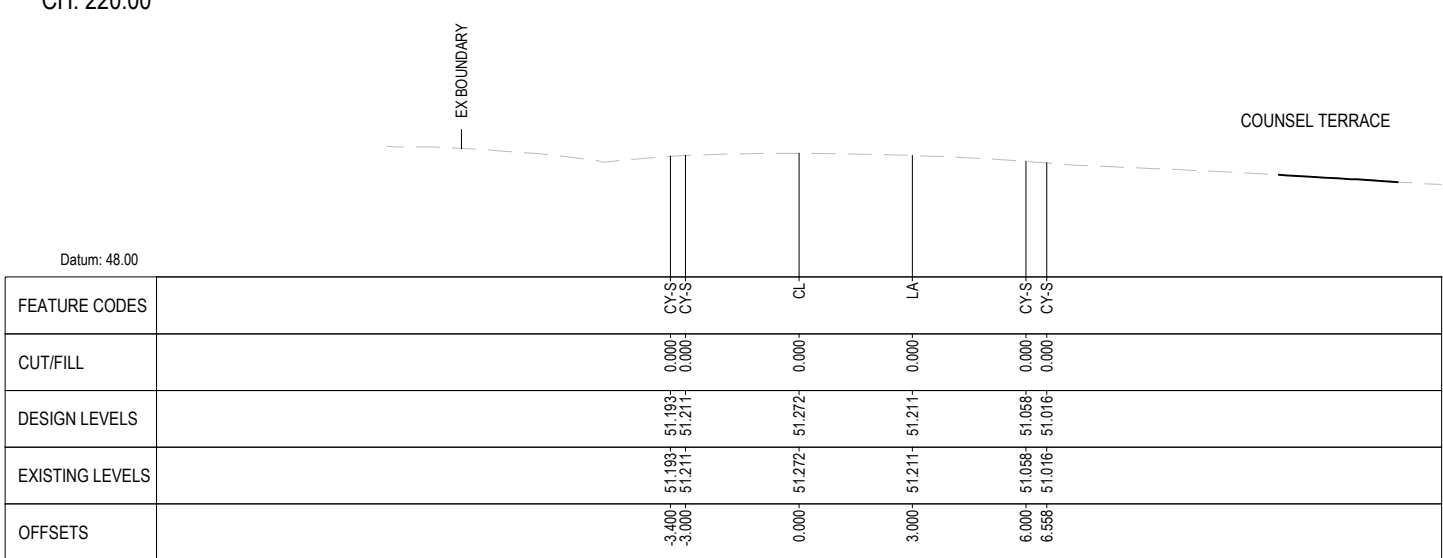
|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



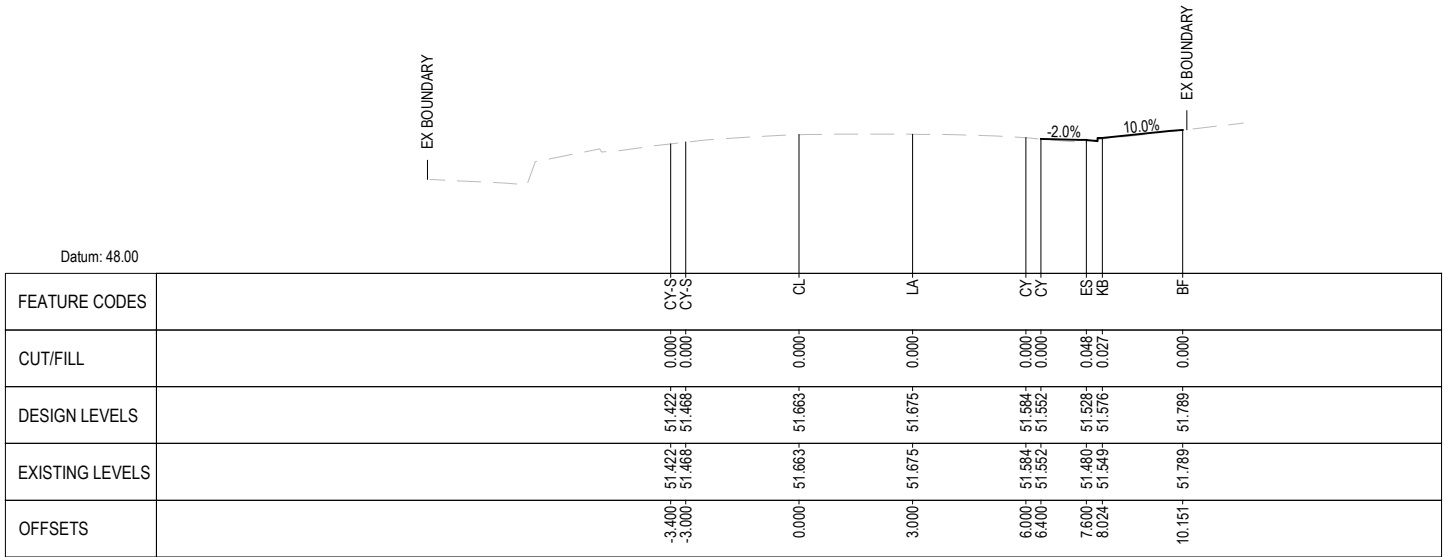
CH: 240.00



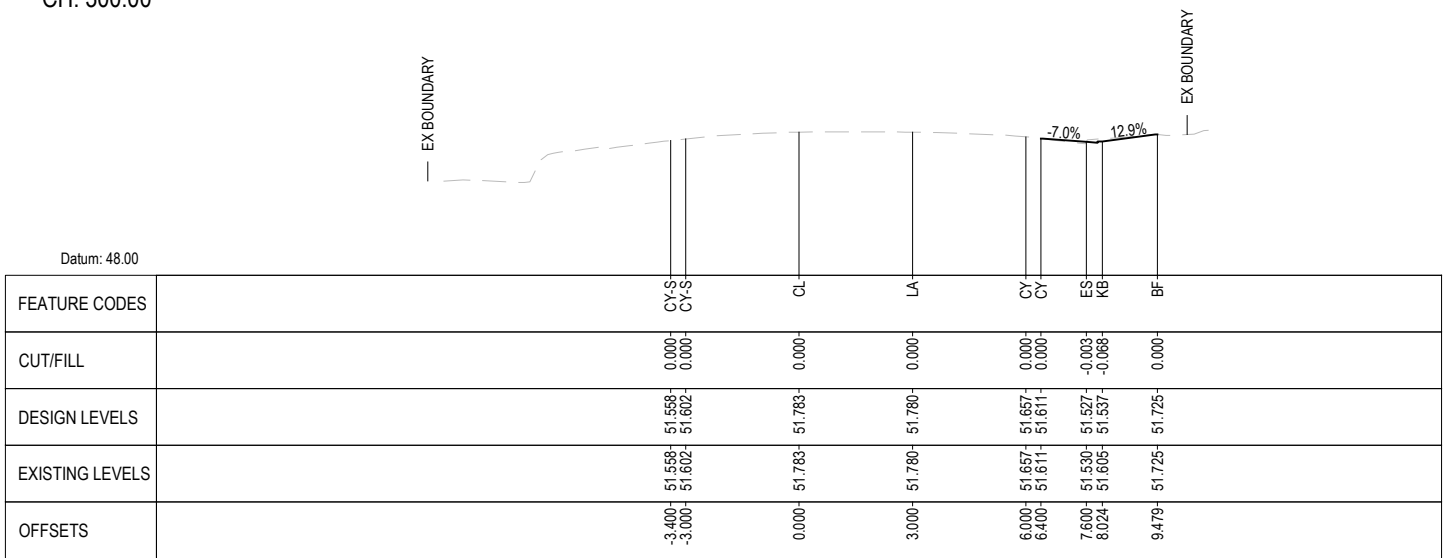
CH: 220.00



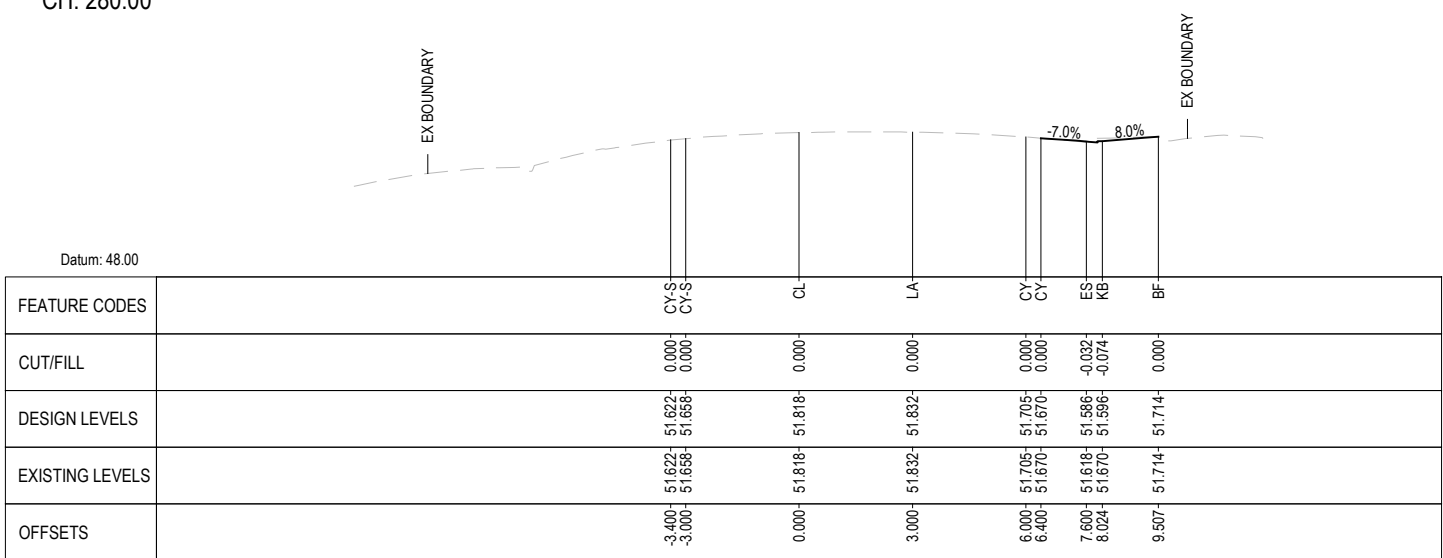
CH: 200.00



CH: 300.00



CH: 280.00



CH: 260.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design                                       | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 |                            |
| Reduced Scale (A3)  | Design Verifier                              |         |          | Date                       |
| 1:200               | Design Check                                 |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|         |                                      |
|---------|--------------------------------------|
| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

|                                 |                   |
|---------------------------------|-------------------|
| Title:                          | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 3 | CIVIL ENGINEERING |
| Drawing No.                     | Rev.              |
| 3230635-CA-0553                 | A                 |

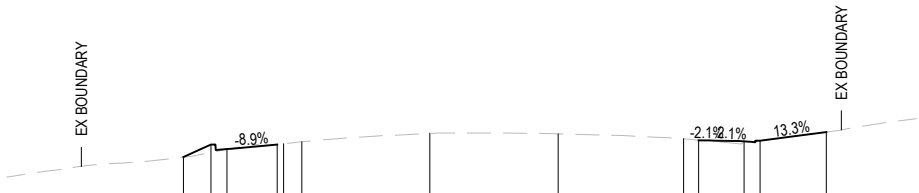


NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

CL - CONTROL LINE/LANE  
LA - LANE LINE  
PW - START OF PAVEMENT WIDENING  
ES - EDGE OF SEAL  
KB - BACK OF KERB  
FF - FRONT OF FOOTPATH  
BF - BACK OF FOOTPATH  
SP - SHARED PATH  
BE - BERM  
CY - CYCLE LANE  
CY-S - CYCLE LANE SEPARATOR  
IA - EARTHWORK INTERFACE



Datum: 48.00

| FEATURE CODES   | IA     | KB     | ES     | PW     | CY-S   | CL     | LA     | CY     | CY     | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.215  | 0.011  | 0.000  | -0.001 | 0.000  | 0.000  | -0.001 | 0.000  | 0.043  | 0.001  | -0.001 |
| DESIGN LEVELS   | 50.596 | 50.931 | 50.811 | 50.929 | 51.000 | 51.222 | 51.211 | 51.077 | 51.041 | 51.016 | 51.026 | 51.258 |
| EXISTING LEVELS | 50.596 | 50.716 | 50.800 | 50.929 | 50.948 | 51.222 | 51.211 | 51.078 | 51.041 | 51.025 | 51.026 | 51.259 |
| OFFSETS         | -6.524 | -5.796 | -5.371 | -4.043 | -3.870 | 0.000  | 3.395  | 6.707  | 7.107  | 8.307  | 8.731  | 10.484 |

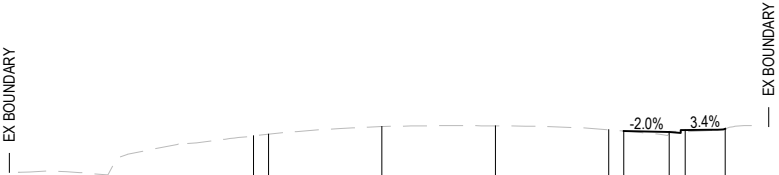
CH: 360.00



Datum: 48.00

| FEATURE CODES   | IA     | KB     | ES     | PW     | CY-S   | CL     | LA     | CY     | CY     | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.133  | 0.007  | 0.000  | 0.000  | 0.000  | -0.001 | 0.001  | 0.000  | 0.022  | 0.013  | 0.000  |
| DESIGN LEVELS   | 50.633 | 51.089 | 50.970 | 50.980 | 51.121 | 51.355 | 51.377 | 51.260 | 51.228 | 51.203 | 51.213 | 51.399 |
| EXISTING LEVELS | 50.633 | 50.956 | 50.963 | 50.980 | 51.121 | 51.355 | 51.378 | 51.259 | 51.228 | 51.201 | 51.213 | 51.399 |
| OFFSETS         | -6.943 | -5.394 | -4.969 | -4.764 | -3.469 | 0.000  | 3.059  | 6.148  | 6.548  | 7.749  | 8.173  | 10.033 |

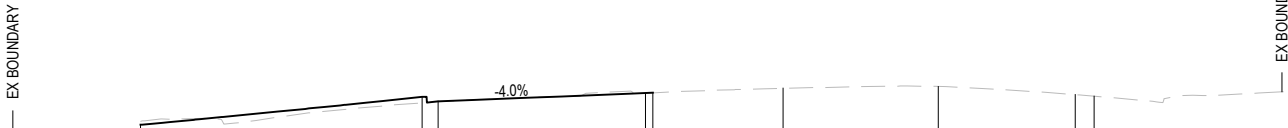
CH: 340.00



Datum: 48.00

| FEATURE CODES   | CY-S   | CL     | LA     | CY     | CY     | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.023  | 0.050  | 0.000  |
| DESIGN LEVELS   | 51.272 | 51.519 | 51.537 | 51.435 | 51.401 | 51.377 | 51.425 | 51.461 |
| EXISTING LEVELS | 51.272 | 51.519 | 51.537 | 51.435 | 51.401 | 51.354 | 51.375 | 51.461 |
| OFFSETS         | -3.400 | 0.000  | 3.000  | 6.000  | 6.400  | 7.600  | 8.024  | 9.080  |

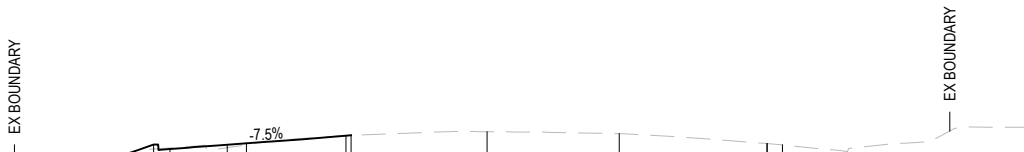
CH: 320.00



Datum: 46.00

| FEATURE CODES   | IA      | KB     | ES     | LA     | PW     | CL     | LA     | CY-S   | CY-S   |
|-----------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.007  | 0.158  | 0.009  | 0.005  | 0.000  | 0.000  | -0.001 | 0.000  | 0.000  |
| DESIGN LEVELS   | 47.936  | 48.469 | 48.349 | 48.560 | 48.578 | 48.697 | 48.743 | 48.530 | 48.490 |
| EXISTING LEVELS | 47.933  | 48.311 | 48.340 | 48.555 | 48.578 | 48.697 | 48.744 | 48.530 | 48.490 |
| OFFSETS         | -17.000 | -9.550 | -9.125 | -3.643 | -3.442 | 0.000  | 4.108  | 7.727  | 8.227  |

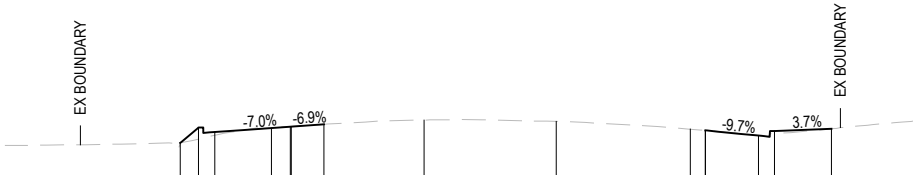
CH: 420.00



Datum: 47.00

| FEATURE CODES   | IA     | KB     | ES     | CY-S   | CY-S   | LA     | PW     | CL     | LA     | CY-S   | CY     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.001 | 0.123  | -0.024 | 0.080  | 0.040  | -0.003 | -0.000 | 0.000  | 0.000  | -0.001 | -0.002 |
| DESIGN LEVELS   | 49.105 | 49.472 | 49.355 | 49.466 | 49.503 | 49.702 | 49.712 | 49.811 | 49.754 | 49.495 | 49.459 |
| EXISTING LEVELS | 49.106 | 49.349 | 49.379 | 49.386 | 49.463 | 49.705 | 49.712 | 49.811 | 49.754 | 49.496 | 49.459 |
| OFFSETS         | -9.870 | -8.824 | -8.393 | -6.870 | -6.362 | -3.729 | -3.599 | 0.000  | 3.500  | 7.411  | 7.812  |

CH: 400.00



Datum: 47.00

| FEATURE CODES   | IA     | KB     | ES     | CY-S   | CY-S   | LA     | PW     | CL     | LA     | CY     | CY     | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.310  | 0.088  | -0.010 | -0.002 | -0.002 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | -0.004 | 0.057  | 0.000  |
| DESIGN LEVELS   | 50.090 | 50.496 | 50.377 | 50.481 | 50.516 | 50.518 | 50.578 | 50.692 | 50.654 | 50.451 | 50.419 | 50.282 | 50.402 | 50.457 |
| EXISTING LEVELS | 50.090 | 50.186 | 50.289 | 50.491 | 50.518 | 50.520 | 50.578 | 50.692 | 50.654 | 50.451 | 50.419 | 50.286 | 50.345 | 50.457 |
| OFFSETS         | -6.451 | -5.953 | -5.540 | -4.039 | -3.539 | -3.513 | -2.653 | 0.000  | 3.500  | 7.045  | 7.444  | 8.847  | 9.273  | 10.761 |

CH: 380.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

| No. | Revision           | By | Chk | Appd | Date     |
|-----|--------------------|----|-----|------|----------|
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |

|                              |  |          |                            |
|------------------------------|--|----------|----------------------------|
| Original Scale (A1)<br>1:100 | Design Drawn<br>A. HOLT                      | 15.11.24 | Approved For Construction* |
| Reduced Scale (A3)<br>1:200  | Design Verifier<br>L. CHEN                   | 15.11.24 | Date                       |
|                              | Design Check                                 |          |                            |
|                              | * Refer to Revision 1 for Original Signature |          |                            |



Client:  
Project: CARRINGTON ROAD IMPROVEMENTS PROJECT

Title: DETAILED CROSS SECTIONS SHEET 4

|                                 |           |
|---------------------------------|-----------|
| Discipline<br>CIVIL ENGINEERING | Rev.<br>A |
| Drawing No.<br>3230635-CA-0554  |           |

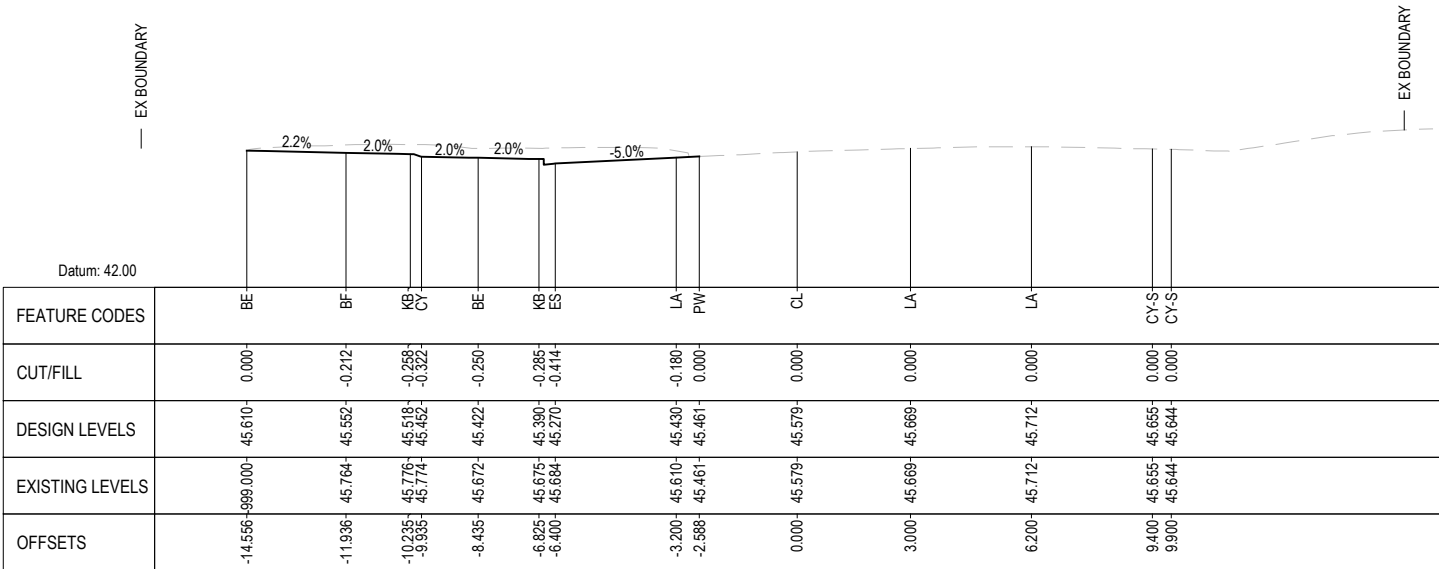


NOTES

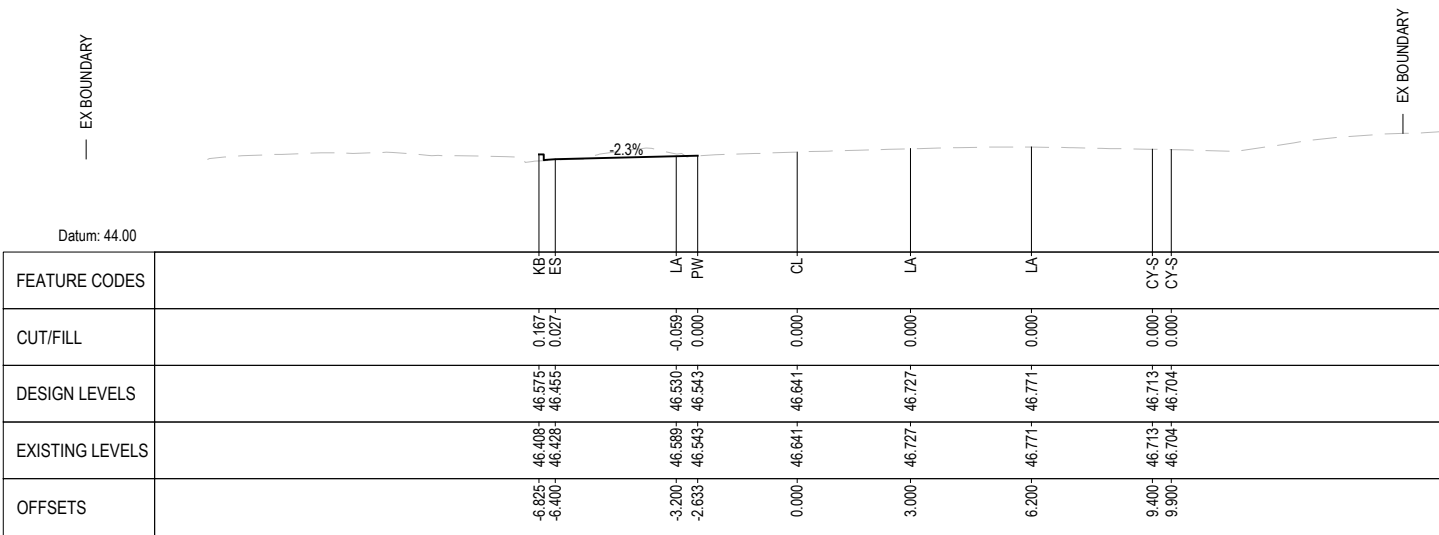
1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

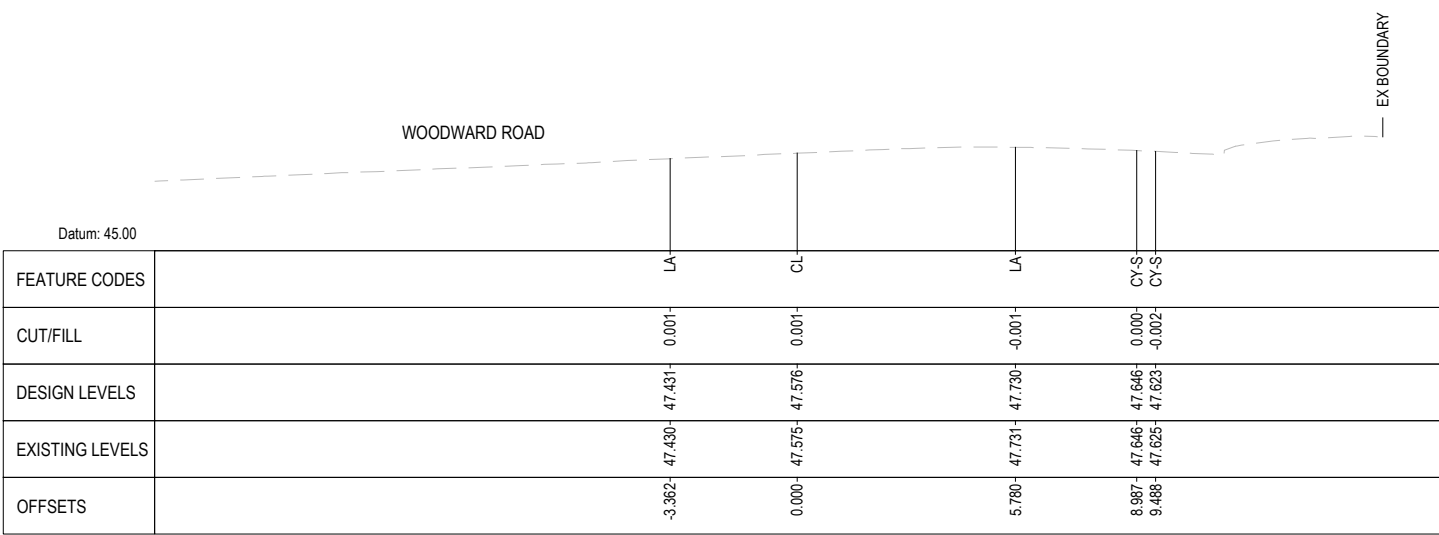
|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



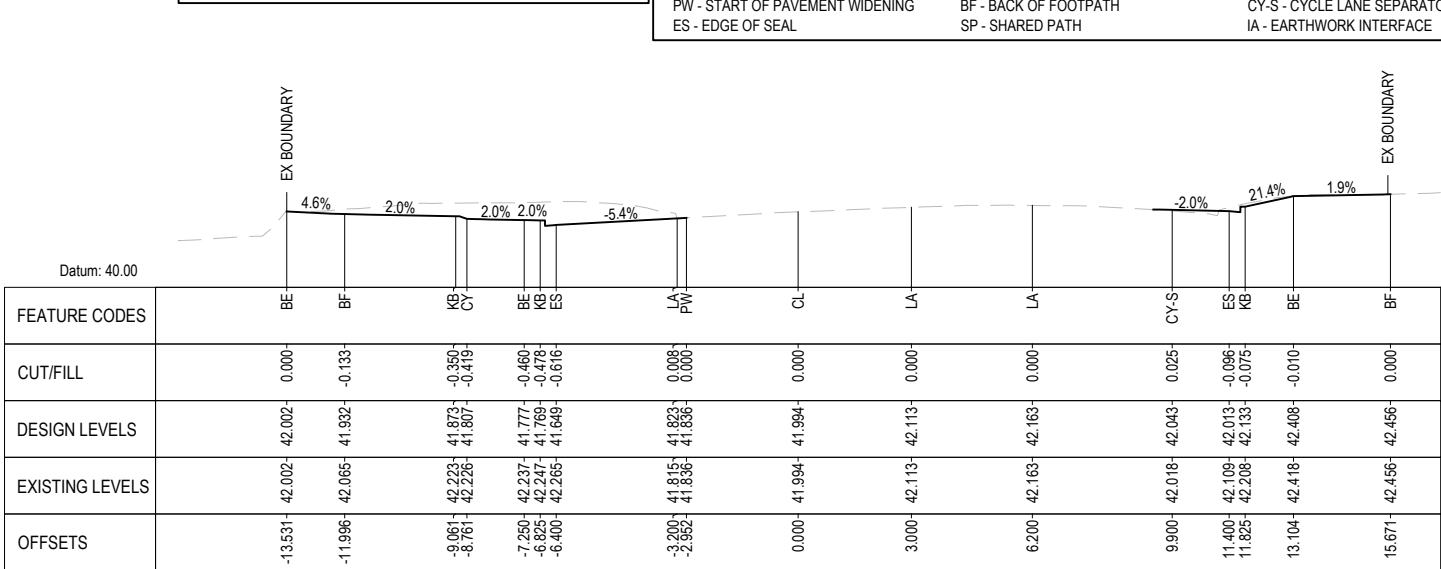
CH: 480.00



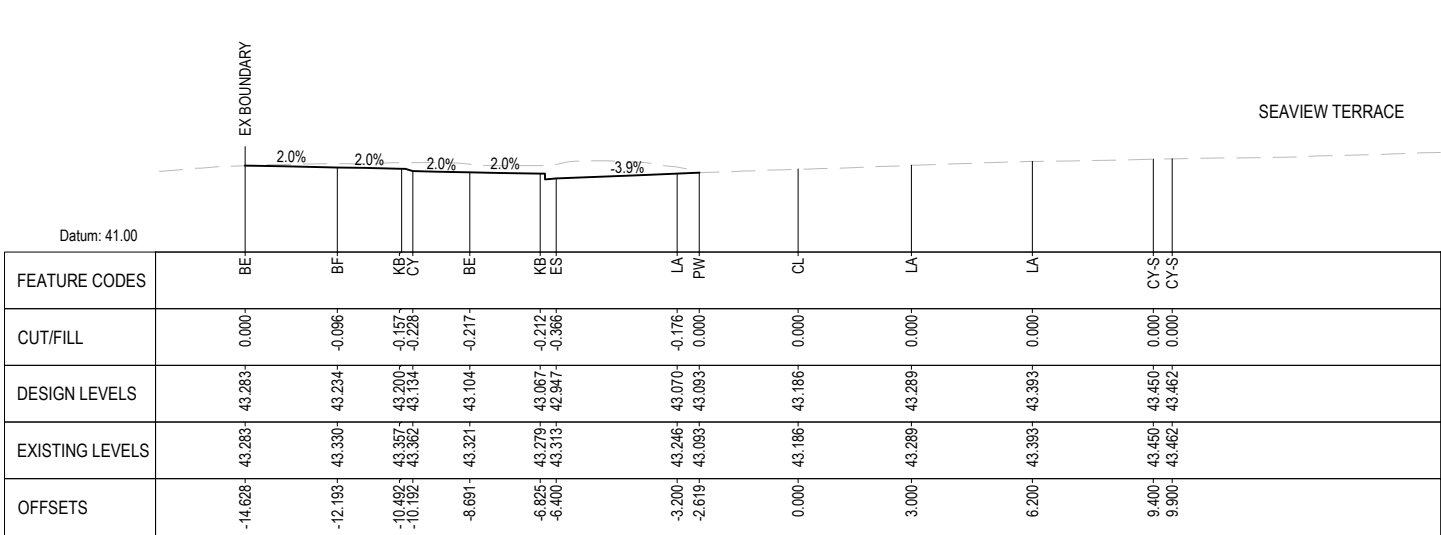
CH: 460.00



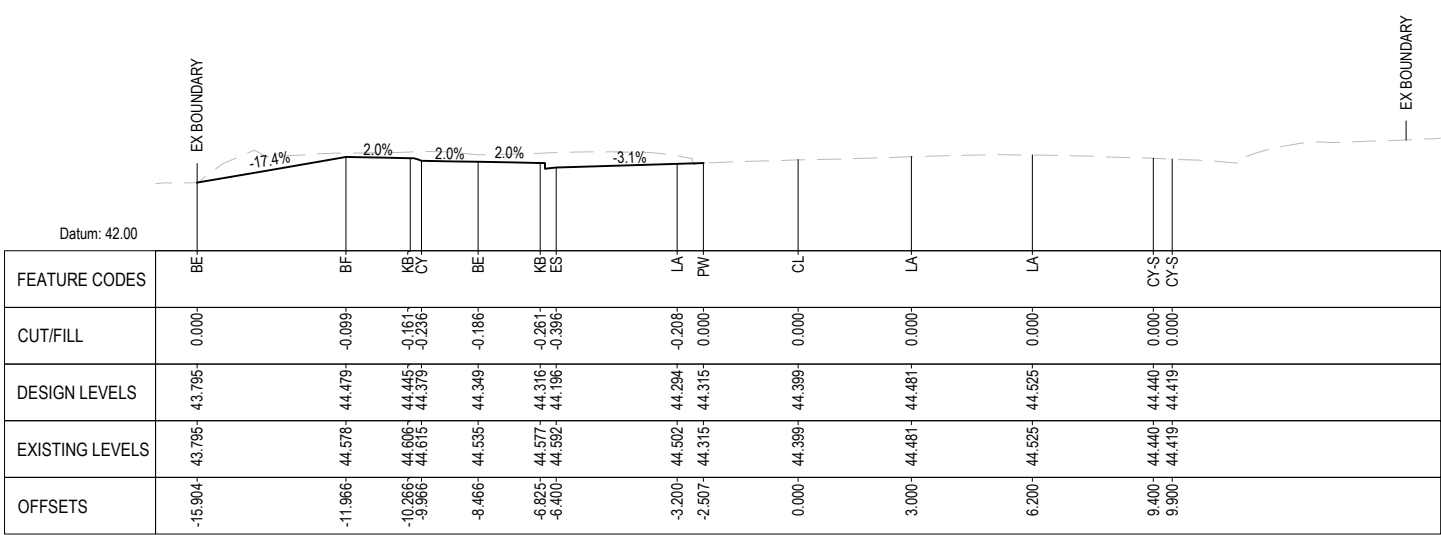
CH: 440.00



CH: 540.00



CH: 520.00



CH: 500.00

PRELIMINARY  
NOT FOR CONSTRUCTION

|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design                                       | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 |                            |
| Reduced Scale (A3)  | Design                                       |         |          | Date                       |
| 1:200               | Check  |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|          |                                      |
|----------|--------------------------------------|
| Project: | CARRINGTON ROAD IMPROVEMENTS PROJECT |
|----------|--------------------------------------|

|        |                                 |
|--------|---------------------------------|
| Title: | DETAILED CROSS SECTIONS SHEET 5 |
|--------|---------------------------------|

|             |                   |
|-------------|-------------------|
| Discipline  | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0555   |
| Rev.        | A                 |

NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

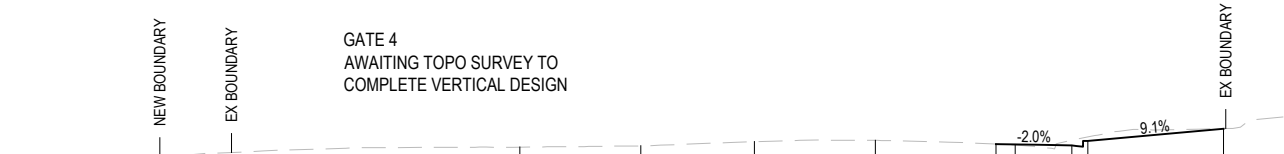
|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



Datum: 35.00

| FEATURE CODES   | LA     | CL     | LA     | LA     | PW     | CY-S   | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.012  | -0.065 | -0.013 | 0.000  |
| DESIGN LEVELS   | 38.028 | 38.195 | 38.328 | 38.371 | 38.294 | 38.284 | 38.254 | 38.374 | 38.726 |
| EXISTING LEVELS | 38.028 | 38.195 | 38.328 | 38.371 | 38.294 | 38.272 | 38.309 | 38.387 | 38.726 |
| OFFSETS         | -3.200 | 0.000  | 3.000  | 6.200  | 9.400  | 9.900  | 11.400 | 11.825 | 15.432 |

CH: 600.00



Datum: 37.00

| FEATURE CODES   | LA     | CL     | LA     | LA     | PW     | CY-S   | ES     | KB     | BF     |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.017  | -0.140 | -0.104 | 0.000  |
| DESIGN LEVELS   | 39.539 | 39.572 | 39.684 | 39.718 | 39.621 | 39.611 | 39.581 | 39.701 | 40.028 |
| EXISTING LEVELS | 39.539 | 39.572 | 39.684 | 39.718 | 39.621 | 39.594 | 39.721 | 39.805 | 40.028 |
| OFFSETS         | -3.200 | 0.000  | 3.000  | 6.200  | 9.400  | 9.900  | 11.400 | 11.825 | 15.414 |

CH: 580.00



Datum: 38.00

| FEATURE CODES   | BF      | KB     | ES     | PW     | LA     | CL     | LA     | LA     | PW     | CY-S   | ES     | KB     | BF     |
|-----------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.002  | -0.303 | -0.409 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.022  | -0.125 | -0.063 | 0.000  |
| DESIGN LEVELS   | 40.510  | 40.467 | 40.347 | 40.597 | 40.602 | 40.775 | 40.903 | 40.923 | 40.800 | 40.790 | 40.760 | 40.880 | 41.276 |
| EXISTING LEVELS | 40.512  | 40.770 | 40.756 | 40.597 | 40.602 | 40.775 | 40.903 | 40.923 | 40.768 | 40.768 | 40.885 | 40.943 | 41.276 |
| OFFSETS         | -12.383 | -8.825 | -8.400 | 3.288  | -3.200 | 0.000  | 3.000  | 6.200  | 9.400  | 9.900  | 11.400 | 11.825 | 15.384 |

CH: 560.00



Datum: 32.00

| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | PW     | CY-S   | ES     | KB     | BF     |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.456  | -0.456  | -0.456  | -0.440 | -0.370 | -0.486 | -0.297 | 0.043  | 0.000  | 0.001  | 0.000  | 0.000  | 0.016  | 0.034  | 0.120  | 0.000  |
| DESIGN LEVELS   | 34.355  | 34.315  | 34.217  | 34.207 | 34.176 | 34.054 | 34.107 | 34.165 | 34.185 | 34.270 | 34.300 | 34.171 | 34.171 | 34.161 | 34.131 | 34.304 |
| EXISTING LEVELS | 34.811  | 34.771  | 34.769  | 34.647 | 34.546 | 34.540 | 34.404 | 34.122 | 34.185 | 34.289 | 34.300 | 34.171 | 34.145 | 34.131 | 34.251 | 34.304 |
| OFFSETS         | -12.165 | -10.463 | -10.162 | -8.460 | -7.124 | -6.700 | -3.500 | 0.000  | 1.256  | 3.200  | 6.400  | 9.600  | 10.100 | 11.600 | 12.025 | 15.899 |

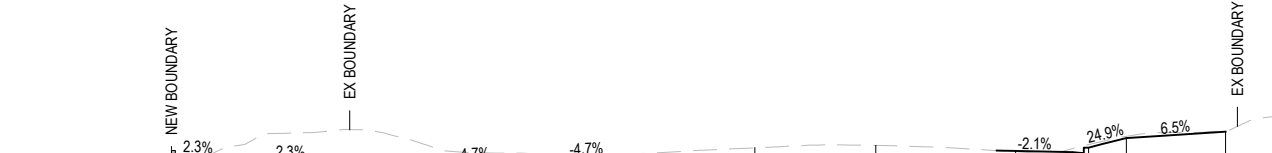
CH: 660.00



Datum: 33.00

| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | CY-S   | ES     | KB     | BE     | BF     |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.546  | -0.666  | -0.680  | -0.392 | -0.358 | -0.542 | -0.220 | 0.030  | 0.000  | 0.001  | -0.001 | 0.014  | -0.103 | -0.043 | 0.009  | 0.000  |
| DESIGN LEVELS   | 35.563  | 35.526  | 35.460  | 35.423 | 35.389 | 35.268 | 35.328 | 35.390 | 35.400 | 35.545 | 35.579 | 35.439 | 35.409 | 35.529 | 35.685 | 35.738 |
| EXISTING LEVELS | 36.109  | 36.192  | 36.150  | 35.815 | 35.747 | 35.810 | 35.548 | 35.360 | 35.400 | 35.544 | 35.580 | 35.425 | 35.512 | 35.572 | 35.676 | 35.738 |
| OFFSETS         | -12.345 | -10.661 | -10.362 | -8.661 | -7.124 | -6.700 | -3.500 | 0.000  | 0.537  | 3.200  | 6.400  | 10.100 | 11.600 | 12.025 | 13.025 | 15.698 |

CH: 640.00



Datum: 34.00

| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | PW     | CL     | LA     | LA     | CY-S   | ES     | KB     | BE     | BF     |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.299   | -0.203  | -0.322  | -0.695 | -0.789 | -0.817 | -0.186 | 0.000  | 0.000  | 0.000  | 0.000  | 0.022  | -0.090 | -0.079 | -0.044 | -0.001 |
| DESIGN LEVELS   | 36.765  | 36.733  | 36.666  | 36.631 | 36.581 | 36.460 | 36.610 | 36.741 | 36.776 | 36.936 | 37.000 | 36.853 | 36.822 | 36.942 | 37.191 | 37.361 |
| EXISTING LEVELS | 36.466  | 36.936  | 36.888  | 37.326 | 37.370 | 37.277 | 36.796 | 36.741 | 36.776 | 36.936 | 37.000 | 36.831 | 36.912 | 37.021 | 37.235 | 37.362 |
| OFFSETS         | -12.340 | -10.949 | -10.650 | -9.149 | -6.967 | -6.543 | -3.343 | -0.543 | 0.000  | 3.097  | 6.297  | 9.997  | 11.497 | 11.922 | 12.922 | 15.544 |

CH: 620.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

| No. | Revision           | By | Chk | Appd | Date     |
|-----|--------------------|----|-----|------|----------|
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design                                       | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Design Verifier                              |         |          |                            |
| 1:200               | Design Check                                 |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|         |                                      |
|---------|--------------------------------------|
| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

|                                 |                   |
|---------------------------------|-------------------|
| Title:                          | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 6 | CIVIL ENGINEERING |
| Drawing No.                     | Rev.              |
| 3230635-CA-0556                 | A                 |

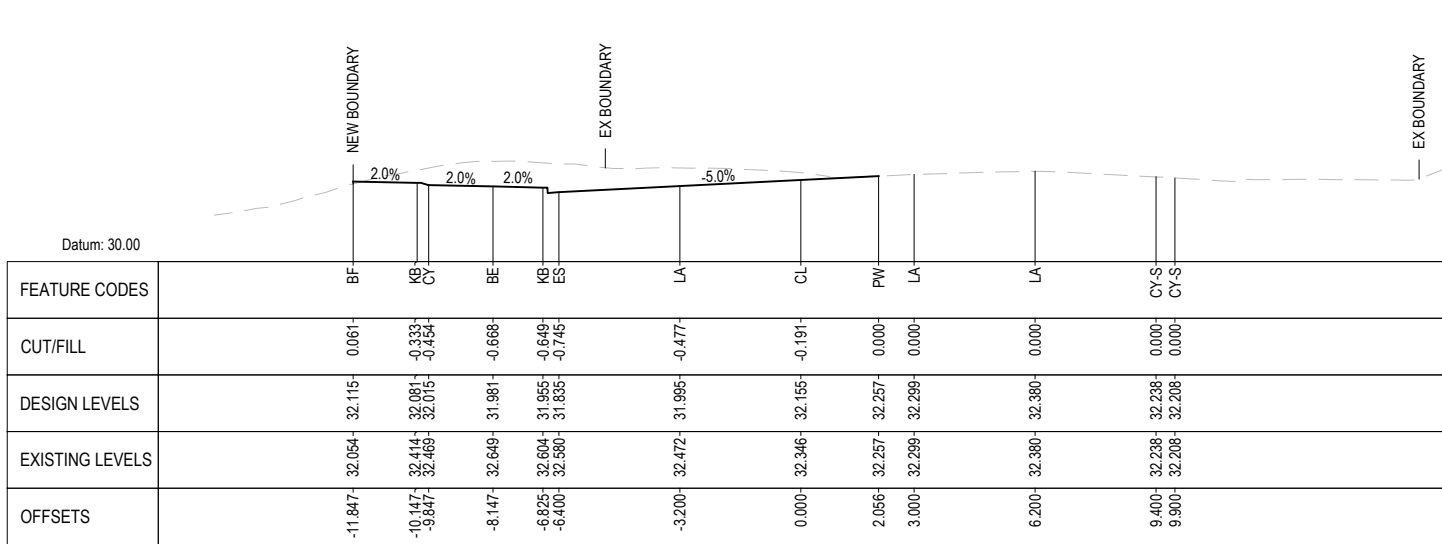


NOTES

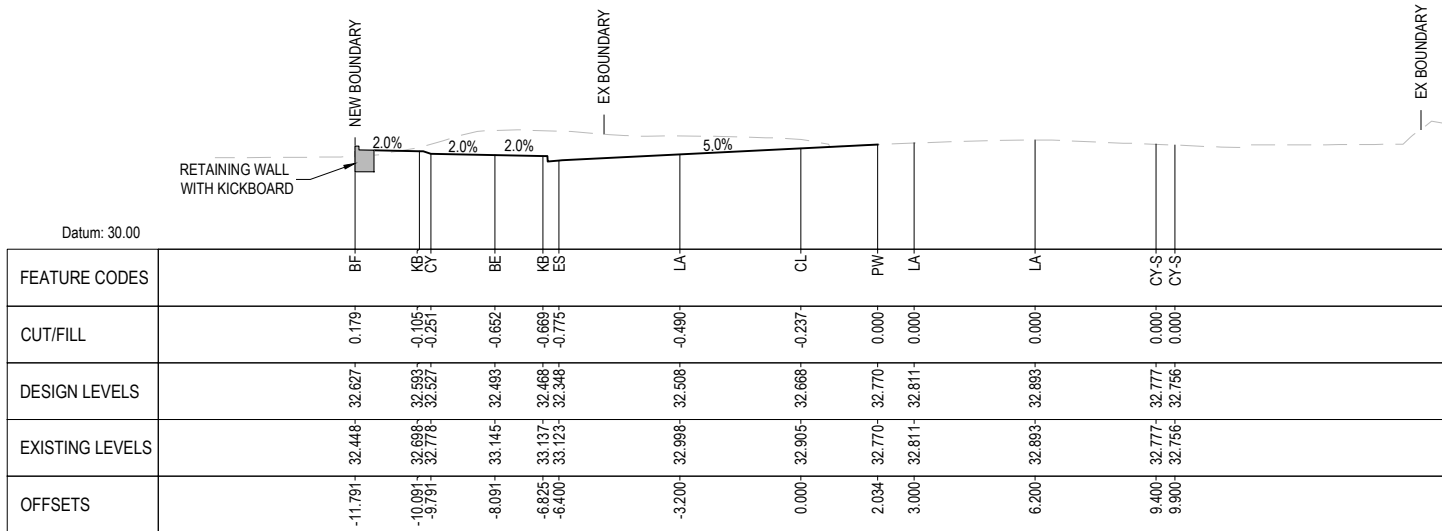
1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

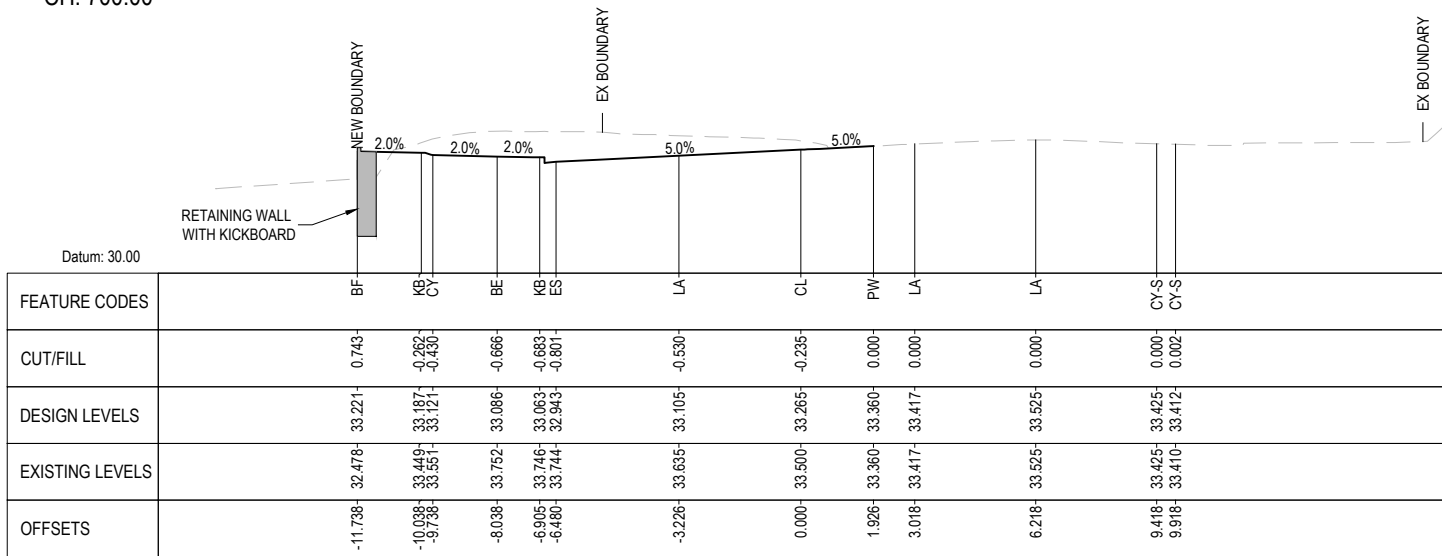
|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



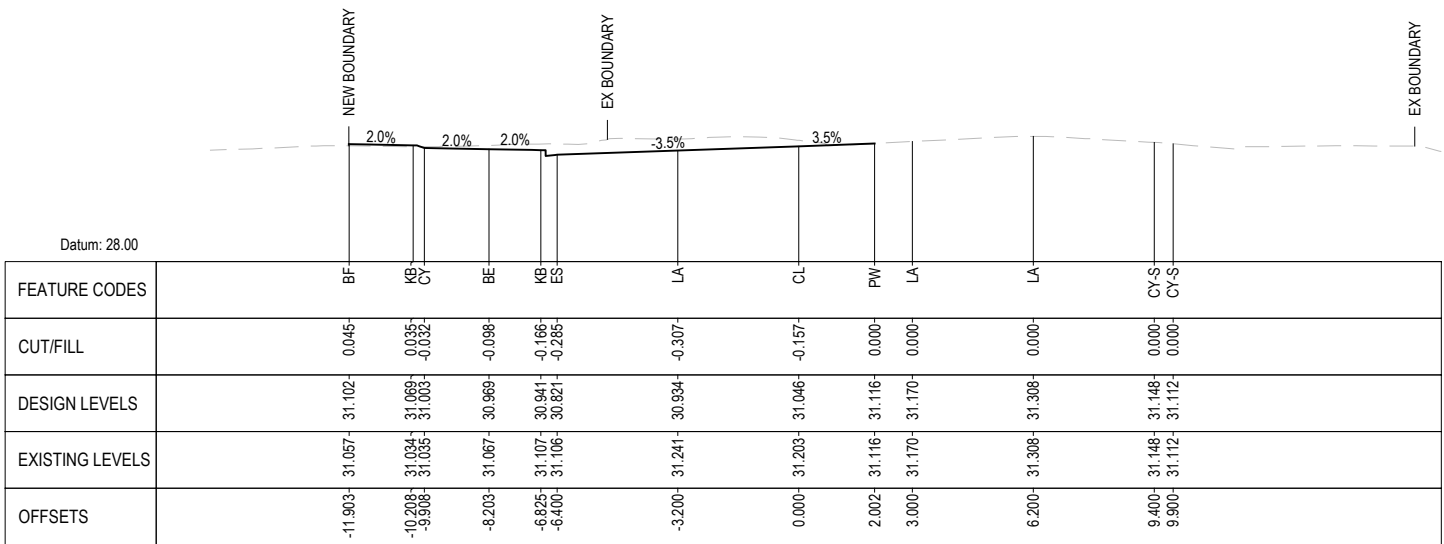
CH: 720.00



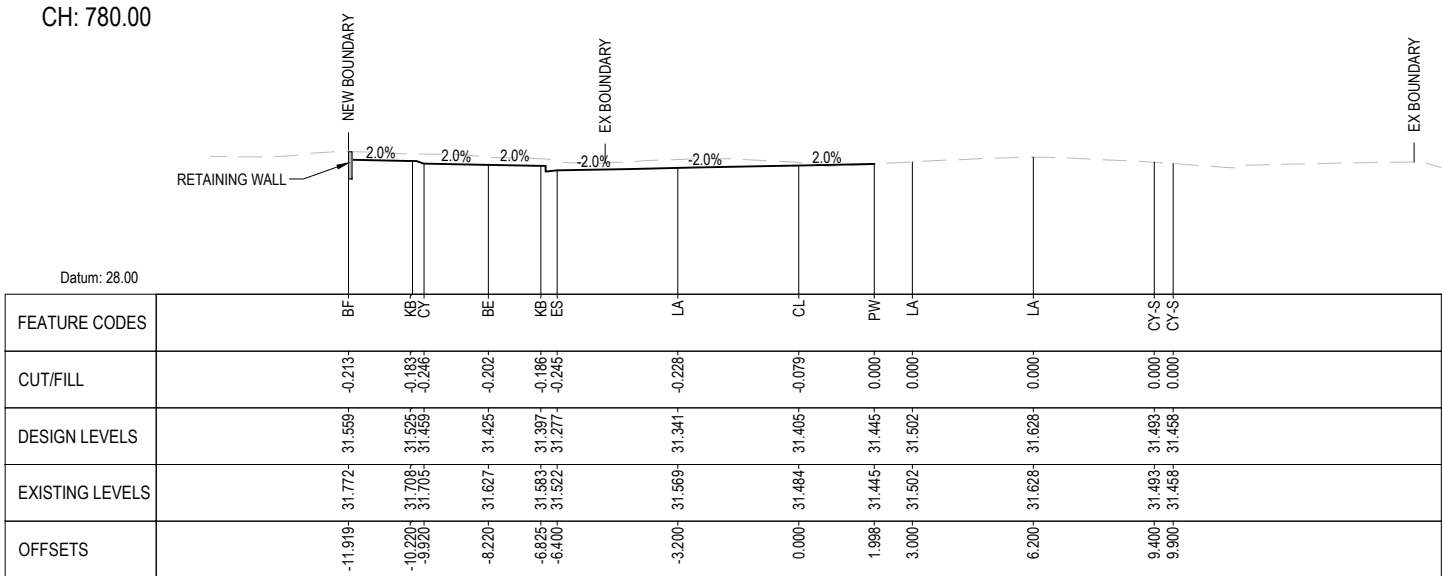
CH: 700.00



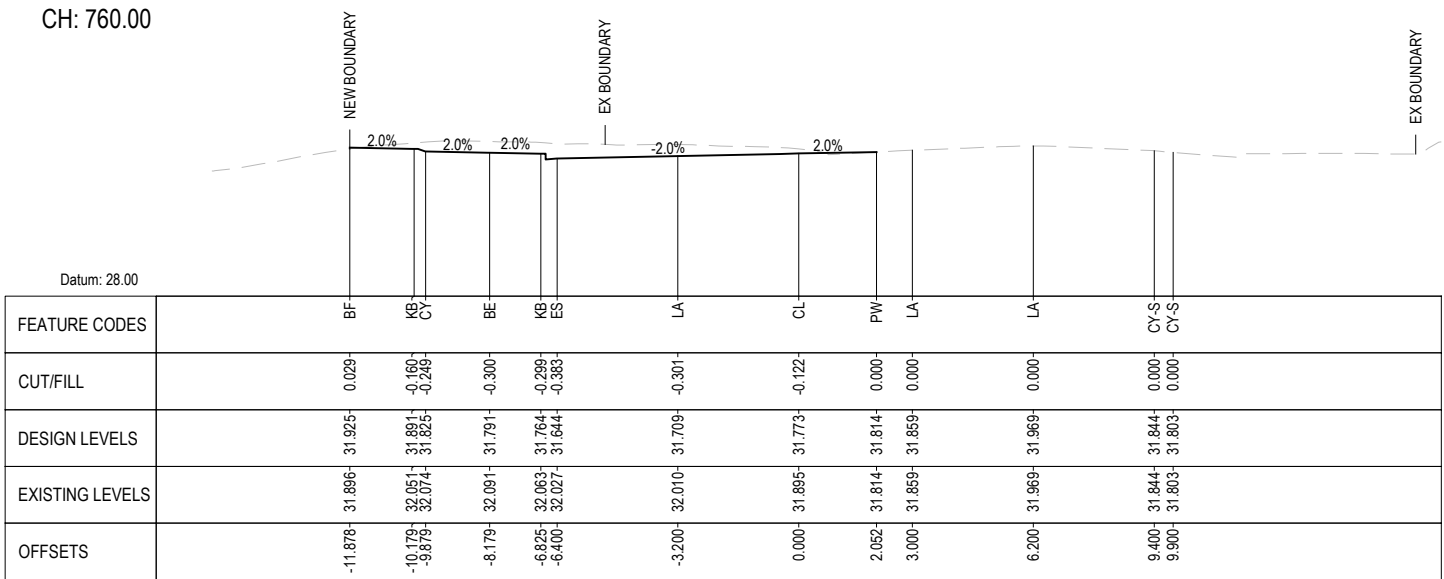
CH: 680.00



CH: 780.00



CH: 760.00



CH: 740.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design Drawn                                 | A. HOLT | 15.11.24 | Approved For Construction* |
| Reduced Scale (A3)  | Design Verifier                              | L. CHEN | 15.11.24 | Date                       |
| 1:200               | Dwg Check                                    |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|         |                                      |
|---------|--------------------------------------|
| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

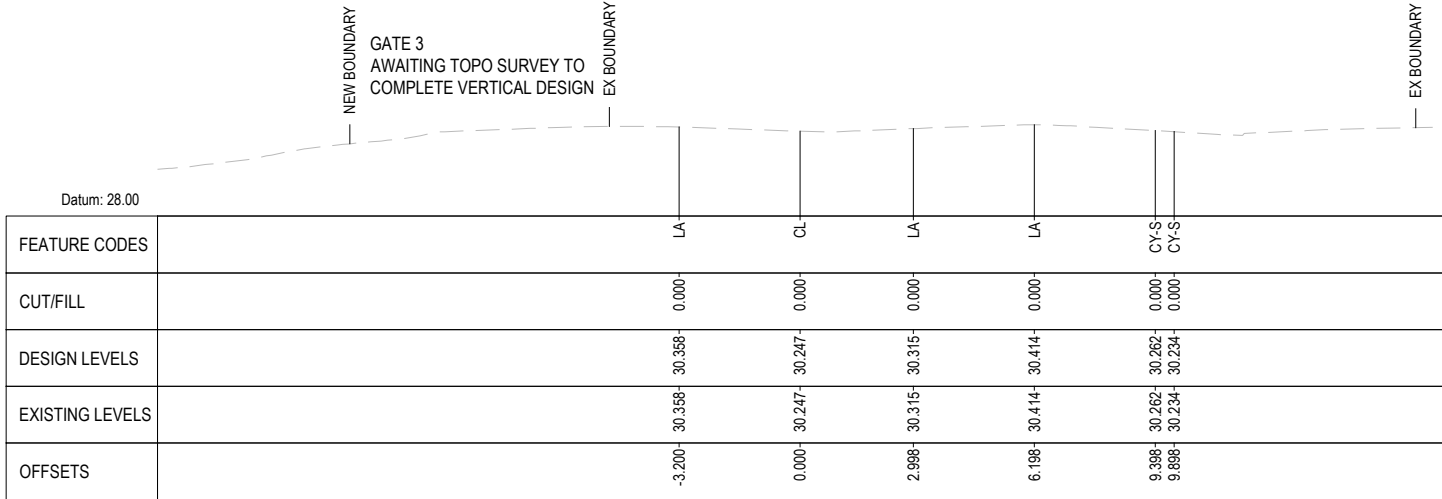
|                                 |                   |
|---------------------------------|-------------------|
| Title:                          | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 7 | CIVIL ENGINEERING |
| Document No. 3230635-CA-0557    | Rev. A            |

NOTES

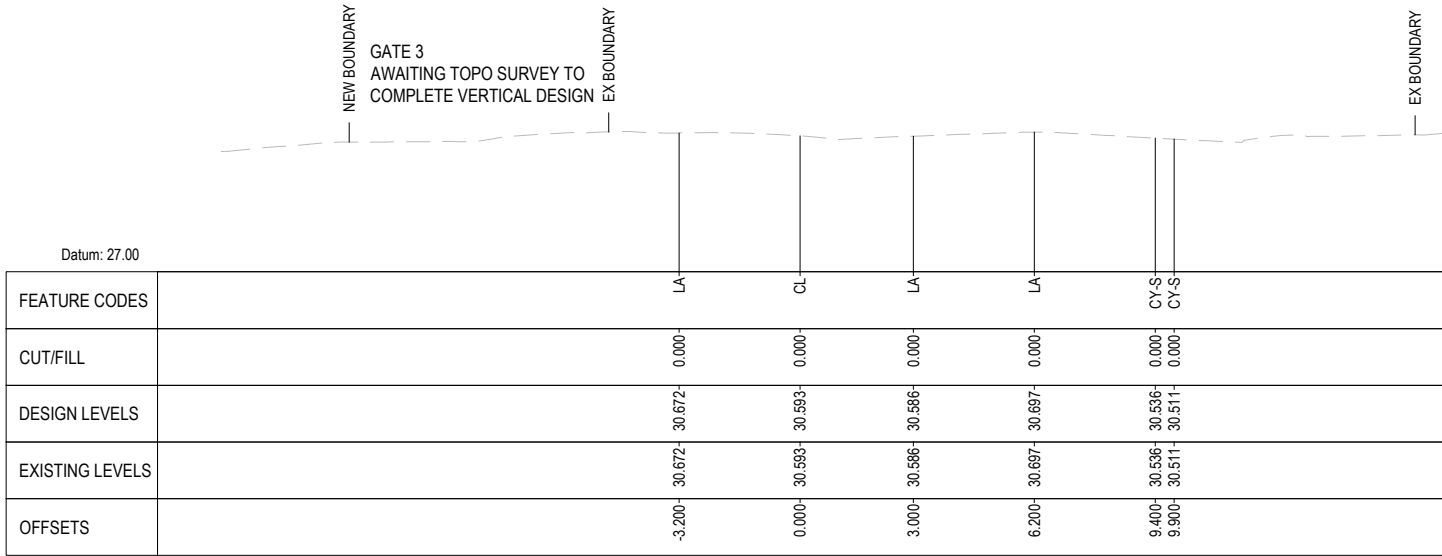
1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

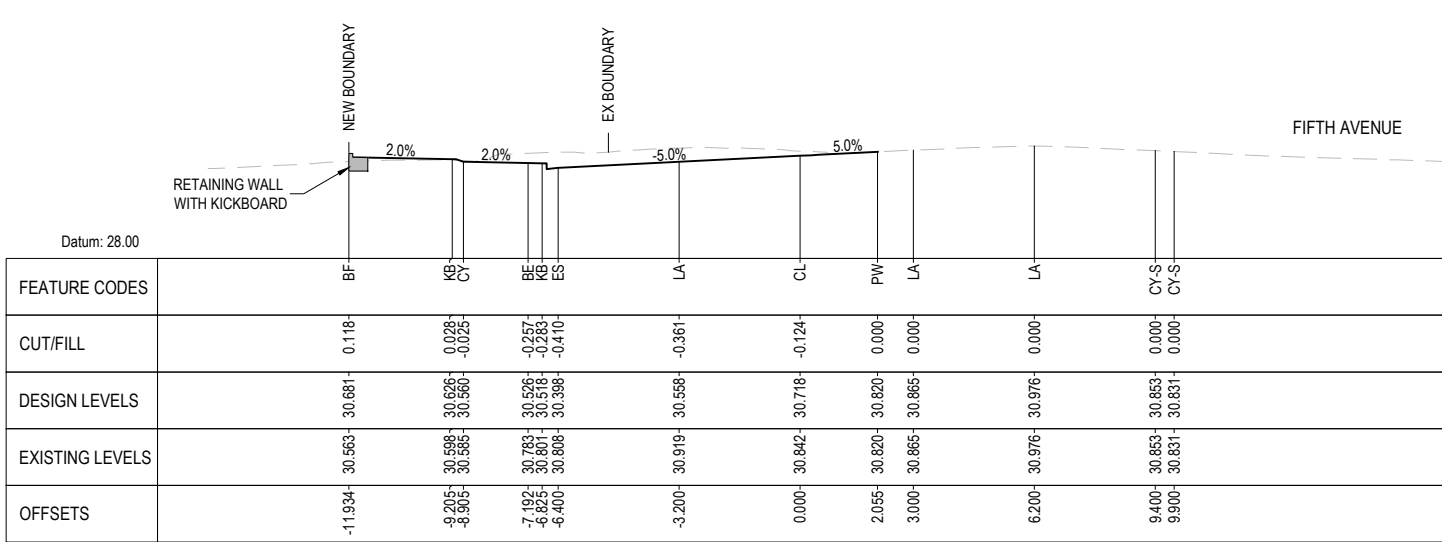
|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



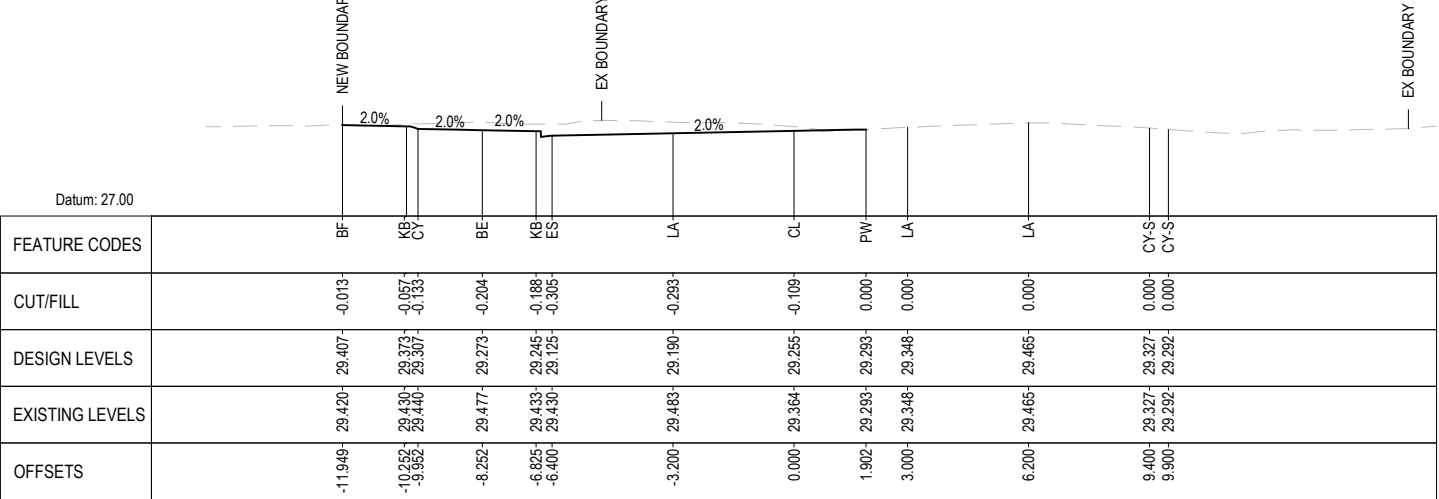
CH: 840.00



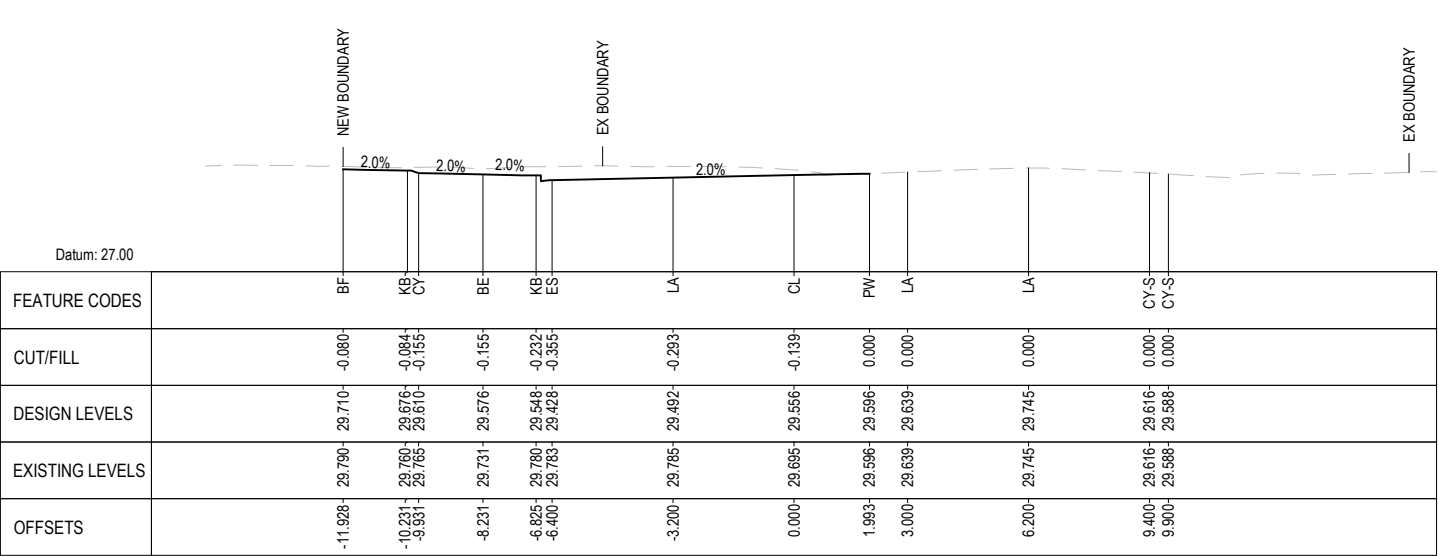
CH: 820.00



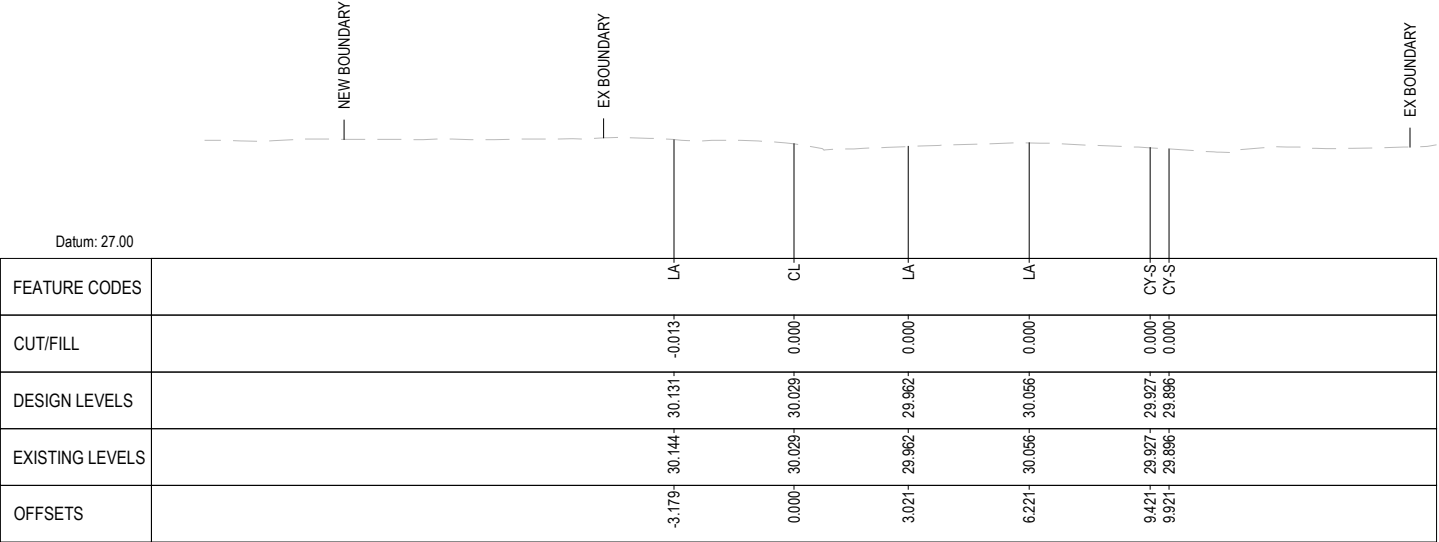
CH: 800.00



CH: 900.00



CH: 880.00



CH: 860.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

|     |                    |    |     |      |          |  |  |  |  |
|-----|--------------------|----|-----|------|----------|--|--|--|--|
|     |                    |    |     |      |          |  |  |  |  |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |  |  |  |  |
| No. | Revision           | By | Chk | Appd | Date     |  |  |  |  |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design                                       | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 |                            |
| Reduced Scale (A3)  | Design                                       |         |          |                            |
| 1:200               | Check  |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



