Appendix E: Liquefaction Hazard Cross Sections

Notes:

1. Subsurface conditions are inferred from borehole logs and correlations from CPT data. The nature and continuity of the subsoils away from the the investigation locations are inferred and it must be appreciated that actual ground conditions could vary from the assumed model.
2. Strength and density descriptions follow NZ Geotechnical Society "Guidelines for the Field Classification and Description of Soil & Rock for Engineering Purposes" (December, 2005).
3. No data avaliable in top 1.2m due to services pre-drill.
4. Ground surface profile inferred from LiDAR data (flown by NZ Aerial Mapping 8-10 March 2011) where available.
5. CPT and borehole elevations are relative to Lyttelton Datum (mean sea level).
6. Soil material type, density and strength have been inferred from CPT data using methodologies published in Lunne, Robertson & Powell (1997).

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Sheet 1 of 1

CHRISTCHURCH CITY COUNCIL

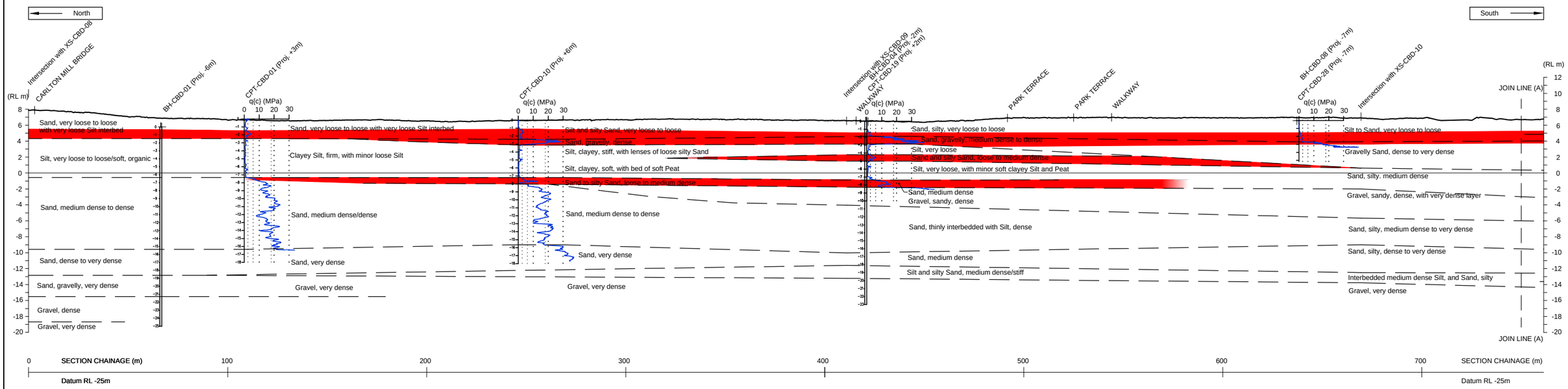
GEOLOGICAL INTERPRETATIVE REPORT

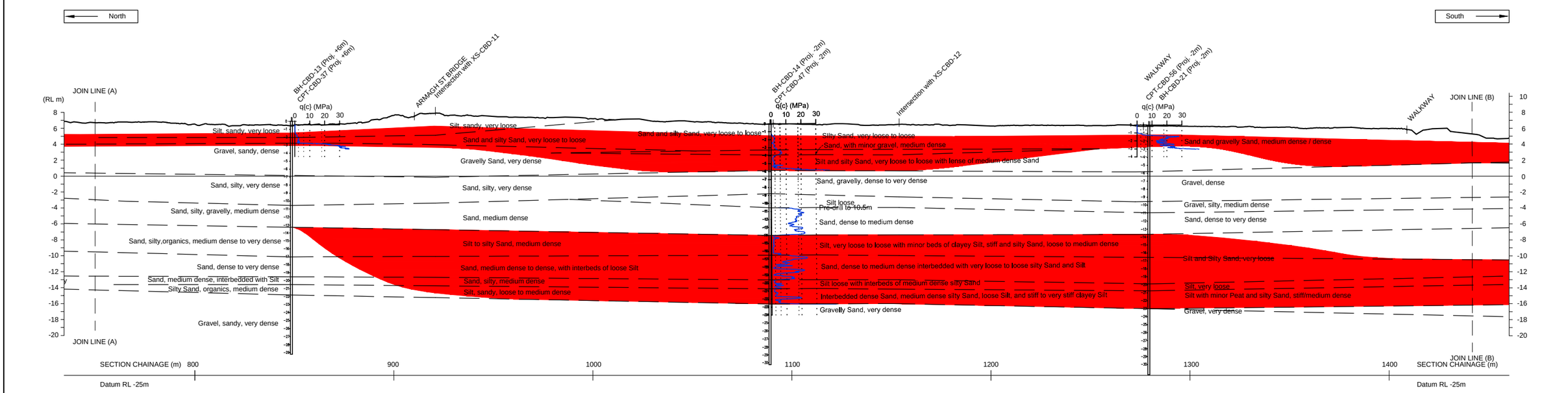
CHRISTCHURCH CENTRAL CITY

Liquifaction Hazard Cross Section Location Plan

FIG. No. E1

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

Zones within which materials considered susceptible to liquefaction are likely to be present and should be subject to detailed further investigation and assessment.

Inferred material boundaries taken from Geological Cross Sections.

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SCALES (AT A3 SIZE)
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Sheet 1 of 3

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-1 (Park Terrace / Rolleston Avenue)

FIG. No. E2

REV. 1

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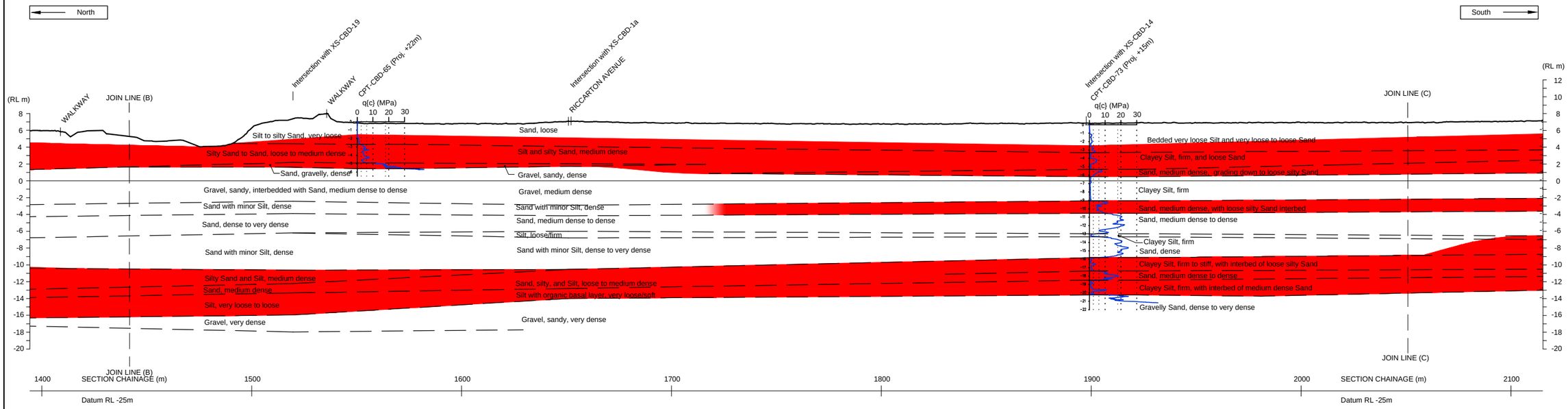

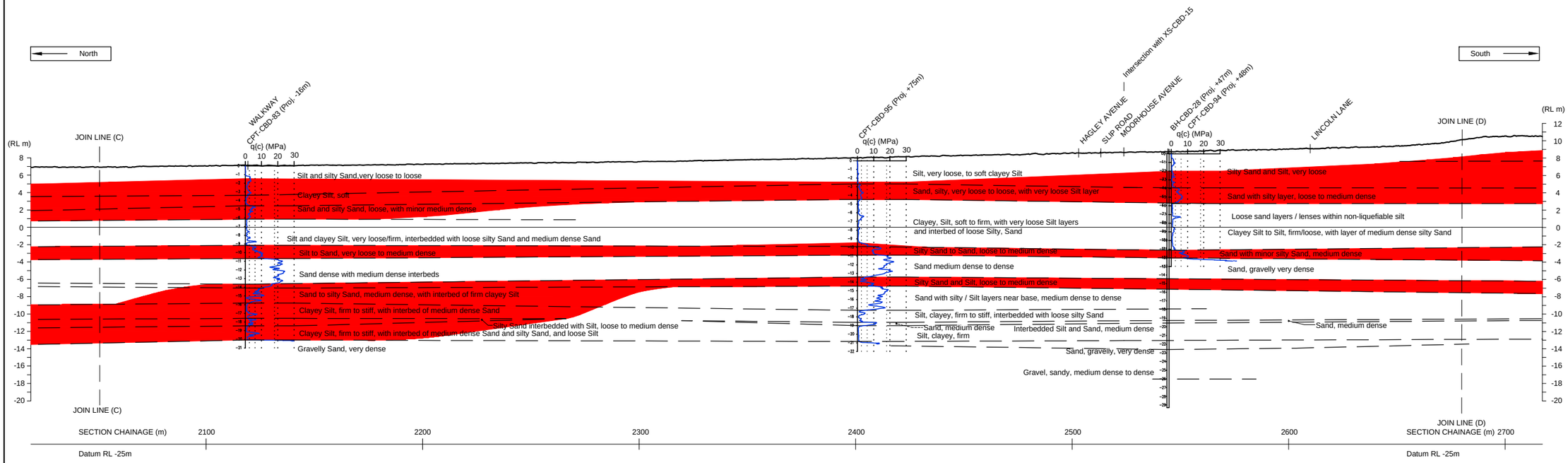

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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Horizontal

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SCALES (AT A3 SIZE)
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CHRISTCHURCH CITY COUNCIL

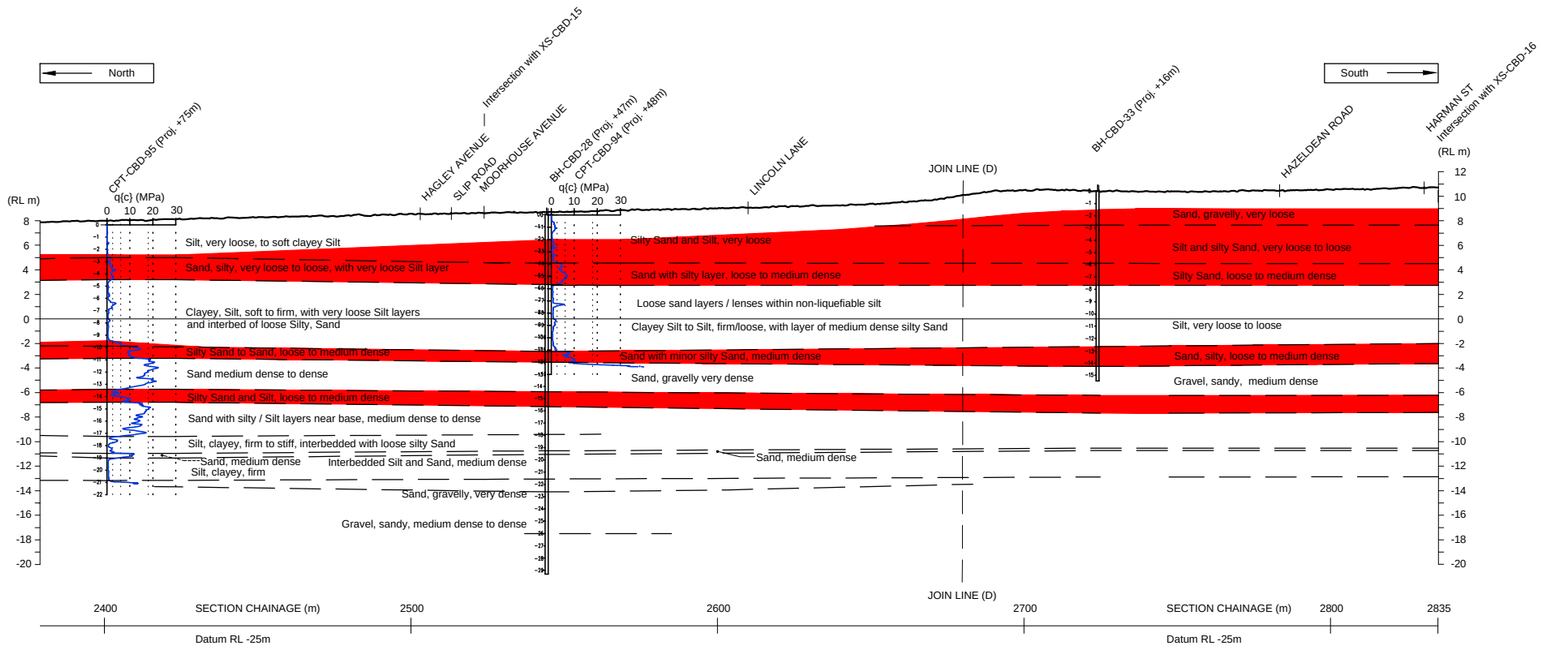
GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-1 (Park Terrace / Rolleston Avenue)

FIG. No. E2

REV. 1



(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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Horizontal

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CHRISTCHURCH CITY COUNCIL

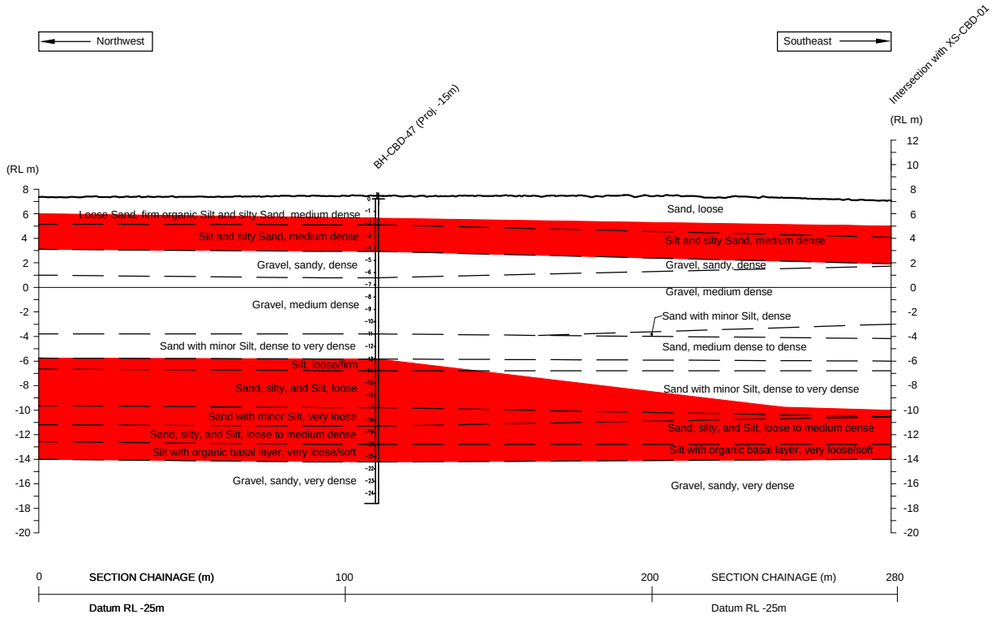
GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-1 (Park Terrace / Rolleston Avenue)

FIG. No. E2

REV. 1



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LEGEND

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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-01a (Riccarton Avenue / Christchurch Hospital)

FIG. No. E3

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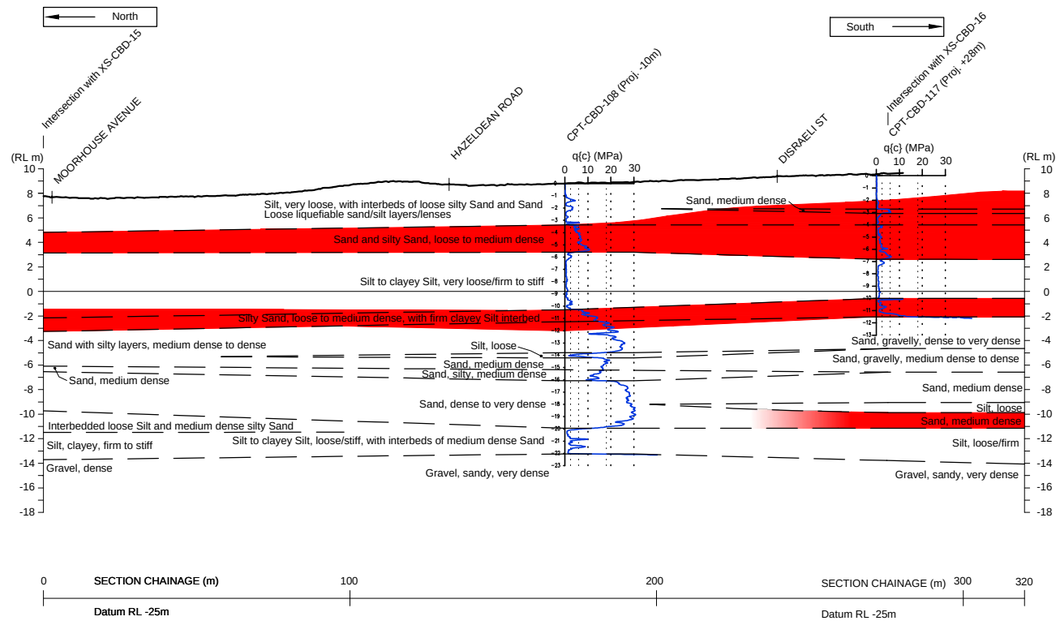

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Horizontal

LEGEND

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GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-01b (Selwyn Street)

FIG. No. E4

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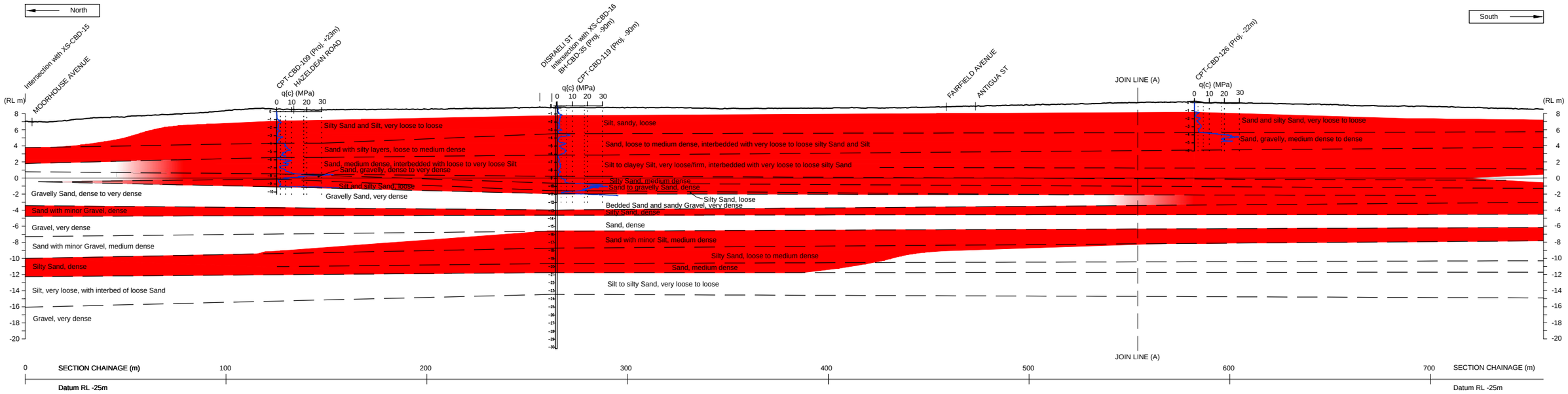

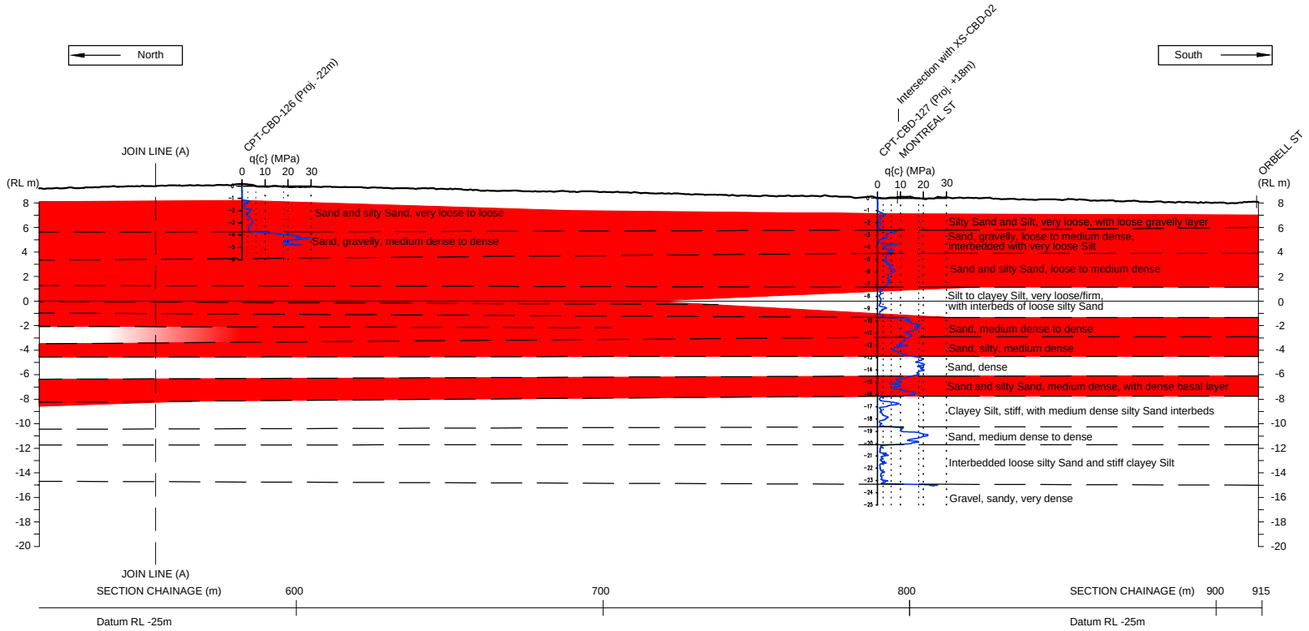

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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Horizontal

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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-1c (Antigua Street)

FIG. No. E5

REV. 1

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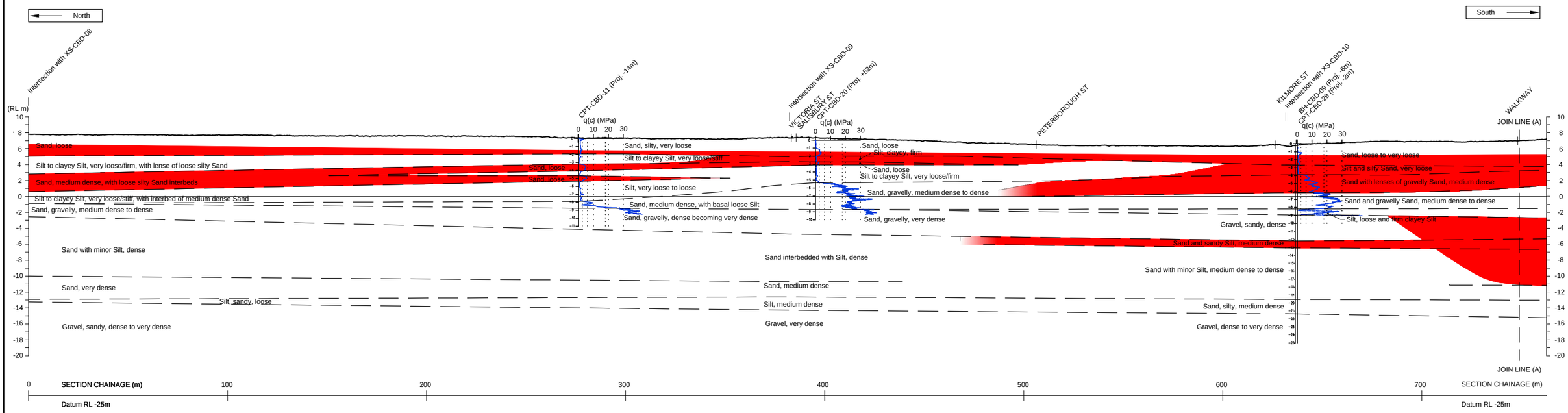

