

# Materials Advisory & Testing Service Ltd

Concrete, Soils, Aggregates, Asphaltic Concrete, Bitumen, Metals, Geological Investigations

Postal: PO Box 37-231, Stokes Valley, Lower Hutt 5141, NZ  
Delivery: 8 Oates Street, Stokes Valley, Lower Hutt

Telephone: (04) 566 0266  
Email: office.mats.ltd@gmail.com

## COMPACTION TEST REPORT

19 February 2022

Lab.Ref.No: **MA 22/ 071**

### GOODMAN CONTRACTORS LTD

4 Anne Street  
**WAIKANAE 5036**  
Attn: Mr Dave Morgan

<u>Copy sent to:</u>	GOODMANS
By Email to:	<a href="mailto:dave.m@goodmans.nz">dave.m@goodmans.nz</a>

### PROJECT:

**ANDERSON PARK ESTATES – Stage 2  
104 – 110 NGARARA ROAD, WAIKANAE**

### SUBJECT:

EARTHWORKS – Compaction Testing as required.

### MATERIAL:

Fine Sand, advised as all ex SITE as cut-to-fill.  
See "TARGET & OTHER INFORMATION" below.

### CONTRACTOR:

**Goodman Contractors Limited**

### ENGINEERS:

**Main: CGW (Ian Hussey)  
Geotech: CGW (Martin Williams)**

### TESTED BY:

Harald Harsveldt

### DATE OF TEST:

**17 February 2022**

### TESTS REQUIRED:

Fill material – In-situ Density & Moisture Content for determination of acceptability of compaction achieved.  
With supplementary DCP ("Scala") testing for confirmation of fill layer consistency throughout the depth of fill placed.

### COMPACTION REQUIREMENT:

As advised by email from Geotech. Engineers (ABUILD) dated 13 March 2020 and subsequent verbal instruction for STAGE 1. These criteria are applied herein for this STAGE 2 and will continue until advised otherwise by CGW.

### DUNE SAND FILL:

#### Compaction Acceptance Criteria:

- Minimum **95%** compaction relative to the MDD established (using NZ Std. Comp.), and
- Water Content standard requirements as within the range of **-4 to +2%** of Optimum, **WAIVED** by the Engineers (ABUILD).
- AIR VOIDS maximum **10%**, subsequently **WAIVED** by the Engineers (ABUILD).
- **DCP tests** required to confirm fill layer consistency or adequacy of compaction throughout the depth of fill placed. This function is being undertaken by the CONTRACTOR and for Stage 1 was undertaken by the Geotech. Engineers (ABUILD).

See "TARGET & OTHER INFORMATION" following

### TARGET & OTHER INFORMATION:

**MAX. DRY DENSITY (NZS Comp.)**

Optimum Moisture Content:  
for further info, see Test Report(s):

*Fine grey-brown sand with  
trace of gravels from WEST  
side of site*

**1.55 t/m<sup>3</sup>**

**18.0%**

MATS Ref: MA22/055A

*Fine grey-brown sand with  
trace of organics (rootlets)  
from EAST side of site*

**1.52 t/m<sup>3</sup>**

**20.0%**

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13/09/2023

**Lab.Ref.No: MA 22/ 071 cont'd.**

### INFORMATION PROVIDED and INTRODUCTION:

We were advised by our client that this series of tests was to provide data on COMPACTION to verify comparability for future client-provided NDM testing.

The area under test, on lots 21 and 22, were said-to-be constructed with approx. 1 to 2m of sand fill, but the Test Platforms were UNDERCUT approx. 300 – 500mm below current ground level.

### BRIEF / REQUEST:

This request was for independent VERIFICATION TESTING, as GOODMANS were to be conducting their own testing on backfill compaction.

As such, we attended site and tested at 4 pre-determined test locations – see TABLE 1 results.

GOODMANS then tested these same 4 marked locations, and we noted their results and they are recorded within TABLE 2.

Note that the REPORTED RESULTS (both sets in TABLES 1 and 2) are recalculated (from any NDM-calculated results) using a spreadsheet with input figures being:

- WET DENSITY
- MOISTURE CONTENT, and
- TARGET MDD.

The limitations in respect of the GOODMANS results for Moisture / Density recorded in TABLE 2 and the DCP results recorded in TABLE 3 are explained in "SPECIAL NOTES" below

**TEST RESULTS:** [See Result Table(s) following]

<b>TEST RESULT TABLE(S):</b>	For this <i>compaction test at:</i>	<b>ANDERSON PARK ESTATES – Stage 2</b>
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### FILL AREA(S):

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.**

**On LOTS 21 and 22 – Test Pads undercut 300 – 500mm below current Ground Level.**

**See Photo(s) and/or "marked up" Plan attached.**

**TABLE 1 (Density & Moisture Content Test Results) – MATS Ltd's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1	300	1673	1565	6.9	103.0	730135.32	363004.79
2	300	1713	1569	9.2	103.2	730143.74	362989.92
3	300	1702	1588	7.2	104.5	730150.72	362999.45
4	300	1765	1628	8.4	107.1	730157.99	362989.17
MIN	No Result <95%				103.0	ACCEPTABLE	
MEAN					104.5		

Lab.Ref.No: MA 22/ 071 cont'd.

**TABLE 2 (Density & Moisture Content Test Results) – GOODMAN's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1	300	1652	1535	7.6	101.0	730135.32	363004.79
2	300	1690	1550	9.0	102.0	730143.74	362989.92
3	300	1707	1586	7.6	104.4	730150.72	362999.45
4	300	1759	1618	8.7	106.5	730157.99	362989.17
MIN	No Result <95%				101.0	ACCEPTABLE	
MEAN					103.5		

**TABLE 3 [DCP ("Scala") Test Results] – recorded from Testing by GOODMAN'S:**  
[adjacent to NDM Tests as in TABLE(S) above]

Depth below Test Pad (mm)	TEST #1 (blows per 100 mm)	TEST #2 (blows per 100 mm)	TEST #3 (blows per 100 mm)	TEST #4 (blows per 100 mm)
100	Not recorded	Not recorded	Not recorded	Not recorded
200	9	12	11	12
300	7	10	10	11
400	12	10	11	13
500	14	12	12	13
600	13	12	11	14
RESULT:	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

#### NOTES: DENSITY TESTS

- Density and Moisture Content results obtained in accordance with NZS 4407: 2015 tests 4.2 & 4.3, using a Troxler 3440 Nuclear Density Gauge
- Troxler 3440 (Serial Numbers **18355** or **38278**) precision at selected Count Time of 1 min. (as used):  
Composition Error: Backscatter Mode +/- 40kg/cu.m.  
Direct Transmission Mode +/- 20kg/cu.m.
- For this "Site Visit", 300, 250 and 200 etc. refer to the scalar positions of the nuclear source rod (ie the layer depth beneath the Gauge), in mm, being in 'Direct Transmission' mode. Similarly 'BS' refers to scalar position in 'Backscatter' mode.
- A 'Moisture Offset' was not required for this material to ensure accuracy of results.

#### DYNAMIC CONE ("Scala") PENETRATION TESTING

- Test Method used: NZS 4402: 1986 test 6.5.2 (Procedure 2).
- "P" noted in the Scala Blowcount column in the RESULT TABLE(S) is "PUSH" - a blowcount per 50mm of 0.5 or less.
- "Ref." noted in the Scala Blowcount column in the RESULT TABLE(S) is "REFUSAL" - a blowcount per 50mm of 20 or greater.
- GOODMANS have elected to provide results in 100mm penetration increments whereas we would normally record in 50mm increments.

#### SPECIAL NOTES:

- While we did not operate the GOODMAN'S Troxler 3440 (S/N: 38479), we checked that:
  - It is in current calibration (until 28/7/2022), and
  - No "Moisture Offset" was employed, but
  - We did not verify the status of the "Standard Counts", but witnessed that Goodman's operator had followed the prescribed procedures in respect of the operation on site.

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**Lab.Ref.No: MA 22/ 071 cont'd.**

2. We did not operate the GOODMANS DCP ("Scala") unit, and simply recorded the results achieved. Thus:
  - a. We presume that it is in current calibration, and
  - b. Verified that the method of operation was in accordance with the prescribed Test Method.

**REMARKS:**

1. Compaction Equipment Employed: Tyre-rolled with loaded Moxies.
2. DCP ("Scala") Tests, where performed are taken on the same nominal 1m<sup>2</sup> test area within which the NDM tests are performed.
3. Request and readiness for this test was advised by our Client (Mr Dave Morgan - Goodmans).
4. Mr Martin Williams (CGW) was present on site at the commencement of testing.
5. Test Location coordinates provided by GOODMANS. See Site Plan and/or Site Photo(s) for further information.
6. ***For the ALL ABOVE TESTS, we have applied the "TARGET" MDD-OMC value related to the client-advised SOURCE of the fill as established from samples provided by our client (GOODMANS).***

**EXCLUSIONS:**

Please note that the tests herein – if the surface layer of 300 – 500mm removed is considered as included – have only verified the compaction therefore to a depth of approx. 1m below current Ground Level, and therefore NOT to the total depth of fill place if it exceeds this depth.

**CONCLUSION:**

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.  
 On LOTS 21 and 22 – Test Pads undercut 300 – 500mm below current Ground Level.  
 See Photo(s) and/or "marked up" Plan attached.**

With the provisos in "REMARKS" and "EXCLUSIONS" above accepted:

The **COMPACTION** achieved on the max. 600mm layer BELOW the surface of the undercut Test Pads, as tested during this Site Visit, **IS ACCEPTABLE** in terms of the specification requirement adopted in that:

- ALL results **MEET** the relative Compaction requirement,
- ALL DCP results confirm that the fill is reasonably **CONSISTENT** throughout the layer when compared to the DENSITY results in the 300mm surface layer, and noting that
- **MOISTURE CONTENT** and **AIR VOIDS** criteria are **NOT APPLICABLE**.

**MOISTURE / DENSITY COMPARISONS:**

On average, the result comparison shows that, applying the appropriate COMPOSITION ERROR of +/- 20kg/cu.m. to BOTH sets of results, the comparative DRY DENSITIES are within the range (or variation) that can be expected.

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Lab.Ref.No: MA 22/ 071 cont'd.

Further, as the MOISTURE CONTENTS affect the DRY DENSITIES, and the Dry Densities are within the expected range, the Moisture Contents can be regarded similarly as being within the expected range.

THEREFORE, we conclude that the TWO SETS OF RESULTS are COMPARABLE.

**THIS REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL**

Report Prepared: Duigald Myers  
Report Checked:

APPROVED:

Duigald Myers  
**DIRECTOR**

Attached: Site Photo(s) and / or Site Plan(s) marked up showing test locations / areas and exclusions (if any).

**SITE PHOTO(S):**



Above: Indicative Test Locations and Preparation

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**SITE PHOTO(S) – cont'd:**



**Above: Showing DCP testing on prepared undercut Test-Pad**



**Above: Close-up of undercut Test-Pad**

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**SITE PLAN**  
 (Not to known scale):



Basic Test Area identified above

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## COMPACTION TEST REPORT

26 February 2022

Lab.Ref.No: **MA 22/ 084**

### GOODMAN CONTRACTORS LTD

4 Anne Street  
**WAIKANAE 5036**  
 Attn: Mr Dave Morgan

Copy sent to:	GOODMANS
By Email to:	<a href="mailto:dave.m@goodmans.nz">dave.m@goodmans.nz</a>

### PROJECT:

**ANDERSON PARK ESTATES – Stage 2  
 104 – 110 NGARARA ROAD, WAIKANAE**

### SUBJECT:

EARTHWORKS – Compaction Testing as required.

### MATERIAL:

Fine Sand, advised as all ex SITE as cut-to-fill.  
 See "TARGET & OTHER INFORMATION" below.

### CONTRACTOR:

**Goodman Contractors Limited**

### ENGINEERS:

**Main: CGW (Ian Hussey)  
 Geotech: CGW (Martin Williams)**

### TESTED BY:

Harald Harsveldt

### DATE OF TEST:

**22 February 2022**

### TESTS REQUIRED:

Fill material – In-situ Density & Moisture Content for determination of acceptability of compaction achieved.  
 With supplementary DCP ("Scala") testing for confirmation of fill layer consistency throughout the depth of fill placed.

<b>COMPACTION REQUIREMENT:</b> As advised by email from Geotech. Engineers (ABUILD) dated 13 March 2020 and subsequent verbal instruction for STAGE 1. These criteria are applied herein for this STAGE 2 and will continue until advised otherwise by CGW.	<b>DUNE SAND FILL:</b> <b>Compaction Acceptance Criteria:</b> <ul style="list-style-type: none"> <li>• Minimum <b>95%</b> compaction relative to the MDD established (using NZ Std. Comp.), and</li> <li>• Water Content standard requirements as within the range of <b>-4 to +2%</b> of Optimum, <b>WAIVED</b> by the Engineers (ABUILD).</li> <li>• <b>AIR VOIDS</b> maximum <b>10%</b>, subsequently <b>WAIVED</b> by the Engineers (ABUILD).</li> <li>• <b>DCP tests</b> required to confirm fill layer consistency or adequacy of compaction throughout the depth of fill placed. This function is being undertaken by the CONTRACTOR and for Stage 1 was undertaken by the Geotech. Engineers (ABUILD).</li> </ul>
See "TARGET & OTHER INFORMATION" following	

<b>TARGET &amp; OTHER INFORMATION:</b>  <b>MAX. DRY DENSITY (NZS Comp.)</b> <i>Optimum Moisture Content:</i> for further info, see Test Report(s):	<i>Fine grey-brown sand with trace of gravels from WEST side of site</i>  <b>1.55 t/m<sup>3</sup></b> <b>18.0%</b> MATS Ref: MA22/055A	<i>Fine grey-brown sand with trace of organics (rootlets) from EAST side of site</i>  <b>1.52 t/m<sup>3</sup></b> <b>20.0%</b> MATS Ref: MA22/055B
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**Lab.Ref.No: MA 22/ 084 cont'd.**

**INFORMATION PROVIDED and INTRODUCTION:**

We were advised by our client that this series of tests was to provide data on COMPACTION to verify comparability for future client-provided NDM testing.

The area under test, on lots 21 and 22, were said-to-be constructed with approx. 1 to 2m of sand fill, but the Test Platforms were UNDERCUT approx. 300 – 500mm below current ground level.

**BRIEF / REQUEST:**

This request was for independent VERIFICATION TESTING, as GOODMANS were to be conducting their own testing on backfill compaction.

As such, we attended site and tested at 4 pre-determined test locations – see TABLE 1 results.

GOODMANS then tested these same 4 marked locations, and we noted their results and they are recorded within TABLE 2.

Note that the REPORTED RESULTS (both sets in TABLES 1 and 2) are recalculated (from any NDM-calculated results) using a spreadsheet with input figures being:

- WET DENSITY
- MOISTURE CONTENT, and
- TARGET MDD.

The limitations in respect of the GOODMANS results for Moisture / Density recorded in TABLE 2 and the DCP results recorded in TABLE 3 are explained in "SPECIAL NOTES" below

**TEST RESULTS:** [See Result Table(s) following]

TEST RESULT TABLE(S):	For this <i>compaction test at:</i>	<b>ANDERSON PARK ESTATES – Stage 2</b>
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**FILL AREA(S):**

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.**  
**On LOTS 21 and 22 – Test Pads undercut 300 – 500mm below current Ground Level.**  
 See Photo(s) and/or "marked up" Plan attached.

**TABLE 1 (Density & Moisture Content Test Results) – MATS Ltd's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1	300	1689	1545	9.3	101.7	730140.82	363003.68
2	300	1718	1624	5.8	106.8	730130.06	363001.97
3	300	1681	1546	8.7	101.7	730144.52	362989.95
4	300	1700	1578	7.7	103.8	730150.56	362987.95
MIN	<b>No Result &lt;95%</b>				101.7	<b>ACCEPTABLE</b>	
MEAN					103.5		

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Lab.Ref.No: MA 22/ 084 cont'd.

**TABLE 2 (Density & Moisture Content Test Results) – GOODMAN's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1	300	1699	1557	9.1	102.5	730140.82	363003.68
2	300	1723	1619	6.4	106.5	730130.06	363001.97
3	300	1710	1575	8.6	103.6	730144.52	362989.95
4	300	1703	1574	8.2	103.5	730150.56	362987.95
MIN	No Result <95%				102.5	ACCEPTABLE	
MEAN					104.0		

**TABLE 3 [DCP ("Scala") Test Results] – recorded from Testing by GOODMAN'S:  
[adjacent to NDM Tests as in TABLE(S) above]**

Depth below Test Pad (mm)	TEST #1 (blows per 100 mm)	TEST #2 (blows per 100 mm)	TEST #3 (blows per 100 mm)	TEST #4 (blows per 100 mm)
100	3	4	3	4
200	6	10	4	6
300	8	9	7	10
400	10	14	8	12
500	14	13	11	15
600	18	15	15	18
RESULT:	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

**NOTES: DENSITY TESTS**

- Density and Moisture Content results obtained in accordance with NZS 4407: 2015 tests 4.2 & 4.3, using a Troxler 3440 Nuclear Density Gauge
- Troxler 3440 (*Serial Numbers 18355 or 38278*) precision at selected Count Time of 1 min. (as used):  
Composition Error: Backscatter Mode +/- 40kg/cu.m.  
Direct Transmission Mode +/- 20kg/cu.m.
- For this "Site Visit", 300, 250 and 200 etc. refer to the scalar positions of the nuclear source rod (ie the layer depth beneath the Gauge), in mm, being in 'Direct Transmission' mode. Similarly 'BS' refers to scalar position in 'Backscatter' mode.
- A 'Moisture Offset' was not required for this material to ensure accuracy of results.

**DYNAMIC CONE ("Scala") PENETRATION TESTING**

- Test Method used: NZS 4402: 1986 test 6.5.2 (Procedure 2).
- "P" noted in the Scala Blowcount column in the RESULT TABLE(S) is "PUSH" - a blowcount per 50mm of 0.5 or less.
- "Ref." noted in the Scala Blowcount column in the RESULT TABLE(S) is "REFUSAL" - a blowcount per 50mm of 20 or greater.
- GOODMANS have elected to provide results in 100mm penetration increments whereas we would normally record in 50mm increments.

**SPECIAL NOTES:**

- While we did not operate the GOODMAN'S Troxler 3440 (S/N: 38479), we checked that:
  - It is in current calibration (until 28/7/2022), and
  - No "Moisture Offset" was employed, but
  - We did not verify the status of the "Standard Counts", but witnessed that Goodman's operator had followed the prescribed procedures in respect of the operation on site.

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**Lab.Ref.No: MA 22/ 084 cont'd.**

2. We did not operate the GOODMANS DCP ("Scala") unit, and simply recorded the results achieved. Thus:
  - a. We presume that it is in current calibration, and
  - b. Verified that the method of operation was in accordance with the prescribed Test Method.

**REMARKS:**

1. Compaction Equipment Employed: Tyre-rolled with loaded Moxies.
2. DCP ("Scala") Tests, where performed are taken on the same nominal 1m<sup>2</sup> test area within which the NDM tests are performed.
3. Request and readiness for this test was advised by our Client (Mr Kevin Peel - Goodmans).
4. Mr Martin Williams (CGW) was **not** present on site at the commencement of testing.
5. Test Location coordinates provided by GOODMANS. See Site Plan and/or Site Photo(s) for further information.
6. ***For the ALL ABOVE TESTS, we have applied the "TARGET" MDD-OMC value related to the client-advised SOURCE of the fill as established from samples provided by our client (GOODMANS).***

**EXCLUSIONS:**

Please note that the tests herein – if the surface layer of 300 – 500mm removed is considered as included – have only verified the compaction therefore to a depth of approx. 1m below current Ground Level, and therefore NOT to the total depth of fill place if it exceeds this depth.

**CONCLUSION:**

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.  
 On LOTS 21 and 22 – Test Pads undercut 300 – 500mm below current Ground Level.  
 See Photo(s) and/or "marked up" Plan attached.**

With the provisos in "REMARKS" and "EXCLUSIONS" above accepted:

The **COMPACTION** achieved on the max. 600mm layer BELOW the surface of the undercut Test Pads, as tested during this Site Visit, **IS ACCEPTABLE** in terms of the specification requirement adopted in that:

- ALL results **MEET** the relative Compaction requirement,
- ALL DCP results confirm that the fill is reasonably **CONSISTENT** throughout the layer when compared to the DENSITY results in the 300mm surface, and noting that
- The 1<sup>st</sup> 100 – 150mm layer can be expected to be "low" given the lack of confinement of this non-cohesive material, and
- MOISTURE CONTENT and AIR VOIDS criteria are **NOT APPLICABLE**.

**MOISTURE / DENSITY COMPARISONS:**

On average, the result comparison shows that, applying the appropriate COMPOSITION ERROR of +/- 20kg/cu.m. to BOTH sets of results, the comparative DRY DENSITIES are within the range (or variation) that can be expected.

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**Lab.Ref.No: MA 22/ 084 cont'd.**

Further, as the MOISTURE CONTENTS affect the DRY DENSITIES, and the Dry Densities are within the expected range, the Moisture Contents can be regarded similarly as being within the expected range.

**THEREFORE, we conclude that the TWO SETS OF RESULTS are COMPARABLE.**

**THIS REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL**

Report Prepared: Harald Harsveldt  
 Report Checked:

**APPROVED:**

**Duigald Myers**  
**DIRECTOR**

*Attached: Site Photo(s) and / or Site Plan(s) marked up showing test locations / areas and exclusions (if any).*

**SITE PHOTO(S):**



**Above: Test Area and Preparation**

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**SITE PHOTO(S) – cont'd:**



**Above: Showing ISD testing on prepared undercut Test-Pad**



**Above: Close-up of undercut Test-Pad**

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## COMPACTION TEST REPORT

29 March 2022  
 Lab.Ref.No: **MA 22/ 178**

**GOODMAN CONTRACTORS LTD**  
 4 Anne Street  
**WAIKANAE 5036**  
 Attn: Mr Dave Morgan

<u>Copy sent to:</u>	GOODMANS
By Email to:	<a href="mailto:dave.m@goodmans.nz">dave.m@goodmans.nz</a>

**PROJECT:** **ANDERSON PARK ESTATES – Stage 2**  
**104 – 110 NGARARA ROAD, WAIKANAE**

**SUBJECT:** EARTHWORKS – Compaction Testing as required.  
**MATERIAL:** Fine Sand, advised as all ex SITE as cut-to-fill.  
 See "TARGET & OTHER INFORMATION" below.

**CONTRACTOR:** Goodman Contractors Limited  
**ENGINEERS:** Main: CGW (Ian Hussey)  
 Geotech: CGW (Martin Williams)

**TESTED BY:** Harald Harsveldt  
**DATE OF TEST:** 28 March 2022  
**TESTS REQUIRED:** Fill material – In-situ Density & Moisture Content for determination of acceptability of compaction achieved.  
 With supplementary DCP ("Scala") testing for confirmation of fill layer consistency throughout the depth of fill placed.

<p><b>COMPACTION REQUIREMENT:</b>                  As advised by email from Geotech. Engineers (ABUILD) dated 13 March 2020 and subsequent verbal instruction for STAGE 1. These criteria are applied herein for this STAGE 2 and will continue until advised otherwise by CGW.</p>	<p><b><u>DUNE SAND FILL:</u></b>  <b>Compaction Acceptance Criteria:</b></p> <ul style="list-style-type: none"> <li>Minimum <b>95%</b> compaction relative to the MDD established (using NZ Std. Comp.), and</li> <li>Water Content standard requirements as within the range of <b>-4 to +2%</b> of Optimum, <b>WAIVED</b> by the Engineers (ABUILD).</li> <li>AIR VOIDS maximum <b>10%</b>, subsequently <b>WAIVED</b> by the Engineers (ABUILD).</li> <li><b>DCP tests</b> required to confirm fill layer consistency or adequacy of compaction throughout the depth of fill placed. This function is being undertaken by the CONTRACTOR and for Stage 1 was undertaken by the Geotech. Engineers (ABUILD).</li> </ul>
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See "TARGET & OTHER INFORMATION" following

<p><b>TARGET &amp; OTHER INFORMATION:</b></p> <p><b>MAX. DRY DENSITY (NZS Comp.)</b>                  Optimum Moisture Content:                  for further info, see Test Report(s):</p>	<p><i>Fine grey-brown sand with trace of gravels from WEST side of site</i></p> <p><b>1.55 t/m<sup>3</sup></b>  <b>18.0%</b>                  MATS Ref: MA22/055A</p>	<p><i>Fine grey-brown sand with trace of organics (rootlets) from EAST side of site</i></p> <p><b>1.52 t/m<sup>3</sup></b>  <b>20.0%</b>                  MATS Ref: MA22/055B</p>
--	---	---

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Lab.Ref.No: **MA 22/ 178 cont'd.**

### INFORMATION PROVIDED and INTRODUCTION:

We were advised by our client that this series of tests was to provide data on COMPACTION to verify comparability for future client-provided NDM testing.

The area under test, on lots 12, 11, 28 and 29, were said-to-be constructed with approx. 1 to 2m of sand fill, but the Test Platforms were UNDERCUT approx. 400 – 500mm below current ground level.

### BRIEF / REQUEST:

This request was for independent VERIFICATION TESTING, as GOODMANS were to be conducting their own testing on backfill compaction.

As such, we attended site and tested at 4 pre-determined test locations – see **TABLE 1** results.

GOODMANS then tested these same 4 marked locations, **DCP** Tests only. We noted their results, and they are recorded within **TABLE 3**.

Note that the REPORTED RESULTS (both sets in TABLES 1 and 2) are re-calculated (from any NDM-calculated results) using a spreadsheet with input figures being:

- WET DENSITY
- MOISTURE CONTENT, and
- TARGET MDD.

The limitations in respect of the GOODMANS results for Moisture / Density recorded in TABLE 2 and the DCP results recorded in TABLE 3 are explained in "SPECIAL NOTES" below

### TEST RESULTS: [See Result Table(s) following]

TEST RESULT TABLE(S):	For this compaction test at:	<b>ANDERSON PARK ESTATES – Stage 2</b>
-----------------------	------------------------------	--

### FILL AREA(S):

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.  
 On LOTS 12, 11, 28 and 29 – Test Pads undercut 400 – 500mm below current Ground  
 Level. See Photo(s) and/or "marked up" Plan attached.**

**TABLE 1 (Density & Moisture Content Test Results) – MATS Ltd's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
<b>1</b>	300	1739	1578	<b>10.2</b>	<b>103.8</b>	730218.90	362993.34
<b>2</b>	300	1777	1617	<b>9.9</b>	<b>106.4</b>	730233.32	362987.47
<b>3</b>	300	1652	1520	<b>8.7</b>	<b>100.0</b>	730229.42	362977.43
<b>4</b>	300	1618	1508	<b>7.3</b>	<b>99.2</b>	730239.94	362973.28
<b>MIN</b>	<b>No Result &lt;95%</b>				<b>99.2</b>	<b>ACCEPTABLE</b>	
<b>MEAN</b>					<b>102.4</b>		

**Lab.Ref.No: MA 22/ 178 cont'd.**

**TABLE 2 (Density & Moisture Content Test Results) – GOODMAN's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1							
2							
3							
4							
MIN	No Result <95%					NOT TESTED	
MEAN							

**TABLE 3 [DCP ("Scala") Test Results] – recorded from Testing by GOODMANS: [adjacent to NDM Tests as in TABLE(S) above]**

Depth below Test Pad (mm)	TEST #1 (blows per 100 mm)	TEST #2 (blows per 100 mm)	TEST #3 (blows per 100 mm)	TEST #4 (blows per 100 mm)
100	4	5	4	3
200	7	7	5	5
300	8	10	6	4
400	10	12	6	4
500	10	13	6	5
600	10	14	6	7
700	9	15	6	7
800	9	15	6	7
RESULT:	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

**NOTES: DENSITY TESTS**

- Density and Moisture Content results obtained in accordance with NZS 4407: 2015 tests 4.2 & 4.3, using a Troxler 3440 Nuclear Density Gauge
- Troxler 3440 (*Serial Numbers 18355 or 38278*) precision at selected Count Time of 1 min. (as used):  
 Composition Error: Backscatter Mode +/- 40kg/cu.m.  
 Direct Transmission Mode +/- 20kg/cu.m.
- For this "Site Visit", 300, 250 and 200 etc. refer to the scalar positions of the nuclear source rod (ie the layer depth beneath the Gauge), in mm, being in 'Direct Transmission' mode. Similarly 'BS' refers to scalar position in 'Backscatter' mode.
- A 'Moisture Offset' was not required for this material to ensure accuracy of results.

**DYNAMIC CONE ("Scala") PENETRATION TESTING**

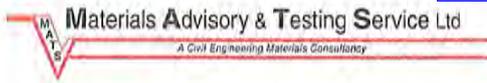
- Test Method used: NZS 4402: 1986 test 6.5.2 (Procedure 2).
- "P" noted in the Scala Blowcount column in the RESULT TABLE(S) is "PUSH" - a blowcount per 50mm of 0.5 or less.
- "Ref." noted in the Scala Blowcount column in the RESULT TABLE(S) is "REFUSAL" - a blowcount per 50mm of 20 or greater.
- GOODMANS have elected to provide results in 100mm penetration increments whereas we would normally record in 50mm increments.

**SPECIAL NOTES:**

- While we did not operate the GOODMANS Troxler 3440 (S/N: 38479), we checked that:
  - It is in current calibration (until 28/7/2022), and
  - No "Moisture Offset" was employed, but
  - We did not verify the status of the "Standard Counts", but witnessed that Goodmans operator had followed the prescribed procedures in respect of the operation on site.

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Work: (04) 566 0266  
Email: office.mats ltd@gmail.com

**Lab.Ref.No: MA 22/ 178 cont'd.**

- 2. We did not operate the GOODMANS DCP ("Scala") unit, and simply recorded the results achieved. Thus:
  - a. We presume that it is in current calibration, and
  - b. Verified that the method of operation was in accordance with the prescribed Test Method.

**REMARKS:**

- 1. Compaction Equipment Employed: Tyre-rolled with loaded Moxies.
- 2. DCP ("Scala") Tests, where performed are taken on the same nominal 1m<sup>2</sup> test area within which the NDM tests are performed.
- 3. Request and readiness for this test was advised by our Client (Mr Kevin Peel - Goodmans).
- 4. Test Location coordinates provided by GOODMANS. See Site Plan and/or Site Photo(s) for further information.
- 5. ***For the ALL ABOVE TESTS, we have applied the "TARGET" MDD-OMC value related to the client-advised SOURCE of the fill as established from samples provided by our client (GOODMANS).***
- 6. With reference to **Test #4 on Lot 29** (see "TABLES 1 & 3" above), whilst the results for Compaction and DCP do comply (see "COMPACTION REQUIREMENTS" above), GOODMANS representatives on site advised this specific area will be reworked and retest may be requested.

**EXCLUSIONS:**

- Please note that the tests herein – if the surface layer of 400 – 500mm removed is considered as included – have only verified the compaction therefore to a depth of approx. 1m below current Ground Level, and therefore NOT to the total depth of fill place if it exceeds this depth.
- We were advised that Goodmans Troxler was not available for "VERIFICATION TESTING" (see BRIEF / REQUEST above) for these tests, hence reference to this - within this report only - is excluded.

**CONCLUSION:**

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.  
On LOTS 12, 11, 28 and 29 – Test Pads undercut 400 – 500mm below current Ground Level. See Photo(s) and/or "marked up" Plan attached.**

With the provisos in "REMARKS" and "EXCLUSIONS" above accepted:

The **COMPACTION** achieved on the max. 500mm layer BELOW the surface of the undercut Test Pads, as tested during this Site Visit, **IS ACCEPTABLE** in terms of the specification requirement adopted in that:

- ALL results **MEET** the relative Compaction requirement,
- ALL 4 of 4 DCP results confirm that the fill is reasonably **CONSISTENT** throughout the layer when compared to the DENSITY results in the 300mm surface, and noting that
- The 1<sup>st</sup> 100 – 150mm layer can be expected to be "low" given the lack of confinement of this non-cohesive material, and
- MOISTURE CONTENT and AIR VOIDS criteria are **NOT APPLICABLE**.

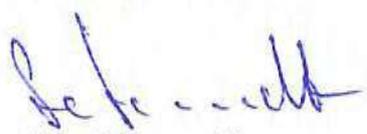
**Lab.Ref.No: MA 22/ 178 cont'd.**

**MOISTURE / DENSITY COMPARISONS:**

N/A for this test, see EXCLUSIONS above.

**THIS REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL**

Report Prepared: Harald Harsveldt  
 Report Checked: 

**APPROVED:**   
 Harald Harsveldt  
**DIRECTOR**

*Attached: Site Photo(s) and / or Site Plan(s) marked up showing test locations / areas and exclusions (if any).*

**SITE PHOTO(S):**



**Above: Test Overview of Test Area and Preparation**



**Above: Undercut Pad and Testing**

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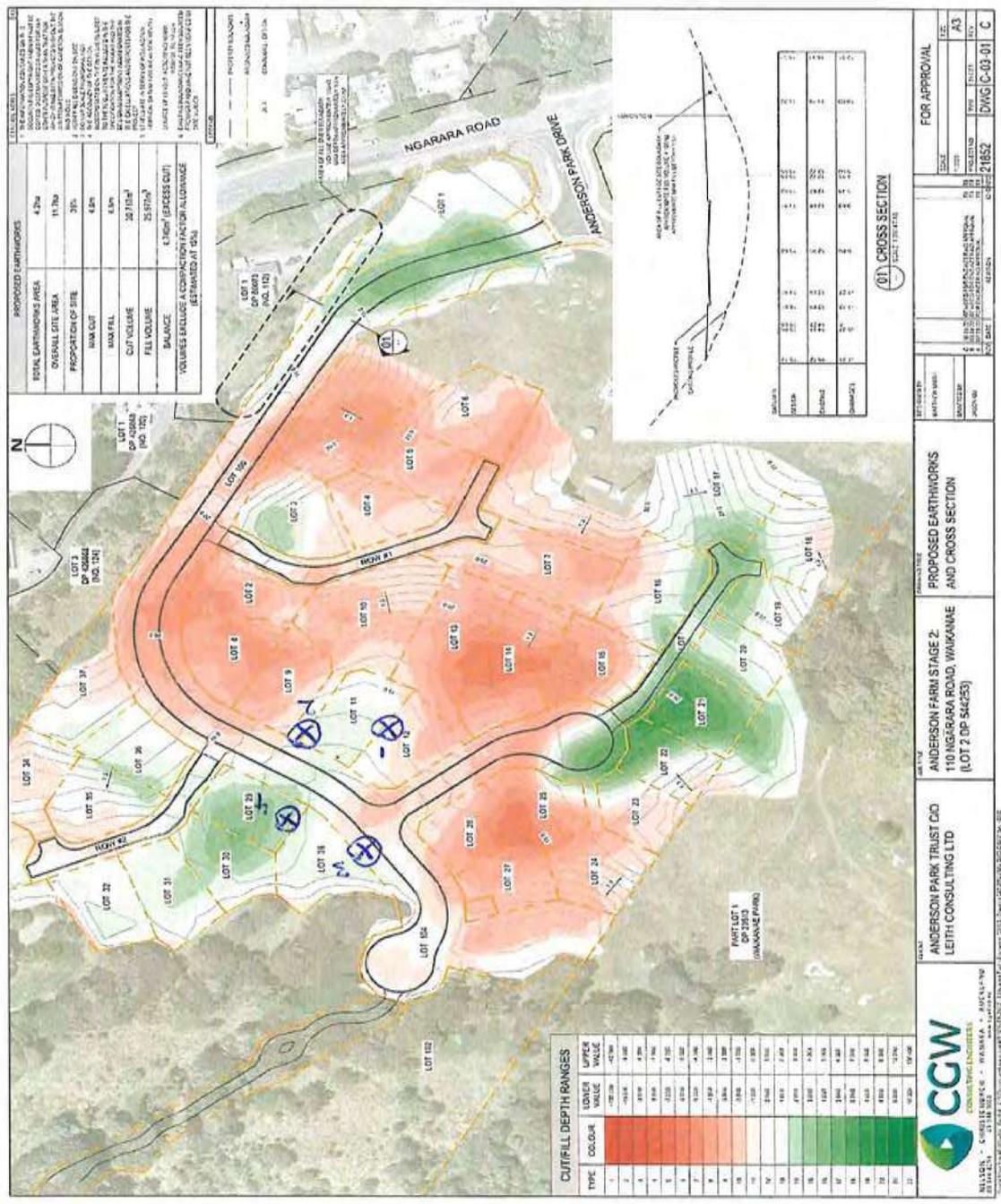


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Lab.Ref.No: MA 22/ 178 cont'd.

### SITE PLAN

(Not to known scale):  
Basic Test Area identified above





# Materials Advisory & Testing Service Ltd

Concrete, Soils, Aggregates, Asphaltic Concrete, Bitumen, Metals, Geological Investigations

Postal: PO Box 37-231, Stokes Valley, Lower Hutt 5141, NZ Telephone: (04) 566 0266  
 Delivery: 8 Oates Street, Stokes Valley, Lower Hutt Email: office.mats.ltd@gmail.com

## COMPACTION TEST REPORT

11 April 2022

Lab.Ref.No: **MA 22/ 198**

### GOODMAN CONTRACTORS LTD

4 Anne Street  
**WAIKANAE 5036**  
 Attn: Mr Kevin Peel

Copy sent to:	GOODMANS
By Email to:	<a href="mailto:kevin@goodmans.nz">kevin@goodmans.nz</a>

### PROJECT:

**ANDERSON PARK ESTATES – Stage 2  
 104 – 110 NGARARA ROAD, WAIKANAE**

### SUBJECT:

EARTHWORKS – Compaction Testing as required.

### MATERIAL:

Fine Sand, advised as all ex SITE as cut-to-fill.  
 See "TARGET & OTHER INFORMATION" below.

### CONTRACTOR:

**Goodman Contractors Limited**

### ENGINEERS:

**Main: CGW (Ian Hussey)  
 Geotech: CGW (Martin Williams)**

### TESTED BY:

Harald Harsveldt

### DATE OF TEST:

**6 April 2022**

### TESTS REQUIRED:

Fill material – In-situ Density & Moisture Content for determination of acceptability of compaction achieved.  
 With supplementary DCP ("Scala") testing for confirmation of fill layer consistency throughout the depth of fill placed.

### COMPACTION REQUIREMENT:

As advised by email from Geotech. Engineers (ABUILD) dated 13 March 2020 and subsequent verbal instruction for STAGE 1. These criteria are applied herein for this STAGE 2 and will continue until advised otherwise by CGW.

### DUNE SAND FILL:

#### Compaction Acceptance Criteria:

- Minimum **95%** compaction relative to the MDD established (using NZ Std. Comp.), and
- Water Content standard requirements as within the range of **-4 to +2%** of Optimum, **WAIVED** by the Engineers (ABUILD).
- AIR VOIDS maximum **10%**, subsequently **WAIVED** by the Engineers (ABUILD).
- **DCP tests** required to confirm fill layer consistency or adequacy of compaction throughout the depth of fill placed. This function is being undertaken by the CONTRACTOR and for Stage 1 was undertaken by the Geotech. Engineers (ABUILD).

See "TARGET & OTHER INFORMATION" following

TARGET & OTHER INFORMATION:	<i>Fine grey-brown sand with trace of gravels from WEST side of site</i>	<i>Fine grey-brown sand with trace of organics (rootlets) from EAST side of site</i>
<b>MAX. DRY DENSITY (NZS Comp.)</b>	<b>1.55 t/m<sup>3</sup></b>	<b>1.52 t/m<sup>3</sup></b>
<i>Optimum Moisture Content:</i>	<b>18.0%</b>	<b>20.0%</b>
for further info, see Test Report(s):	MATS Ref: MA22/055A	MATS Ref: MA22/055B

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**Lab.Ref.No: MA 22/ 198 cont'd.**

**INFORMATION PROVIDED and INTRODUCTION:**

We were advised by our client that this series of tests was to provide data on COMPACTION to verify comparability for future client-provided NDM testing.

The area under test, on lots 29 and 30, were said-to-be constructed with approx. 1 to 2m of sand fill, but the Test Platforms were UNDERCUT approx. 400 – 500mm below current ground level.

**BRIEF / REQUEST:**

This request was for independent VERIFICATION TESTING, as GOODMANS were to be conducting their own testing on backfill compaction.

As such, we attended site and tested at 4 pre-determined test locations – see **TABLE 1** results.

GOODMANS then tested these same 4 marked locations, **DCP** Tests only. We noted their results, and they are recorded within **TABLE 3**.

Note that the REPORTED RESULTS (both sets in TABLES 1 and 2) are re-calculated (from any NDM-calculated results) using a spreadsheet with input figures being:

- WET DENSITY
- MOISTURE CONTENT, and
- TARGET MDD.

The limitations in respect of the GOODMANS results for Moisture / Density recorded in TABLE 2 and the DCP results recorded in TABLE 3 are explained in "SPECIAL NOTES" below

**TEST RESULTS:** [See Result Table(s) following]

TEST RESULT TABLE(S):	For this compaction test at:	<b>ANDERSON PARK ESTATES – Stage 2</b>
-----------------------	------------------------------	--

**FILL AREA(S):**

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.**  
**Around LOTS 29 & 30 – Test Pads undercut nominal 400 – 500mm below current Ground Level. See Photo(s) and/or "marked up" Plan attached.**

**TABLE 1 (Density & Moisture Content Test Results) – MATS Ltd's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1	300	1664	1557	6.9	102.4	730270.70	362964.06
2	300	1688	1591	6.1	104.7	730259.69	362955.10
3	300	1634	1517	7.7	99.8	730253.16	362964.40
4	300	1669	1558	7.1	102.5	730255.79	362975.74
MIN	No Result <95%				99.8	ACCEPTABLE	
MEAN					102.4		

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Lab.Ref.No: MA 22/ 198 cont'd.

**TABLE 2 (Density & Moisture Content Test Results) – GOODMAN's results:**

Test	Depth (mm)	Wet Density kg/cu.m	Dry Density kg/cu.m	Water Content %	Compaction (%)	COORDINATES (Supplied by Client)	
						Northing	Easting
1							
2							
3							
4							
MIN	No Result <95%					NOT TESTED	
MEAN							

**TABLE 3 [DCP ("Scala") Test Results] – recorded from Testing by GOODMAN'S:**  
 [adjacent to NDM Tests as in TABLE(S) above]

Depth below Test Pad (mm)	TEST #1 (blows per 100 mm)	TEST #2 (blows per 100 mm)	TEST #3 (blows per 100 mm)	TEST #4 (blows per 100 mm)
100	5	4	3	3
200	7	5	4	4
300	7	9	7	5
400	8	10	10	10
500	8	13	10	11
600	8	14	12	12
700	9	14	16	11
800	12	15	17	12
RESULT:	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

**NOTES: DENSITY TESTS**

- Density and Moisture Content results obtained in accordance with NZS 4407: 2015 tests 4.2 & 4.3, using a Troxler 3440 Nuclear Density Gauge
- Troxler 3440 (*Serial Numbers 18355 or 38278*) precision at selected Count Time of 1 min. (as used):  
 Composition Error: Backscatter Mode +/- 40kg/cu.m.  
 Direct Transmission Mode +/- 20kg/cu.m.
- For this "Site Visit", 300, 250 and 200 etc. refer to the scalar positions of the nuclear source rod (ie the layer depth beneath the Gauge), in mm, being in 'Direct Transmission' mode. Similarly 'BS' refers to scalar position in 'Backscatter' mode.
- A 'Moisture Offset' was not required for this material to ensure accuracy of results.

**DYNAMIC CONE ("Scala") PENETRATION TESTING**

- Test Method used: NZS 4402: 1986 test 6.5.2 (Procedure 2).
- "P" noted in the Scala Blowcount column in the RESULT TABLE(S) is "PUSH" - a blowcount per 50mm of 0.5 or less.
- "Ref." noted in the Scala Blowcount column in the RESULT TABLE(S) is "REFUSAL" - a blowcount per 50mm of 20 or greater.
- GOODMANS have elected to provide results in 100mm penetration increments whereas we would normally record in 50mm increments.

**SPECIAL NOTES:**

- While we did not operate the GOODMAN'S Troxler 3440 (S/N: 38479), we checked that:
  - It is in current calibration (until 28/7/2022), and
  - No "Moisture Offset" was employed, but

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**13/09/2023**

**Lab.Ref.No: MA 22/ 198 cont'd.**

- c. We did not verify the status of the "Standard Counts", but witnessed that Goodmans operator had followed the prescribed procedures in respect of the operation on site.
2. We did not operate the GOODMANS DCP ("Scala") unit, and simply recorded the results achieved. Thus:
  - a. We presume that it is in current calibration, and
  - b. Verified that the method of operation was in accordance with the prescribed Test Method.

#### REMARKS:

1. Compaction Equipment Employed: Tyre-rolled with loaded Moxies.
2. DCP ("Scala") Tests, where performed are taken on the same nominal 1m<sup>2</sup> test area within which the NDM tests are performed.
3. Request and readiness for this test was advised by our Client (Mr Kevin Peel - Goodmans).
4. Test Location coordinates provided by GOODMANS. See Site Plan and/or Site Photo(s) for further information.
5. ***For the ALL ABOVE TESTS, we have applied the "TARGET" MDD-OMC value related to the client-advised SOURCE of the fill as established from samples provided by our client (GOODMANS).***
6. Refer to our previous report MA22-178 of 28 March 2022, we were advised that on Lot 29 a "retest may be requested". Test numbers #3 & #4 in TABLE 1 above, are in the same basic area.

#### EXCLUSIONS:

- Please note that the tests herein – if the surface layer of 400 – 500mm removed is considered as included – have only verified the compaction therefore to a depth of approx. 1m below current Ground Level, and therefore NOT to the total depth of fill place if it exceeds this depth.
- We were advised that Goodmans Troxler was not available for "VERIFICATION TESTING" (see BRIEF / REQUEST above) for these tests, hence reference to this - within this report only - is excluded.

#### CONCLUSION:

**FILL TESTS on Local fine grey/brown sand ex Site Cuts.  
 On LOTS 29 and 30 – Test Pads undercut nominal 400 – 500mm below current Ground Level. See Photo(s) and/or "marked up" Plan attached.**

With the provisos in "REMARKS" and "EXCLUSIONS" above accepted:

The **COMPACTION** achieved on the max. 500mm layer BELOW the surface of the undercut Test Pads, as tested during this Site Visit, **IS ACCEPTABLE** in terms of the specification requirement adopted in that:

- ALL results **MEET** the relative Compaction requirement,
- ALL 4 of 4 DCP results confirm that the fill is reasonably **CONSISTENT** throughout the layer when compared to the DENSITY results in the 300mm surface, and noting that
  - The 1<sup>st</sup> 100 – 150mm layer can be expected to be "low" given the lack of confinement of this non-cohesive material, and
- MOISTURE CONTENT and AIR VOIDS criteria are **NOT APPLICABLE**.