Client:

Project: CARRINGTON ROAD IMPROVEMENTS PROJECT

Title: DETAILED CROSS SECTIONS SHEET 8

|             |                   |
|-------------|-------------------|
| Discipline  | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0558   |
| Rev.        | A                 |



NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

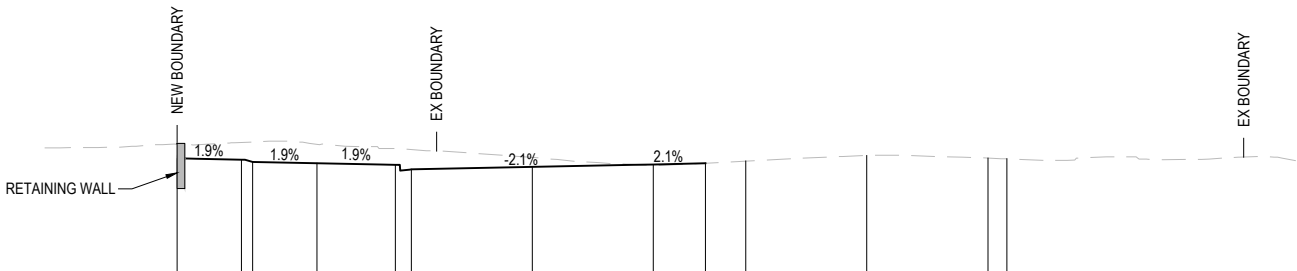
FEATURE CODE LEGEND

|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |

www.beca.com

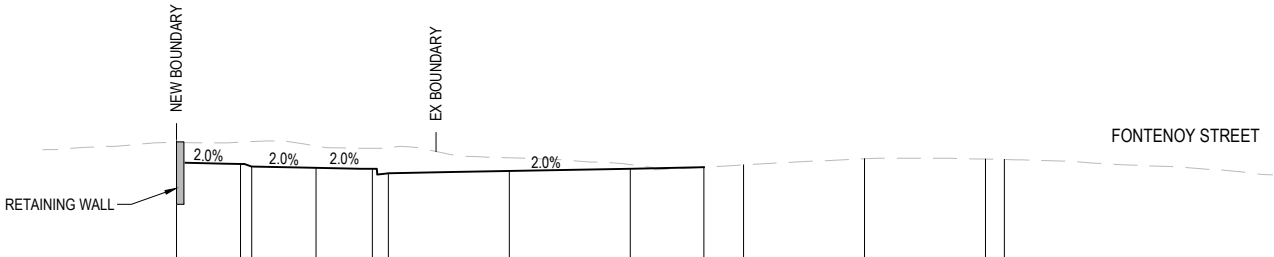
www.beca.com

Document No. 3230635-CA-0559.DWG



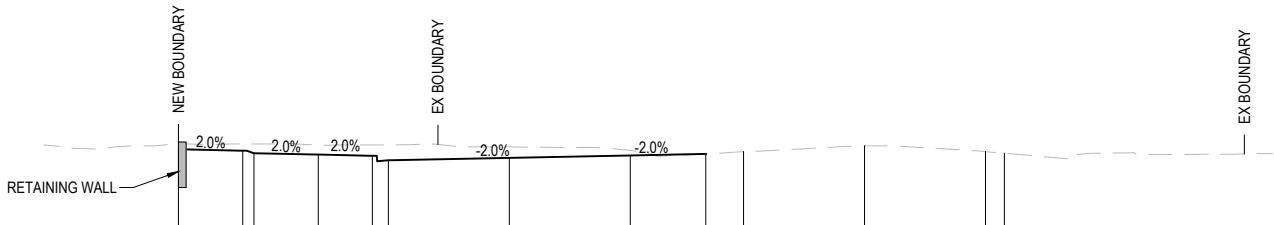
| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.372  | -0.455  | -0.534  | -0.504 | -0.434 | -0.523 | -0.249 | 0.030  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 28.134  | 28.101  | 28.035  | 28.002 | 27.962 | 27.843 | 27.909 | 27.975 | 28.004 | 28.062 | 28.212 | 28.140 | 28.121 |
| EXISTING LEVELS | 28.506  | 28.556  | 28.569  | 28.506 | 28.396 | 28.366 | 28.158 | 27.945 | 28.004 | 28.062 | 28.212 | 28.140 | 28.121 |
| OFFSETS         | -12.597 | -10.899 | -10.599 | -8.898 | -6.825 | -6.400 | -3.200 | 0.000  | 1.380  | 2.446  | 5.649  | 8.852  | 9.352  |

CH: 960.00



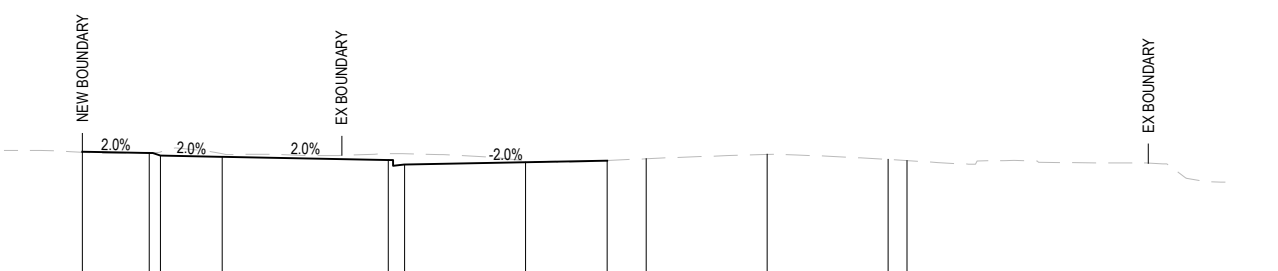
| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.534  | -0.575  | -0.657  | -0.577 | -0.543 | -0.679 | -0.350 | -0.107 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 28.701  | 28.666  | 28.600  | 28.566 | 28.536 | 28.416 | 28.479 | 28.541 | 28.579 | 28.640 | 28.804 | 28.794 | 28.784 |
| EXISTING LEVELS | 29.235  | 29.241  | 29.257  | 29.143 | 29.079 | 29.095 | 28.829 | 28.648 | 28.579 | 28.640 | 28.804 | 28.794 | 28.784 |
| OFFSETS         | -12.009 | -10.312 | -10.012 | -8.312 | -6.825 | -6.400 | -3.200 | 0.000  | 1.946  | 3.000  | 6.200  | 9.400  | 9.900  |

CH: 940.00



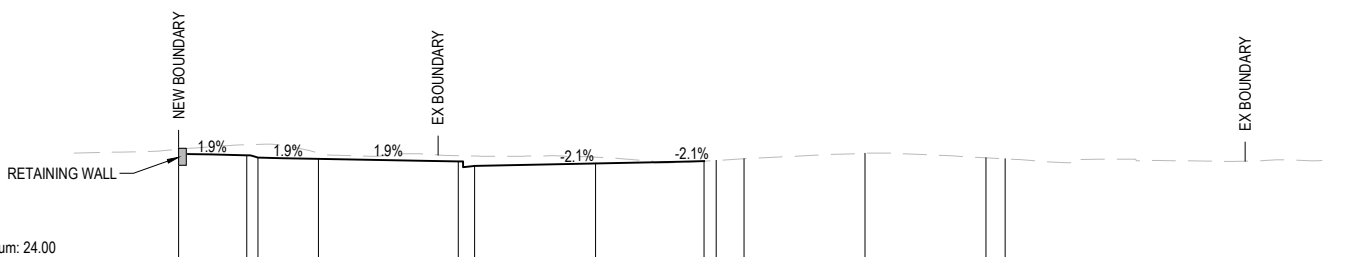
| FEATURE CODES   | BF      | KB      | CY     | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.161  | -0.180  | -0.248 | -0.257 | -0.283 | -0.403 | -0.294 | -0.132 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 29.118  | 29.084  | 29.018 | 28.984 | 28.955 | 28.835 | 28.899 | 28.963 | 29.002 | 29.059 | 29.217 | 29.061 | 29.018 |
| EXISTING LEVELS | 29.279  | 29.264  | 29.266 | 29.241 | 29.238 | 29.238 | 29.193 | 29.095 | 29.002 | 29.059 | 29.217 | 29.061 | 29.018 |
| OFFSETS         | -11.954 | -10.254 | -9.954 | -8.254 | -6.825 | -6.400 | -3.200 | 0.000  | 1.994  | 3.000  | 6.200  | 9.400  | 9.900  |

CH: 920.00



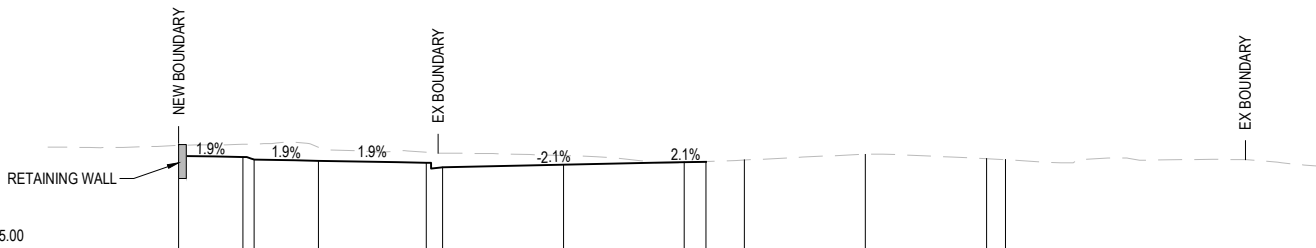
| FEATURE CODES   | BF      | KB      | CY      | BE      | KB     | ES     | LA     | PW     | CL     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | 0.017   | -0.015  | -0.068  | -0.078  | -0.168 | -0.286 | -0.036 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 26.311  | 26.275  | 26.209  | 26.177  | 26.088 | 25.968 | 26.032 | 26.076 | 26.125 | 26.238 | 26.104 | 26.076 |
| EXISTING LEVELS | 26.294  | 26.290  | 26.307  | 26.255  | 26.256 | 26.254 | 26.068 | 26.076 | 26.125 | 26.238 | 26.104 | 26.076 |
| OFFSETS         | -14.922 | -13.156 | -12.856 | -11.223 | -6.825 | -6.400 | -3.200 | -1.041 | 0.000  | 3.200  | 6.400  | 6.900  |

CH: 1020.00



| FEATURE CODES   | BF      | KB      | CY      | BE      | KB     | ES     | LA     | PW     | CL     | LA     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.122  | -0.278  | -0.353  | -0.157  | -0.155 | -0.263 | -0.162 | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 26.931  | 26.897  | 26.831  | 26.801  | 26.732 | 26.612 | 26.680 | 26.741 | 26.799 | 26.802 | 26.948 | 26.829 | 26.801 |
| EXISTING LEVELS | 27.053  | 27.175  | 27.184  | 26.958  | 26.897 | 26.875 | 26.842 | 26.741 | 26.759 | 26.802 | 26.948 | 26.829 | 26.801 |
| OFFSETS         | -14.227 | -12.428 | -12.128 | -10.526 | -6.825 | -6.400 | -3.200 | -0.325 | 0.732  | 3.934  | 7.137  | 7.638  | 7.638  |

CH: 1000.00



| FEATURE CODES   | BF      | KB      | CY      | BE     | KB     | ES     | LA     | CL     | PW     | LA     | LA     | CY-S   | CY-S   |
|-----------------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CUT/FILL        | -0.276  | -0.339  | -0.407  | -0.356 | -0.277 | -0.373 | -0.245 | 0.011  | 0.000  | 0.000  | 0.000  | 0.000  | 0.000  |
| DESIGN LEVELS   | 27.560  | 27.528  | 27.463  | 27.430 | 27.371 | 27.257 | 27.325 | 27.393 | 27.405 | 27.448 | 27.599 | 27.483 | 27.456 |
| EXISTING LEVELS | 27.836  | 27.865  | 27.870  | 27.786 | 27.654 | 27.630 | 27.570 | 27.382 | 27.405 | 27.448 | 27.599 | 27.483 | 27.456 |
| OFFSETS         | -13.378 | -11.679 | -11.379 | -9.678 | -6.825 | -6.400 | -3.200 | 0.000  | 0.572  | 1.588  | 4.791  | 7.994  | 8.495  |

CH: 980.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

| No. | Revision           | By | Chk | Appd | Date     |
|-----|--------------------|----|-----|------|----------|
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |

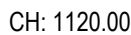
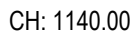
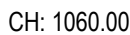
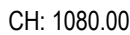
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|--|----------------------------|----------|----------------------------|
| Original Scale (A1)<br>1:100                 | Design Drawn<br>A. HOLT    | 15.11.24 | Approved For Construction* |
| Reduced Scale (A3)<br>1:200                  | Design Verifier<br>L. CHEN | 15.11.24 | Date                       |
| * Refer to Revision 1 for Original Signature |                            |          |                            |



|         |                                      |
|---------|--------------------------------------|
| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

|                                 |                   |
|---------------------------------|-------------------|
| Title:                          | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 9 | CIVIL ENGINEERING |
| Drawing No.                     | Rev.              |
| 3230635-CA-0559                 | A                 |

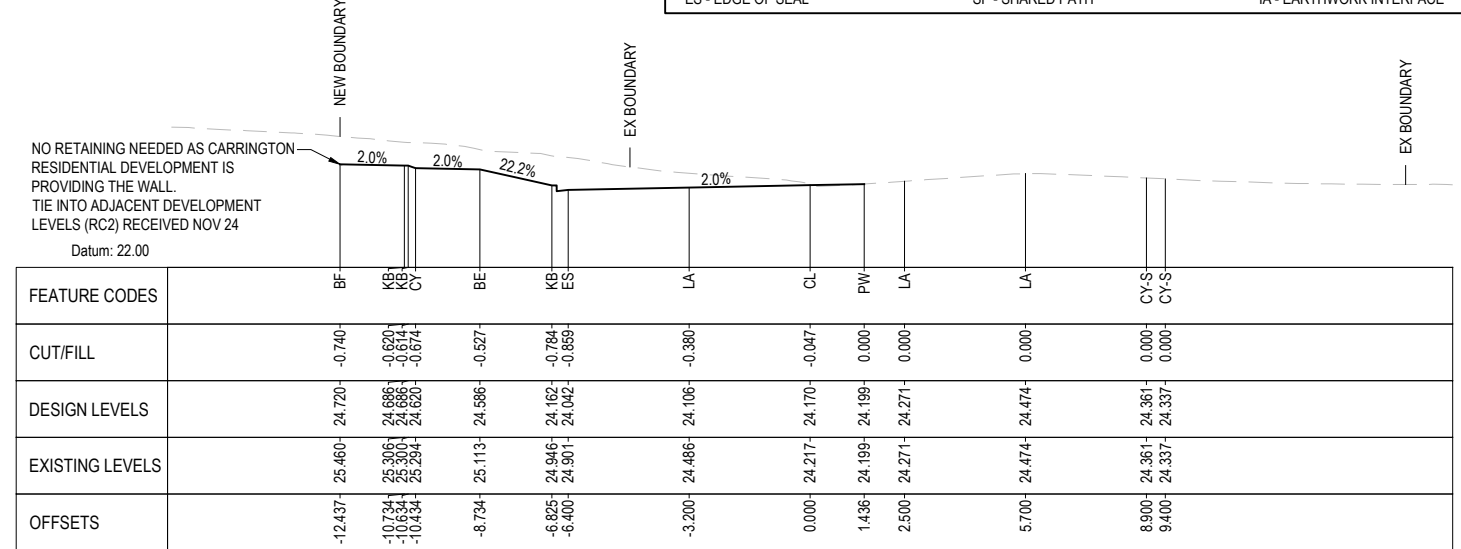
| FEATURE CODE LEGEND             |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



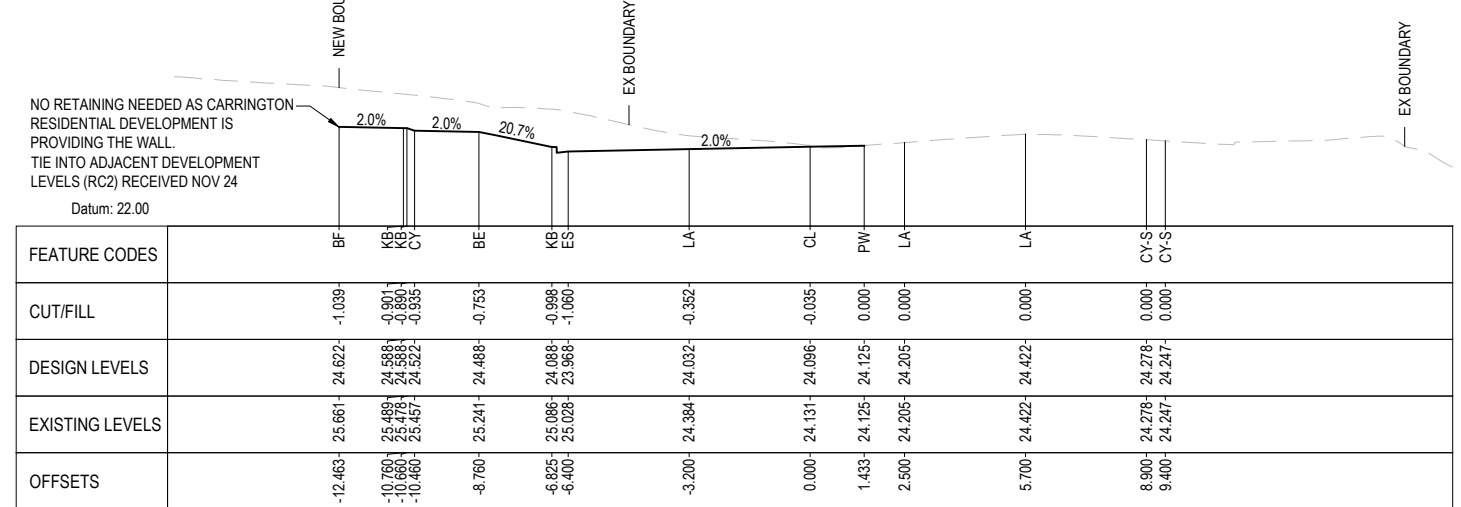
|             |                 |                   |
|-------------|-----------------|-------------------|
| Discipline  |                 | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0560 | Rev.<br>A         |

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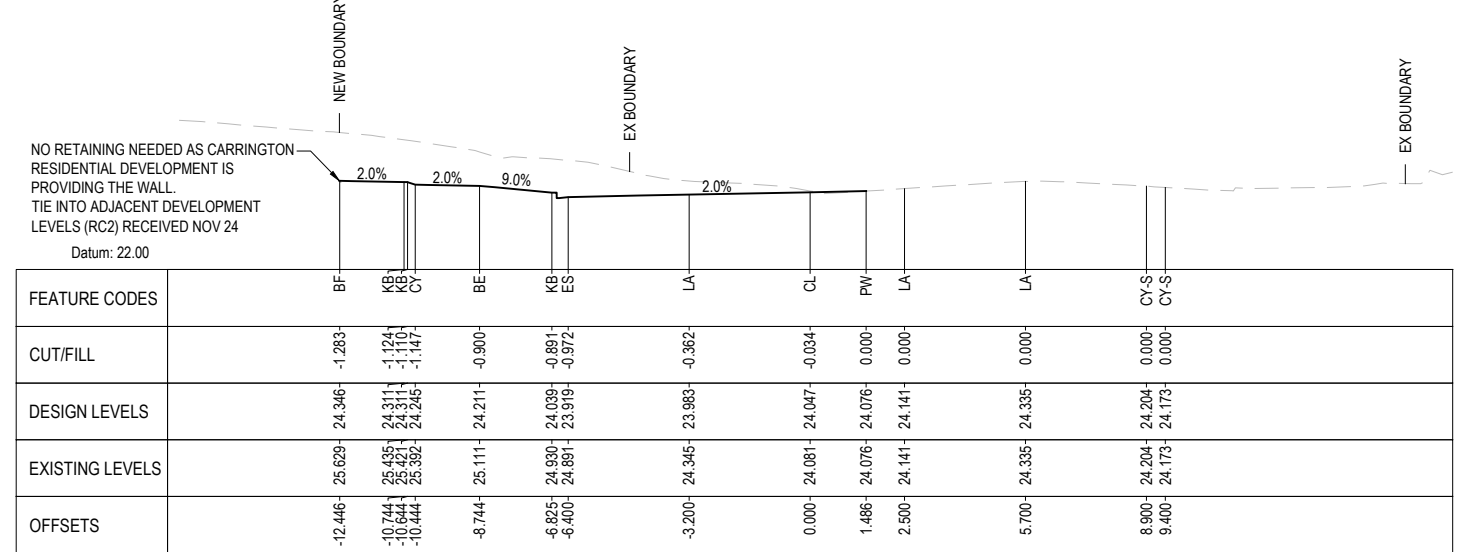




CH: 1260.00



CH: 1240.00



CH: 1220.00

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| A   | PRELIMINARY DESIGN | AH | CD  | CMA 18.12.24 |
| No. | Revision           | By | Chk | Appd Date    |

Project: **CARRINGTON ROAD  
IMPROVEMENTS PROJECT**

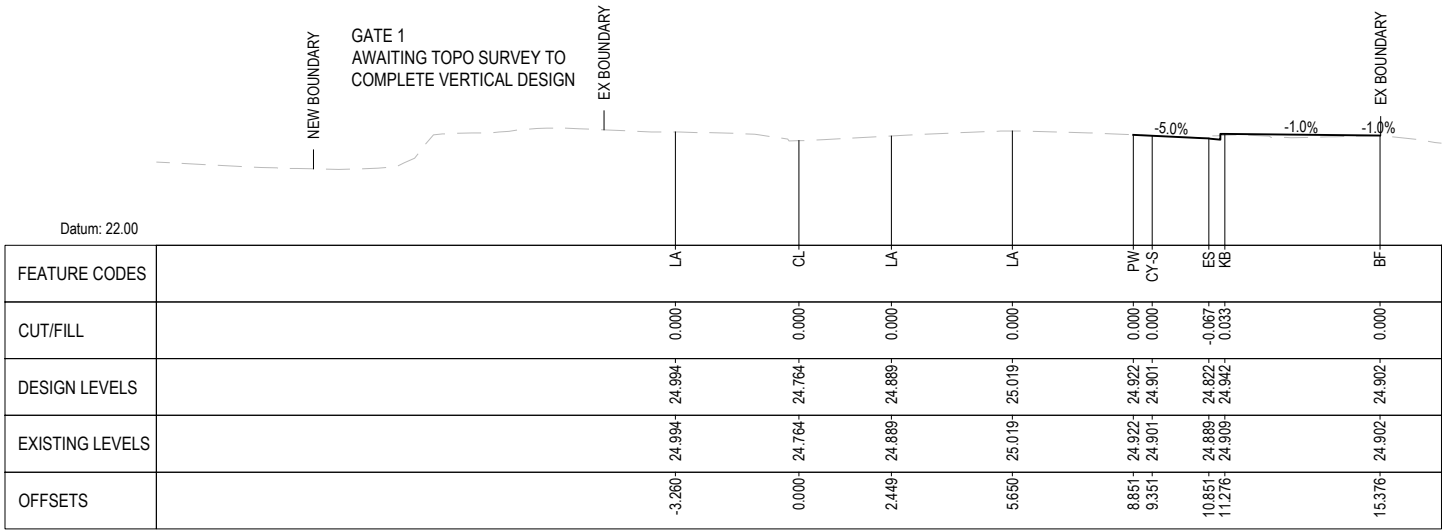
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| Discipline  |                 | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0561 | Rev.<br>A         |

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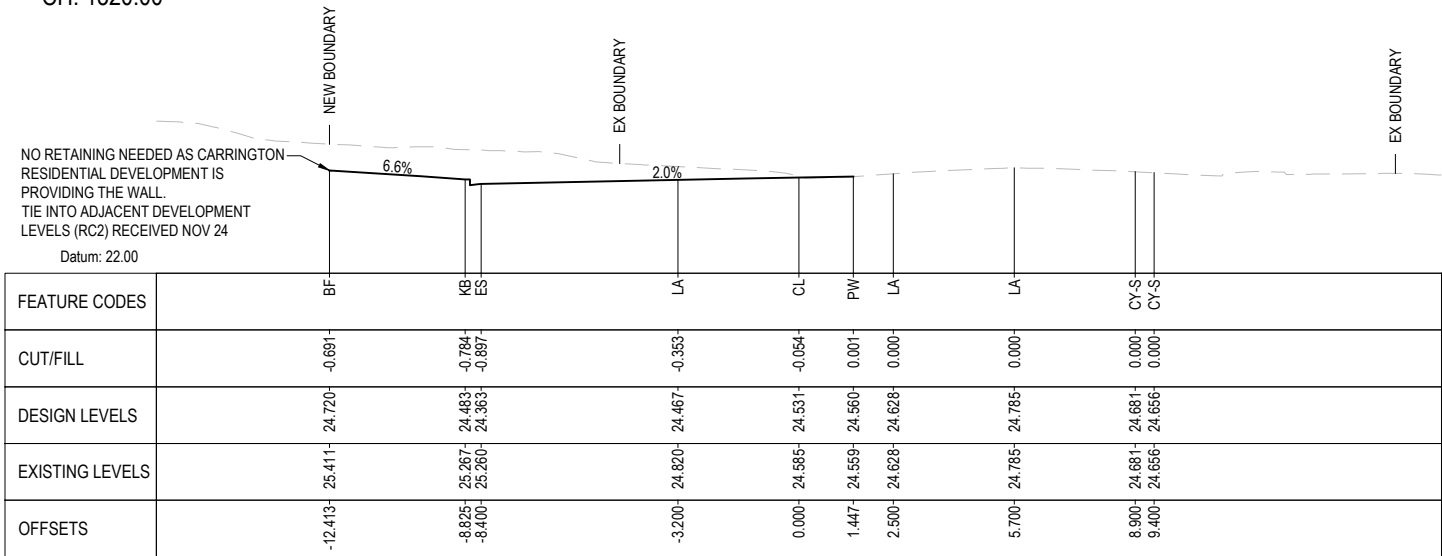
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FEATURE CODE LEGEND

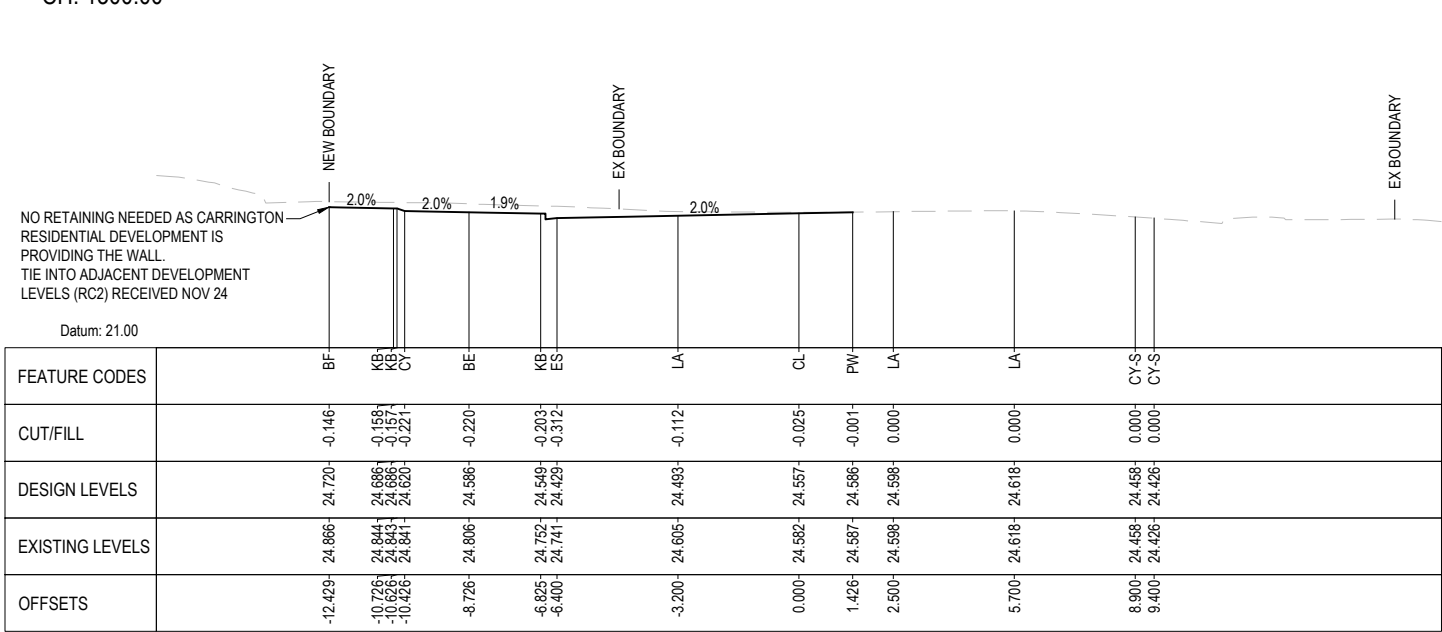
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LA - LANE LINE  
PW - START OF PAVEMENT WIDENING  
ES - EDGE OF SEAL  
KB - BACK OF KERB  
FF - FRONT OF FOOTPATH  
BF - BACK OF FOOTPATH  
SP - SHARED PATH  
BE - BERM  
CY - CYCLE LANE  
CY-S - CYCLE LANE SEPARATOR  
IA - EARTHWORK INTERFACE