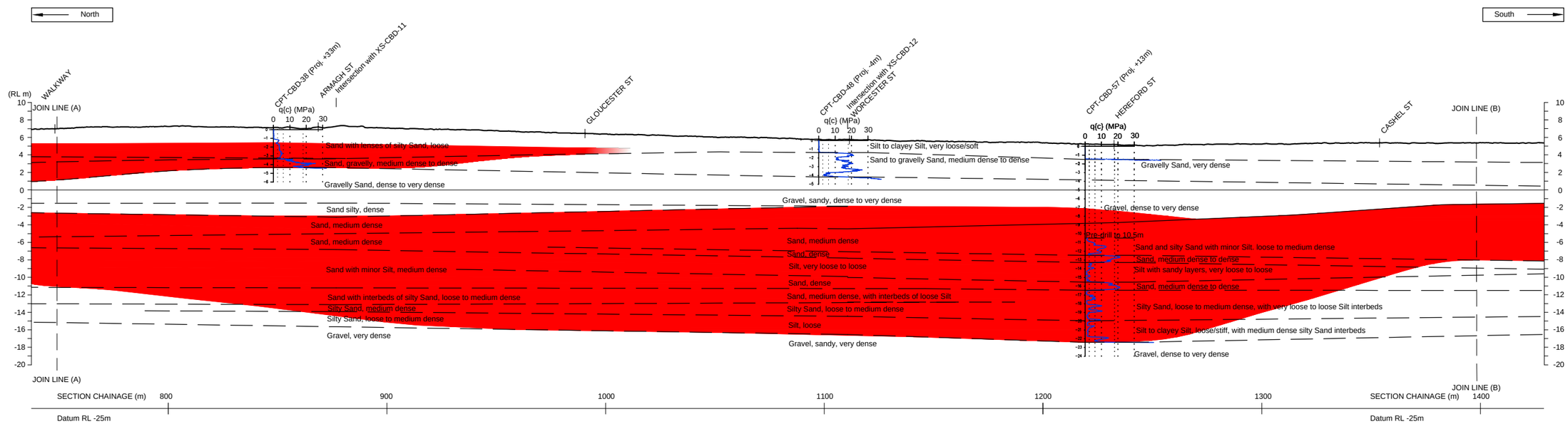

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-02 (Montreal Street)

FIG. No. E6

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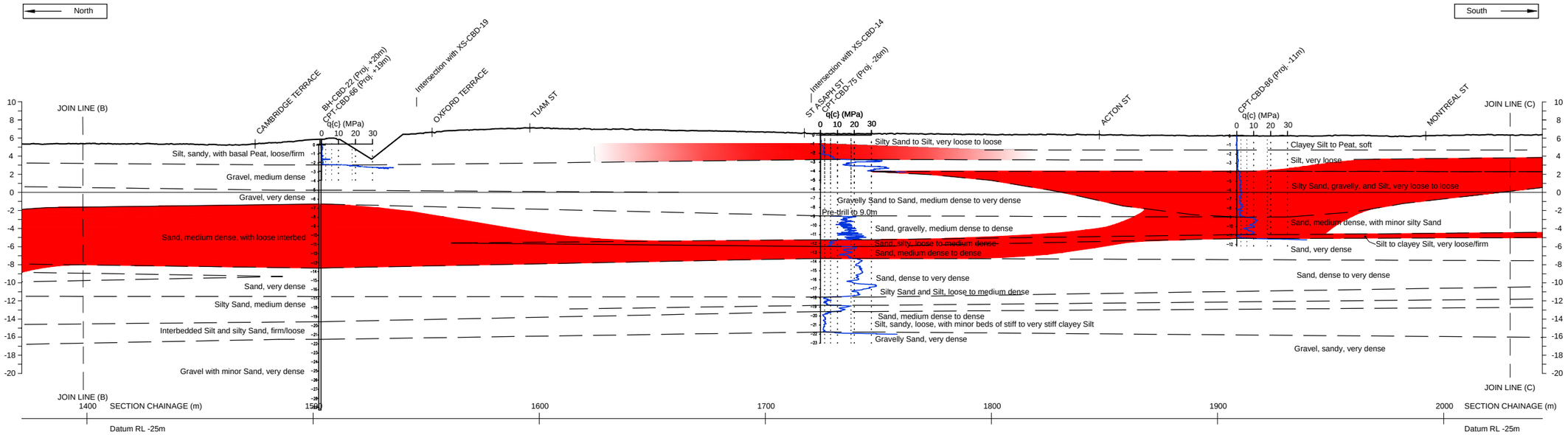

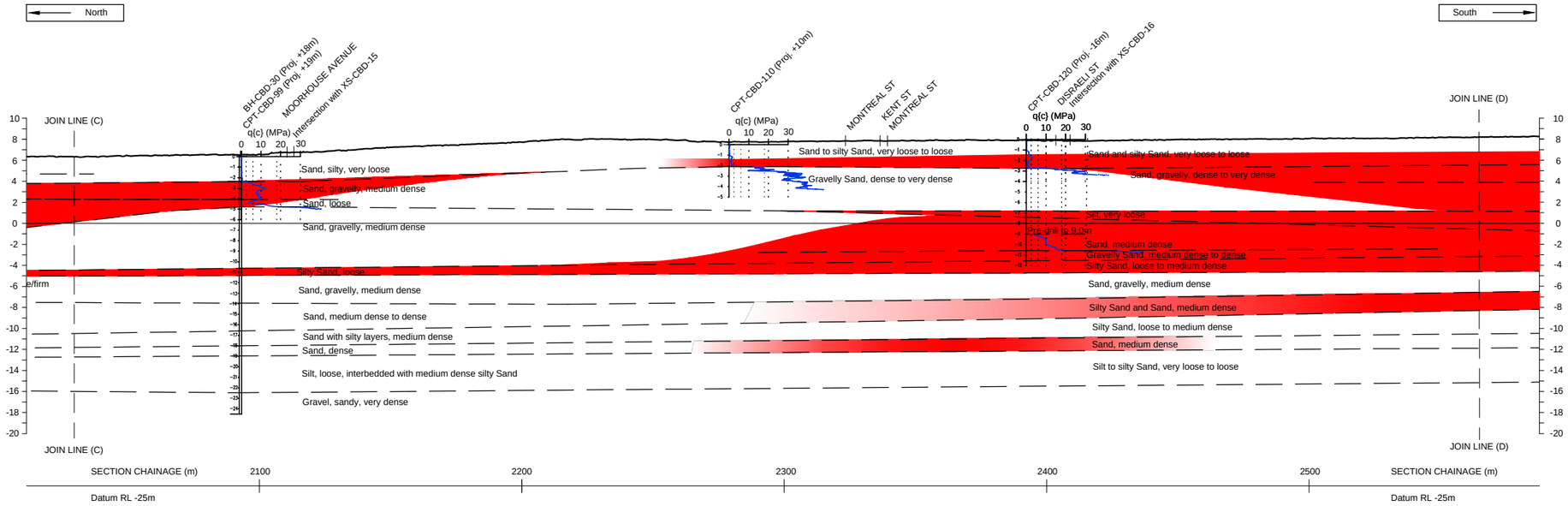

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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Horizontal

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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-02 (Montreal Street)

FIG. No. E6

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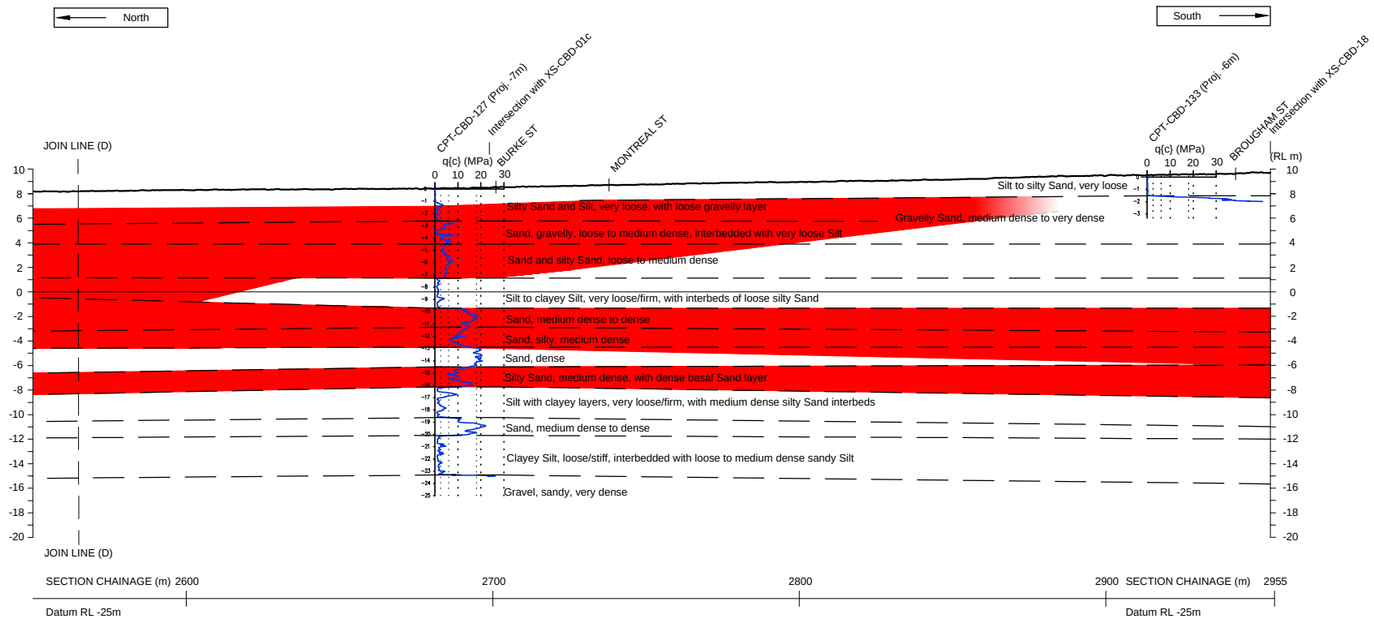

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

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SCALES (AT A3 SIZE)
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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-02 (Montreal Street)

FIG. No. E6

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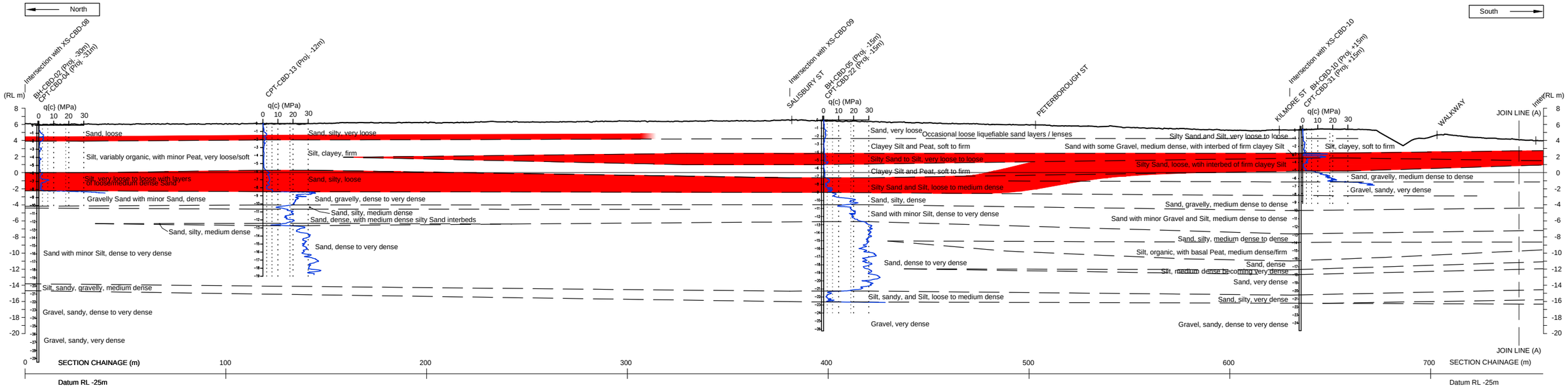

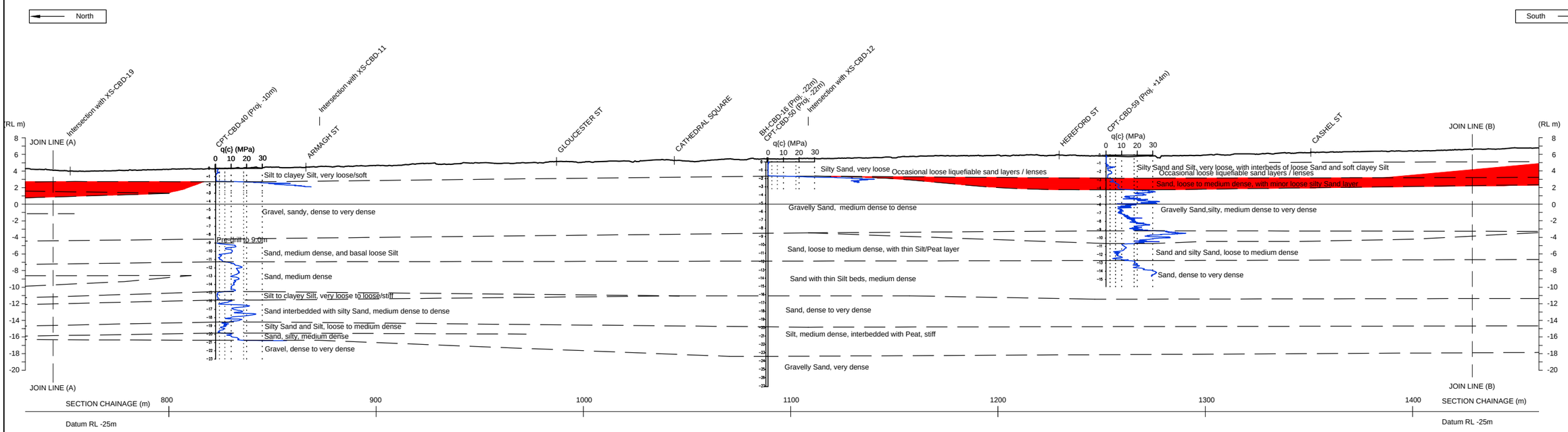

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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SCALES (AT A3 SIZE)
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LHXS-CBD-03 (Colombo Street)

FIG. No. E7

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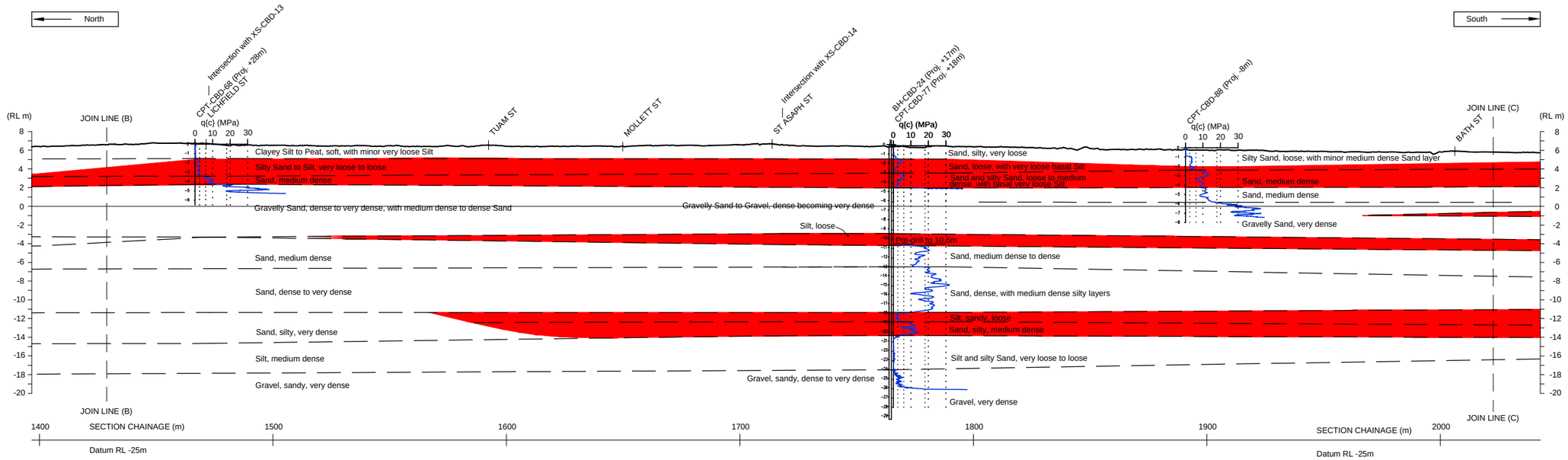

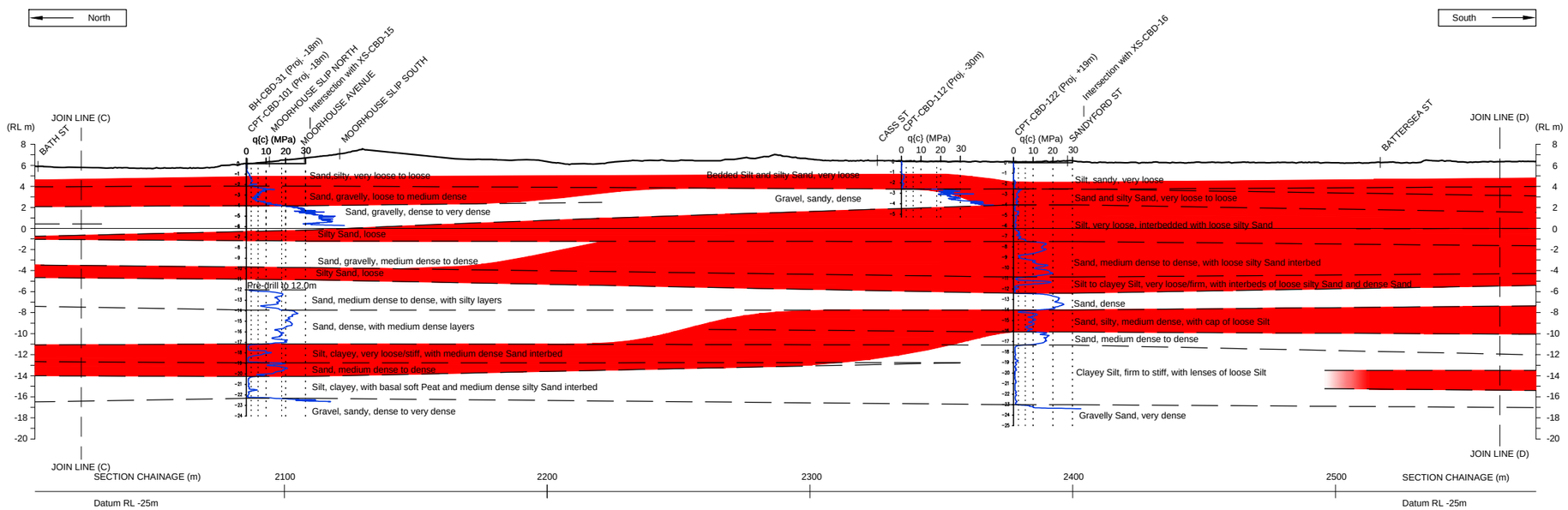

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

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Sheet 2 of 3

CHRISTCHURCH CITY COUNCIL

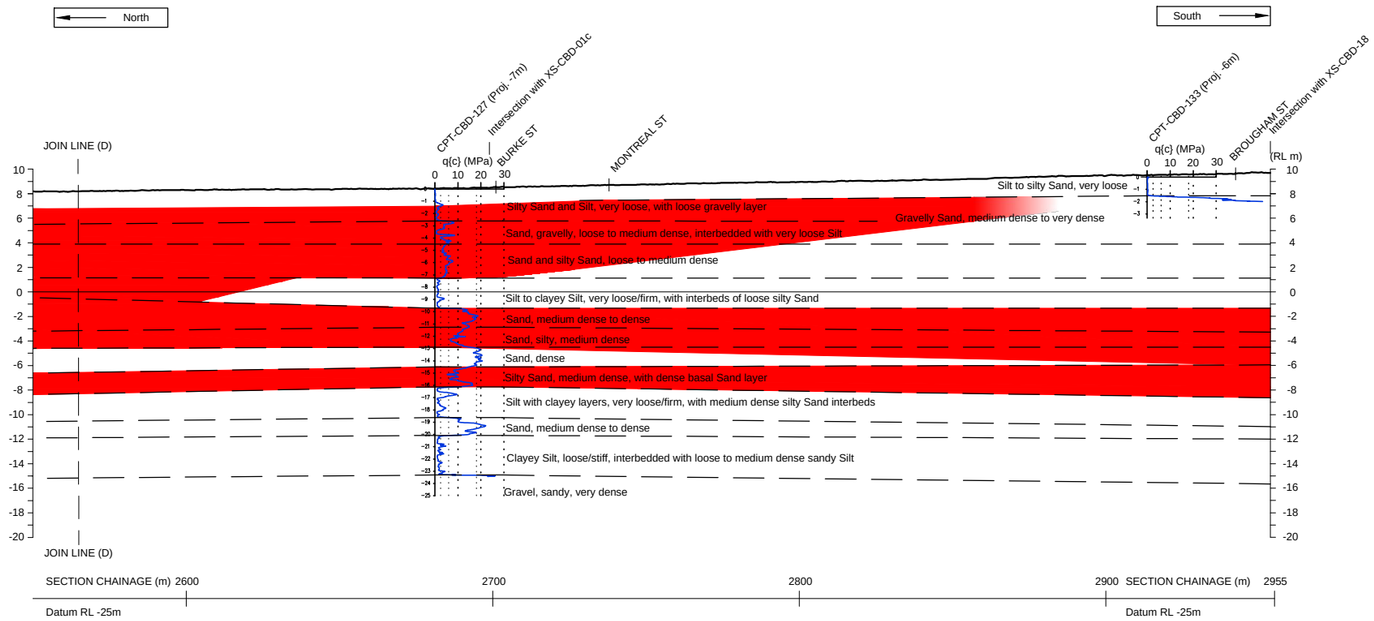
GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-03 (Colombo Street)

FIG. No. E7

REV. 1



(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

Zones within which materials considered susceptible to liquefaction are likely to be present and should be subject to detailed further investigation and assessment.