**Lab.Ref.No: MA 22/ 198 cont'd.**

**MOISTURE / DENSITY COMPARISONS:**

N/A for this test, see EXCLUSIONS above.

**THIS REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL**

Report Prepared: Harald Harsveldt  
 Report Checked:



**APPROVED:**



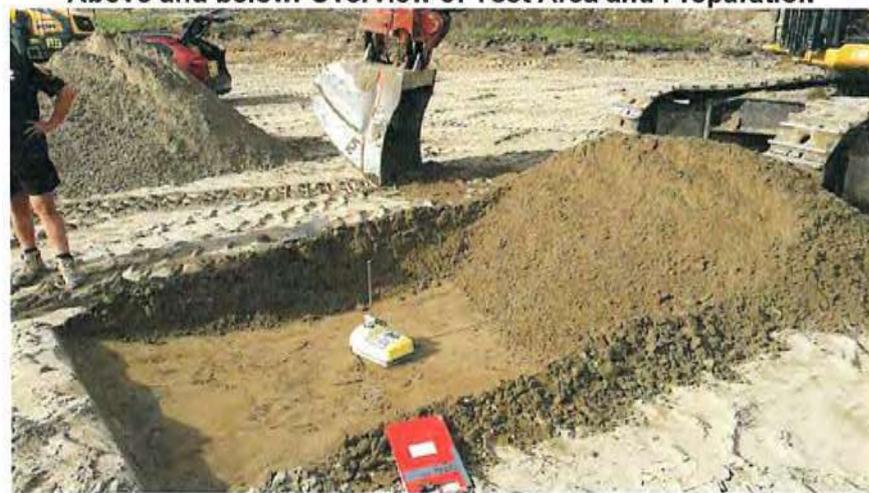
**Harald Harsveldt**  
**DIRECTOR**

*Attached: Site Photo(s) and / or Site-Plan(s) marked up showing test locations / areas and exclusions (if any).*

**SITE PHOTO(S):**



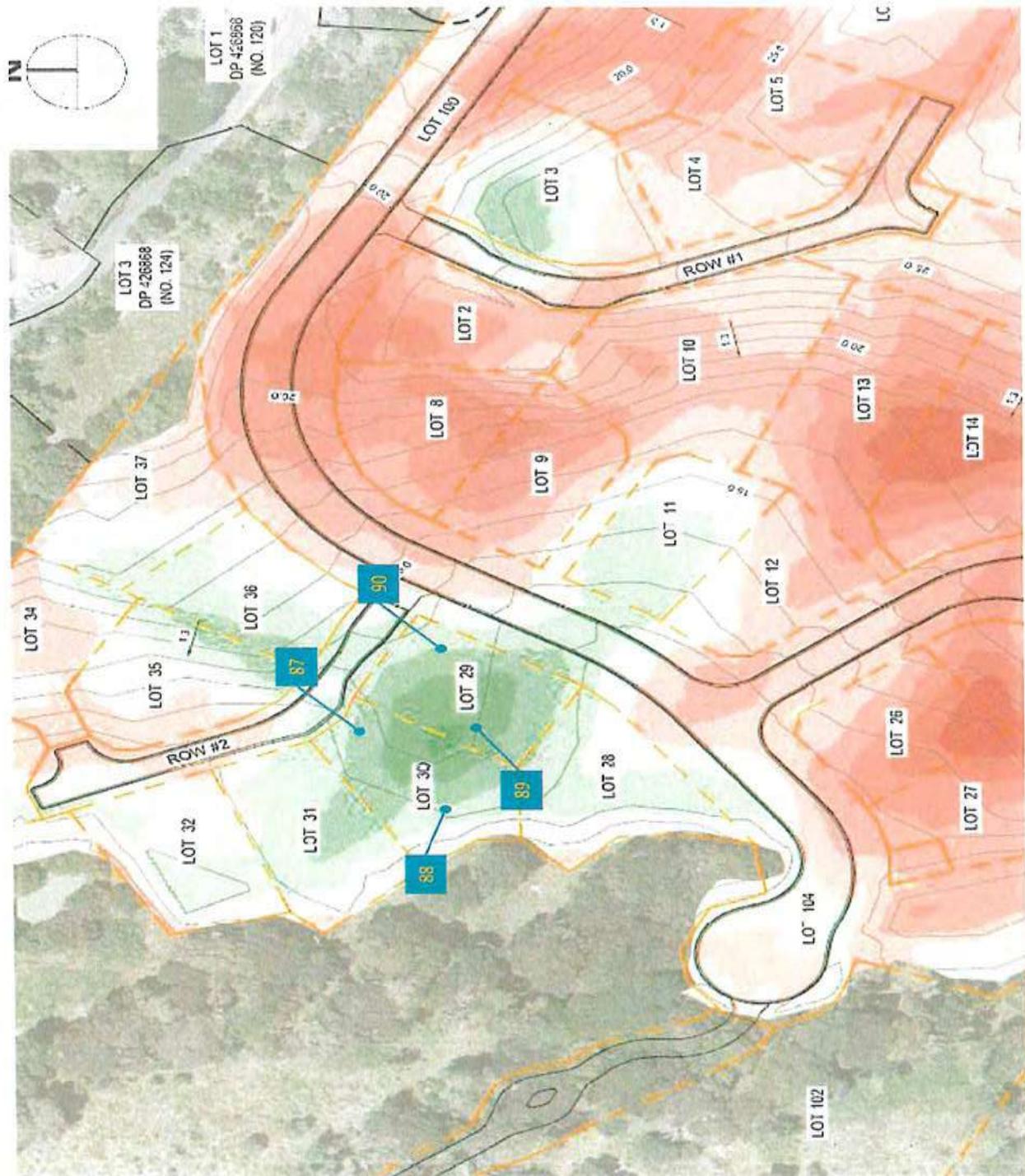
**Above and below: Overview of Test Area and Preparation**



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Lab.Ref.No: MA 22/ 198 cont'd.

**SITE PLAN**  
 (Not to known scale):



Basic Test Area identified above

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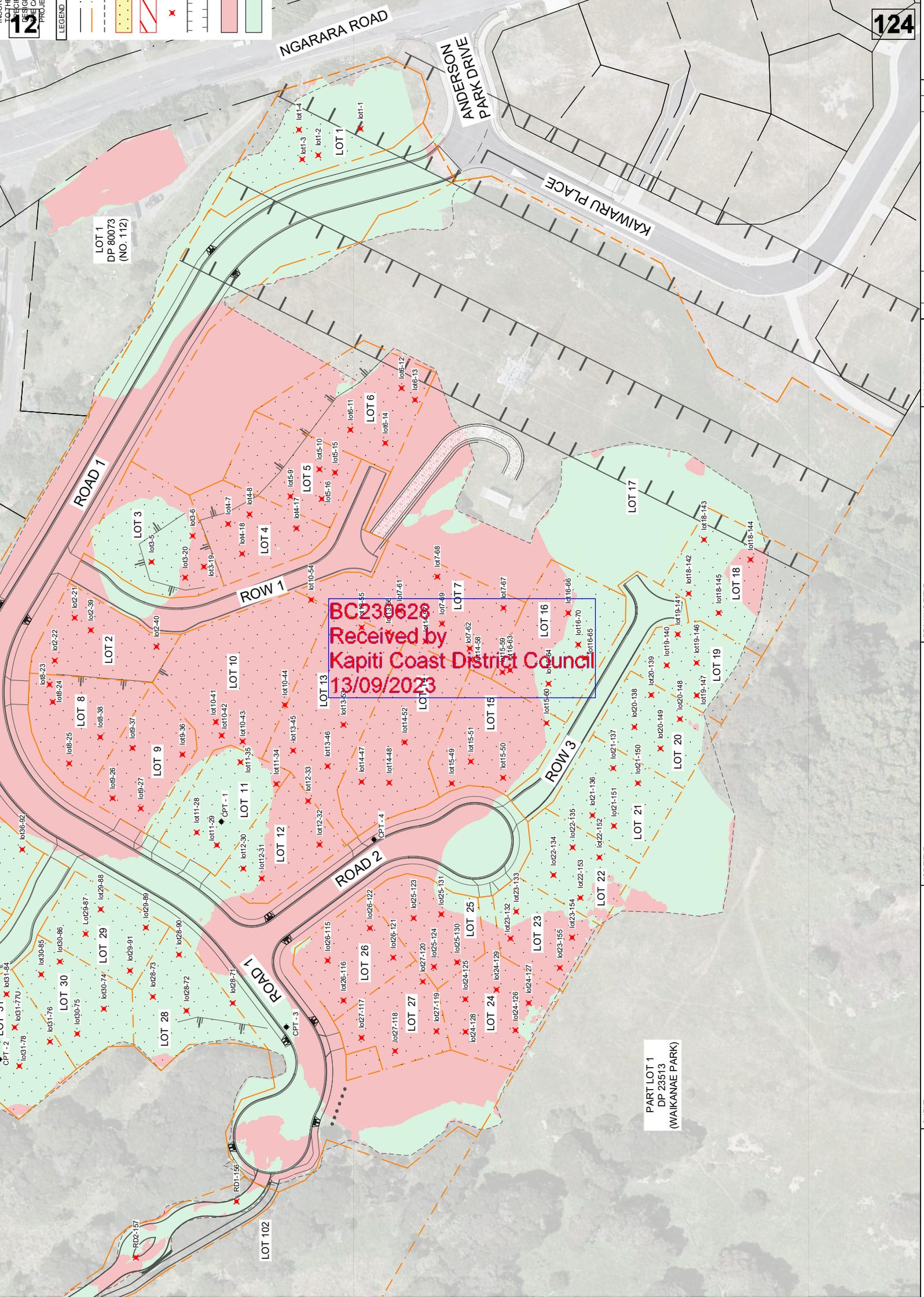


**Appendix E: Post Earthworks Machine Scala Testing**

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LEGEND

- Orange dashed line: Boundary
- Black dashed line: Road
- Yellow dotted area: Specific zone
- Red diagonal lines: Specific zone
- Red 'X' symbol: Specific marker
- White dashed line: Specific boundary
- Red shaded area: Specific zone
- Green shaded area: Specific zone



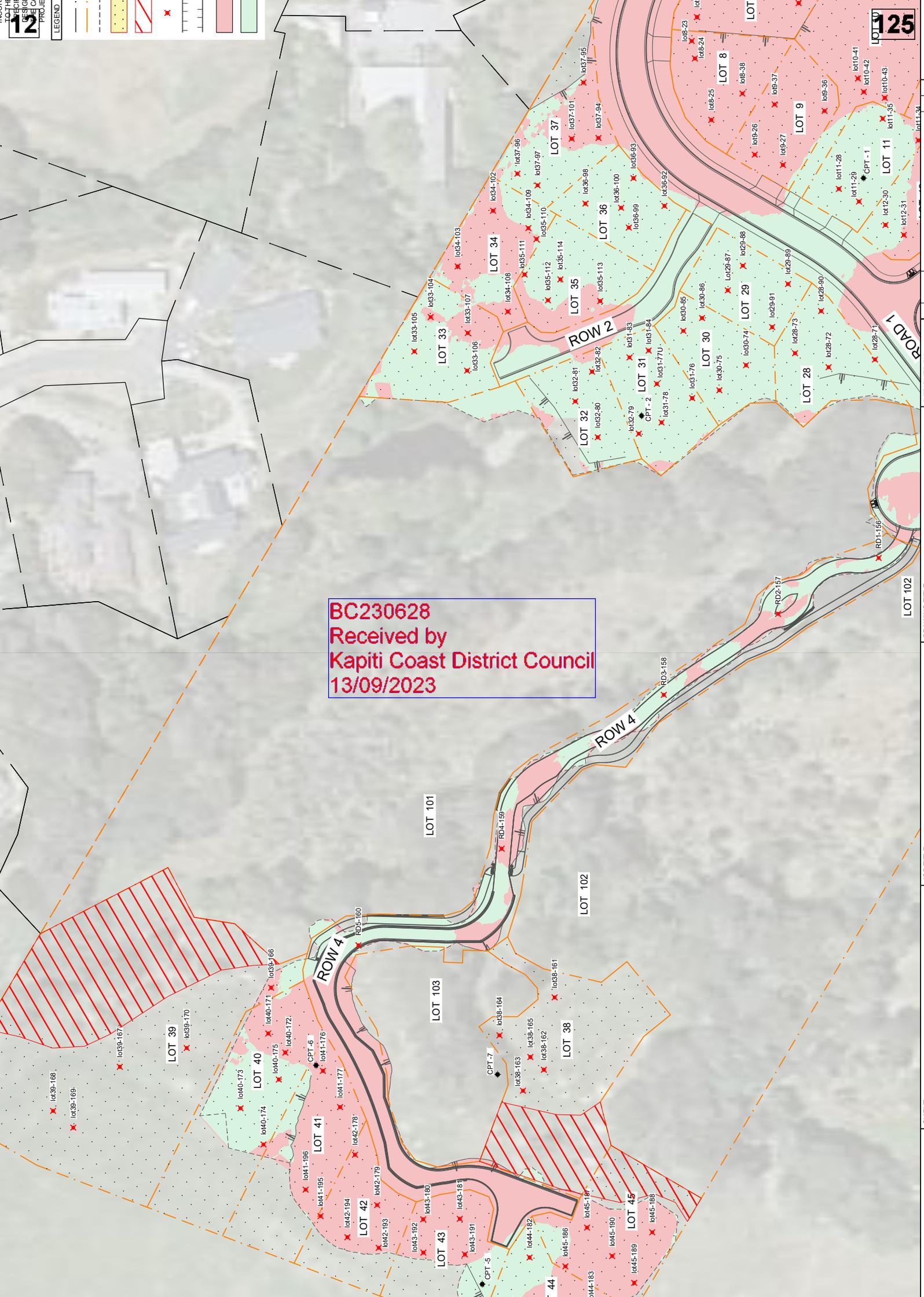
LOT 1  
DP 80073  
(NO. 112)

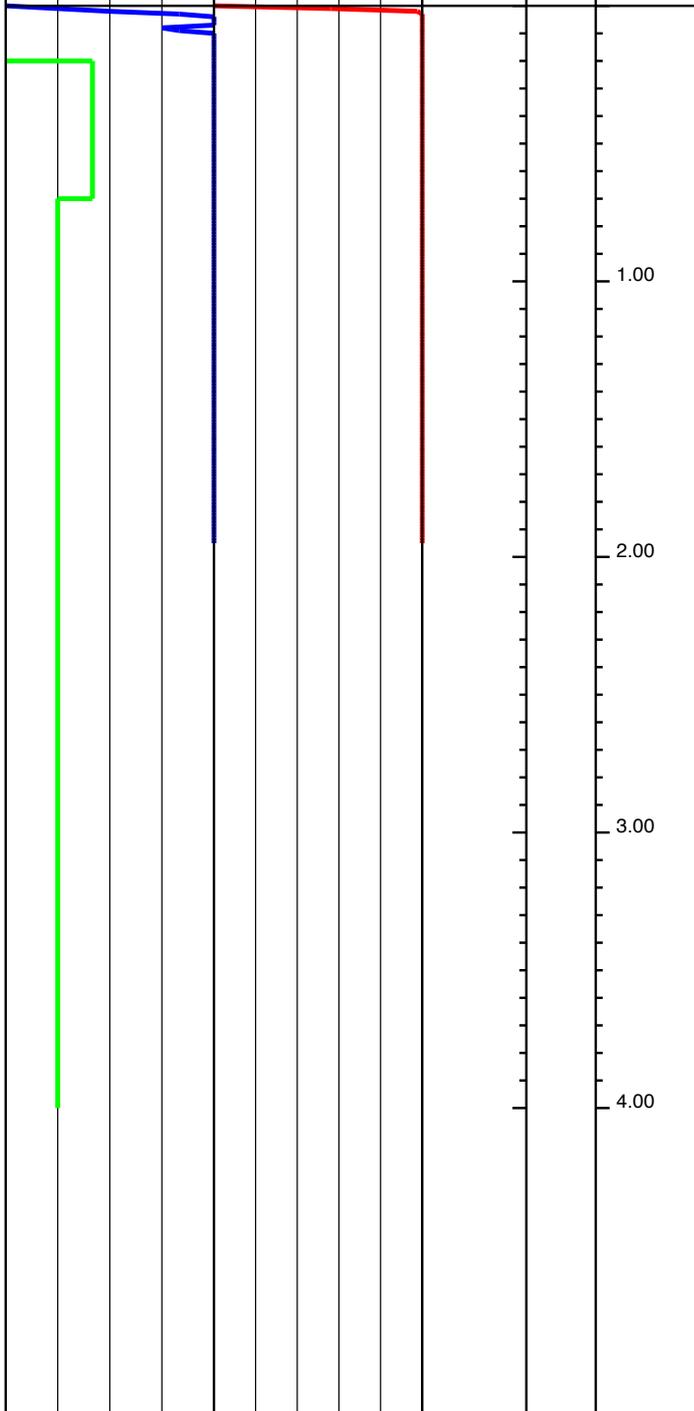
PART LOT 1  
DP 23513  
(WAIKANA E PARK)

LEGEND

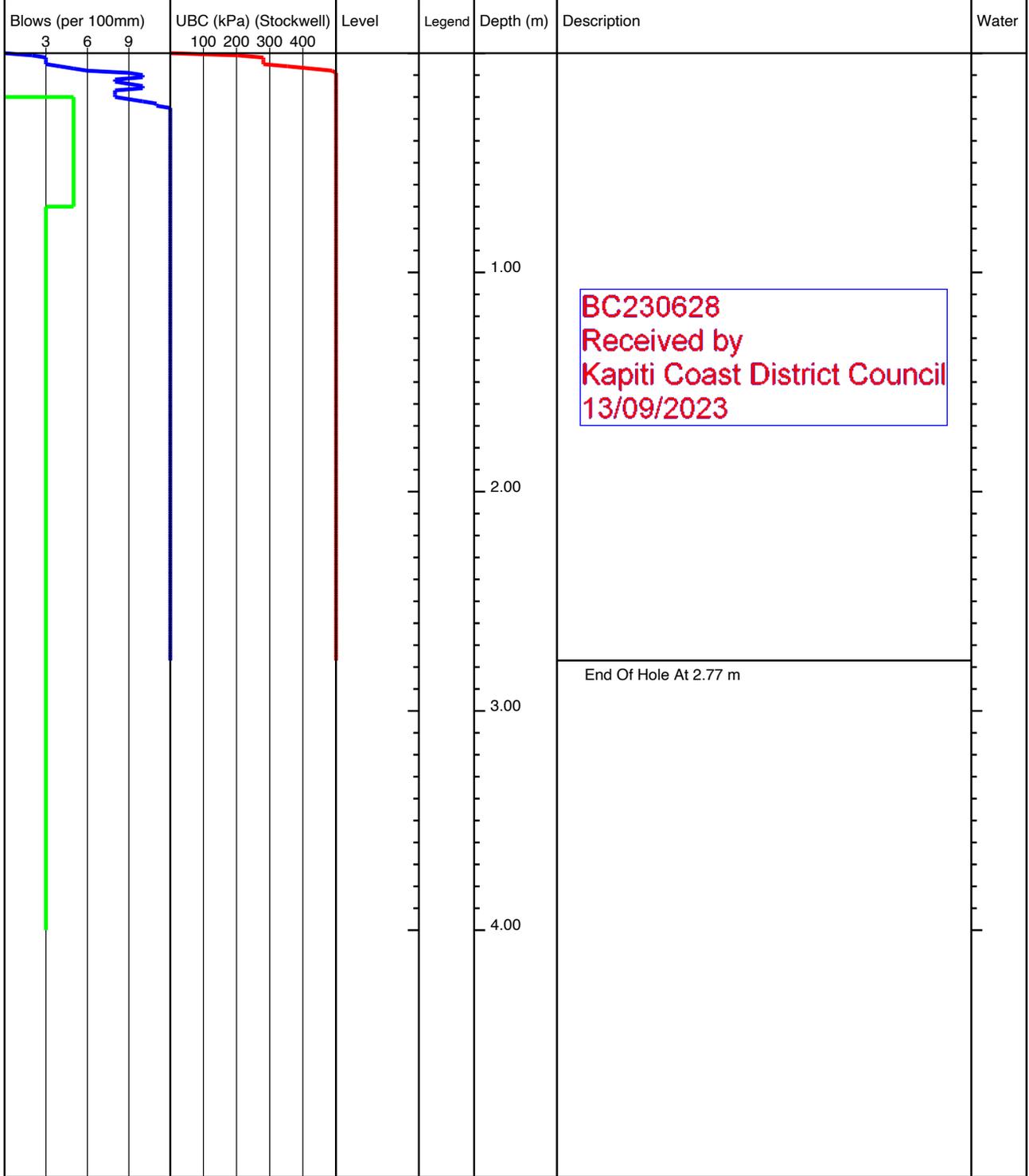
- Orange dashed line: Boundary
- Green shaded area: Road Reserve
- Red hatched area: Proposed Lot
- Red star: Corner
- Black dot: CPT
- Black line: Road
- Grey area: Existing Lot

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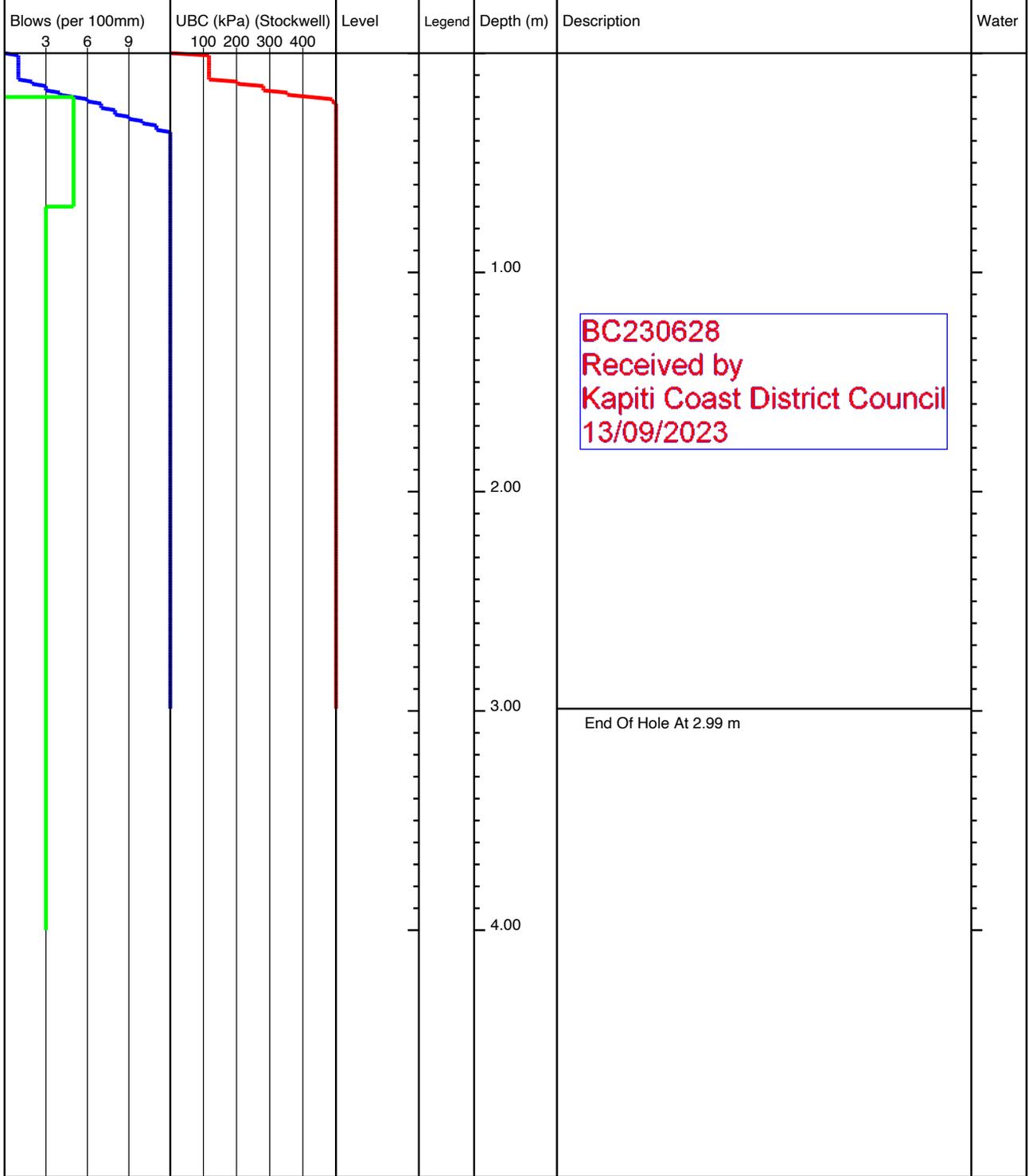
		Project Title: 110 Ngarara Rd, Waikanae				lot01-1
		Project Number: 21852		Client: Anderson Park Trust		
		GL (mAOD):		N Coord: -40.869758		E Coord: 175.051195
Date: 08/08/2022		Method: Machine Scala		Logged By: ND		Scale: 1:25 Sheet 1 Of 1
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<p>End Of Hole At 1.95 m</p> <div style="border: 1px solid red; padding: 5px; margin-top: 20px;"> <p style="color: red; font-weight: bold;">BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot01-2
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869663	E Coord: 175.051117
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



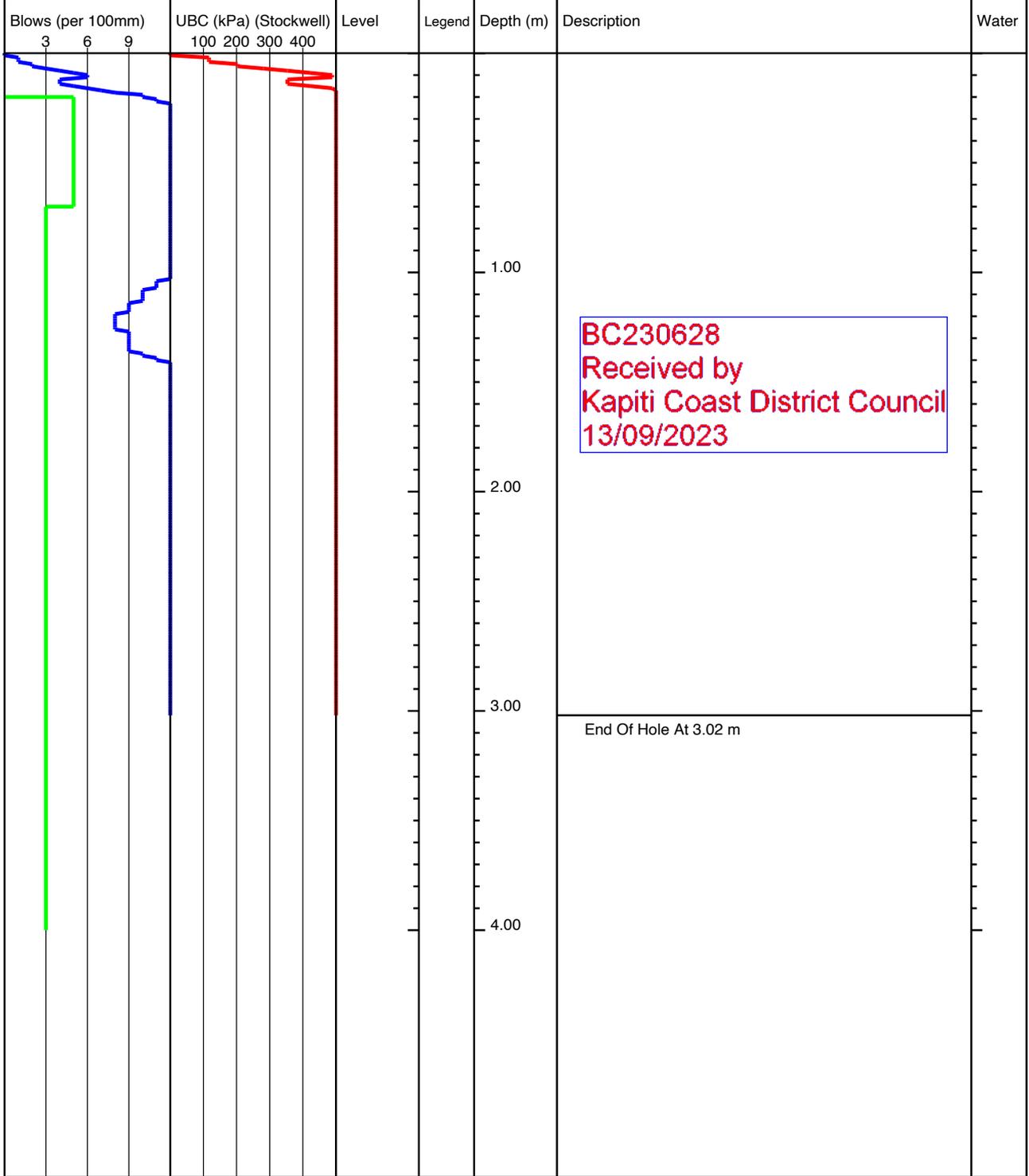
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot01-3
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869627	E Coord: 175.051105
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



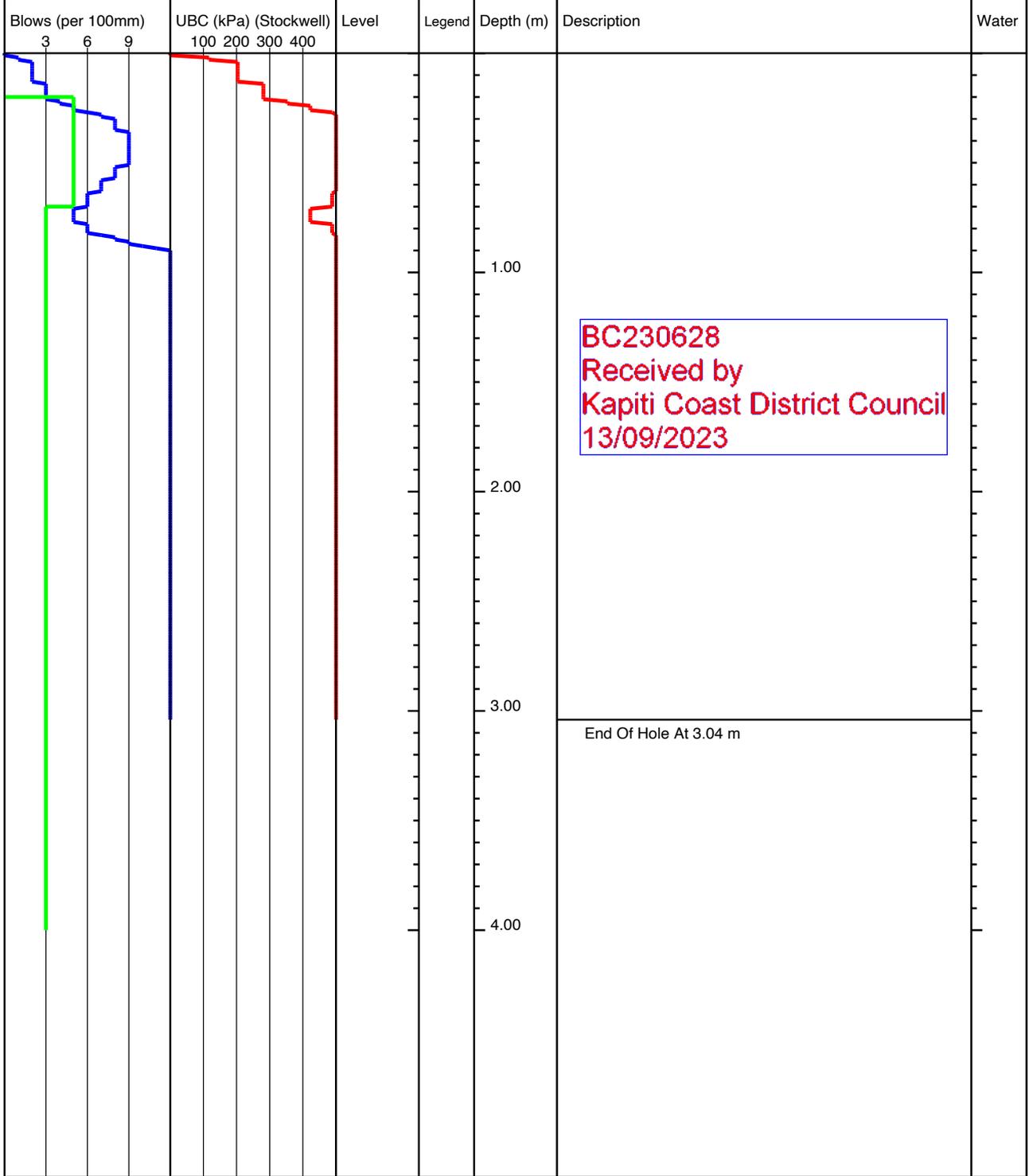
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot01-4
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86962	E Coord: 175.051193
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



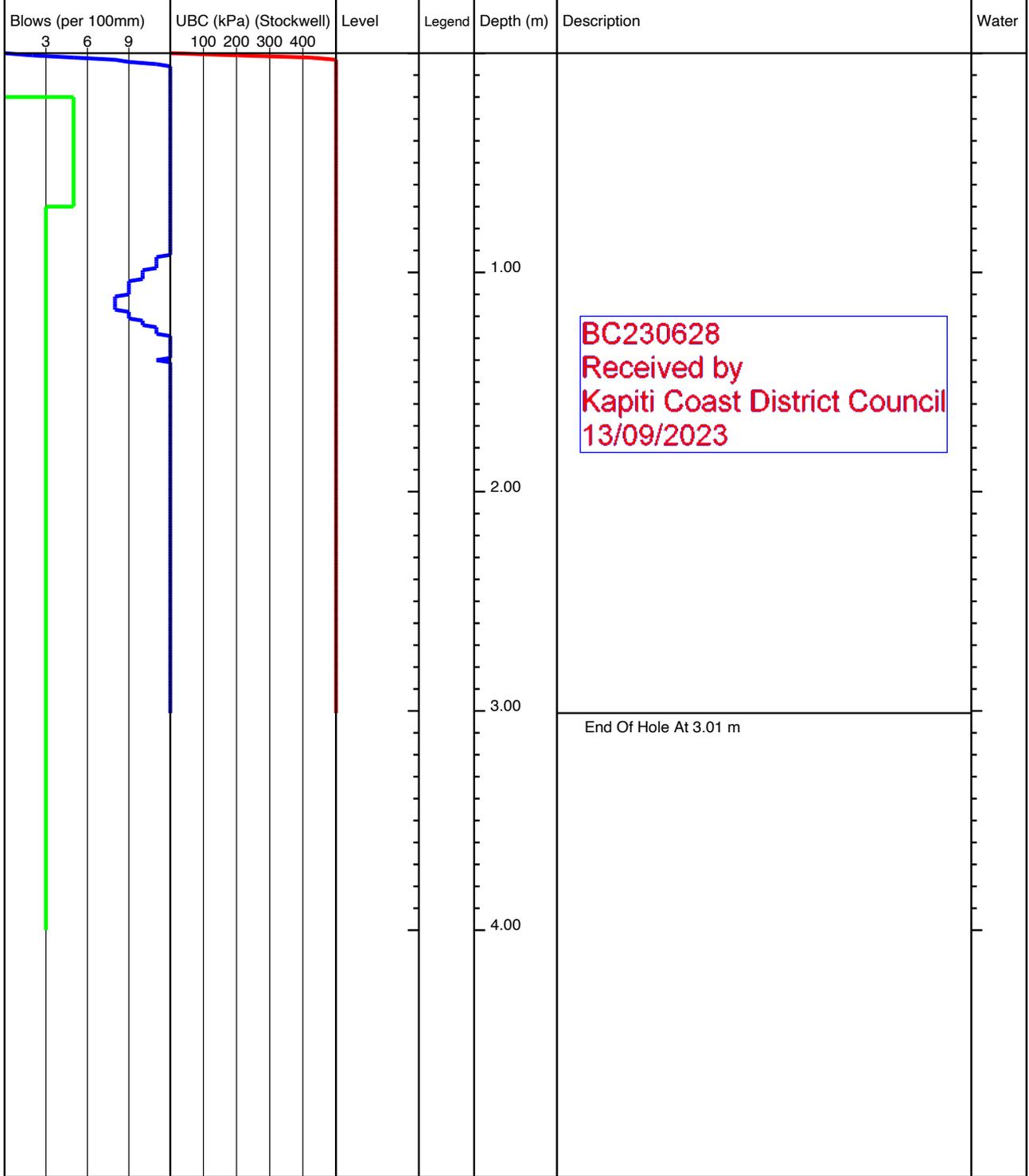
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot02-21
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869112	E Coord: 175.049745
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



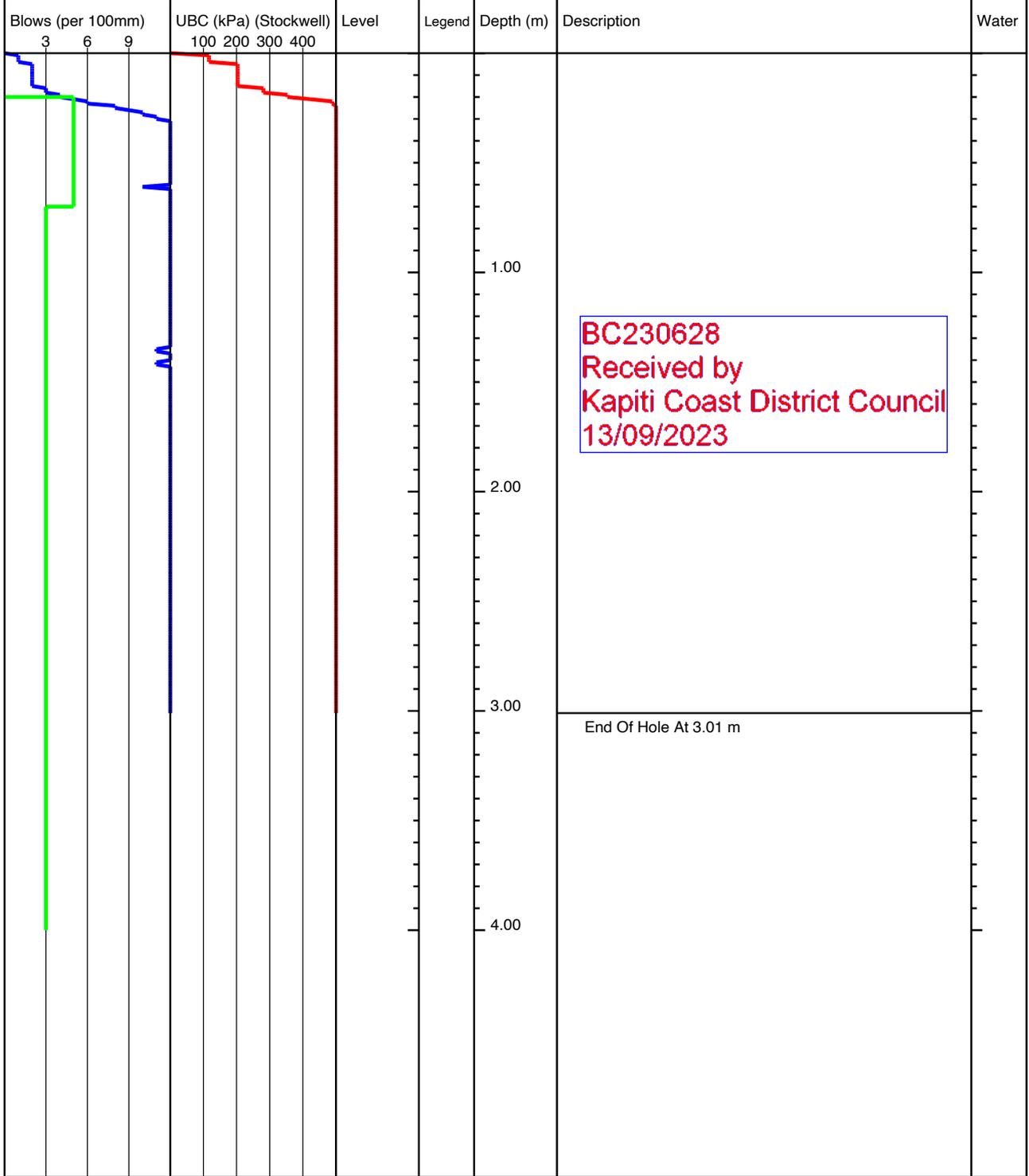
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot02-22
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869067	E Coord: 175.049618
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

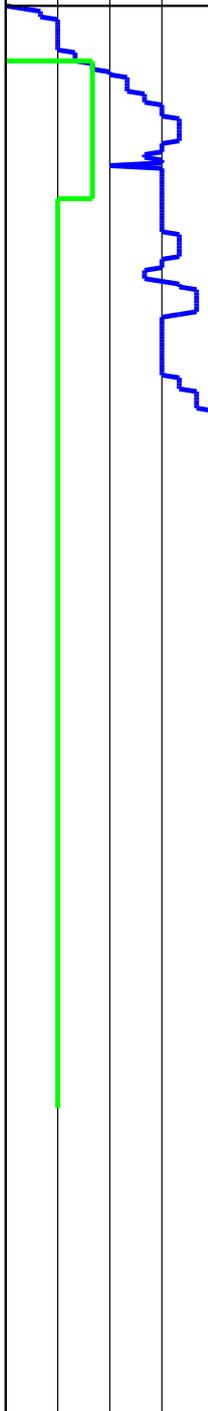
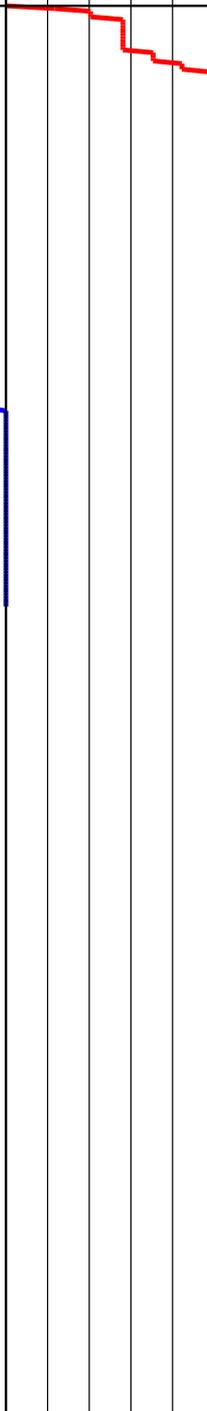
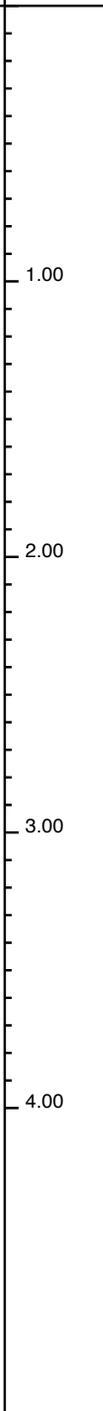