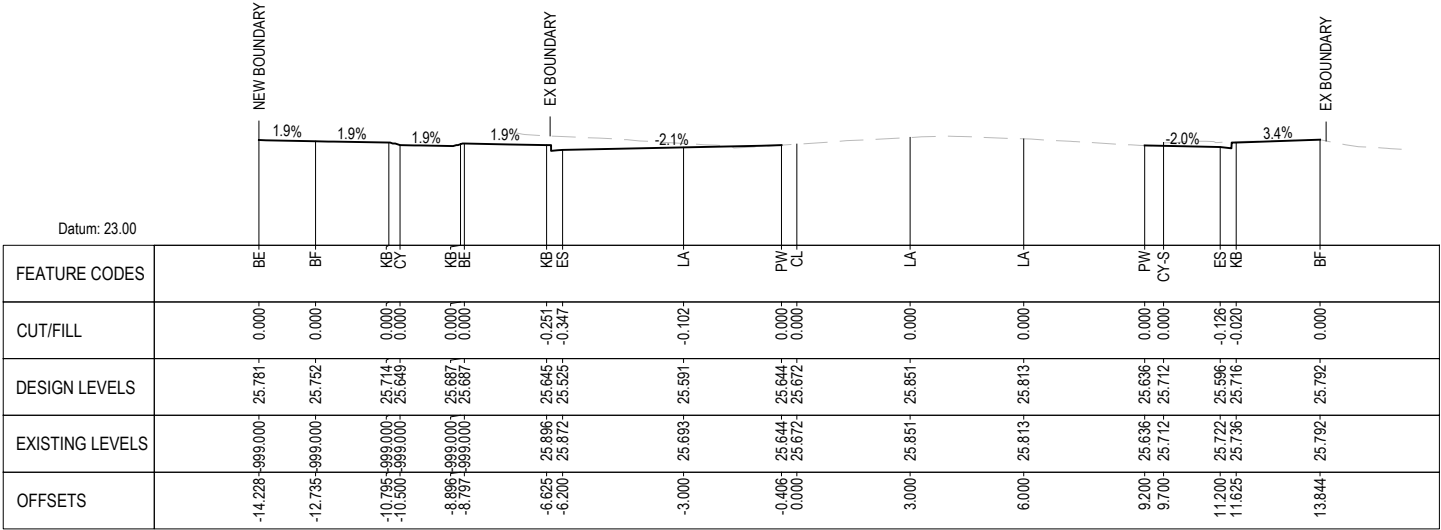
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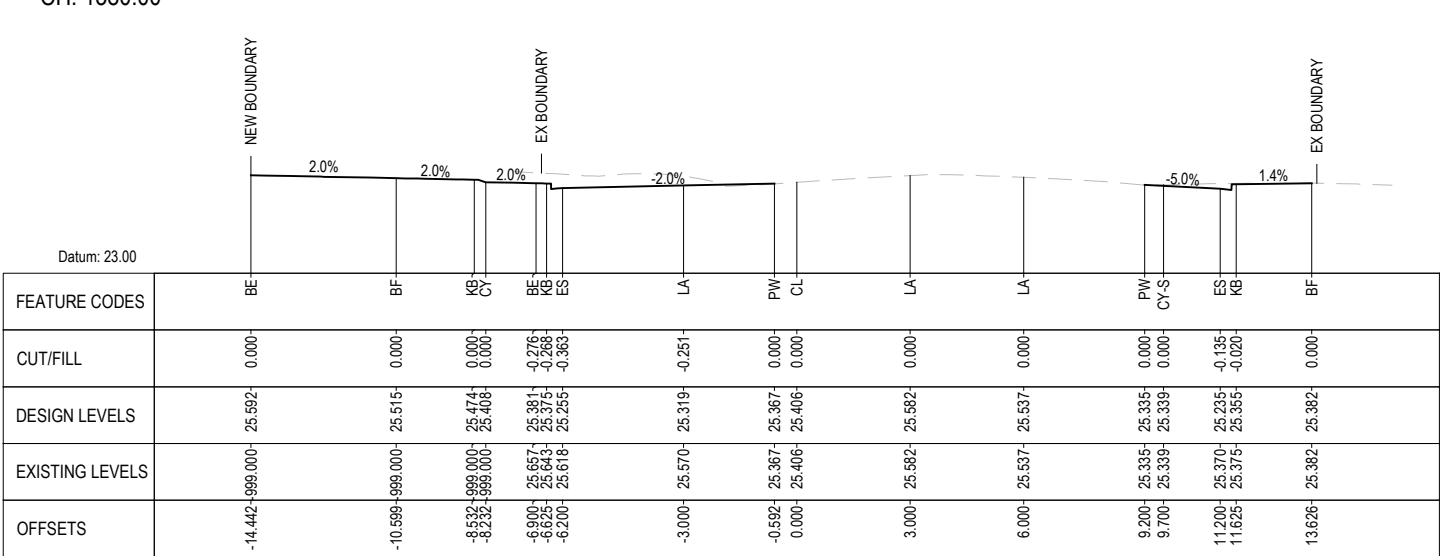
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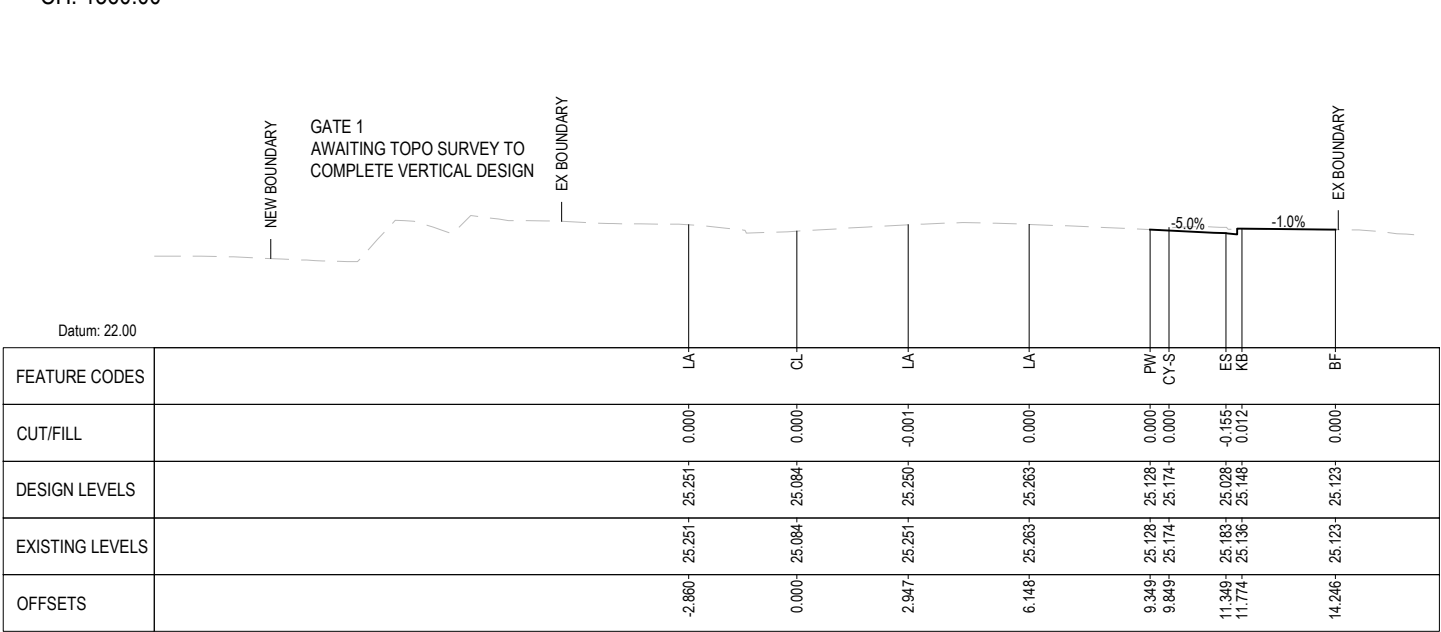
CH: 1280.00



CH: 1380.00



CH: 1360.00



CH: 1340.00

PRELIMINARY  
NOT FOR CONSTRUCTION

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| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |  |  |  |  |
| No. | Revision           | By | Chk | Appd | Date     |  |  |  |  |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design Drawn                                 | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Design Verifier                              | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Dwg Check                                    |         |          |                            |
| 1:200               | * Refer to Revision 1 for Original Signature |         |          |                            |



|         |                                      |
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| Client: | Project:                             |
|         | CARRINGTON ROAD IMPROVEMENTS PROJECT |

|                                  |                   |
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| Title:                           | Discipline:       |
| DETAILED CROSS SECTIONS SHEET 12 | CIVIL ENGINEERING |
| Drawing No.                      | Rev.              |
| 3230635-CA-0562                  | A                 |

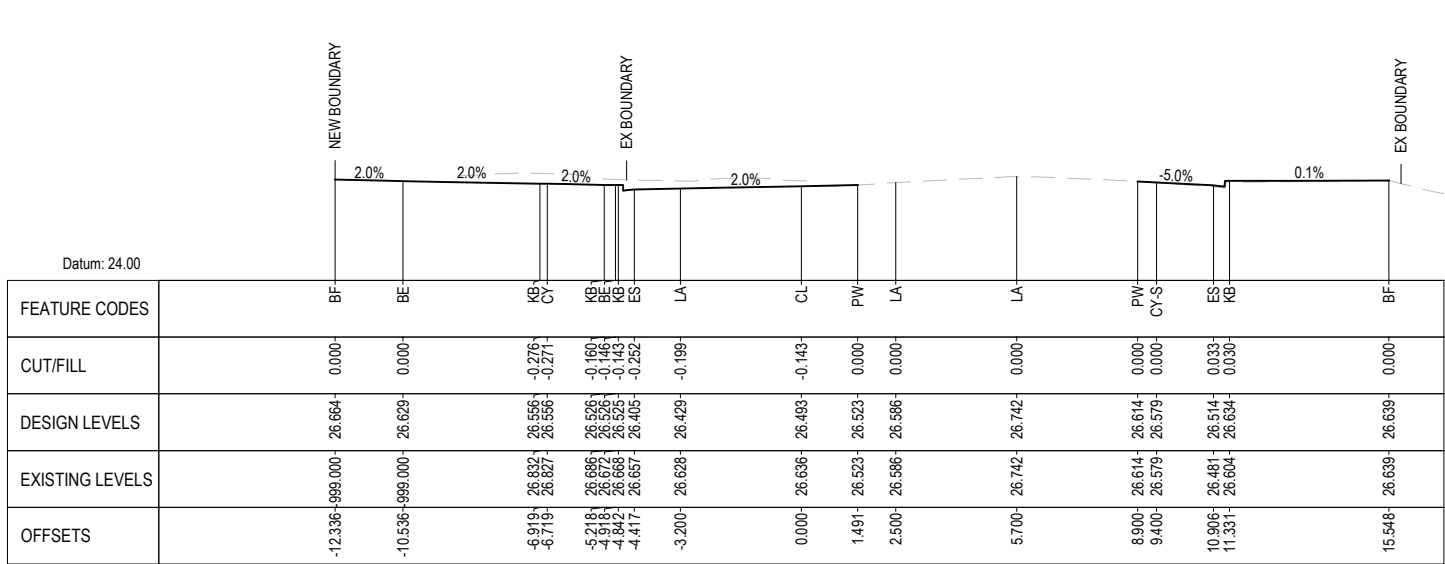


NOTES

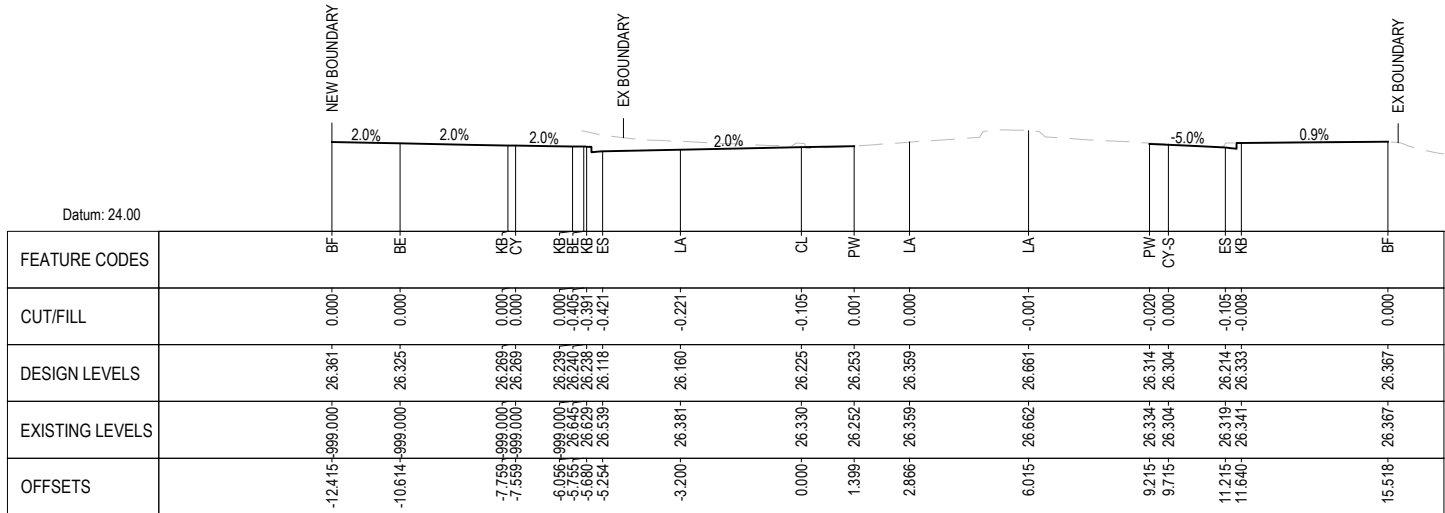
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FEATURE CODE LEGEND

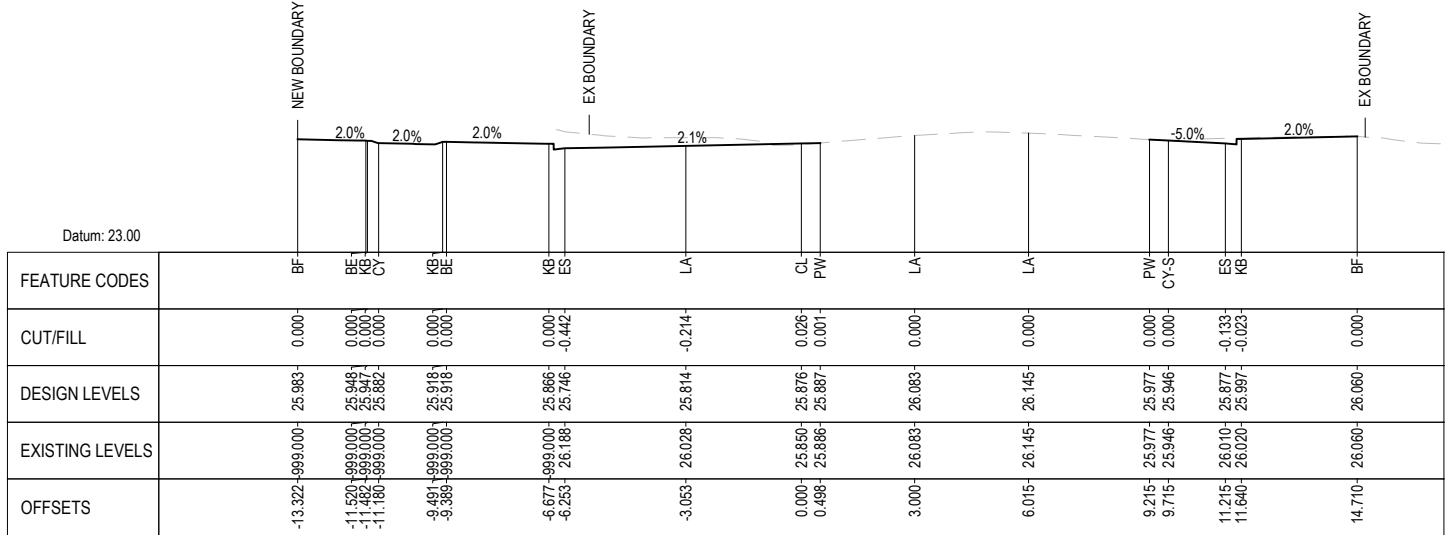
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| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |



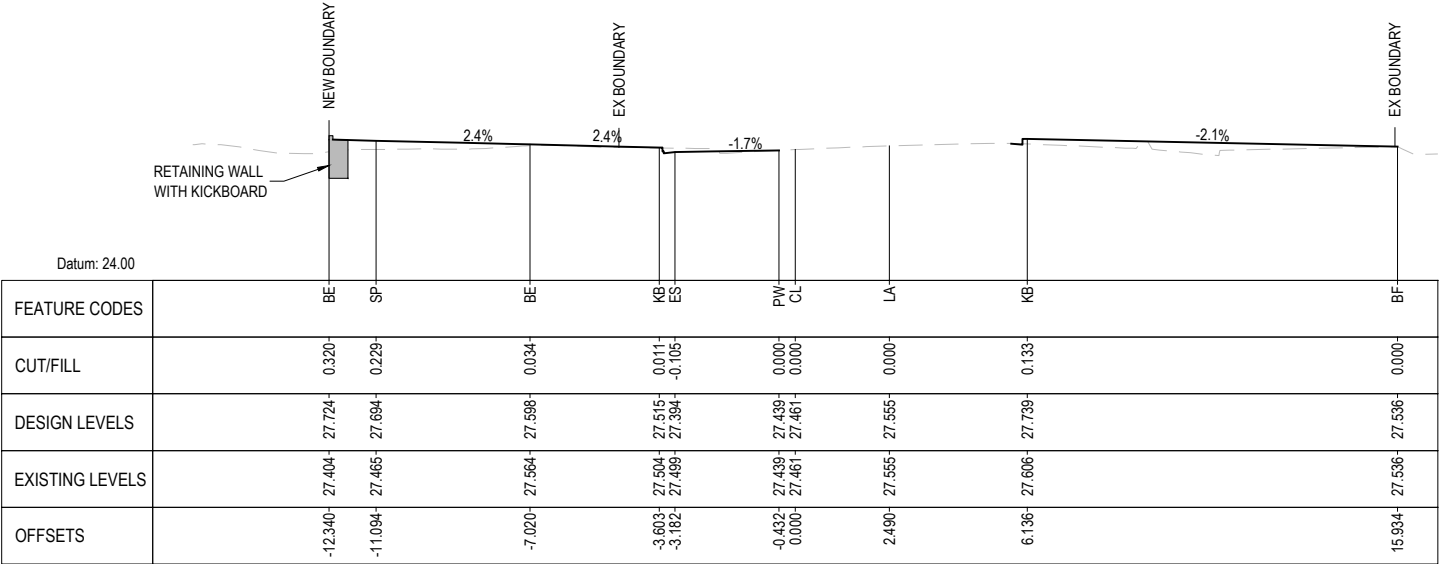
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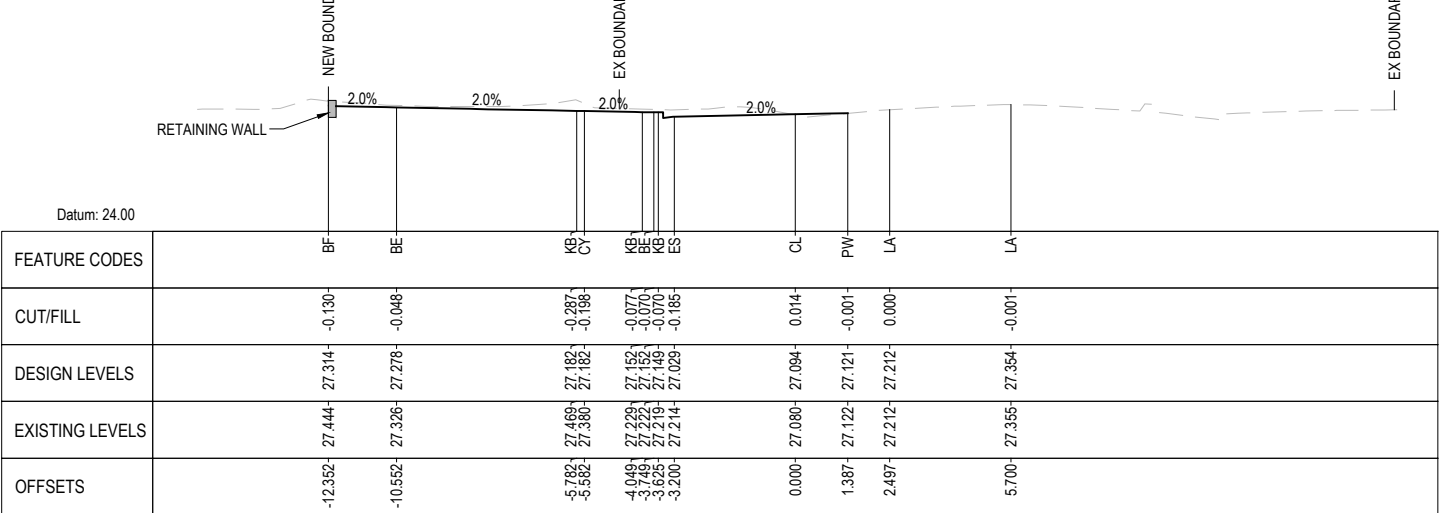
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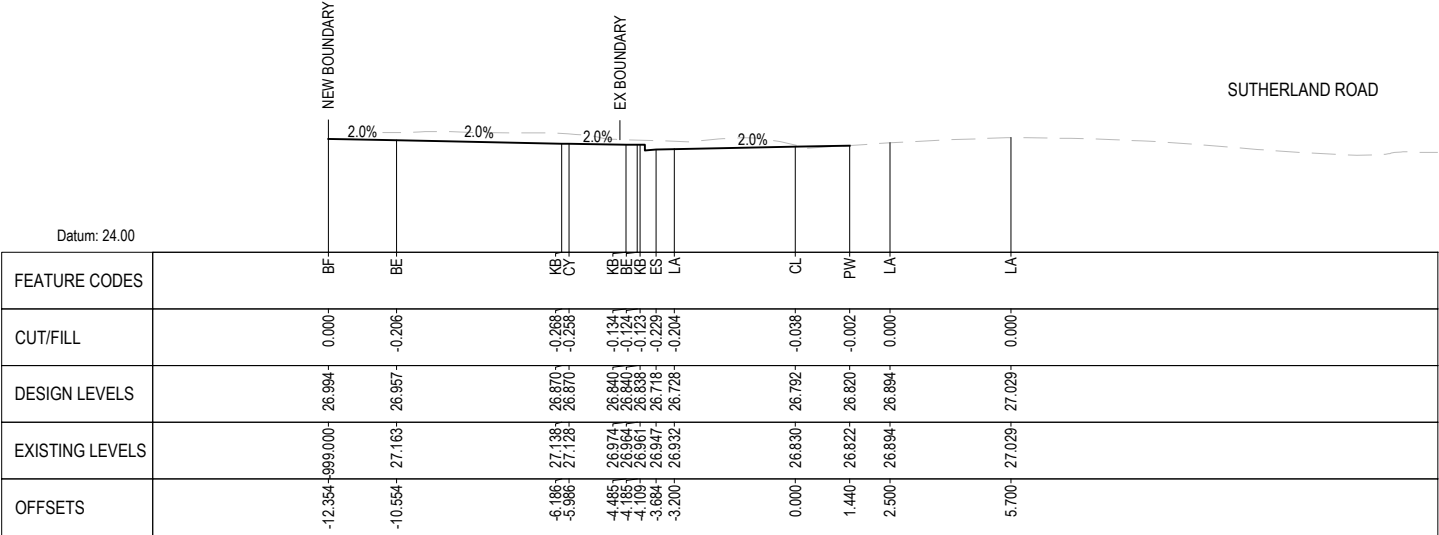
CH: 1400.00



CH: 1500.00



CH: 1480.00



CH: 1460.00

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

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|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

|                     |        |         |          |                            |
|---------------------|--------|---------|----------|----------------------------|
| Original Scale (A1) | Design | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Drawn  | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Design |         |          |                            |
| 1:200               | Check  |         |          |                            |
|                     |        |         |          |                            |



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|----------|--------------------------------------|
| Project: | CARRINGTON ROAD IMPROVEMENTS PROJECT |
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|        |                                  |
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| Title: | DETAILED CROSS SECTIONS SHEET 13 |
|--------|----------------------------------|

|             |                   |
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| Discipline: | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0563   |
| Rev.        | A                 |

NOTES

1. REFER TO DRAWINGS 3230635-CA-0201-0212 FOR CHAINAGES.

FEATURE CODE LEGEND

|                                 |                        |                             |
|---------------------------------|------------------------|-----------------------------|
| CL - CONTROL LINE/LANE          | KB - BACK OF KERB      | BE - BERM                   |
| LA - LANE LINE                  | FF - FRONT OF FOOTPATH | CY - CYCLE LANE             |
| PW - START OF PAVEMENT WIDENING | BF - BACK OF FOOTPATH  | CY-S - CYCLE LANE SEPARATOR |
| ES - EDGE OF SEAL               | SP - SHARED PATH       | IA - EARTHWORK INTERFACE    |

GREAT NORTH ROAD

Datum: 25.00

|                 |         |
|-----------------|---------|
| FEATURE CODES   | CL      |
| CUT/FILL        | 0.000-  |
| DESIGN LEVELS   | 28.402- |
| EXISTING LEVELS | 28.402- |
| OFFSETS         | 0.000-  |

CH: 1605.65

GREAT NORTH ROAD

Datum: 25.00

|                 |                      |         |         |
|-----------------|----------------------|---------|---------|
| FEATURE CODES   | KB ES                | CL      | LA      |
| CUT/FILL        | 0.006-<br>0.001-     | 0.000-  | 0.000-  |
| DESIGN LEVELS   | 28.200-<br>28.086-   | 28.404- | 28.443- |
| EXISTING LEVELS | 28.194-<br>28.085-   | 28.404- | 28.443- |
| OFFSETS         | -13.876-<br>-13.271- | 0.000-  | 3.148-  |

CH: 1600.00

EX BOUNDARY

1.7%

EX BOUNDARY

Datum: 25.00

|                 |                    |                    |         |         |
|-----------------|--------------------|--------------------|---------|---------|
| FEATURE CODES   | SP                 | KB ES              | CL      | LA      |
| CUT/FILL        | -0.033-            | 0.140-<br>-0.001-  | 0.000-  | 0.000-  |
| DESIGN LEVELS   | 28.364-<br>28.397- | 28.308-<br>28.188- | 28.326- | 28.385- |
| EXISTING LEVELS | 28.397-<br>28.397- | 28.168-<br>28.189- | 28.326- | 28.385- |
| OFFSETS         | -8.420-            | -5.119-<br>-4.678- | 0.000-  | 3.182-  |

CH: 1580.00

Datum: 25.00

|                 |                    |                    |                    |         |         |         |                    |
|-----------------|--------------------|--------------------|--------------------|---------|---------|---------|--------------------|
| FEATURE CODES   | BF                 | CY                 | KB ES              | CL      | LA      | KB      | BF                 |
| CUT/FILL        | -0.019-            | 0.226-             | 0.133-<br>0.000-   | 0.000-  | 0.000-  | 0.117-  | 0.000-             |
| DESIGN LEVELS   | 28.297-            | 28.242-            | 28.202-<br>28.082- | 28.169- | 28.243- | 28.310- | 28.399-            |
| EXISTING LEVELS | 28.316-<br>28.373- | 28.016-<br>28.016- | 28.069-<br>28.082- | 28.169- | 28.243- | 28.493- | 28.399-<br>28.399- |
| OFFSETS         | -8.373-            | -5.625-            | -3.625-<br>-3.200- | 0.000-  | 3.200-  | 7.277-  | 11.951-            |

CH: 1560.00

Datum: 25.00

|                 |                    |                    |                    |         |         |         |                    |
|-----------------|--------------------|--------------------|--------------------|---------|---------|---------|--------------------|
| FEATURE CODES   | BF                 | CY                 | KB ES              | CL      | LA      | KB      | BF                 |
| CUT/FILL        | -0.019-            | 0.232-             | 0.130-<br>0.000-   | 0.000-  | 0.000-  | 0.105-  | 0.000-             |
| DESIGN LEVELS   | 28.166-            | 28.111-            | 28.071-<br>27.951- | 28.038- | 28.085- | 28.149- | 28.250-            |
| EXISTING LEVELS | 28.185-<br>28.382- | 27.879-<br>27.879- | 27.941-<br>27.951- | 28.038- | 28.085- | 28.044- | 28.250-<br>28.250- |
| OFFSETS         | -8.382-            | -5.625-            | -3.625-<br>-3.200- | 0.000-  | 2.915-  | 7.290-  | 11.949-            |

CH: 1540.00

NEW BOUNDARY

-0.9%

-0.9%

-0.9%

-1.6%

-1.6%

-1.6%

Datum: 23.00

|                 |                    |                    |                    |                    |                    |                    |                    |                    |
|-----------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| FEATURE CODES   | BE                 | SP                 | BE                 | KB ES              | CL                 | LA                 | KB                 | BF                 |
| CUT/FILL        | 0.000-             | -0.067-            | 0.161-             | 0.135-<br>0.000-   | 0.000-             | 0.000-             | 0.136-             | 0.000-             |
| DESIGN LEVELS   | 27.790-            | 27.836-            | 27.869-            | 27.878-<br>27.758- | 27.850-            | 27.889-            | 27.930-            | 27.801-            |
| EXISTING LEVELS | 27.790-<br>27.790- | 27.903-<br>27.903- | 27.708-<br>27.743- | 27.878-<br>27.758- | 27.850-<br>27.850- | 27.889-<br>27.889- | 27.794-<br>27.794- | 27.801-<br>27.801- |
| OFFSETS         | -13.539-           | -8.354-            | -4.625-            | -3.625-<br>-3.200- | 0.000-             | 2.297-             | 6.865-             | 14.792-            |

CH: 1520.00

PRELIMINARY  
NOT FOR CONSTRUCTION

|     |                    |    |     |      |          |
|-----|--------------------|----|-----|------|----------|
|     |                    |    |     |      |          |
| A   | PRELIMINARY DESIGN | AH | CD  | CMA  | 18.12.24 |
| No. | Revision           | By | Chk | Appd | Date     |

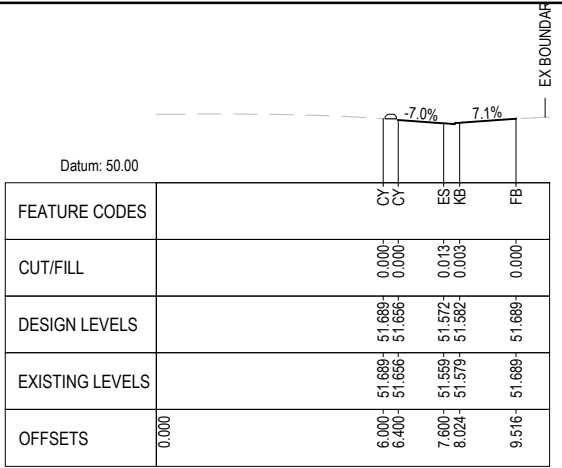
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| Original Scale (A1) | Design Drawn                                 | A. HOLT | 15.11.24 | Approved For Construction* |
| 1:100               | Design Verifier                              | L. CHEN | 15.11.24 | Date                       |
| Reduced Scale (A3)  | Dwg Check                                    |         |          |                            |
| 1:200               | * Refer to Revision 1 for Original Signature |         |          |                            |



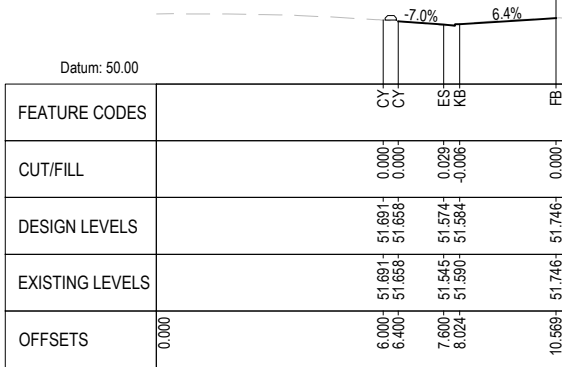
Project: CARRINGTON ROAD IMPROVEMENTS PROJECT

Title: DETAILED CROSS SECTIONS SHEET 14

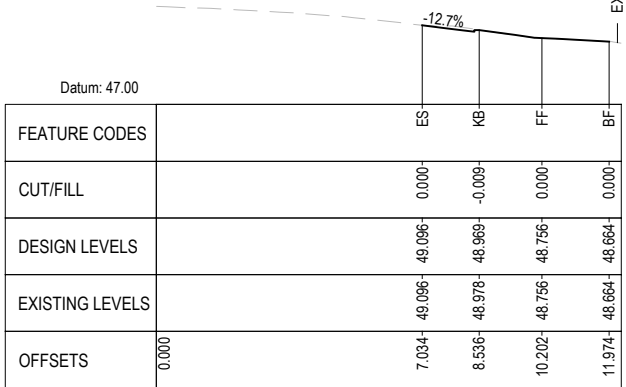
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|-------------|-------------------|
| Discipline  | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0564   |
| Rev.        | A                 |



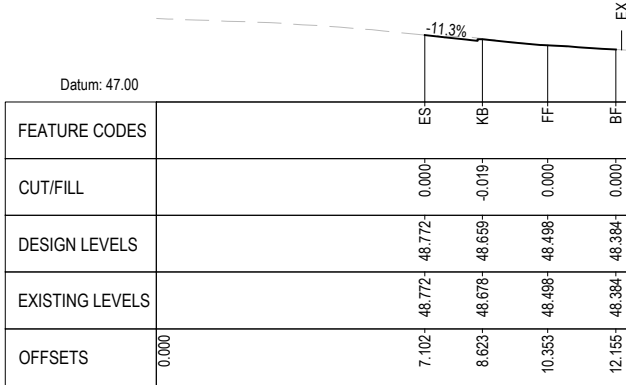
CH: 265.00 #198-202 Carrington Road Driveway



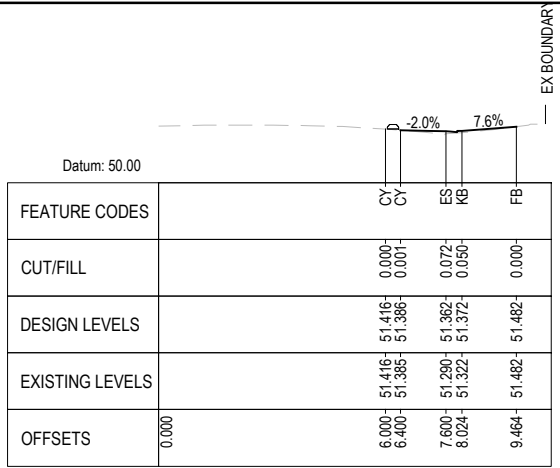
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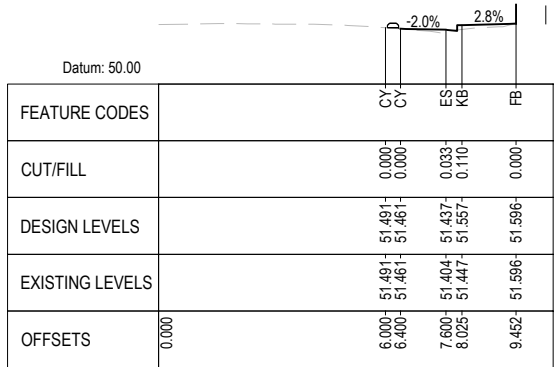
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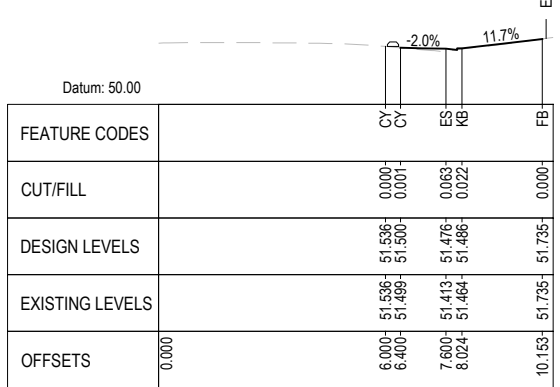
CH: 144.00 #1/214 Carrington Road Driveway



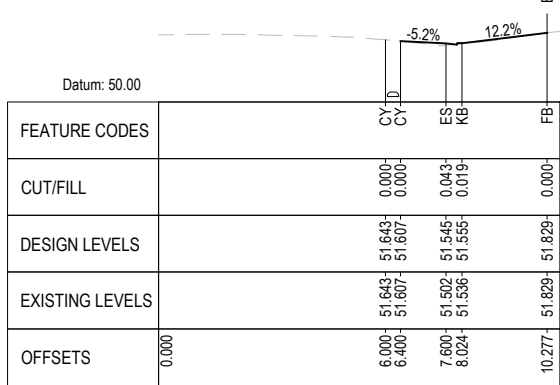
CH: 322.00 #188 Carrington Road Driveway



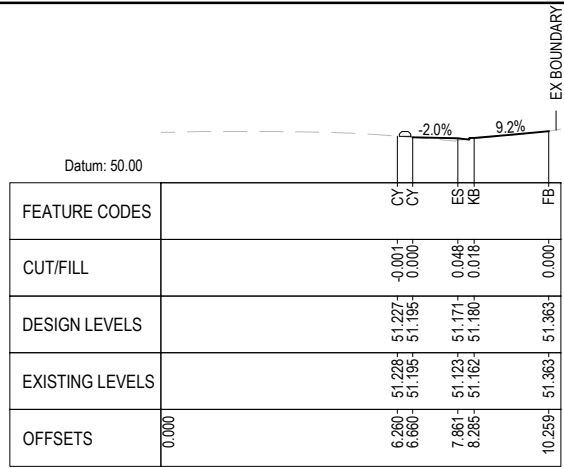
CH: 312.73 #190 Carrington Road - Ex Wall



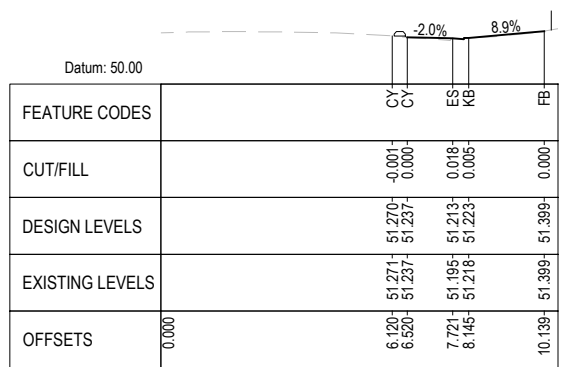
CH: 306.00 #190 Carrington Road Driveway



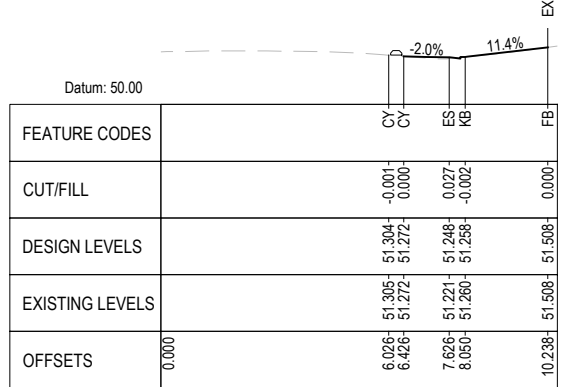
CH: 284.00 #196 Carrington Road Driveway