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CHRISTCHURCH CITY COUNCIL

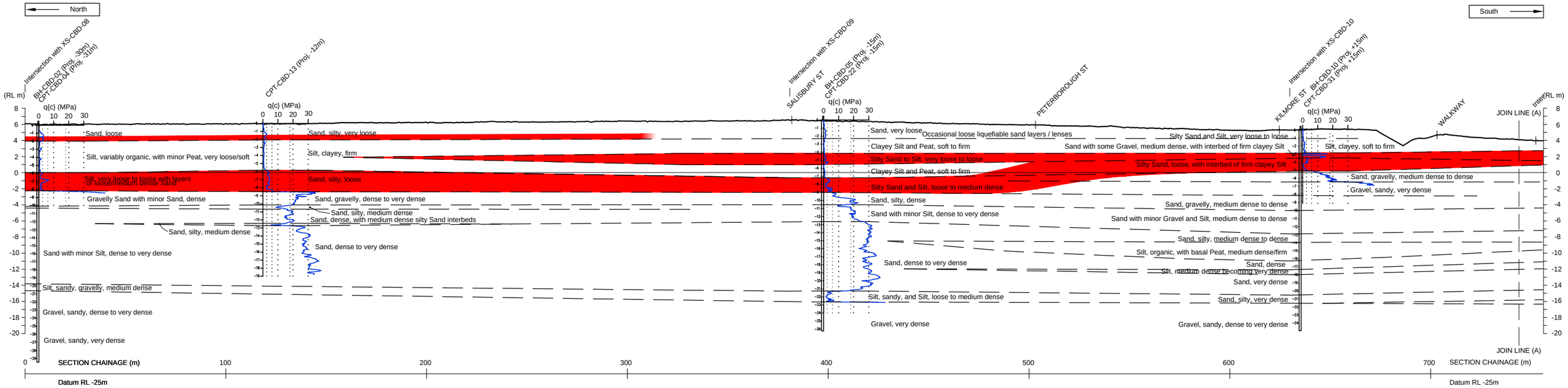
GEOLOGICAL INTERPRETATIVE REPORT

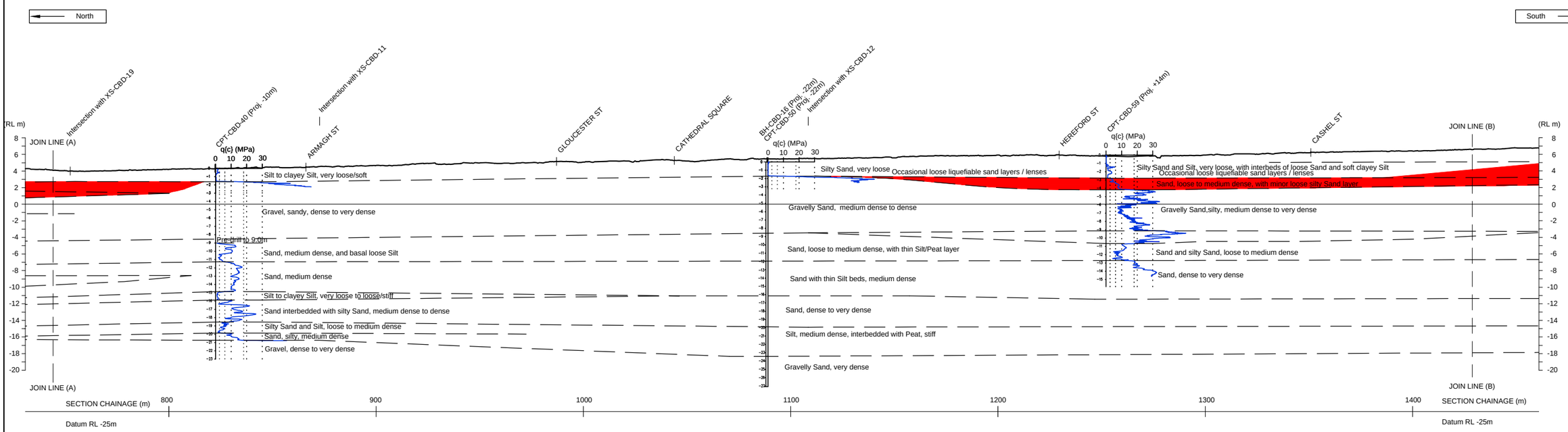
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-02 (Montreal Street)

FIG. No. E6

REV. 1





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Sheet 1 of 3

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-03 (Colombo Street)

FIG. No. E7

REV. 1

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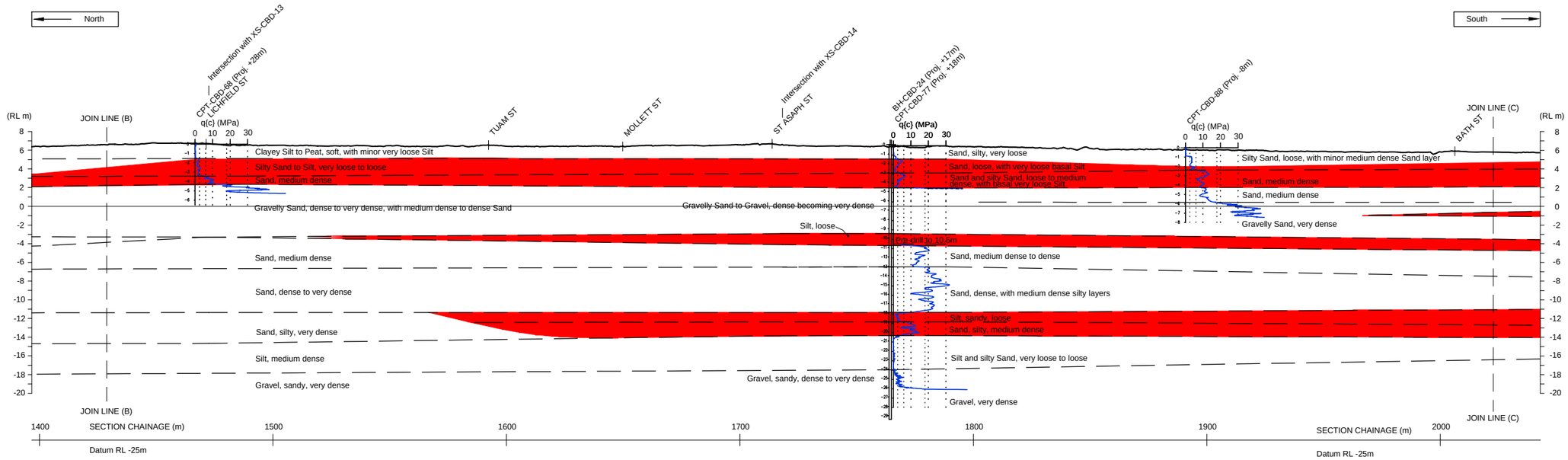

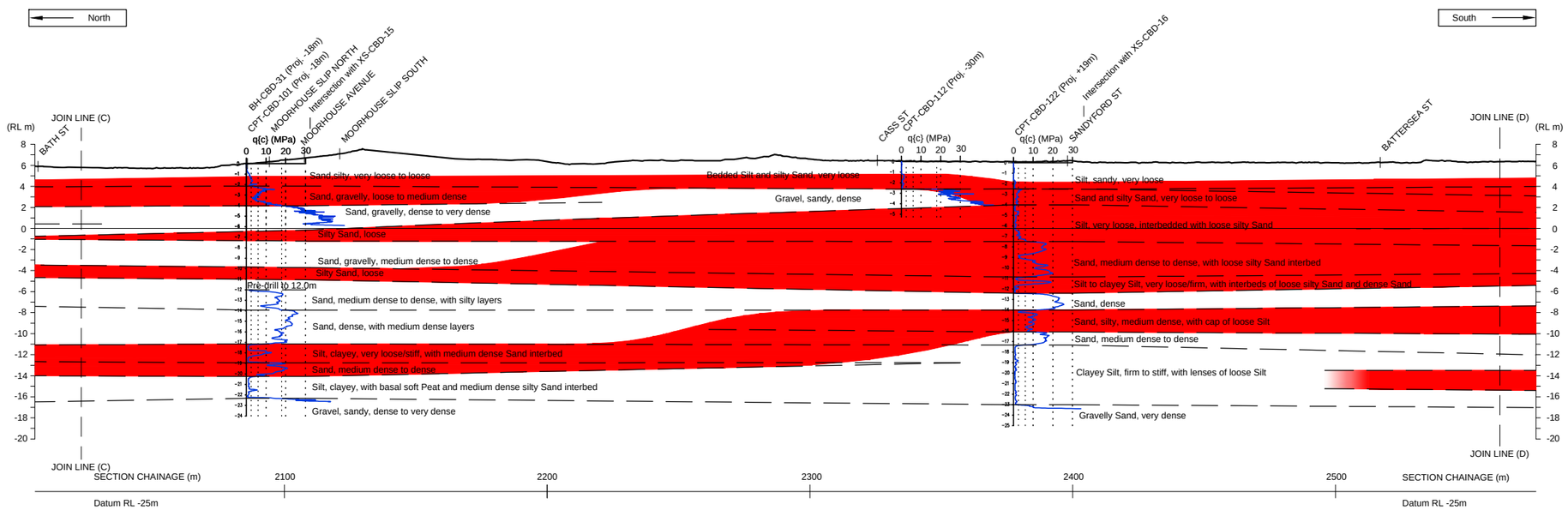

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Horizontal

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SCALES (AT A3 SIZE)
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Sheet 2 of 3

CHRISTCHURCH CITY COUNCIL

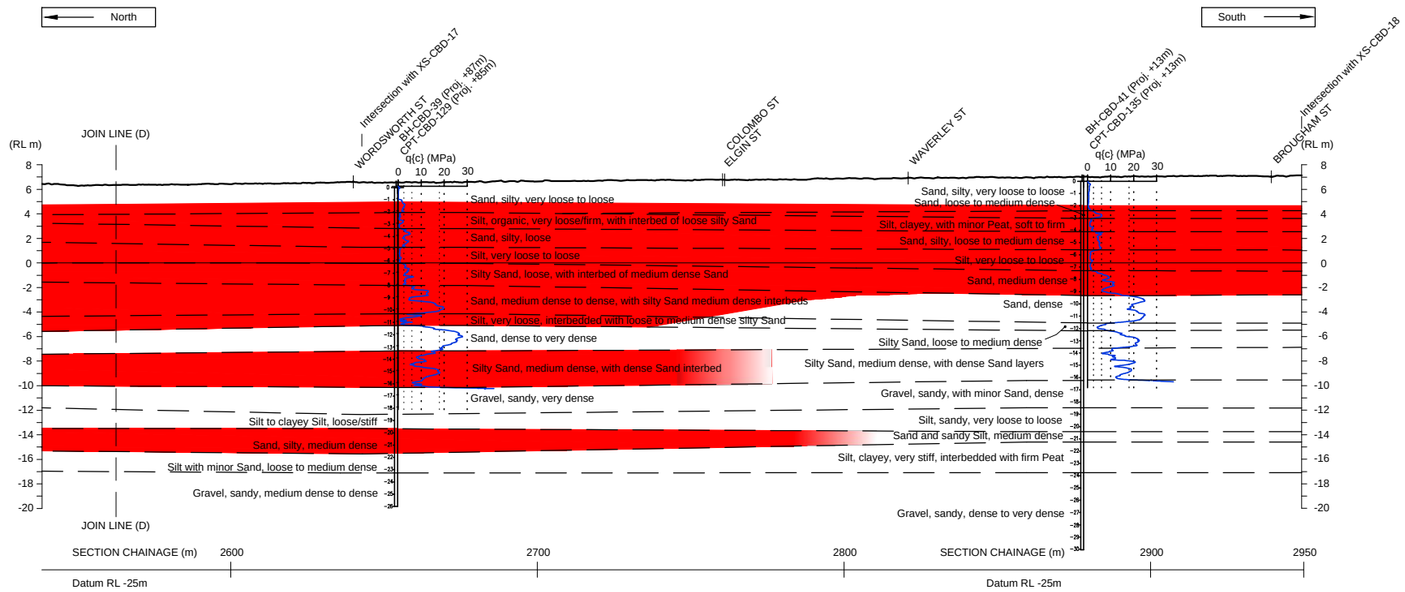
GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-03 (Colombo Street)

FIG. No. E7

REV. 1



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Sheet 3 of 3

CHRISTCHURCH CITY COUNCIL

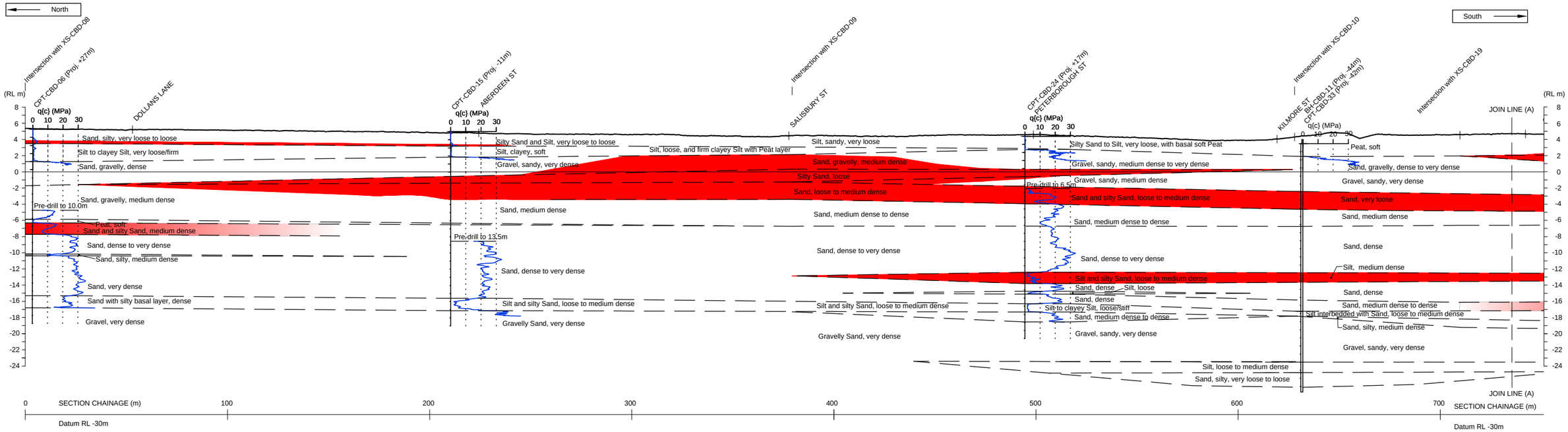
GEOLOGICAL INTERPRETATIVE REPORT

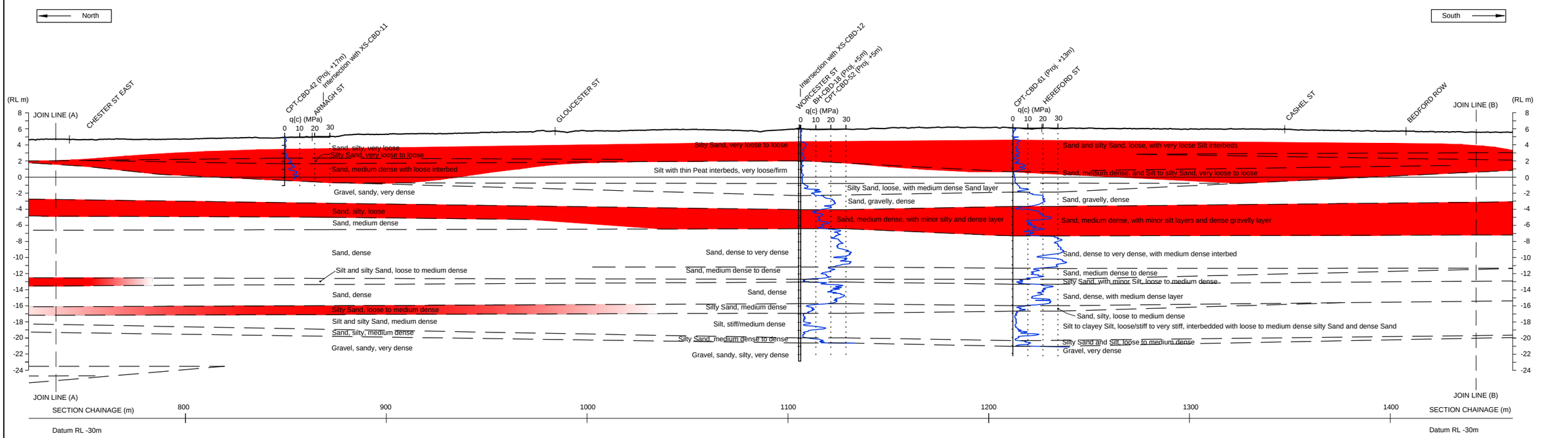
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-03 (Colombo Street)

FIG. No. E7

REV. 1





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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-04 (Madras Street)

FIG. No. E8

REV. 1

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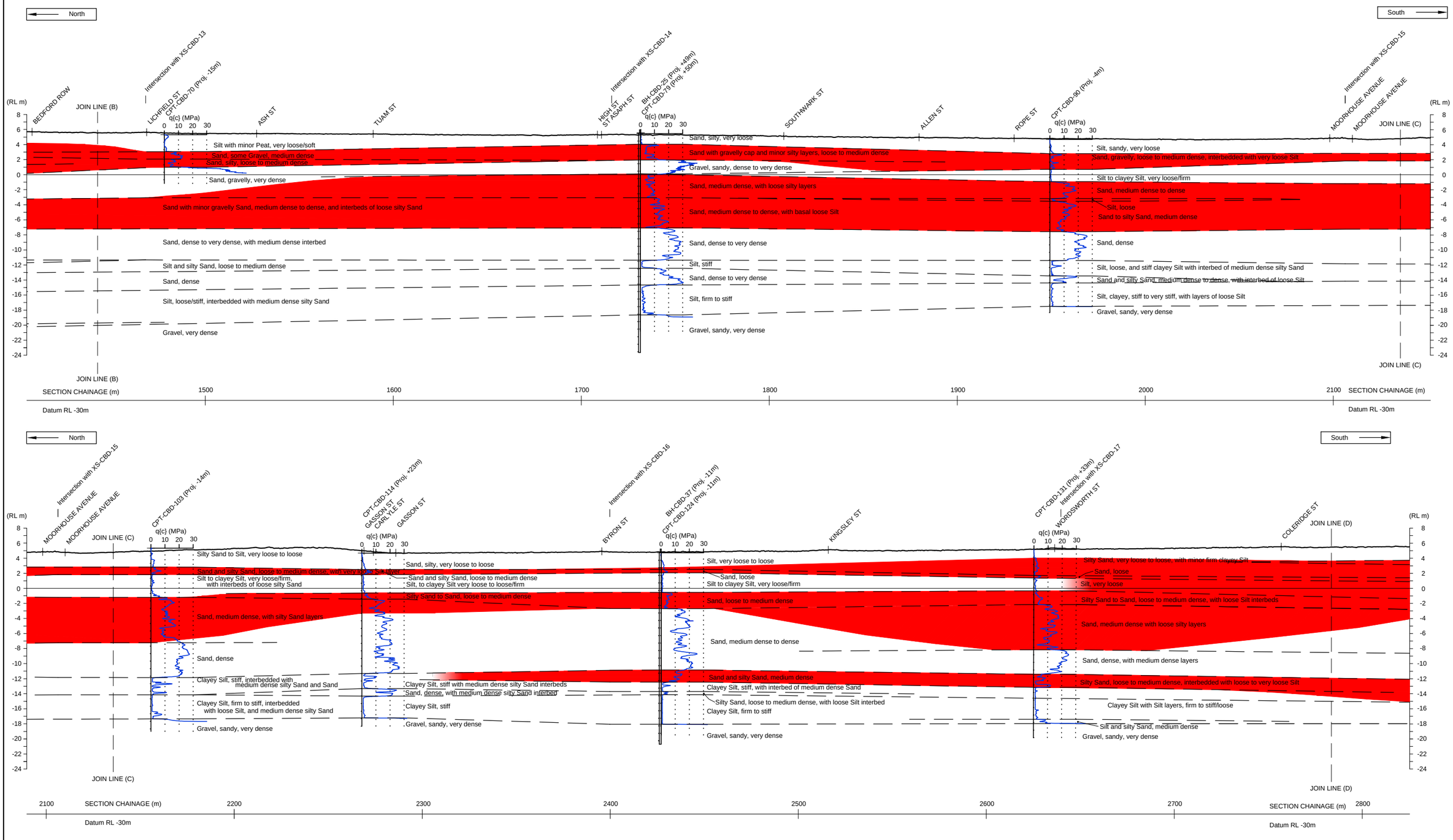

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0 20 40 60 80 100m

Horizontal

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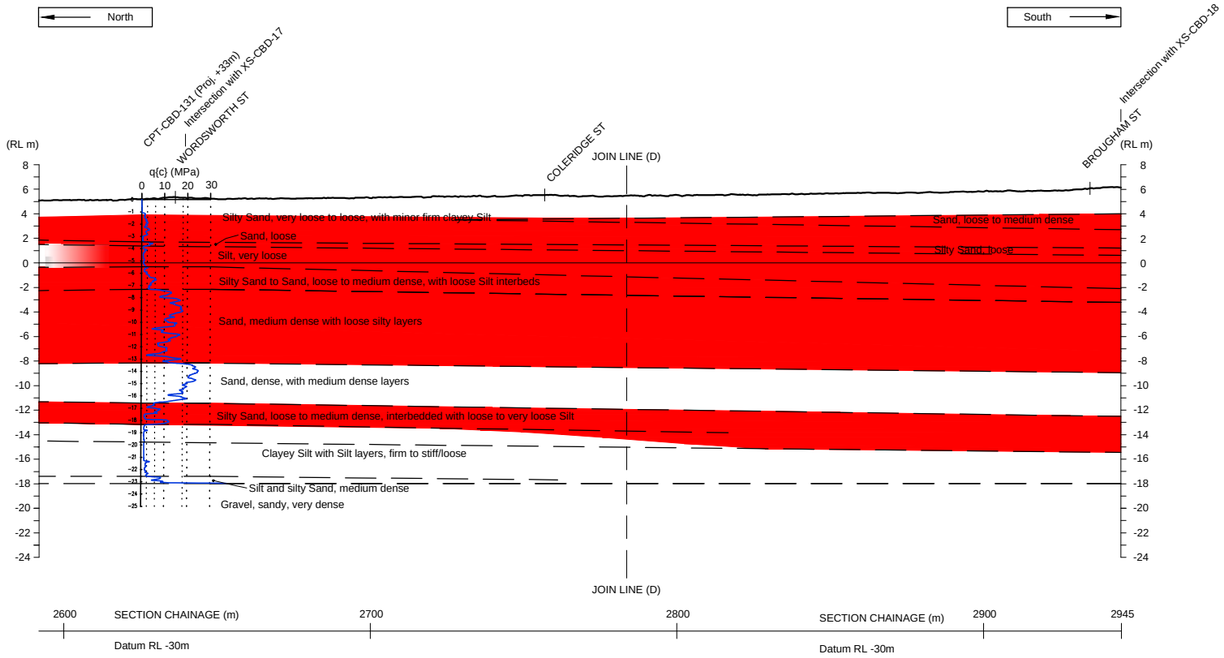
Sheet 2 of 3

CHRISTCHURCH CITY COUNCIL
GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-04 (Madras Street)

FIG. No. E8

REV. 1



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CHRISTCHURCH CITY COUNCIL
GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-04 (Madras Street)

FIG. No. E8

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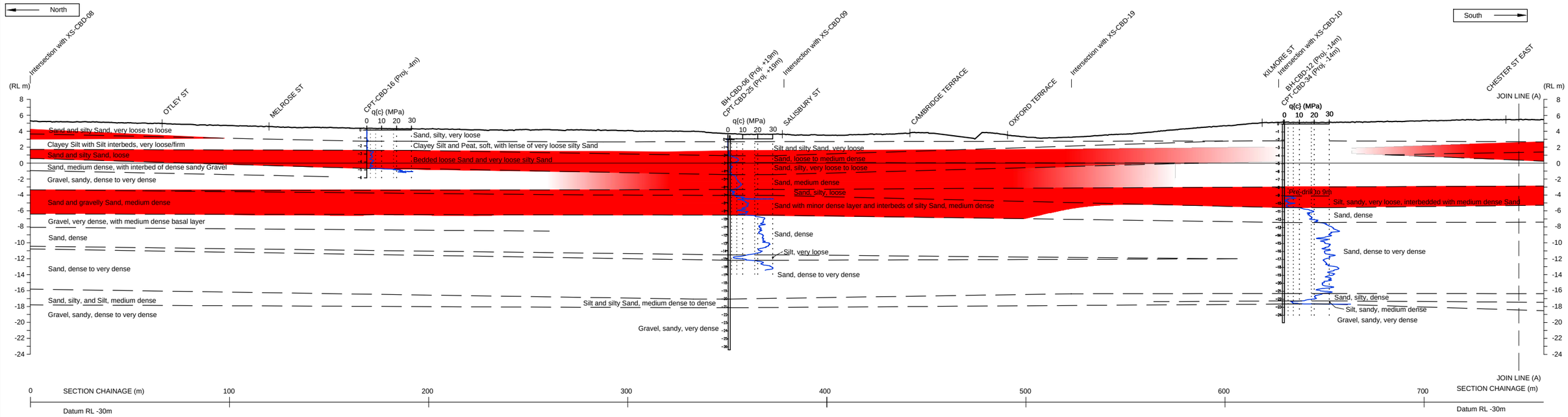

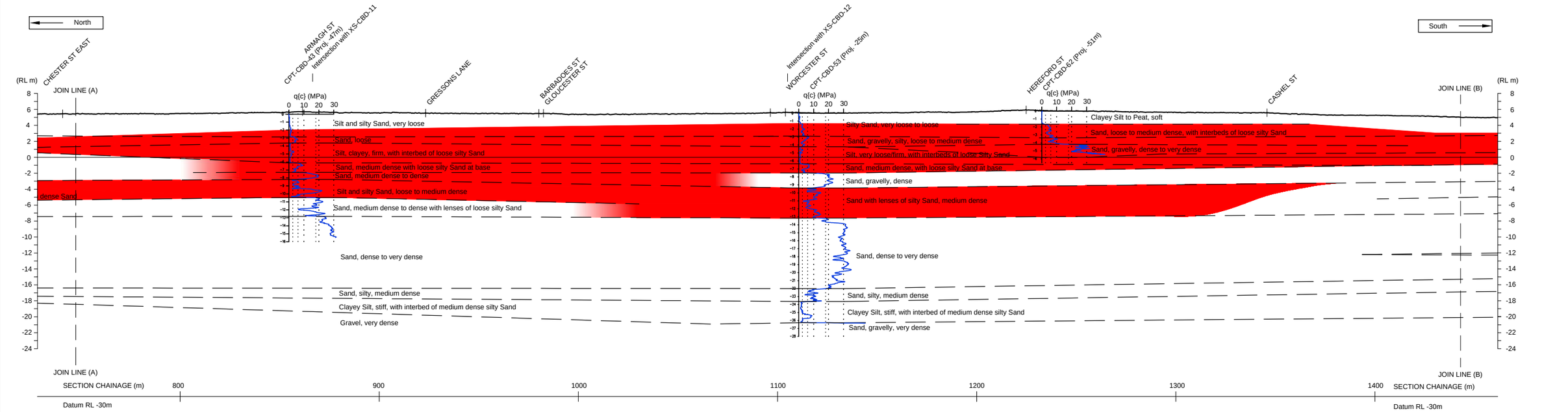

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m Horizontal

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Sheet 1 of 3

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-05 (Barbadoes Street)