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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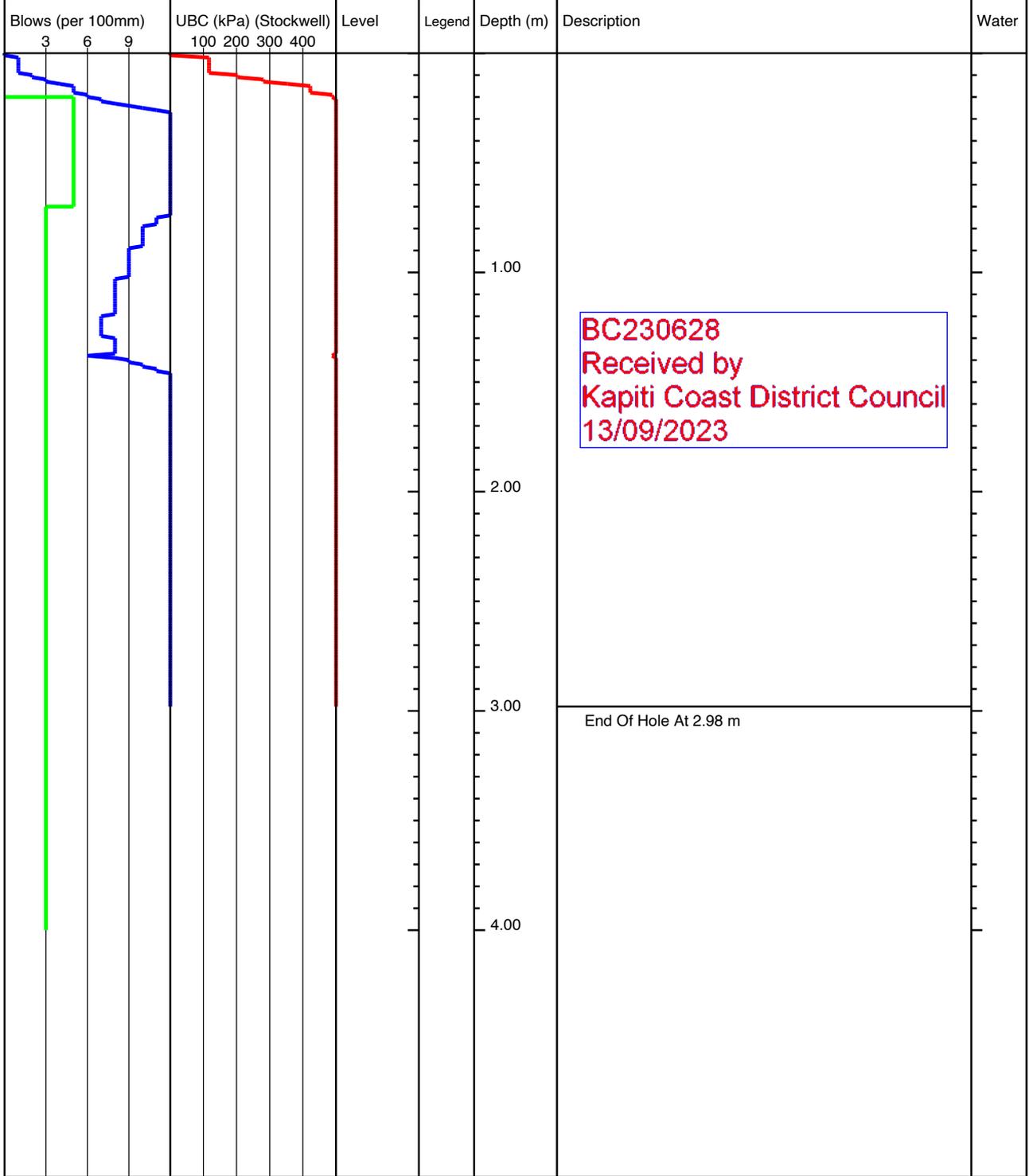
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869148	E Coord: 175.049708
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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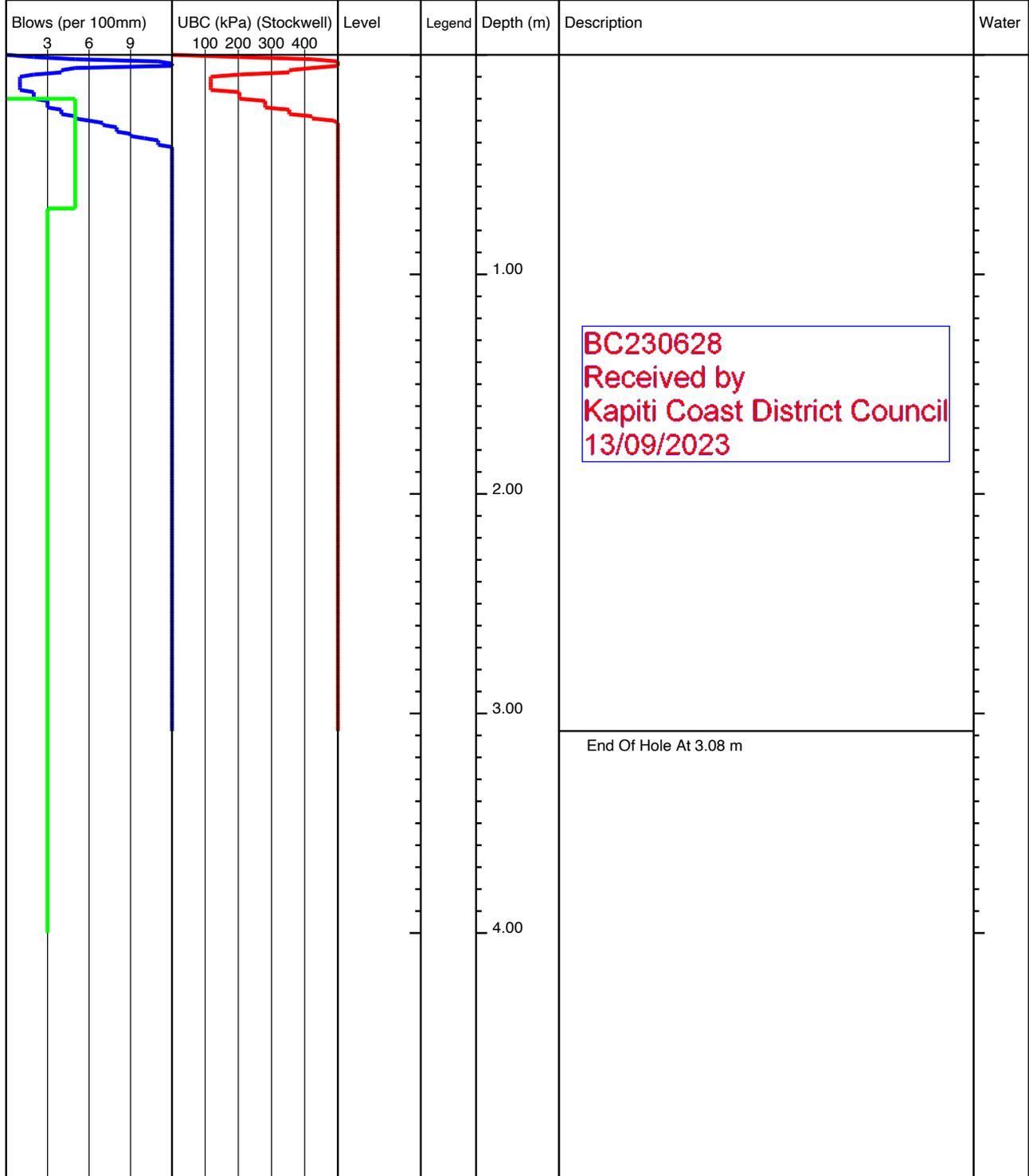
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		Project Number: 21852		Client: Anderson Park Trust	lot02-40			
		GL (mAOD):		N Coord: -40.869295	E Coord: 175.049658			
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1			
Blows (per 100mm)		UBC (kPa) (Stockwell)		Level	Legend	Depth (m)	Description	Water
3 6 9		100 200 300 400						
							<p>End Of Hole At 2.18 m</p> <div style="border: 1px solid red; padding: 5px; margin-top: 100px;"> <p style="color: red; font-weight: bold;">BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>	
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level						<b>REMARKS</b> No Groundwater Encountered		

	Project Title: 110 Ngarara Rd, Waikanae		lot03-19
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869402	E Coord: 175.049895
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



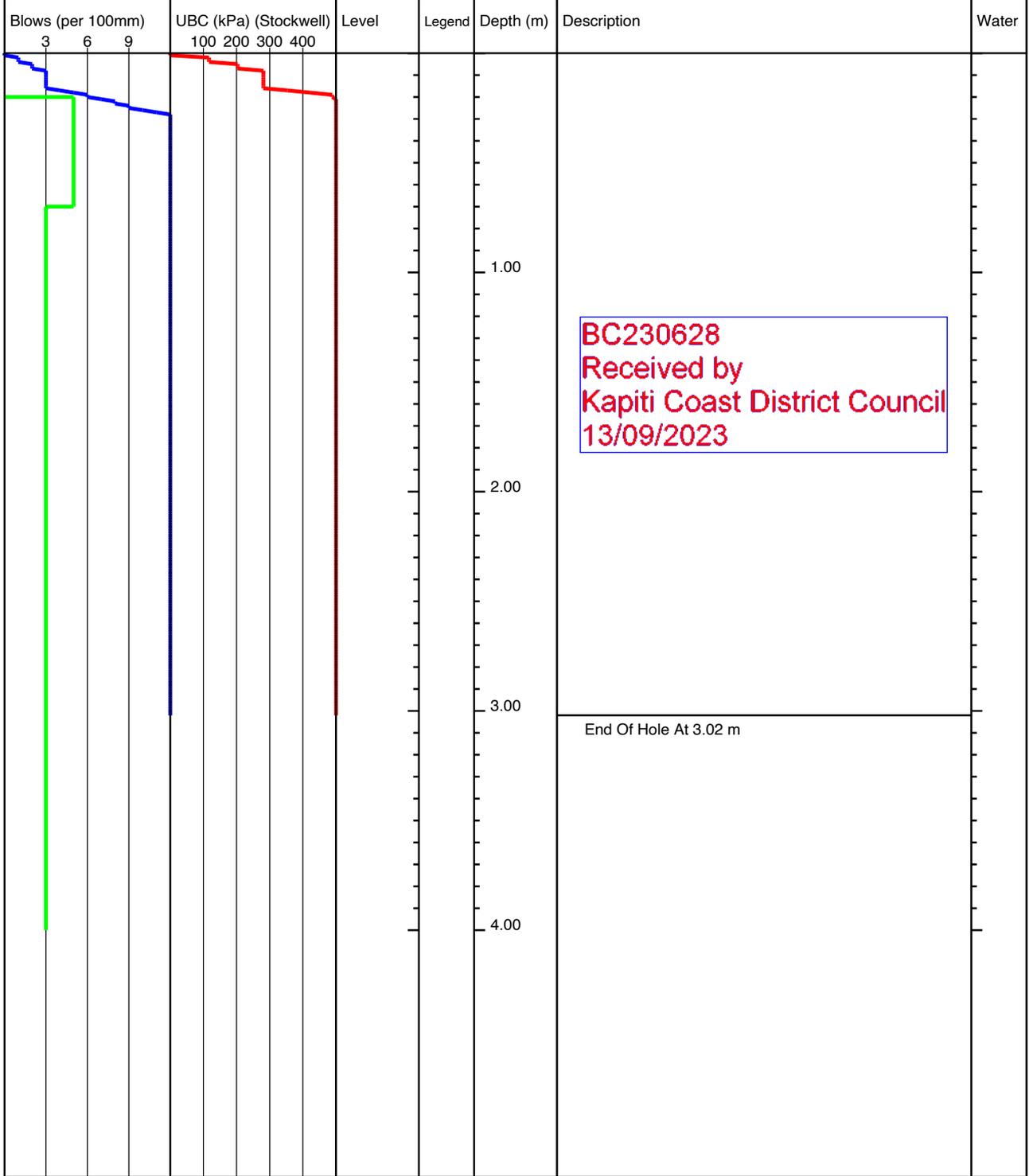
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot03-20
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86936	E Coord: 175.049863
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



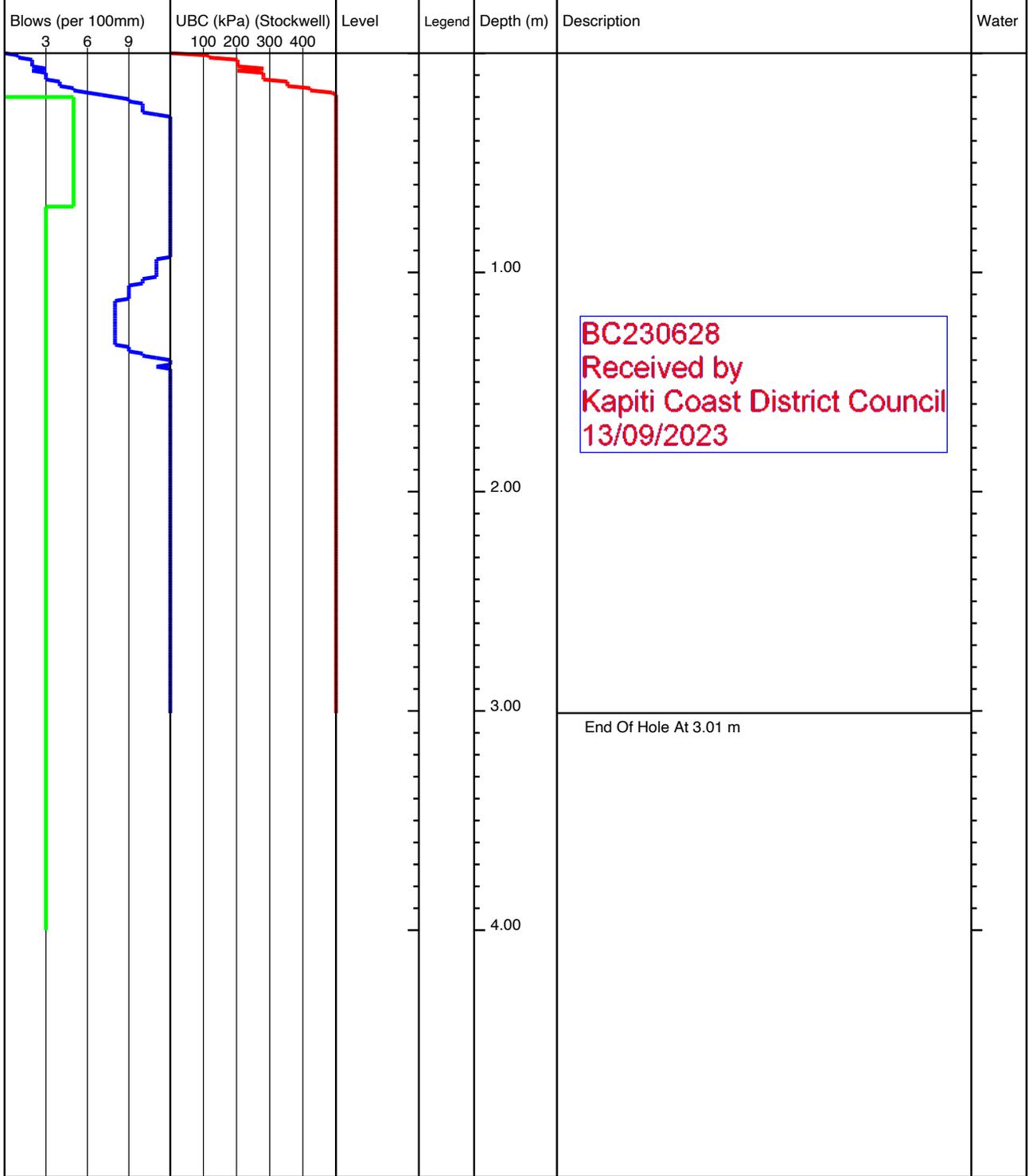
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot03-5
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869285	E Coord: 175.04991
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



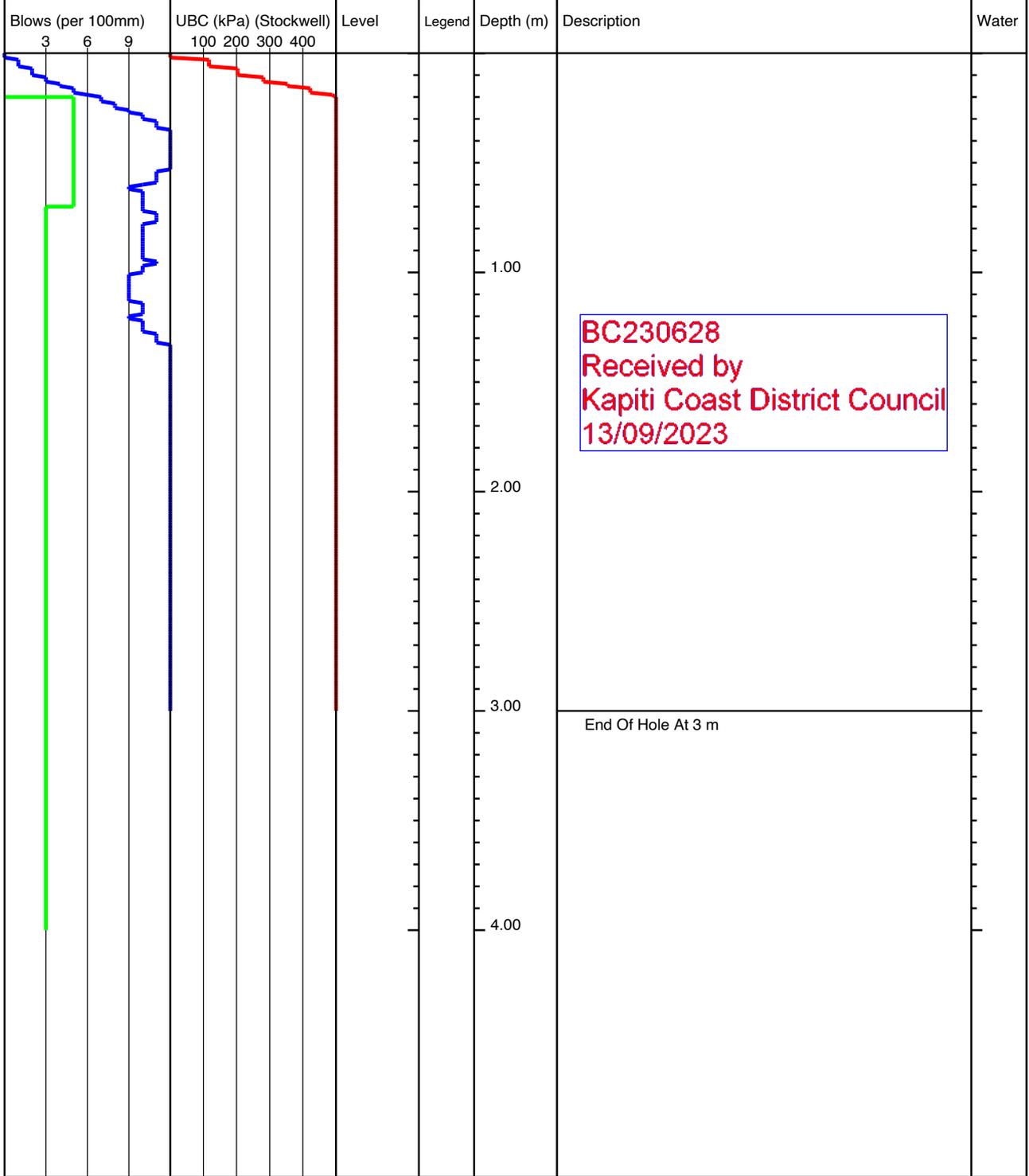
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot03-6
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869377	E Coord: 175.049987
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



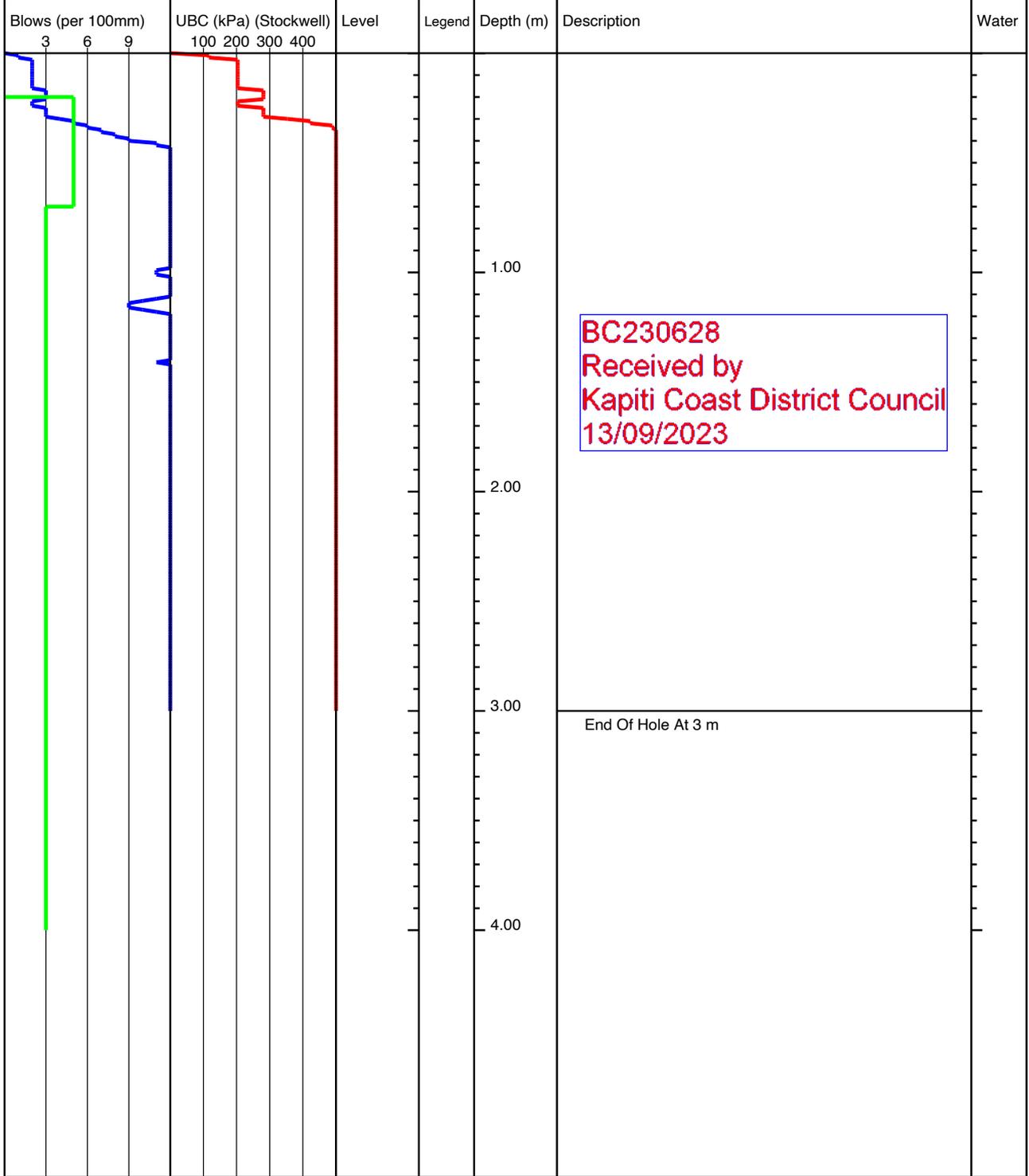
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot04-17
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86961	E Coord: 175.050008
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



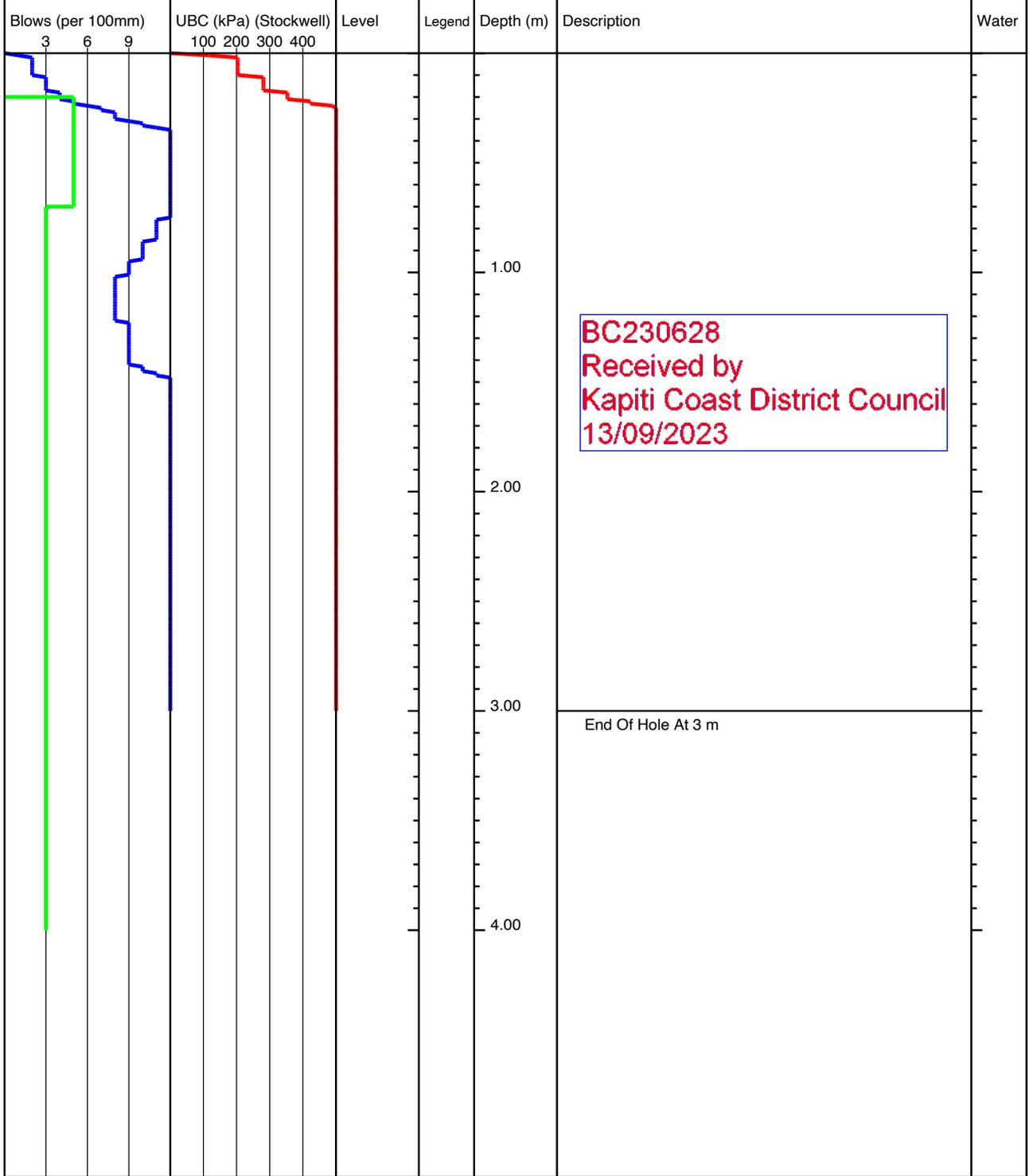
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot04-18
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869488	E Coord: 175.049933
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



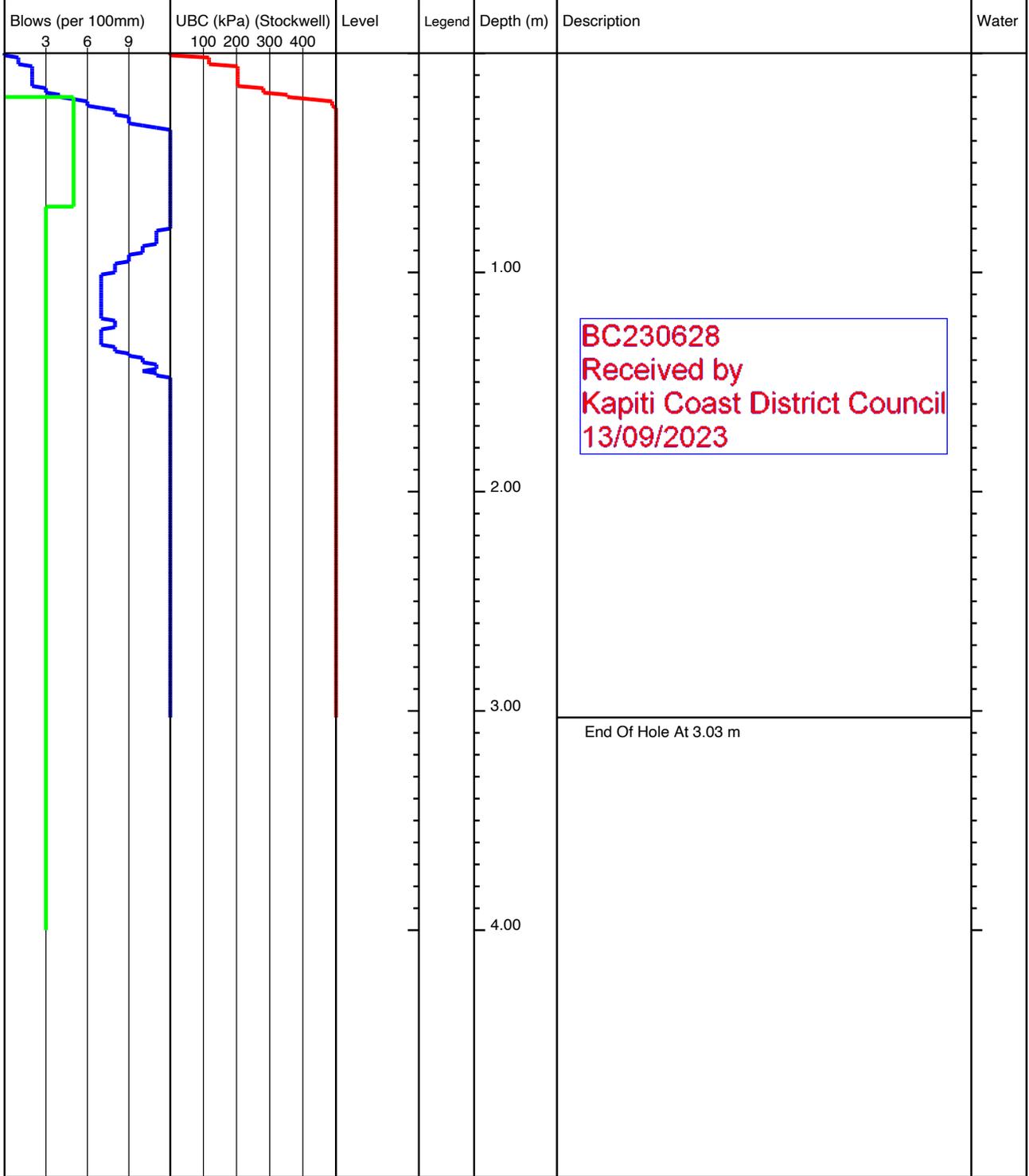
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot04-7
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869457	E Coord: 175.050022
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



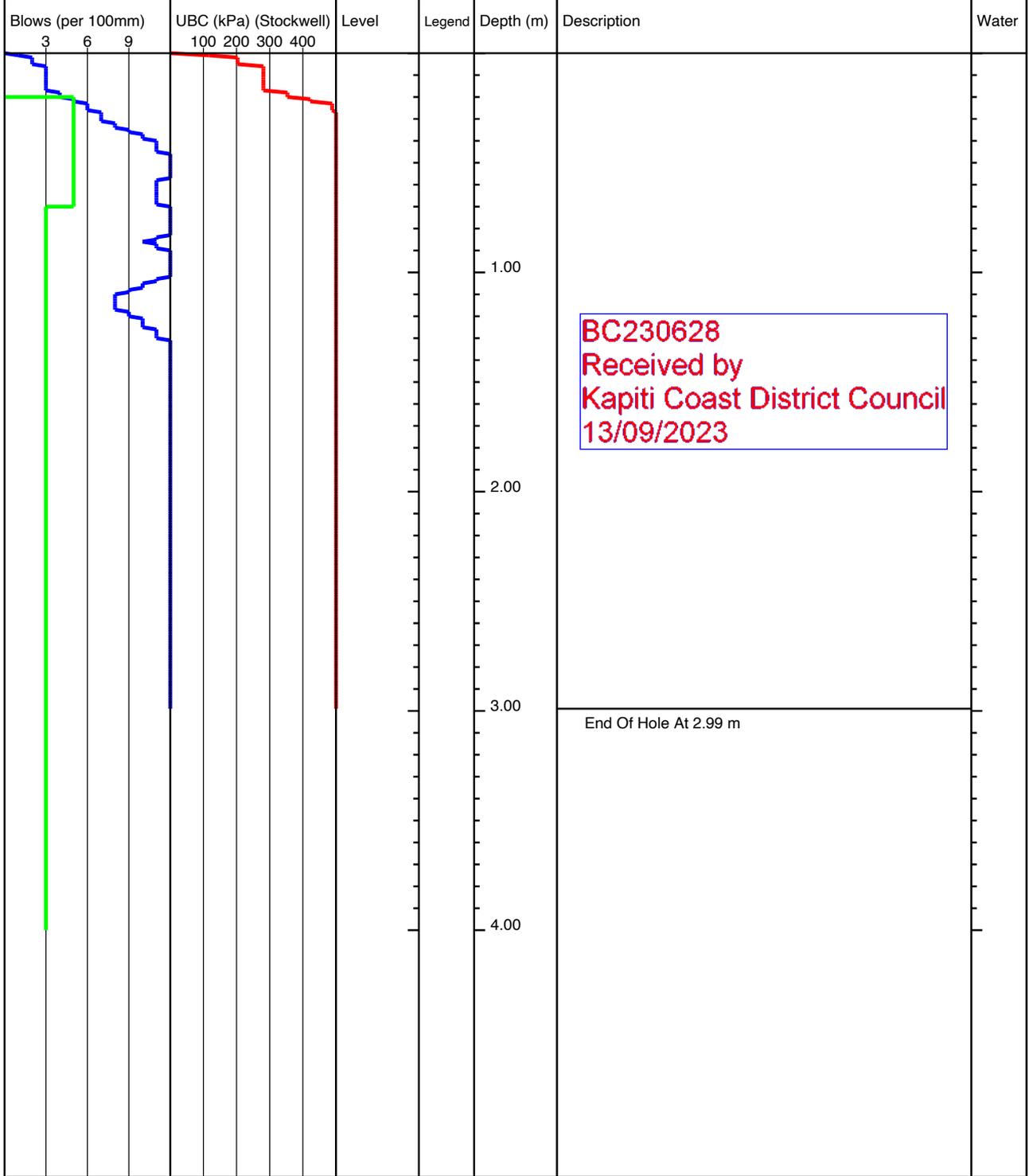
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot04-8
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869505	E Coord: 175.05005
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



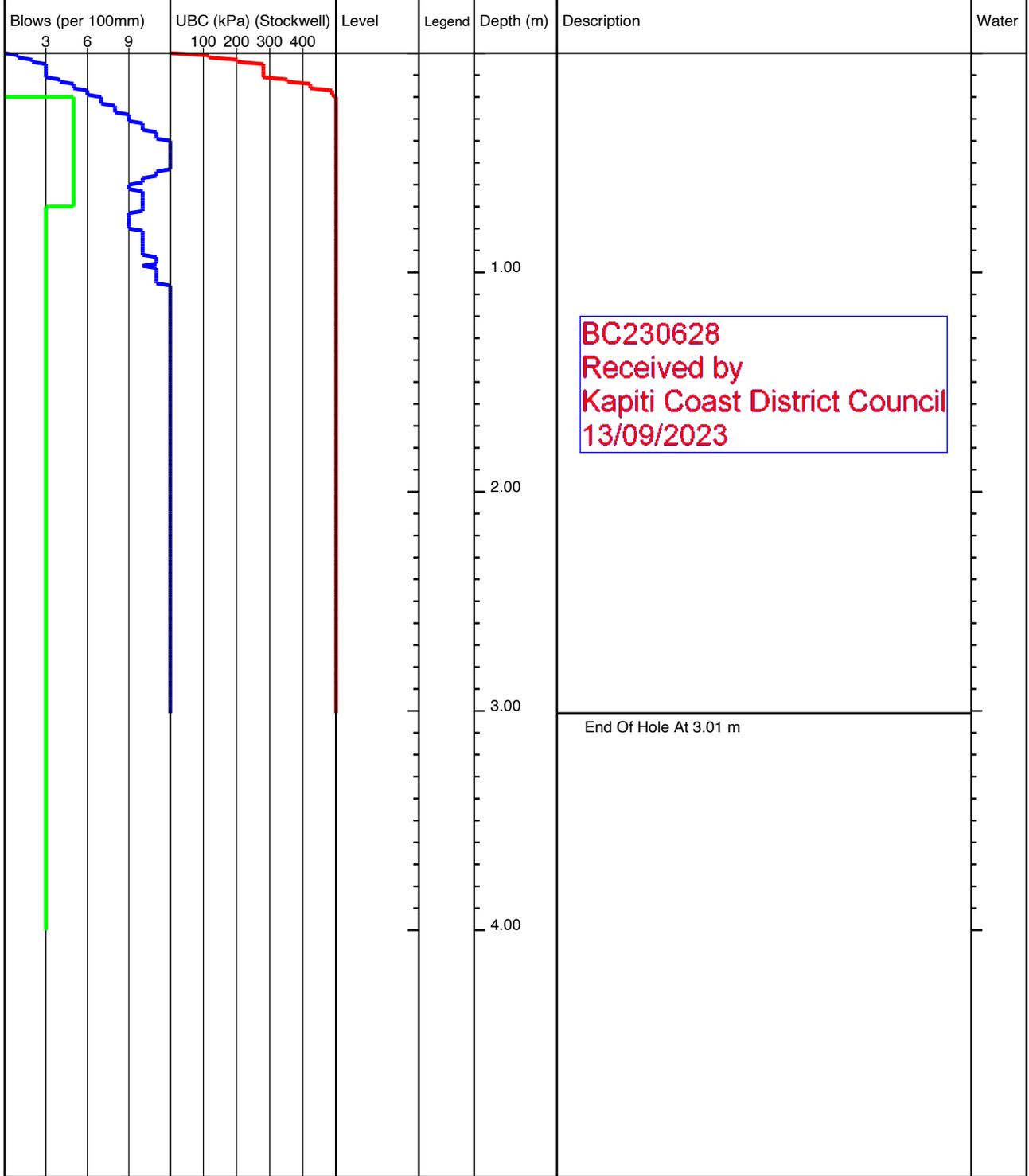
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot05-10
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869662	E Coord: 175.050183
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



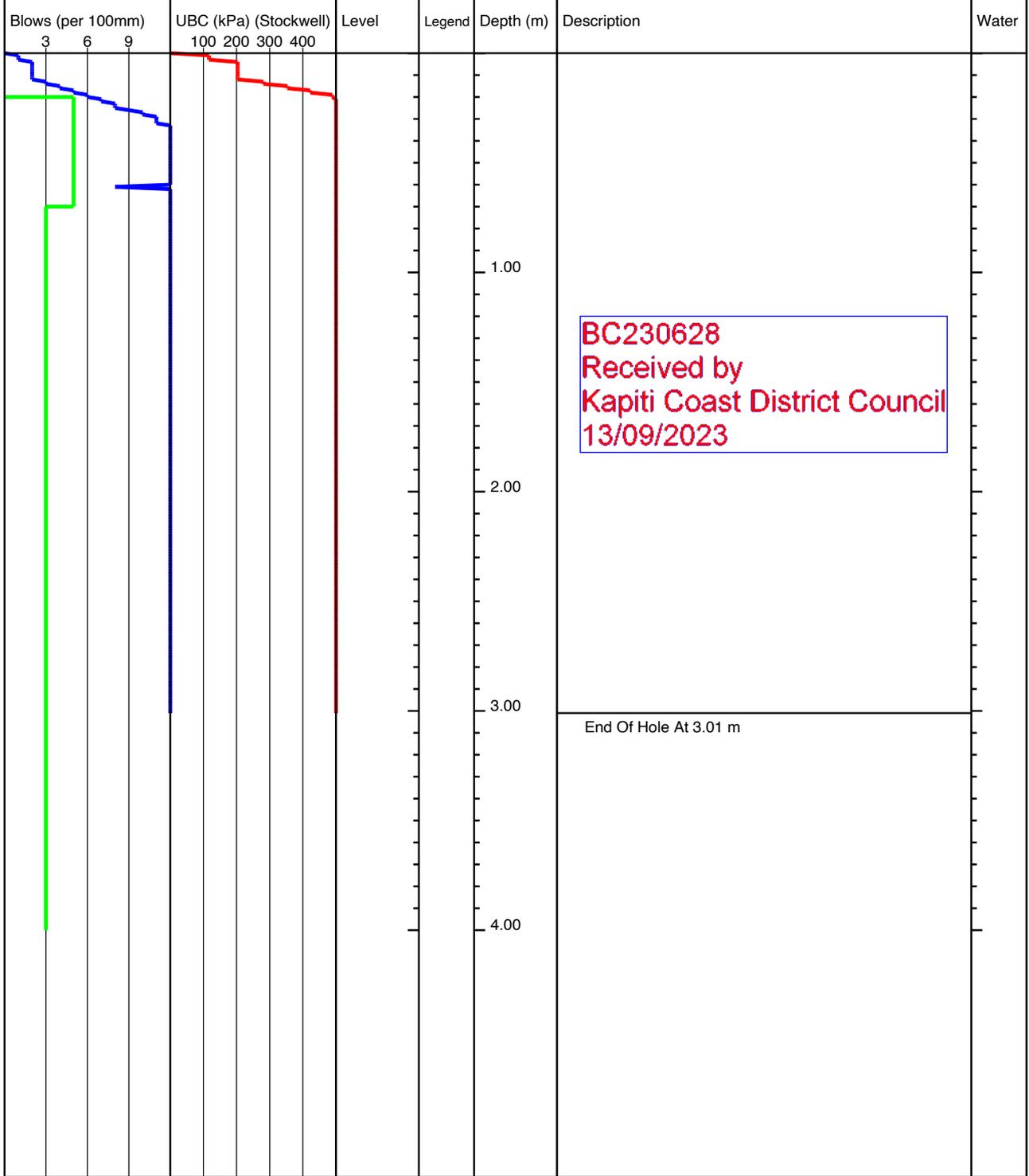
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot05-15
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869697	E Coord: 175.050173
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



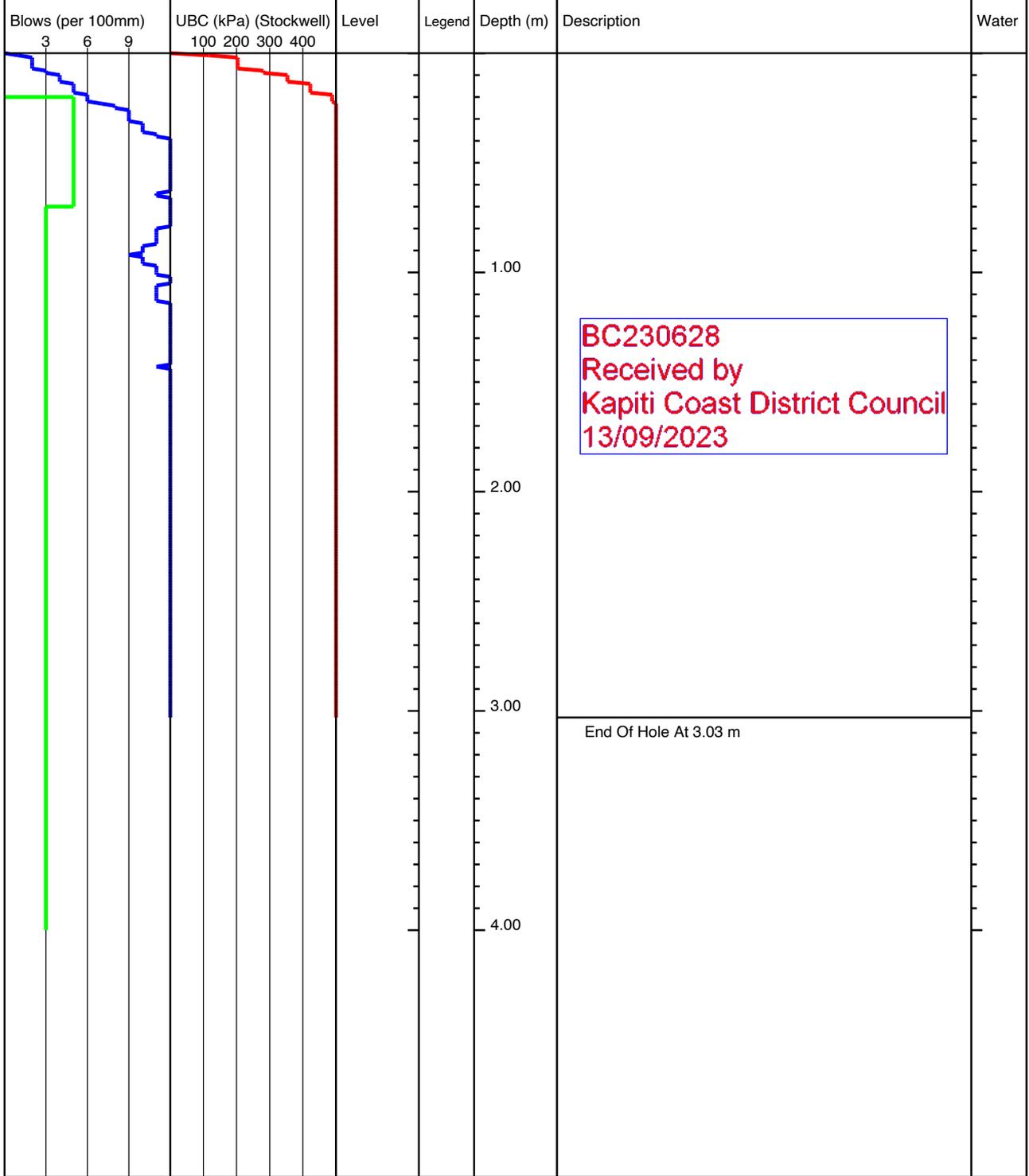
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot05-16
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869667	E Coord: 175.050095
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



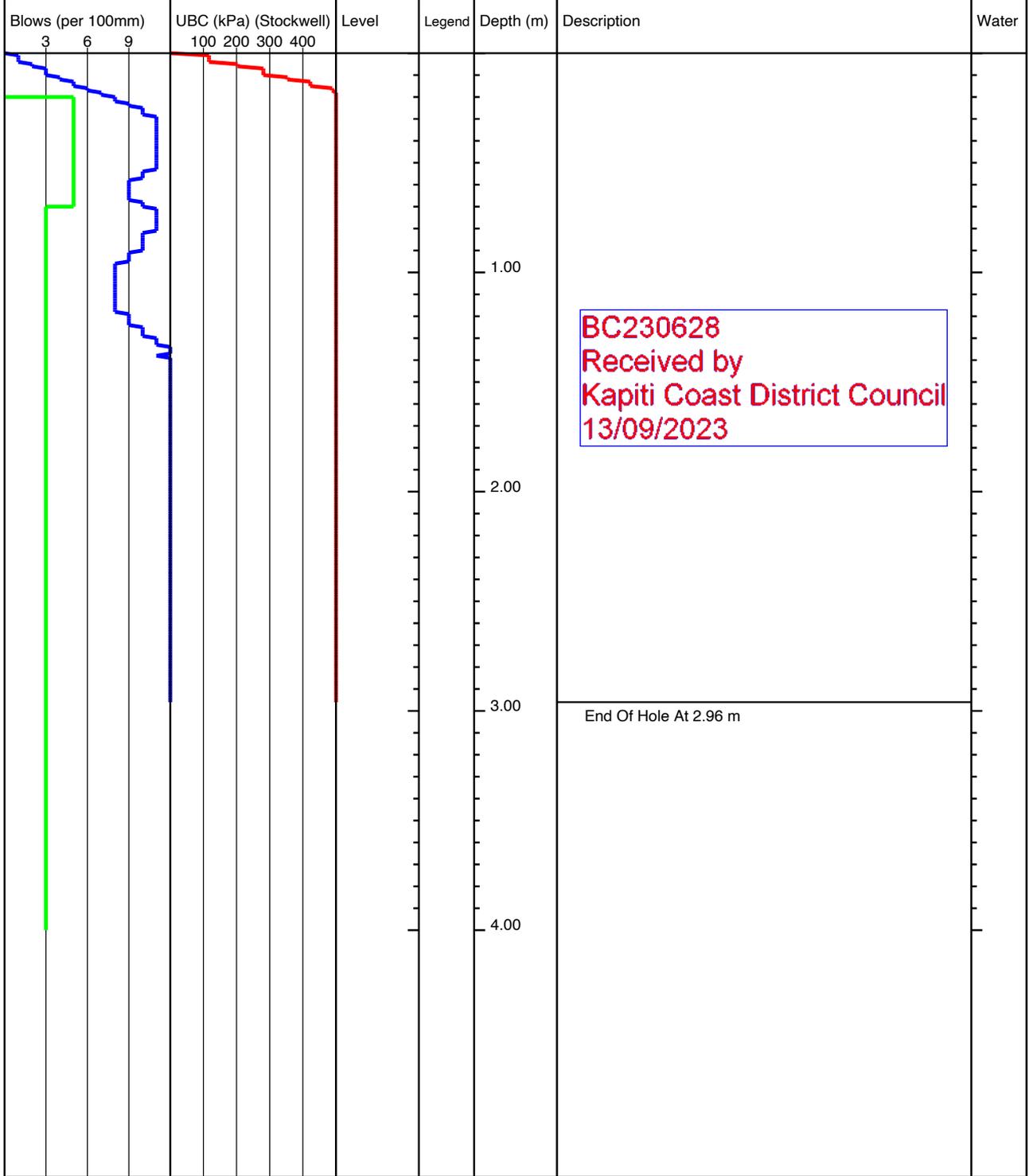
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot05-9
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869597	E Coord: 175.050103
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