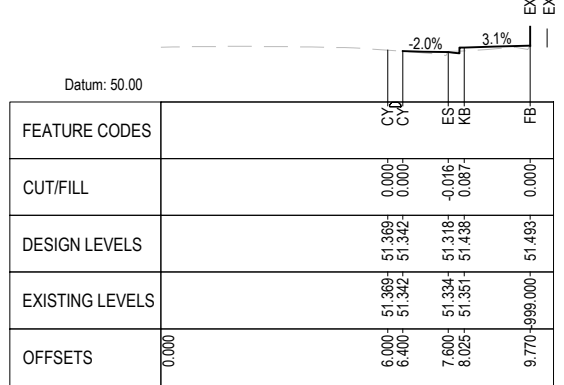
CH: 344.00 #184 Carrington Road Driveway



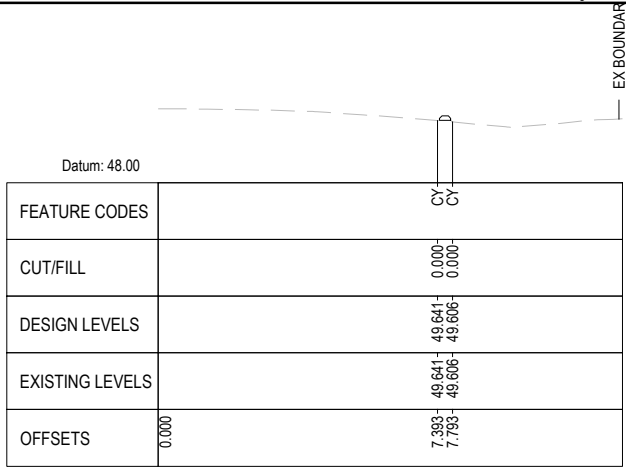
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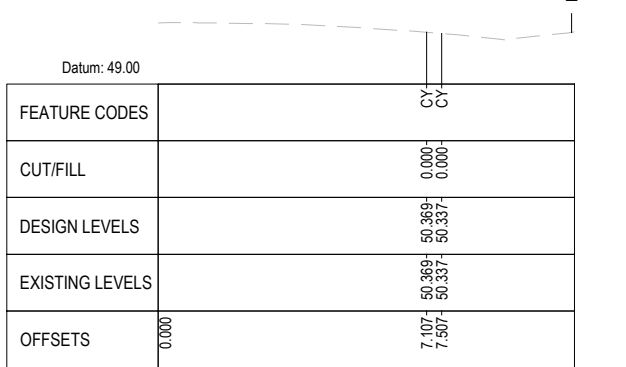
CH: 335.00 #188A Carrington Road Driveway



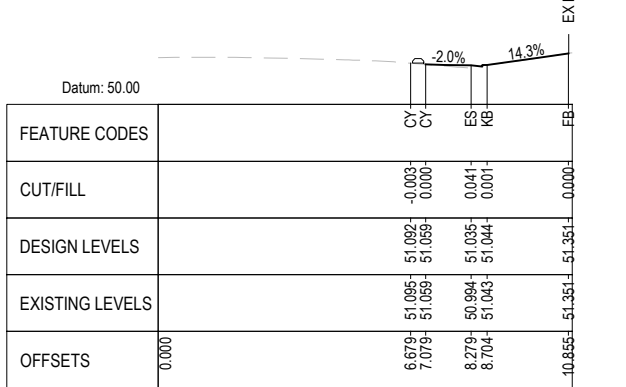
CH: 327.57 #188 Carrington Road - Ex Wall



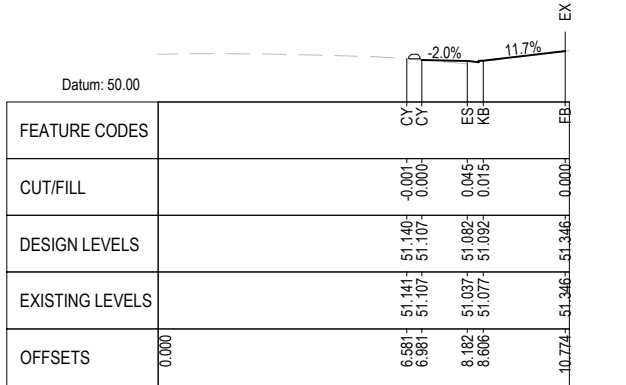
CH: 397.00 #178 Carrington Road Driveway



CH: 382.00 #180 Carrington Road Driveway



CH: 359.00 #182 Carrington Road Driveway



CH: 355.50 #184 Carrington Road Driveway

**PRELIMINARY**  
**NOT FOR CONSTRUCTION**

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|     |                    |    |     |      |          |  |  |  |  |
| A   | PRELIMINARY DESIGN | By | CD  | CMA  | 18.12.24 |  |  |  |  |
| No. | Revision           | By | Chk | Appd | Date     |  |  |  |  |

|                     |  |         |          |                            |
|---------------------|--|---------|----------|----------------------------|
| Original Scale (A1) | Design Drawn                                 | A. HOLT | 15.11.24 | Approved For Construction* |
| Reduced Scale (A3)  | Design Verifier                              | L. CHEN | 15.11.24 | Date                       |
| 1:200               | Design Check                                 |         |          |                            |
|                     | * Refer to Revision 1 for Original Signature |         |          |                            |



|          |                                      |
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| Project: | CARRINGTON ROAD IMPROVEMENTS PROJECT |
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|        |  |
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| Title: | DETAILED CROSS SECTIONS PROSPERO TO WOODWARD DRIVEWAYS |
|--------|--|

|             |                   |
|-------------|-------------------|
| Discipline  | CIVIL ENGINEERING |
| Drawing No. | 3230635-CA-0565   |
| Rev.        | A                 |





124 Halsey Street,  
PO Box 6345, AUCKLAND,  
1142, New Zealand  
T: +64 9 300 9000 // F: +64 9 300 9300  
E: [info@beca.com](mailto:info@beca.com) // [www.beca.com](http://www.beca.com)

Auckland Transport Private Bag 92250  
Auckland 1142  
New Zealand

16 April 2025

**Attention: Kelly Durham**

Dear Kelly

### **Carrington Road Corridor Upgrade PS - response to Groundwater s92 questions**

Regarding the further information request from Penny Anson of Auckland Council, dated 31 March 2025, concerning the proposed improvements to Carrington Road and the construction of the Point Chevalier Watermain No.2 Project, please find below our groundwater assessment of effects (AEE) to address the groundwater-related items outlined in the request.

## **1 Introduction**

Auckland Transport (AT) intends to upgrade Carrington Road into a multi-modal urban road corridor which will comprise the widening of the existing Carrington Road Corridor and improvements or construction of various associated features such as bus lanes, cycle lanes and footpaths (Carrington Road Improvement Project, CRIP).

In conjunction, Watercare Services Limited (Watercare) has proposed the Point Chevalier Watermain No. 2 Project (the Watermain) along Carrington Road. The project involves the installation of Ø750mm concrete-lined steel (CLS) pipeline, approximately 1 km in length between Seaview Terrace and Sutherland Road.

Unless otherwise noted, the CRIP and Watermain projects are referred to collectively in this letter as 'the Project'. The Project extent is shown in Figure 1 and a full Project Description can be found in Section 3 of the Assessment of Effects on the Environment (AEE) report.

Our memorandum dated 18 February 2025 (included in **Appendix A**) provides a high-level review of the proposed works against the Auckland Unitary Plan (Operative in Part) (AUP(OP)) permitted activity standards (PA standards) for the taking, using, damming and diversion of water (E7.6.1.6 and E7.6.1.10).

The proposed works considered in the memo are:

- **New active mode bridge over the KiwiRail North Auckland Line (NAL) designation and associated approach structures** – a new separate pedestrian bridge alongside the existing Mount Albert rail bridge on its northern side with associated approach structures.
- **Service relocations / diversions** – potential underground service relocations along the wider alignment.
- **Retaining walls** – several lengths of retaining wall along the alignment to enable widening of the road and stabilisation of sloped ground (if required).
- **Watermain No 2** – installation of a new 750 mm diameter pipeline along the western side of Carrington Road requiring 2.5-3 m excavation to avoid utility conflicts.

- **Air, scour and cross connection/isolation valve chambers** – installation of air and scour valves as required to some 2.1-2.7 m depth respectively, and installation of cross connections / isolation valve chamber at northern end of alignment to up to 3.2 m depth.

The only proposed works, associated with the watermain, which may potentially encounter groundwater is the excavation to install the air valve chamber, and cross-connection and isolation valve chambers at the northern termination within the Oakley Hospital historic heritage extent (Figure 2). These works of up to 2 months construction and are within 17 m to 28 m of the Oakley Hospital Main Building and will require resource consent as a restricted discretionary activity.



Figure 1: Carrington Road Improvement Project Extent (in white) and Point Chevalier Watermain No 2. Extent in blue. Historic heritage extent (Historic Oakley Hospital) outlined in cyan.



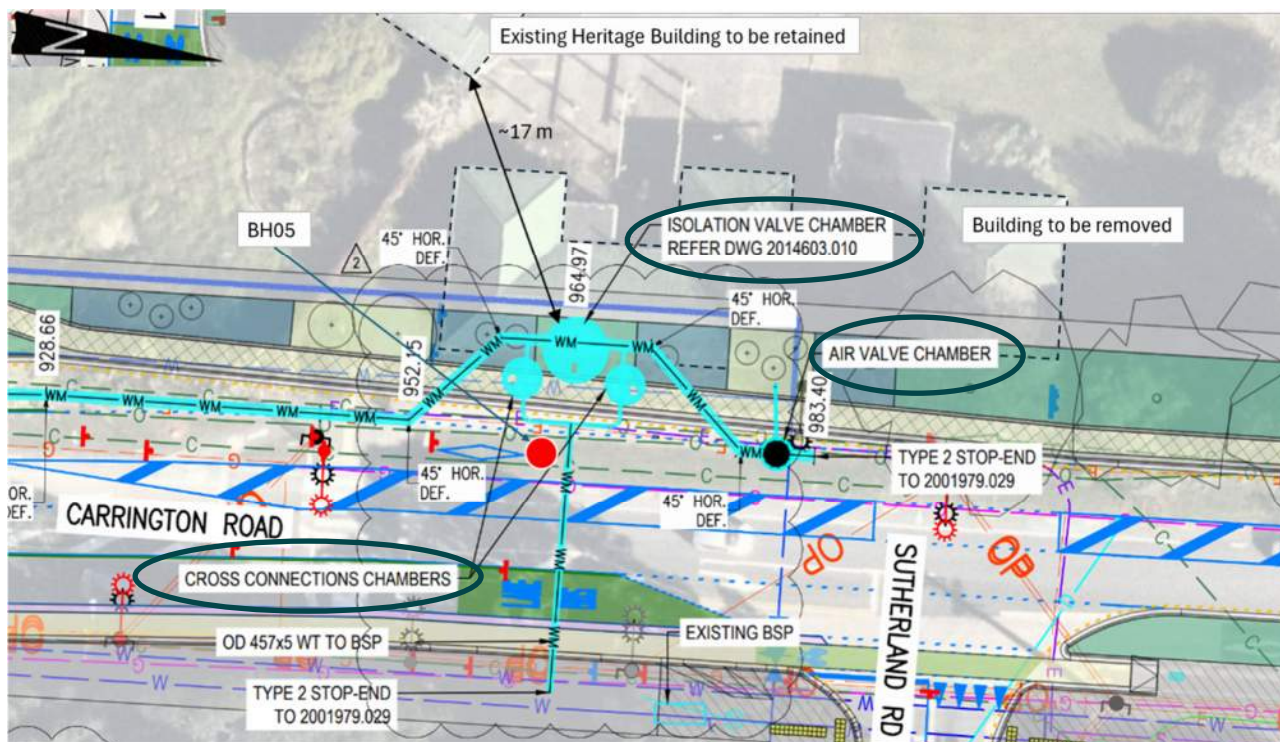


Figure 2: Excerpt of preliminary Point Chevalier Watermain No. 2 – Layout Plan and Pipe Longitudinal Section - Sheet 7 (DWG 2014603.408 Rev B) showing isolation and cross connection valve chambers in relation to existing heritage building (Oakley Hospital Main Building).

## 2 Summary of Activities and Permitted Activity (PA) Status

A summary of the proposed works and their PA status is provided in Table 1 – the PA check itself is detailed in Appendix A.

The focus of this groundwater assessment is on the excavations related to the installation of the isolation valve, cross connections and air valve chambers (from Watermain Chainage 850 and 983) which do not meet the PA standards. This is primarily due to a separation of less than 10 m from the Oakley Hospital historic heritage extent, as well as other criteria where applicable, for which consent for a Restricted Discretionary activity is sought.

A technical non-compliance may occur for service relocation and diversions on Carrington Road within 10 m distance of the historic heritage overlay where they take longer than 10 days. However, as these services (comprising comms, gas, electricity and existing watermain) are all to be replaced as part of the proposed works and the Applicant is in active and regular consultation with the utility owners to resolve potential effects, these services will be excluded from this assessment. Additionally, effects on AT and Watercare assets are not considered in this assessment.

If retaining walls are progressed, the conceptual size is piles to a maximum of 3.2 m beneath existing ground level (for the highest retaining wall of up to 1.6 m retained height). The conceptual pile hole size is OD 450 mm, augured 1.2 m centre to centre spacing. The proposed retaining walls are unlikely to permanently drain or impede groundwater and piles are anticipated to be less than 1.5 m in diameter hence meet the PA standards.



Table 1: Summary of Permitted Activity Status

| Activity / works                            | PA rules for diversion of groundwater (E7.6.1.10.) | PA rules for take of groundwater (E7.6.1.6.) | Assessed further in this AEE? |
|---|--|--|-------------------------------|
| 1. Active mode bridge over the KiwiRail NAL | <b>MEETS</b>                                       | <b>MEETS</b>                                 | <b>x</b>                      |
| 2. Service relocations / diversions         | <b>MEETS *</b>                                     | <b>MEETS</b>                                 | <b>x</b>                      |
| 3. Retaining walls                          | <b>MEETS</b>                                       | <b>MEETS</b>                                 | <b>x</b>                      |
| 4. Watermain No. 2                          | <b>MEETS *</b>                                     | <b>MEETS</b>                                 | <b>x</b>                      |
| 5. Air valve chamber                        | <b>DOES NOT MEET</b>                               | <b>MEETS</b>                                 | ✓                             |
| 6. Scour valve chamber                      | <b>MEETS</b>                                       | <b>MEETS</b>                                 | <b>x</b>                      |
| 7. Cross connection / isolation valve       | <b>DOES NOT MEET</b>                               | <b>DOES NOT MEET</b>                         | ✓                             |

Notes: \*Meets PA standard E7.6.1.10 (1) (d) and (e) as trench excavations expected to be progressively opened and closed in less than 10 days; however, if works take longer than 10 days then activity will not be permitted, primarily due to being less than 10 m separation distance from historical heritage overlay.

### 3 Site Geology

The understanding of the geology in the cross connection and isolation valve area is based on borehole BH05 which was installed in December 2024 adjacent to the location of a cross-connection chamber (Figure 2 and bore log provided in Appendix B). The borehole confirms the site is underlain by stiff silty clay of the Tauranga Group to some 4.3 m depth, underlain by completely weathered very stiff silty clay soils of the East Coast Bays Formation (ECBF) to 5.2 m depth. A deeper historical borehole (MBR10), drilled to 15 m depth in 2007, approximately 108 m further south as part of the Waterview Connection project, indicates the residual ECBF extends to 9 m depth where it sharply transitions to extremely to very weak ECBF rock.

This sequence is consistent with the geology of the published geological map 1:250,000 Geology of the Auckland Area (GNS Science, 2023) which indicates the northern end of the alignment to be underlain by Takaanini Formation of the Tauranga Group and East Coast Bays Formation of the Waitematā Group.

### 4 Site Groundwater Levels

Groundwater level at the location of the cross connection and isolation valve area is approximately 1.2 m below ground level (bgl) based on manual measurements of a piezometer installed to 5.2 m depth in BH05. The measurements were taken on the 6<sup>th</sup> and 18<sup>th</sup> December 2024 hence represent early summer.

Groundwater data from piezometers installed along the alignment in December 2024 above and from hand auger investigations in November 2024 indicate the groundwater is generally 1.2 m to 4.1 m below ground along the alignment. There is a general trend of groundwater getting shallower towards the north as elevation drops. The shallowest groundwater level is recorded at the cross-connection and isolation valve area.

## 5 Hydraulic Parameters

As no hydraulic conductivity or pumping testing has been undertaken by the Project, we have utilised historical investigations across the wider area to guide the likely hydraulic parameters for use in our assessment.

The Waterview Connection project (whose investigation area includes the cross-connection / isolation valve area on Carrington Road) divides the Tauranga Group alluvium in the northern area into one unit composed of silty clay or clayey silt, and the other as pumiceous sands and silts (Well Connected Alliance, 2012). Attempts were made to statistically separate these units based on hydraulic conductivity, however there was significant overlap, likely due to the high fines content (e.g. typically 30% but up to 60%), even in the sandier units, which may dominate hydraulic behavior.

Based on 27 in-situ tests (packer and rising head tests) undertaken in Tauranga Group alluvium over the wider Waterview Connection project area, the Alliance adopted:

- A geometric mean of  $6 \times 10^{-8}$  m/s as the lower bound horizontal hydraulic conductivity (K) value.
- A nominal K-value of  $2 \times 10^{-7}$  m/s to account for slightly higher K that can be expected in the sandier units.
- An upper bound value of  $1 \times 10^{-6}$  m/s to reflect the maximum value encountered during testing.

Specific yield was estimated by the Alliance to be approximately 0.05 to 0.10 based on laboratory and pumping tests undertaken for the Waterview Connection project.

The values reported for the Waterview Connection project align with our experience across the wider Auckland area and so have been utilised for this assessment.

## 6 Analytical Assessment of Potential Drawdown

The principal risk from the proposed works, although low, is groundwater drawdown-induced consolidation settlement. Therefore, analytical calculations have been undertaken of the potential groundwater drawdown from excavation and installation of the DN3200 to DN4000 isolation valve chamber, as it requires the deepest excavation and is closest to the Oakley Hospital Main Building (17 m distance). All other excavations (air valve and cross connections) are shallower and further from potentially affected buildings, services and assets hence will be lower risk.

### 6.1 CIRIA R113 (2005)

The magnitude and extent of drawdown has been assessed using the method set out in Figures 12 and 13 of CIRIA R113 (2005). Table 2 provides a summary of calculated drawdown extent, and the calculations are included in **Appendix C**.

Table 2: Calculated Drawdown at Isolation Valve Chamber Excavation

| Site                    | Groundwater Level      | Dewatering Level       | Maximum Drawdown | Max extent of drawdown (s = 0 m) | Max extent of measurable drawdown (s = 0.25 m) |
|-------------------------|------------------------|------------------------|------------------|----------------------------------|--|
| Isolation valve chamber | 25.3 mRL<br>(1.2 mbgl) | 22.8 mRL<br>(3.7 mbgl) | 2.5 m            | 5.4 m                            | 3.7 m  |

Drawdown extent is based on the equation originally proposed by Sichardt (1931) which considers steady state (permanent) drawdown irrespective of time, based on permeability and required drawdown at an equivalent

“well”. The magnitude of drawdown at distance is based on a normalised drawdown cone; the derived drawdown cone for the key isolation valve chamber excavation using the upper, lower and nominal case for hydraulic conductivity is shown in Figure 3.

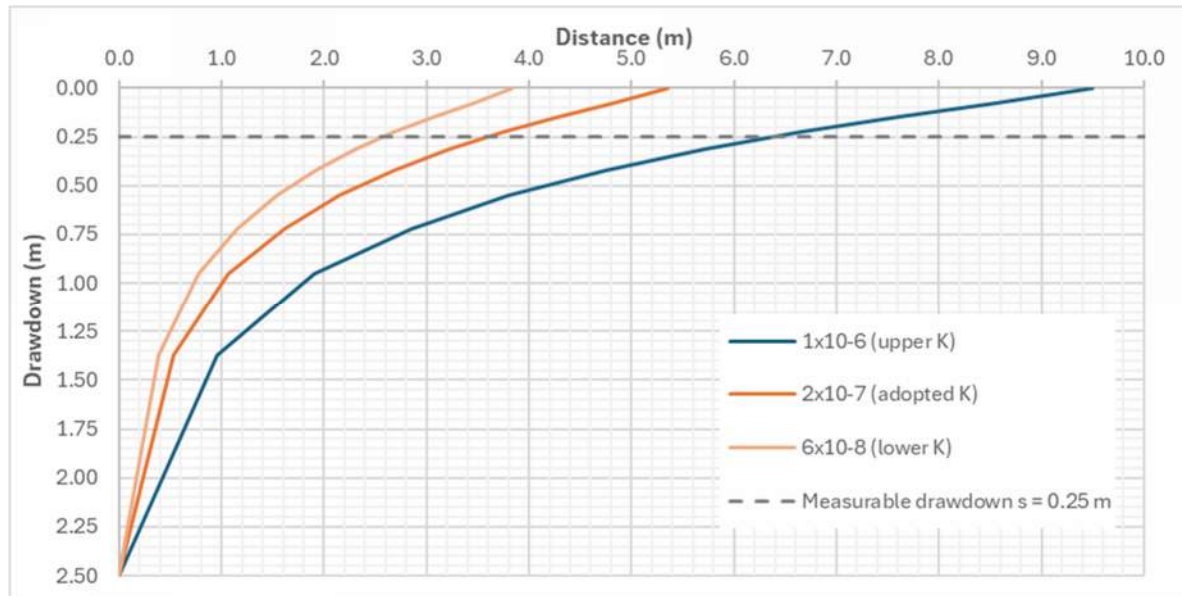


Figure 3: Sichert-derived drawdown cones for DN4000 isolation valve chamber excavation (the upper and lower K values are also shown as plausible upper and lower bounds of permeability).

Subsequent versions of CIRIA (C750) have more explicitly noted that the Sichert equation is intended to derive a radius of influence ( $R_0$ ) for assessing inflows. The assessment of inflows for an equivalent well may not be particularly sensitive to  $R_0$  (which is a log function in most equations), but the assessment of drawdown effects will be sensitive.

In our experience, the assessment of  $R_0$  is sensitive to assumed hydraulic conductivity e.g., a plausible increase in hydraulic conductivity by a factor of 5 would increase the drawdown extents noted above by ~176%.

This is shown by the upper K line ( $1 \times 10^{-6}$  m/s) on Figure 3 to provide an upper bound assessment of drawdown. This assessment suggests a potential increase in the extent of drawdown by ~4 m; however, in all cases the calculated extent of drawdown remains less than 10 m.

## 6.2 Theis (1935)

As a further check, the extent of drawdown was also calculated using a Theis back-analysis. These calculations are included in **Appendix C** also.

Whilst Theis is more strictly suited to a confined aquifer, the method assumes that water can only come from storage (i.e., ignores any rainfall recharge, expected to be significant for this aquifer) and hence drawdown in a confined aquifer is always greater than that for an unconfined, and so Theis is expected to give a reasonable upper bound estimate in this case.

Using the  $R_0$  value obtained from Sichert and equations 6.8 and 6.10 set out in CIRIA C750, groundwater inflow to the excavation was calculated for initially a fully penetrating ‘well’ then a partially penetrating ‘well’ as represented by the excavation here.



Assuming a pumping rate of 0.8 m<sup>3</sup>/d for 1 month, a Theis forward calculation indicates a measurable drawdown extent<sup>1</sup> of ~10 m which is consistent with the Sichardt assessment. As the duration of pumping is extended, Theis indicates that the drawdown extent continues to increase (due to lack of recharge) and after two months may approach ~14 m (~47% greater than the upper bound shown on Figure 3). In practice, given the target drawdown within the excavation is 2.5 m, the maximum extent of drawdown is constrained by the dewatering level set for the excavation. Consequently, the extent of drawdown predicted by Theis would not be fully achieved.

On balance, and given the Oakley Hospital Main Building is beyond the maximum extent of drawdown calculated by either method, the Sichardt equation is considered to provide a reasonable estimate of drawdown extent in an unconfined aquifer, and as can be seen from the comparison in **Appendix C** it also yields a steeper drawdown gradient and hence is considered appropriate for the assessment of settlement impacts (if required).

A high-level check of the potential for consolidation settlement has been calculated using a simplified 1D linear calculation. No consolidation settlement is expected to occur at the Oakley Hospital Main Building to the west as it is beyond the maximum extent of drawdown. Table 3 lists the services on the west side of Carrington Road (in order of increasing distance from proposed chamber excavations and expected consolidation settlement).

Table 3: Services within maximum extent of drawdown and expected drawdown and consolidation settlement.

| Service                               | Owner        | Distance from proposed chamber excavations (m) | Expected drawdown (m) | Potential consolidation settlement (mm) |
|---------------------------------------|--------------|--|-----------------------|---|
| Existing watermain                    | Watercare    | 0  | 2.5                   | 18                                      |
| Communications cable                  | Chorus       | 1.3  | 1.23                  | 9                                       |
| Electricity pilot / fibre optic cable | Vector Fibre | 1.4  | 1.18                  | 8                                       |
| 11kv – 6kv electricity cable          | Vector Power | 1.7  | 1.05                  | 7                                       |
| Communications cable                  | EON NZ       | 2.1  | 0.9                   | 6                                       |
| Communications cable                  | Chorus       | 3.9  | 0.55                  | 4                                       |
| 50 mm PE medium pressure gas pipeline | Vector Gas   | 5  | 0.4                   | 2                                       |

All of the services above will be diverted or replaced during the course of the works.

There is no consolidation settlement expected on the east side of Carrington Road hence any services or structures at this location are unlikely to be affected.

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<sup>1</sup> Taken as 0.25 m drawdown, being at a level that can be readily distinguished from any short-term fluctuations in response to rainfall etc.

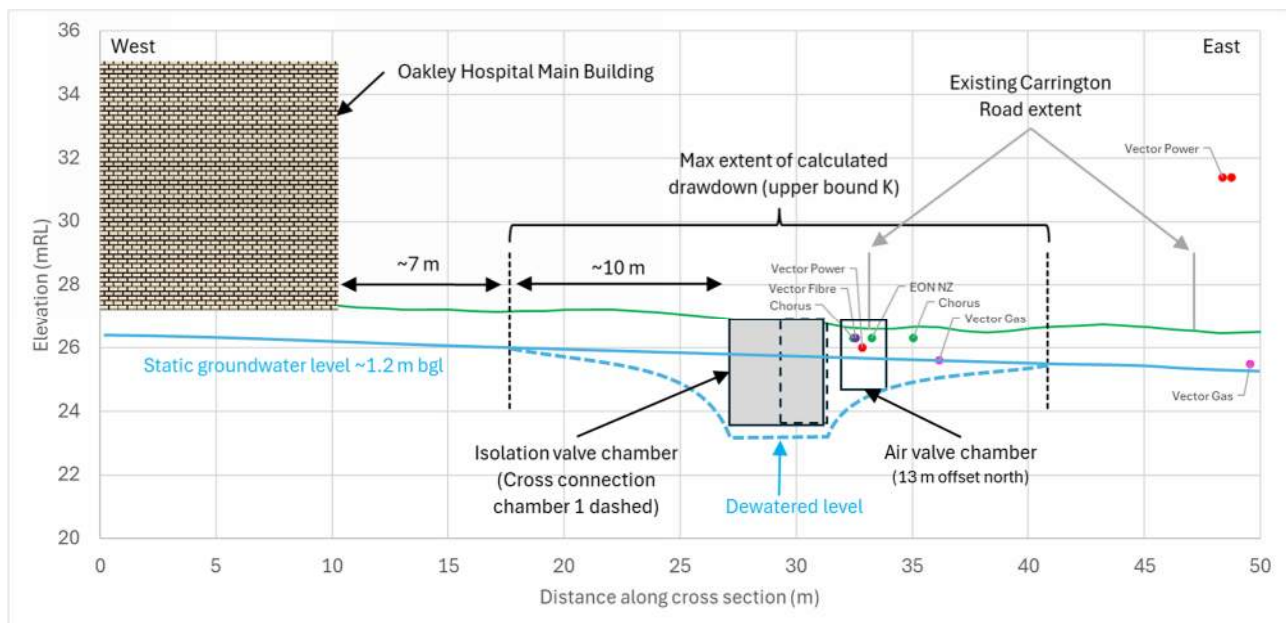


Figure 4: Cross section through Isolation valve chamber excavation perpendicular to Carrington Road alignment showing maximum calculated extent of drawdown in relation to existing services.

## 7 Summary

The analytical assessment of potential drawdown indicates a limited extent of drawdown consistent with the low permeability materials where the critical case isolation valve chamber excavation will take place, ~17 m from Oakley Hospital Main Building and dewatering to 3.7 m depth (max drawdown of 2.5 m depth). Dewatering is estimated to take 2 months in duration. The next closest excavations are greater than 20 m from Oakley Hospital Main Building and to shallower depths (i.e., 2.1 m depth for the air valve chamber and some 2.3 m depth for the cross-connection chambers) hence the potential for their drawdown extents to reach the heritage building is even lower. Considering the calculated magnitude and extent of groundwater drawdown, along with the relatively short excavation and dewatering durations, the risk of consolidation settlement is assessed to be negligible to minor.

Experience from the projects such as Waterview Connection, for which permanent drawdown occurred, suggest that negligible consolidation settlement would occur over a two-month time frame (i.e., the upper estimate of isolation valve chamber construction). The results of post-construction monitoring on that project indicated that generally the water table would need to be drawn down for a much longer period (at least 6 months) before any measurable consolidation settlement would likely occur.

As noted in our previous memo, works do not encroach on any pre-1905 features on the site not already affected by AT's CRIP project, which have been addressed in the overarching Assessment of Environmental Effects (e.g., Airing Court wall).

The replacement and diversion of services is expected to meet PA standards as generally they will be undertaken by trenching that is progressively opened and closed in under 10 days hence are exempt from further assessment. However, in the event that dewatered durations of up to 30 days are required, standards E7.6.1.10 (2) to (5) will be met but services will not achieve 10 m distance from the historical heritage overlay between (Watermain) Ch 850 and CH 883. Given the relatively shallow depth of these services and their distance from the Oakley Hospital Main Building, the potential for effects is anticipated to be less than that of the isolation valve chamber excavation, hence the risk is assessed to be negligible to minor.

## 8 Response to Groundwater s92 queries

Based on the results of our assessment above, we believe that we have addressed the majority of questions specifically relating to groundwater through demonstrating that those activities, which will likely encounter groundwater will likely have less than minor to negligible effects. To cover off the queries (as numbered in Auckland Council's request) for completeness:

50. *As noted under item 49, please provide a clear isopach earthworks plan to show the location, distribution, and depths of proposed earthworks. The plan must also show the maximum cut and fill depths.*

Currently, we do not have a complete model necessary to generate an isopach plan. However, Detailed Cross-Sections showing indicative cut and fill depths have been prepared; and are included as attachments to the Section 92 response. It is noted that ongoing discussions with adjacent developers are likely to result in the deletion of proposed retaining walls along the western boundary and replacement with batters – these details are not shown in the cross-sections.

As noted in Section 2 of this assessment, the key area is between Watermain Chainage 850 and 983 where excavations related to the installation of the isolation valve, cross connections and air valve chambers will occur. Using the CRIP chainages as used in the Detailed Cross-Sections, this extent corresponds approximately with the cross-sections for Chainages 1340-1460 (see sheets 3230635-CA-0562 to 0563).

51. *Please identify the critical cross-sections for assessment – please consider: the deepest excavations, proximity to adjacent buildings/structures, driveways and public services and the shallowest groundwater levels.*

Cross section presented in Figure 4 of this letter.

52. *Please provide a concept design for the proposed retaining walls, together with lateral wall deflection analyses, using WALLAP (or similar software) or following an empirical approach if appropriate, in order to determine the likely lateral wall deflection and assist in the preparation of a mechanical settlement profiles at the critical cross-sections, from the edge of the proposed excavation extending beneath neighbouring buildings/structures (including driveways) and public services.*

Concept retaining wall design has not started. Retaining walls may not be required along the alignment. Refer to Section 2 of this assessment for high level discussion on likely retaining wall sizing, if retaining walls are required.

53. *Please note the preparation of profiles, at the critical cross-sections, should show the total (combined) settlement (i.e. the consolidation settlement due to groundwater drawdown plus the mechanical settlement due to retaining wall deflection) beneath the neighbouring buildings/structures and public services. The profiles should be annotated with the calculated maximum differential settlement (slope gradient) across neighbouring driveways, buildings/structures and public services, if any.*

Given consolidation settlement only affects owner assets and services within the road corridor in which works relate (within 10 m of the isolation valve) we consider the preparation of profiles at key critical cross sections unnecessary.

54. *Please provide an assessment of the tolerance/sensitivity of the neighbouring buildings and structures to the predicted differential settlement that could result from the dewatering and retaining wall deflections, with respect to their age, construction and foundation types, from the structural design engineer for the project. A Stage 1 Assessment - Burland Classification of Damage for the neighbouring buildings/structures is also required. If the Stage 1 assessment indicates "Slight Damage or greater" then, a Stage 2 assessment is required.*



This is not relevant as no settlement is expected at the building, hence the building is considered to have negligible risk of damage.

55. *The identification of potentially affected public services and the assessment of the combined effect of groundwater drawdown and retaining wall deflection on these services using appropriate assessment criteria.*

There are no other known public services in proximity to the works not already specified in Section 6.2 and those within the maximum extent of drawdown are scheduled to be diverted or replaced.

56. *The assessment of the combined effect of groundwater drawdown and retaining wall deflection on the neighbouring services/structures/driveways should use the appropriate assessment criteria.*

The only excavation and dewatering likely to be greater than 10 days' duration is excavation related to the isolation valve and air valve chambers and cross connections. No retaining walls are proposed in this area. Retaining walls, if required elsewhere along the alignment, are unlikely to permanently drain or impede groundwater.

57. *The groundwater memo by Beca Ltd concluded that a Groundwater Settlement Monitoring & Contingency Plan (GSMCP) is required. Please provide a draft GSMCP for review. The draft GSMCP should include (but not be limited to): a plan showing the locations and types of monitoring devices including groundwater monitoring bores, building settlement marks on the neighbouring buildings/structures, ground settlement marks including on the neighbouring driveway, retaining wall deflection marks and inclinometers (if required). Alert and alarm trigger levels and monitoring frequency are also required for total and differential settlement of the ground surface, buildings and retaining walls and alert levels 1 and 2 for groundwater level monitoring. Identification of neighbouring buildings/structures that require pre-and-post dewatering detailed condition surveys, together with those public services (if any), which require pre-and -post dewatering CCTV condition survey, together with a description of the proposed construction methodology/sequence and contingency options.*

Our groundwater memo recommended preparation of a GSMCP to set out how excavation for the cross connections and isolation valve chamber will avoid, remedy or mitigate adverse effects from ground settlement and on the Oakley Hospital heritage building. Although the analytical assessment in this letter indicates that groundwater drawdown is unlikely to reach the heritage building, we still recommend installing and monitoring a shallow bore to confirm that drawdown effects align with this assessment. This will enable contingency actions, if needed, as set out in the attached draft Groundwater Monitoring and Contingency Plan (GMCP).

Yours sincerely



**James Botting**

Senior Hydrogeologist

on behalf of

**Beca Limited**

Phone Number: +64 9 300 9000

Email: James.Botting@beca.com

**Copy**

Mandy McDavitt, Beca Limited

Liam Winter, Beca Limited



## Appendix A – Check of Groundwater Permitted Activity Status

**To:** Liam Winter  
**From:** James Botting  
**Copy:** Mandy McDavitt  
**Subject:** Carrington Road Improvements Project - Check of Groundwater Permitted Activity Status

**Date:** 20 February 2025  
**Our Ref:** 3230635-776096487-5127

## 1 Introduction

Auckland Transport (AT) intends to upgrade Carrington Road into a multi-modal urban road corridor which will comprise the widening of the existing Carrington Road Corridor and improvements or construction of various associated features such as bus lanes, cycle lanes and footpaths. The extent of Carrington Road is shown in Figure 1.