FIG. No. E9

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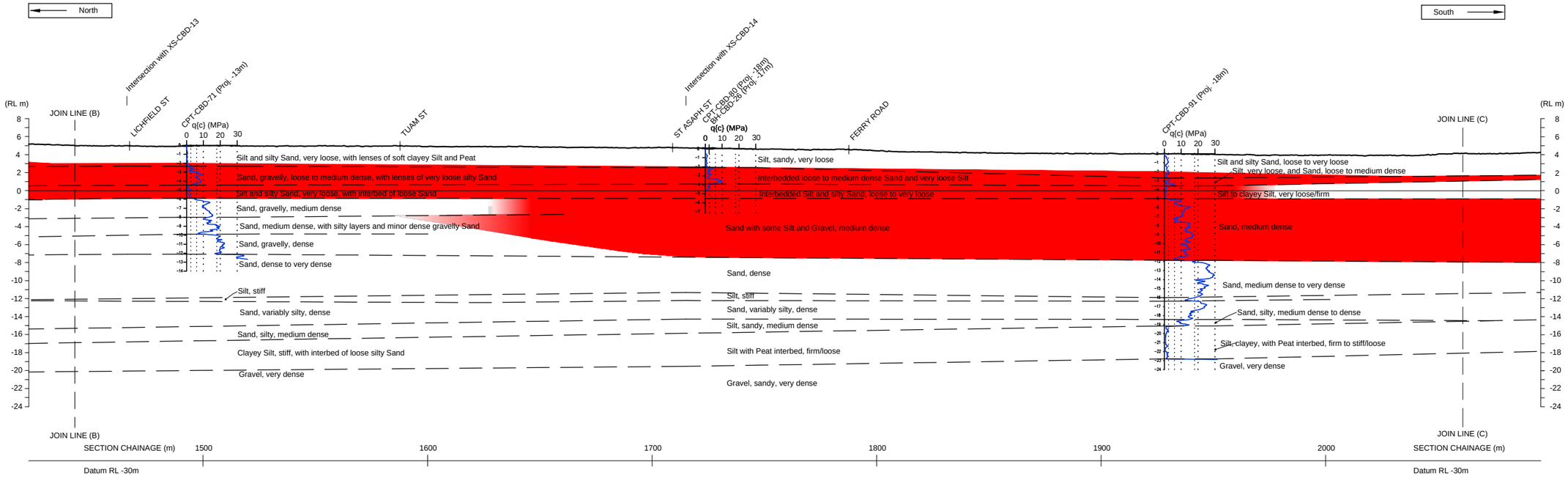

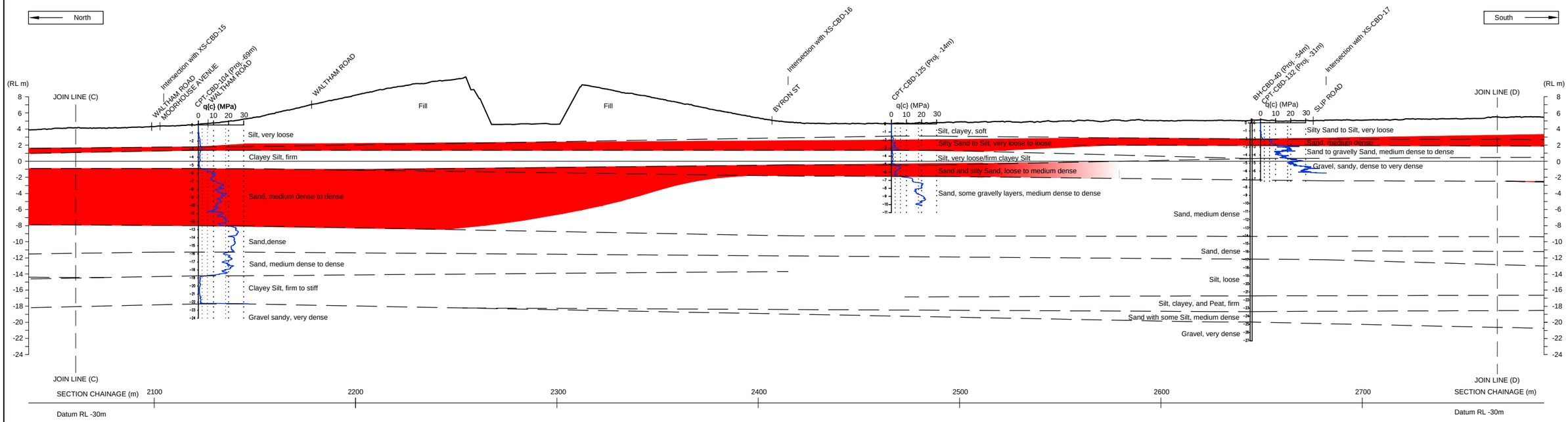

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0 20 40 60 80 100m Horizontal

LEGEND

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SCALES (AT A3 SIZE)
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CHRISTCHURCH CITY COUNCIL

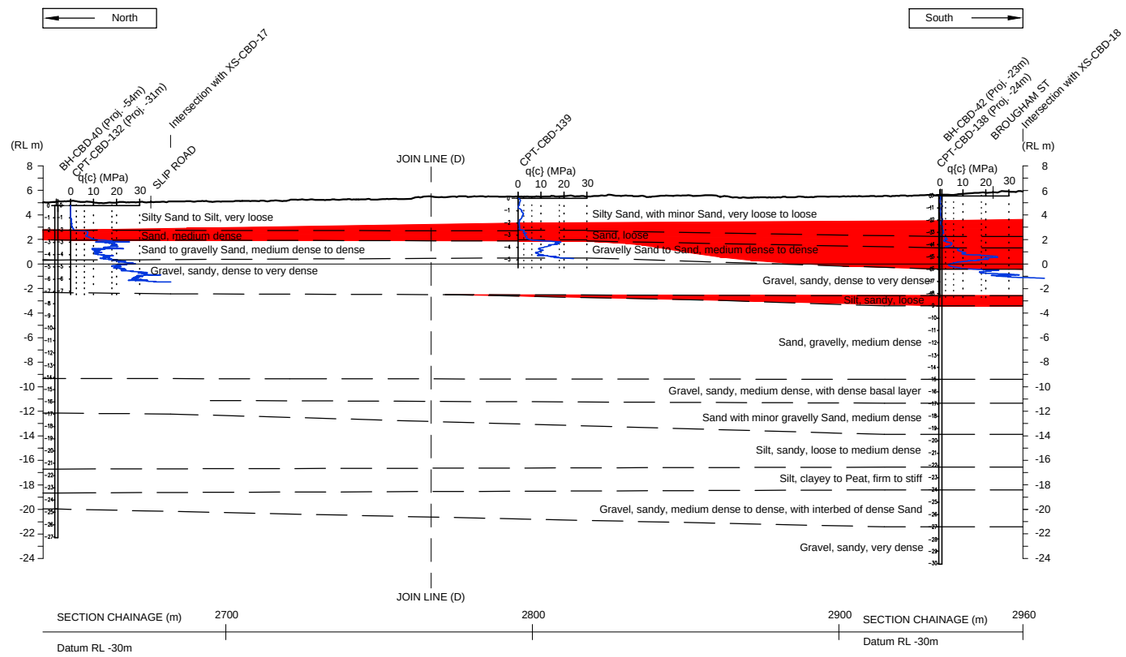
GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-05 (Barbadoes Street)

FIG. No. E9

REV. 1



(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-05 (Barbadoes Street)

FIG. No. E9

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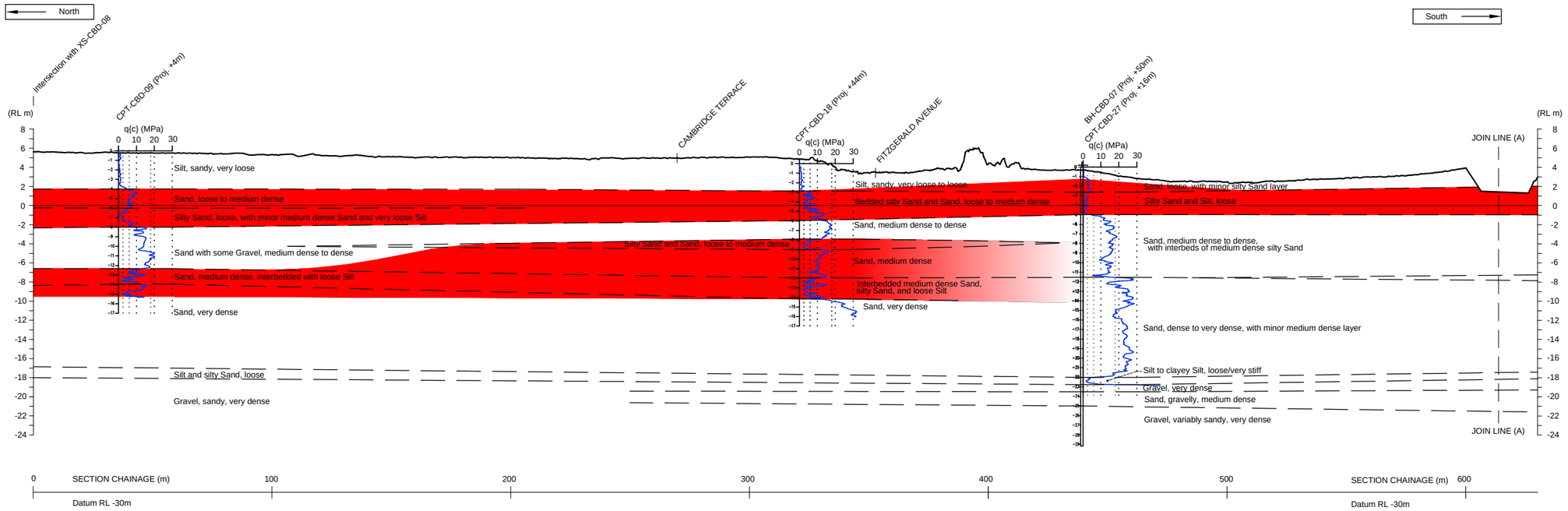

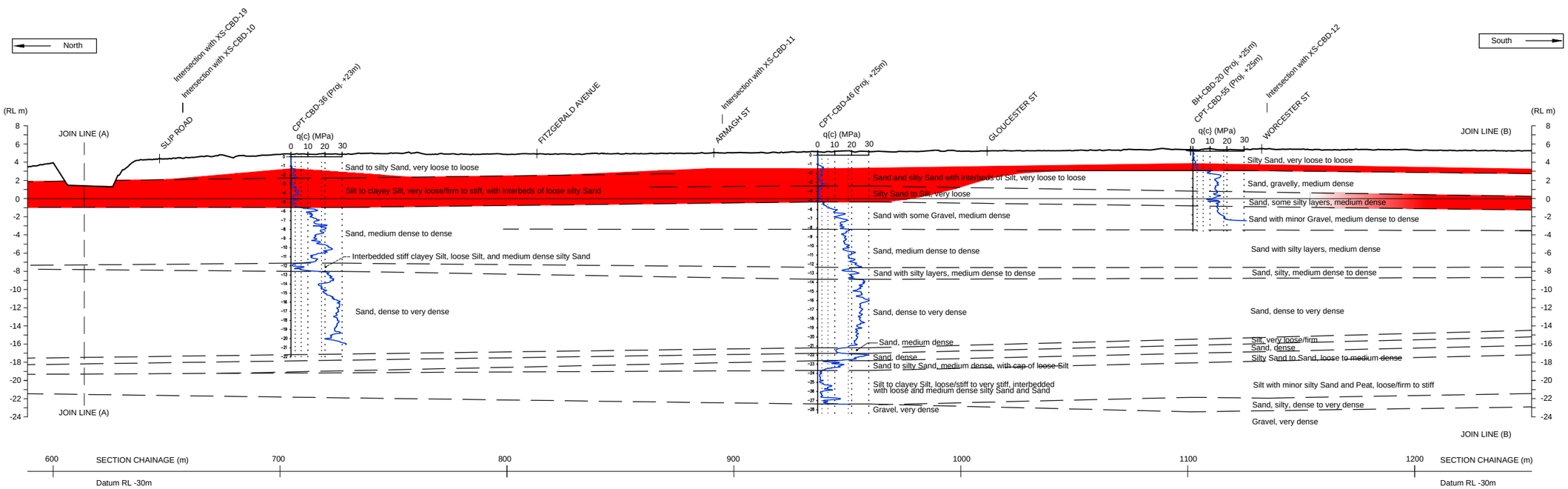

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SCALES (AT A3 SIZE)
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Sheet 1 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-06 (Fitzgerald Avenue)

FIG. No. E10

REV. 1

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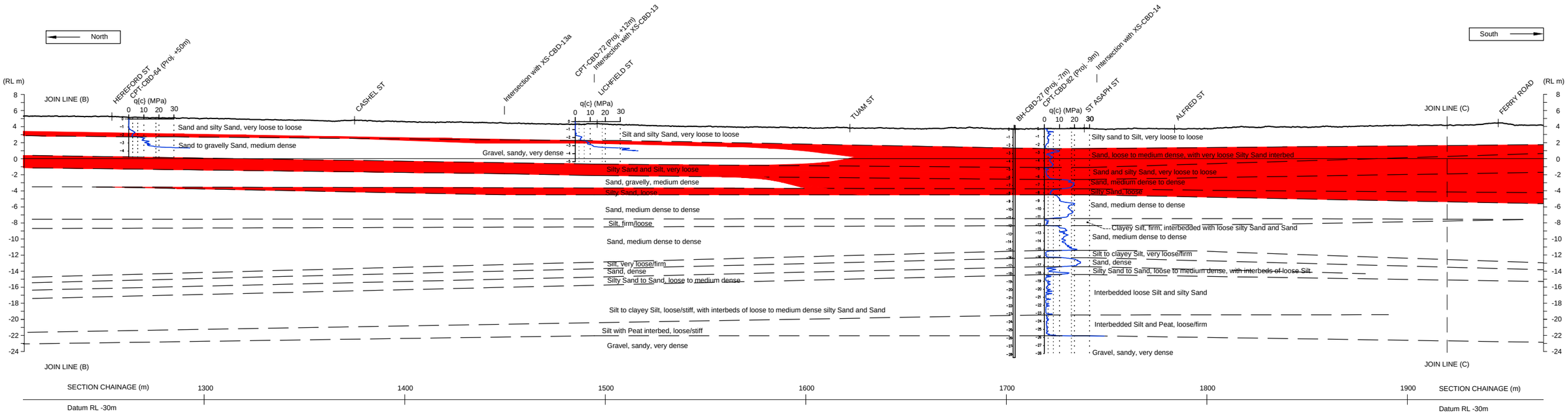

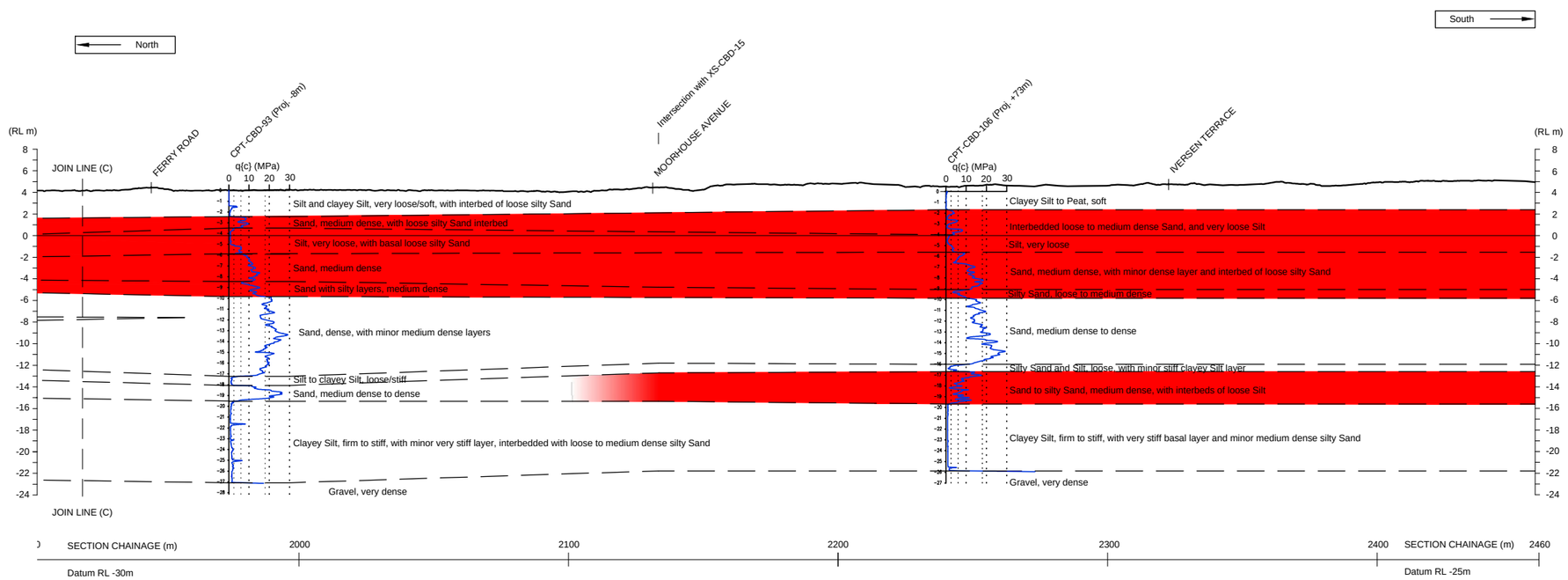

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Horizontal

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Sheet 2 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-06 (Fitzgerald Avenue)

FIG. No. E10

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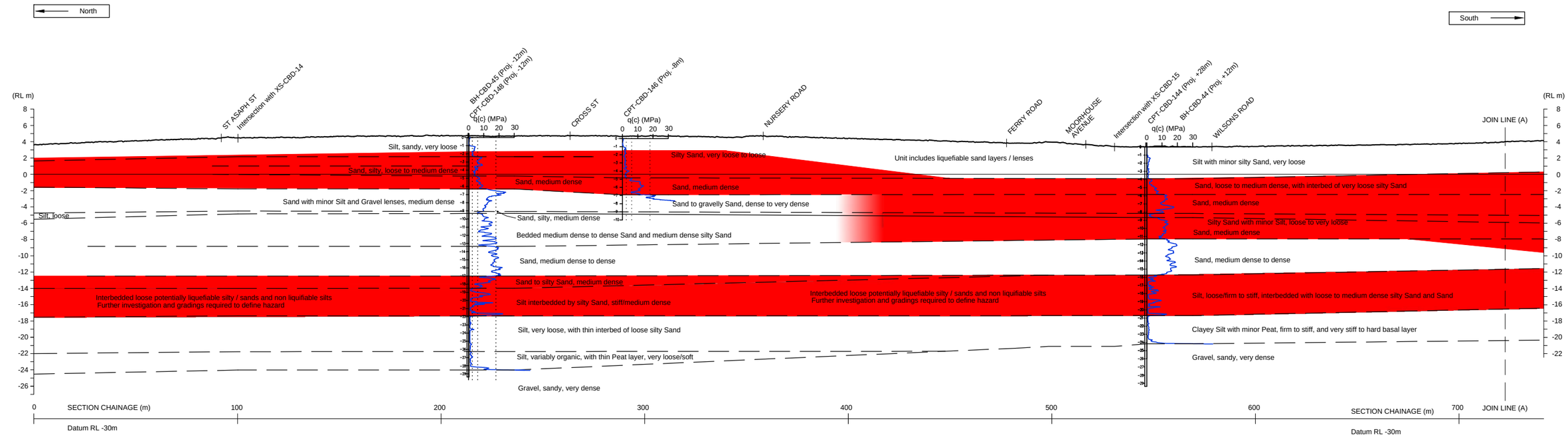

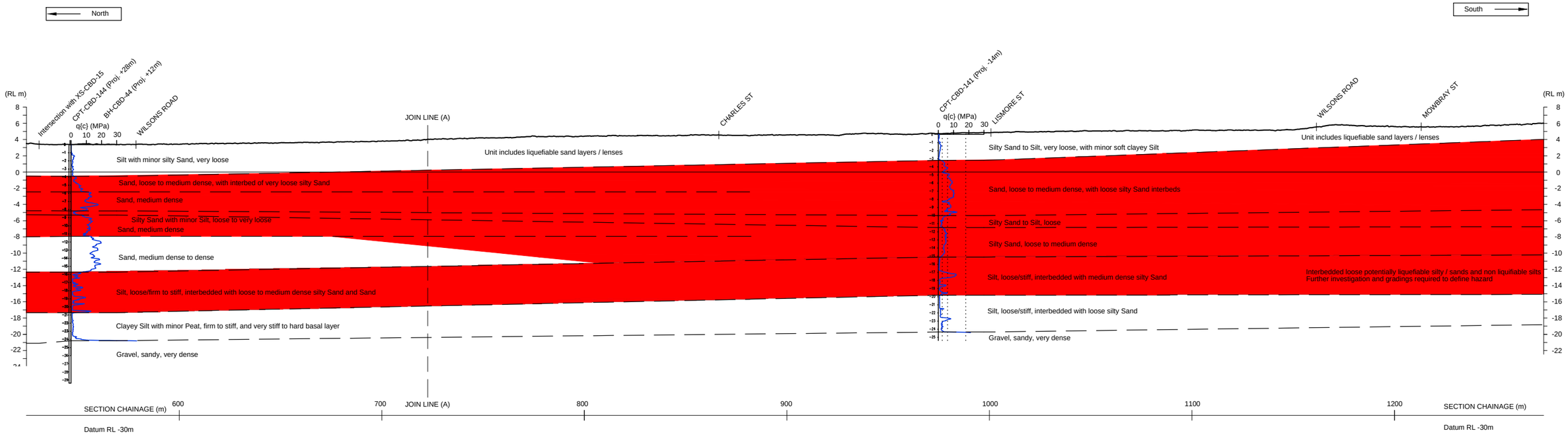

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0 20 40 60 80 100m Horizontal

LEGEND

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Sheet 1 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-07 (Wilsons Road)

FIG. No. E11

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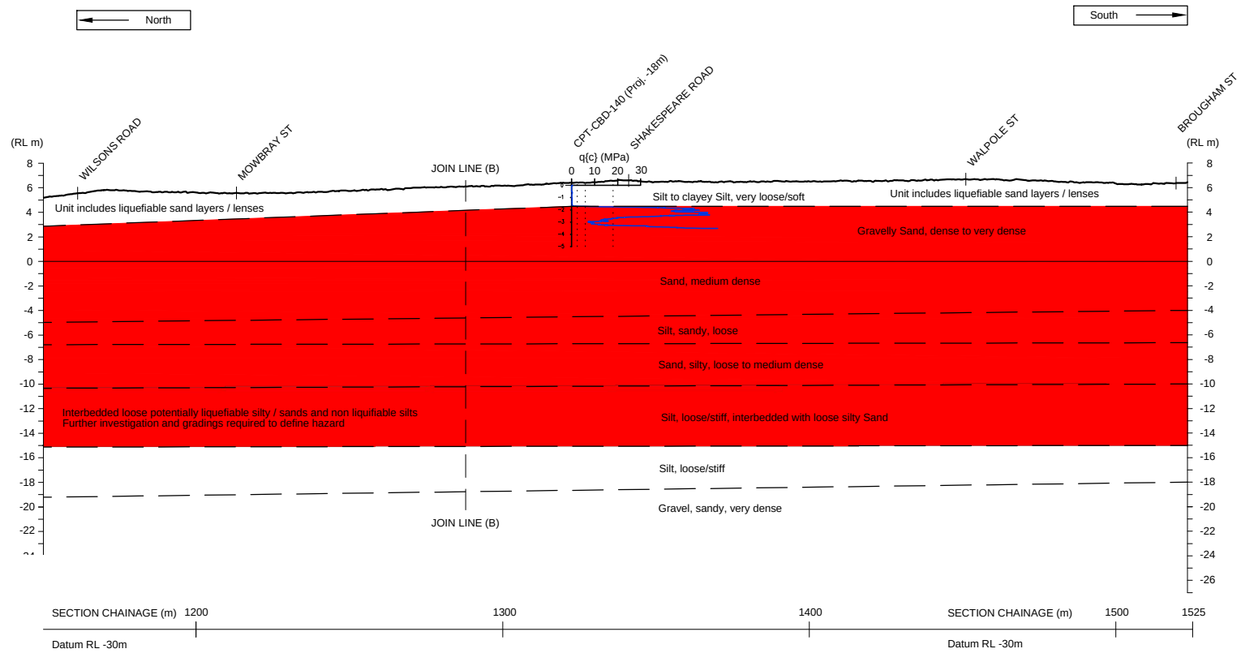