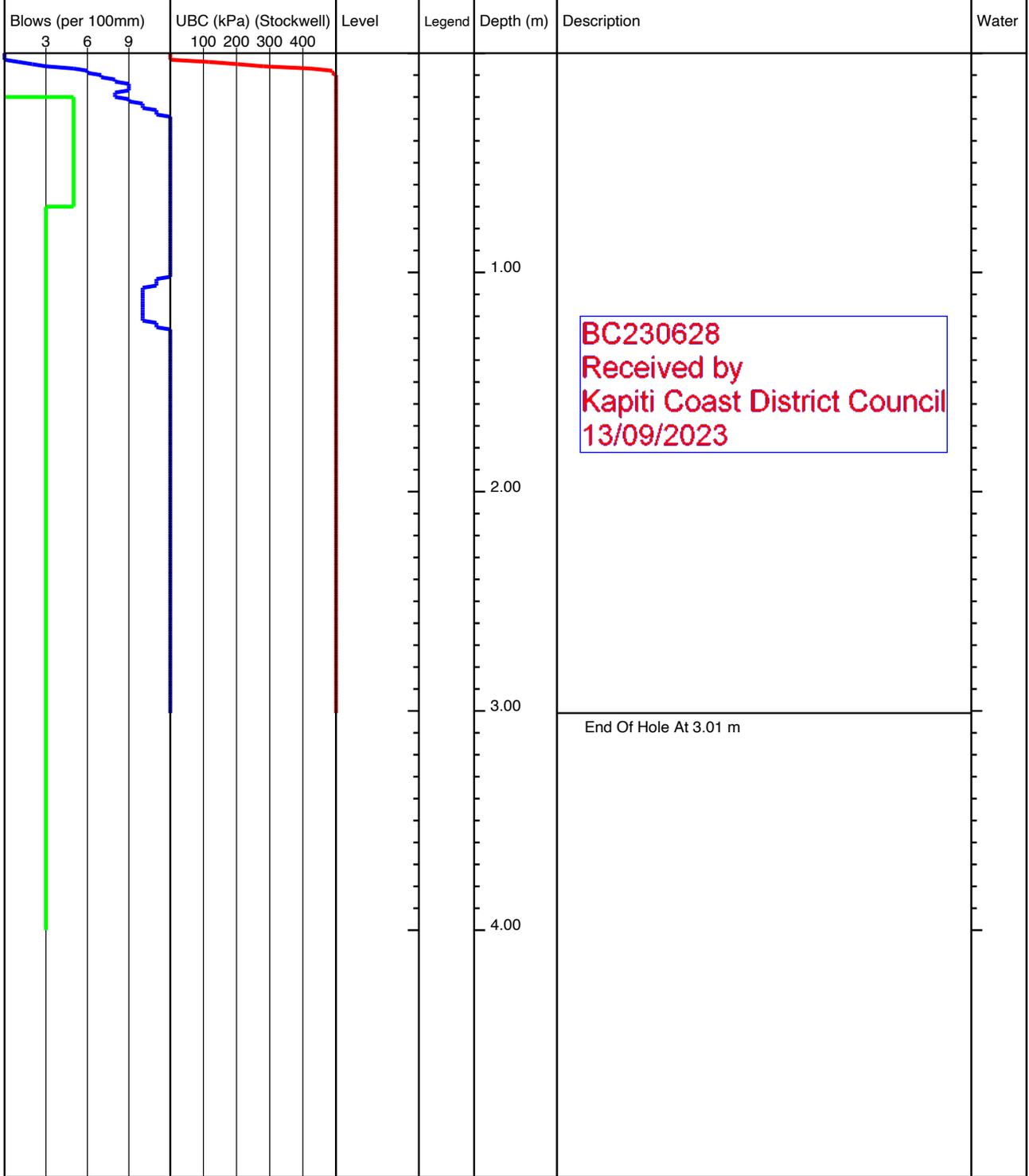
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot06-11
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869732	E Coord: 175.0503
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



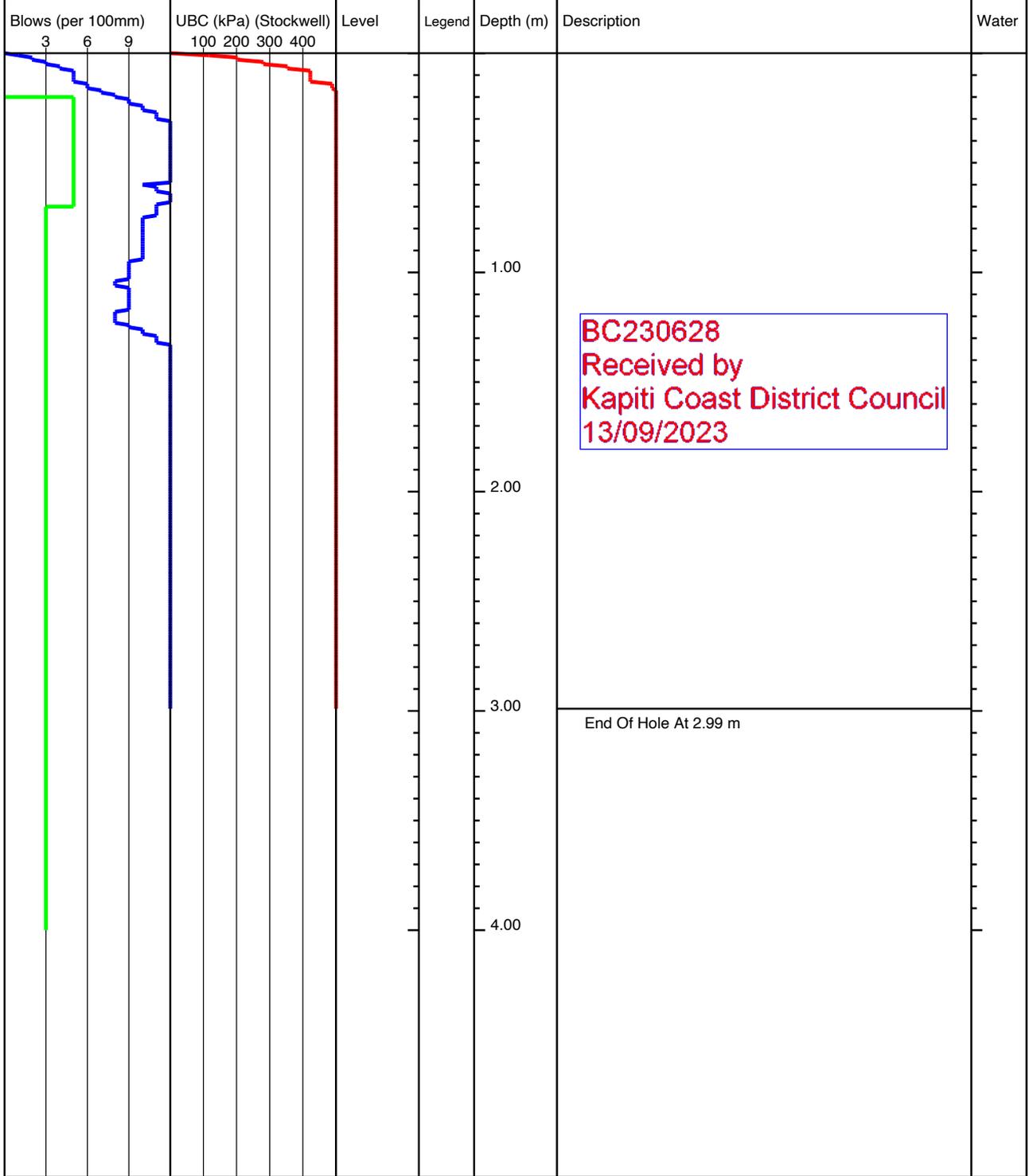
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot06-12
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869847	E Coord: 175.050423
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



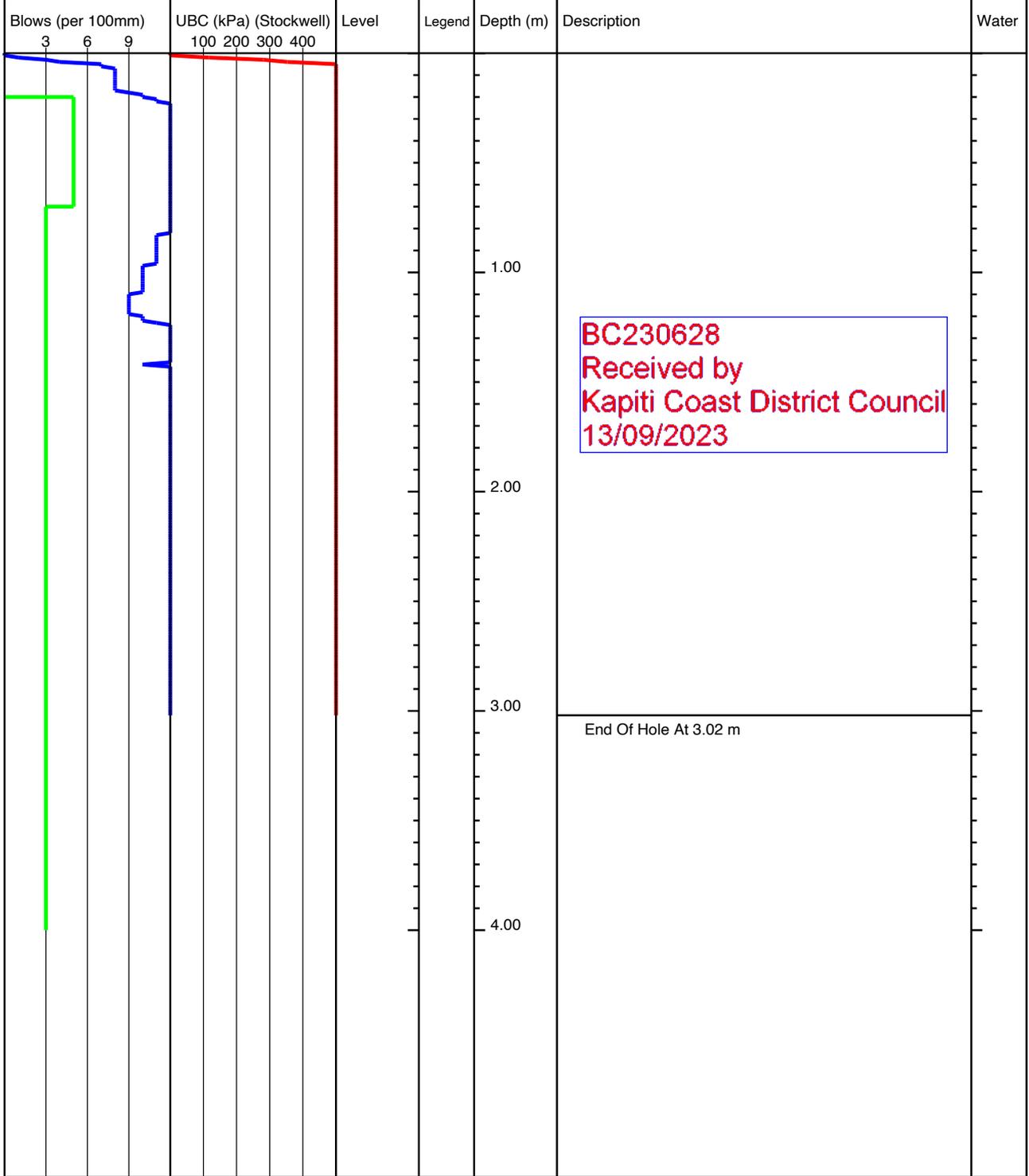
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot06-13
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869877	E Coord: 175.050388
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



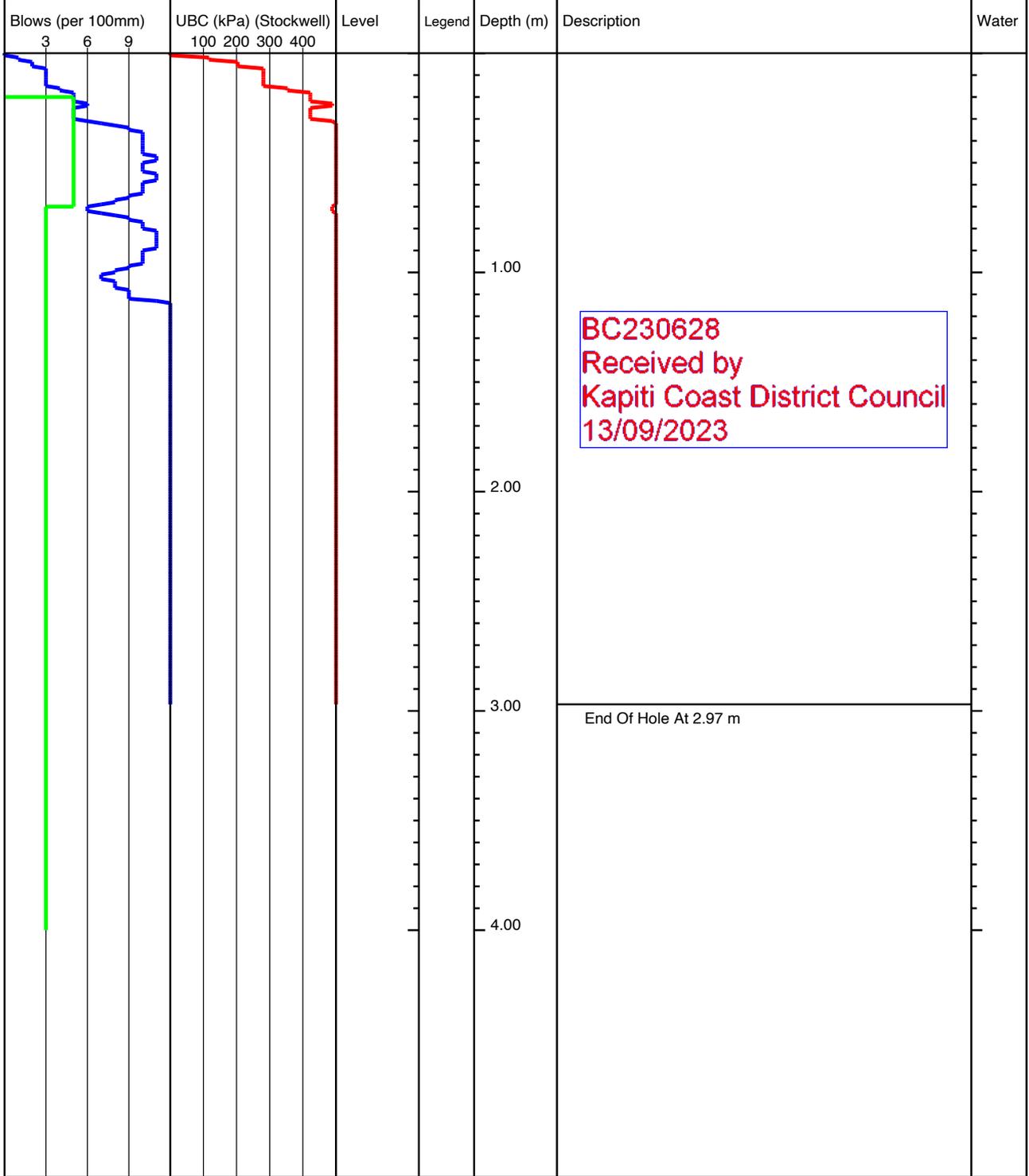
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot06-14
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86981	E Coord: 175.05026
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



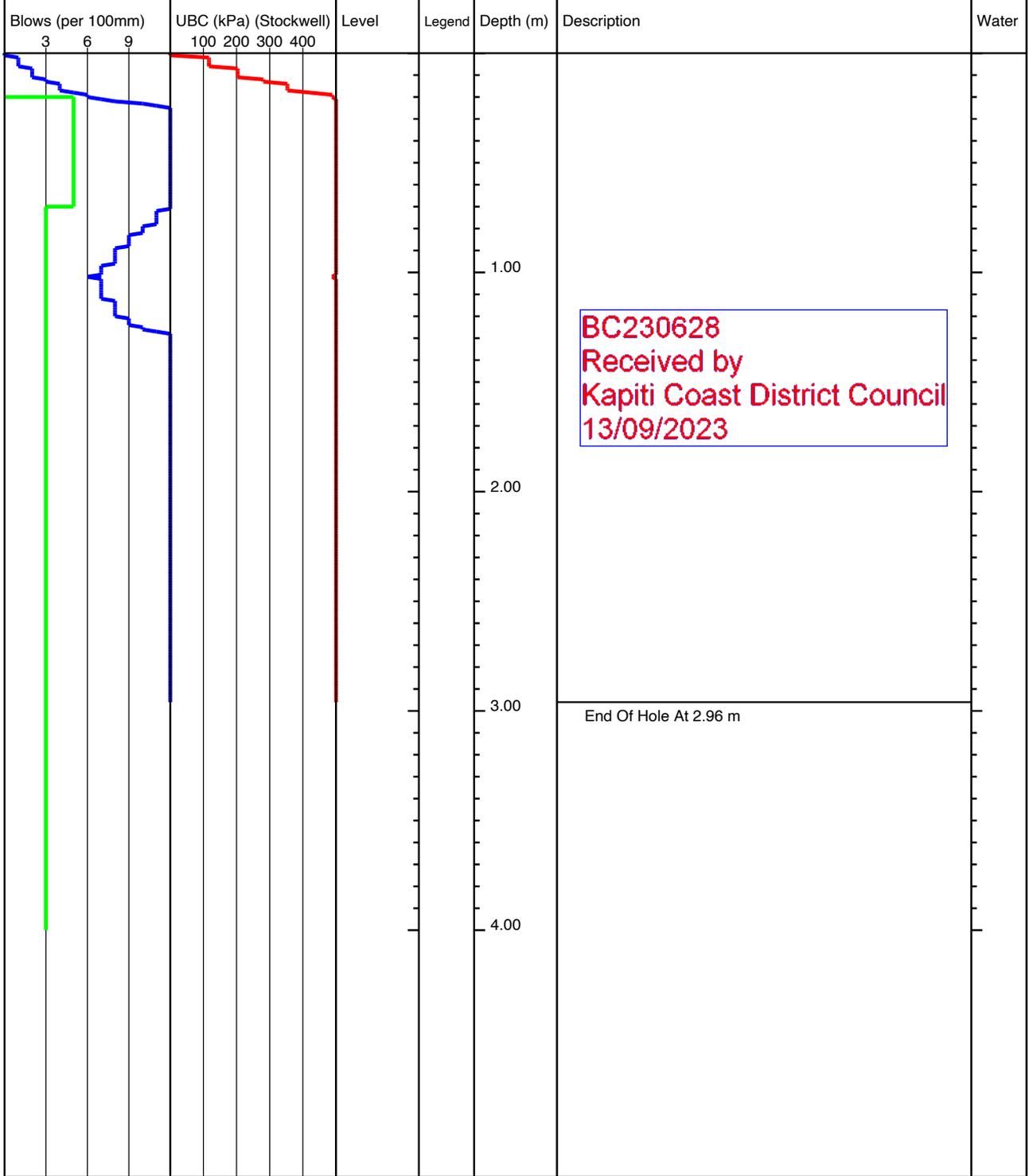
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot07-61
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86984	E Coord: 175.049762
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



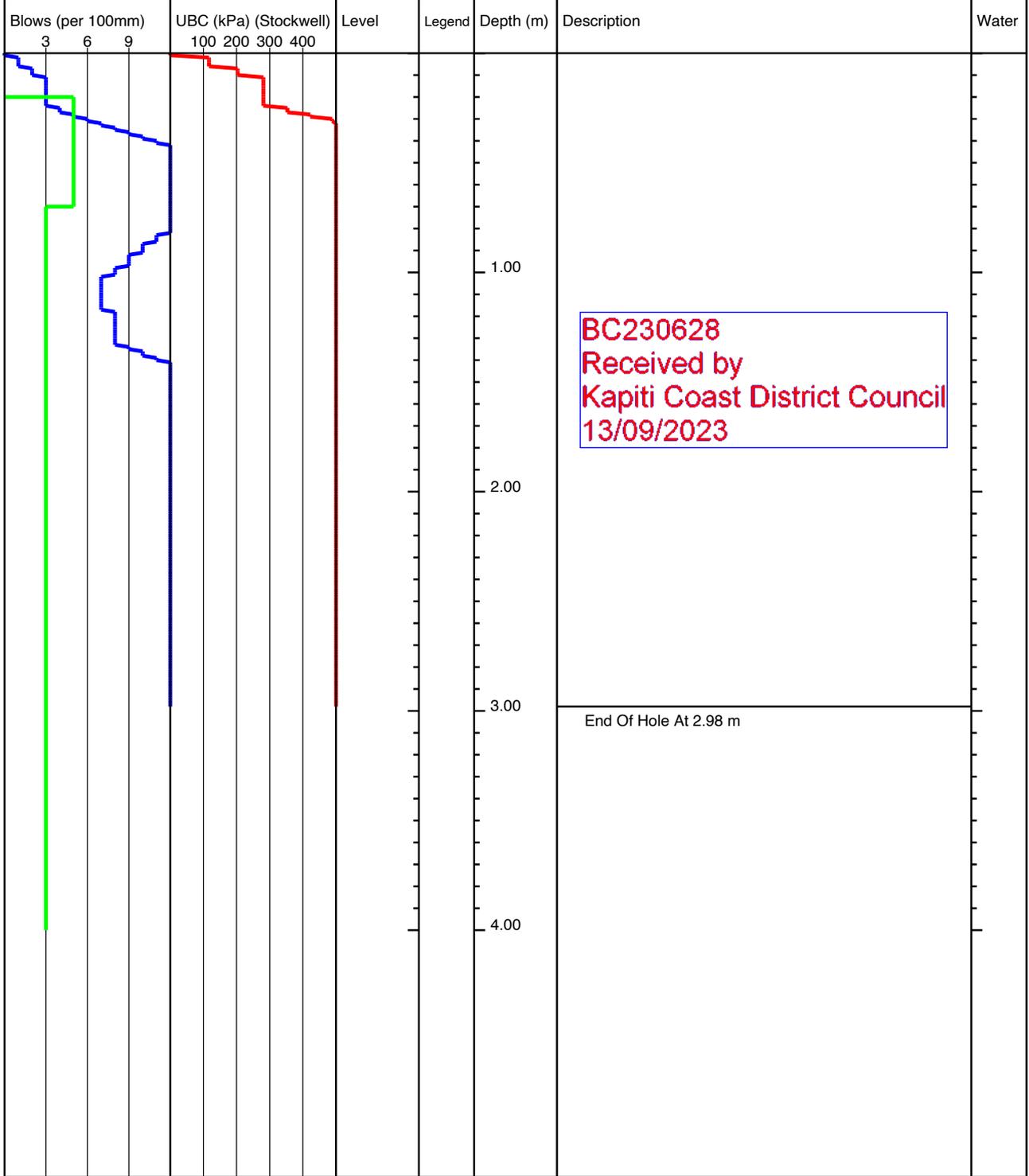
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot07-62
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869997	E Coord: 175.049648
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



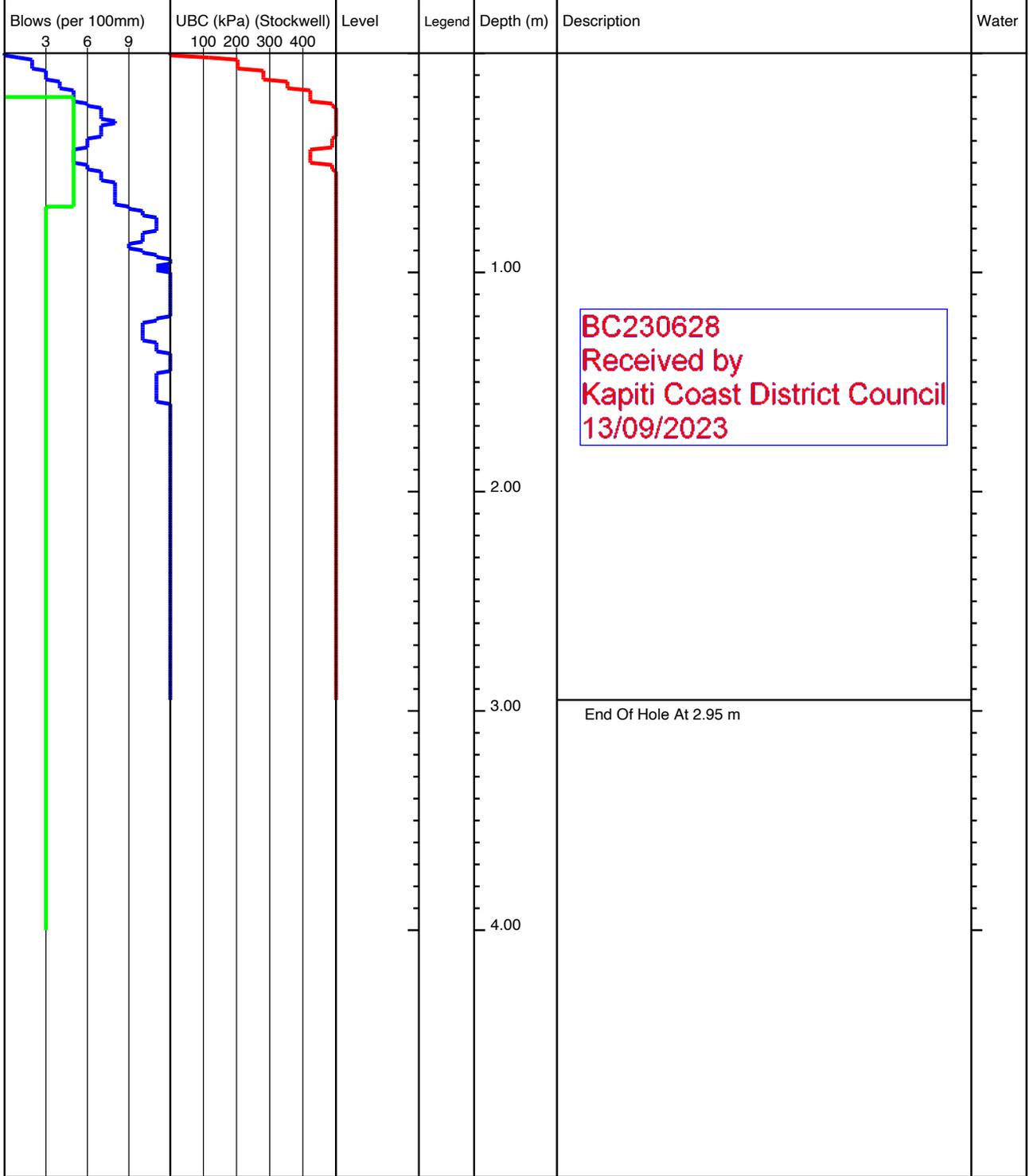
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot07-67
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870073	E Coord: 175.049768
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



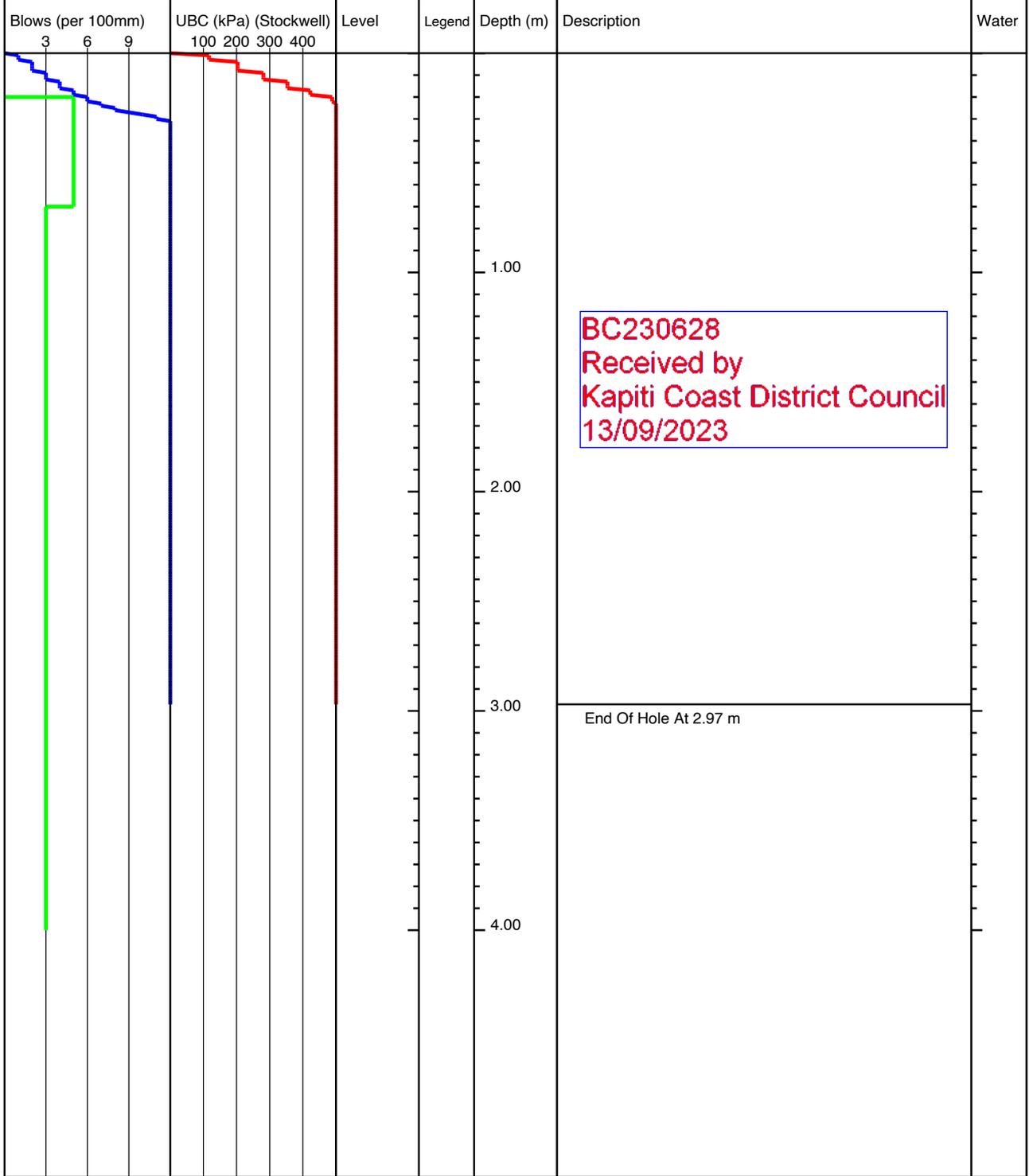
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot07-68
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869925	E Coord: 175.049862
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



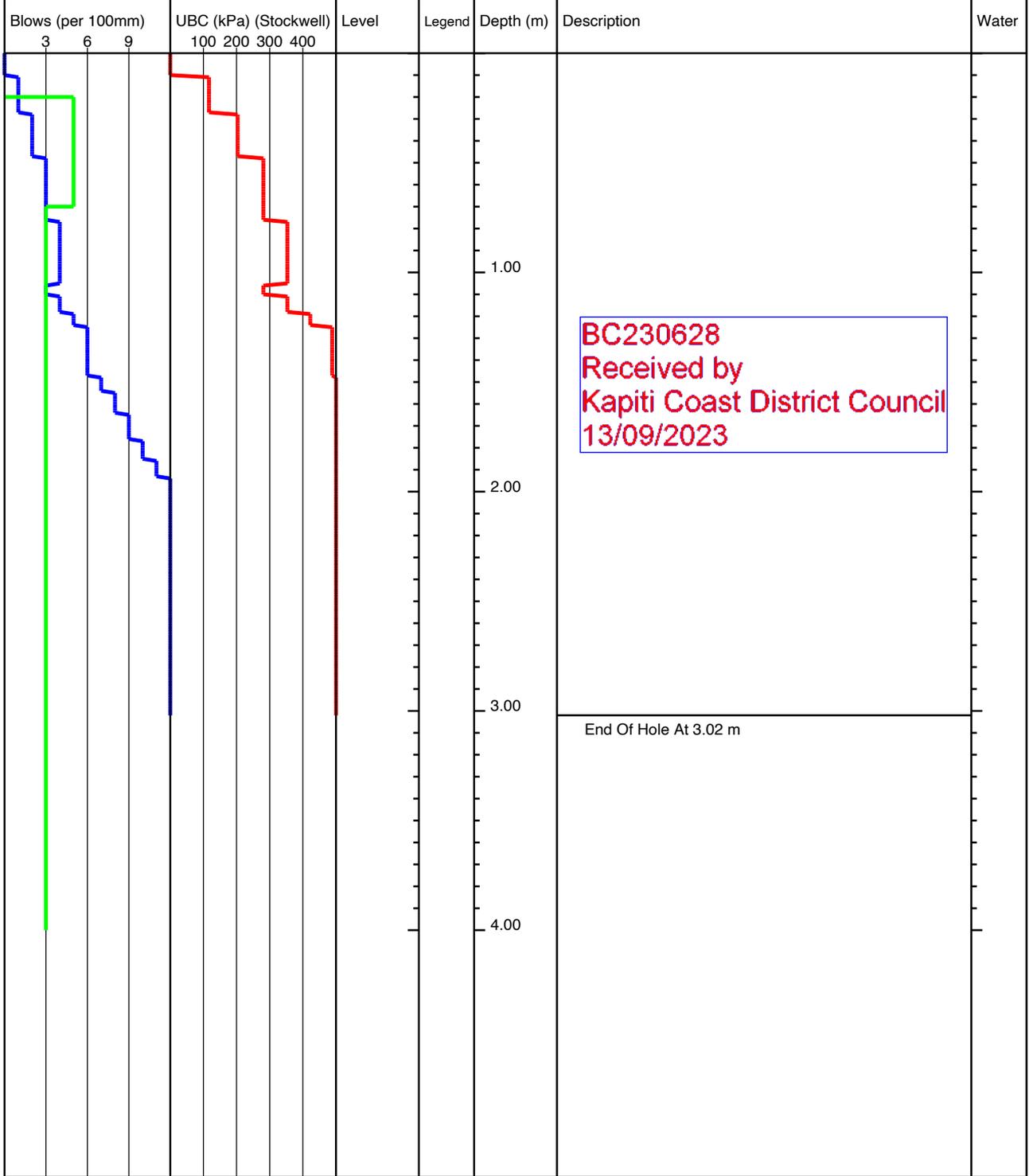
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot07-69
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869935	E Coord: 175.049722
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



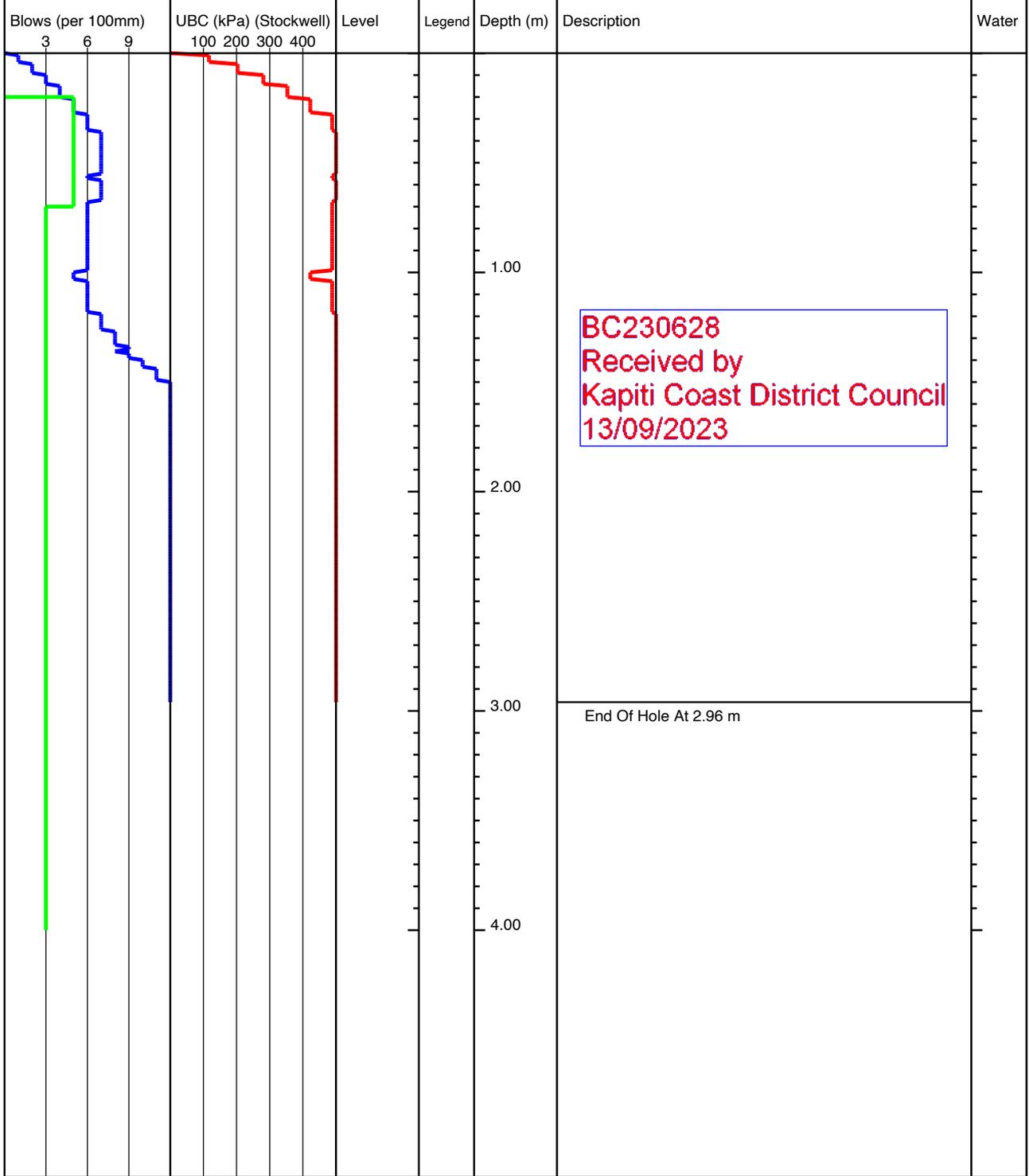
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot08-23
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869055	E Coord: 175.049547
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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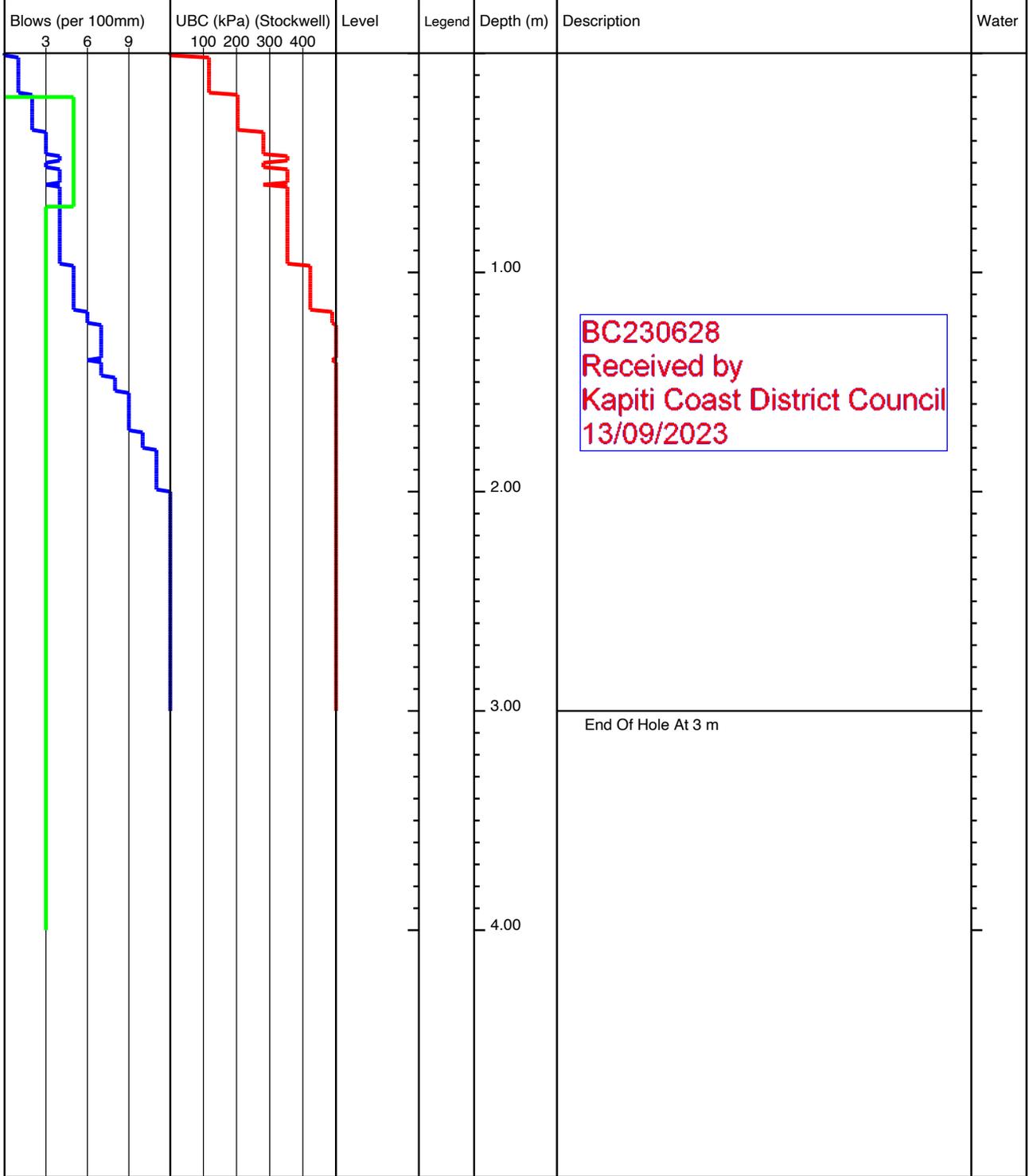
	Project Title: 110 Ngarara Rd, Waikanae		lot08-24
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869062	E Coord: 175.049495
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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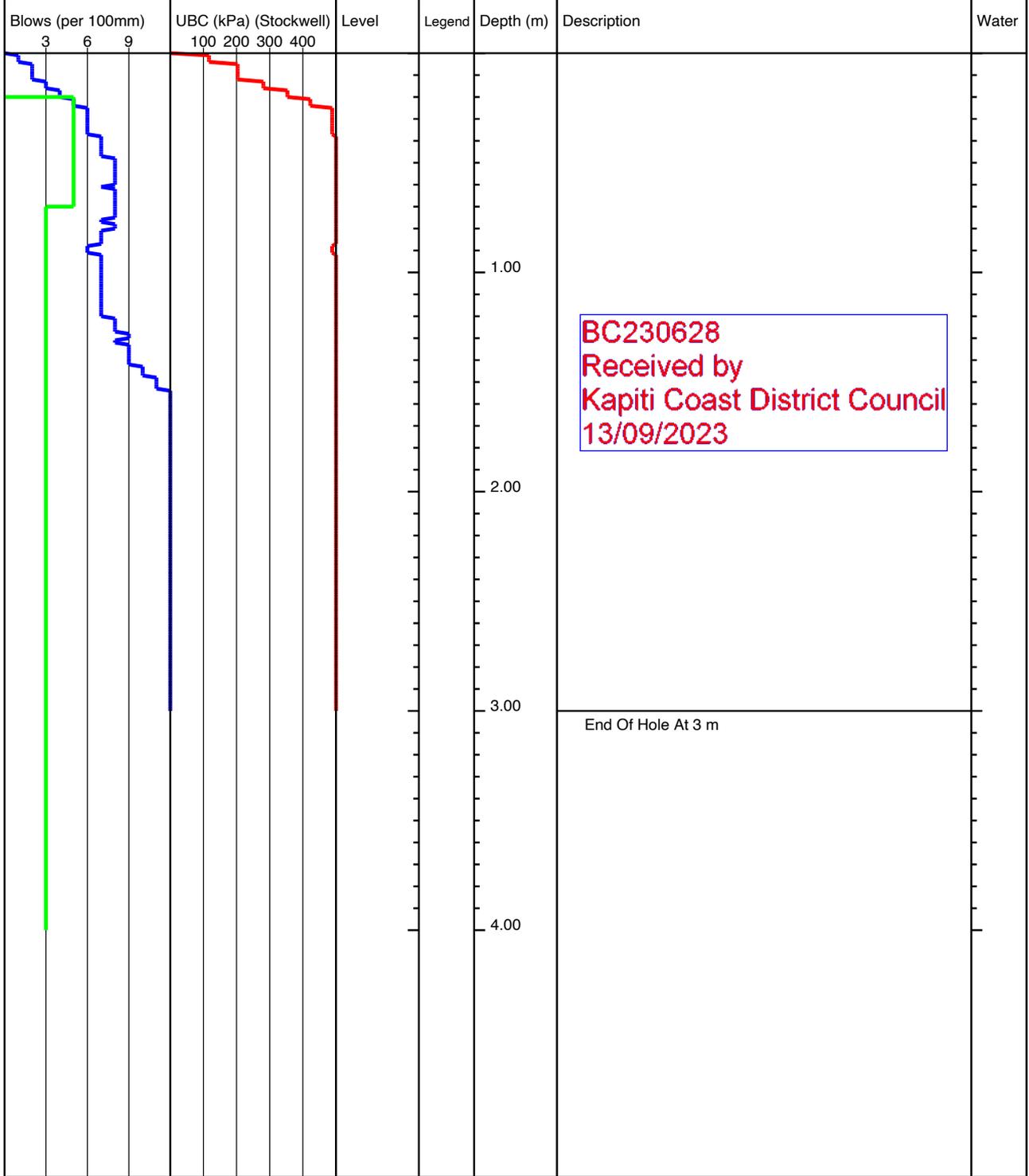


	Project Title: 110 Ngarara Rd, Waikanae		lot08-38
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869168	E Coord: 175.04939
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