In conjunction, Watercare Services Limited (Watercare) has proposed the Point Chevalier Watermain No. 2 Project (the Watermain) along Carrington Road. The Watermain is a Ø750mm concrete-lined steel (CLS) pipeline approximately 1km in length between Seaview Terrace and Sutherland Road, and forms part of a wider scheme to improve supply, maintain levels of service, and provide resilience to both the Point Chevalier and Khyber water supply zones. The design and planning for the Watermain has been expedited to realise efficiencies with the CRIP, and to enable the projects to be constructed concurrently. The Watermain extent is shown in Figure 3.

Unless otherwise noted, the CRIP and Watermain projects are referred to collectively in this report as 'the Project'. A full Project Description can be found in Section 3 of the Assessment of Effects on the Environment (AEE) report.

The Detailed Design and earthworks methodology for the road improvements has not been confirmed at the time of preparing this memo. Based on the Preliminary Design we understand that the only proposed works associated with the road improvements, which may potentially encounter groundwater, is piling associated with a new active mode bridge over the KiwiRail North Auckland Line (NAL) designation at the southern end of the alignment (Figure 2). Along the wider alignment, multiple existing services run parallel to Carrington Rd on both sides, typically located beneath the current footpaths (underground electricity lines, water mains, gas pipeline, telecommunications cables and less frequently stormwater pipelines) and due to the density of services it is presumed some services may require relocation as a result of the Project. For completeness, approach structures for the bridge and proposed retaining walls along the alignment have also been considered.

The Detailed Design and earthworks methodology for the Watermain has also not been confirmed at the time of preparing this memo; however, based on the Preliminary Design we understand that the only proposed works, associated with the watermain, which may potentially encounter groundwater is open trenching to allow installation of the new pipeline and excavation to install 4 No. below-ground chambers, most notably a cross connection isolation valve chamber at the northern termination within the Oakley Hospital historic heritage extent.

Confirmation is required as to whether the proposed works would encounter groundwater and thus would require resource consent as a restricted discretionary activity. This memo provides a high-level review of the proposed works against the Auckland Unitary Plan (Operative in Part) (AUP(OP))



permitted activity standards (PA standards) for the taking, using, damming and diversion of water (E7.6.1.6 and E7.6.1.10).

The proposed works we have considered are:

- **New active mode bridge over the KiwiRail North Auckland Line (NAL) designation and associated approach structures** – a new separate pedestrian bridge alongside the existing Mount Albert rail bridge on its northern side with associated approach structures.
- **Service relocations / diversions** – potential underground service relocations along the wider alignment.
- **Retaining walls** – several lengths of retaining wall along the alignment to enable widening of the road and stabilisation of sloped ground (if required).
- **Watermain No 2** – installation of a new 750mm diameter pipeline along the western side of Carrington Road requiring 2.5-3 m excavation to avoid utility conflicts.
- **Air, scour and cross connection/isolation valve chambers** – installation of air and scour valves as required to some 2.1-2.7 m depth respectively, and installation of a cross connection / isolation valve chamber at northern end of alignment to up to 3.2 m depth.

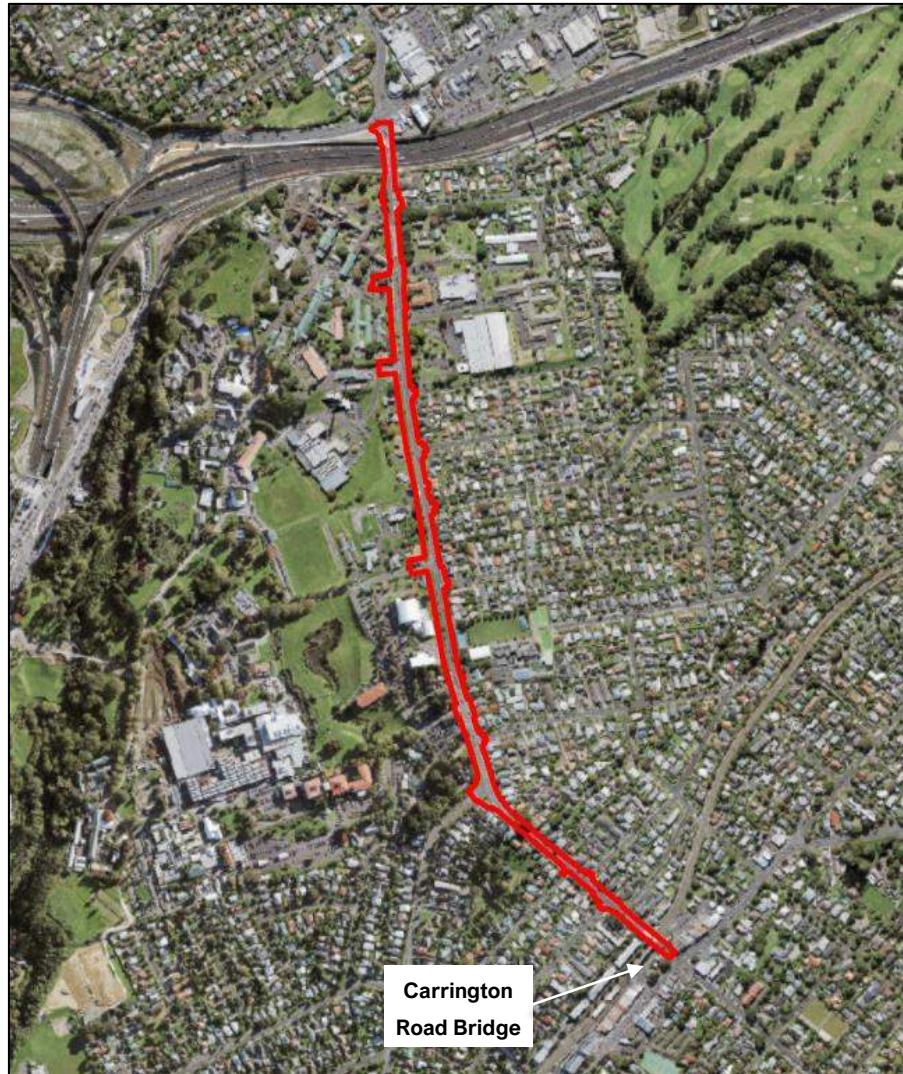


Figure 1: Carrington Road Improvement Project Extent (in red). (Base image source: Auckland Council GeoMaps)



# Carrington Road Improvements Project

## Technical Memorandum

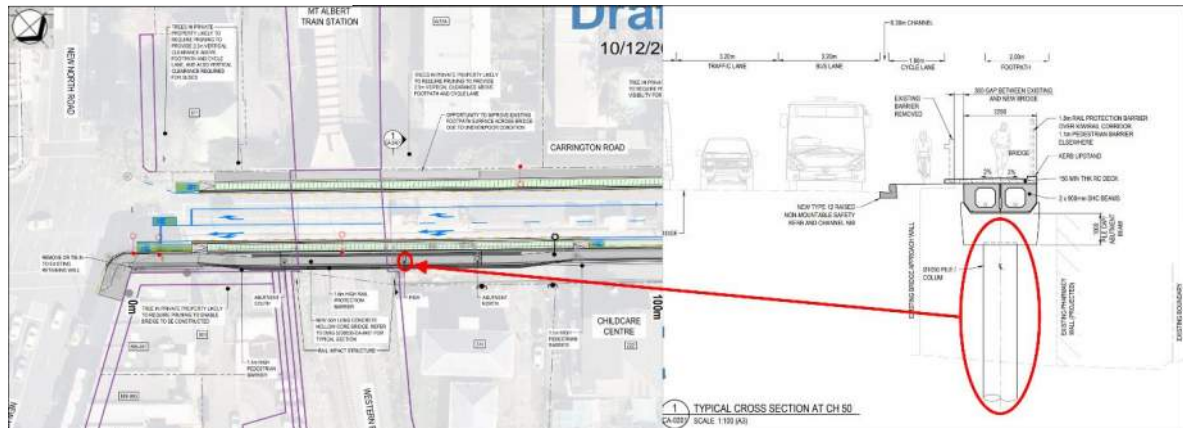


Figure 2: Excerpt of preliminary General Arrangement Plan CH 0 to CH100 (DWG 3230635-CA-0201 Rev A) and Typical Cross Section (DWG 3230635-CA-0401 Rev A) showing new active mode bridge over the KiwiRail NAL designation and indicative location of pier / column.



Figure 3: Sketch showing extent of Point Chevalier Watermain No.2



## **2 Design / Construction Assumptions**

### **2.1 New active mode bridge over the KiwiRail NAL designation and approach structures**

Based on Preliminary Design, the bridge foundation type is expected to comprise a deep piled foundation. Bridge pile(s) are anticipated to be less than 1.5 m in diameter. The approach structures may require a shallow undercut (~0.5 m), and piles are also anticipated to be less than 1.5 m in diameter hence both piling components are likely to fully meet the PA standards.

### **2.2 Service relocation / diversion**

Some relocation / diversion of existing site services is anticipated to accommodate both the CRIP and Watermain projects. Full details of these works (method, depths, locations etc.) are not currently available however the PA standards for groundwater diversion and dewatering under the AUP(OP) specifically provide for short duration (< 10 day) trenching. For this reason, works associated with services are likely to fully meet the PA standards.

### **2.3 Retaining walls**

Retaining walls may be required at several points along the alignment to facilitate widening of the corridor and stabilise sloped or cut ground. The retaining walls, if required, are not currently designed beyond concept however they are unlikely to permanently drain or impede groundwater and piles are anticipated to be less than 1.5 m in diameter hence are likely to fully meet the PA standards.

### **2.4 Watermain No. 2**

Installation of a ~1 km long watermain along Carrington Road from Seaview Terrace to Sutherland Road via open trenching will be timed to align with the construction of the CRIP. Each section of open trench is expected to be progressively opened and closed within 10 days hence will fully meet the PA standards.

### **2.5 Scour and air valve chambers, and cross connection and isolation valve chamber**

The Preliminary Design indicates an air valve chamber, and a scour valve chamber will be utilised in the northern and middle sections of the watermain. Installation of these chambers requires excavation to some 2.1 (air valve) to 2.7 m depth (scour valve), some 0.9 m below to 0.4 m above the inferred groundwater level in these areas respectively. If groundwater is encountered, it is anticipated that dewatering will not be required for greater than 30 days thus meeting E7.6.1.6.

The cross connection and isolation valve chamber at the northern end of the watermain alignment is expected to be installed in a DN3200 or DN4000 pre-cast concrete chamber (Figure 4). The expected foundation depth is approximately 3.2 m plus an additional 0.5 m to provide for a dry working floor. The groundwater level may be drawn down ~2.5 m below a natural groundwater level of 1.2 m at this location. As construction of the cross connection and isolation valve chamber may take longer than 30 days, it is unlikely that the PA standards can be met and consent for a Restricted Discretionary Activity will be required.

As noted in Section 2.4, works also encroach on the Oakley Hospital historic heritage overlay (Figure 4), however the valve chambers are approximately 18 m from the Main Building and there are no other pre-1905 features on the site not already affected by AT's CRIP project, which have been addressed in the overarching Assessment of Environmental Effects.

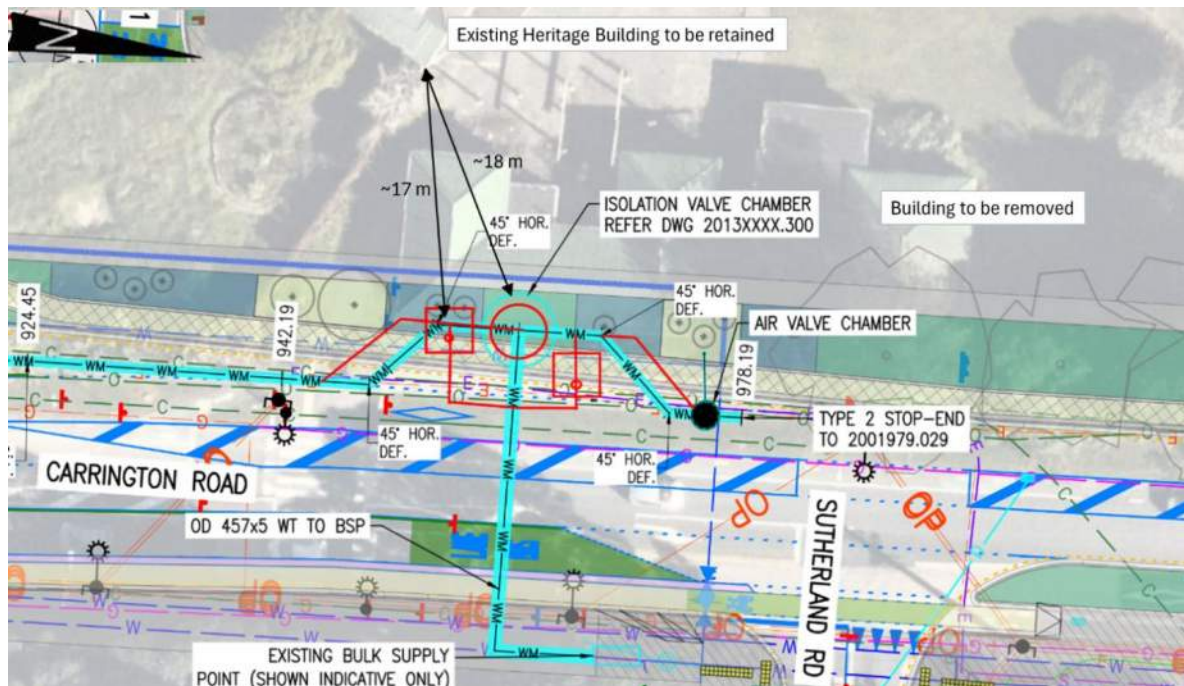


Figure 4: Excerpt of preliminary Carrington Road – Layout Plan and Pipe Longitudinal Section - Sheet 7 (DWG 2013XXX.208 Rev A) showing Isolation and cross connection valve chamber.

### 3 Site Groundwater Levels

Previous investigations have been carried out for various projects in the general vicinity of the project area. These were provided for the purpose of this project or obtained from the New Zealand Geotechnical Database (NZGD). The water levels were summarised in the Jacobs Preliminary Geotechnical Appraisal Report (Jacobs, 2023) (Appendix A). The depth to groundwater indicated by previous investigations within 100 m of the proposed alignment (Jacobs 2023) ranges between 1 m to 4 m below ground level (bgl) across the whole alignment, noting there is a groundwater level data gap at the southern end of the alignment.

Additionally, piezometers were installed in boreholes BH03, BH04 and BH05 along the Watermain No 2 alignment in December 2024. Manually recorded groundwater levels indicate the groundwater level is approximately 1.2 m below ground level in the northern part of the site and between 3.3 and 3.5 m below ground level in the southern part of the site. The water levels have been summarised from the Beca Geotechnical Interpretive Report in Appendix B.

4 Assessment of Permitted Activity Status

Table 1 provides a comparison of the proposed activities against the AUP(OP) criteria for groundwater diversion (E7.6.1.10). Piles up to 1.5 m in external diameter are exempt from standards E7.6.1.10 (2) to (6).

Potential excavations to relocate services are likely to be progressively undertaken and hence completed within 10 days and therefore would comply with E7.6.1.10 (1) and would be exempt from standards E7.6.1.10 (2) to (6). However, we have also tested against E7.6.1.10 (2) to (6) for completeness in the event that dewatered durations of up to 30 days are required.

Table 2 provides a comparison of those same activities against the criteria for a groundwater take associated with dewatering (E7.6.1.6). It is expected that excavation works for service relocation (if required) could be managed to allow each excavation to be open and closed within a period of 30 days or less.



Table 1: Assessment of activity against the AUP(OP) PA standards for diversion of groundwater (E7.6.1.10)

| Standard E7.6.1.10 |  | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s))  | Service Diversion / Relocations<br>(unknown depth) | Retaining walls<br>(Max 1.5 m diameter piles) | Watermain No 2<br>(2.5 m to 3 m depth) | Air valve and scour valve chambers<br>(2.1-2.7 m depth) | Cross connection / isolation valve<br>(~3.7 m depth) |
|--------------------|--|--|--|---|--|---|--|
| 1                  | The following activities are exempt from the Standards E7.6.1.10 (2) – (6) |  |  |   |  |   |  |
|                    | (a)  | pipes cables or ... that are drilled or thrust and less than 1.2 m in external diameter                    | n/a  | n/a   | n/a                                    | n/a   | n/a  |
|                    | (b)  | pipes ... up to 1.5 m in external diameter where a closed faced or earth pressure balanced machine is used | n/a  | n/a   | n/a                                    | n/a   | n/a  |
|                    | (c)  | piles up to 1.5 m in external diameter are exempt from these standards                                     | MEETS  | n/a   | MEETS                                  | n/a   | n/a  |
|                    | (d)  | diversions for no longer than 10 days  | n/a  | MEETS   | n/a                                    | MEETS   | DOES NOT MEET  |
|                    |  |  |  |   |  | DOES NOT MEET   | DOES NOT MEET  |

# Carrington Road Improvements Project

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| Standard E7.6.1.10 |   |  | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s)) | Service Diversion / Relocations<br>(unknown depth)                                      | Retaining walls<br>(Max 1.5 m diameter piles) | Watermain No 2<br>(2.5 m to 3 m depth)  | Air valve and scour valve chambers<br>(2.1-2.7 m depth)        | Cross connection / isolation valve<br>(~3.7 m depth)  |
|--------------------|---|--|---|---|---|---|--|---|
|                    | (e)   | diversions for network utilities and road network linear trenching activities .... | n/a   | (excavations likely open for < 10 days but tested remaining standards for completeness) | n/a   | (excavations likely open for < 10 days but tested remaining standards for completeness) | (excavation likely open for > 10 days)                         | (excavation likely open for > 10 days)  |
| 2                  | Any excavation that extends below natural groundwater level, must not exceed:                                       |  |   |   |   |   |  |   |
|                    | (a)   | 1 ha in total area   | EXEMPT  | MEETS   | EXEMPT  | MEETS   | MEETS  | MEETS   |
|                    | (b)   | 6 m depth below the natural ground level   |   | (excavation =< 3.0 m bgl approx.)   |   | (excavation =< 3.0 m bgl approx.)   | (excavation =< 3.0 m bgl approx.)                              | (excavation =< 3.7 m bgl approx.)   |
| 3                  | The natural groundwater level must not be reduced by more than 2 m on the boundary of any adjoining site            |  | EXEMPT  | MEETS<br>(excavation < 3 m bgl, therefore max drawdown ~2 m)                            | EXEMPT  | MEETS<br>(excavation < 3 m bgl, therefore max drawdown ~2 m)                            | MEETS<br>(excavation < 3 m bgl, therefore max drawdown ~0.9 m) | DOES NOT MEET<br>(excavation =< 3.7 m bgl, therefore max drawdown ~2.5 m within adjoining site) |
| 4                  | Any structure, excluding sheet piling ... that physically impedes the flow of groundwater through the site must not |  |   |   |   |   |  |   |

# Carrington Road Improvements Project

## Technical Memorandum

| Standard E7.6.1.10 |   |   | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s)) | Service Diversion / Relocations<br>(unknown depth)                | Retaining walls<br>(Max 1.5 m diameter piles) | Watermain No 2<br>(2.5 m to 3 m depth)                  | Air valve and scour valve chambers<br>(2.1-2.7 m depth)  | Cross connection / isolation valve<br>(~3.7 m depth)  |
|--------------------|---|---|---|---|---|---|--|---|
|                    | (a)   | impede the flow of groundwater over a length of > 20 m  | EXEMPT  | MEETS<br><br>(flow will re-equilibrate around the pipes/services) | EXEMPT  | MEETS<br><br>(flow will re-equilibrate around the pipe) | MEETS<br><br>(flow will re-equilibrate around the chamber)   | MEETS<br><br>(flow will re-equilibrate around the valves)   |
|                    | (b)   | extend more than 2 m below the natural groundwater level  |   |   |   |   |  |   |
| 5                  | The distance to any existing building or structure ... on an adjoining site from the edge of any: |   |   |   |   |   |  |   |
|                    | (a)   | trench or open excavation that extends below natural groundwater level must be at least equal to the depth of the excavation; | EXEMPT  | TBC   | EXEMPT  | MEETS   | MEETS<br><br>(The excavation depths for the scour valve and air valve are 2.7m and 2.1m respectively. There are no buildings within those distances of the excavations). | MEETS<br><br>(the excavation for the isolation valve is ~2.5 m bgl and the distance to the nearest building will be at least 17m as the nearest existing building on the site is to be demolished as part of the Carrington Residential |
|                    | (b)   | tunnel or pipe with an external diameter of 0.2 - 1.5 m that extends below natural groundwater level must be 2 m or greater   |   |   |   |   |  |   |



# Carrington Road Improvements Project

## Technical Memorandum

| Standard E7.6.1.10 |   | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s)) | Service Diversion / Relocations<br>(unknown depth)   | Retaining walls<br>(Max 1.5 m diameter piles) | Watermain No 2<br>(2.5 m to 3 m depth)  | Air valve and scour valve chambers<br>(2.1-2.7 m depth)   | Cross connection / isolation valve<br>(~3.7 m depth)   |
|--------------------|---|---|--|---|---|---|--|
|                    | (c) a tunnel or pipe with an external diameter of up to 0.2 m that extends below natural groundwater level has no separation requirement. |   |  |   |   |   | Development to accommodate the works).   |
| 6                  | The distance from the edge of any excavation that extends below natural groundwater level, must not be less than:                         |   |  |   |   |   |  |
|                    | (a) 50 m from the Wetland Management Areas Overlay  | EXEMPT  | MEETS  | EXEMPT  | MEETS   | MEETS   | MEETS  |
|                    | (b) 10 m from a scheduled Historic Heritage Overlay   |   | DOES NOT MEET<br>(service relocations are unlikely to achieve 10m separation from the scheduled Historic Heritage overlay (ID 01618)). |   | DOES NOT MEET<br>(the Watermain will not achieve 10 m separation from the scheduled Historic Heritage overlay (ID 01618)) | DOES NOT MEET<br>(the air valve chamber will not achieve 10m separation from the scheduled Historic Heritage overlay (ID 01618)). | DOES NOT MEET<br>(the cross connection / isolation valve chamber will not achieve 10m separation from the scheduled Historic |

| Standard E7.6.1.10  |                                      |  | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s)) | Service Diversion / Relocations<br>(unknown depth) | Retaining walls<br>(Max 1.5 m diameter piles) | Watermain No 2<br>(2.5 m to 3 m depth) | Air valve and scour valve chambers<br>(2.1-2.7 m depth) | Cross connection / isolation valve<br>(~3.7 m depth) |
|---|--------------------------------------|--|---|--|---|--|---|--|
|   |                                      |  |   |  |   |  |   | Heritage overlay (ID 01618)).                        |
| (c)   | 10 m from a lawful groundwater take. |  |   | MEETS  |   | MEETS                                  | MEETS   | MEETS  |
| <p><b>MEETS</b> indicates the activity meets the standard, and, <b>n/a</b> indicates the standard is not relevant.</p> <p><b>CHECKING REQUIRED</b> indicates that further assessment / analysis would be required to confirm if the standard can be met</p> <p><b>DOES NOT MEET</b> indicates the activity does not meet the standard</p> |                                      |  |   |  |   |  |   |  |

Table 2: Assessment of activity against the AUP(OP) PA standards for take of groundwater (E7.6.1.6) (all conditions must be met)

| Standard E7.6.1.6 |  | New pedestrian over-rail bridge<br>(Max 1.5 m diameter pile(s))                   | Service Diversion / Relocations<br>(unknown depth)                                       | Retaining walls<br>(Max 1.5 m diameter piles)                                     | Watermain No 2<br>(2.5 m to 3 m depth)   | Air valve and scour valve chambers<br>(2.1-2.7 m depth)                                  | Cross connection  |
|-------------------|--|---|--|---|--|--|---|
| 1                 | The water take must not be geothermal water;   | MEETS<br>(no geothermal conditions)   | MEETS<br>(shallow excavations, no geothermal conditions)                                 | MEETS<br>(no geothermal conditions)   | MEETS<br>(no geothermal conditions)  | MEETS<br>(no geothermal conditions)  | MEETS<br>(no geothermal conditions)   |
| 2                 | The water take must not be for a period of more than 10 days where it occurs in peat soils, or 30 days in other types of soil or rock; and   | MEETS<br>(no peat soils, groundwater abstraction during piling will be < 30 days) | MEETS<br>(no peat soils, groundwater abstraction from each excavation will be < 30 days) | MEETS<br>(no peat soils, groundwater abstraction during piling will be < 30 days) | MEETS<br>(no peat soils, groundwater abstraction from each excavation will be < 30 days) | MEETS<br>(no peat soils, groundwater abstraction from each excavation will be < 30 days) | DOES NOT MEET<br>(some seepage of groundwater could occur into the excavation for a period exceeding 30 days) |
| 3                 | The water take must only occur during construction   | MEETS<br>(dewatering will occur during construction only)                         |  |   |  |  |   |
|                   | MEETS indicates the activity meets the standard, and, n/a indicates the standard is not relevant.<br><br>CHECKING REQUIRED indicates that further assessment / analysis would be required to confirm if the standard can be met<br><br>DOES NOT MEET indicates the activity does not meet the standard |   |  |   |  |  |   |

## 5 Summary

### **New pedestrian-over-rail bridge foundation piles**

The piling works for bridge foundations and approach meet the Permitted Activity standard exemptions under E7.6.1.10(1) and is therefore expected to be a Permitted Activity. In any case, these activities are expected to fully meet the Permitted Activity Standards for groundwater take and diversion under E7.6.1.10(2)-(6).

### **Service diversions/relocations**

Excavation and dewatering for potential service relocations / diversions meet the Permitted Activity standard exemptions under E7.6.1.10(1) if trenching activities are progressively opened, closed and stabilized where the part of the trench that is open, at any given time, is no longer than 10 days. Accordingly, the activities are expected to be a Permitted Activity. However, if the trench is open for more than 10 days, it is unlikely to meet E7.6.1.10 (6 b) due to its localised proximity to a scheduled historic heritage extent of place; and would still need to be tested against E7.6.1.10 (5) once depths are finalised.

### **Retaining walls**

The retaining walls are currently in the concept design stage; however, the piles are expected to be less than 1.5 m in diameter and are unlikely to permanently drain or impede groundwater. Consequently, they are likely to fully meet the Permitted Activity standard exemptions under E7.6.1.10(1); and the standards under E7.6.10(2)-(6) and accordingly are expected to be a Permitted Activity.

### **Watermain No. 2 pipeline**

The watermain will be progressively trenched and each section will be opened and closed within 10 days thus meeting Permitted Activity standard exemptions under E7.6.1.10 (1) and is therefore expected to be a Permitted Activity. However, if any part of the trench is open for more than 10 days, it may not meet standard E7.6.10(6b) due to its localised proximity to a scheduled historic heritage extent of place.

### **Air valve and scour valve chambers**

The installation of the air valve chamber, and a scour valve chamber likely do not meet the Permitted Activity standard exemptions under E7.6.1.10 (1) due to the excavations being open for more than 10 days. Although the scour valve chamber likely meets the standards under E7.6.10(2)-(6) and accordingly is expected to be a Permitted Activity, the air valve chamber is unlikely to meet E7.6.1.10(6b) due to its proximity to a scheduled historic heritage extent of place.

### **Cross connection / isolation valve**

The construction of the cross-connection and isolation valve chamber at the northern end of the alignment is expected to require dewatering for more than 30 days, making compliance with the Permitted Activity standard exemptions unlikely. In addition, the Permitted Activity standards E7.6.1.10 (1, 3, and 6) will not be fully met due to parts of the excavation being open for more than 10 days, the groundwater level being lowered by more than 2.0 m below the natural groundwater



level, and due to encroachment into the Oakley Hospital Historic Heritage extent of place (albeit while being located at least 17m from the primary feature (the former Oakley Hospital Main Building)).

## Conclusion

As summarised above, the majority of the activities contemplated as part of the Project are anticipated to be Permitted Activities – either by meeting the E7.6.1.10(1) Permitted Activity standard exemptions; or by meeting the relevant Permitted Activity standards under E7.6.1.10(2)-(6).

The exception to this is the construction of the cross-connection and isolation valve chamber at the northern end of the alignment. Excavations for works in this localised part of the Project are likely to:

- Exceed 30 days in duration (noting that diversion and dewatering will only occur during construction);
- Will exceed permitted drawdown depths (2.5m drawdown > 2m permitted drawdown); and
- Will encroach/not achieve a 10m separation from the Oakley Hospital Historic Heritage extent of place (noting that the excavation will be located at least 17m from the nearest point of the primary feature (the former Oakley Hospital Main Building)).

It is therefore anticipated that resource consent for groundwater diversion and dewatering will be required under E7.4.1(20) and (28) for this localised part of the Project during construction. Based on the matters of discretion set out at E7.8.1(6), it is considered that the key matters of relevance to the Project are how excavation for the cross connection and isolation valve chamber will avoid, remedy, or mitigate adverse effects from ground settlement; and on the Oakley Hospital heritage building. To this end, it is recommended that the conditions of consent include a requirement for a Groundwater and Settlement Monitoring and Contingency Plan.

## 6 Applicability Statement

This report has been prepared by Beca Ltd (Beca) on the specific instructions of Auckland Transport (Client). It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

In preparing this report Beca has relied on the current understanding of proposed construction works, as well as the following:

- Preliminary Geotechnical Appraisal Report prepared by Jacobs New Zealand Limited for Auckland Transport, dated 3 March 2023
- New Zealand Geotechnical Database, available at <[www.nzgd.org.nz/](http://www.nzgd.org.nz/)>, accessed 13 November 2024
- Auckland Council GeoMaps Underground Services layers, available at <https://geomapspublic.aucklandcouncil.govt.nz/>, accessed 13 November 2024

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from

those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers. No part of this report shall be taken out of context and, to the maximum extent permitted by law, no responsibility is accepted by Beca for the use of any part of this report in any context, or for any purpose, other than that stated here.

This memorandum has been verified by a Hydrogeological Professional on the basis of the agreed commission. No amendments should be made to the content of this document without subsequent re-verification by the geotechnical author and verifier.

### **James Botting**

Senior Hydrogeologist

Phone Number: +64 9 300 9000

Email: [James.Botting@beca.com](mailto:James.Botting@beca.com)

### **Jose Cervan**

Hydrogeologist

Phone Number: +64 21 227 3924

Email: [Jose.Cervan@beca.com](mailto:Jose.Cervan@beca.com)



## Appendix A – Preliminary Geotechnical Appraisal Report

# B

## Appendix B – Geotechnical Interpretive Report



# B

Appendix B – Bore logs

# Geotechnical Log Key Sheet

## SOIL AND ROCK DESCRIPTIONS

Soil and Rock Descriptions are in general accordance with the NZ Geotechnical Society (NZGS), 2005.  
Hand-held Vane Shear Strength measurements are in general accordance with the NZGS, 2001.