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Horizontal

LEGEND

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CHRISTCHURCH CITY COUNCIL

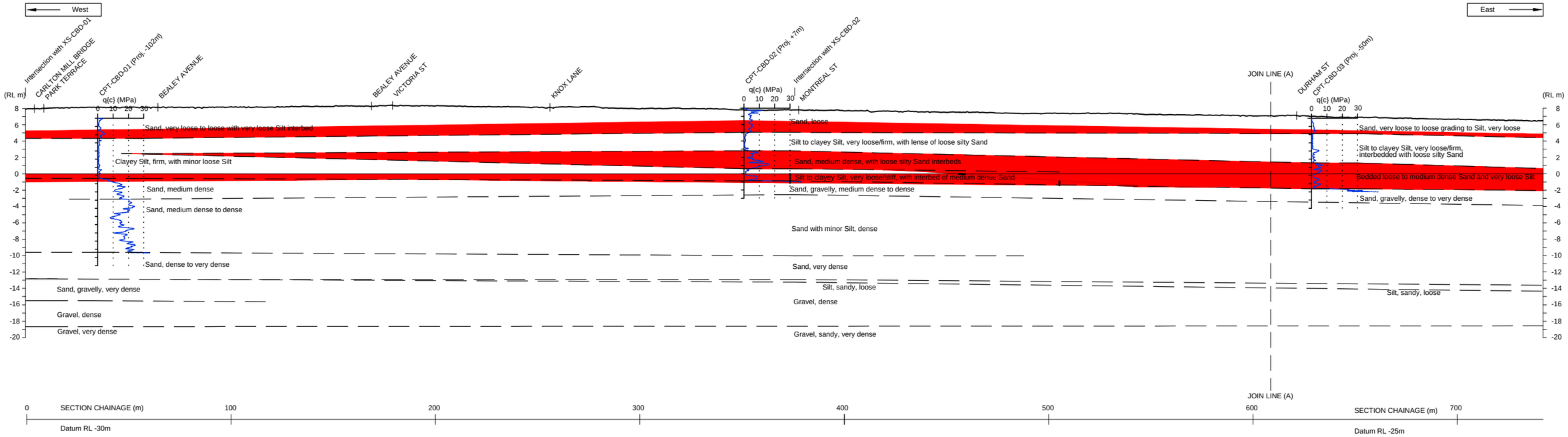
GEOLOGICAL INTERPRETATIVE REPORT

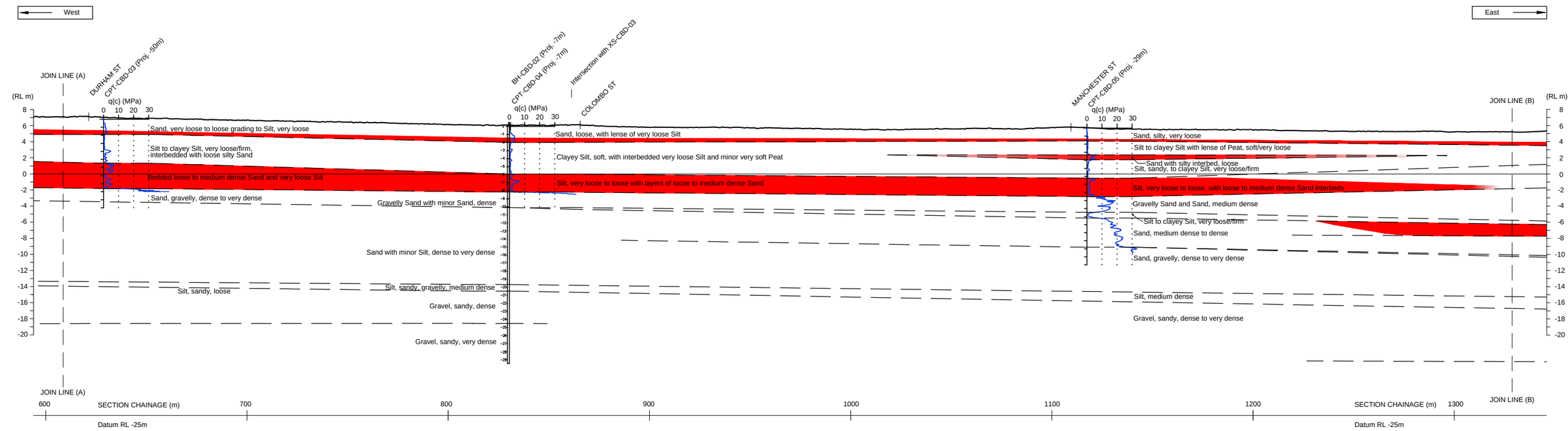
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-07 (Wilsons Road)

FIG. No. E11

REV. 1





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Horizontal

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-08 (Bealey Avenue)

FIG. No. E12

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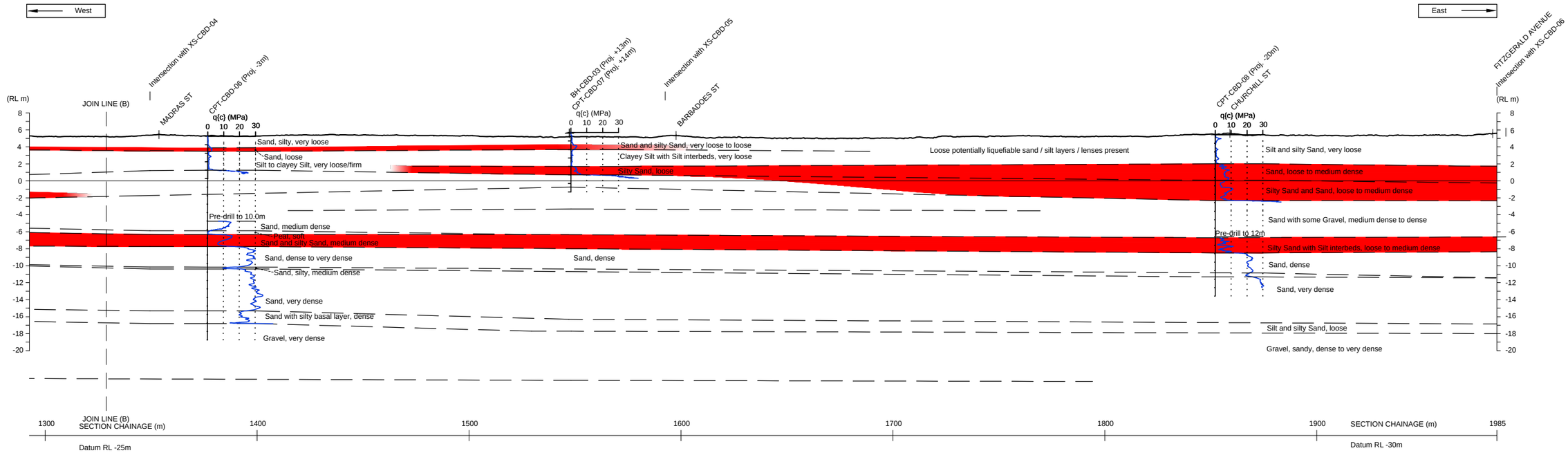

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Horizontal

LEGEND

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-08 (Bealey Avenue)

FIG. No. E12

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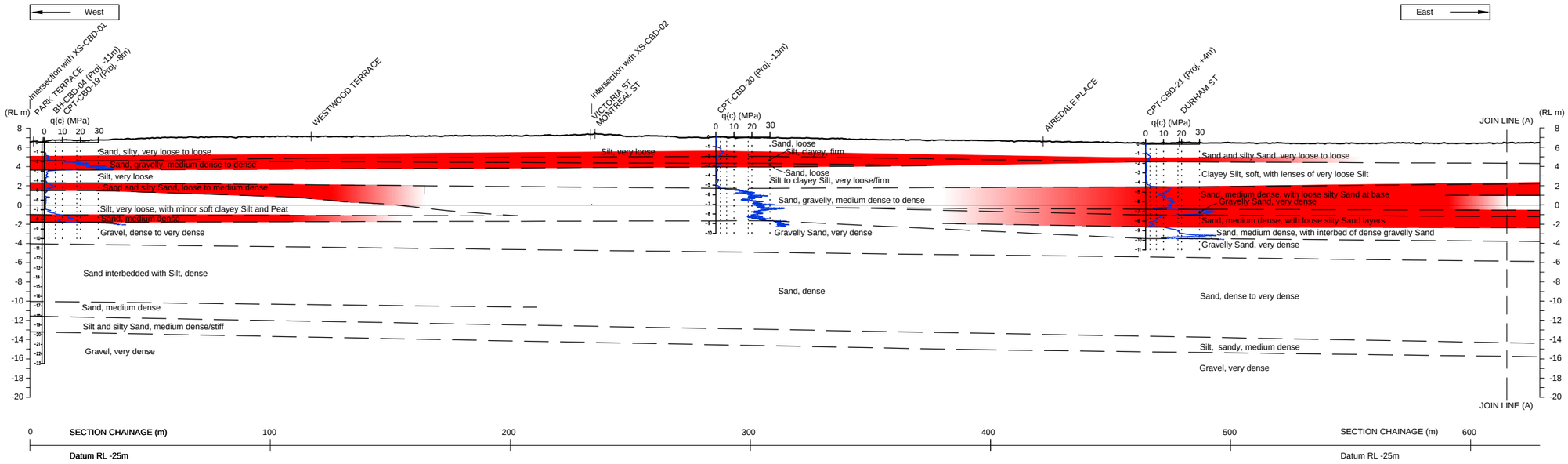

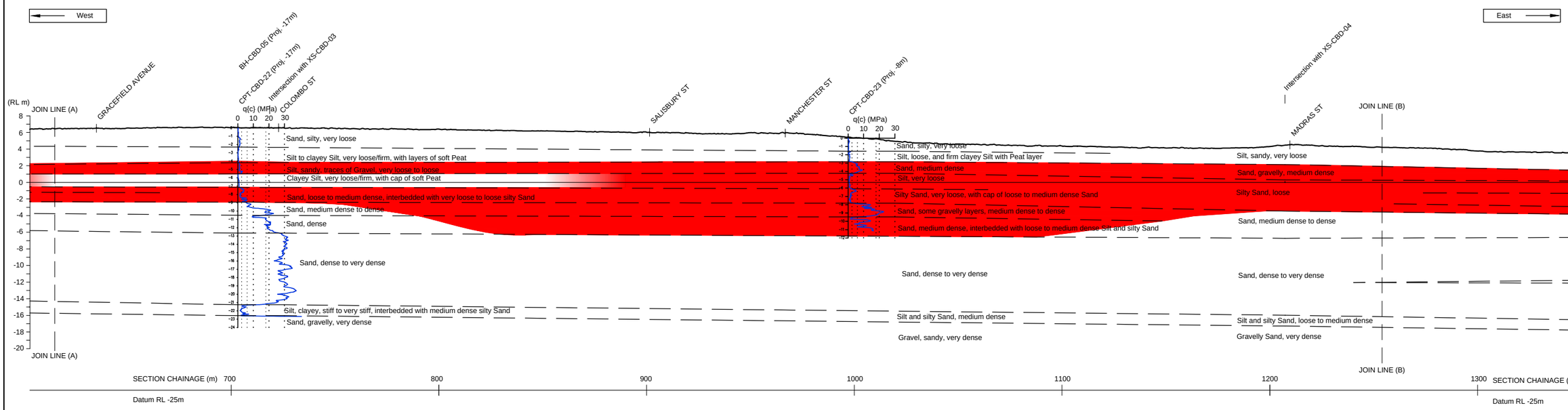

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-09 (Salisbury Street)

FIG. No. E13

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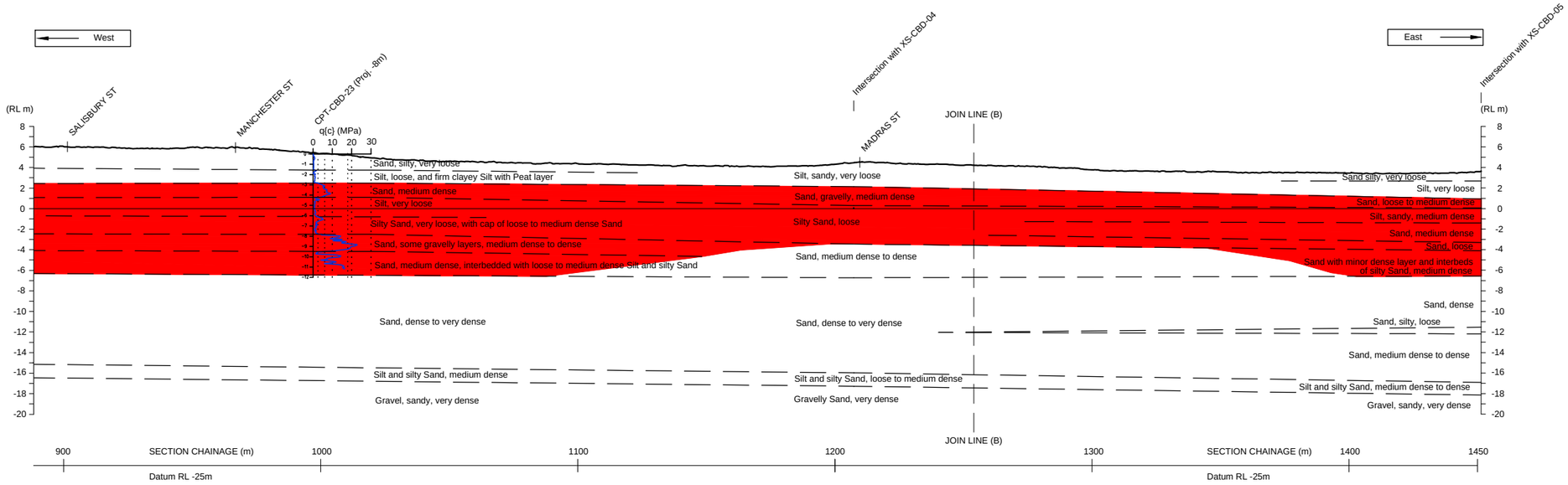

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LEGEND

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-09 (Salisbury Street)

FIG. No. E13

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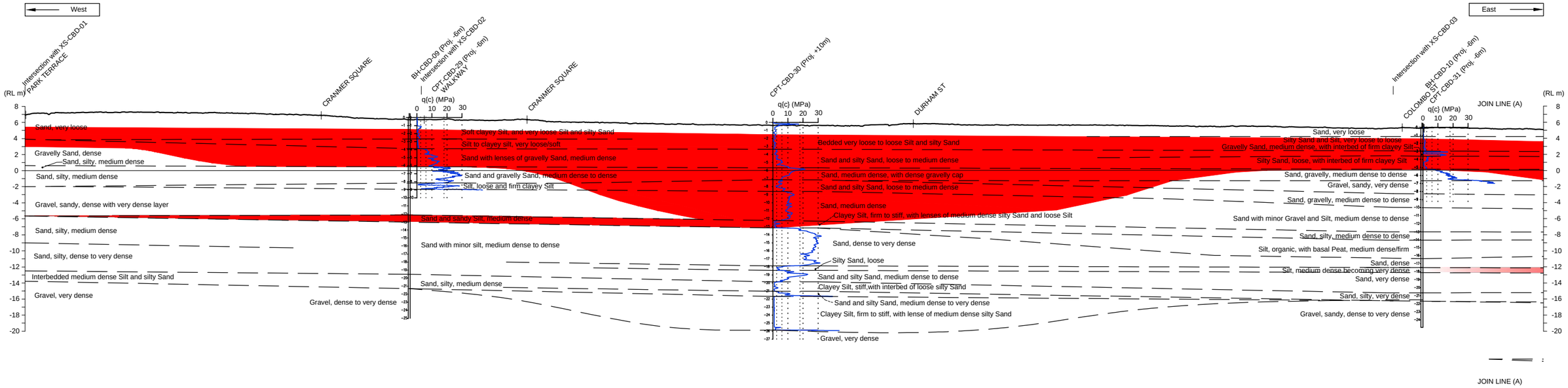

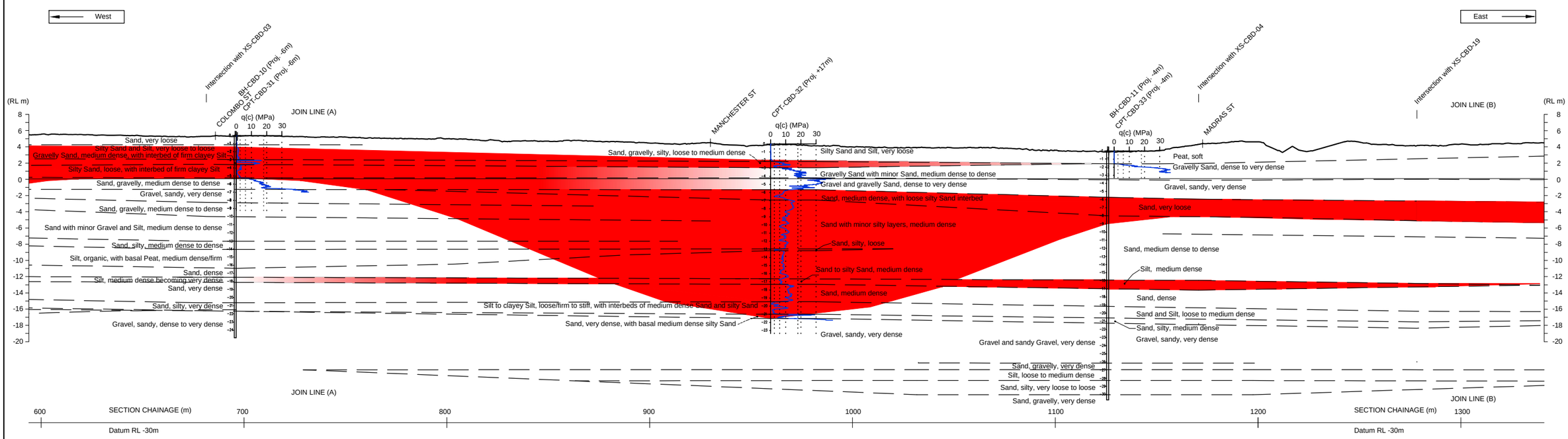

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Horizontal

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-10 (Kilmore Street)

FIG. No. E14

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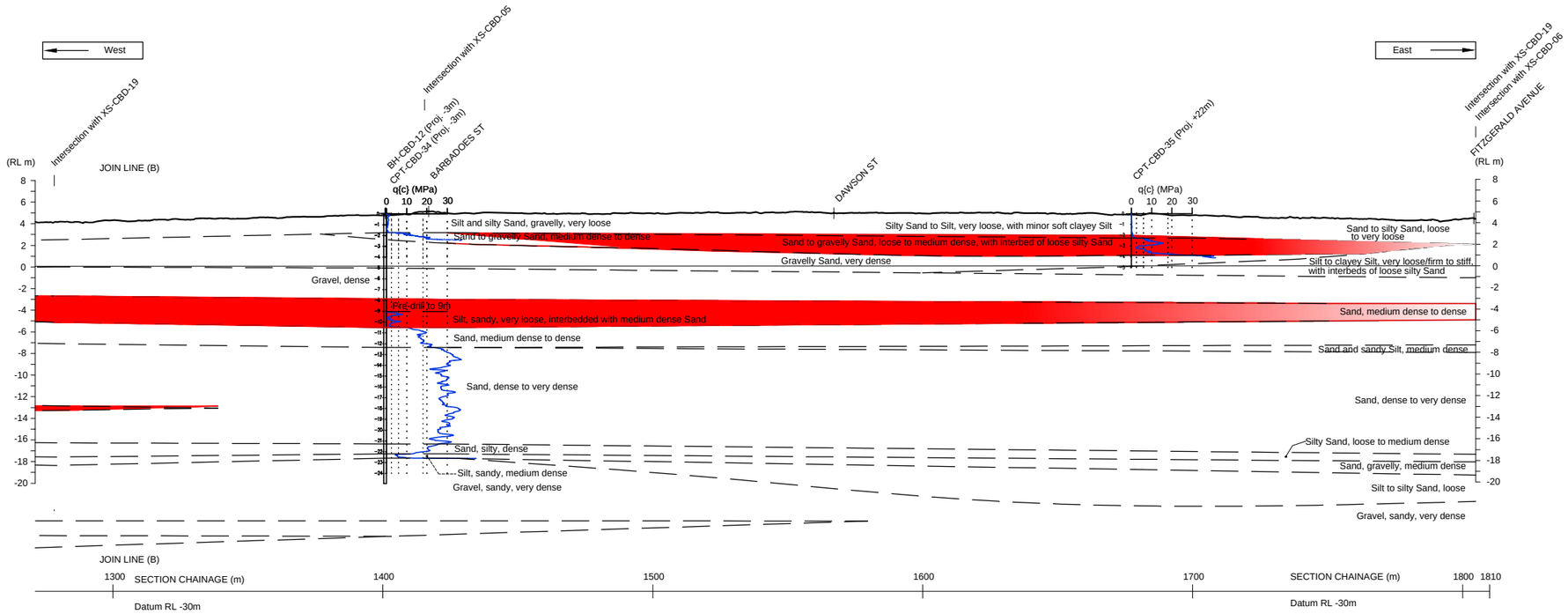

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Horizontal

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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-10 (Kilmore Street)

FIG. No. E14

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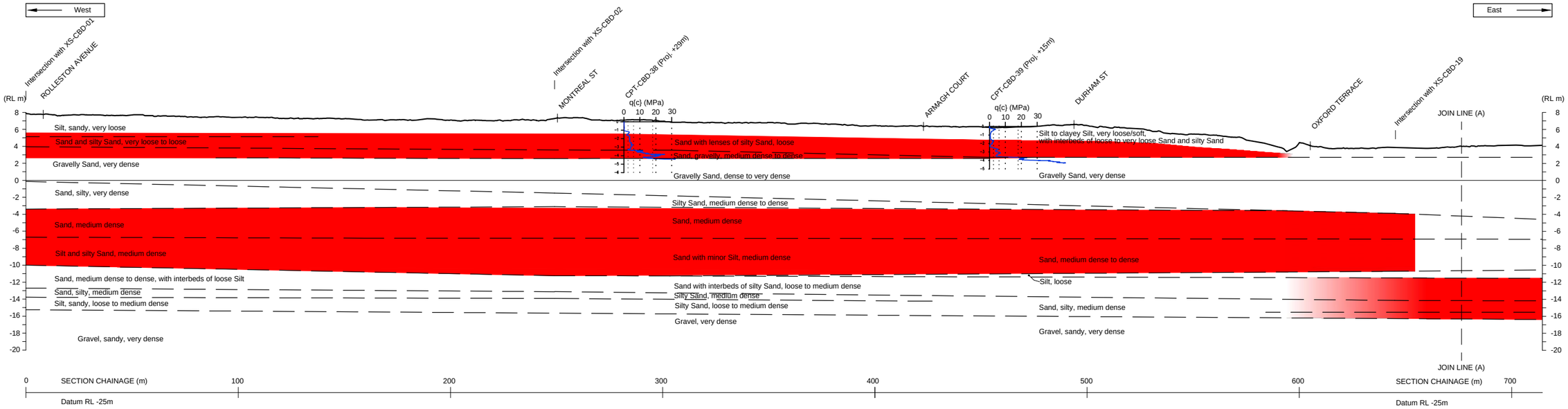