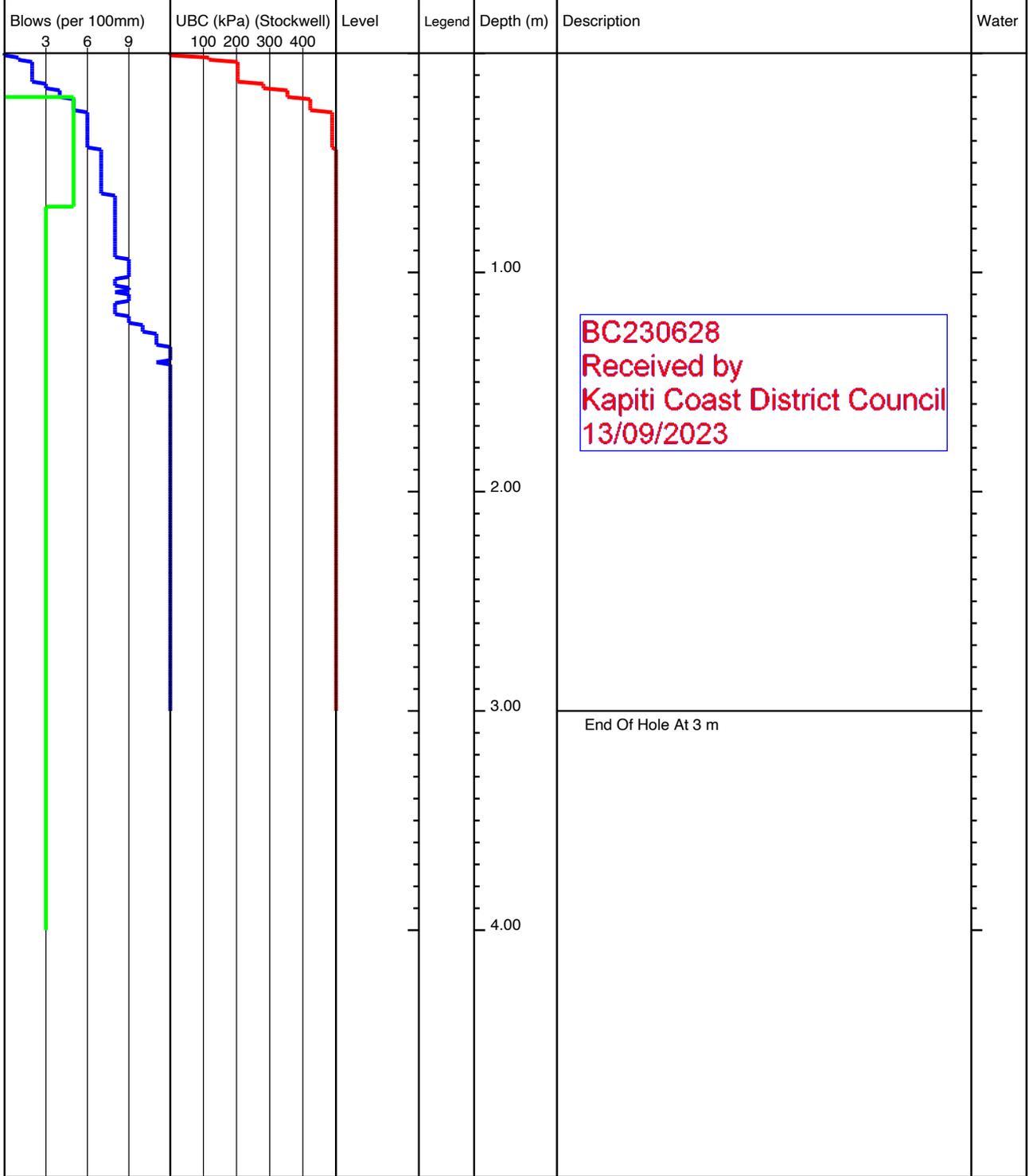
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot09-26
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869195	E Coord: 175.049208
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



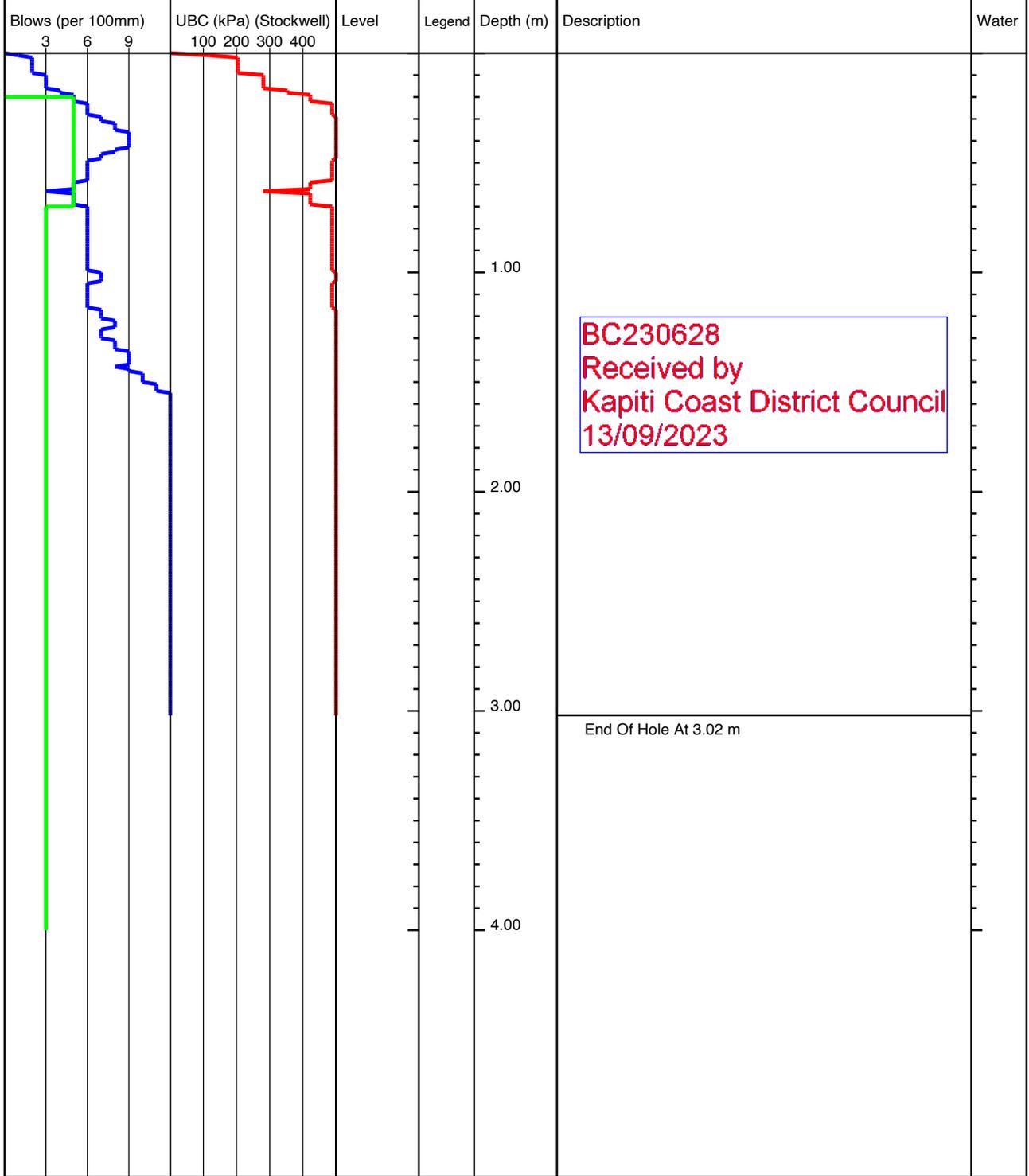
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot09-27
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869258	E Coord: 175.049177
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



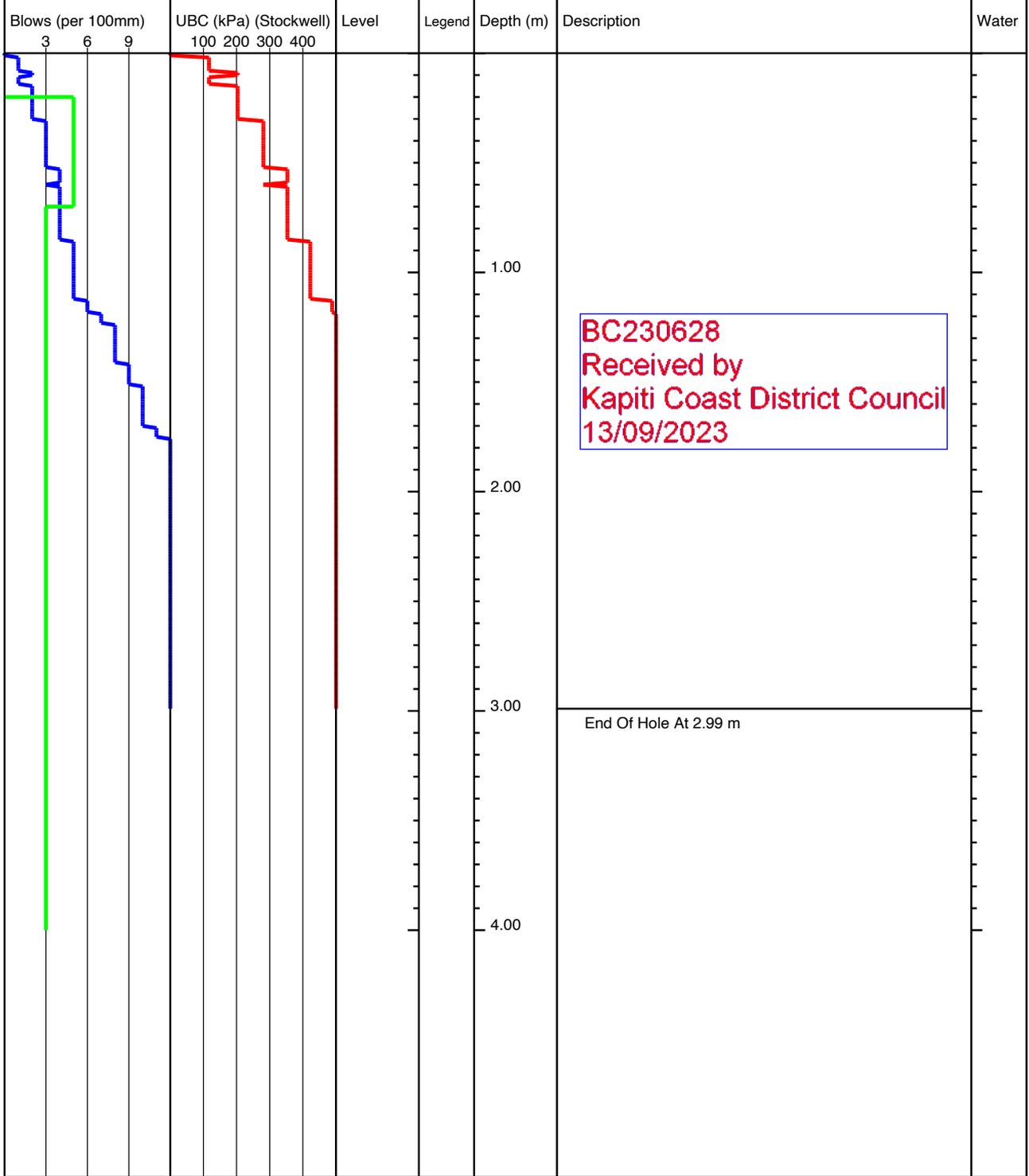
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot09-36
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869352	E Coord: 175.049337
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



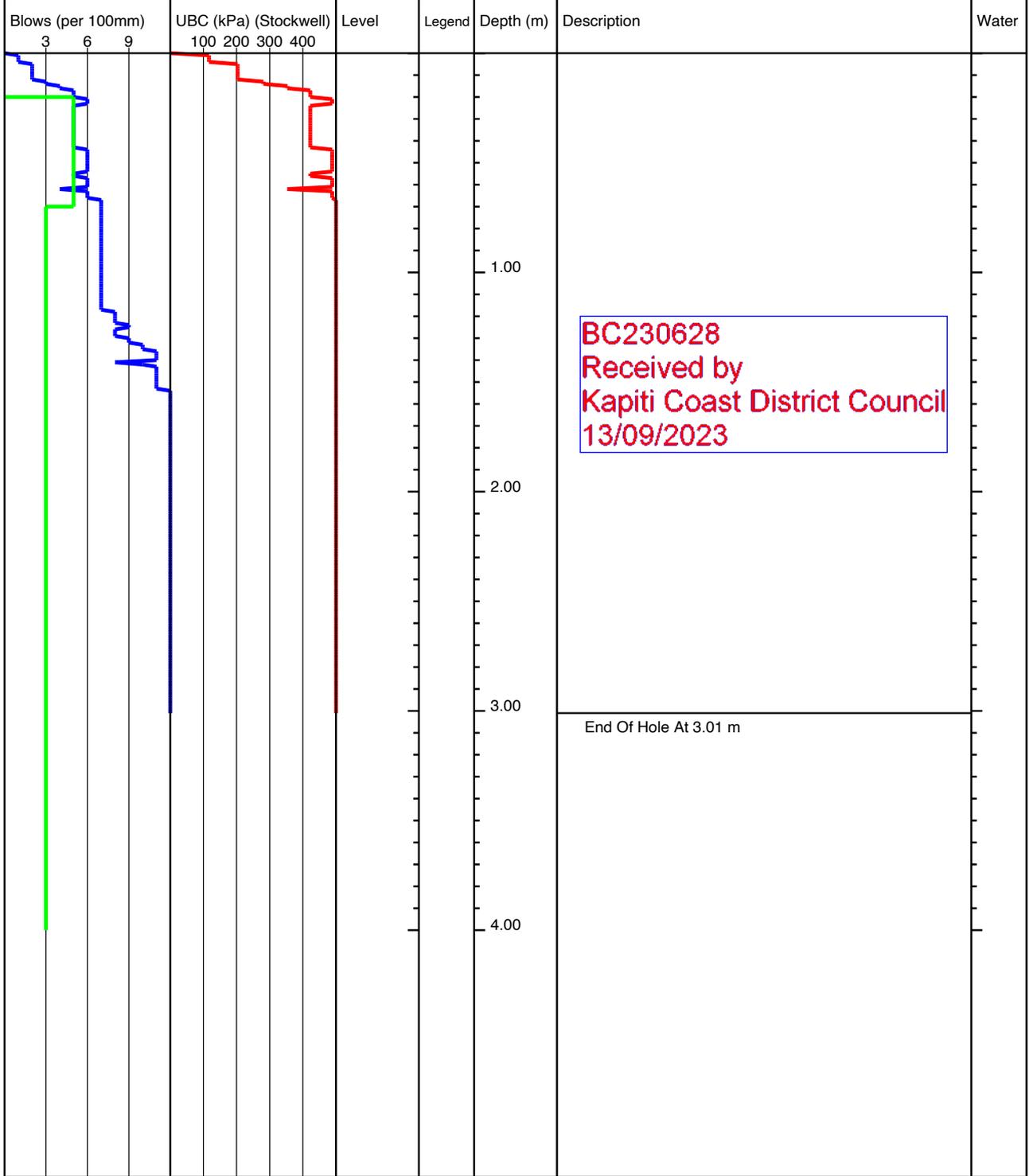
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot09-37
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86924	E Coord: 175.049357
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



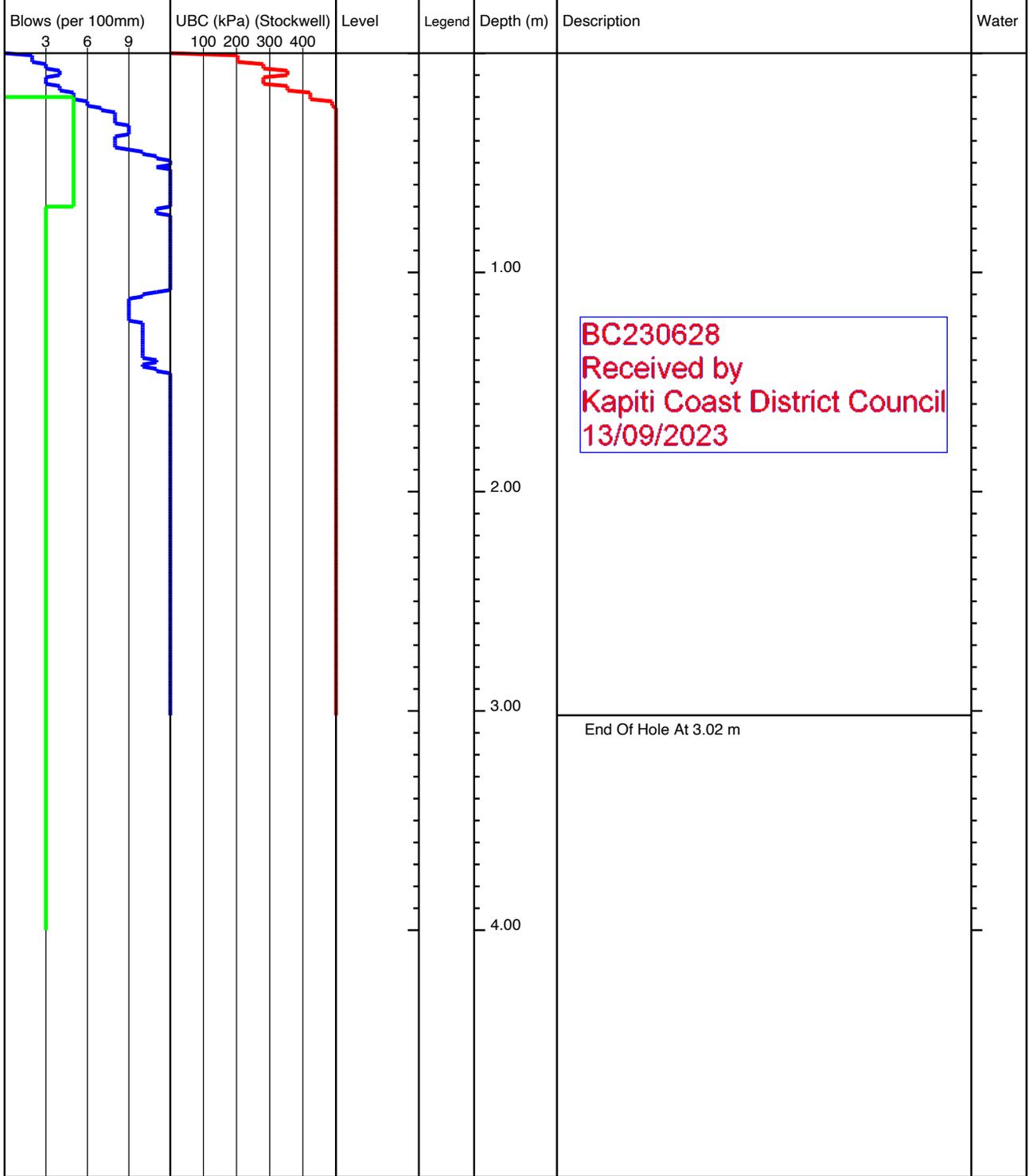
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot10-41
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869427	E Coord: 175.049433
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



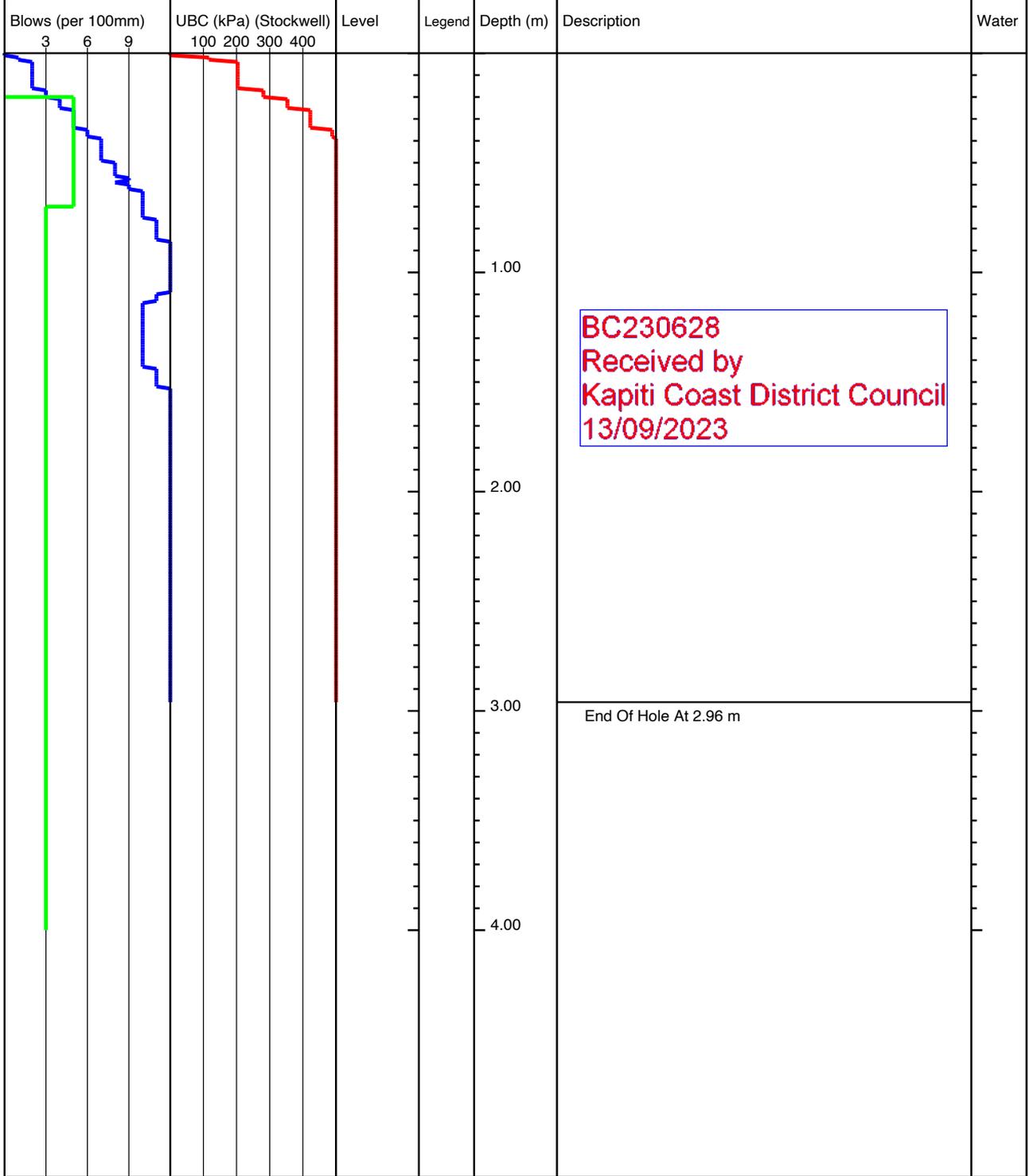
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot10-42
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86944	E Coord: 175.049393
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



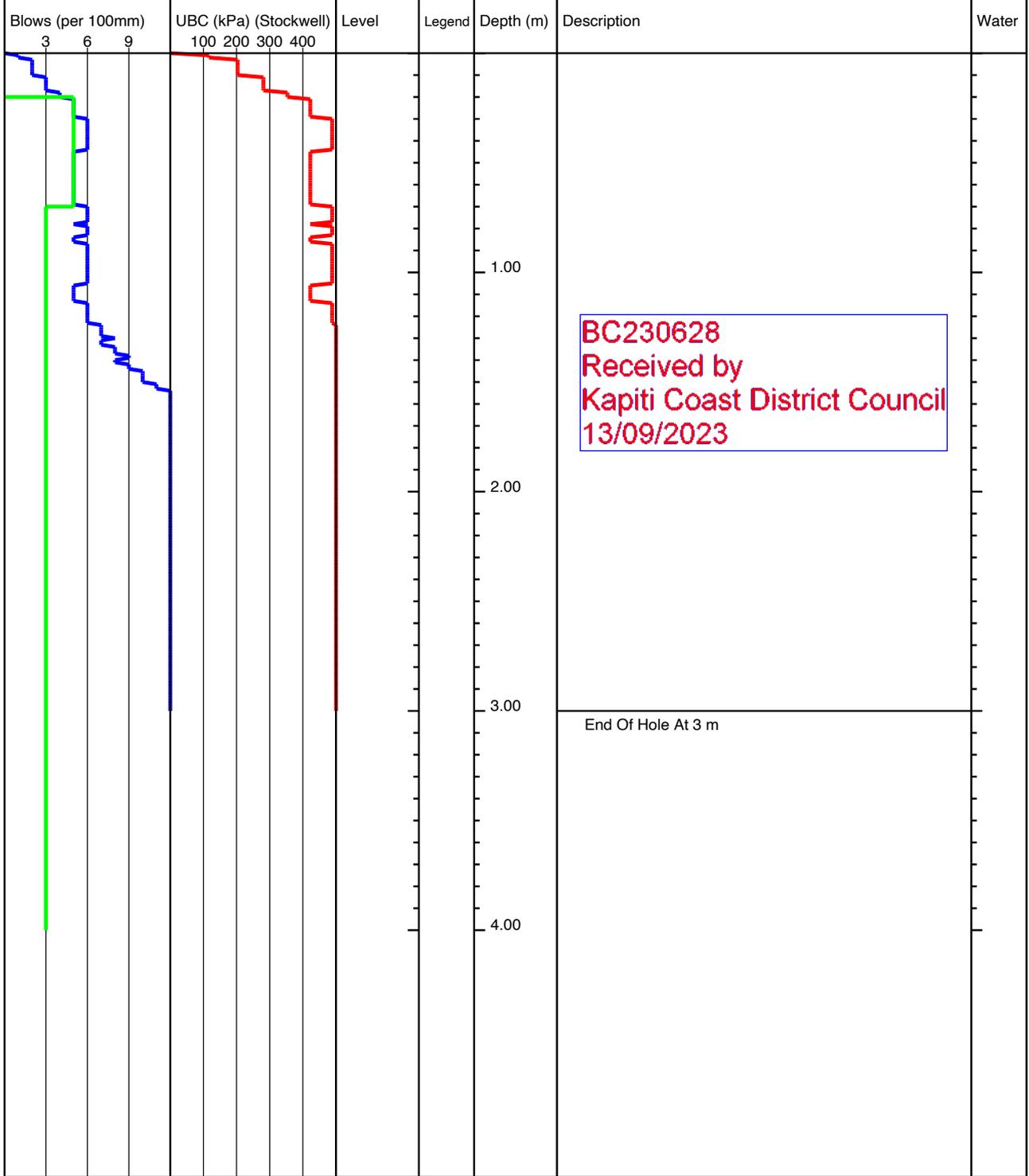
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot10-43
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869487	E Coord: 175.049375
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



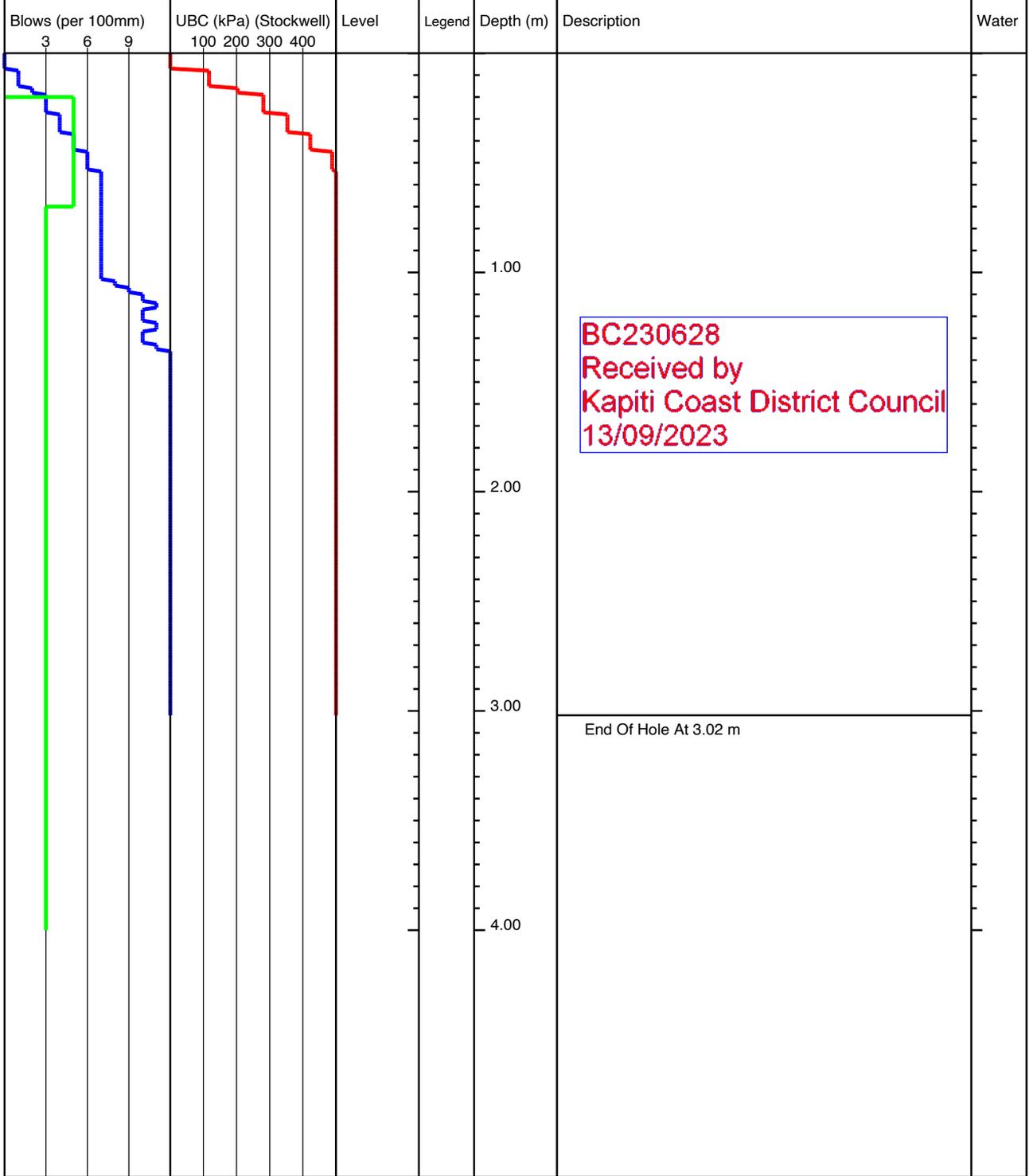
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot10-44
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869582	E Coord: 175.049483
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



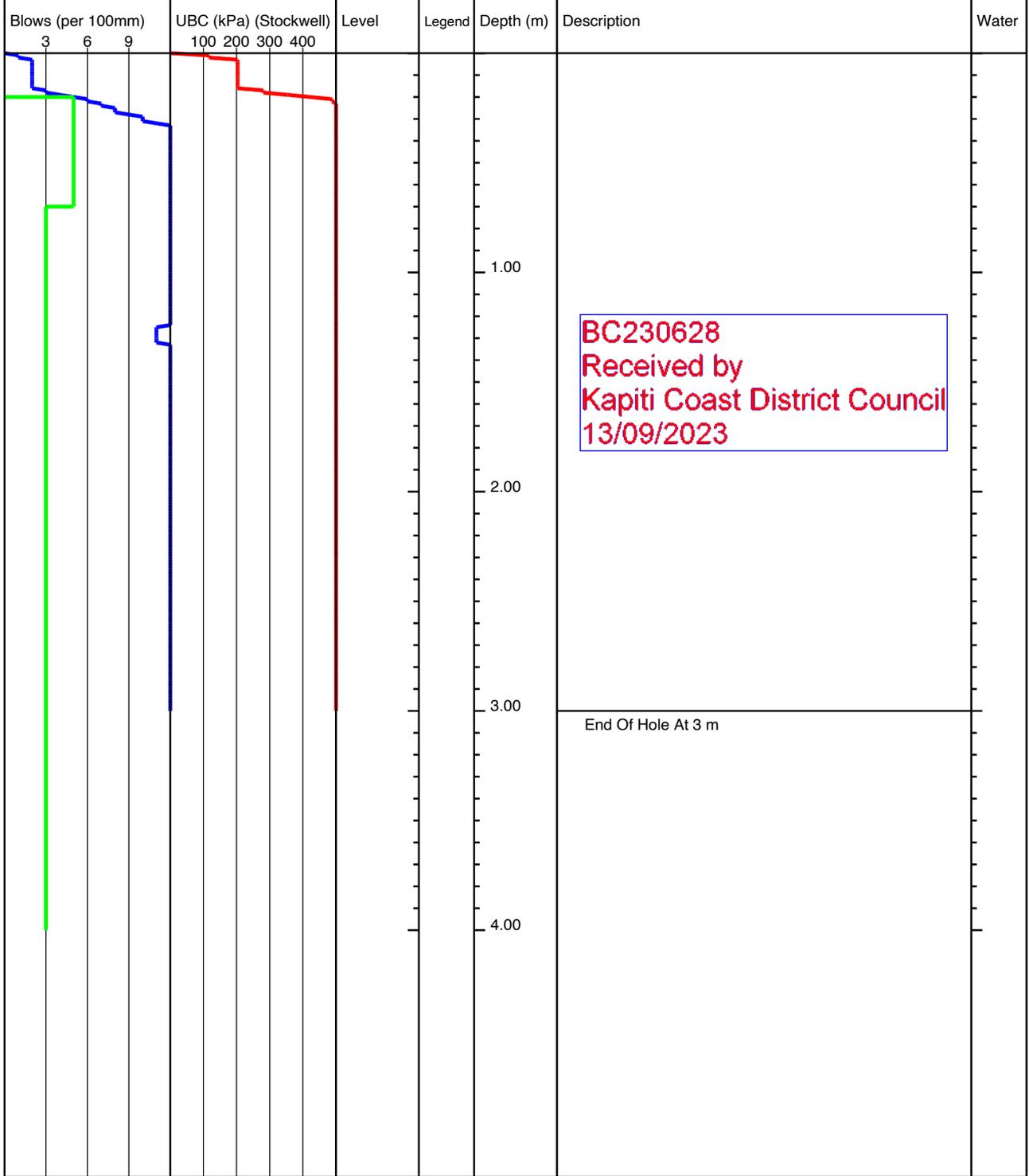
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot10-54
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869642	E Coord: 175.049795
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



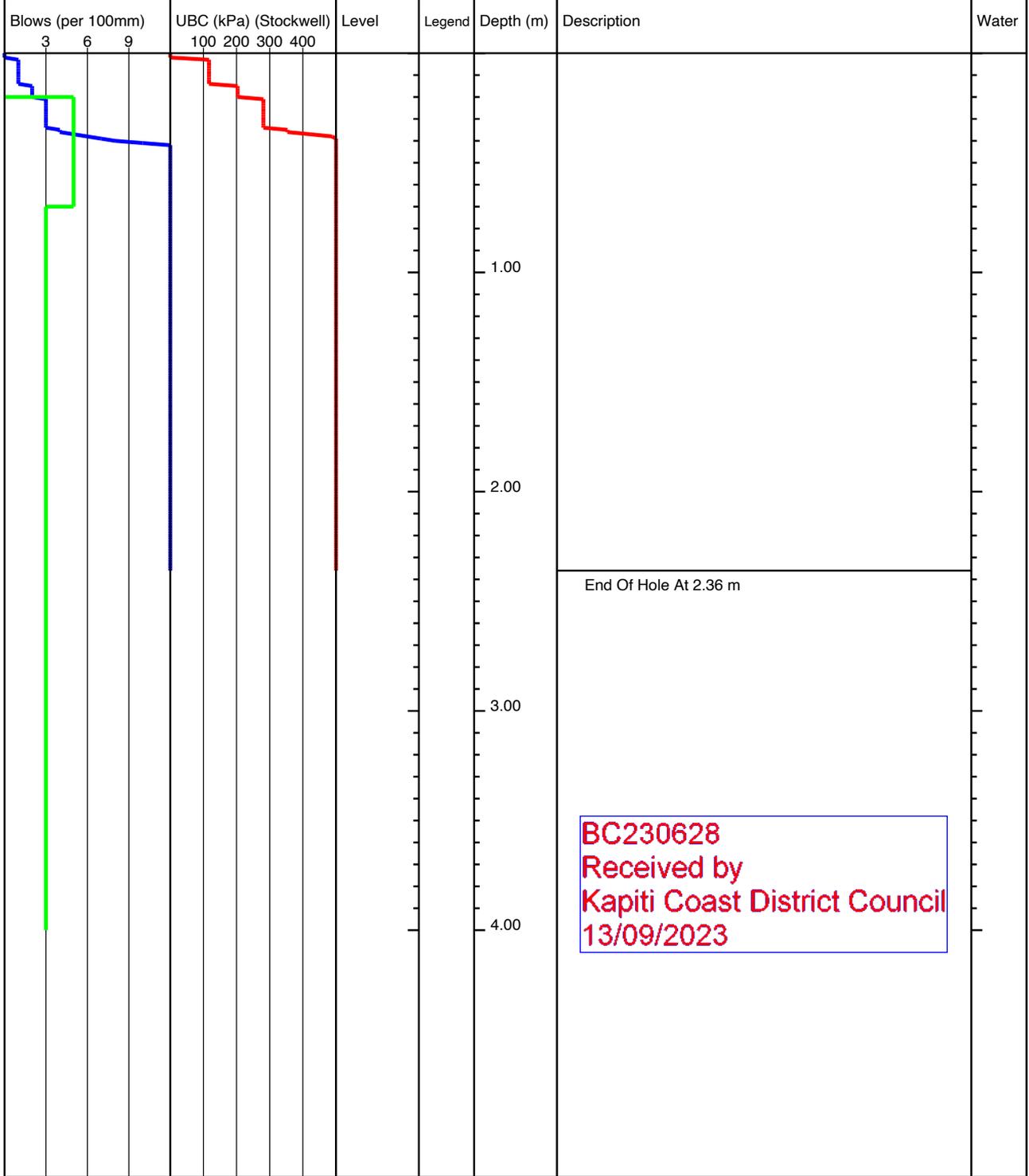
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot11-28
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869383	E Coord: 175.049105
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



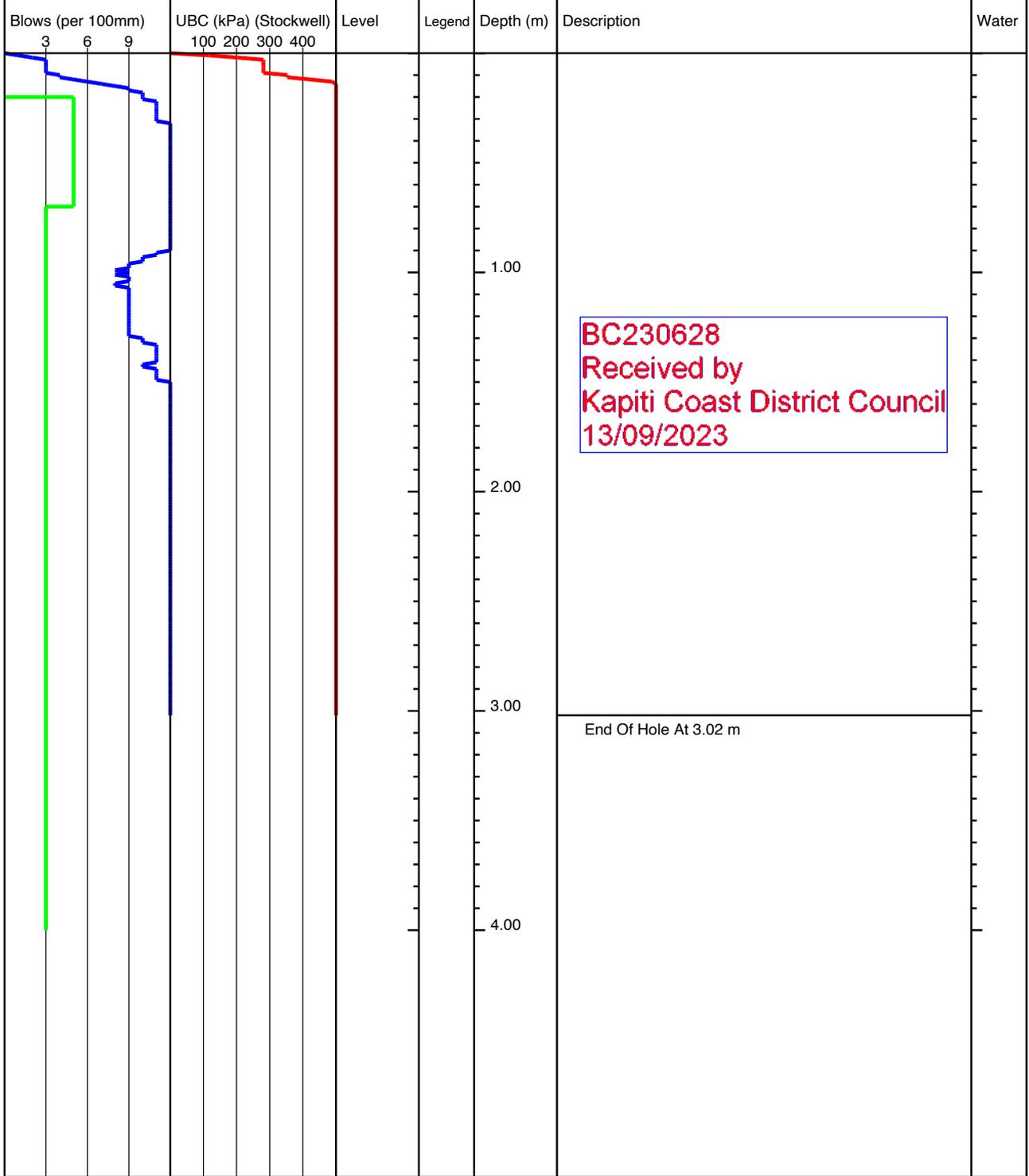
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot11-29
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869428	E Coord: 175.049067
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



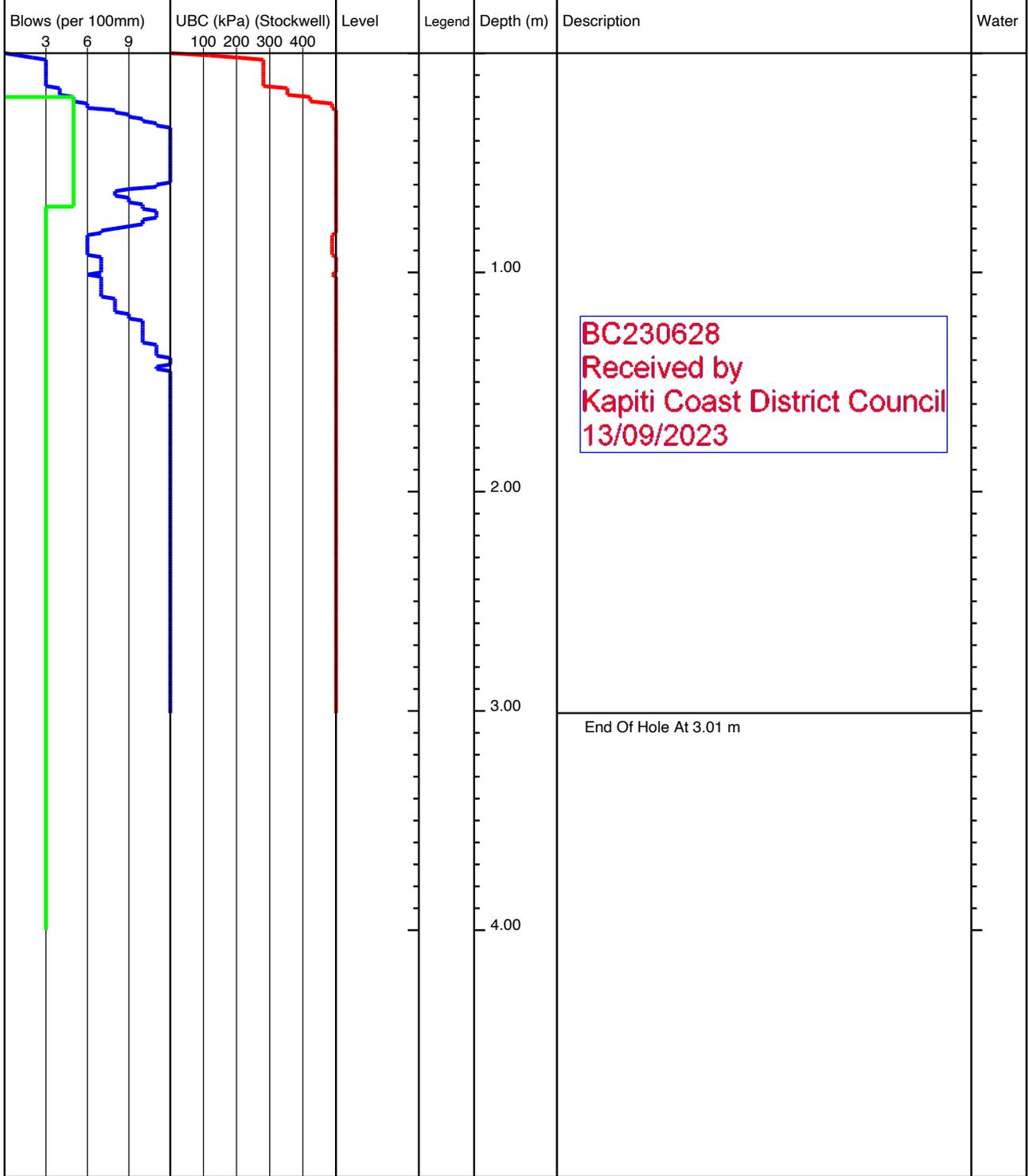
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot11-34
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869562	E Coord: 175.049248
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

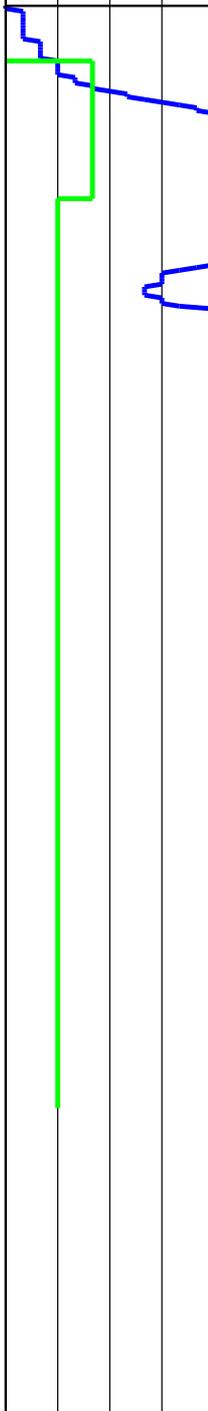
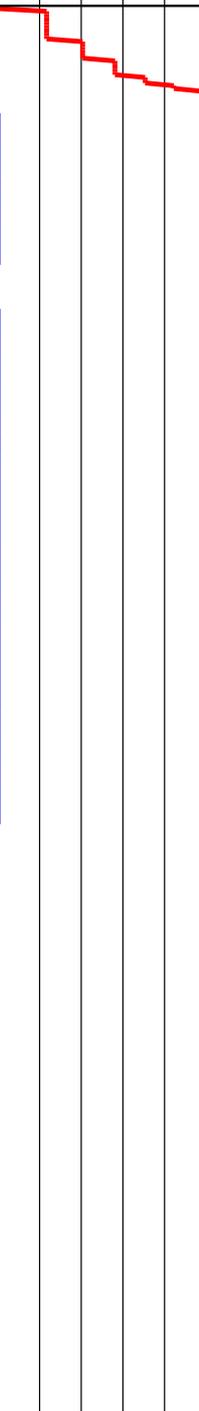