### METHODS

|      |                             |
|------|-----------------------------|
| BH   | Machine Borehole            |
| CPT  | Cone Penetration Test       |
| DCP  | Dynamic Cone Penetration    |
| HA   | Hand Auger                  |
| SPT  | Standard Penetration Test   |
| IVAN | In-situ Vane Test           |
| MA   | Machine Auger               |
| OB   | Open Barrel                 |
| SNC  | Sonic Core Drilling         |
| TP   | Test Pit/Trench             |
| TT   | Triple Tube                 |
| PT   | Thin-walled Open Drive Tube |
| VE   | Vacuum Excavation           |
| W    | Wash Boring                 |


### WEATHERING

|    |                      |
|----|----------------------|
| CW | Completely Weathered |
| HW | Highly Weathered     |
| MW | Moderately Weathered |
| SW | Slightly Weathered   |
| UW | Unweathered          |

### SAMPLES

|   |  |
|---|--|
| B | Bulk Disturbed Sample                      |
| C | Core Sample                                |
| D | Small Disturbed Sample                     |
| U | Thin-wall Open Drive<br>(Push) Tube Sample |

### WATER

|   |                            |
|---|----------------------------|
|  | Groundwater Level<br>(GWL) |
|---|----------------------------|

### IN-SITU TESTS





















#### Shear Vane

|  |  |
|--|--|
| Su                                     | In-situ peak undrained shear strength and remoulded undrained shear strength |
| UTP                                    | Unable to Penetrate  |
| CB                                     | Pilcon-type vane tested in Core Barrel                                       |
| DH                                     | Pilcon-type vane tested in-situ (downhole)                                   |
| GV                                     | Geonor vane, tested in-situ  |
| IcV                                    | Iccone vane, tested in-situ  |
| <b>Standard Penetration Test (SPT)</b> |  |
| N                                      | SPTn Sampler (Split-spoon)   |
| Nc                                     | SPTn Solid Cone  |
| HB                                     | SPT Hammer Bouncing  |

### TERMINOLOGY






|     |                          |
|-----|--------------------------|
| RL  | Reduced Level            |
| RQD | Rock Quality Designation |

### GRAPHIC LOG (1 or a combination of the following)




|  |                    |   |                  |   |                       |   |                      |   |                |
|--|--------------------|---|------------------|---|-----------------------|---|----------------------|---|----------------|
|    | Clay               |    | Silt             |    | Sandstone (SST)       |    | Conglomerate         |    | Fine Igneous   |
|   | Gravel             |   | Sand             |   | Siltstone (ZST)       |   | Limestone            |   | Coarse Igneous |
|  | Shells             |  | Organic Material |  | Mudstone              |  | Foliated Metamorphic |  | Ignimbrite     |
|  | Cobbles / Boulders |  | Wood             |  | Interbedded SST & ZST |  | Asphalt              |  | No Core        |

### MONITORING INSTALLATION

#### Backfill Material

|  |        |   |              |   |           |
|--|--------|---|--------------|---|-----------|
|  | Sand   |  | Grout        |  | Bentonite |
|  | Gravel |  | Cement Mixes |   |           |

#### Standpipe

|   |       |   |         |   |                |
|---|-------|---|---------|---|----------------|
|  | Plain |  | Slotted |  | Vibrating Wire |
|---|-------|---|---------|---|----------------|

### ORGANIC SOILS

#### Von Post Degree of Humification

|     |  |
|-----|--|
| H1  | Completely unconverted and mud-free peat, when pressed gives clear water and plant structure is visible.   |
| H2  | Partially unconverted and mud-free peat, when pressed gives almost clear water and plant structure is visible.   |
| H3  | Very slightly decomposed or very slightly muddy peat, when pressed gives marked muddy water, no peat substance passes through the fingers and plant structure is less visible. |
| H4  | Slightly decomposed or slightly muddy peat, when pressed gives muddy water and plant structure is less visible.  |
| H5  | Moderately decomposed or very muddy peat with growth structure evident but slightly obliterated.   |
| H6  | Moderately decomposed or very muddy peat with indistinct growth structure.   |
| H7  | Fairly well decomposed or very muddy peat but the growth structure can just be seen.   |
| H8  | Well decomposed or very muddy peat with very indistinct growth structure.  |
| H9  | Practically decomposed or mud-like peat in which almost no growth structure is evident.  |
| H10 | Completely decomposed or mud peat where no growth structure can be seen, entire substance passes through the fingers when pressed.   |

| Machine Borehole Log                                       |          |                            |          |  |                             |     |         |                                  |        | Borehole ID: BH05               |   |  |                           |
|--|----------|----------------------------|----------|--|-----------------------------|-----|---------|----------------------------------|--------|---------------------------------|---|--|---------------------------|
| Project: Carrington Road Watermain                         |          |                            |          |  |                             |     |         |                                  |        | Project number: 3250660         |   |  |                           |
| Site location: 28 to 158 Carrington Road                   |          |                            |          |  |                             |     |         |                                  |        | Client: Watercare Services Ltd. |   |  |                           |
| Location: Grass berm opposite 28 Carrington Road           |          |                            |          |  | Coordinate system: NZTM2000 |     |         | Vertical datum: NZVD 2016        |        |                                 |   |  |                           |
|  |          |                            |          |  | Northing: 5917905.0         |     |         | Ground level (mRL): 26.50        |        |                                 |   |  |                           |
|  |          |                            |          |  | Easting: 1752404.0          |     |         | Location method: Geomaps +/- 10m |        |                                 |   |  |                           |
| Installations  | Drilling |                            |          |  | In Situ Tests               |     | Samples | Depth (m)                        | RL (m) | Graphic Log                     | Soil/ Rock Description                                    | Geological Unit  |                           |
|  | GWL      | Fluid Return               | Recovery | Method   | Casing                      | RQD |         |                                  |        |                                 |   |  | Su (kPa)                  |
|  |          |                            | 0%       | VE   |                             |     |         |                                  |        |                                 | 0.0-2.0m: vacuum excavation.                              | Tauranga Group   |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   | 4.35-4.5m: no recovery.<br>Very stiff, silty CLAY; light orange brown; moist, high plasticity. | East Coast Bays Formation |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 | 5.20m - End of Borehole, Hole terminated at target depth. |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
|  |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
| Date started: 27/11/2024                                   |          | Date end: 27/11/2024       |          | Comments:  |                             |     |         |                                  |        |                                 |   |  |                           |
| Logged by: SH  |          | Drilled by: Pro-Drill Ltd. |          | Terminated at target depth.                          |                             |     |         |                                  |        |                                 |   |  |                           |
| Vane ID: 1509  |          | Equipment: SLG 02          |          | Groundwater measured as 1.33mbgl at 9am on 6/12/2024 |                             |     |         |                                  |        |                                 |   |  |                           |
| Vane type: Core barrel                                     |          | Method: OB/VE/SPT          |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
| Vane width: 19mm   |          | Inclination: 90°           |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
| SPT No: 4508 TB  |          | Diameter: 85mm             |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
| SPT efficiency: 80%  |          | Fluid type: Water          |          |  |                             |     |         |                                  |        |                                 |   |  |                           |
| For Explanation of Symbols and Abbreviations See Key Sheet |          |                            |          |  |                             |     |         |                                  |        |                                 |   |  |                           |

Photo Log

Location ID: BH05

Sheet 1 of 1

|                |  |                     |                         |
|----------------|--|---------------------|-------------------------|
| Project:       | Carrington Road Watermain              | Project number:     | 3250660                 |
| Site location: | 28 to 158 Carrington Road              | Client Name:        | Watercare Services Ltd. |
| Location:      | Grass berm opposite 28 Carrington Road | Coordinate system:  | NZTM2000                |
|                |  | Vertical datum:     | NZVD 2016               |
|                |  | Northing:           | 5917905.0               |
|                |  | Ground level (mRL): | 26.50                   |
|                |  | Easting:            | 1752404.0               |
|                |  | Location method:    | Geomaps +/- 10m         |



- 0.00mbgl to 5.20mbgl





Beca

BOREHOLE No: **MBR10**

## MACHINE BOREHOLE LOG

SHEET 1 of 2

|   |  |                             |  |
|---|--|-----------------------------|--|
| PROJECT: WRR Waterview Connection   |  | JOB NUMBER: 3814238/130     |  |
| SITE LOCATION: Waterview - Owairaka   |  | CLIENT: Transit New Zealand |  |
| BOREHOLE LOCATION: Grass verge adjacent to Unitech, opposite 50 Carrington Rd |  |                             |  |
| COORDINATES: N 6,479,503.86 m<br>E 2,662,839.00 m                             |  | R L: 25.44 m<br>DATUM: MSL  |  |

| GEOLOGICAL UNIT | DRILLING   |             |               |        |     | IN-SITU TESTS |              |                        | SAMPLES<br>R L (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION | MOISTURE | CONSISTENCY | SOIL / ROCK DESCRIPTION  | INSTRUMENTATION      |
|-----------------|------------|-------------|---------------|--------|-----|---------------|--------------|------------------------|--------------------|-----------|-------------|----------------|----------|-------------|--|----------------------|
|                 | FLUID LOSS | WATER LEVEL | CORE RECOVERY | METHOD | RQD | SV (kPa)      | $\tau$ (kPa) | SPT 'N'                |                    |           |             |                |          |             |  |                      |
| No Recovery     |            |             | 0 %           | Vacuum |     |               |              |                        |                    | 25        |             |                |          |             | No recovery - vacuum excavated to avoid services.  | Bentonite & concrete |
| Tauranga Group  |            |             | 100 %         | TT     |     |               |              | 3<br>5<br>5<br>N=10    |                    | 24        | x x x x     | MH             | M        | St          | Stiff, mottled light grey and brown SILT, minor clay; moist, moderately plastic. Thinly laminated, rootlets.       |                      |
|                 |            |             | 100 %         | SPT    |     |               |              |                        |                    |           | x x x x     | MH             | M        | St          | Stiff, mottled light grey and orangey brown fine sandy SILT, trace clay; moist, moderately plastic when wetted.    |                      |
|                 |            |             | 40 %          | TT     |     |               |              |                        |                    | 23        | x x x x     |                |          |             |  |                      |
|                 |            |             | 100 %         | SPT    |     |               |              | 2<br>2<br>3<br>N=5     |                    | 22        | x x x x     | SW             | M        | L           | Loose, light reddish brown SAND, minor silt and clay; moist, moderately plastic.                                   |                      |
|                 |            |             | 100 %         | TT     |     | 98/54         | 137/75       |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 100 %         | TT     |     | 54/28         | 137/38       |                        |                    |           |             |                |          |             |  |                      |
| Waitemata Group |            |             | 100 %         | TT     |     |               |              | 1<br>2<br>4<br>N=6     |                    | 21        | x x x x     | SM             | M        | L           | Loose, light grey SAND, trace silt; moist, non plastic. [HW - CW Waitemata Group]                                  | Backfill Gravel      |
|                 |            |             | 100 %         | SPT    |     |               |              |                        |                    |           | x x x x     |                |          |             | Black fibrous organics.  |                      |
|                 |            |             | 100 %         | TT     |     | 69/39         | 96/53        |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 100 %         | TT     |     | 42/21         | 58/29        |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 90 %          | SPT    |     |               |              | 5<br>8<br>5<br>N=13    |                    | 19        | x x x x     |                |          |             | Black fibrous organics.  |                      |
|                 |            |             | 100 %         | TT     |     | 60/25         | 85/34        |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 100 %         | TT     |     | 52/21         | 72/29        |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 100 %         | SPT    |     |               |              | 5<br>7<br>9<br>N=16    |                    | 18        | x x x x     |                |          |             |  |                      |
|                 |            |             | 100 %         | TT     |     | 61/26         | 85/36        |                        |                    |           |             |                |          |             |  |                      |
|                 |            |             | 100 %         | TT     |     | 120/40        | 168/55       |                        |                    |           |             |                |          |             | Medium dense, thin to moderately thickly bedded, dark grey SAND and SILT; moist, non plastic. [HW Waitemata Group] |                      |
|                 |            |             | 85 %          | SPT    |     |               |              | 10<br>15<br>18<br>N=33 |                    | 16        | x x x x     | M              | EW       |             | Extremely weak, SW dark grey uncemented to poorly SANDSTONE; moist, moderately thinly bedded. [SW Waitemata Group] |                      |
|                 |            |             | 100 %         | TT     |     |               |              |                        |                    |           |             |                |          |             |  |                      |

|                        |                                  |  |
|------------------------|----------------------------------|--|
| DATE STARTED: 24/9/07  | DRILLED BY: Pro-Drill (Auck) Ltd | COMMENTS: Shear strengths (SV) measured in end of core barrel. |
| DATE FINISHED: 24/9/07 | DRILL TYPE: QM-200               |  |
| LOGGED BY: HW          | DRILL METHOD: OB/SPT/TT          |  |
| PILCON VANE No: DR4833 | DRILL FLUID: Water               |  |
| REVIEWED BY:           |                                  |  |

FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET



Beca

BOREHOLE No: **MBR10**

## MACHINE BOREHOLE LOG

SHEET 2 of 2

| PROJECT: WRR Waterview Connection   |            |             |               |        |     |               |             |                 |                        | JOB NUMBER: 3814238/130          |             |                |          |             |  |  |                 |  |  |
|---|------------|-------------|---------------|--------|-----|---------------|-------------|-----------------|------------------------|----------------------------------|-------------|----------------|----------|-------------|--|--|-----------------|--|--|
| SITE LOCATION: Waterview - Owairaka   |            |             |               |        |     |               |             |                 |                        | CLIENT: Transit New Zealand      |             |                |          |             |  |  |                 |  |  |
| BOREHOLE LOCATION: Grass verge adjacent to Unitech, opposite 50 Carrington Rd |            |             |               |        |     |               |             |                 |                        |                                  |             |                |          |             |  |  |                 |  |  |
| COORDINATES: N 6,479,503.86 m   |            |             |               |        |     |               |             |                 |                        | R L: 25.44 m                     |             |                |          |             |  |  |                 |  |  |
| E 2,662,839.00 m  |            |             |               |        |     |               |             |                 |                        | DATUM: MSL                       |             |                |          |             |  |  |                 |  |  |
| GEOLOGICAL UNIT   | DRILLING   |             |               |        |     | IN-SITU TESTS |             |                 | SAMPLES<br>R L (m)     | DEPTH (m)                        | GRAPHIC LOG | CLASSIFICATION | MOISTURE | CONSISTENCY | SOIL / ROCK DESCRIPTION  | INSTRUMENTATION  |                 |  |  |
|   | FLUID LOSS | WATER LEVEL | CORE RECOVERY | METHOD | RQD | CASING        | SV<br>(kPa) | $\tau$<br>(kPa) |                        |                                  |             |                |          |             |  |  | SPT<br>'N'      |  |  |
| Waitemata Group   |            |             | 100 %         | SPT TT |     |               |             |                 | 50 for 100 mm<br>N=50+ | 15                               |             |                |          |             | M EW   | Extremely weak, SW dark grey uncemented to poorly SANDSTONE; moist, moderately thinly bedded. [SW Waitemata Group] | Bentonite       |  |  |
|   |            |             | 75 %          | TT     |     |               |             |                 |                        | 11                               |             |                |          |             |  |  | Sand            |  |  |
|   |            |             | 0 %           | SPT    |     |               |             |                 | 50 for 140 mm<br>N=50+ | 14                               |             |                |          |             | W VW   | Very weak, SW grey poorly cemented moderately thick SANDSTONE interbedded with moderately thin SILTSTONE.          | Gravel          |  |  |
|   |            |             | 60 %          | TT     |     |               |             |                 |                        | 12                               |             |                |          |             |  |  |                 |  |  |
|   |            |             | 0 %           | SPT    |     |               |             |                 | 50 for 110 mm<br>N=50+ | 13                               |             |                |          |             |  | Two steeply inclined defects.  | Screen + Gravel |  |  |
|   |            |             | 90 %          | TT     |     |               |             |                 |                        | 12                               |             |                |          |             |  |  |                 |  |  |
|   |            |             | 0 %           | SPT    |     |               |             |                 | 50 for 70 mm<br>N=50+  | 14                               |             |                |          |             |  |  |                 |  |  |
|   |            |             | 0 %           | SPT    |     |               |             |                 |                        | 11                               |             |                |          |             |  |  |                 |  |  |
|   |            |             | 0 %           | SPT    |     |               |             |                 |                        | 15                               |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 |                        | 10                               |             |                |          |             |  | End of Borehole 15.07m.  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 16                     |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 9                      |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 17                     |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 8                      |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 18                     |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 7                      |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 19                     |                                  |             |                |          |             |  |  |                 |  |  |
|   |            |             |               |        |     |               |             |                 | 6                      |                                  |             |                |          |             |  |  |                 |  |  |
| DATE STARTED: 24/9/07   |            |             |               |        |     |               |             |                 |                        | DRILLED BY: Pro-Drill (Auck) Ltd |             |                |          |             | COMMENTS: Shear strengths (SV) measured in end of core barrel. |  |                 |  |  |
| DATE FINISHED: 24/9/07  |            |             |               |        |     |               |             |                 |                        | DRILL TYPE: QM-200               |             |                |          |             |  |  |                 |  |  |
| LOGGED BY: HW   |            |             |               |        |     |               |             |                 |                        | DRILL METHOD: OB/SPT/TT          |             |                |          |             |  |  |                 |  |  |
| PILCON VANE No: DR4833  |            |             |               |        |     |               |             |                 |                        | DRILL FLUID: Water               |             |                |          |             |  |  |                 |  |  |
| REVIEWED BY:  |            |             |               |        |     |               |             |                 |                        |                                  |             |                |          |             |  |  |                 |  |  |
| FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS SEE KEY SHEET                    |            |             |               |        |     |               |             |                 |                        |                                  |             |                |          |             |  |  |                 |  |  |



Appendix C – Calculated drawdown and consolidation settlement

# Radius of influence calculation for cross connection / isolation valve (CIRIA C750, equation 6.6 and 6.9)

Based on Sichardt, 1931

$$R_0 \approx Ch\sqrt{k} \quad (\text{eqn 6.9})$$

**k (m/s):** test range 1e-6 = upper bound from Waterview testing to 6e-8 = lower bound adopted by Waterview Connection

But with correction of Cashman and Preene (2013) accounting for excavation radius

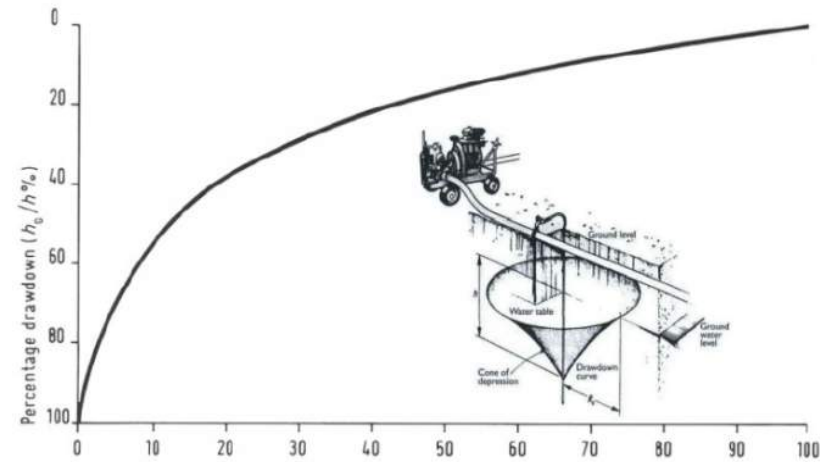
$$R_0 = r_e + 3000(H - h_w)\sqrt{k} \quad \text{where } r_e = (a + b) / \pi \quad (\text{eqn 6.6})$$

note above uses 3000 as assumes a circular excavation which is the expected case to install DN4000 chamber

## Cross connection / isolation valve

|  |       |      |
|--|-------|------|
| Well radius =  | 2     | m    |
| Existing ground level =                              | 26.84 | mRL  |
| Groundwater level =                                  | 1.2   | mbgl |
| Groundwater level =                                  | 25.64 | mRL  |
| Depth of excavation (+0.5 m for dry working floor) = | 3.7   | mbgl |
| Dewatering level =                                   | 23.14 | mRL  |
| Drawdown =   | 2.5   | m    |

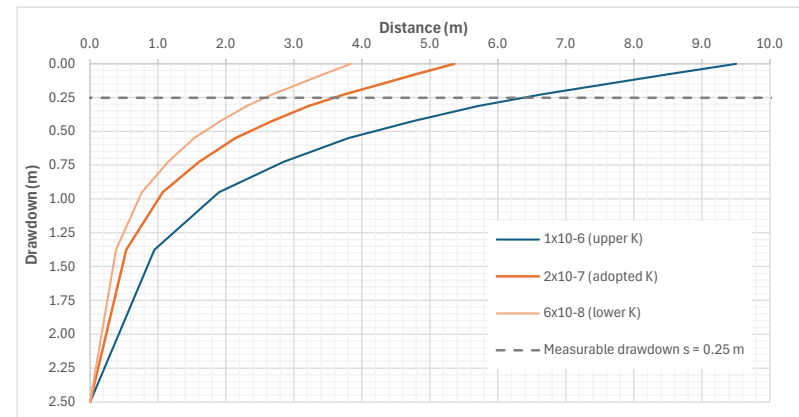
|                                    |       |
|------------------------------------|-------|
| C (for excavation):                | 3000  |
| R <sub>0</sub> where k = 6e-8 m/s: | 3.8 m |
| R <sub>0</sub> where k = 2e-7 m/s: | 5.4 m |
| R <sub>0</sub> where k = 1e-6 m/s: | 9.5 m |



CIRIA R113, Figure 13: Normalised drawdown cone relative to centre of cone of depression

## NORMALISED DRAWDOWN PROFILE

| Distance (m) | Normalised s (m) | 1x10-6 (upper K) |       | 2x10-7 (adopted K) |       | 6x10-8 (lower K) |       |
|--------------|------------------|------------------|-------|--------------------|-------|------------------|-------|
|              |                  | x (m)            | s (m) | x (m)              | s (m) | x (m)            | s (m) |
| 0            | 100              | 0.0              | 2.50  | 0.0                | 2.50  | 0.0              | 2.50  |
| 10           | 55               | 1.0              | 1.38  | 0.5                | 1.38  | 0.4              | 1.38  |
| 20           | 38               | 1.9              | 0.95  | 1.1                | 0.95  | 0.8              | 0.95  |
| 30           | 29               | 2.9              | 0.73  | 1.6                | 0.73  | 1.2              | 0.73  |
| 40           | 22               | 3.8              | 0.55  | 2.1                | 0.55  | 1.5              | 0.55  |
| 50           | 17               | 4.8              | 0.43  | 2.7                | 0.43  | 1.9              | 0.43  |
| 60           | 12.5             | 5.7              | 0.31  | 3.2                | 0.31  | 2.3              | 0.31  |
| 70           | 9                | 6.7              | 0.23  | 3.7                | 0.23  | 2.7              | 0.23  |
| 80           | 6                | 7.6              | 0.15  | 4.3                | 0.15  | 3.1              | 0.15  |
| 90           | 3                | 8.6              | 0.08  | 4.8                | 0.08  | 3.5              | 0.08  |
| 100          | 0                | 9.5              | 0.00  | 5.4                | 0.00  | 3.8              | 0.00  |





Inflow calculations for excavation, considering it as a partially penetrating, large equivalent well in an unconfined aquifer (CIRIA C750, equations 6.8 and 6.10).



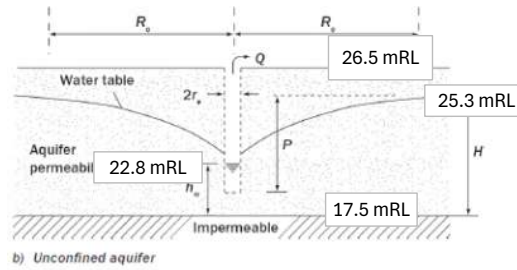
### Cross connection / Isolation valve (LOWER BOUND K)

Fully penetrating (eqn 6.8):

$$\text{Unconfined conditions: } Q = \frac{\pi k (H^2 - h_w^2)}{\ln[R_0/r_e]}$$

|       |              |
|-------|--------------|
| k     | 6.00E-08 m/s |
| H     | 7.80 m       |
| $h_w$ | 5.3 m        |
| $R_0$ | 3.8 m        |
| Re    | 2.0 m        |

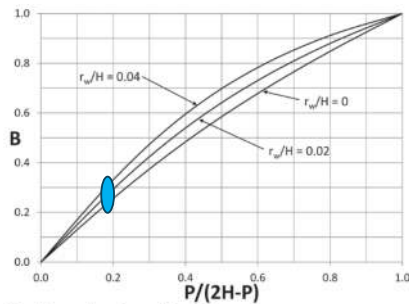
$$Q = 0.00001 \text{ m}^3/\text{s} \\ 1 \text{ m}^3/\text{d}$$



$$\text{where } r_e = (a + b)/\pi \quad (\text{eqn 6.6})$$

$$R_0 = C(H - h_w)\sqrt{k} \quad (\text{eqn 6.9})$$

Corrected for partial penetration



b) Unconfined aquifer

$$P = 2.5 \text{ m} \\ P/(2H-P) = 0.19$$

$$\text{therefore } B = 0.25$$

$$Q_{pp} = BQ_{fp} \quad (\text{eqn 6.10})$$

$$\text{therefore } Q = 2.37\text{E-}06 \text{ m}^3/\text{s} \\ 0.002 \text{ l/s} \\ 0.2 \text{ m}^3/\text{d}$$

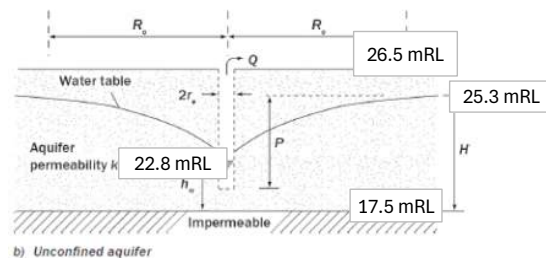
### Cross connection / Isolation valve (ADOPTED K)

Fully penetrating (eqn 6.8):

$$\text{Unconfined conditions: } Q = \frac{\pi k (H^2 - h_w^2)}{\ln[R_0/r_e]}$$

|       |              |
|-------|--------------|
| k     | 2.00E-07 m/s |
| H     | 7.80 m       |
| $h_w$ | 5.3 m        |
| $R_0$ | 5.4 m        |
| Re    | 2.0 m        |

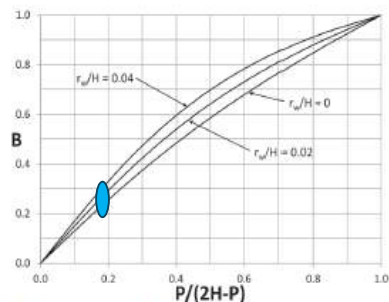
$$Q = 0.00002 \text{ m}^3/\text{s} \quad 0.020897 \\ 2 \text{ m}^3/\text{d}$$



$$\text{where } r_e = (a + b)/\pi \quad (\text{eqn 6.6})$$

$$R_0 = C(H - h_w)\sqrt{k} \quad (\text{eqn 6.9})$$

Corrected for partial penetration



b) Unconfined aquifer

$$P = 2.5 \text{ m} \\ P/(2H-P) = 0.19$$

$$\text{therefore } B = 0.25$$

$$Q_{pp} = BQ_{fp} \quad (\text{eqn 6.10})$$

$$\text{therefore } Q = 5.22\text{E-}06 \text{ m}^3/\text{s} \\ 0.01 \text{ l/s} \\ 0.5 \text{ m}^3/\text{d}$$

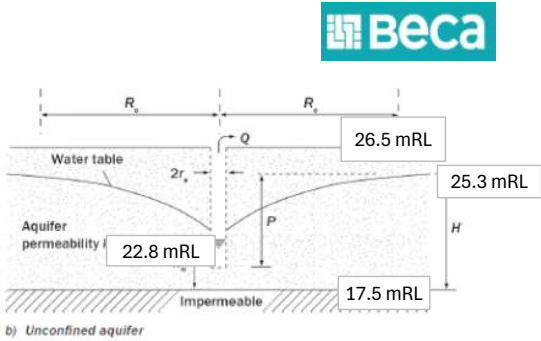
Cross connection / Isolation valve (UPPER BOUND K)

Fully penetrating (eqn 6.8):

Unconfined conditions:  $Q = \frac{\pi k (H^2 - h_w^2)}{\ln [R_e / r_e]}$

|                |              |
|----------------|--------------|
| k              | 1.00E-06 m/s |
| H              | 7.80 m       |
| h <sub>w</sub> | 5.3 m        |
| R <sub>0</sub> | 6.5 m        |
| Re             | 2.0 m        |

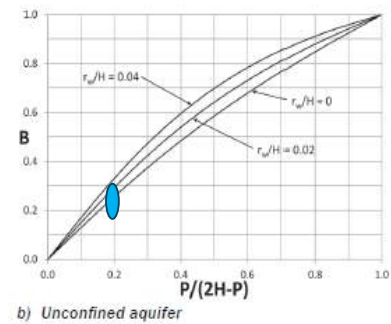
|   |                          |
|---|--------------------------|
| Q | 0.0001 m <sup>3</sup> /s |
|   | 8 m <sup>3</sup> /d      |



where  $r_e = (a + b) / \pi$  (eqn 6.6)

$R_e = C(H - h_w) \sqrt{k}$  (eqn 6.9)

Corrected for partial penetration



P = 2.5 m  
P/(2H-P) = 0.19

therefore **B = 0.25**

$Q_{pp} = BQ_p$  (eqn 6.10)

therefore **Q = 2.18E-05 m<sup>3</sup>/s**  
**0.02 l/s**  
**1.9 m<sup>3</sup>/d**

Cross connection / Isolation valve: for  $k = 2\text{e-}7 \text{ m/s}$ , aquifer = 7.8 m thick, pumping rate of 0.8 m<sup>3</sup>/d and  $S_y = 0.1$

Measurable drawdown  $s = 0.25 \text{ m}$  extends to 14 m after 60 days, i.e. 259% further than Sichardt extent of 5.4 m

### Time-drawdown calculations using Theis equation

| Aquifer parameters                        |         |                   |
|---|---------|-------------------|
| T   | 0.135   | m <sup>2</sup> /d |
| S   | 0.1     |                   |
| B   |         |                   |
| Pumping rate                              |         |                   |
| Q   | 0.01    | l/s               |
| K   | 2.0E-07 | m/s               |
| b   | 7.8     | m                 |
| Expected dewatered duration of excavation |         |                   |

| Radius (m)  | 0.1          | 10           | 17           |
|-------------|--------------|--------------|--------------|
| Time (days) | Drawdown (m) | Drawdown (m) | Drawdown (m) |
| 1           | 2.915        | -            | -            |
| 5           | 3.735        | 0.003        | 0.000        |
| 10          | 4.089        | 0.031        | 0.000        |
| 15          | 4.296        | 0.076        | 0.003        |
| 30          | 4.649        | 0.223        | 0.034        |
| 45          | 4.856        | 0.348        | 0.082        |
| 60          | 5.003        | 0.451        | 0.134        |
| 75          | 5.117        | 0.537        | 0.185        |
| 90          | 5.210        | 0.611        | 0.234        |
| 120         | 5.356        | 0.734        | 0.321        |
| 150         | 5.470        | 0.833        | 0.398        |
| 180         | 5.563        | 0.916        | 0.465        |
| 365         | 5.924        | 1.251        | 0.756        |

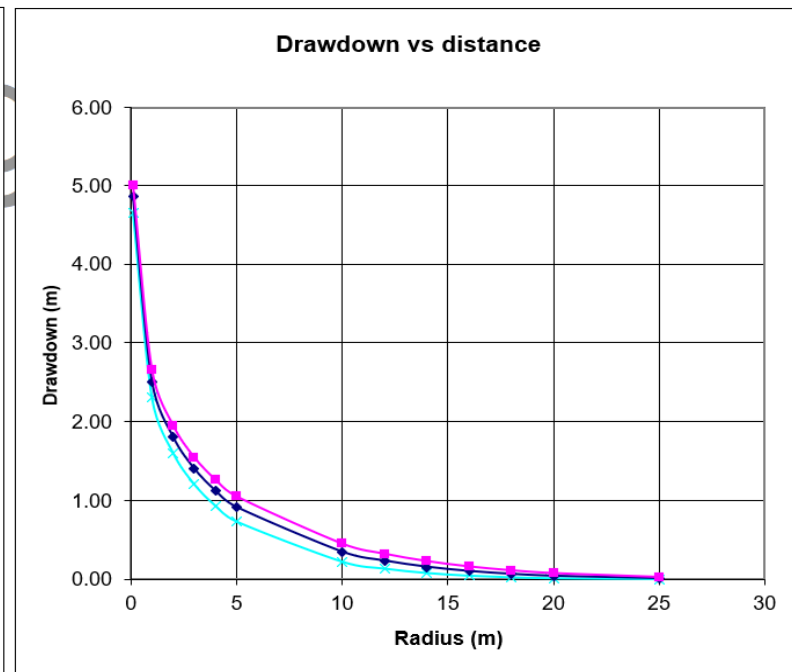
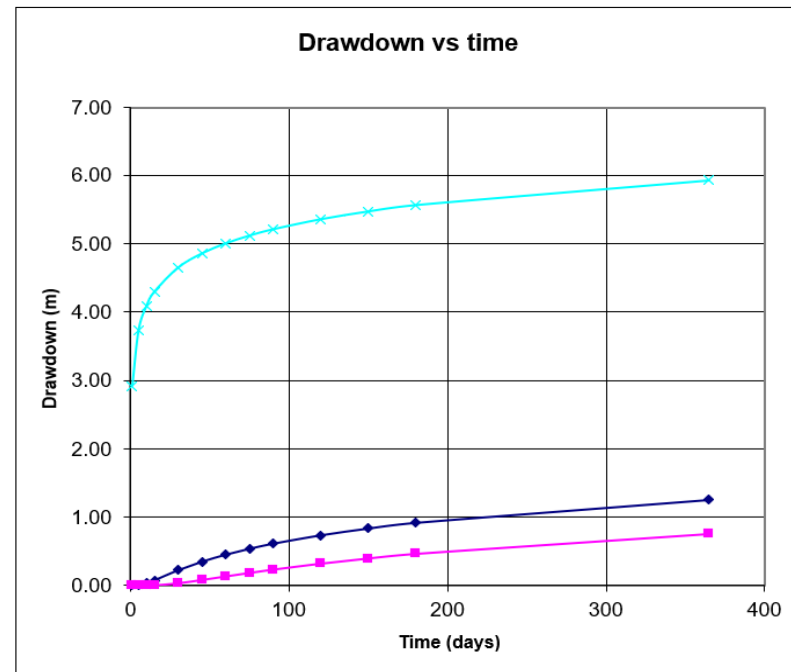
### Distance-drawdown calculations using Theis equation

| Aquifer parameters |          |                   |
|--------------------|----------|-------------------|
| T                  | 0.134784 | m <sup>2</sup> /d |
| S                  | 0.1      |                   |
| B                  |          |                   |
| Pumping rate       |          |                   |
| Q                  | 0.01     | l/s               |

| Time (days) | 30           | 45           | 60           |
|-------------|--------------|--------------|--------------|
| Radius (m)  | Drawdown (m) | Drawdown (m) | Drawdown (m) |
| 0.1         | 4.649        | 4.856        | 5.003        |
| 1           | 2.303        | 2.509        | 2.655        |
| 2           | 1.605        | 1.808        | 1.953        |
| 3           | 1.207        | 1.405        | 1.547        |
| 4           | 0.935        | 1.126        | 1.264        |
| 5           | 0.734        | 0.916        | 1.050        |
| 10          | 0.223        | 0.348        | 0.451        |
| 12          | 0.135        | 0.235        | 0.323        |
| 14          | 0.079        | 0.156        | 0.229        |
| 16          | 0.045        | 0.102        | 0.161        |
| 18          | 0.025        | 0.065        | 0.112        |
| 20          | 0.013        | 0.041        | 0.076        |
| 25          | 0.002        | 0.011        | 0.027        |

Measurable extent of drawdown ( $s=0.25 \text{ m}$ ) for different dewatering durations



| Calculated consolidation settlement for services within groundwater drawdown extent |           |                               |                                   |                    | Primary consolidation settlement<br>$\delta = \Delta\sigma' * H * m_v$  |
|---|-----------|-------------------------------|-----------------------------------|--------------------|---|
| Location  | Parameter | $m_v$<br>(m <sup>2</sup> /MN) | $\Delta P$<br>(mH <sub>2</sub> O) | thickness s<br>(m) |   |
| At excavation ( 0 m distance)   | 0.3       | 2.5                           | 18                                | 9                  | Where $\delta$ = settlement<br>$\Delta\sigma'$ = change in effective stress (kPa)<br>H = thickness of compressible layers (m)<br>$m_v$ = volume compressibility (m <sup>2</sup> /MN)<br><br><i>A range of <math>m_v</math> values were tested between 0.1 - 0.5 however 0.3 adopted as a suitable upper bound for given soil type</i> |
| Chorus comms cable (1.3 m distance)   |           |                               |                                   |                    |   |
| Vector electricity pilot / fibre (1.4 m distance)                                   |           |                               |                                   |                    |   |
| Vector power cable (1.7 m distance)   |           |                               |                                   |                    |   |
| EON NZ comms (2.1 m distance)   |           |                               |                                   |                    |   |
| Chorus comms cable (3.9 m distance)   |           |                               |                                   |                    |   |
| Vector Gas pipeline (5 m distance)  |           |                               |                                   |                    |   |







Appendix D – Draft GMCP

## Introduction

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Auckland Transport (AT) intends to upgrade Carrington Road into a multi-modal urban road corridor which will comprise the widening of the existing Carrington Road Corridor and improvements or construction of various associated features such as bus lanes, cycle lanes and footpaths (Carrington Road Improvement Project, CRIP).

In conjunction, Watercare Services Limited (Watercare) has proposed the Point Chevalier Watermain No. 2 Project (the Watermain) along Carrington Road. The project involves the installation of Ø750 mm concrete-lined steel (CLS) pipeline, approximately 1 km in length between Seaview Terrace and Sutherland Road.

Unless otherwise noted, the CRIP and Watermain projects are referred to collectively in this plan as 'the Project'. The Project extent is shown in Figure 1.

The only proposed works, associated with the watermain, which may potentially encounter groundwater and does not meet the permitted activity requirements under the Auckland Unitary Plan is the excavation to install the air valve chamber, and the cross-connection and isolation valve chambers (Figure 2). These works will take up to 2 months to construct and fall within 10 m of the Oakley Hospital heritage overlay. The construction work is therefore considered a restricted discretionary activity requiring a resource consent..

This **DRAFT** Groundwater Monitoring & Contingency Plan (GMCP) outline text has been prepared to support the resource consent application, for the temporary take and diversion of groundwater associated with construction of the isolation valve chamber, air valve chamber and cross connections. This draft GMCP will need to be updated to reflect the final construction methodology and programme and submitted to Auckland Council prior to any construction works commencing on these named chambers and cross connections.

Placeholder text that will require updating is highlighted by outlined red text

### 1.1 Project description

The wider Project extent is shown in Figure 1. The focus of this GMCP is on works associated with installation of the air valve chamber and associated cross-connection and isolation valve chamber (Figure 2).

Installation of the ~1 km long watermain along Carrington Road from Seaview Terrace to Sutherland Road will be via open trenching. Each section of trench is expected to be progressively opened and closed within 10 days, thereby fully meeting the PA standards.



Figure 1: Carrington Road Improvement Project Extent (in white) and Point Chevalier Watermain No 2. Extent in blue. Historic heritage extent (Historic Oakley Hospital) outlined in cyan.