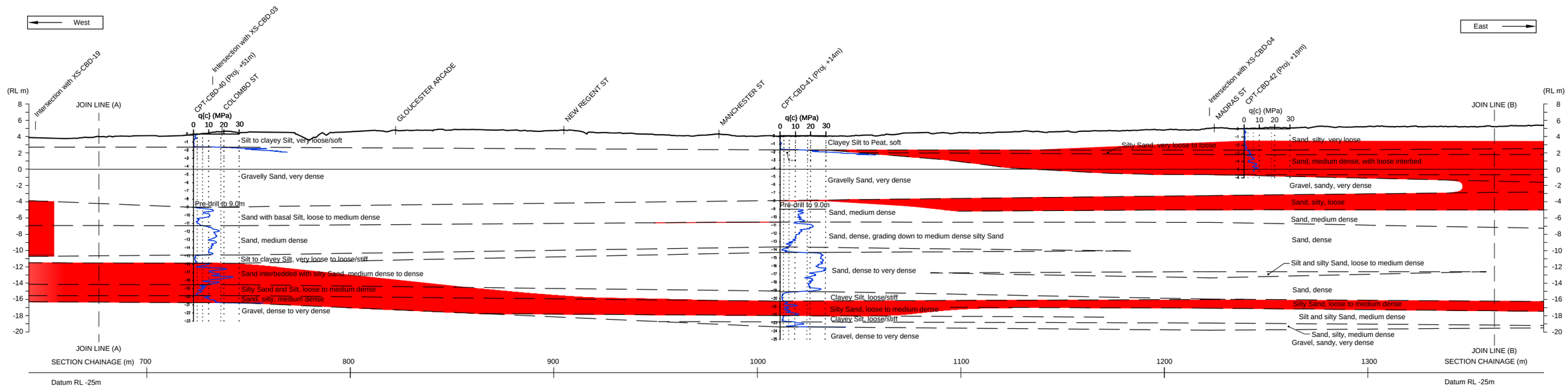

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0 20 40 60 80 100m Horizontal

LEGEND

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CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-11 (Armagh Street)

FIG. No. E15

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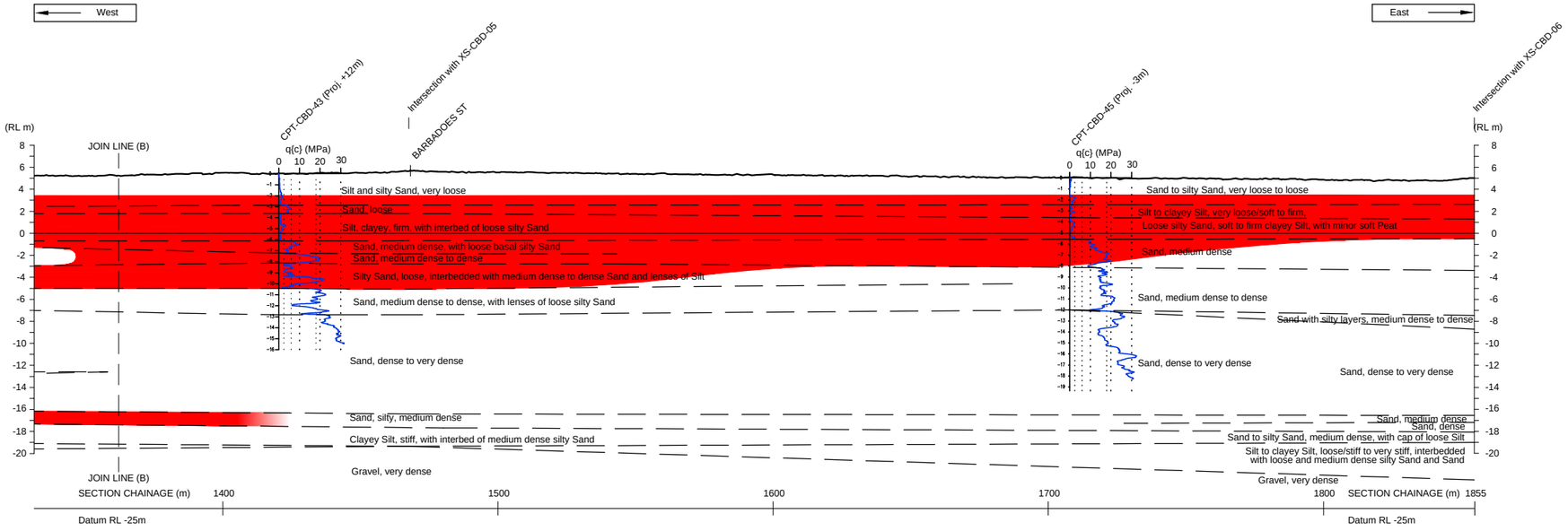

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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Sheet 2 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-11 (Armagh Street)

FIG. No. E15

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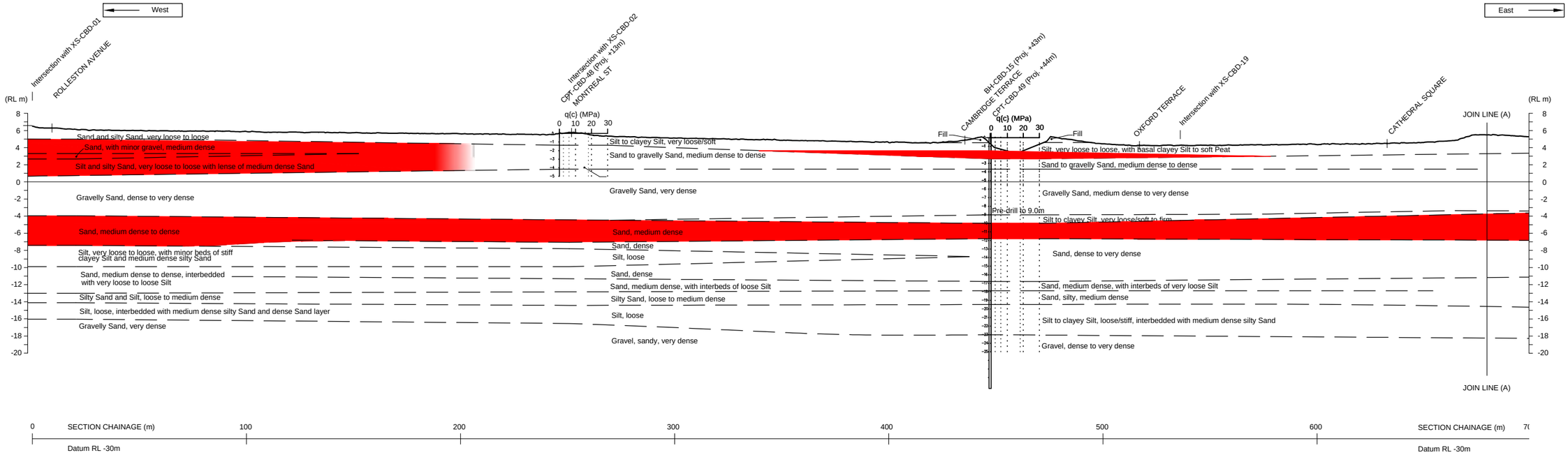

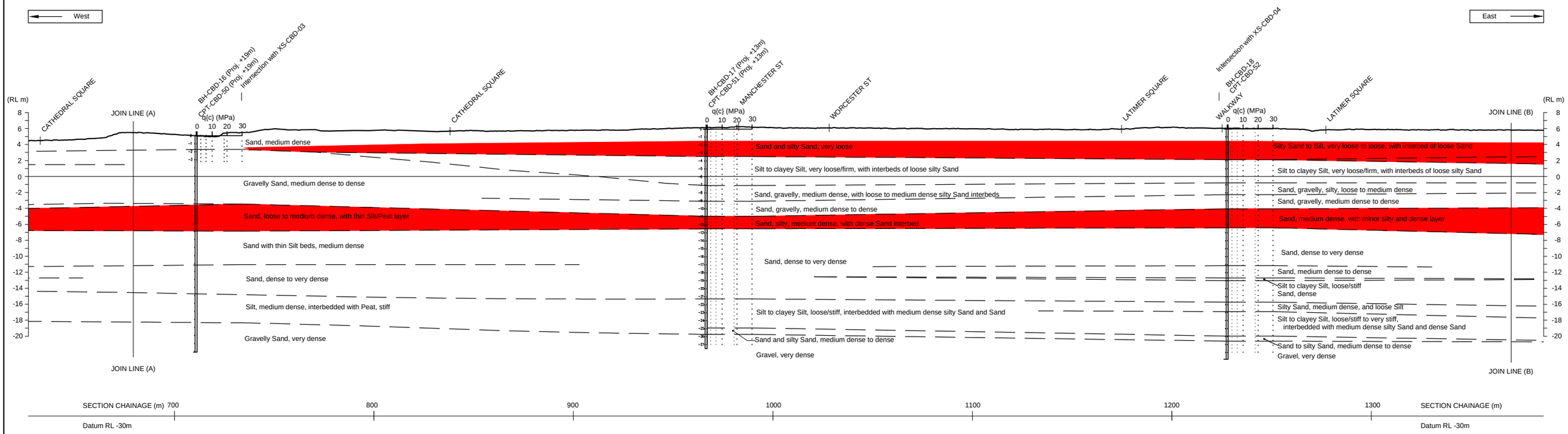

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GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-12 (Worcester Street)

FIG. No. E16

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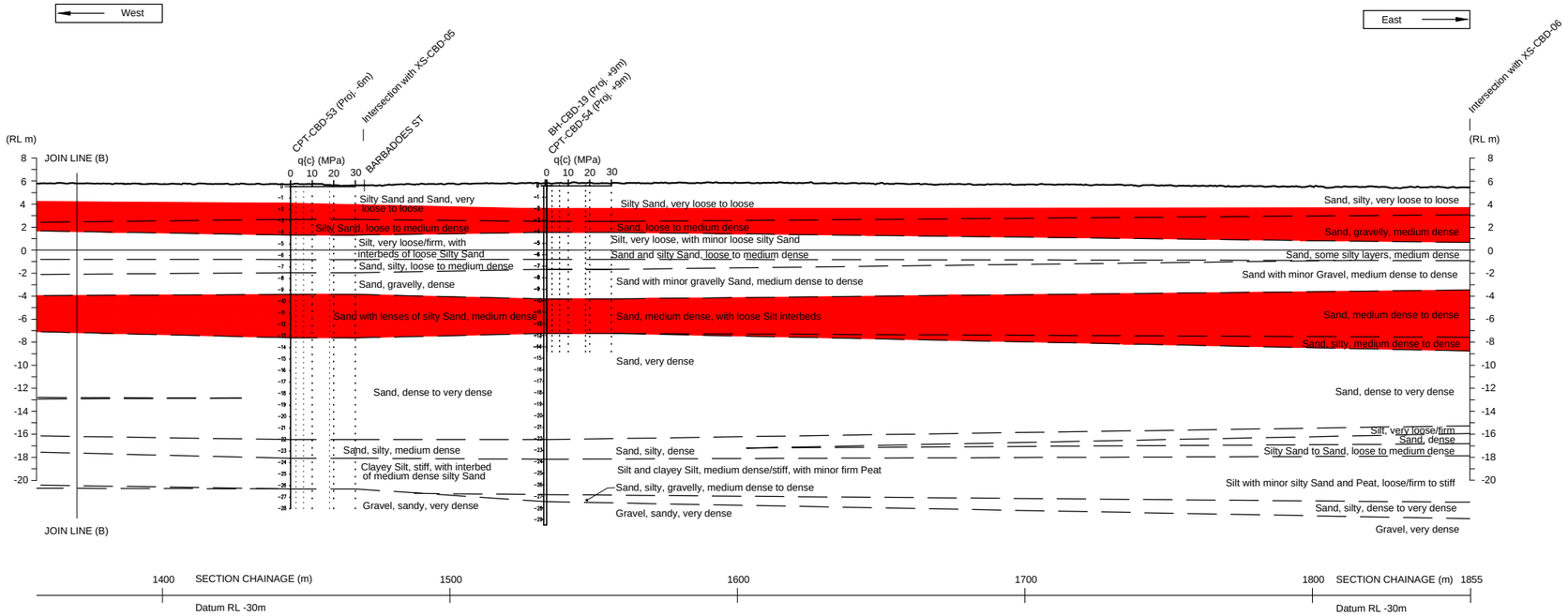

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Horizontal

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SCALES (AT A3 SIZE)
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Sheet 2 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-12 (Worcester Street)

FIG. No. E16

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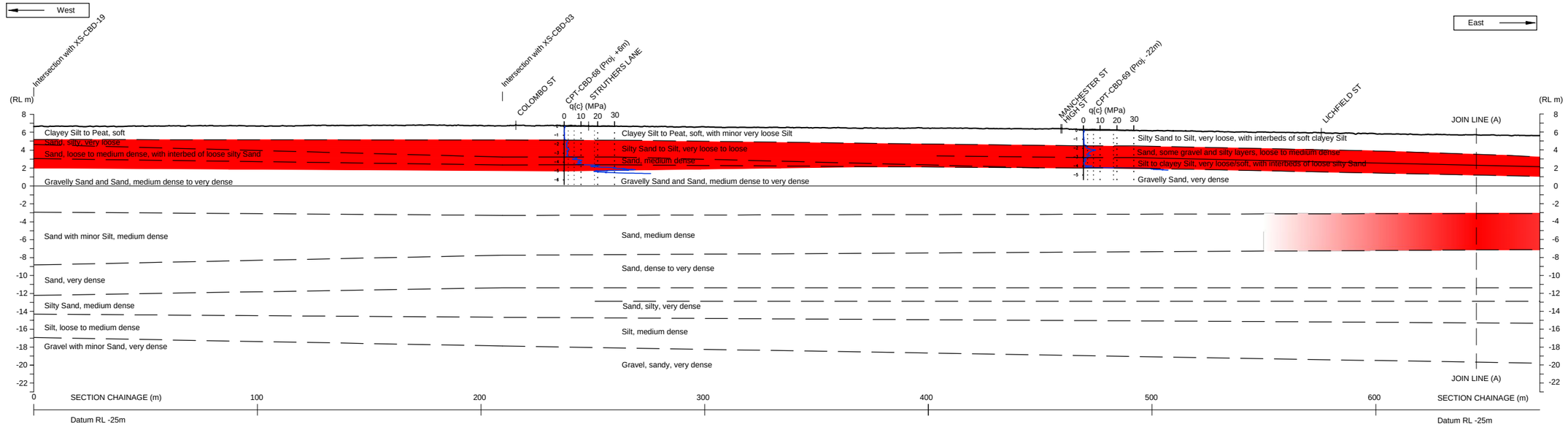

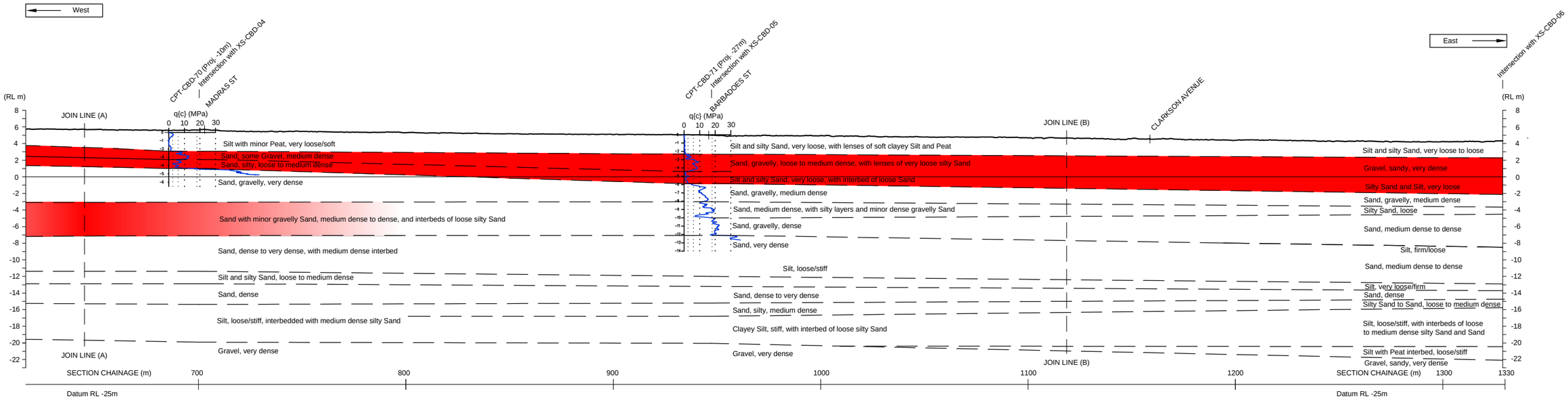

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

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SCALES (AT A3 SIZE) 1:2000 Horizontal 1:500 Vertical

Sheet 1 of 2

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

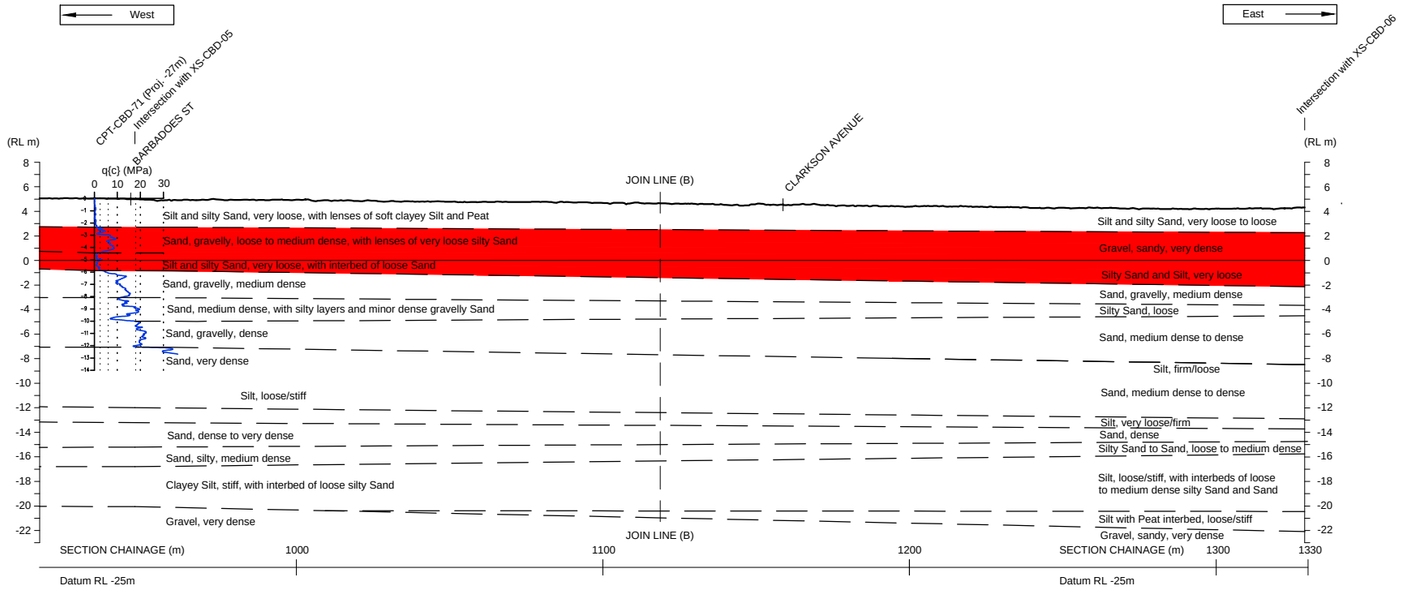
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-13 (Lichfield Street)

FIG. No. D17

REV. 1

LHXS-CBD-13.dwg XS-CBD-13 9/12/2011 2:36:19 p.m.



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Horizontal

LEGEND

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Sheet 2 of 2

CHRISTCHURCH CITY COUNCIL

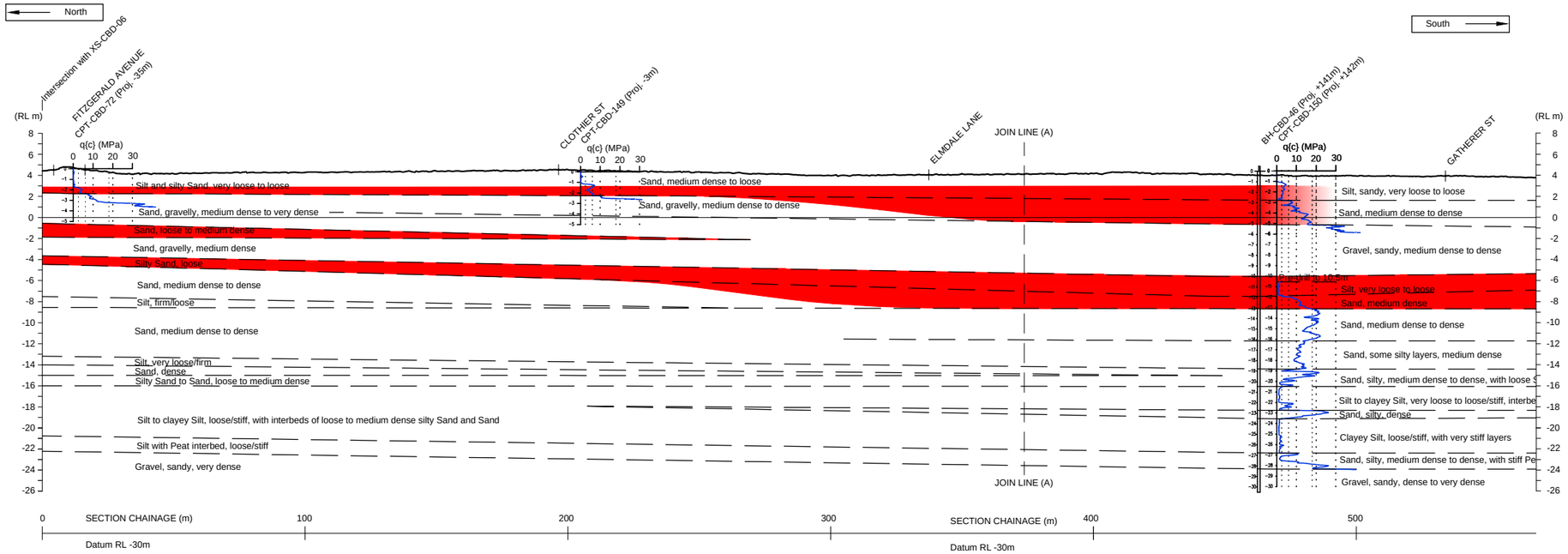
GEOLOGICAL INTERPRETATIVE REPORT

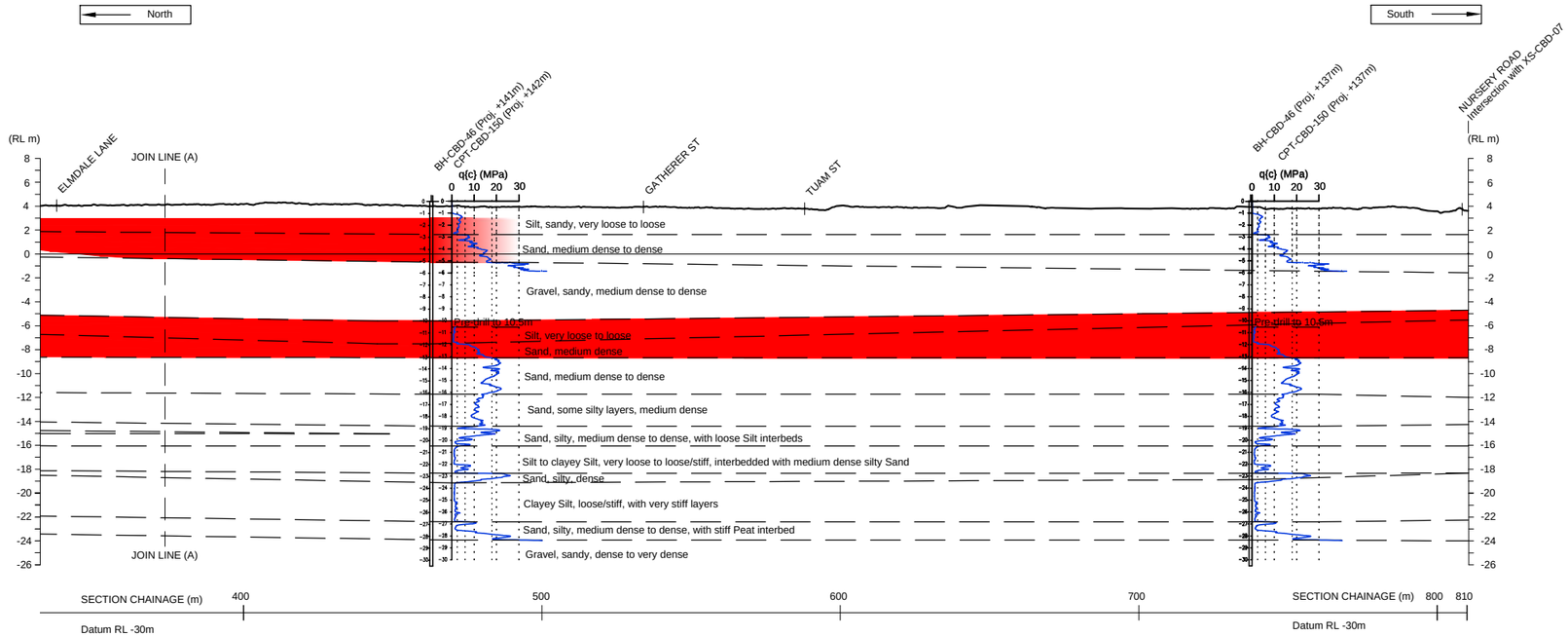
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-13 (Lichfield Street)

FIG. No. D17

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m Horizontal

Note: This section is based on very limited data points and should be used with caution.