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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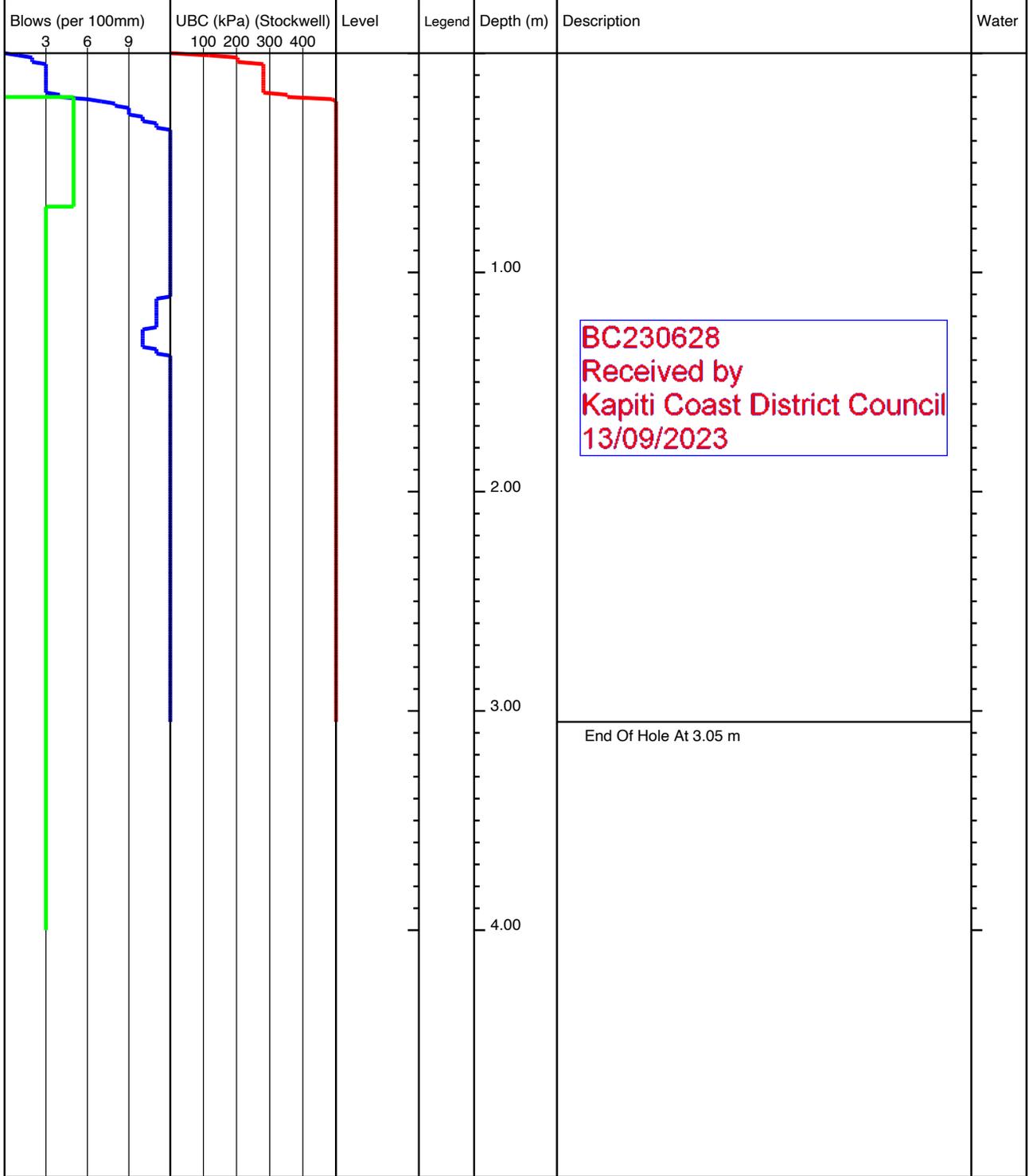
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869482	E Coord: 175.049313
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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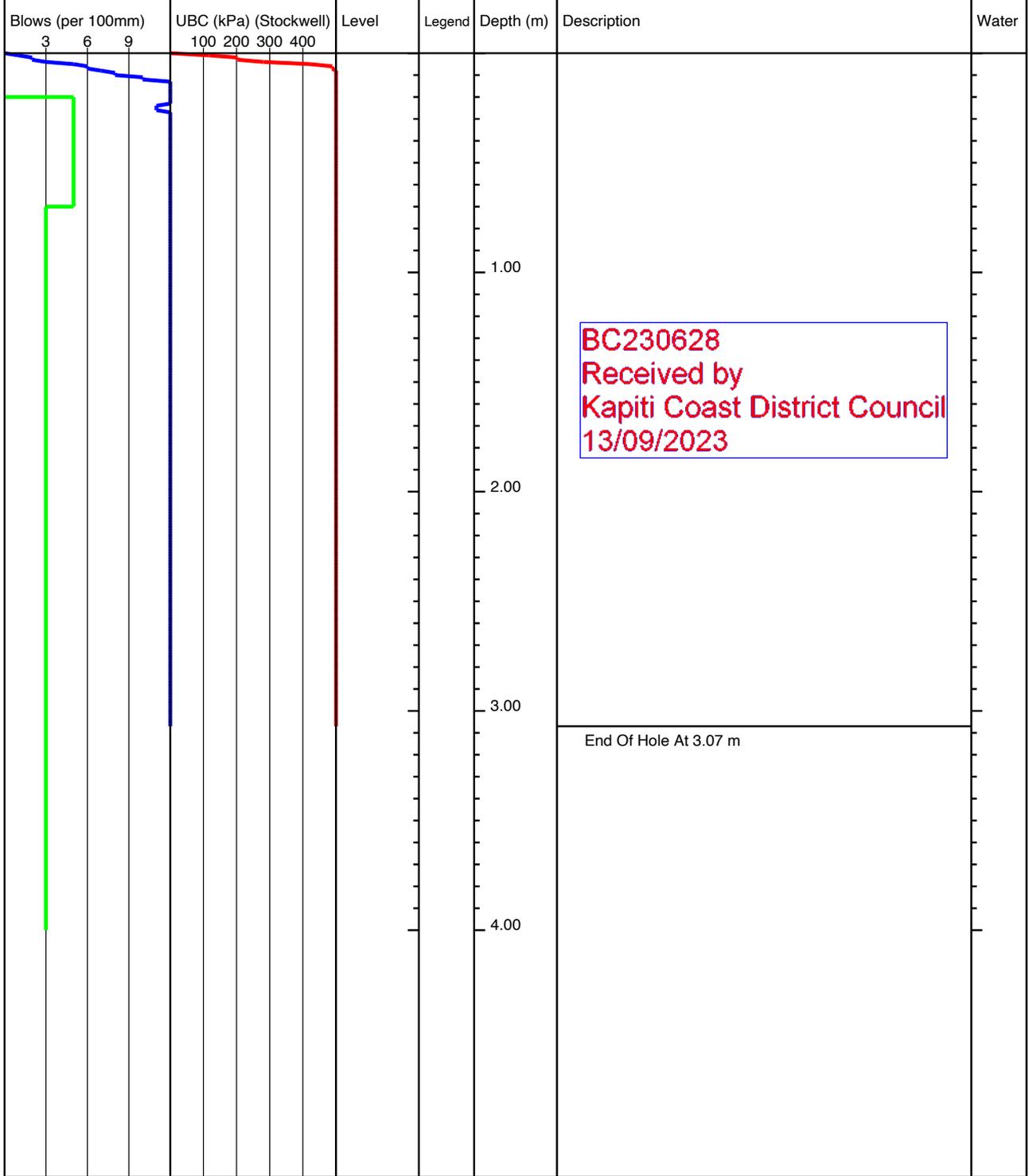
		Project Title: 110 Ngarara Rd, Waikanae								
		Project Number: 21852		Client: Anderson Park Trust	lot12-30					
		GL (mAOD):		N Coord: -40.869487	E Coord: 175.048997					
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1					
Blows (per 100mm)			UBC (kPa) (Stockwell)			Level	Legend	Depth (m)	Description	Water
3 6 9			100 200 300 400							
										
<div style="border: 1px solid red; padding: 5px; display: inline-block;"> <p style="color: red; margin: 0;">BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>										
<p>End Of Hole At 2.97 m</p>										
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level								<b>REMARKS</b> No Groundwater Encountered		

	Project Title: 110 Ngarara Rd, Waikanae		lot12-31
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869528	E Coord: 175.048967
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



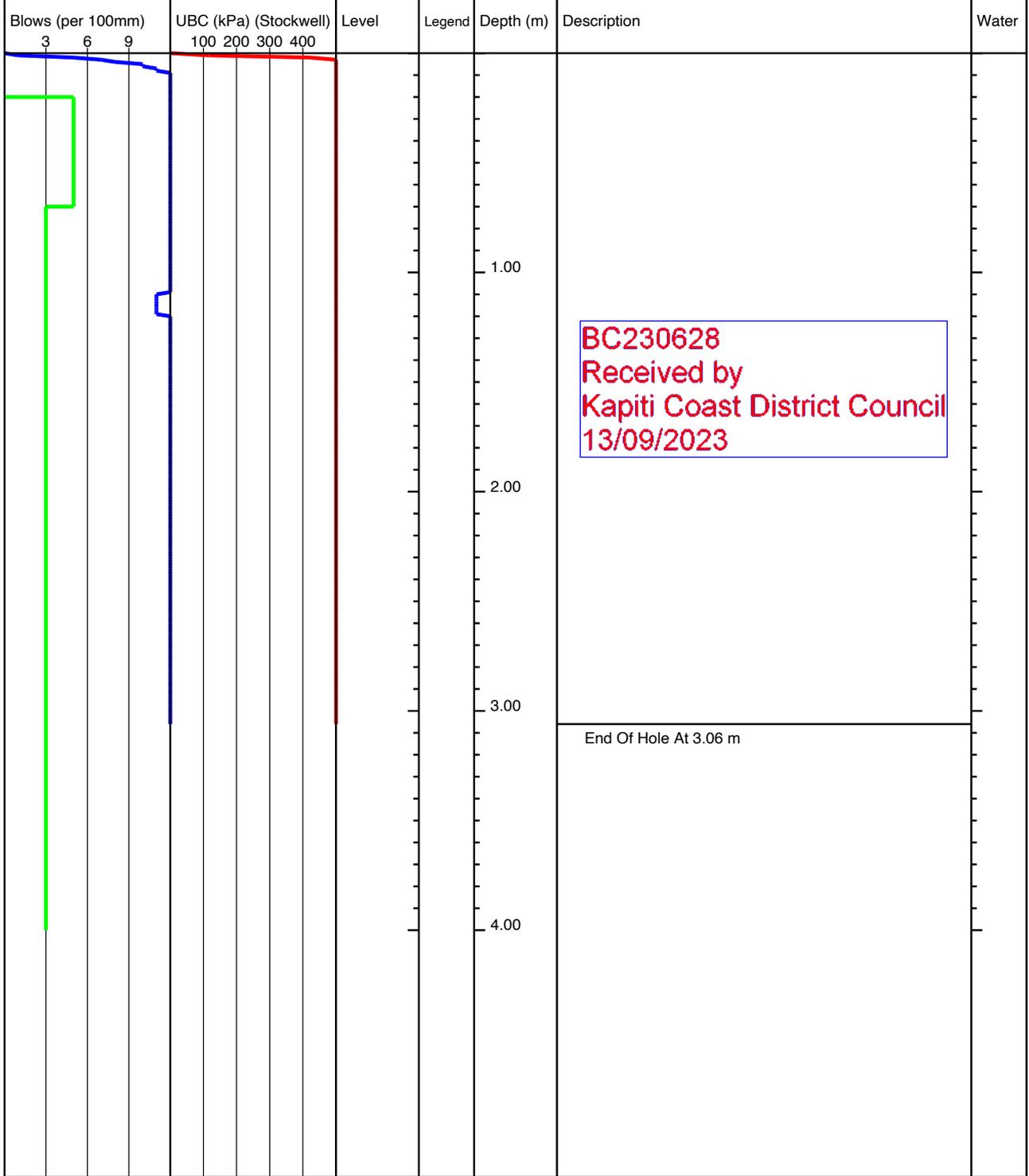
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot12-32
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869658	E Coord: 175.049067
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



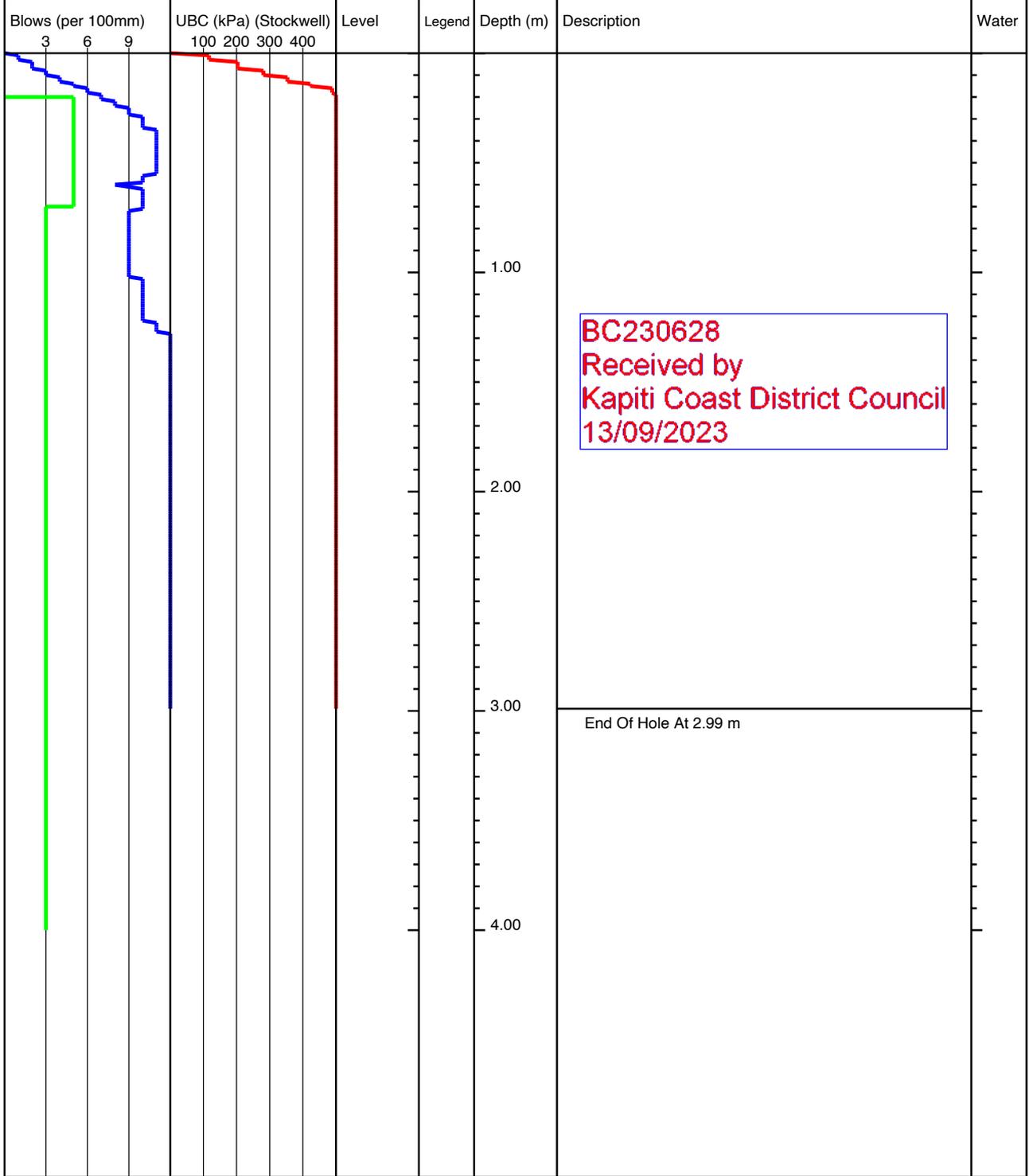
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot12-33
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869633	E Coord: 175.049197
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



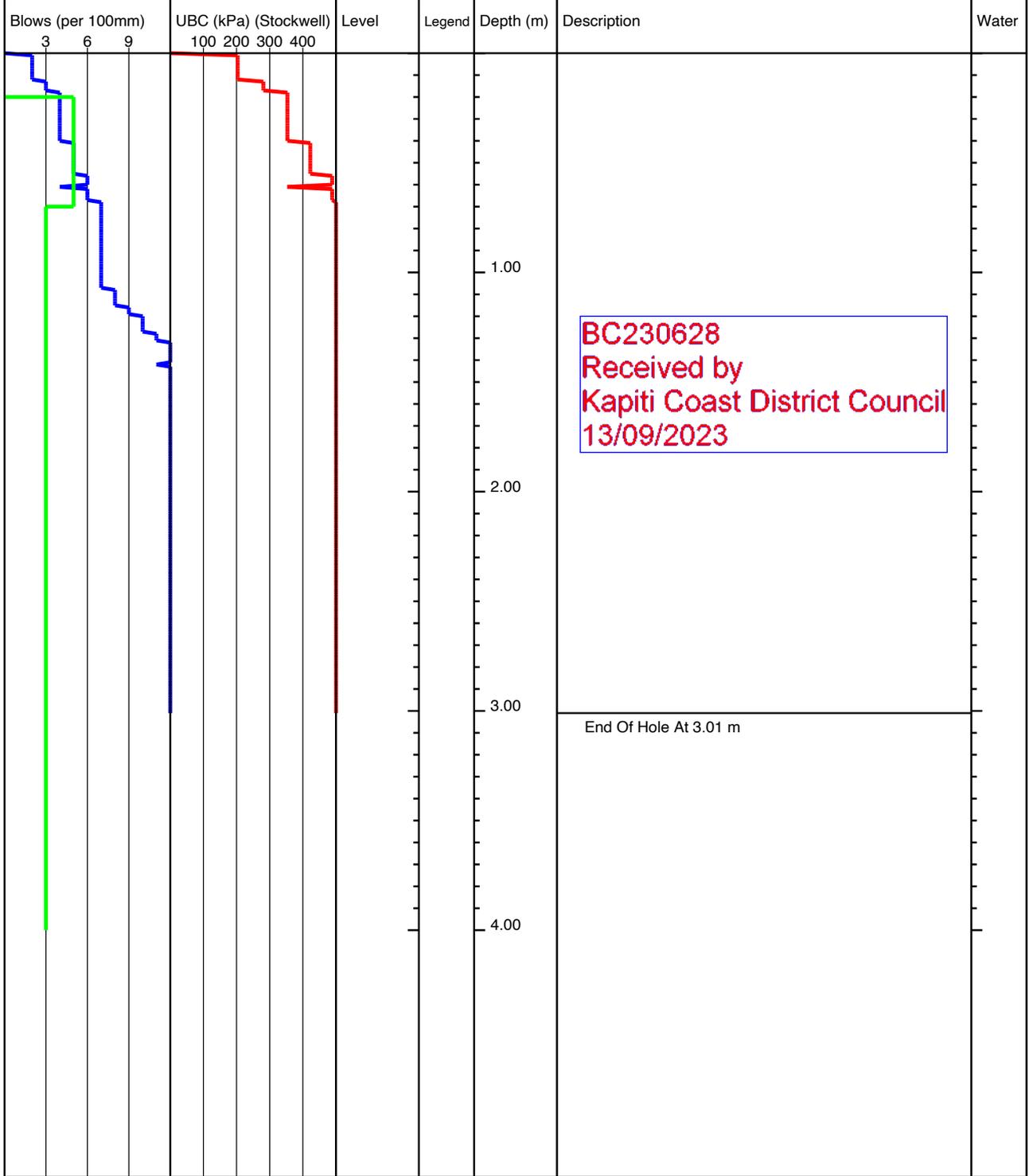
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot13-45
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.8696	E Coord: 175.049347
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



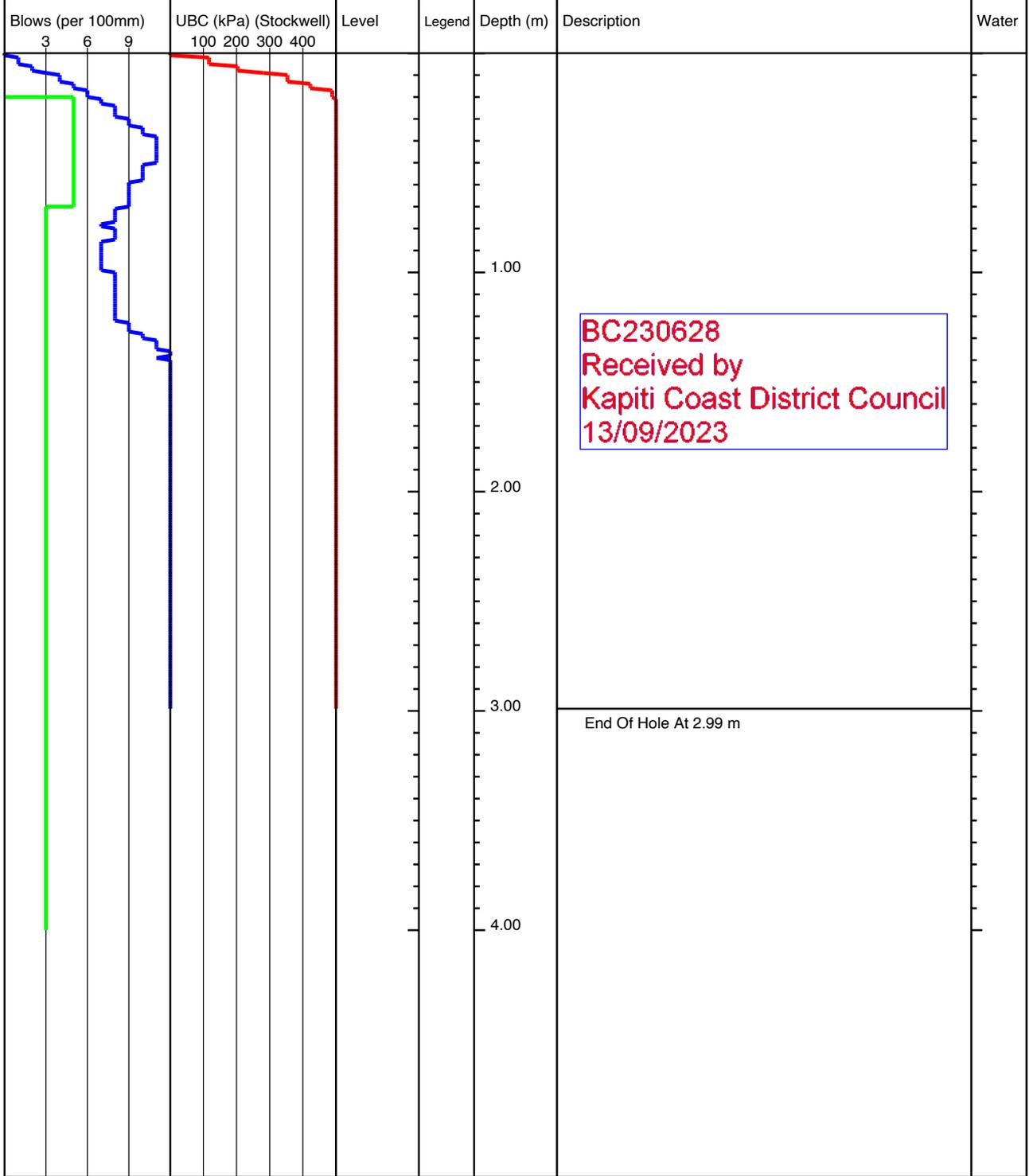
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa   - Groundwater Strike  - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot13-46
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869677	E Coord: 175.0493
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



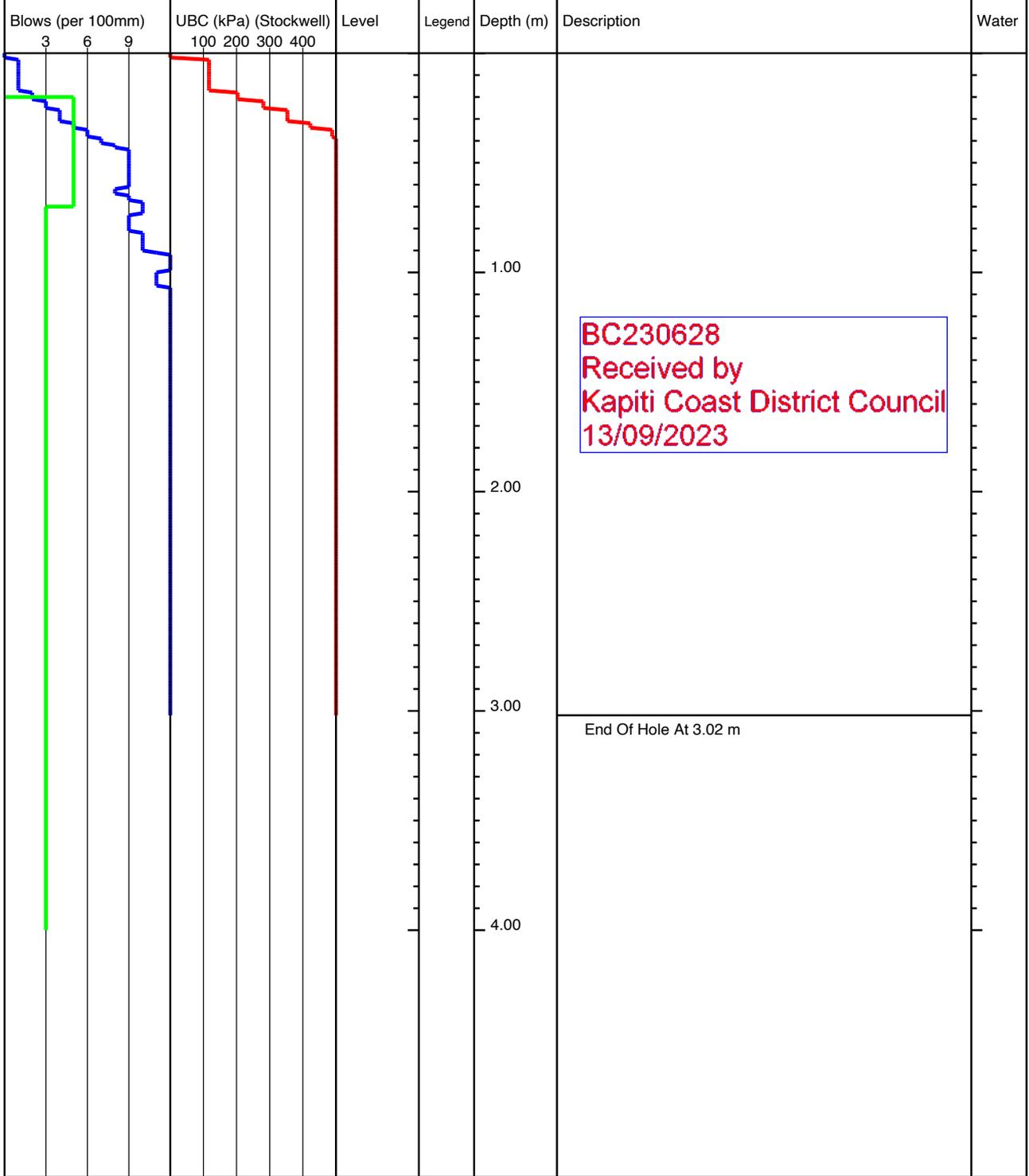
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot13-53
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869713	E Coord: 175.049423
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



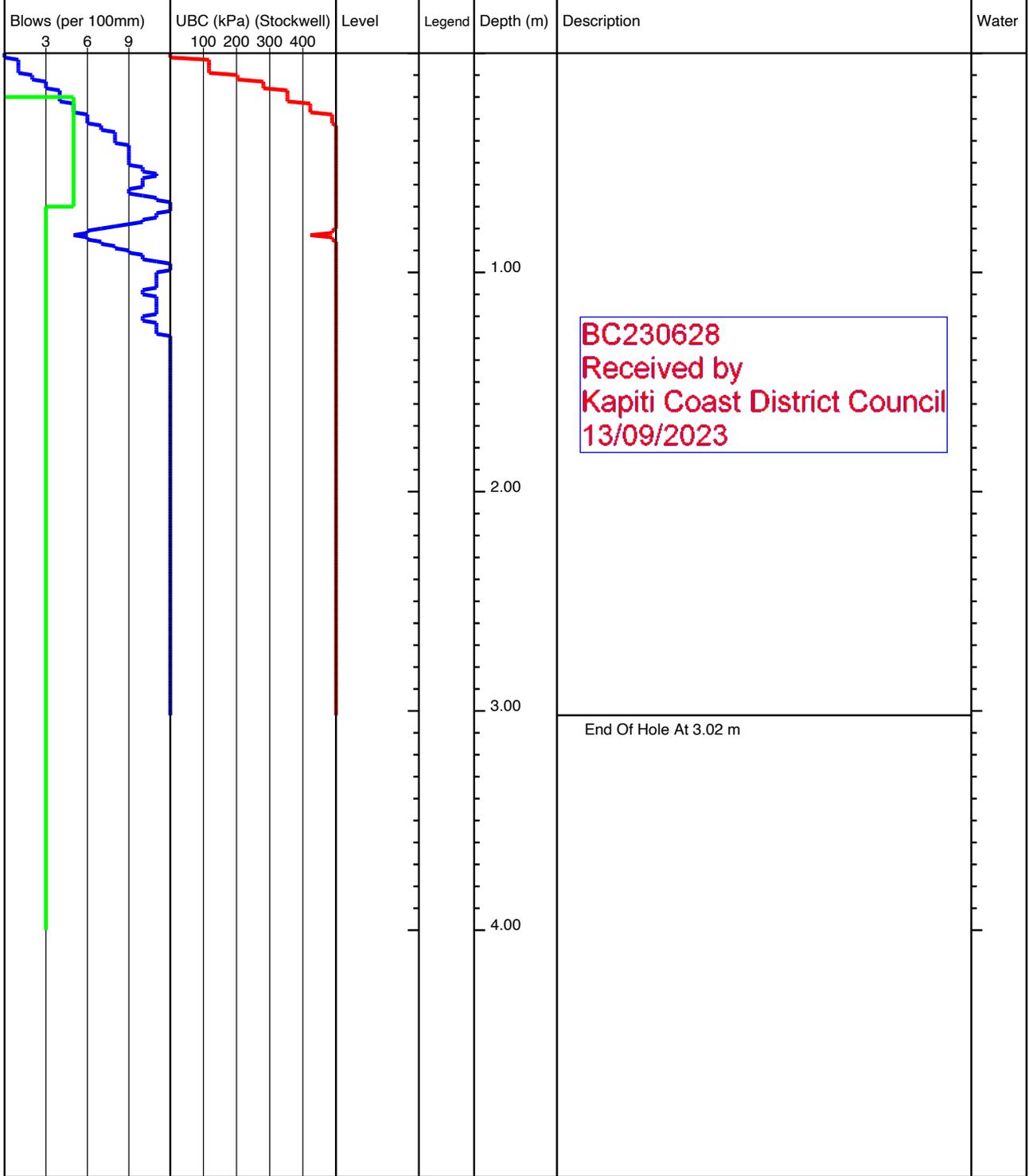
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot13-55
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869755	E Coord: 175.049712
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



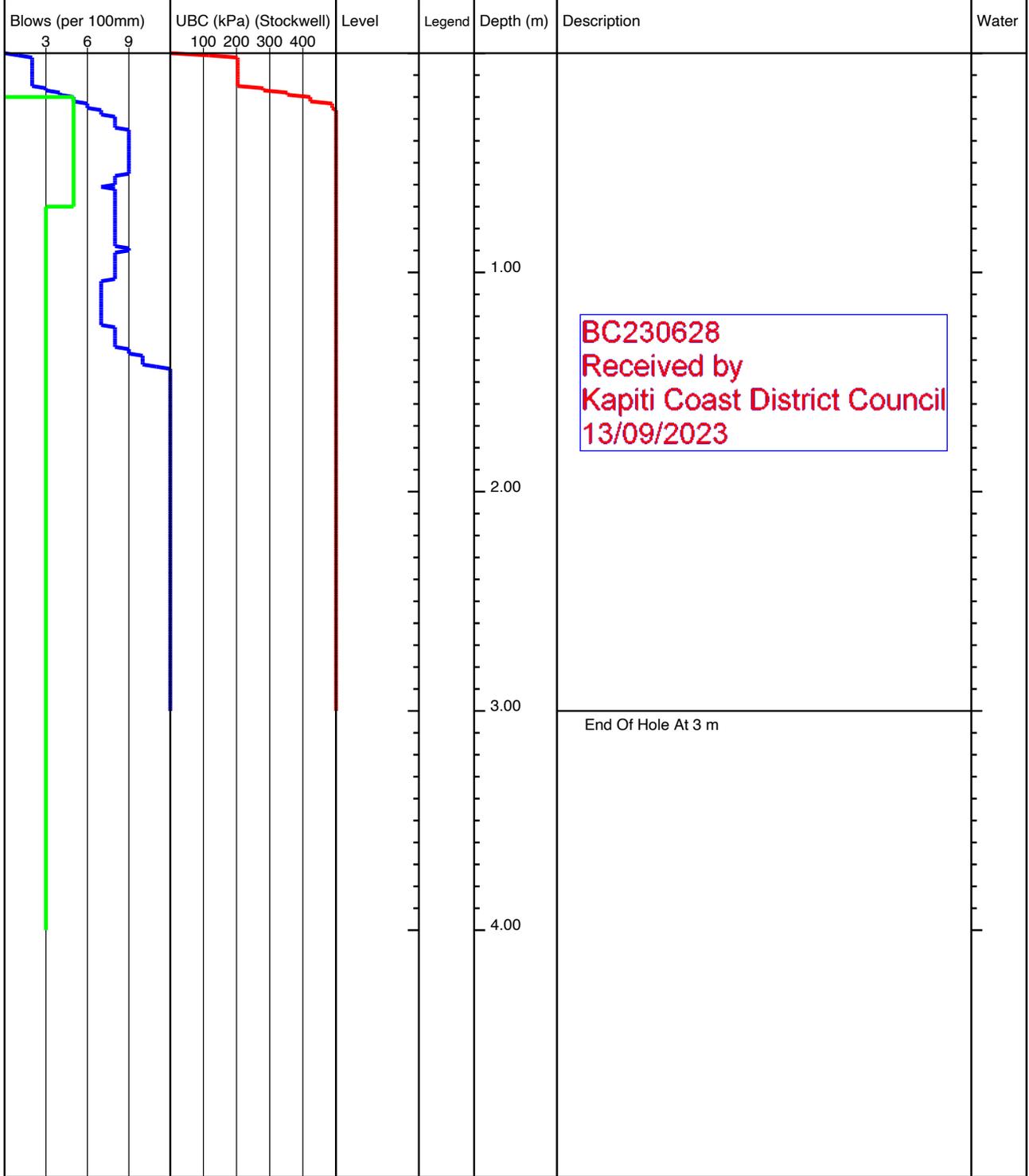
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot13-56
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869815	E Coord: 175.049697
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



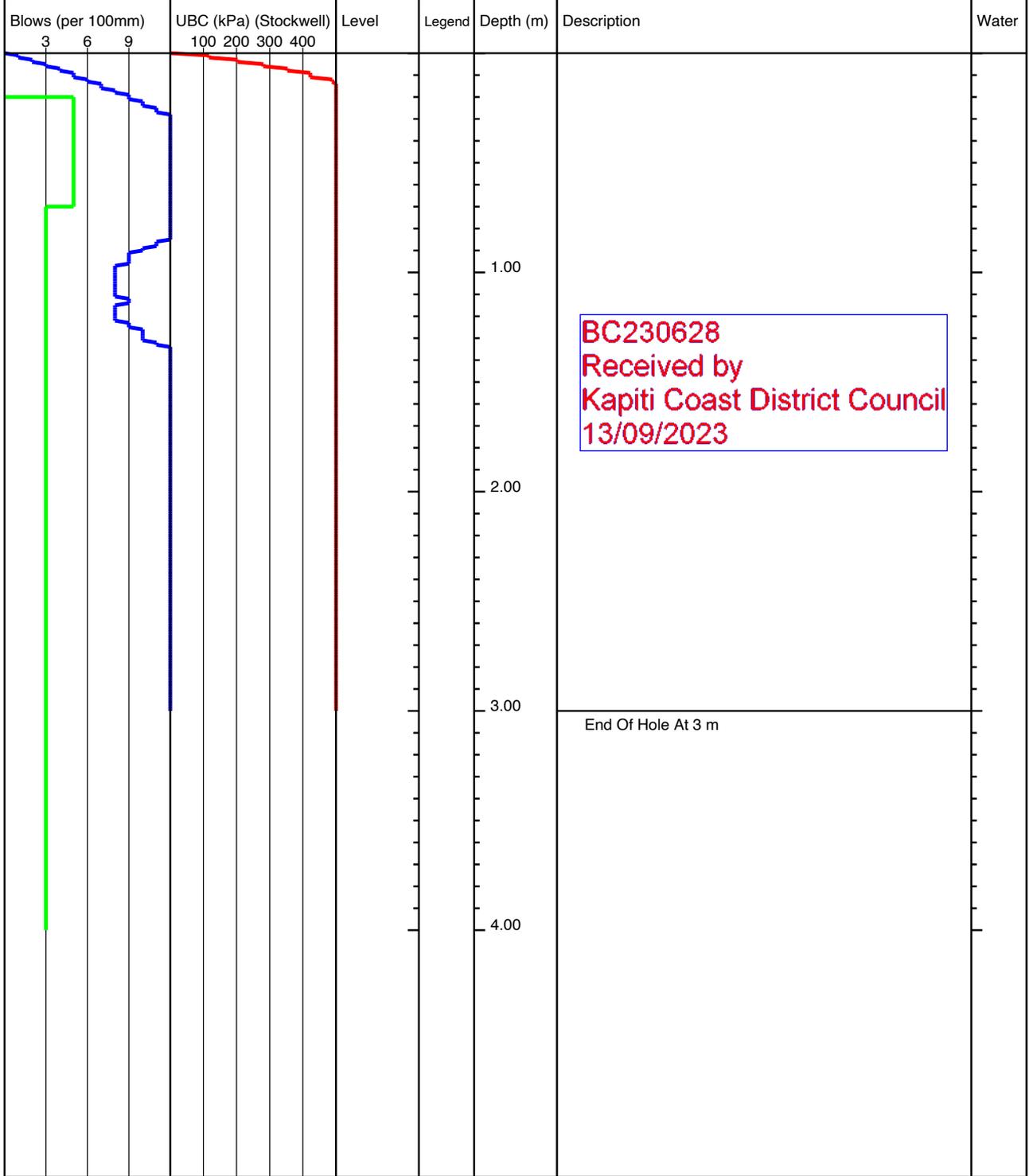
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot14-47
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869753	E Coord: 175.049253
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



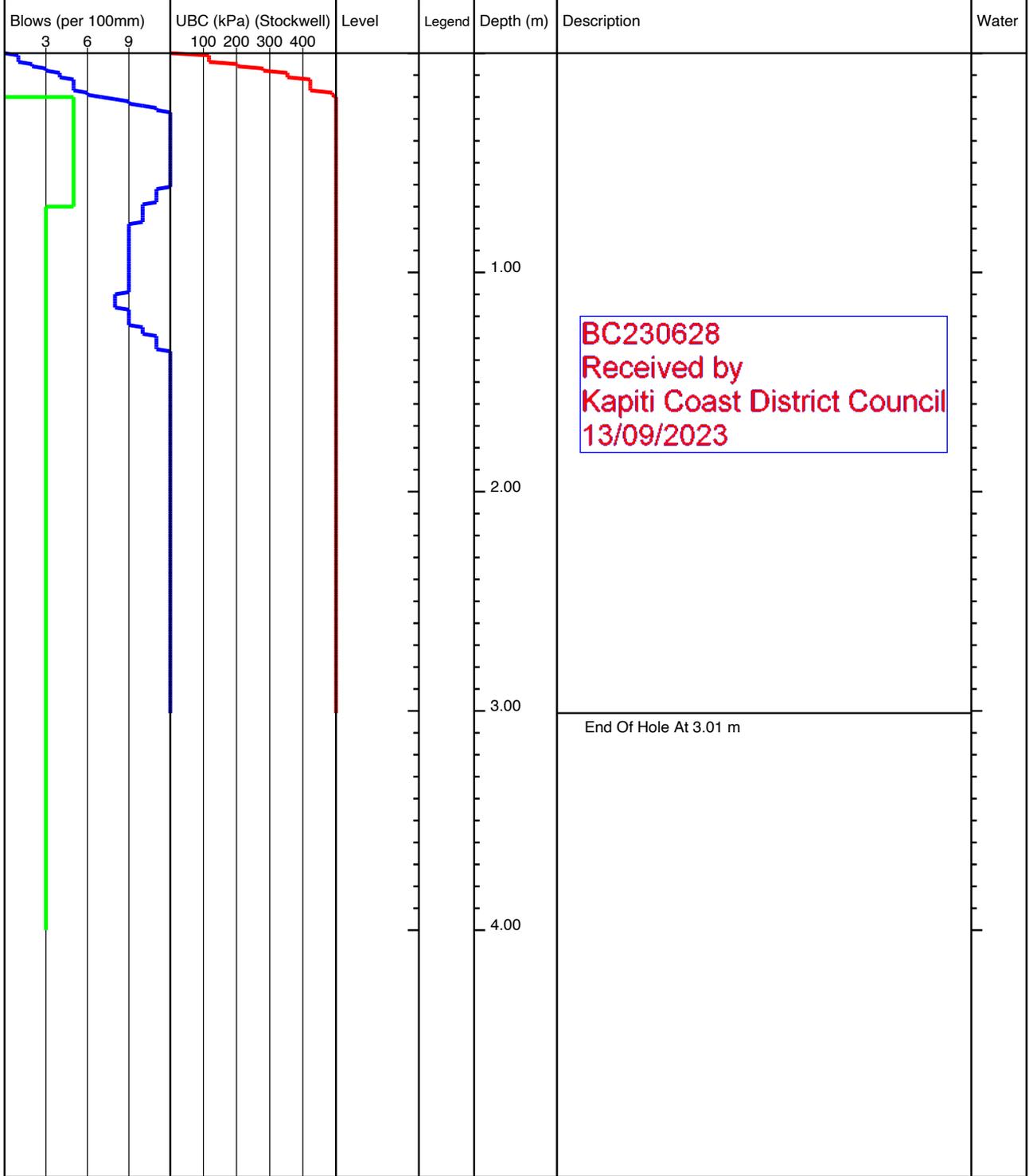
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot14-48
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869815	E Coord: 175.04925
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



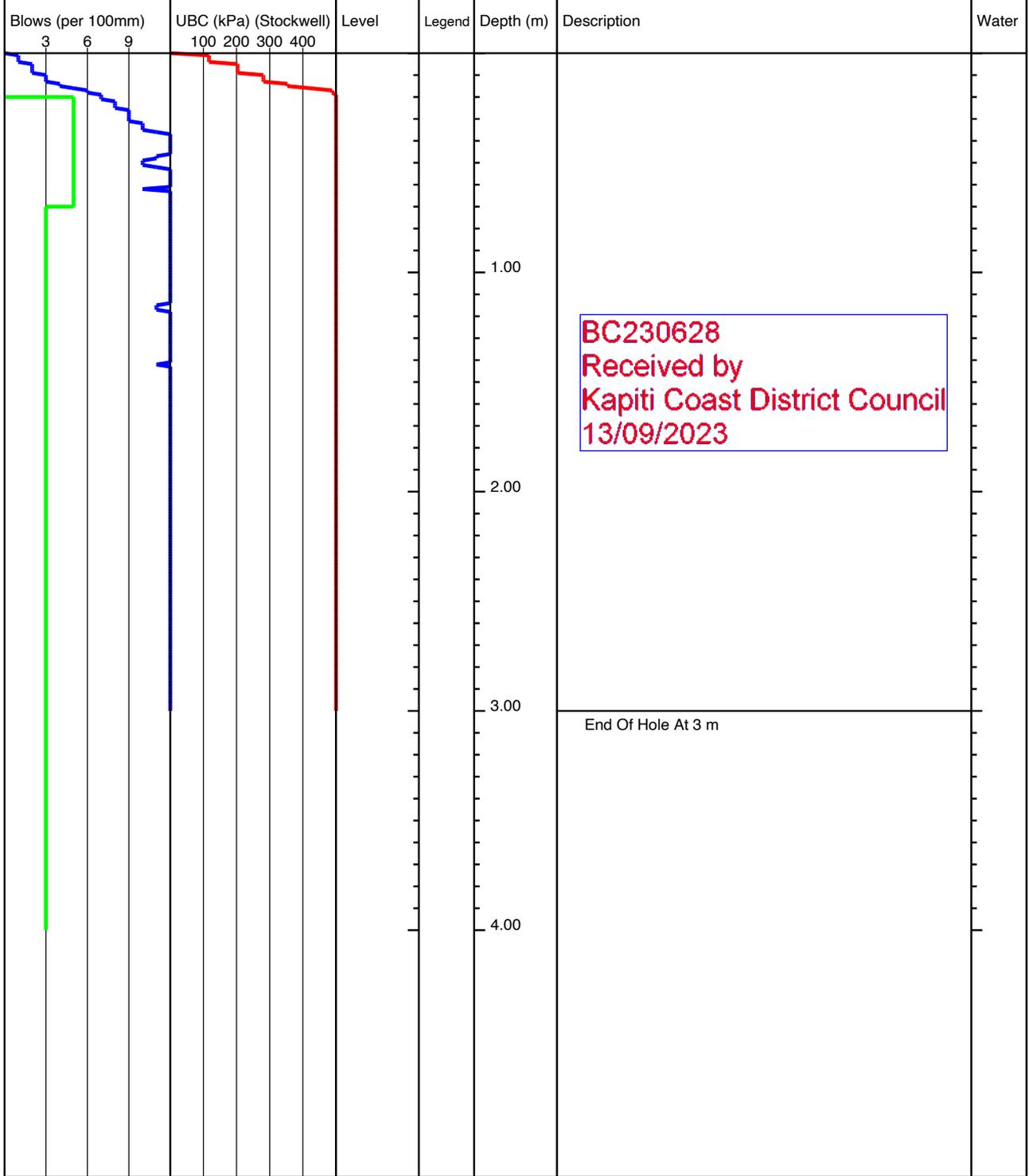
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot14-52
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86985	E Coord: 175.04937
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