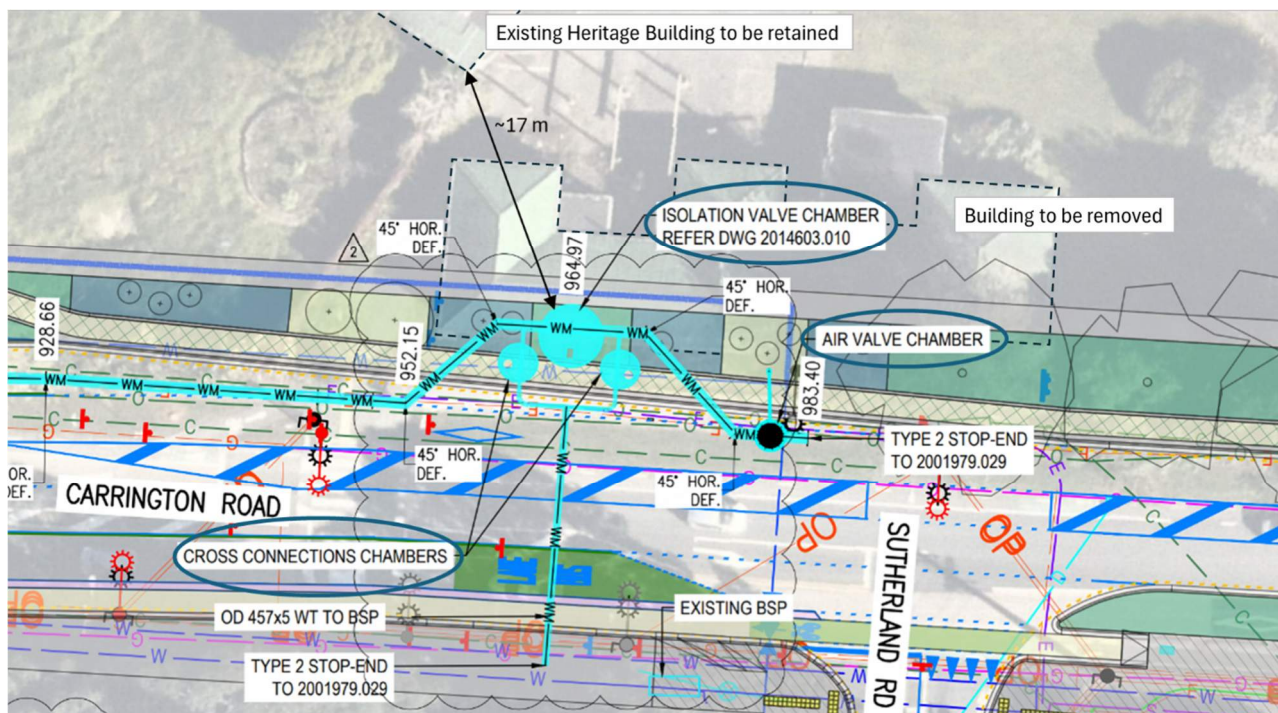


Figure 2: Excerpt of preliminary Point Chevalier Watermain No. 2 – Layout Plan and Pipe Longitudinal Section - Sheet 7 (DWG 2014603.408 Rev B) showing isolation and cross connection valve chambers in relation to the existing heritage building (Oakley Hospital Main Building).

The project includes the following key components:

1. Installation of an 1800 ID air valve chamber which will require excavation to some 2.1 m depth, approximately 0.9 m below the water table.
2. Installation of a 3200 ID precast concrete isolation valve chamber to 3.2 m depth, requiring groundwater to be lowered to 3.7 m depth to allow for dry working conditions. Two cross connections will also be constructed immediately adjacent to the isolation chamber.
3. Construction of the isolation valve chamber and cross connections is expected to take between 30 and 60 days.

## 1.2 Scope of GMCP

This GMCP sets out specifically how groundwater effects will be monitored and managed during the temporary groundwater diversion.

A summary of the works required dewatering, and the assessment of effects due to dewatering (presented at the time of consenting) is provided in **Section 2**.

The monitoring regime proposed for checking groundwater drawdown and settlement effects is described in **Section 3** of this GMCP. This monitoring regime is designed to give warning of groundwater level changes that may be significantly different to the estimated drawdown magnitude and extent that could potentially result in adverse effects. Monitoring can be used to determine areas where the effects may be greater than originally estimated and, where necessary, allow mitigation to be carried out.

**Section 4** presents the alert trigger levels set to instigate reactive measures should excessive groundwater drawdown occur. Specific responses in the event of a trigger level exceedance and recommended mitigation options are presented in **Section 5**.

This GMCP will also describe how the consent conditions are to be met. Table 1 provides a summary of the proposed method for compliance and outlines the relevant sections in this GMCP that provides further details for each condition (where applicable). See Appendix A where all consent conditions are shown.



1.3 Summary of consent conditions

Table 1: Summary of consent conditions

| Condition Number   | Summary of Requirement | Summary of Proposed Methodology to Comply | Relevant GMMP Section |
|--------------------|------------------------|---|-----------------------|
| General Conditions |                        |   |                       |
| 1                  | xxx                    |   |                       |
| 2                  | xxx                    |   |                       |
| 3                  | xxx                    |   |                       |

## 1.4 Key project contacts

Table 2 presents the key personnel working on the Project in terms of specific groundwater matters as defined by the GMCP.

The first point of contact should be xxxxx who will liaise with the other parties as required.

Table 2. Key Contacts

| Role                                     | Person | Phone Number |
|--|--------|--------------|
| Auckland Transport (client contact / PM) |        |              |
| Contractor's Environmental Manager       |        |              |
| SQEP responsible for the monitoring      |        |              |

## 1.5 Roles and responsibilities

This section presents a summary of the key personnel and responsibilities working on the Project in terms of specific contractor and hydrogeology matters as defined by the GMCP.

Table 3: Roles, responsibilities and interfaces

| Role           | Organisation       | Role Responsibility   |
|----------------|--------------------|---|
| Consent Holder | Auckland Transport | Consent Holder and Project Manager<br>Overall responsibility for all contracted operations relating to the exercise of this resource consent, and shall ensure contractors are made aware of the conditions of this resource consent and ensure compliance with those conditions. |
| TBC            | TBC                | Prepare, review and update GMCP prior to dewatering.<br>Physical measurement of piezometer monitoring data<br>Oversight of monitoring data with regards to GMCP<br>Compliance and responding to Alert triggers<br>Reporting of data to Council                                    |

## Environmental Aspects

### 1.6 Key definitions

Terms that relate to the management of groundwater effects are specifically listed in the consent conditions, and the following key terms on this Project are defined below:

|                            |   |
|----------------------------|---|
| Alert Level                | Specific levels at which actions are required as described in the relevant conditions.                              |
| Commencement of Excavation | Means commencement of bulk excavation including the upper 1.2 m of material that is above the water table.          |
| Commencement of Dewatering | Means the commencement of excavation below the water table (~1.2 m bgl) and commencement of taking any groundwater. |
| Completion of Excavation   | When all bulk excavations have been completed.  |

|                                |   |
|--------------------------------|---|
| Completion of Dewatering       | Means in the case of pipe infrastructure, the stage when all pipework and pipe seals (and where required trench stops (collars) have been installed and all back filling is completed within 25 metres of a building or structure and effectively no further groundwater is being taken for the construction of the network at that location. |
| Completion of Construction     | Means when the Code Compliance Certificate (CCC) is issued by Auckland Council.   |
| Seasonal Low Groundwater Level | Means the annual lowest groundwater level – which typically occurs in summer.   |
| SQEP                           | Means Suitably Qualified Engineering Professional   |

## 1.7 Summary of construction works requiring a groundwater take or diversion

Construction of an air valve chamber to some 2.1 m depth, approximately 0.9 m below the water table, will likely take longer than 10 days and require a groundwater diversion.

Installation of two cross connections and an isolation valve chamber to up to 3.2 m depth may take greater than 30 days, therefore both groundwater take and diversion is required.

## 1.8 Assessment of groundwater effects

### 1.8.1 Groundwater drawdown

An analytical assessment was undertaken to evaluate the likely magnitude and extent of groundwater drawdown associated with construction of the isolation valve chamber and cross connections, which are the critical excavations with respect to potential groundwater effects. The assessment is based on the maximum excavation depth (3.2 m plus an additional 0.5 m for a dry working floor) and assumes an open excavation (no groundwater cut-off), an upper bound permeability in soils and that the dewatering might occur for up to 60 days.

The assessment suggests that measurable drawdown (0.25 m) could extend for 6.5 m with the maximum extent of drawdown predicted to be less than 10 m.

### 1.8.2 Risk of ground movement

Consolidation settlement at the nearest 3rd party owned assets and services within 5 m of the excavation was calculated to be between 9 mm and 2 mm respectively; however, these services (comprising comms, gas, electricity and existing watermain) are all to be replaced or diverted as part of the proposed works. No groundwater drawdown is expected at the Oakley Hospital Main Building or on the east side of Carrington Road where additional existing services will remain in place.

The Oakley Hospital Main Building and services on the east side of Carrington Road are therefore unlikely to be affected by any consolidation settlement. We note that our drawdown assessment is conservative as it assumes permanent drawdown. Dewatering will be limited to two months and experience from projects nearby (Waterview) indicate that the water table needs to be drawn down for at least 6 months before consolidation settlement would occur. In reality, consolidation settlement is considered unlikely to occur over the duration of the works.

## Monitoring Requirements

### 1.9 General

This section will detail the monitoring programme designed to confirm that the groundwater conditions, settlement, and response are consistent with the groundwater assessment.

Whilst overall the risk of adverse effects is considered low, the inherent variability in the ground means that there is always some residual risk. Accordingly, some minimum level of groundwater monitoring has been recommended to confirm that the magnitude and extent of any groundwater drawdown is within the predicted range, or to trigger mitigative measures.

### 1.10 Groundwater level monitoring

A single piezometer is proposed to be installed, within the Oakley Hospital historic heritage extent to allow for monitoring of groundwater drawdown between the excavation footprint and the Oakley Hospital Main Building. The location of the piezometer is shown in Figure 3.

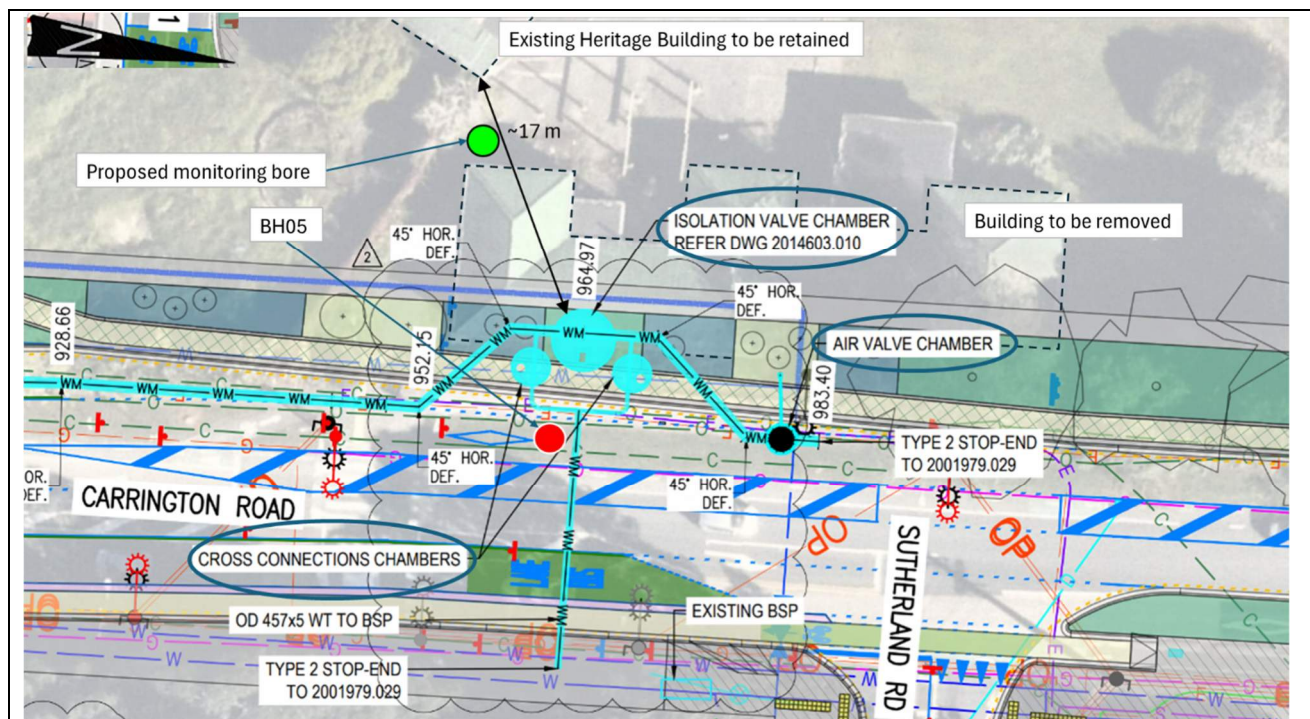


Figure 3: Location of proposed monitoring bore (completed as a piezometer); final location to be confirmed with respect to landowner and building removal works

Table 4 presents the as-built construction details, results of baseline monitoring and proposed trigger levels for the piezometer. Baseline monitoring was undertaken over the period XXX to XXX. The borehole geological log, core photographs and piezometer as built to be provided in Appendix B.

Table 4: Summary of baseline monitoring and proposed triggers for piezometer BC01

| BH ID | Easting (NZTM) | Northing (NZTM) | R.L. ground level (m) | Piezometer Screened Interval (mbgl) | Baseline Monitoring Results (m bgl) | Alert Trigger Level (m bgl) | Alarm Trigger Level (m bgl) |
|-------|----------------|-----------------|-----------------------|-------------------------------------|-------------------------------------|-----------------------------|-----------------------------|
| BC01  | XXXXXXX        | XXXXXXX         | XX.XX                 | XX.XX to XX.XX                      | XX.XX to XX.XX                      | XX.XX                       | XX.XX                       |

A level logger will be used to undertake near-continuous monitoring, this will help to provide a more robust baseline in the absence of longer-term pre-construction monitoring. The level logger will be downloaded minimum weekly from Commencement of Dewatering until Completion of Dewatering, and then monthly for a further three (3) months.

### 1.11 Ground, building or utility settlement monitoring

Given the overall low risk, no specific ground, building or utility monitoring is necessary.

### 1.12 Condition Surveys

Given the overall low risk, no specific condition surveys are necessary.

## Trigger Levels and Trigger Response and Actions

This section details the trigger levels set as required by condition ☒ of the Project's consent conditions, and the response actions in the event of a trigger exceedance.

### 1.13 Establishment of trigger levels

For changes in groundwater level, trigger levels are proposed to be set based on the calculated drawdown at that specific location with:

- The **Alert 1** trigger level set at 0.5 m of calculated drawdown relative to the baseline seasonal low groundwater level, to provide early notification that detectable drawdown is occurring; and
- The **Alert 2** trigger level is set at 1.0 m relative to the baseline seasonal low groundwater level, to notify that drawdown is approaching what was assessed.

Baseline monitoring data will be presented in Table 4 and Appendix C of this GCMP, and absolute trigger levels will be presented in Table 5.

Table 5: Absolute trigger levels (as per Schedule A of the consent conditions)

| Movement |  | Trigger Thresholds (+/-) |                        |
|----------|--|--------------------------|------------------------|
|          |  | Alarm                    | Alert                  |
| a)       | Distance below the pre-dewatering Seasonal Low Groundwater Level and any subsequent groundwater reading at any groundwater monitoring bore (the <b>Groundwater Alert Levels 1 &amp; 2</b> ): | N/A                      | (1) 0.5 m<br>(2) 1.0 m |

### 1.14 Response to alert level 1 triggers

In the event of Alert Level 1 being exceeded, the Consent Holder shall:

- Notify the Council within 24 hours.



- b) Re-measure the affected piezometer to confirm the extent of apparent drawdown.
- c) Ensure the data is reviewed, and advice provided, by a SQEP on the need for mitigation measures or other actions necessary to avoid further deformation. Where mitigation measures or other actions are recommended those measures shall be implemented.
- d) Submit a written report, prepared by the SQEP responsible for overseeing the monitoring, to the Council within five working days of Alert Level exceedance. The report shall provide an analysis of the monitoring data relating to the exceedance, actions taken to date to address the issue, recommendations for additional monitoring (i.e. the need for increased frequency or implementation of visual ground and building survey(s)) and recommendations for future remedial actions necessary to prevent Alarm Levels being exceeded.
- e) Measure and record the piezometer with Alert Level exceedance every two days until such time the written report referred to above has been submitted to the Council.

### 1.15 Response to alert level 2 triggers

In the event of Alert Level 2 being exceeded the Consent Holder shall:

- a) Notify the Council within 24 hours.
- b) Re-measure the affected monitoring piezometer to confirm the extent of apparent drawdown.
- c) Ensure the data is reviewed, and advice provided, by a SQEP on the need for mitigation measures or other actions necessary to avoid further mounding. Where mitigation measures or other actions are recommended those measures shall be implemented.
- d) Submit a written report, prepared by the SQEP responsible for overseeing the monitoring, to the Council within five working days of Alert Level exceedance. The report shall provide an analysis of the monitoring data relating to the exceedance, actions taken to date to address the issue, recommendations for additional monitoring (i.e. the need for increased frequency or implementation of visual ground and building survey(s)) and recommendations for future remedial actions necessary to prevent further exceedances.
- e) Measure and record the piezometer Alert Level exceedance every two days until such time the written report referred to above has been submitted to the Council.

## Potential Mitigation Measures

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If any of the monitoring trigger levels are exceeded the initial response will be as detailed in Section 4.

The need for mitigation measures to be employed would be reviewed on a case-by-case basis with specific consideration of the stage of construction, nature and extent of the exceedance, and the risk of adverse effects. However, the usual suite of responses as outlined below are expected to be considered:

- Review the construction programme and identify opportunities to reduce timeframes or introduce additional staging.
- Reduce or cease dewatering.
- Recharge groundwater where needed through targeted discharge of pumped water.

In the unlikely event of movement (with risk damage) being observed:

- Isolation or underpinning of affected structures/services; and
- Remediation of any resultant damage (as agreed with the asset owner).

## Reporting and Notification

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### 1.16 Notification and commencement and completion of dewatering

The consent holder shall inform the Council in writing at least 10 working days prior to the commencement of any dewatering activities, and again within 10 days of all dewatering activities being completed.

### 1.17 Reporting of monitoring results

A report containing all monitoring data required by the conditions of this consent will be submitted to Council at the completion of pre-construction monitoring, construction monitoring and post-construction monitoring (i.e., 3 reports total).

This will include a construction progress timeline, the monitoring data recorded in that period, and a comparison of that data with previously recorded data and with the Alert Levels for the piezometer.

If no effects have been observed upon the completion of construction monitoring, the construction monitoring report may recommend that post-construction monitoring is not undertaken, subject to Council approval.

## Plan Review

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The draft GMCP has been prepared by Beca, in accordance with the expected resource consent conditions and temporary works.

This GMCP will need be updated to reflect the final conditions, temporary works design and construction programme, with the necessary certification from Council.

This GMCP may also need to be reviewed through the course of the Project to reflect any material changes to construction techniques or the natural environment.

## Attachment K: Response to Local Board Comments on Carrington Road Improvements Project Resource Consent Application

| LB Comments   | AT response  |
|---|--|
| <p>1. We note that the Applicant has not sought public notification and considers the effects are no more than minor. However we do not agree with that assessment and seek full public notification because:</p> <ul style="list-style-type: none"> <li>the scale of this project is extremely large</li> <li>the disruption accompanying the project is significant</li> <li>the duration of the project is up to 32 months - and some of the impacts are unavoidable.</li> </ul> <p>That is not to say that we do not consider the project worthwhile. However full public notification is the only appropriate way forward so the public can provide their views on the environmental and people impacts and the proposal impacts be tested by a panel.</p> | <p><i>AT has engaged extensively with the community and there is broad support for the project. AT has undertaken two rounds of consultation on the street design (in August-September 2023 and May-June 2024) and will undertake a third round with a focus on construction methodology (in mid-2025, as described in AT's response to Council's s92 requests).</i></p> <p><i>The widening of the road is also clearly signalled in the Auckland Unitary Plan Wairaka Precinct provisions, which have been operative since November 2016.</i></p> <p><i>The estimated duration of construction is between 24-32 months. Within that period, construction is planned to be staged such that disruptions are localised at any given time (see Section 3.3 of the AEE). Approximately half of the total duration is for widening works on the western side of the road, which will have minimal effect on the operation of the road.</i></p> <p><i>There is a time and cost to a public notification process and AT has a responsibility to deliver 'better, faster, cheaper'.<sup>1</sup> Moreover, funding for the Project under Kāinga Ora's Infrastructure Acceleration Fund is contingent upon commencing construction in Q1 2026.</i></p> <p><i>Accordingly, AT will not be requesting public notification.</i></p> <p><i>Ultimately the notification decision sits with Auckland Council.</i></p> |

<sup>1</sup> Auckland Transport Statement of Intent: Building Public Confidence 2024-2027

| Stormwater |   |   |
|------------|---|---|
| 2.         | We wish to understand whether the stormwater pond on the Wairaka Precinct site has adequate capacity to receive and treat all the stormwater the Project would create. This device was designed and constructed in 1991, prior to the publication of TP10. De-silting maintenance is significantly overdue, so performance is not currently good although we note it is due to be addressed as part of the Wairaka Precinct recent resource consent applications. | <p><i>This stormwater pond is due to be rehabilitated and upgraded as part of the Carrington Residential Development prior to the completion of the Carrington Road Improvements Project. The pond will have adequate capacity to receive and treat stormwater discharge from a partial catchment area of Carrington Road.</i></p> <p><i>AT's proposed conditions include a requirement for AT to obtain Healthy Waters' confirmation that the planned upgrades to the stormwater pond have been completed prior to the diversion of road stormwater runoff to the pond. This condition was agreed in principle with Healthy Waters prior to the lodgement of the resource consent application.</i></p> |
| 3.         | We request you check Fifth Ave flooding after concerns were raised by a local, Richard Mansell, in June 2024 (who is a CLG member) about flooding in their street and properties.   | <i>AT is aware of the flooding issue raised by Mr Mansell and met with him on site to discuss this in Sept 2024. Flooding impacts are being considered in AT's design.</i>  |
| 4.         | We wish to better understand the Segar Ave swale and which side of the road this is on noting we have planted trees along the northern roadside berm and recently supported no parking off the roading there.   | <p><i>Treatment and conveyance swale are proposed on the northern side of Segar Ave. AT is aware of the recently planted trees and these are being considered in the design.</i></p> <p><i>AT recently implemented signage and broken yellow lines on Segar Ave to address the parking issue. AT also plans to increase parking enforcement in the area to monitor the situation. We expect the proposed swale will deter people from parking on the berm area once constructed.</i></p>  |
| Heritage   |   |   |
| 5.         | We hold concerns regarding the removal of the 19thC 65m long, Airing Court Wall which is within the Extent of Place. Ideally this should retained or potentially reinstated in an area that previously has had it's section of the wall removed.  | <i>The design has already been subject to localised realignment to the east in this location. The extent of realignment enables avoidance of the hospital building, avoidance of the need for land take and removal of mature pōhutukawa on the eastern side of the road, and integration with design to the south (which widens westwards) and north (the existing SH16 bridge).</i>   |

|              |   |   |
|--------------|---|---|
|              | We note the AAE suggests there is feasibility to use these bricks elsewhere.  | <p><i>Narrowing already incorporated without further widening on eastern side would result in road remaining in at its current width. Features integral to the purpose of the project would need to be removed - including bus lane(s), the bus stop, and the southbound right-turn lane for the Gate 1 intersection. Accordingly, removal of the wall is necessary.</i></p> <p><i>AT is proposing specific mitigation to address the removal of the wall including the reuse of bricks from the wall as part of the landscaping treatment in this location. Details of the proposed landscaping treatment are included in AT's response to Council's s92 request.</i></p>  |
| 6.           | We note that NZHPT have not provided an affected party approval at this stage.  | <i>AT is continuing to engage with HNZPT.</i>   |
| <b>Noise</b> |   |   |
| 7.           | There will be construction noise and vibration on properties. It is stated that the watermain work wont create be much difference but it wont be in the road corridor near the Main Hospital Building – and we need to get good clarity around that and the impacts there | <p><i>The Watermain works are partly located within the Historic Heritage Extent of Place, and are within 20m of the Main Hospital Building for a short distance (the Watermain works are 16m from the Main Hospital Building at the nearest point). The Acoustic Assessment notes based on the proposed depth of the Watermain works (including an isolation valve chamber) in this location that high vibration activities (i.e. sheet or vibro piling) will not be required, and that the chamber can be constructed using shoring. While the assessment concluded that the building will not be impacted, it nonetheless has recommended that a building condition survey is completed prior to construction (this requirement is included in the proposed conditions). Any effects on the building will also be addressed in the Construction Noise and Vibration Management Plan (CNVMP) which is a requirement of the proposed conditions.</i></p> <p><i>For completeness it is noted that Beca has undertaken further assessment of the groundwater effects of the Watermain near the Main Hospital Building as part of its response to Council's s92 requests. This work has confirmed</i></p> |



|                  |   |   |
|------------------|---|---|
|                  |   | <i>that the building is beyond the maximum extent of groundwater drawdown, and therefore that no settlement effects are anticipated.</i>  |
| 8.               | Further work needs to be done on managing construction outside sensitive environments (PPFs) including the school, 2 Early Childhood Centres (The Learning Corner 222 Carrington Rd and Collectively Kids, 5 Sutherland Rd) and the collective of Mental Health Services at 5-27 Sutherland Rd.   | <p><i>AT has proposed a condition requiring a CNVMP to be prepared and implemented during construction.</i></p> <p><i>The CNVMP will include procedures to communicate and engage with nearby residents and stakeholders.</i></p> |
| 9.               | We believe there are a range of Protected Premises and Facilities (PPFs) not identified in the report on the parcel at 5-27 Sutherland Rd and are adjoining Carrington Rd. They are not marked as green in the acoustic report but should be. Three main services spread across the whole site and the land is owned by Te Whatu Ora. Logically, they are all PPFs from both a noise and vibration perspective and some are inside the paving noise set back area. They are pink, not green. They also don't appear in the appendix lists. These are very vulnerable people on these premises and this should be thoroughly assessed. | <i>Marshall Day Acoustics have provided further details on this in response to item 17 of the s92 request.</i>  |
| 10.              | We note a large number of homes will be impacted by construction noise and suggest that all potential mitigation is undertaken, including relocating people should the effects be uncontrolled.   | <i>As set out in the response to item no. 8, AT has proposed a condition requiring a CNVMP to be prepared and implemented during construction.</i>  |
| 11.              | We support the proposal for a low noise traffic surface being installed.  | <i>Noted.</i>   |
| <b>Landscape</b> |   |   |

|     |  |   |
|-----|--|---|
| 12. | We note there will be no impact on the trees within Braemar Reserve.   | <i>Noted.</i>   |
| 13. | <p>We note that there is a total of 43 trees to be removed due to the widening, the new swales on Sutherland or elsewhere.:</p> <ul style="list-style-type: none"> <li>• 34 trees will require removal for the proposed upgrade (25 of these will require resource consent for their removal, 7 of which are in poor health or are pest plants).</li> <li>• 9 can be removed as a permitted activity (7 of which are in poor health or are pest plants).</li> <li>• Tree owner approval will be required for the removal of the 43 trees.</li> <li>• The most significant vegetation impacted by the works includes those trees identified in the Wairaka Precinct 17 Sky flower (Tree no. 12718, all though considered in poor condition<sup>19</sup>), Liquidambar (Tree no. 9520) and Variegated Kohuhu Tree no 8521, which are located on the western side of the road corridor</li> </ul> | <p><i>Noted – however these figures appear to be a subset of the totals noted in the lodged AEE documentation. The AEE identified a total of 61 trees to be removed. The figure of 34 tree removals related to proposed removals within Carrington Road only (excluding the remainder of the project); and the figure of 43 removals related to total removals requiring tree owner approval.</i></p> <p><i>Note that these figures have been updated in response to Council s92 requests (addressed further in response to item 18 below; and in responses to items 41 and 44 of the s92 request).</i></p> |
| 14. | 2 Puriri (Trees 122 and 126) adjacent to the northern pocket and northwestern cycleway crossing have been identified as significant to mana whenua and the design will be amended in order to retain the Puriri Trees by shifting the crossing to the north and realigning the cycleway. We are requesting to see these plans.   | <p><i>The proposed location of the northwestern cycleway crossing has been relocated to retain the Puriri trees on the western side.</i></p> <p><i>This is shown in the preliminary plans that were submitted with the resource consent application – General Arrangement Plan 9.</i></p>   |
| 15. | We noted that the Tree Protection section of the Wairaka Precinct states that trees located within an existing or future road-widening area along Carrington Road frontage are not subject to the tree protection controls of Wairaka Precinct.  | <i>Noted.</i>   |

|                  |  |   |
|------------------|--|---|
| 16.              | Some tree pruning may be required which could include a Pohutukawa in 901 New North Road which is located near the proposed Mount Albert Pedestrian bridge.  | <i>Noted.</i>   |
| 17.              | We support the maintenance plan and establishment requirements over a three-year period for landscaping and five years for specimen trees following planting   | <i>Noted.</i>   |
| 18.              | We note a greater number of trees replacing those removed will be planted in the local area and support that given the cooling impact, ecological and wellbeing benefits that the trees deliver. The number of lost and replacement trees is reported in the Urban Design report but they do not tally with this Landscape Report however and we seek this is clarified.   | <p><i>It is noted that the Arboricultural Report, Urban Design Strategy sheets, and Tree Removal Plans have been revised and updated to ensure they are aligned. Updated and marked up copies are provided as <b>Attachments F, G, and H</b> of AT's s92 response. These updates have confirmed small changes to the earlier noted totals – 70 trees in total need to be removed, with 33 of those now requiring resource consent in total.</i></p> <p><i>The current preliminary design plans propose 180 new trees. The final number of new trees may vary from this as detailed design progresses. AT has proposed a condition requiring an Urban Design and Landscape Plan (UDLP) be submitted to Auckland Council for certification. The UDLP conditions require a detailed streetscape landscaping plan to be prepared, showing all planting.</i></p> |
| <b>Transport</b> |  |   |
| 19.              | <p>We note no change in Carrington Road's strategic transport function is anticipated between the current and first decade networks and Carrington Road is classified as:</p> <ul style="list-style-type: none"> <li>• a Primary Arterial.</li> <li>• an Overweight route,</li> <li>• an Over-dimension route.</li> <li>• a Frequent Transit Network (FTN) route</li> <li>• a Major route on the cycle network,</li> </ul> | <i>Noted.</i>   |

|     |   |  |
|-----|---|--|
|     | <ul style="list-style-type: none"> <li>• a Primary route for the walking network</li> </ul>   |  |
| 20. | <p>We note the future modal priorities for the route and that this Project will help deliver on these noting the economic benefits and productivity that are reported on increasing the flows along the corridor.</p>   | <i>Noted.</i>  |
| 21. | <p>We note historic crash data indicates a poor safety record for the corridor, including three serious crashes within a 5-year period. The community remained concerned by the lack of safety in the road corridor especially on the current Mt Albert rail overbridge and the north western cycleway pedestrian crossing. We note that Future Connect identifies Carrington Road as being 'First Ranked' (i.e. highest priority) in terms of safety deficiency, indicating AT's recognition of the safety issues along the corridor. Site specific safety issues include:</p> <ul style="list-style-type: none"> <li>• lack of safe walking (footpath widths and limited safe crossing opportunities)</li> <li>• limited protected cycling (conflict with side streets, bus stops and carpark spaces)</li> <li>• 50km/h speed limit (with associated risk of DSI for vulnerable road users).</li> </ul> | <i>Noted. Safety remains as a key investment objective of the proposed improvements.</i> |
| 22. | <p>We support the measures proposed to avoid, remedy, or mitigate adverse effects including</p> <ul style="list-style-type: none"> <li>• a vehicle Crossing at 155 Carrington Road</li> <li>• loss of on-street carparks on Carrington Rd but the side streets being expected to have capacity to displaced parking and some parking could be reallocated.</li> </ul>   | <i>Noted.</i>  |

|                               |  |  |
|-------------------------------|--|--|
| 23.                           | <p>The community and the Local Board have desperately wanted the overbridge widened to ensure safe passage across the overbridge. This was partially addressed in 2024, when the closure of the Lloyd Ave level pedestrian/rail crossing, led to the construction of a shared path on the overbridge. However the footpath and cycle lane on southern side remains highly unsafe, as does entrance into the rail station at this location. We note that the Project proposes widening of the existing bridge on the eastern side with reconfiguration of space to provide additional room for pedestrians and cyclists and we support the design. We note it will enable:</p> <ul style="list-style-type: none"> <li>• Wider general traffic lanes in the same general lane configuration as existing;</li> <li>• Wider cycle lanes on both sides of the road</li> <li>• Raising of the cycle lane to match the 2024 cycle lane on the eastern side.</li> <li>• We understand from AT that they are still considering whether they can add an additional traffic lane to the bridge and seek further clarity on that.</li> </ul> | <i>Noted.</i>  |
| <b>North Western Cycleway</b> |  |  |
| 24.                           | <p>The NW cycleway is Auckland's most heavily used commuter cycleway. The Carrington Road crossing is dangerous and extremely more so in the past until remedial works were undertaken in the last 5 years. We seek the crossing design is reviewed for safety and how pedestrian and cyclist flows will be smoothly managed across the crossing. We request that prelim and final designs are checked for safety issues with respect to:</p>  | <p><i>AT recently provided an update to Local Board regarding the signalisation of this crossing, with wider waiting areas on both sides of the crossing.</i></p> <p><i>The design will be subject to safety assessments as it is developed.</i></p> |



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|                     | <ul style="list-style-type: none"> <li>the large number of people queueing and stacking on the footpath on both side Carrington Rd especially at peak hours</li> <li>how those stacking interact with those walking or cycling along Carrington Road</li> <li>whether the proposed footpath widening is adequate to accommodate all those waiting.</li> </ul>  |  |
| 25.                 | <p>We seek assurance that this is the best and safest option practicable option or whether other options such as a signalised intersection would be better. We also note that new street lights are proposed at the crossing but we see no evidence on the plans about signals that would give crossing users priority as currently exists and the local board was advised of, by AT, in February 2025. This is a worse outcome for the cycleway users and the waiting space would be inadequate as has been evidenced historically at the St Lukes Rd crossing point (until remediation was undertaken.</p> | <p><i>A review of signalisation or a roundabout was undertaken and has been shared with the Board. AT has indicated to the Board that smart signals could be installed and is considering this.</i></p>  |
| <b>Urban Design</b> |  |  |
| 26.                 | <p>We support the reuse of basalt and heritage bricks from the walls and the reuse of the basalt kerbstones.</p>   | <p><i>Noted.</i></p>   |
| 27.                 | <p>We note in the Urban Design report that 14 trees are due to be removed from Segar Avenue but these numbers do not align with the landscape report. We also note it also states there are:</p> <ul style="list-style-type: none"> <li>48 trees to be removed (1,206m2 of canopy) being 34 on Carrington Rd and 14 on Segar Ave</li> <li>9 trees to be transplanted (18m2 of canopy)</li> <li>23 trees to be retained (1110m2 of canopy)</li> </ul>   | <p><i>The Urban Design, Landscape and Arboricultural Assessments have all been reviewed and where necessary updated to be consistent re. the number of trees being removed.</i></p> <p><i>Further information on this is provided in the s92 response.</i></p> |

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| 28. | 180 trees are proposed to be planted including on Segar Ave (1,624m of canopy cover based on 10 years of mature canopy).   | <i>Noted. Refer to response to item no. 18.</i>  |
| 39. | We are concerned these figures do not support those in other reports and seek assurance this is correct and if so, support this mitigation.  | <i>Refer to responses to item nos. 18 and 27.</i>  |
| 30. | One outstanding issue for the Local Board is the size and location of the tree removals, swales and new plantings along Segar Ave. We have recently received several complaints from residents about poor vehicle parking and berm parking along the northern side. The Local Board have also planted trees along this side so wish to clearly understand the impacts. | <p><i>Refer to the response to item no. 4.</i></p> <p><i>AT is still developing the design for Segar Ave and will consider these comments as part of this. AT is aware of the parking issues in this location.</i></p> <p><i>AT is aware of the recently planted trees and these are being considered in the design.</i></p> |