LEGEND

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Sheet 1 of 1

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GEOLOGICAL INTERPRETATIVE REPORT

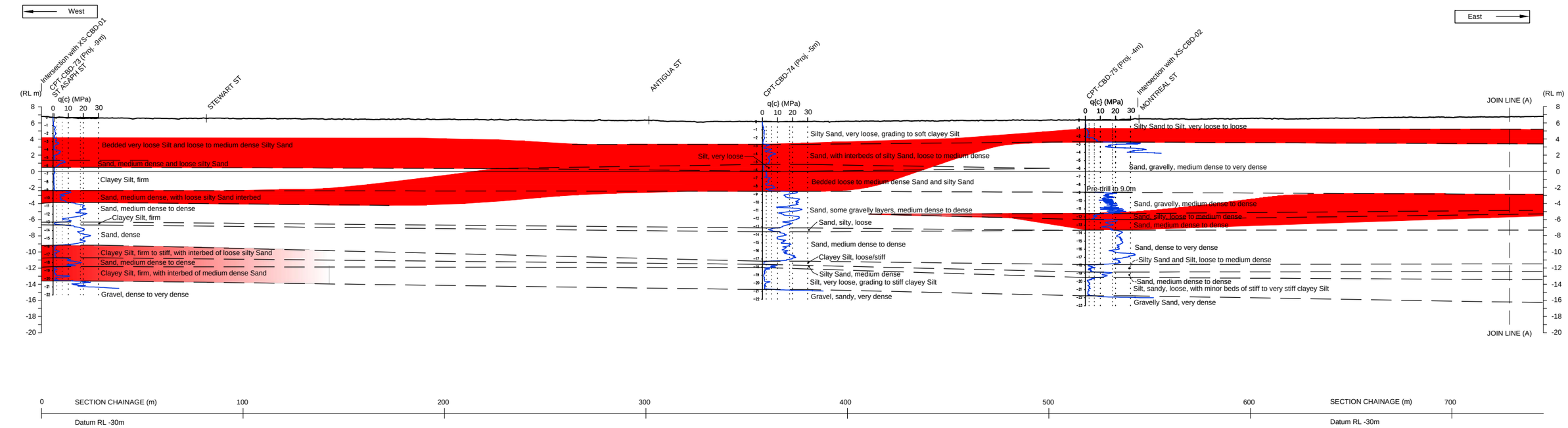
CHRISTCHURCH CENTRAL CITY

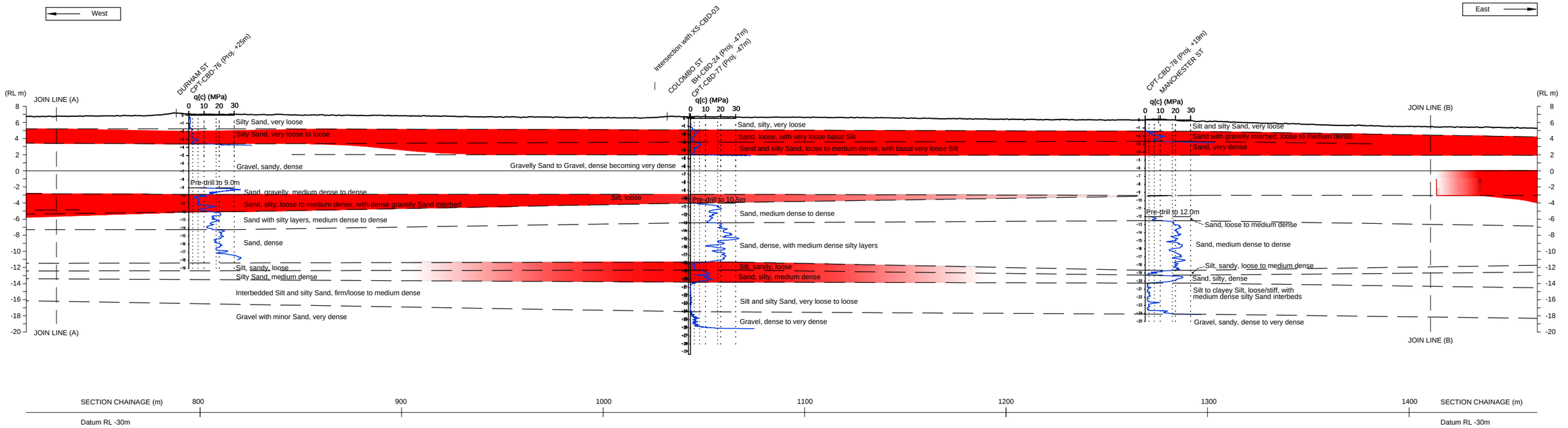
LHXS-CBD-13A (Essex Street)

FIG. No. E18

REV. 1

LHXS-CBD-13a.dwg XS-CBD-13a 9/12/2011 2:31:16 p.m.





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m Horizontal

LEGEND

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SCALES (AT A3 SIZE)
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Sheet 1 of 3

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-14 (St Asaph Street)

FIG. No. E19

REV. 1

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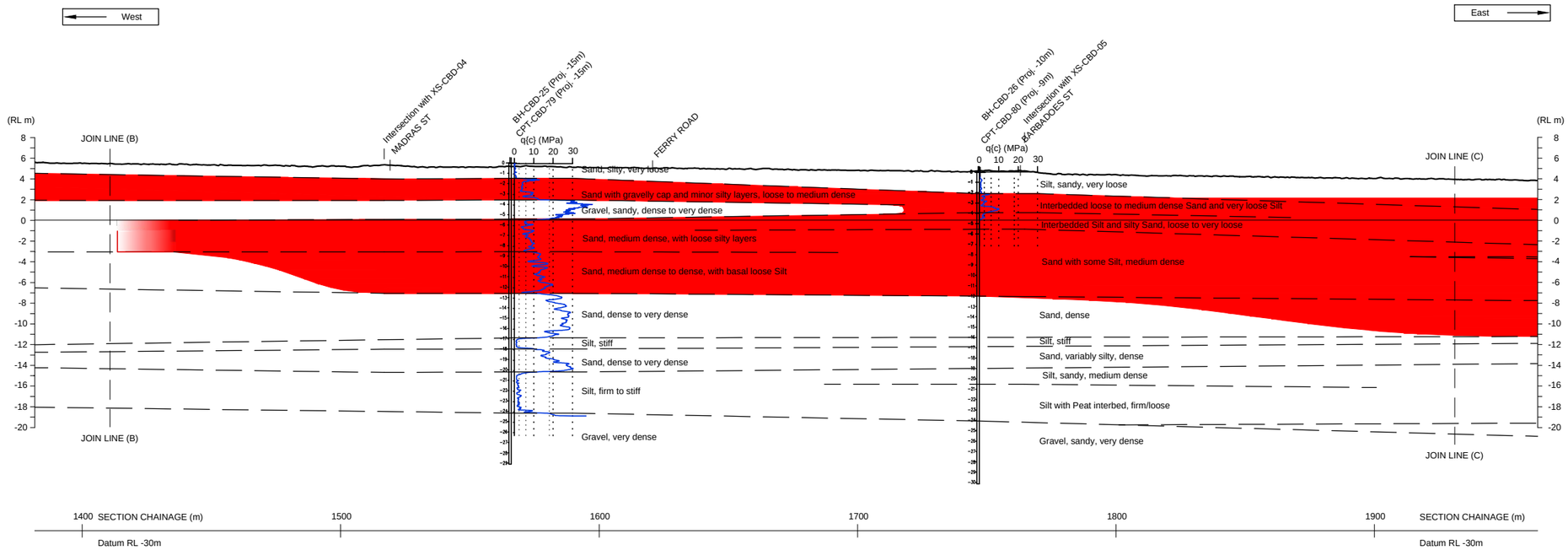

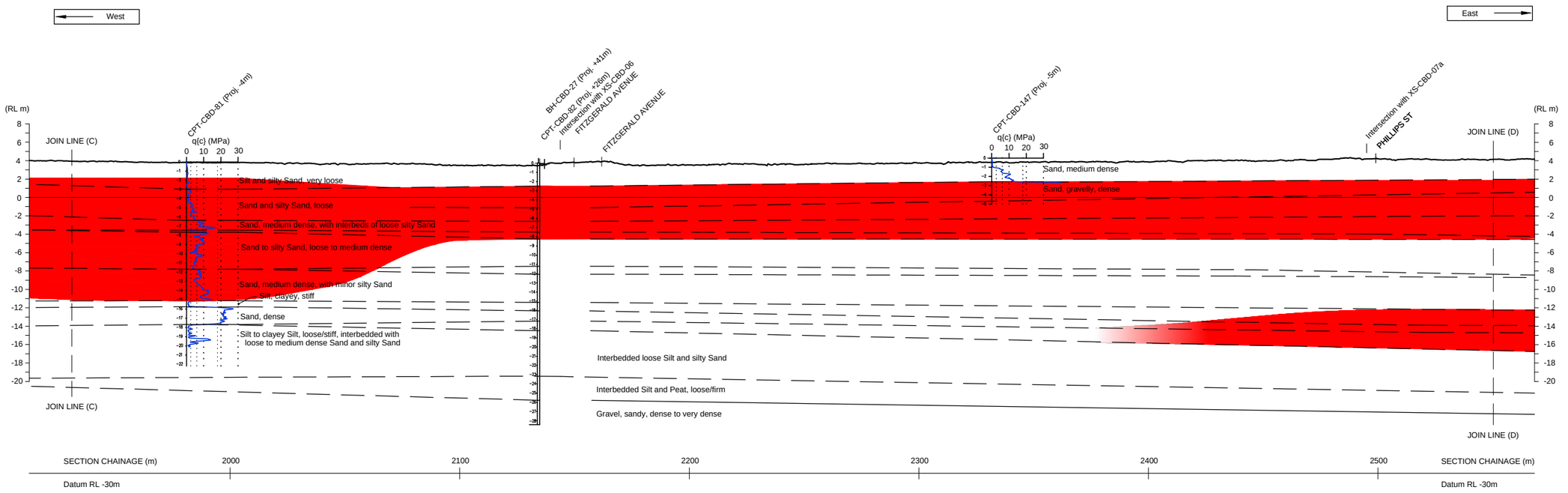

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m Horizontal

LEGEND

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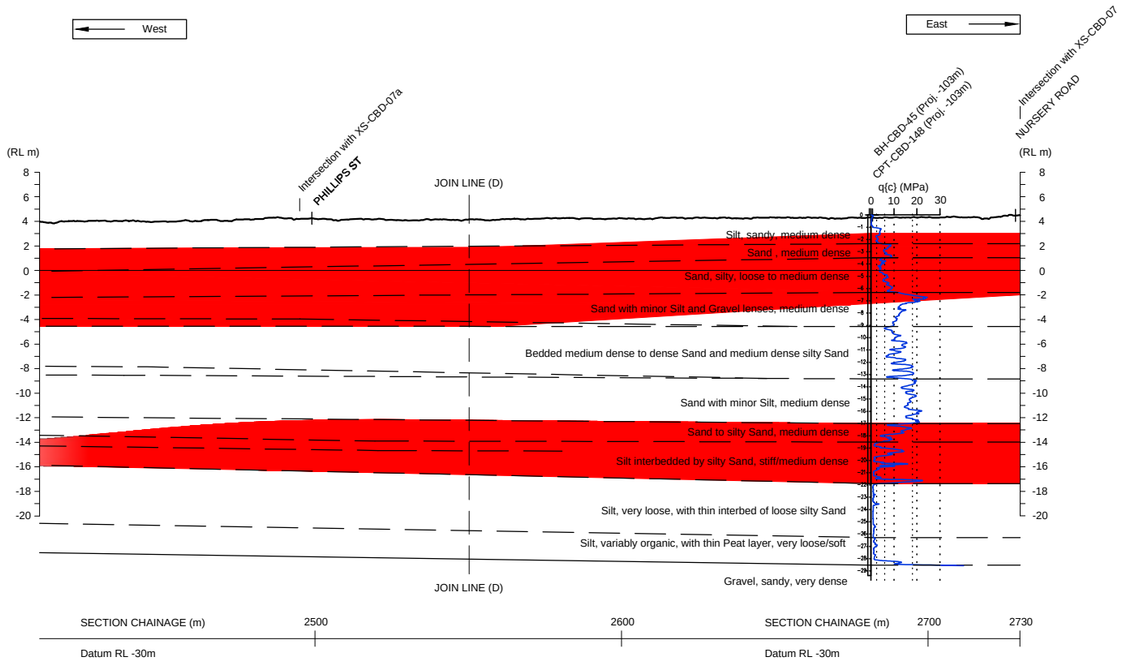
CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-14 (St Asaph Street)

FIG. No. E19

REV. 1



(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

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CHRISTCHURCH CITY COUNCIL

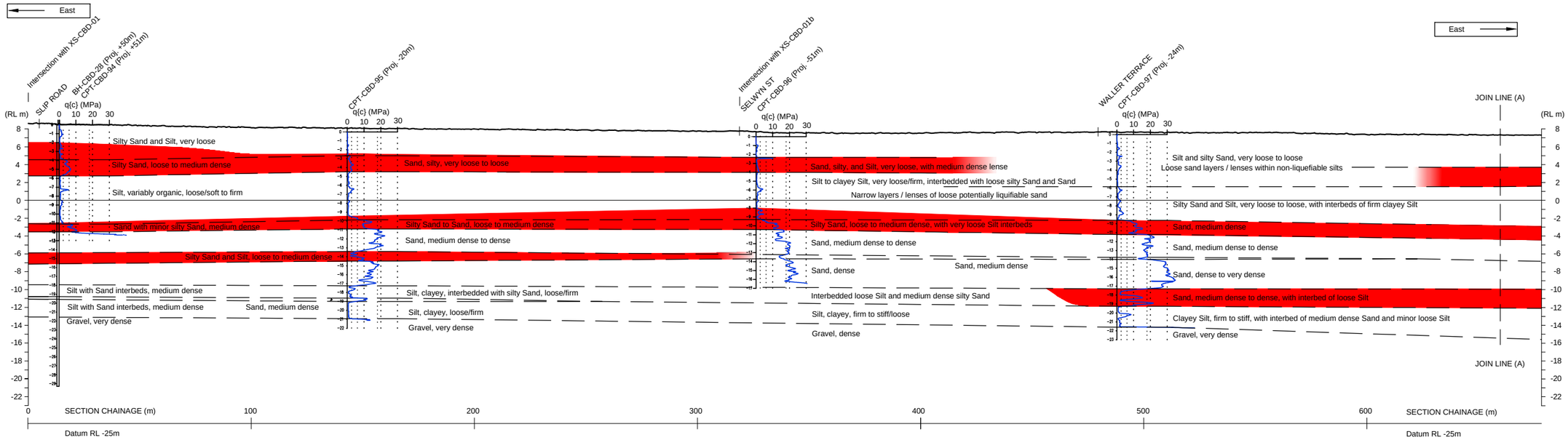
GEOLOGICAL INTERPRETATIVE REPORT

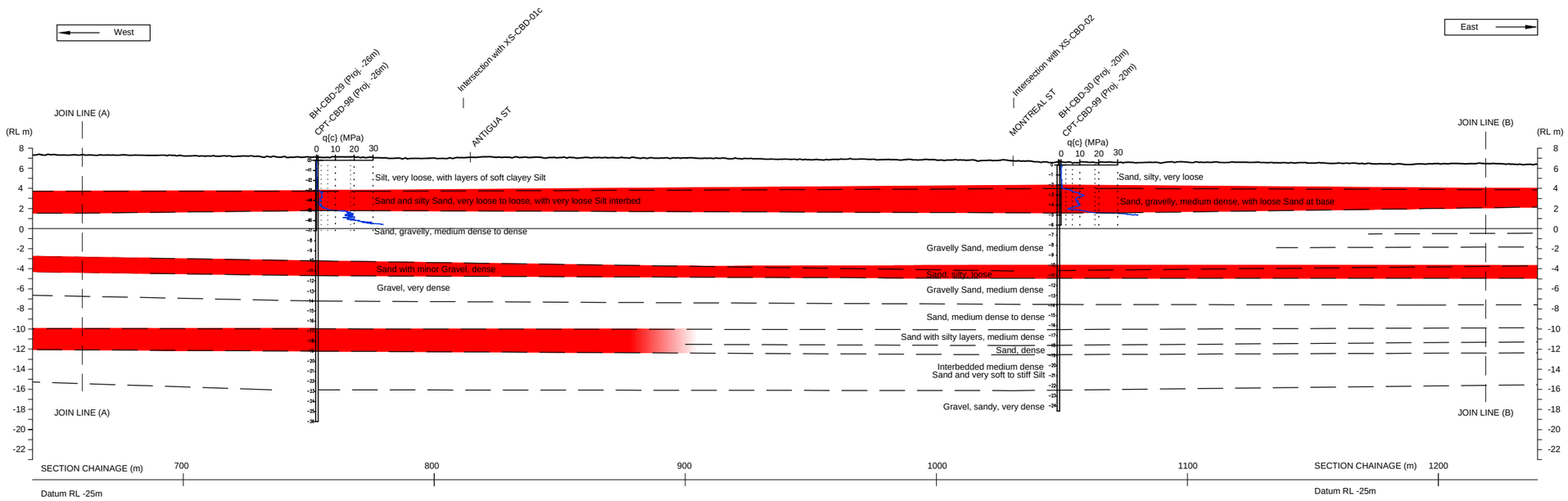
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-14 (St Asaph Street)

FIG. No. E19

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

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Sheet 1 of 3

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-15 (Moorhouse Avenue)

FIG. No. E20

REV. 1

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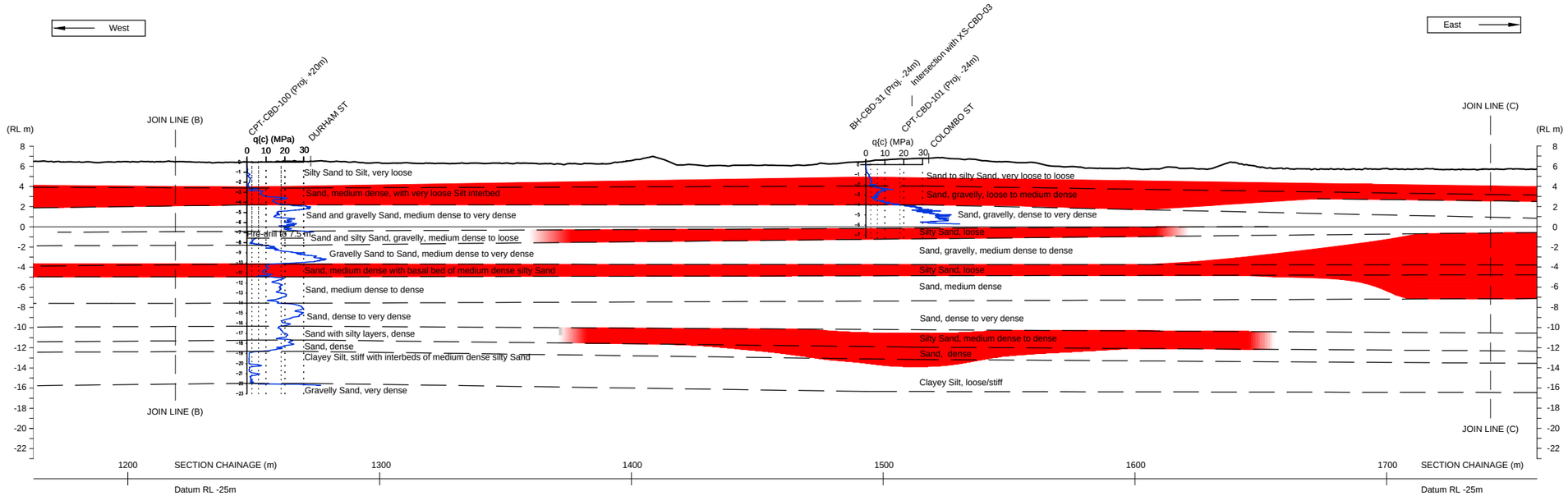

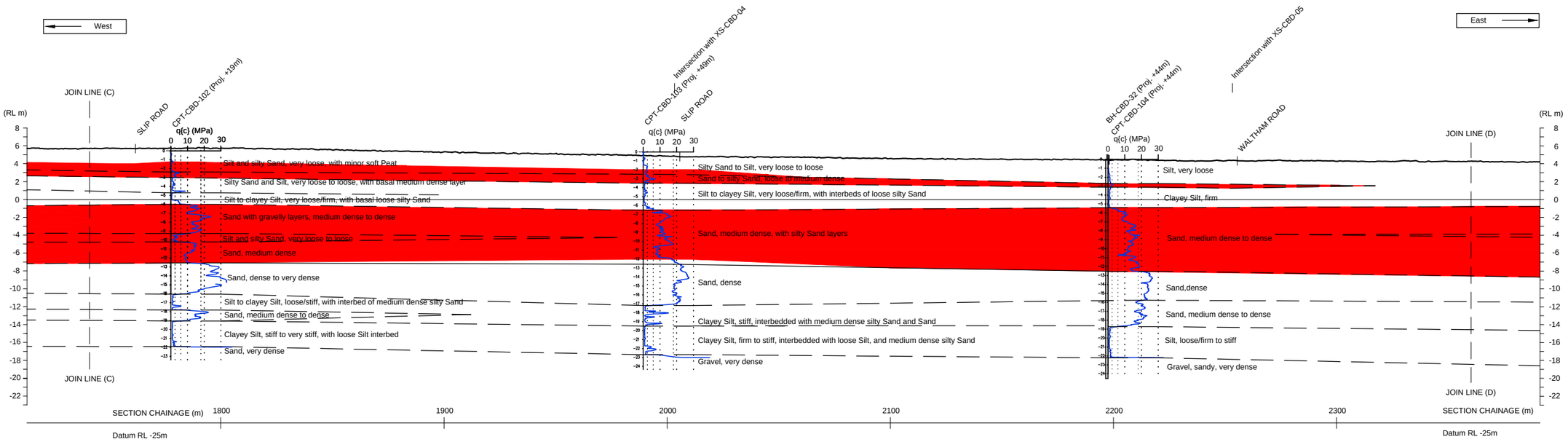

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

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SCALES (AT A3 SIZE)
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CHRISTCHURCH CITY COUNCIL