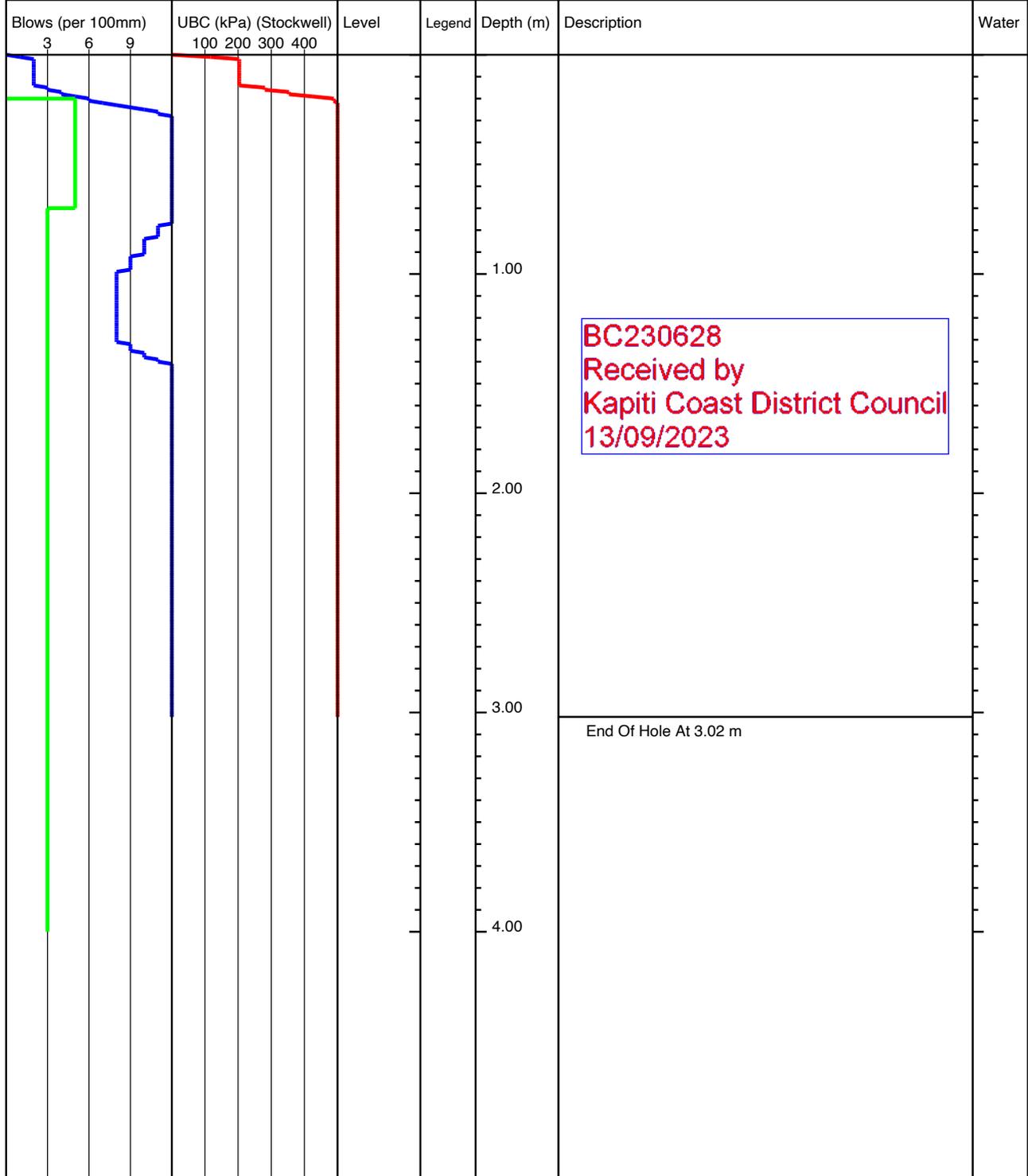
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot14-57
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869898	E Coord: 175.04967
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



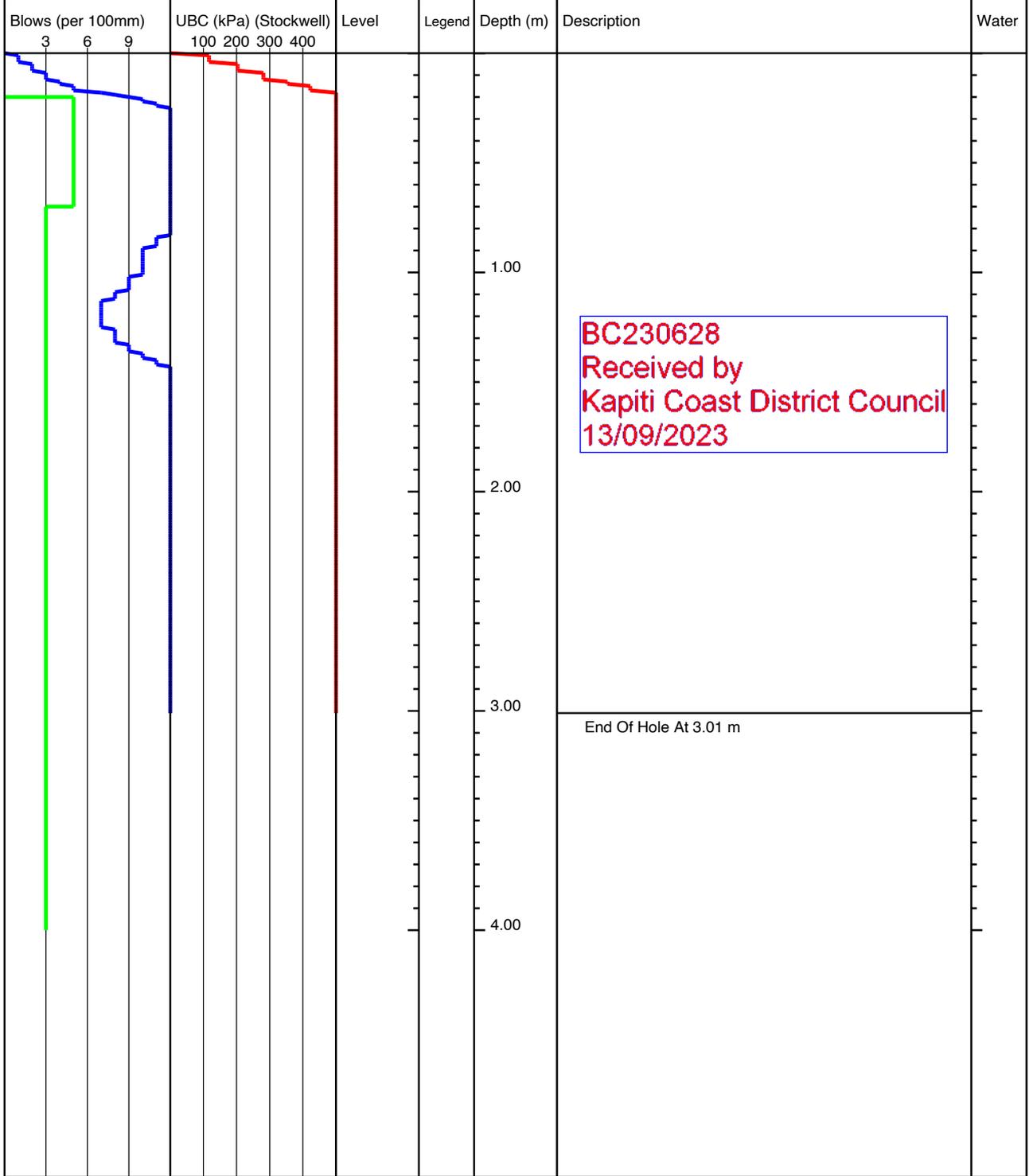
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot14-58
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869998	E Coord: 175.049615
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



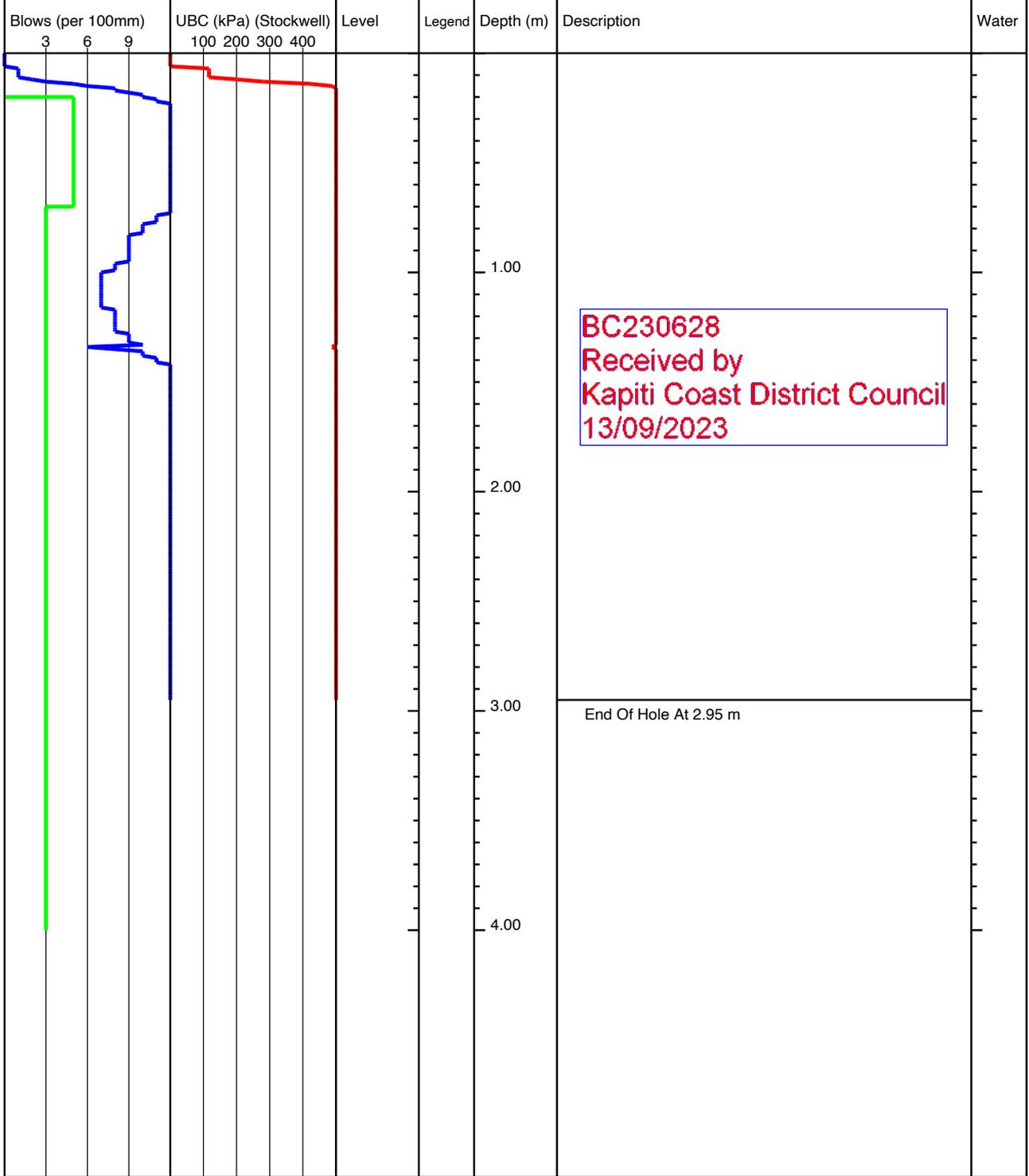
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot15-49
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869955	E Coord: 175.049247
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



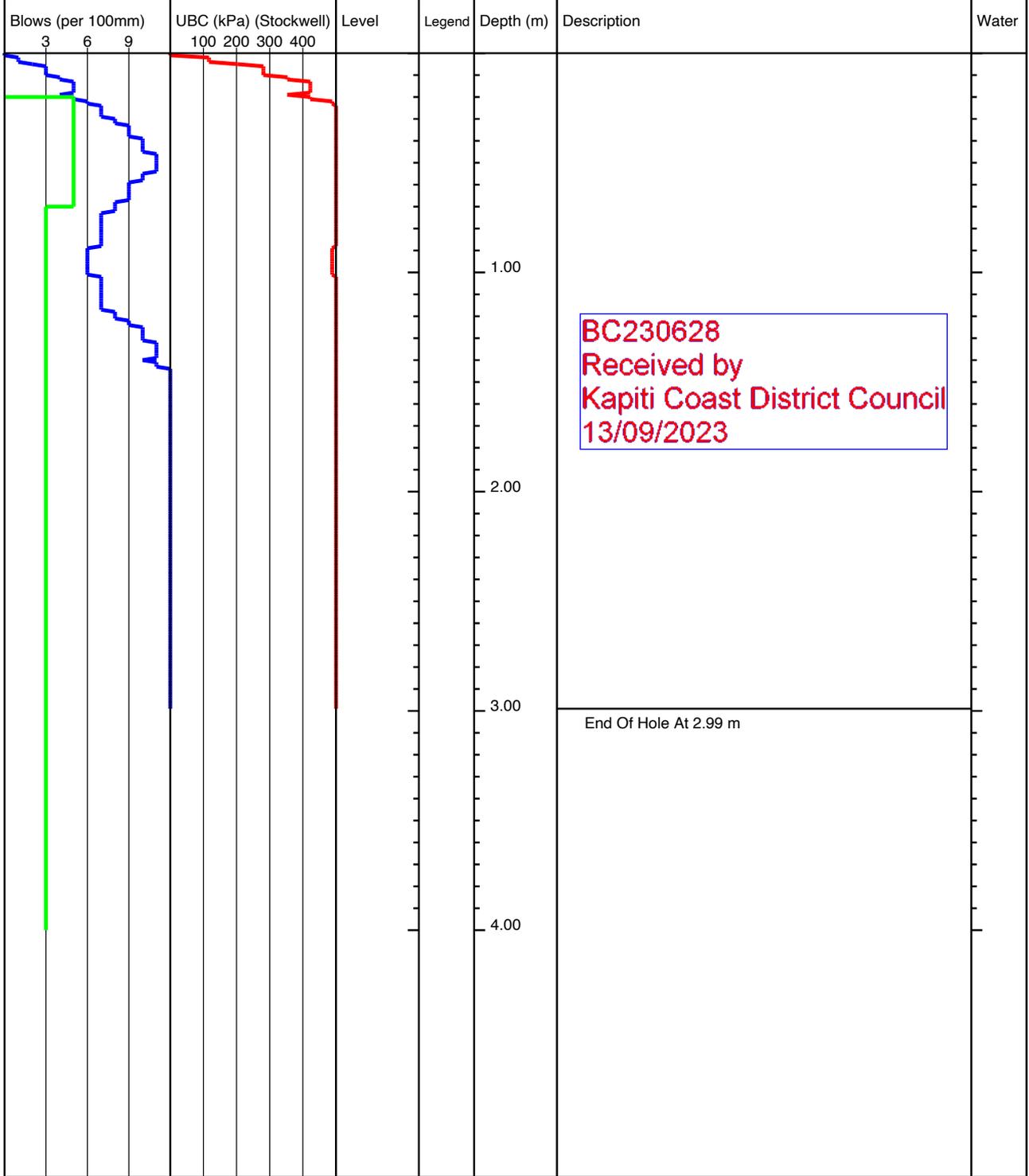
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot15-50
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.87007	E Coord: 175.049263
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



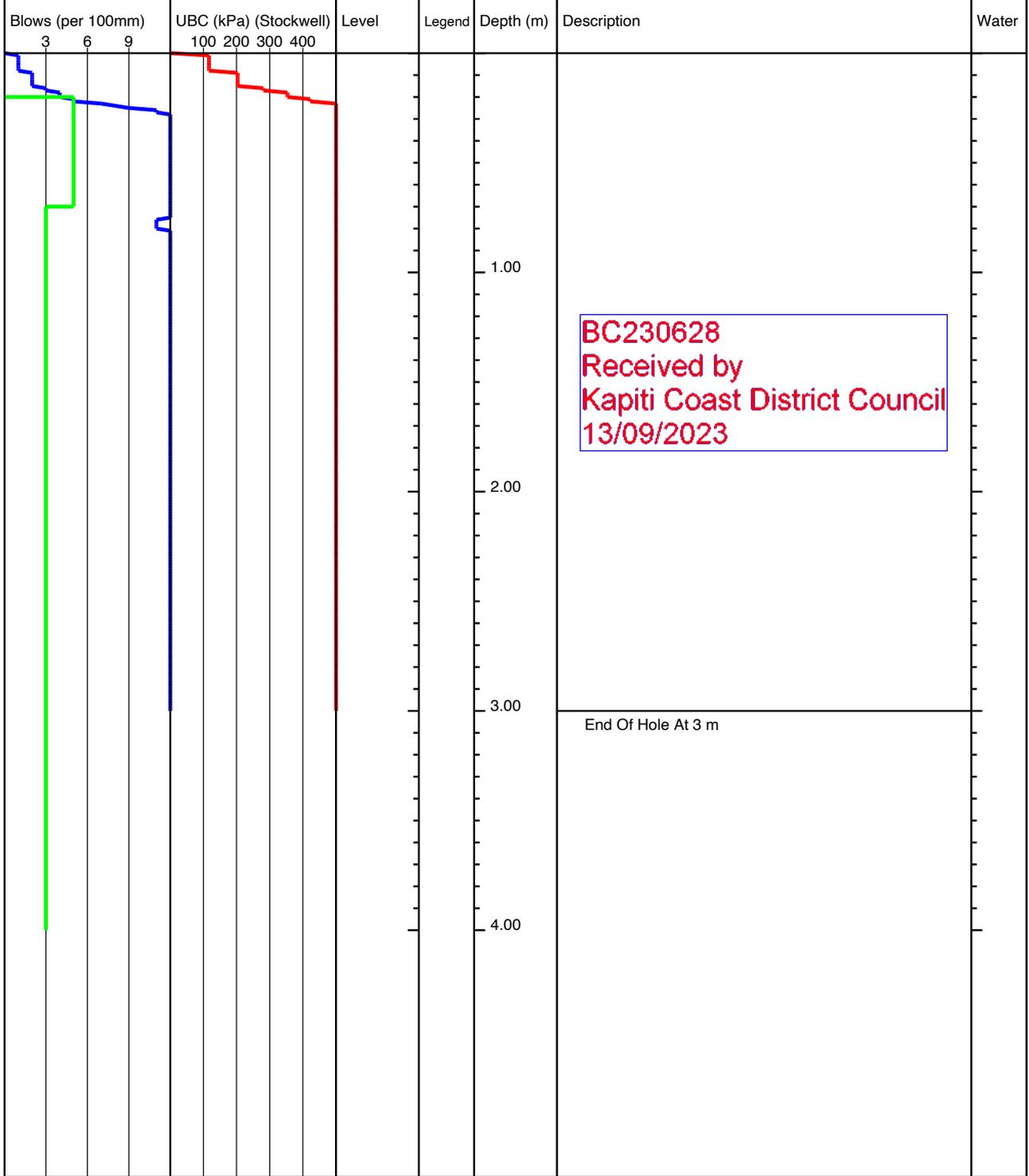
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot15-51
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869998	E Coord: 175.049312
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



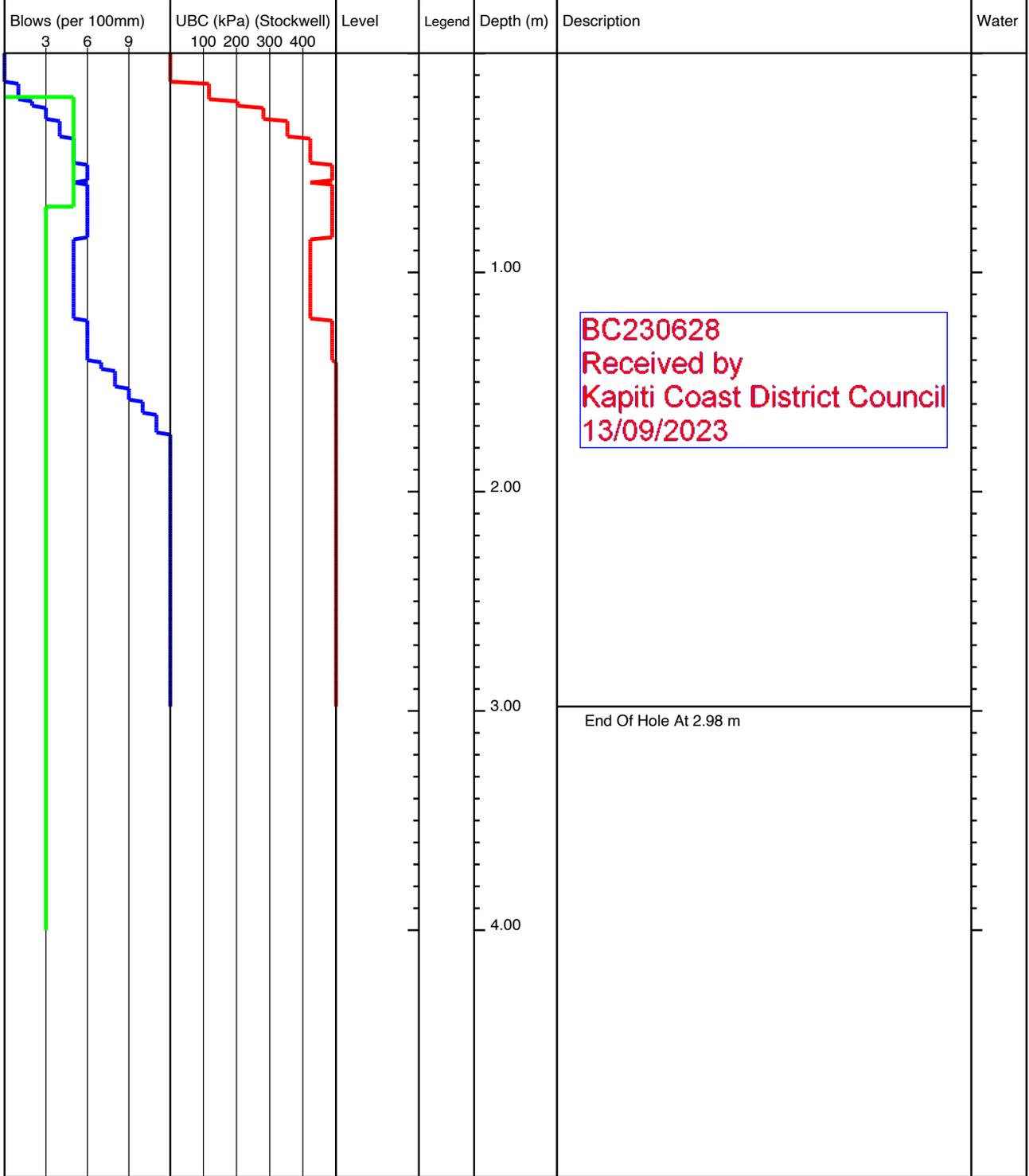
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot15-59
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.87007	E Coord: 175.049577
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



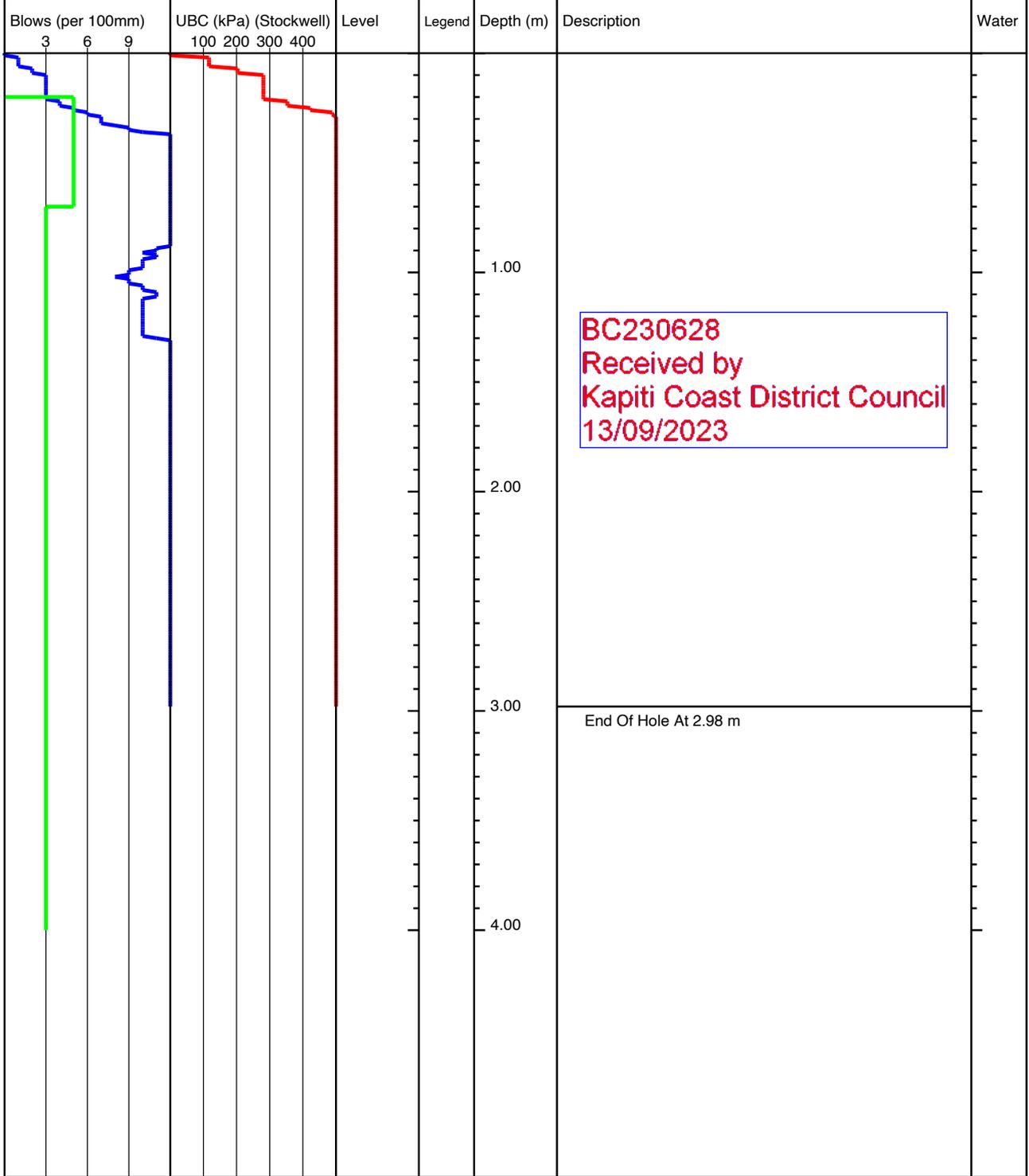
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot15-60
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870168	E Coord: 175.049425
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

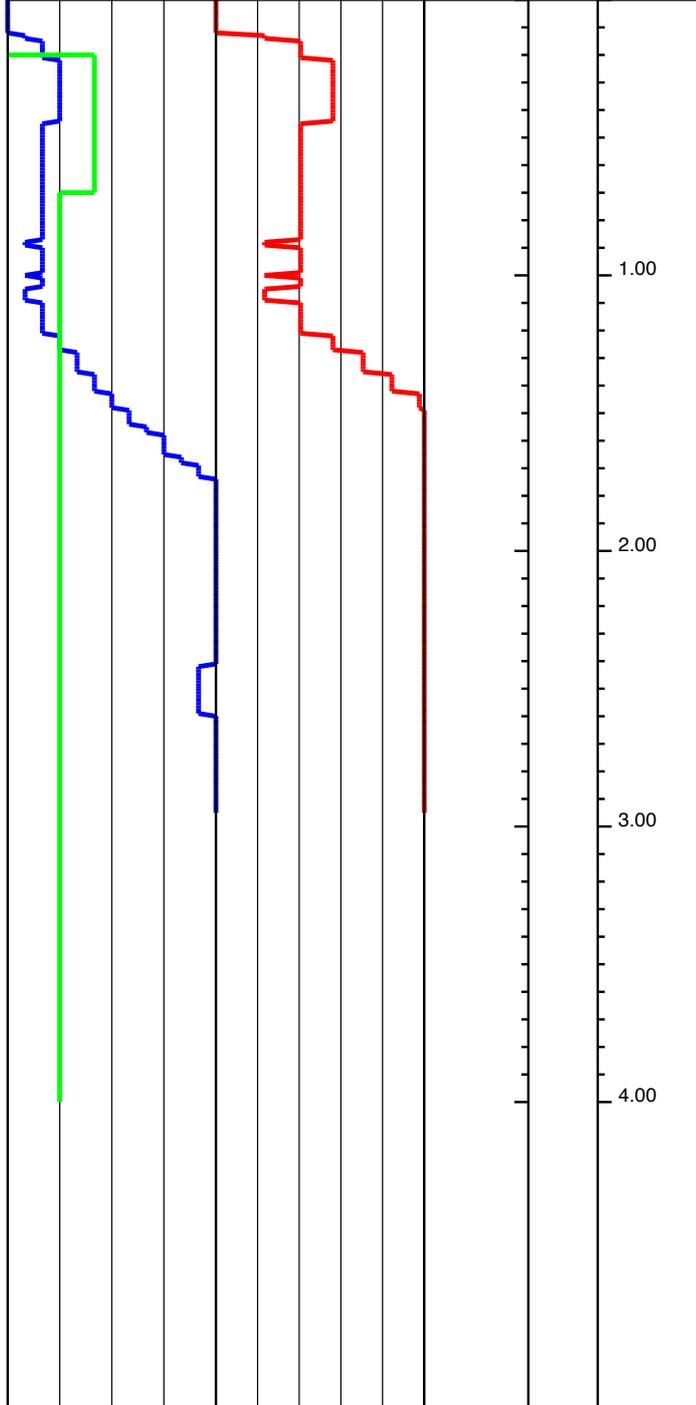


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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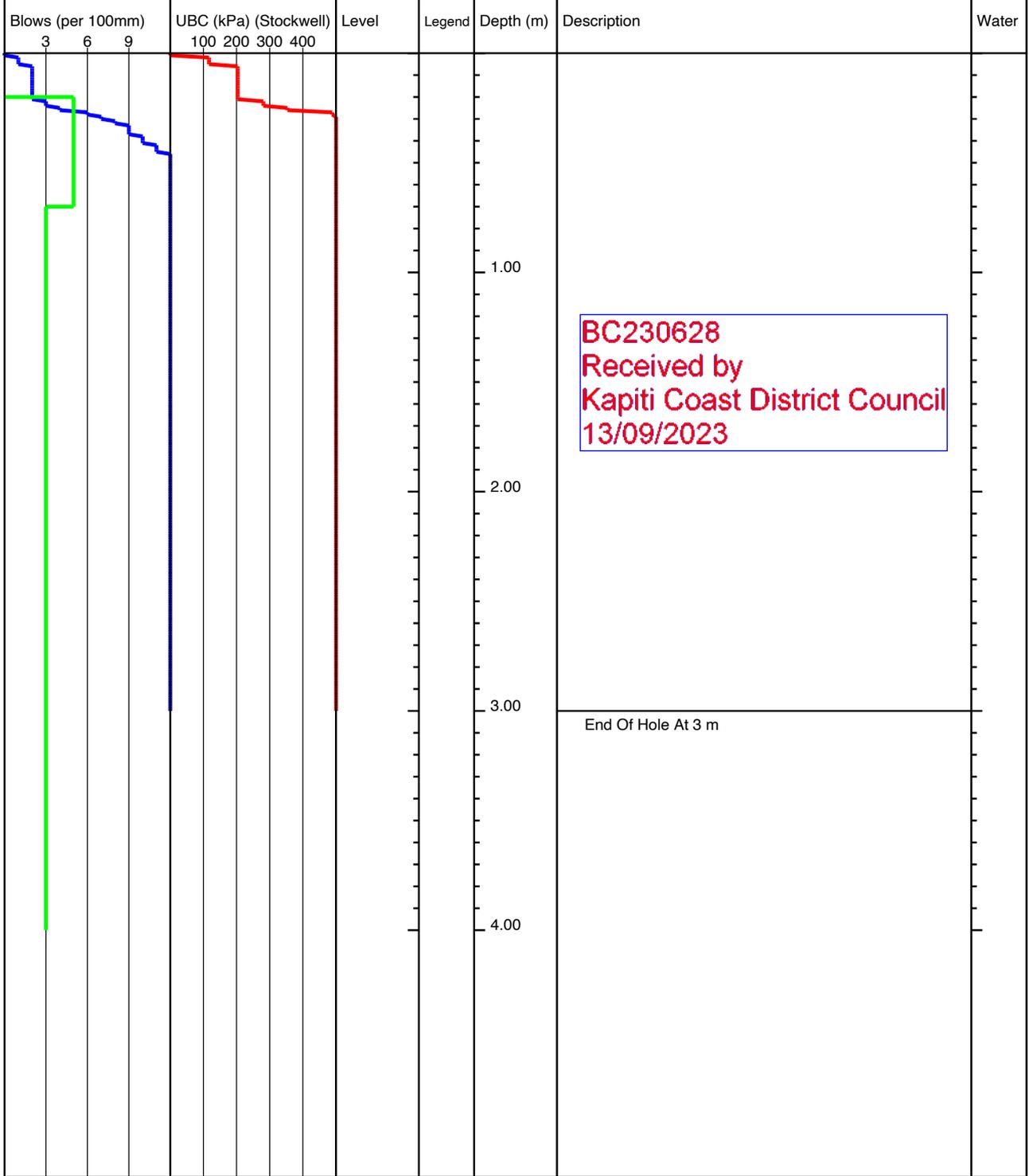
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870087	E Coord: 175.049583
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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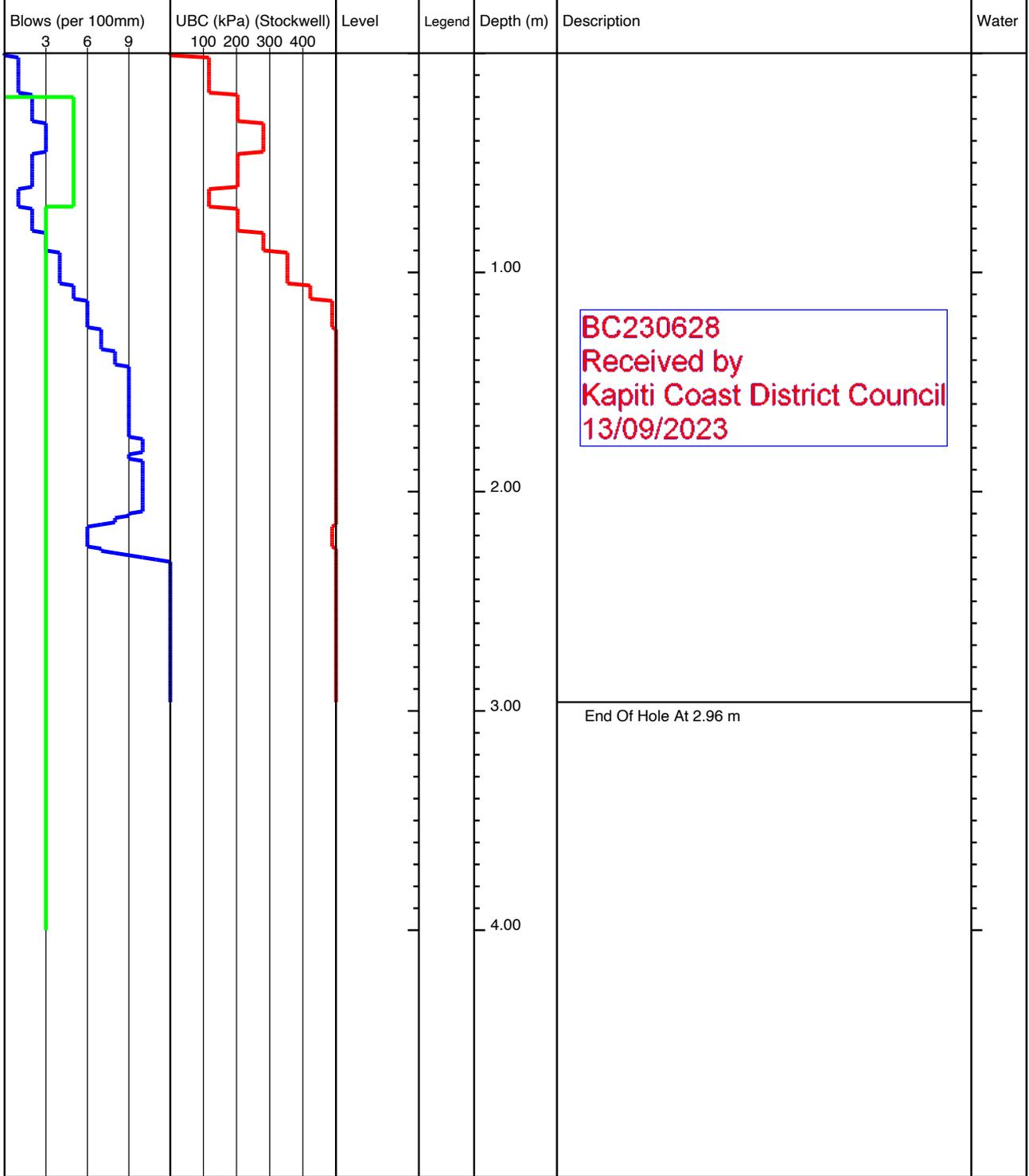
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		Project Number: 21852	Client: Anderson Park Trust		lot16-64	
		GL (mAOD):	N Coord: -40.870173		E Coord: 175.049542	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND		Scale: 1:25 Sheet 1 Of 1
Blows (per 100mm) 3 6 9	UBC (kPa) (Stockwell) 100 200 300 400	Level	Legend	Depth (m)	Description	Water
				<p style="border: 1px solid red; padding: 5px; color: red;">BC230628 Received by Kapiti Coast District Council 13/09/2023</p>		
					End Of Hole At 2.95 m	
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot16-65
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870255	E Coord: 175.049618
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



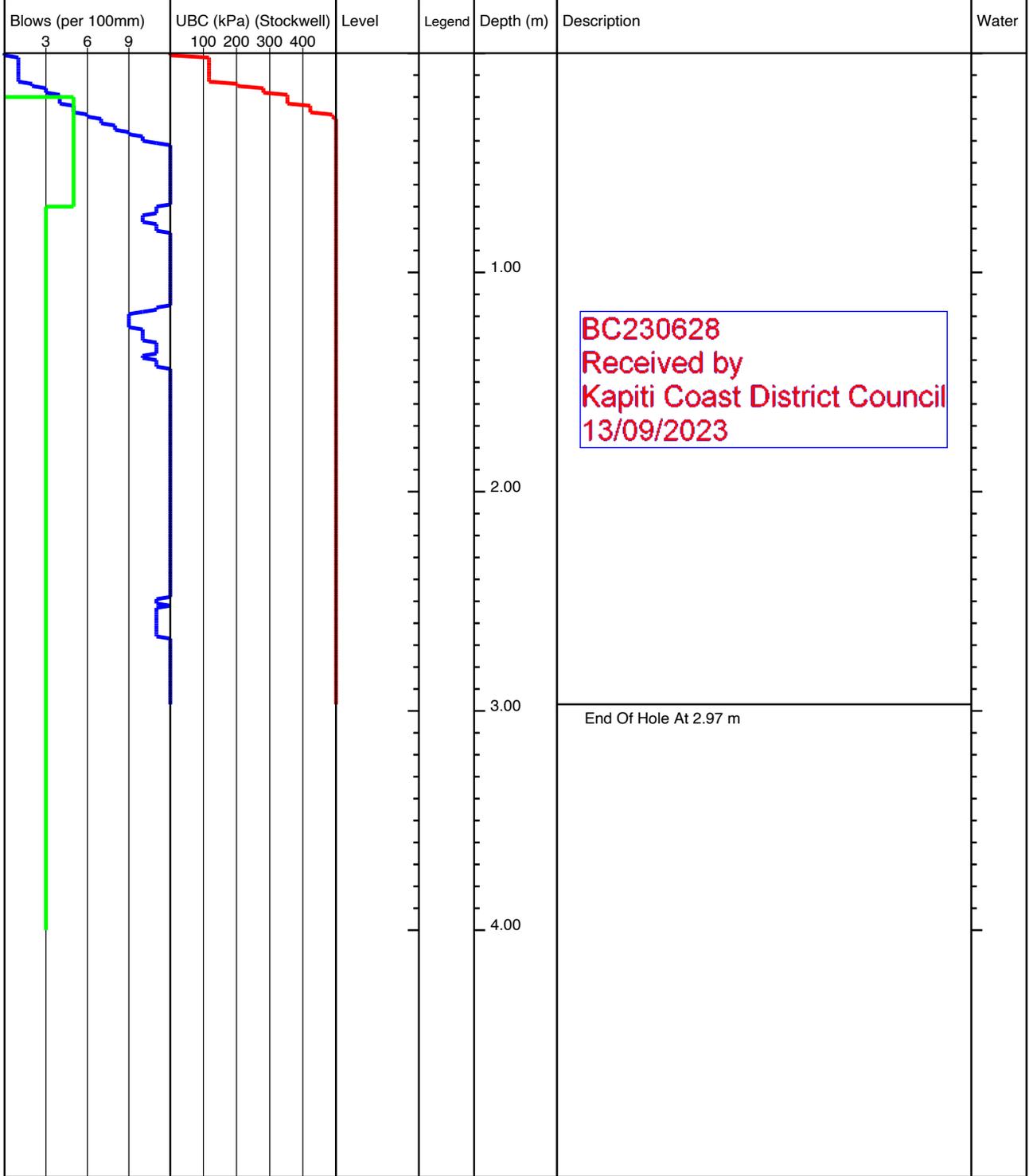
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot16-66
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870218	E Coord: 175.049752
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



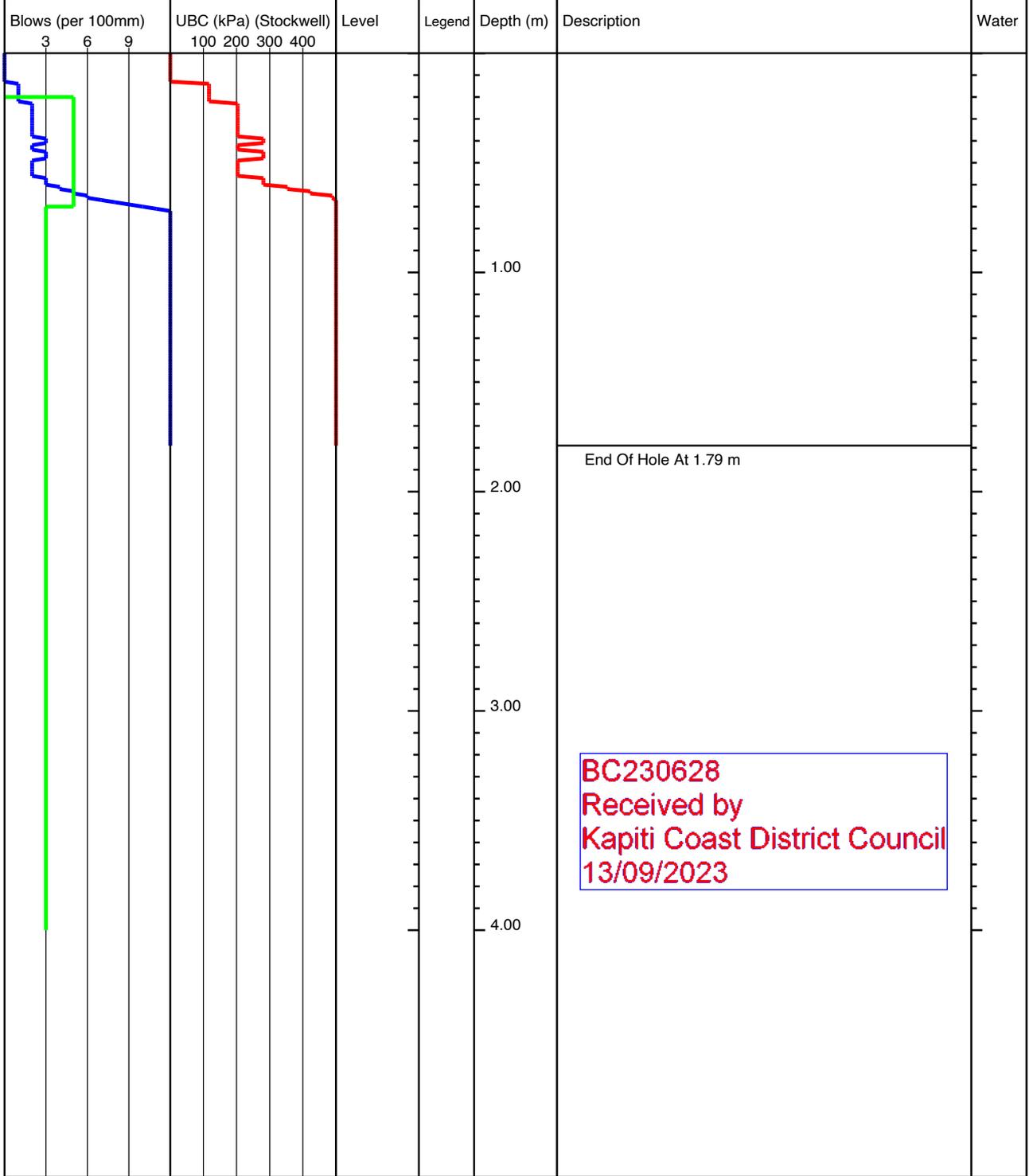
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot16-70
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.87024	E Coord: 175.049658
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



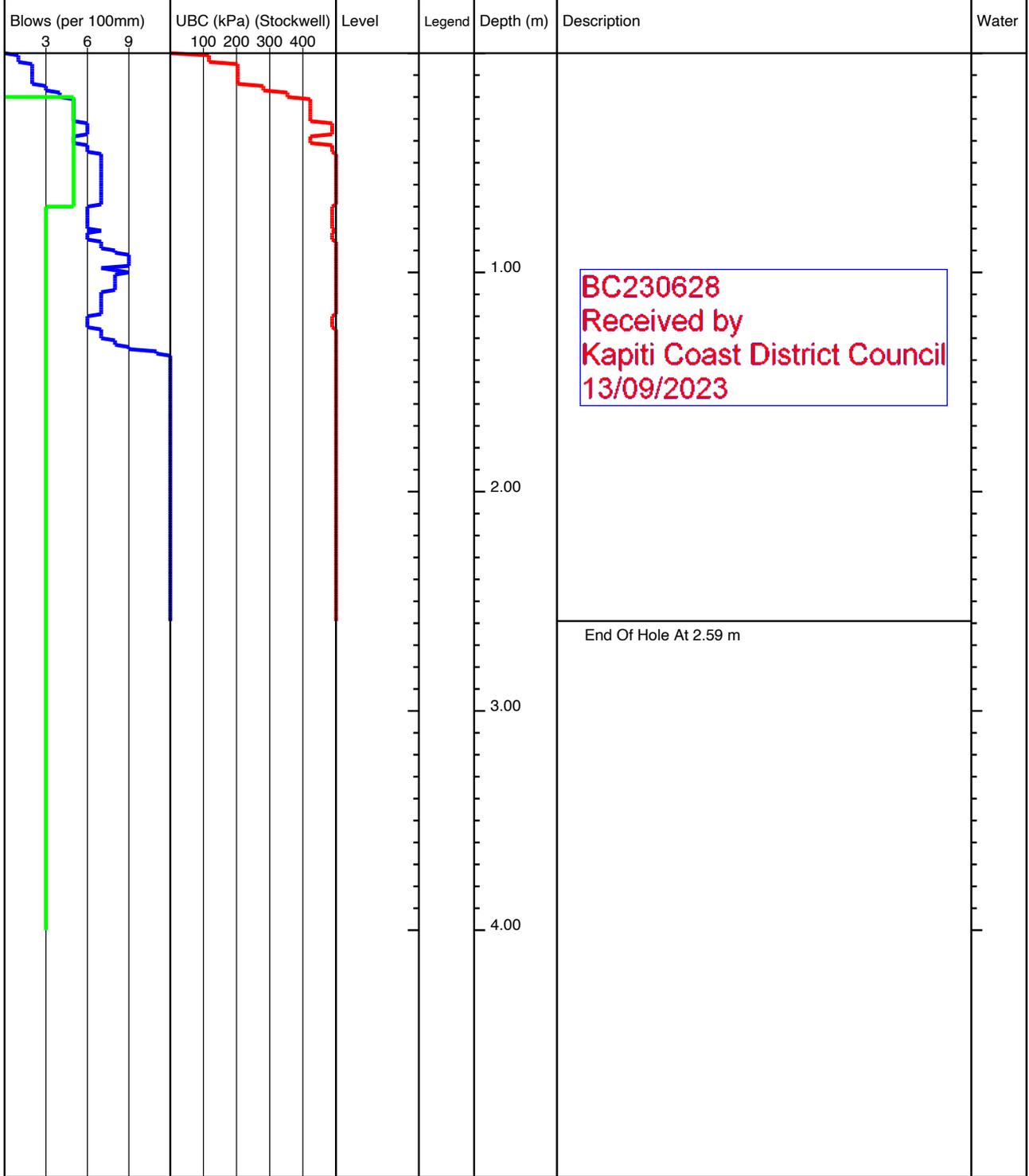
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot18-142
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870488	E Coord: 175.049808
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