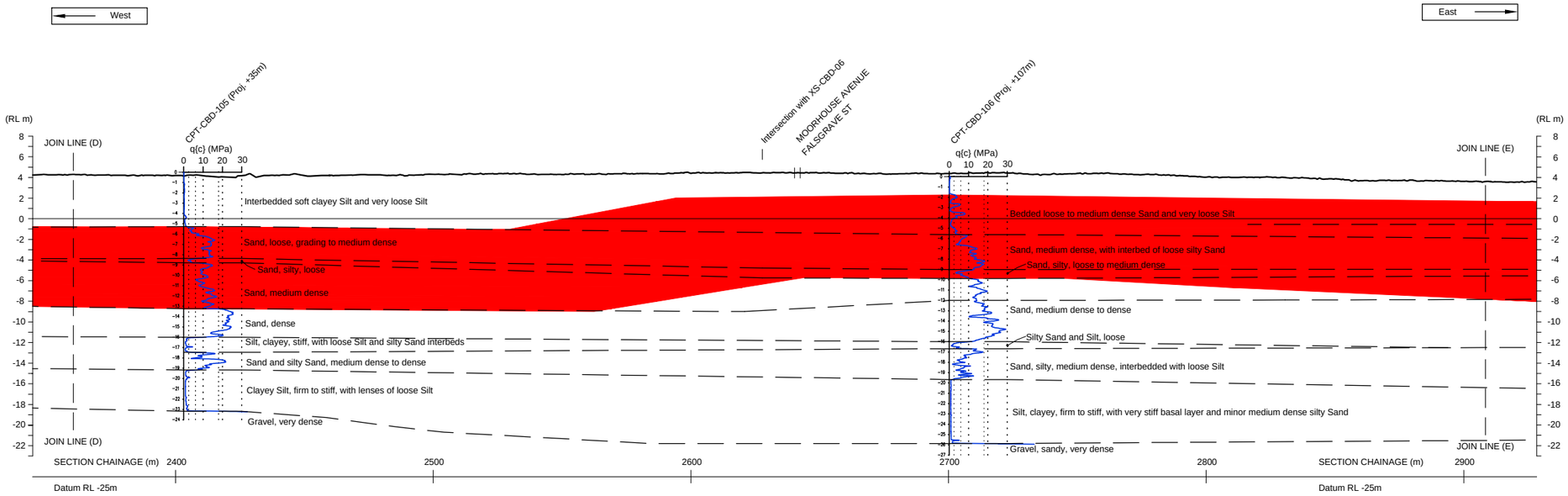
GEOLOGICAL INTERPRETATIVE REPORT

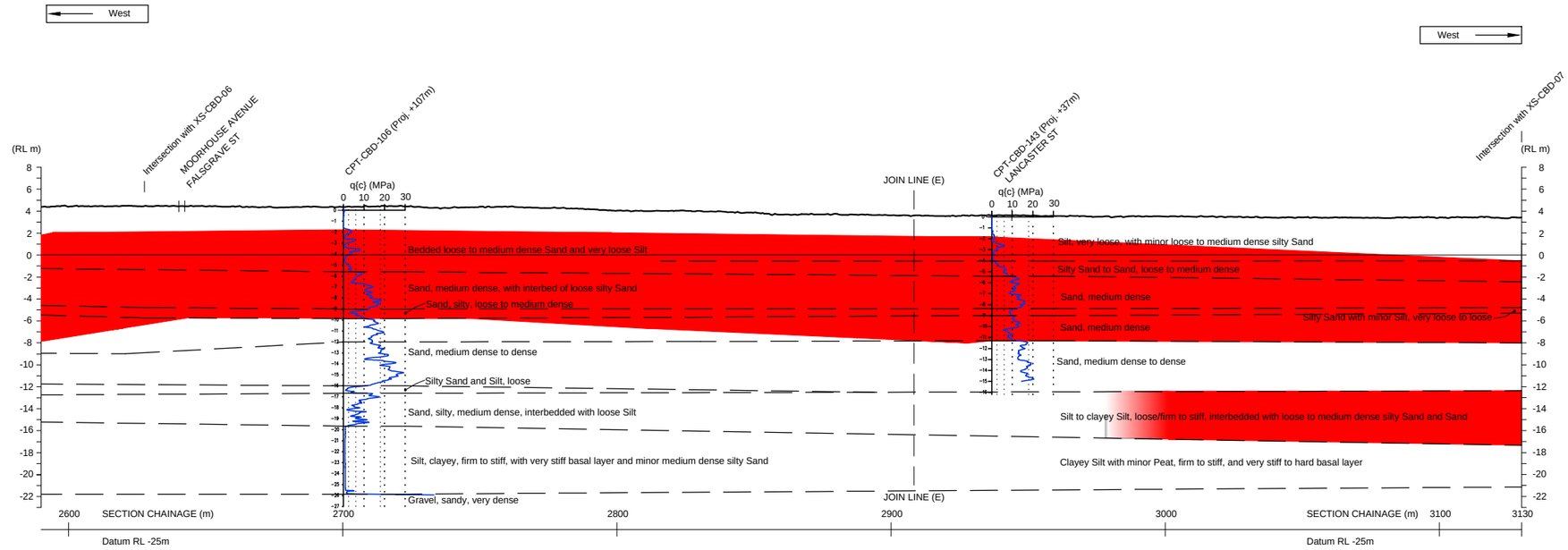
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-15 (Moorhouse Avenue)

FIG. No. E20

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

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CHRISTCHURCH CITY COUNCIL

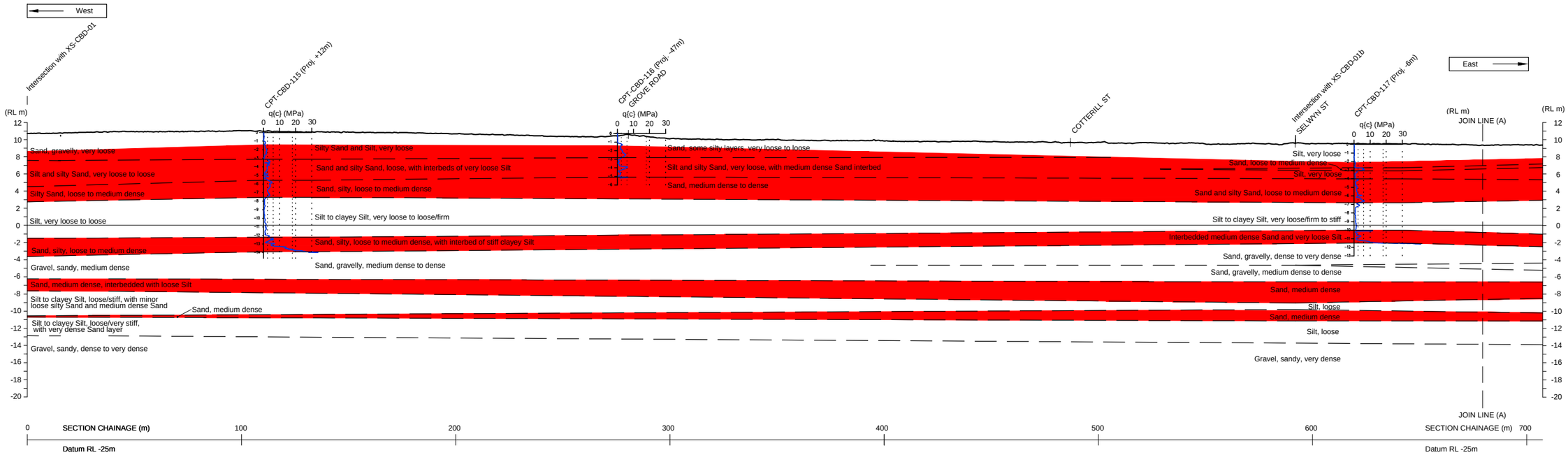
GEOLOGICAL INTERPRETATIVE REPORT

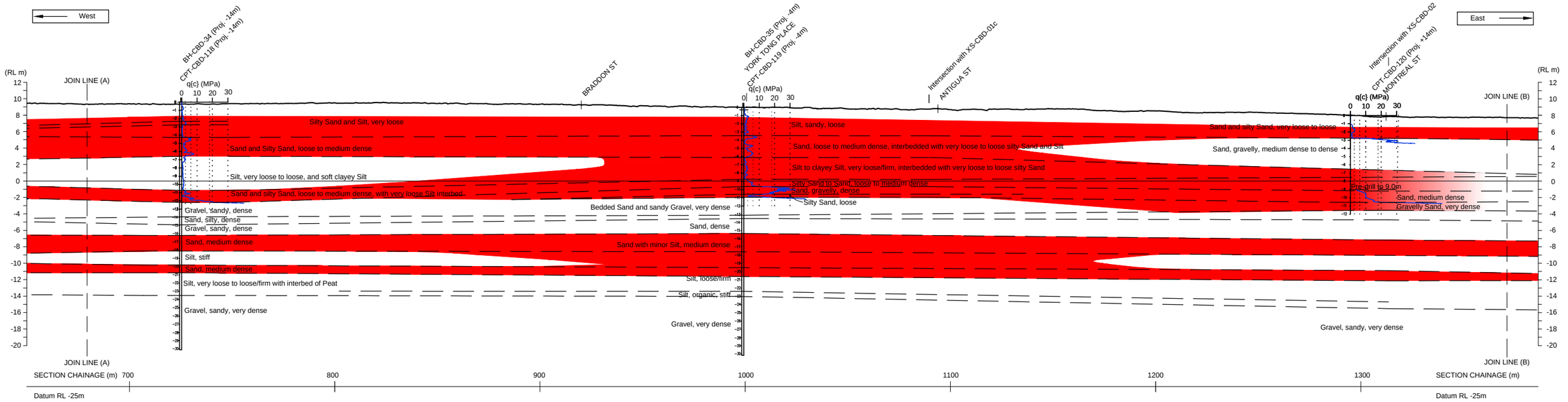
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-15 (Moorhouse Avenue)

FIG. No. E20

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

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SCALES (AT A3 SIZE)
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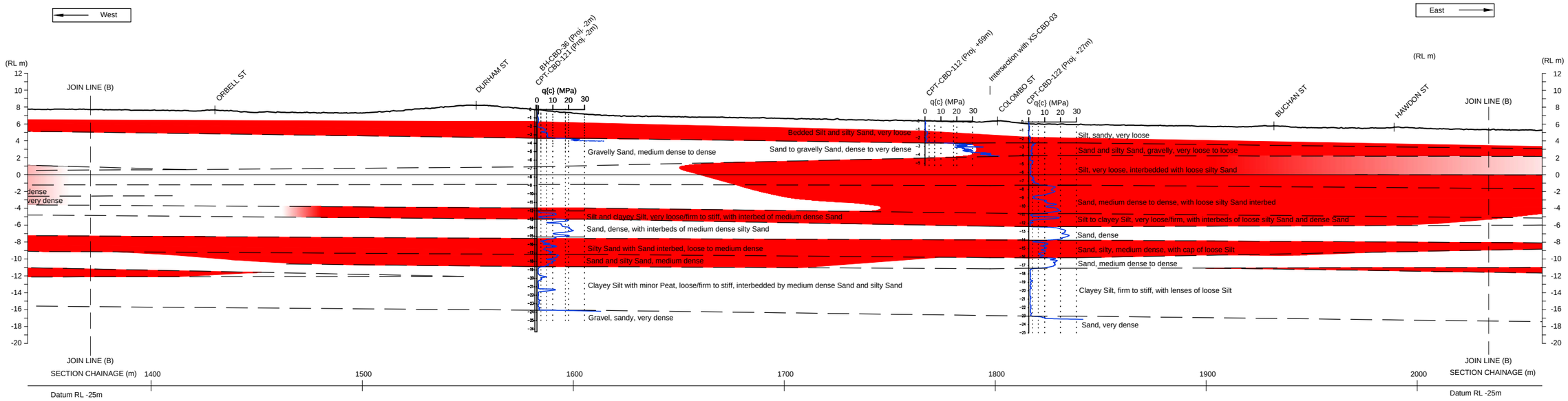
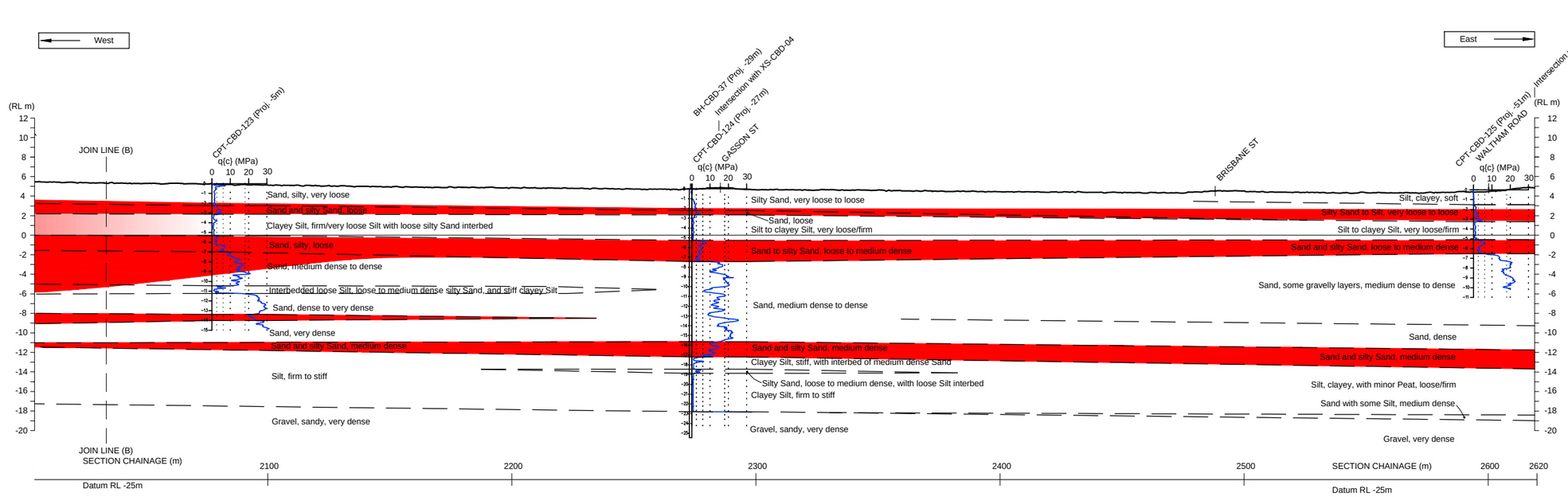
CHRISTCHURCH CITY COUNCIL
GEOLOGICAL INTERPRETATIVE REPORT
CHRISTCHURCH CENTRAL CITY
LHXS-CBD-16 (Harman Street - Disraeli Street)

FIG. No. E21

REV. 1

LHXS-CBD-16.dwg XS-CBD-16 9/12/2011 2:06:10 p.m.





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

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CHRISTCHURCH CITY COUNCIL

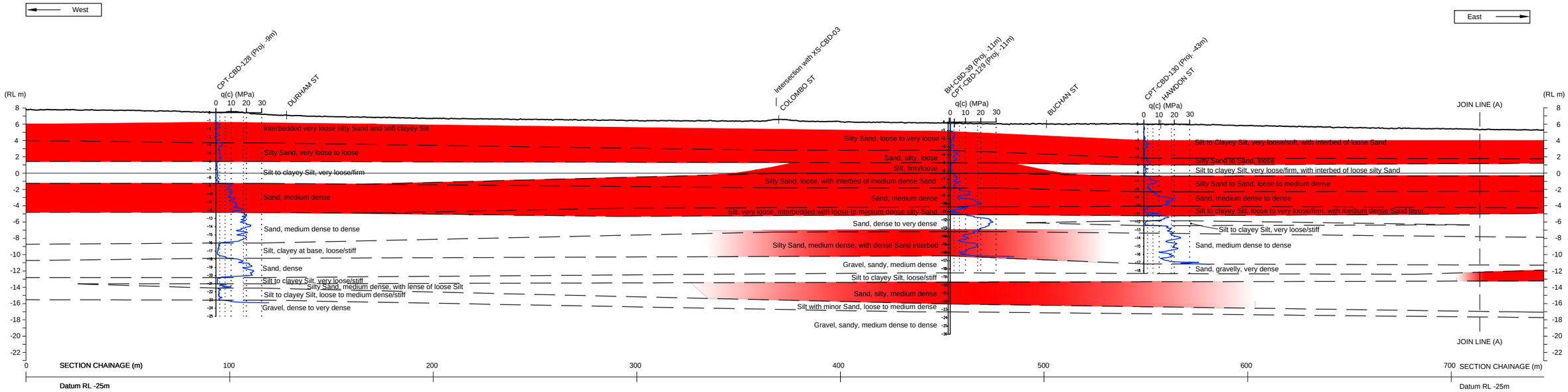
GEOLOGICAL INTERPRETATIVE REPORT

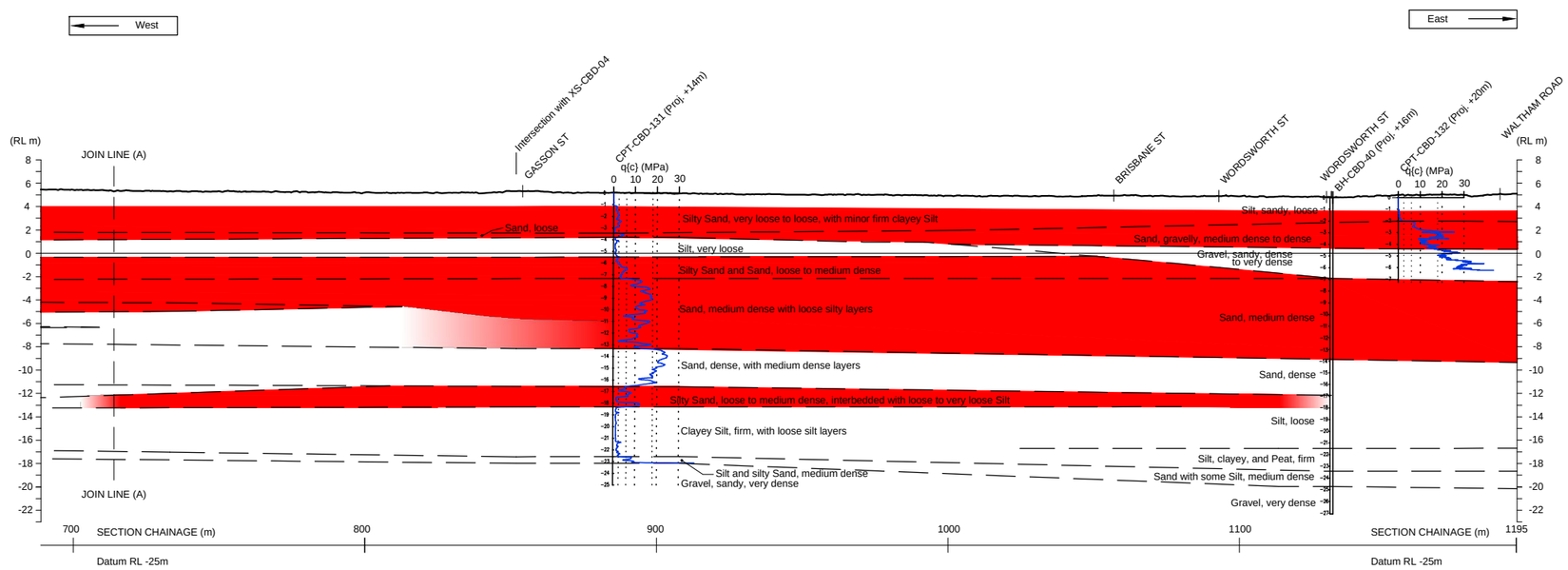
CHRISTCHURCH CENTRAL CITY

LHXS-CBD-16 (Harman Street - Disraeli Street)

FIG. No. E21

REV. 1





(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

Zones within which materials considered susceptible to liquefaction are likely to be present and should be subject to detailed further investigation and assessment.

Inferred material boundaries taken from Geological Cross Sections.

Notes:

1. This information is presented for preliminary purposes only. Site specific investigations and geotechnical assessments are required to define the liquefaction hazard present at individual sites.
2. This information should only be used by appropriately qualified and experienced geotechnical specialists who have a good understanding of the issues surrounding liquefaction.
3. This information should only be used in conjunction with the Geological Interpretative Report and should not be reproduced in isolation from the remainder of the report.
4. Zones identified as containing materials considered susceptible to liquefaction are simplified. Non-liquefiable materials may be present within the zones identified and materials susceptible to liquefaction may be present at greater depths, but typically of less significant extent / severity.
5. Site-specific investigations should be carried out in accordance with Geotechnical earthquake engineering practice. Module 1 - Guideline for the identification, assessment and mitigation of liquefaction hazards. New Zealand Geotechnical Society Inc. July 2010.

Christchurch City Council

Tonkin & Taylor
Environmental and Engineering Consultants
33 Parkhouse Road, Christchurch
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REVIEWED	T&T	12/11
DRAFTING CHECKED	T&T	12/11

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SCALES (AT A3 SIZE)
1:2000 Horizontal
1:500 Vertical

Sheet 1 of 1

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-17 (Wordsworth Street)

FIG. No. E22

REV. 1

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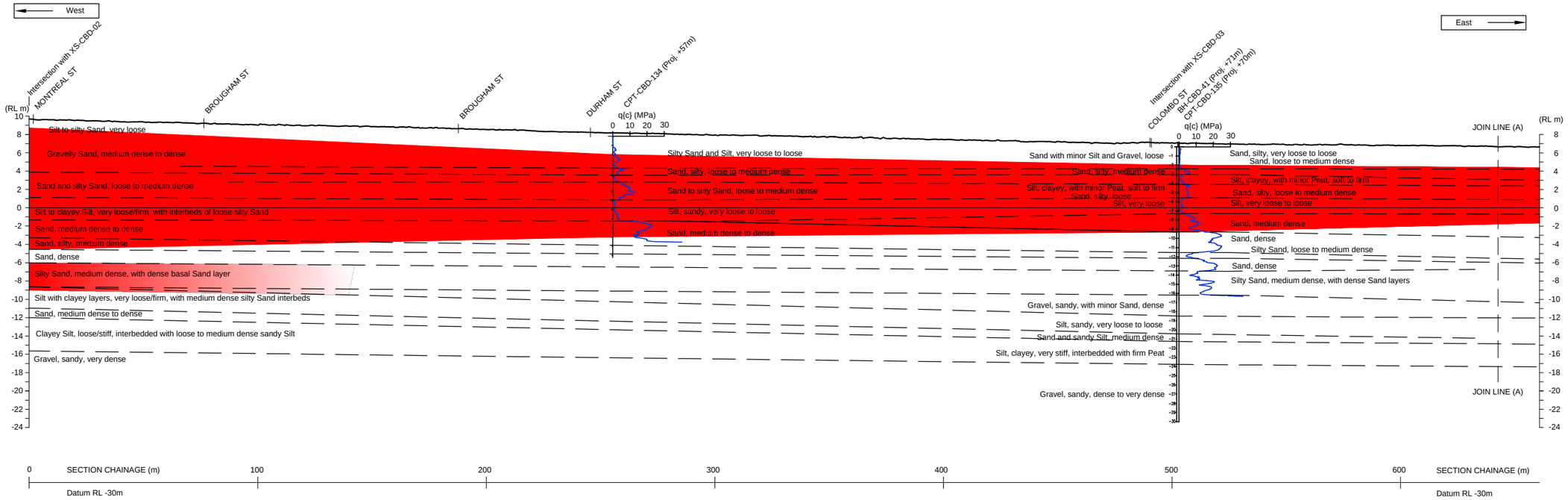

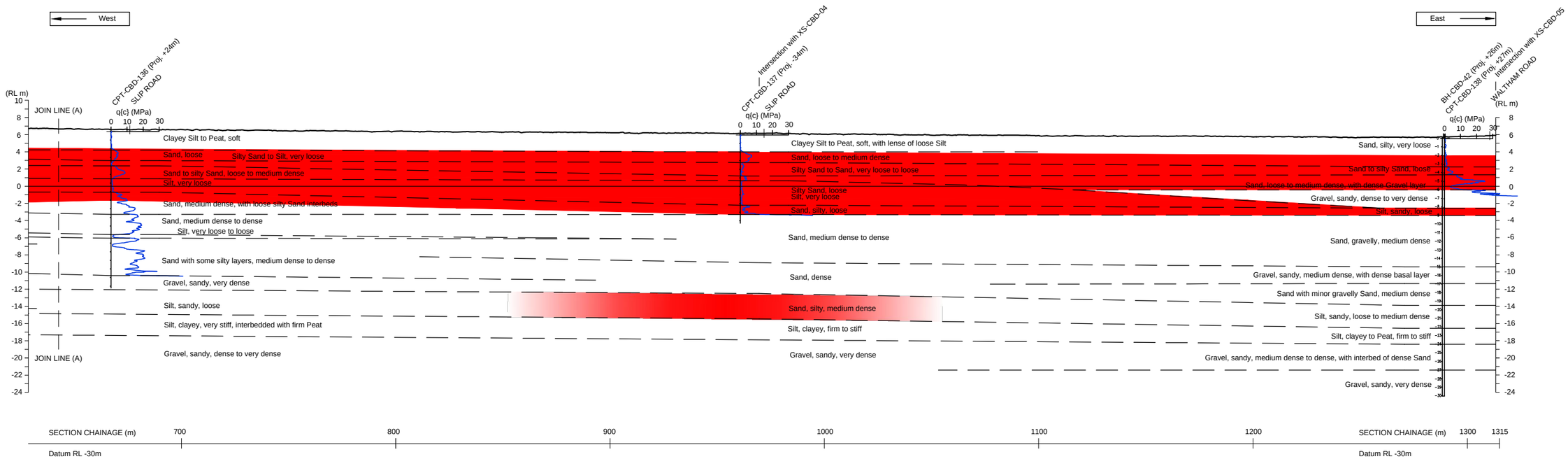

(A3 Scale) 1:2000 Horizontal 1:500 Vertical

0 20 40 60 80 100m

Horizontal

LEGEND

Zones within which materials considered susceptible to liquefaction are likely to be present and should be subject to detailed further investigation and assessment.

Inferred material boundaries taken from Geological Cross Sections.

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SCALES (AT A3 SIZE)
1:2000 Horizontal
1:500 Vertical

Sheet 1 of 1

CHRISTCHURCH CITY COUNCIL

GEOLOGICAL INTERPRETATIVE REPORT

CHRISTCHURCH CENTRAL CITY

LHXS-CBD-18 (Brougham Street)

FIG. No. E23

REV. 1

LHXS-CBD-18.dwg XS-CBD-18 9/12/2011 1:53:02 p.m.