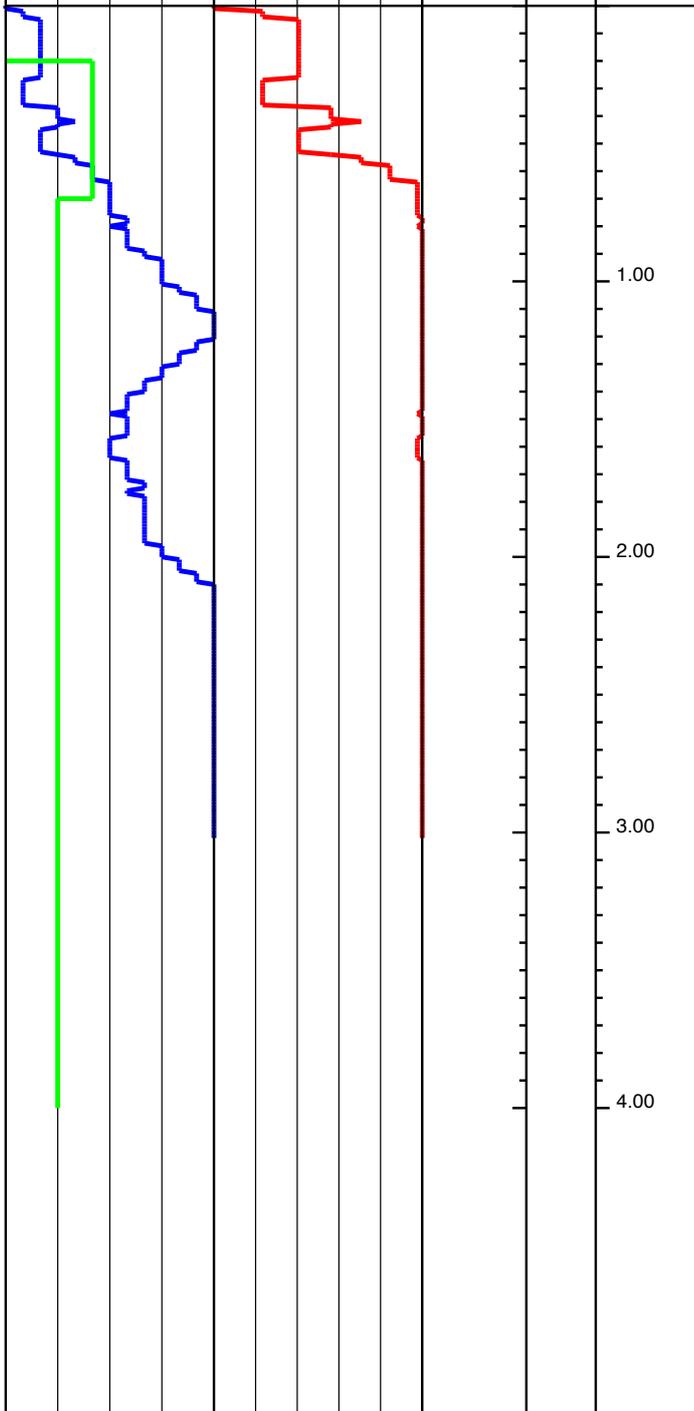


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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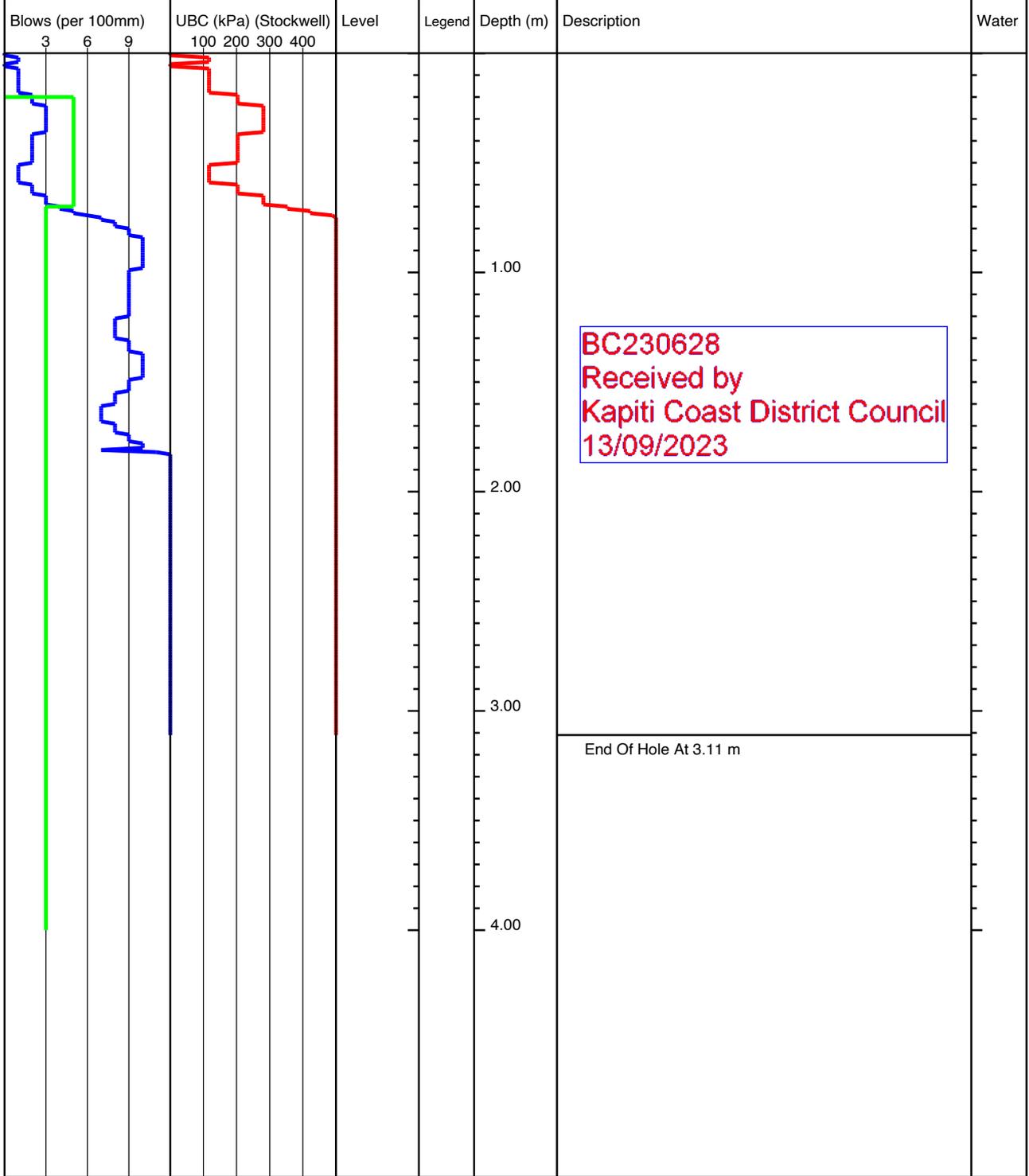
	Project Title: 110 Ngarara Rd, Waikanae		lot18-143
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870523	E Coord: 175.049968
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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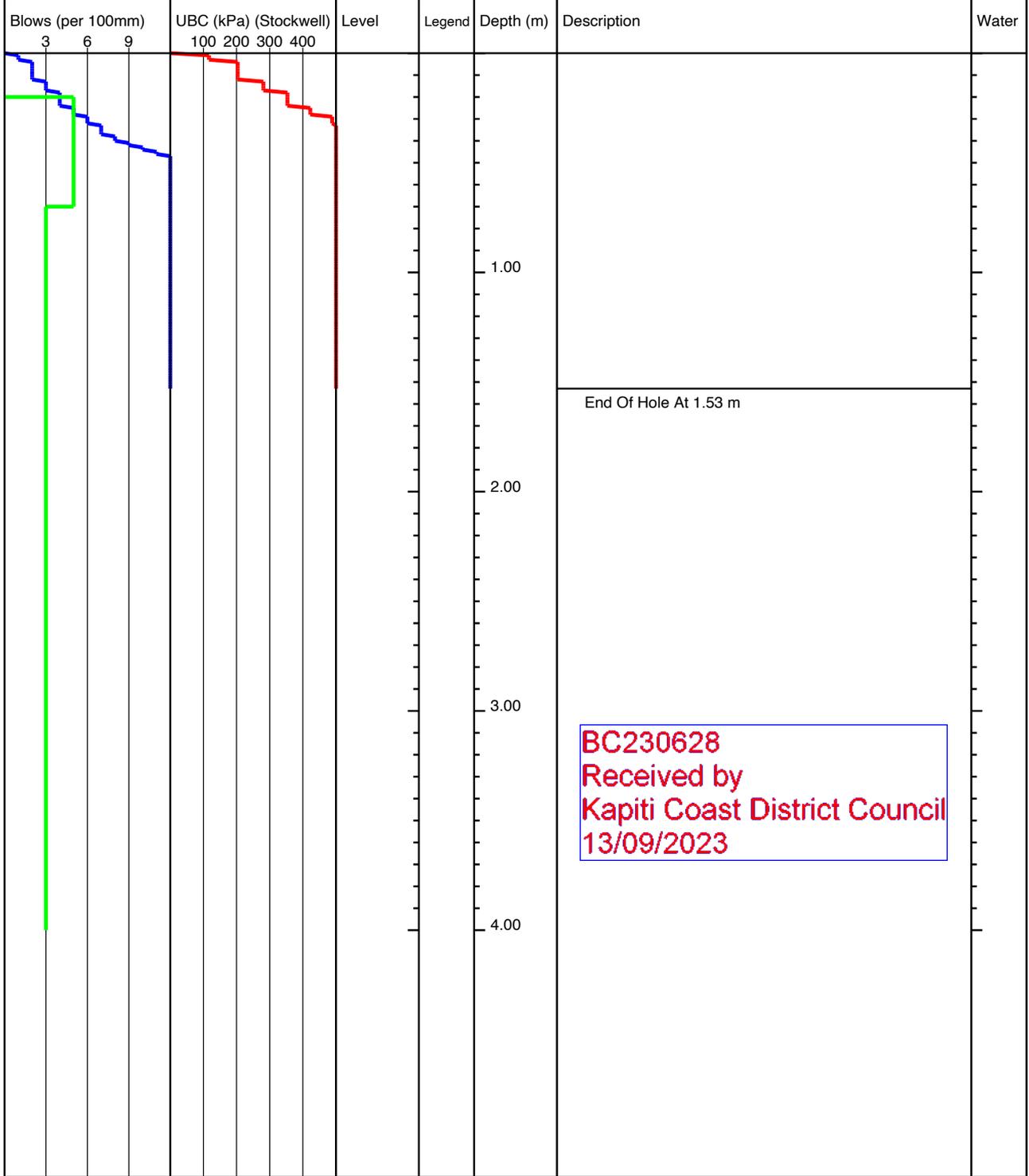
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		Project Number: 21852		Client: Anderson Park Trust	lot18-144	
		GL (mAOD):		N Coord: -40.870627	E Coord: 175.049908	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1	
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<p style="border: 1px solid red; padding: 5px; display: inline-block;">BC230628 Received by Kapiti Coast District Council 13/09/2023</p>						
End Of Hole At 3.02 m						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot18-145
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870555	E Coord: 175.04975
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



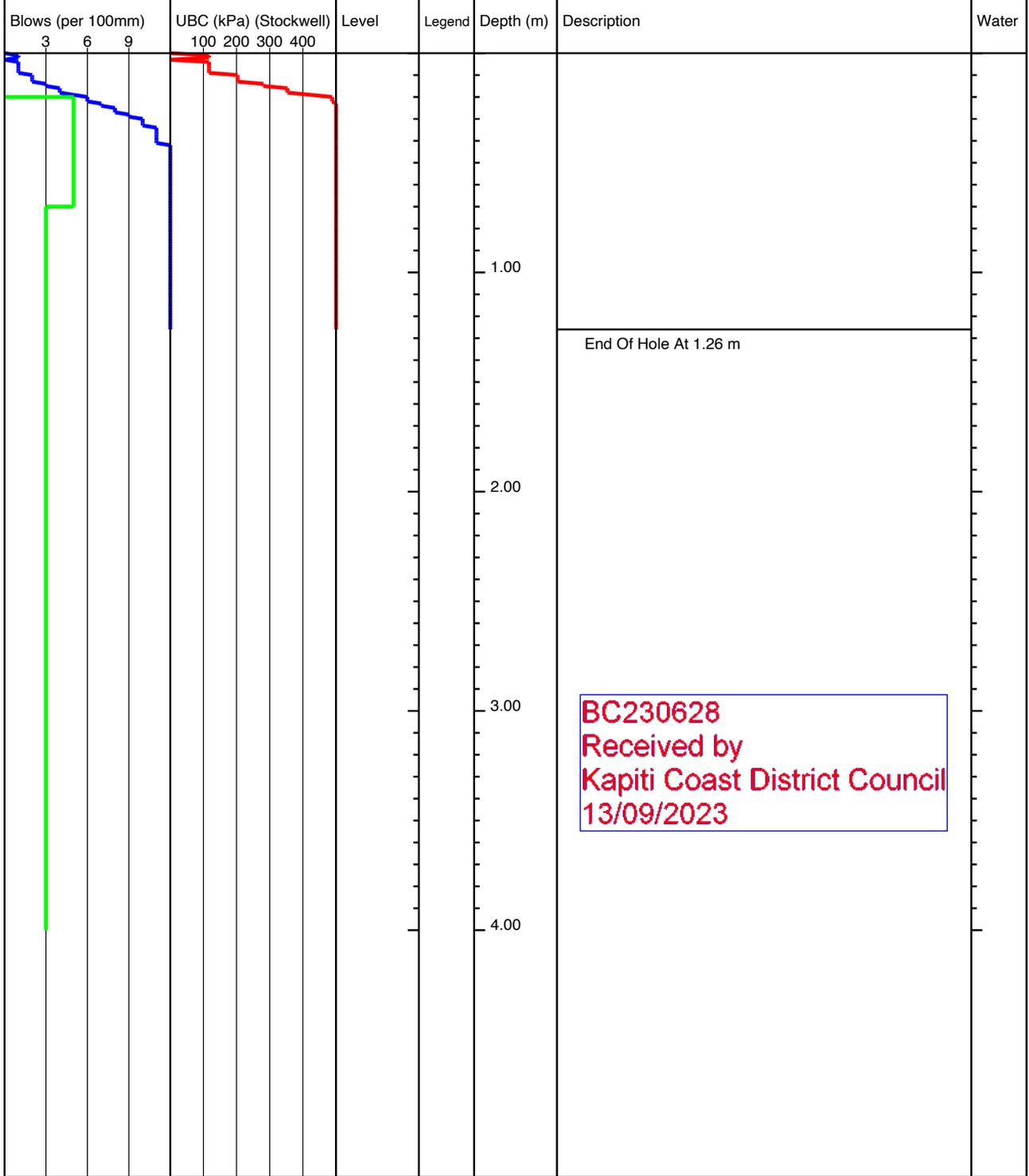
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot19-140
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870438	E Coord: 175.049595
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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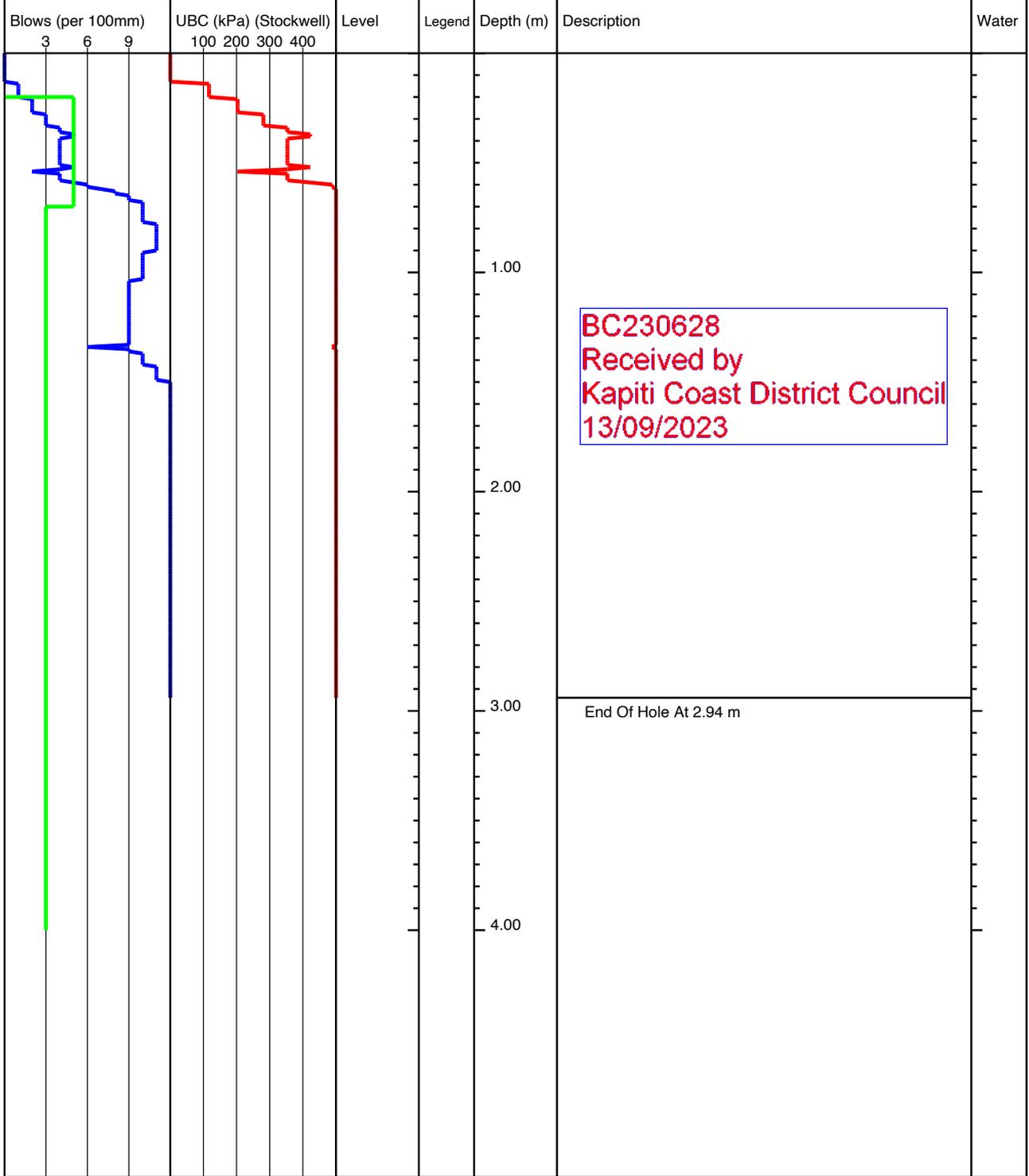
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870463	E Coord: 175.049687
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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 13/09/2023

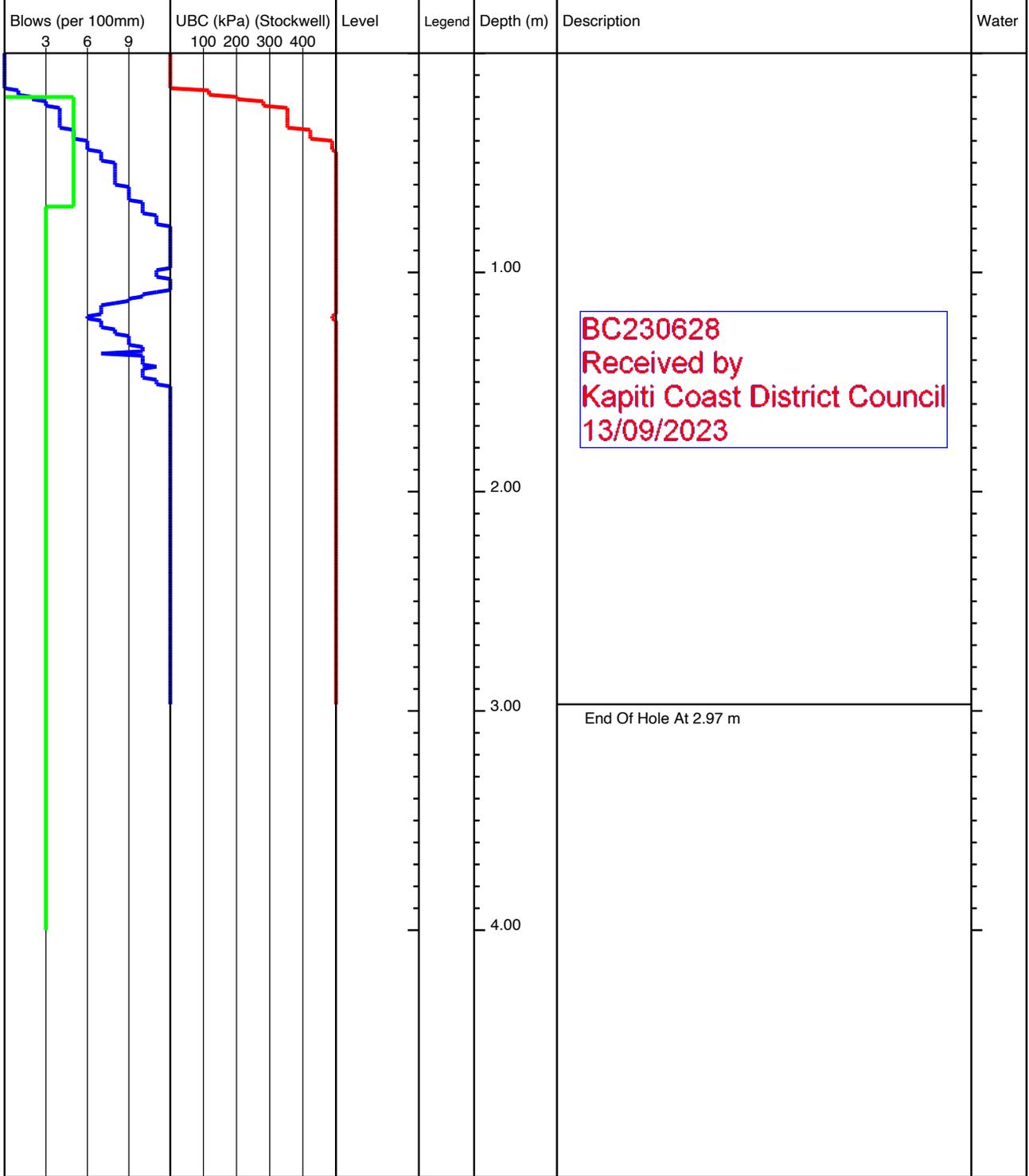
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot19-146
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870505	E Coord: 175.049602
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



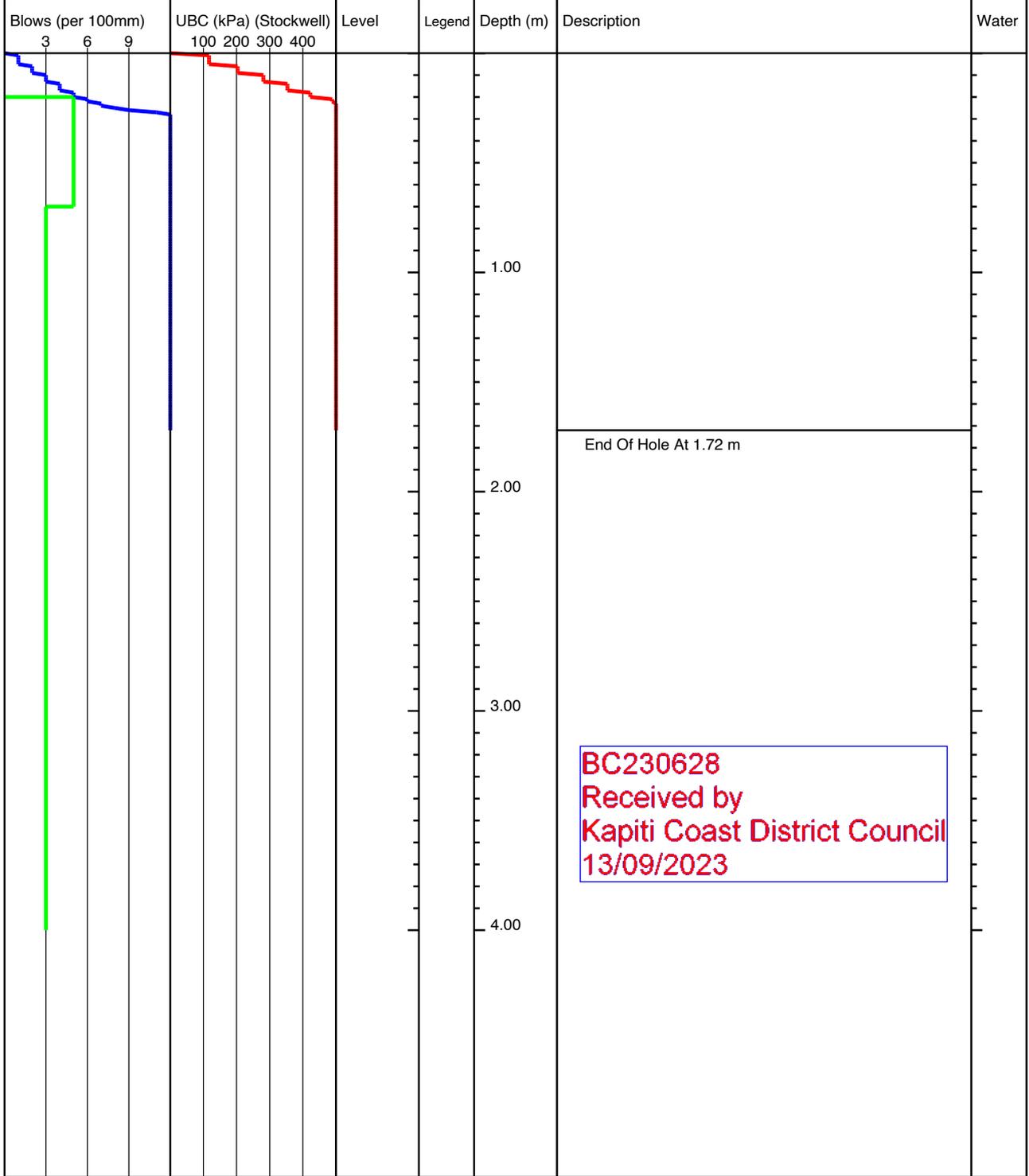
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot19-147
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870505	E Coord: 175.049505
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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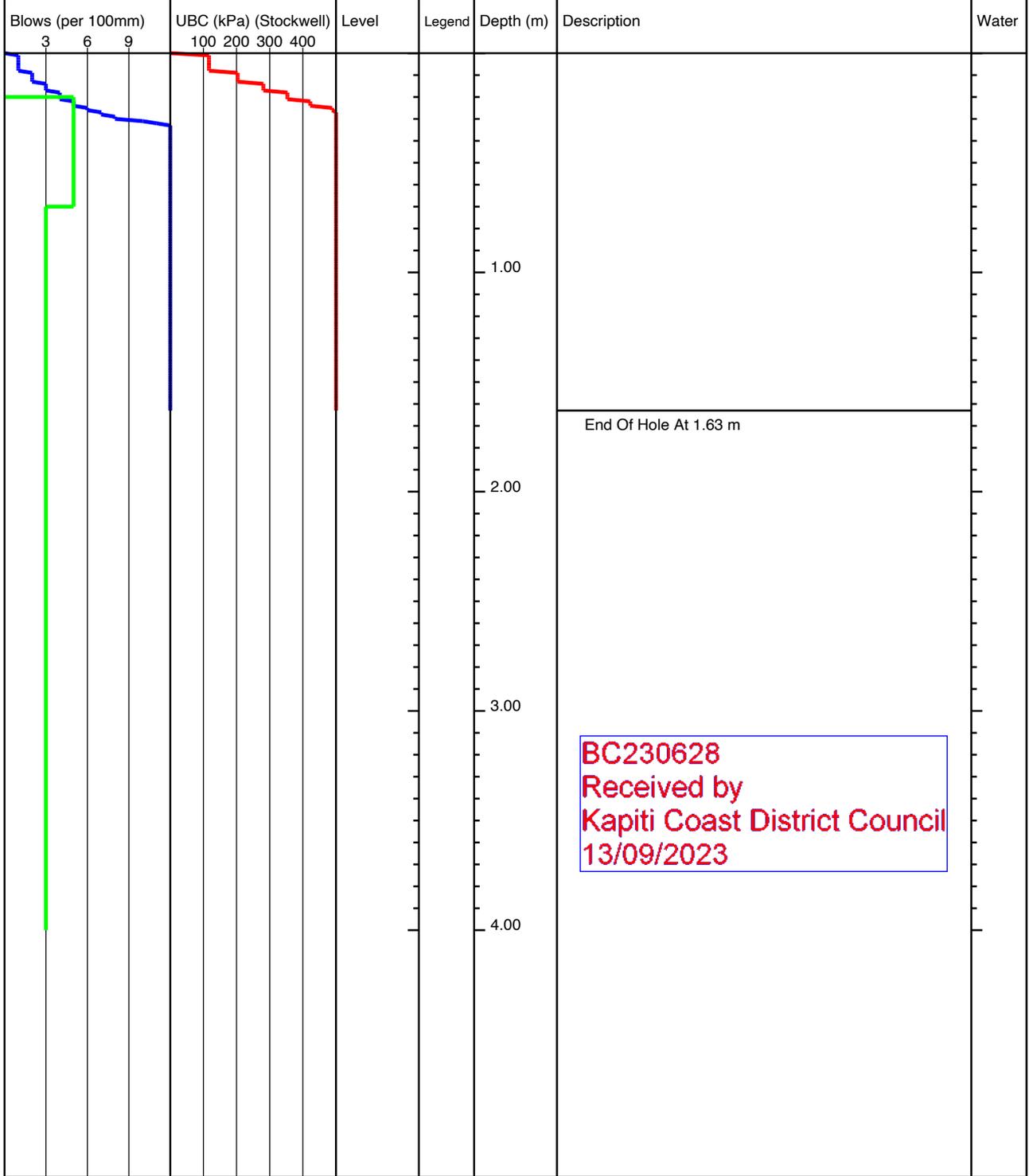
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870365	E Coord: 175.049412
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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 13/09/2023

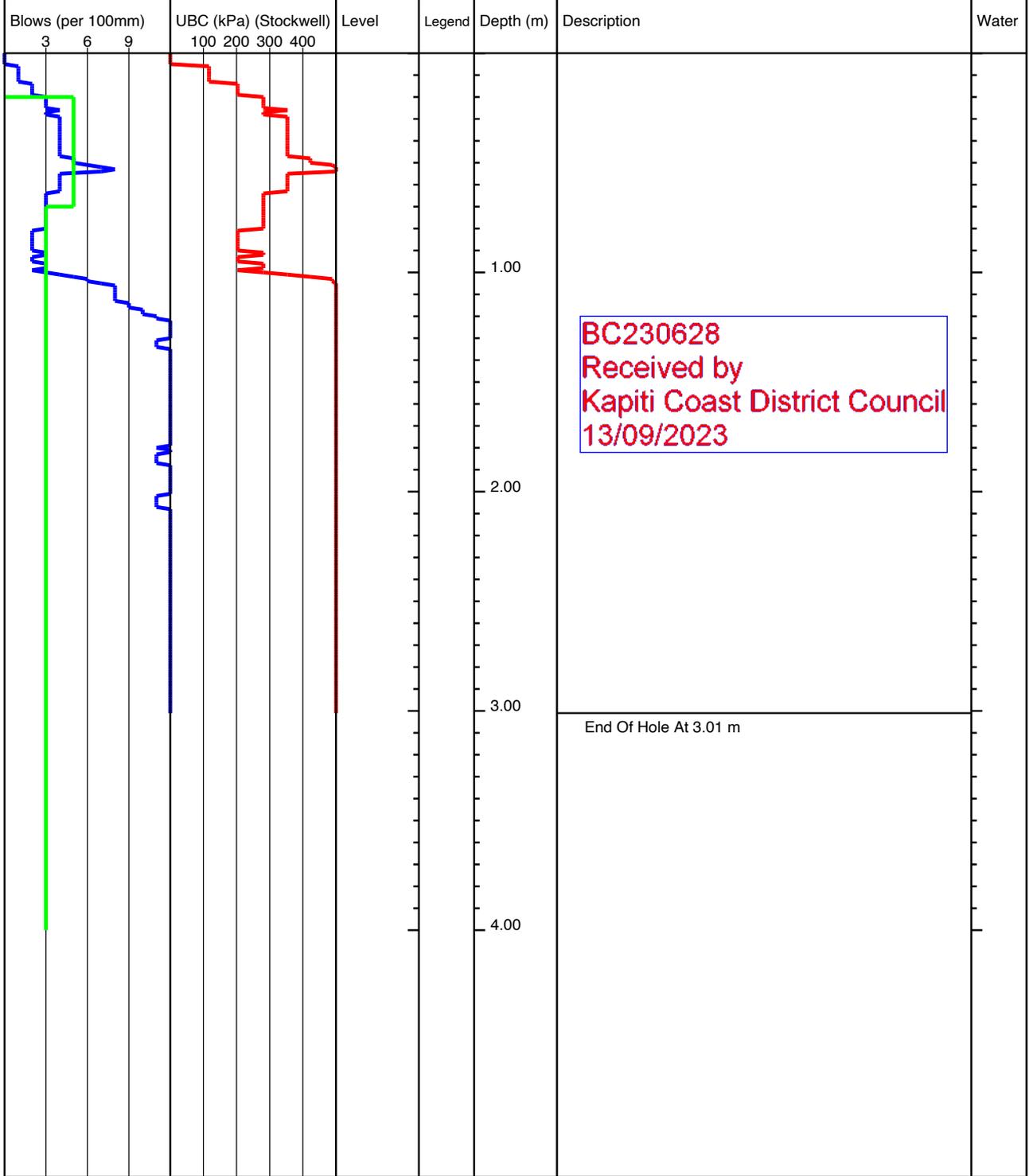
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot20-139
	Project Number: 21852	Client: Anderson Park Trust	
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Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



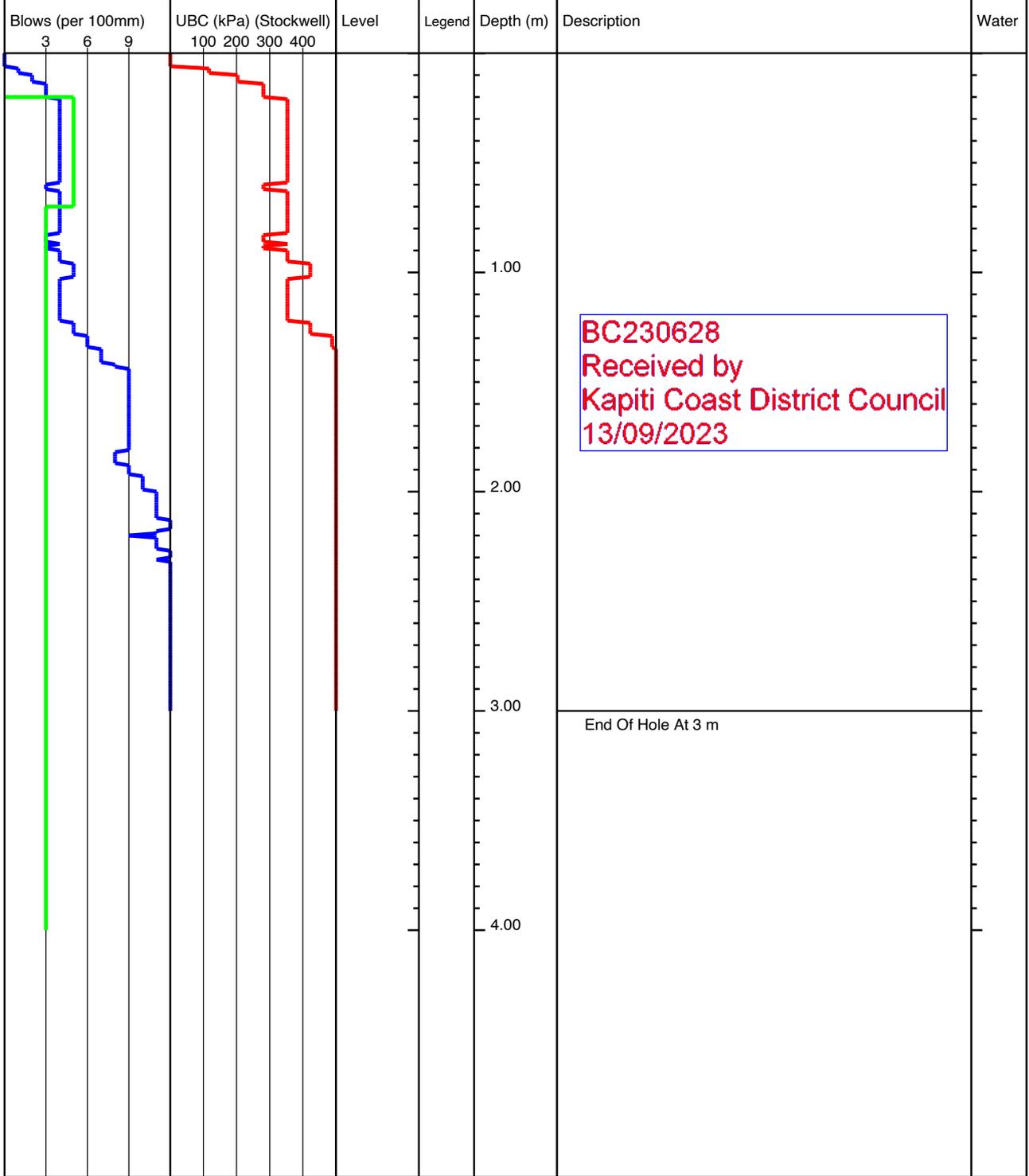
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot20-148
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870467	E Coord: 175.049435
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



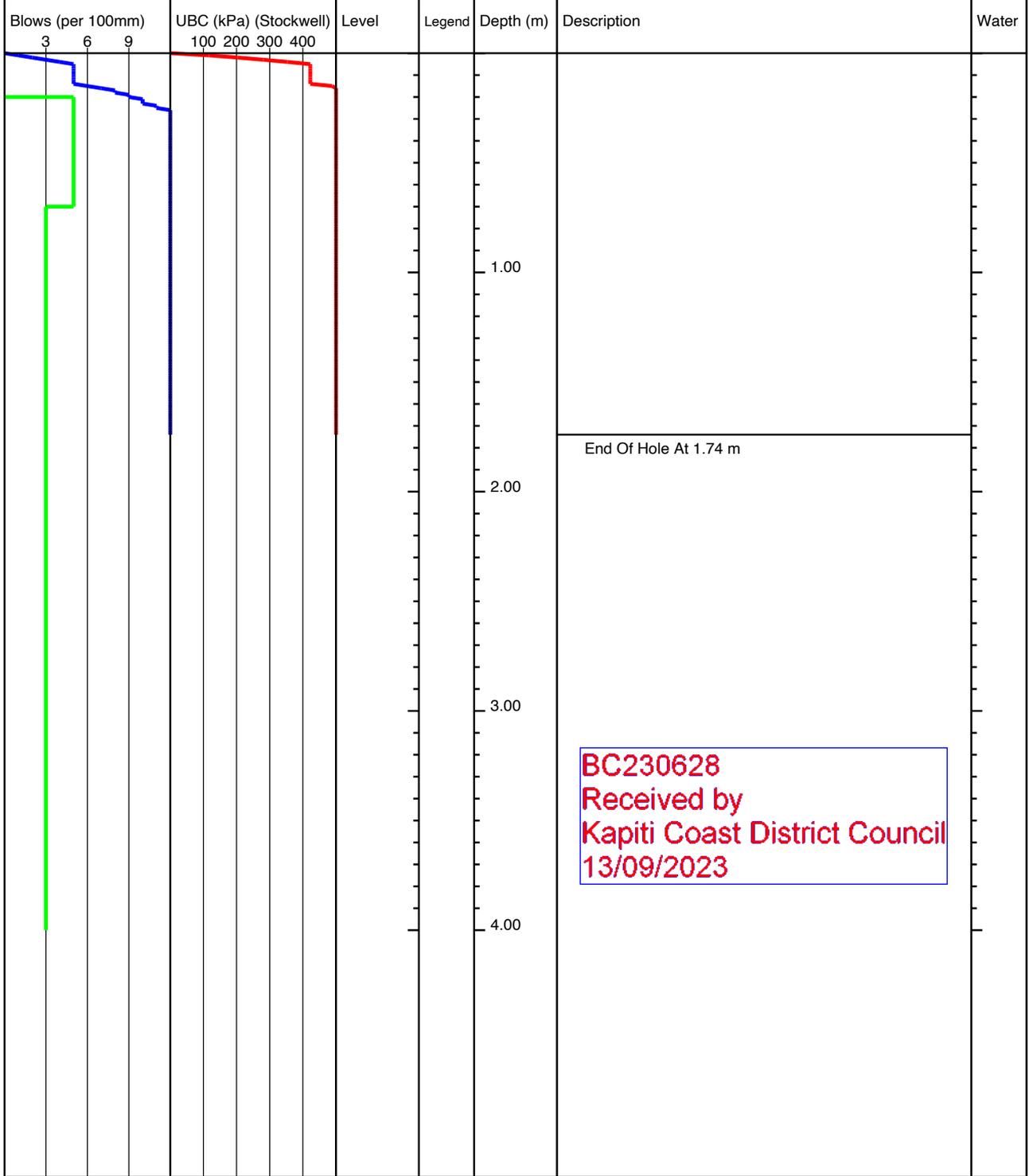
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot20-149
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870423	E Coord: 175.049348
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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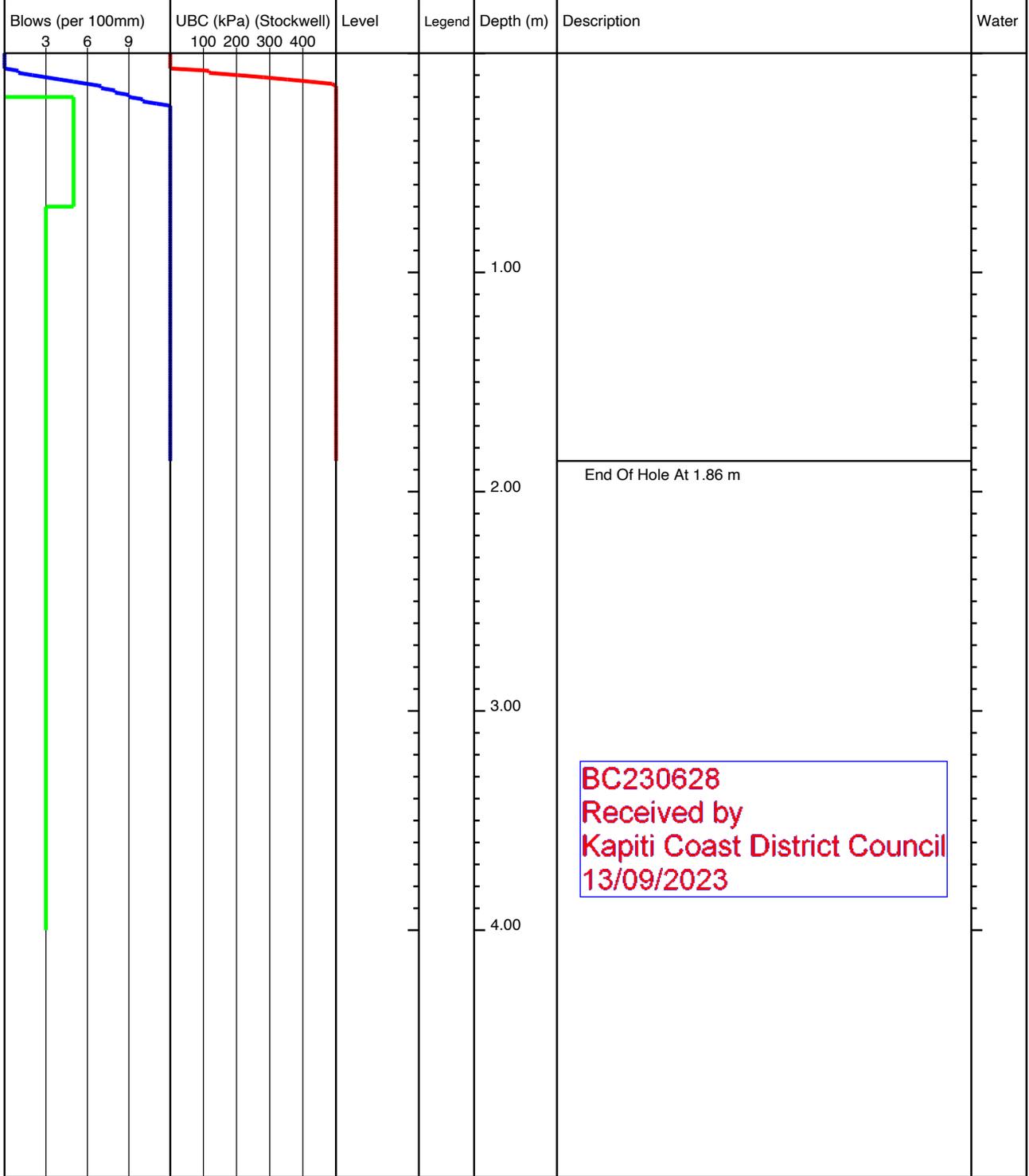
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.87027	E Coord: 175.04915
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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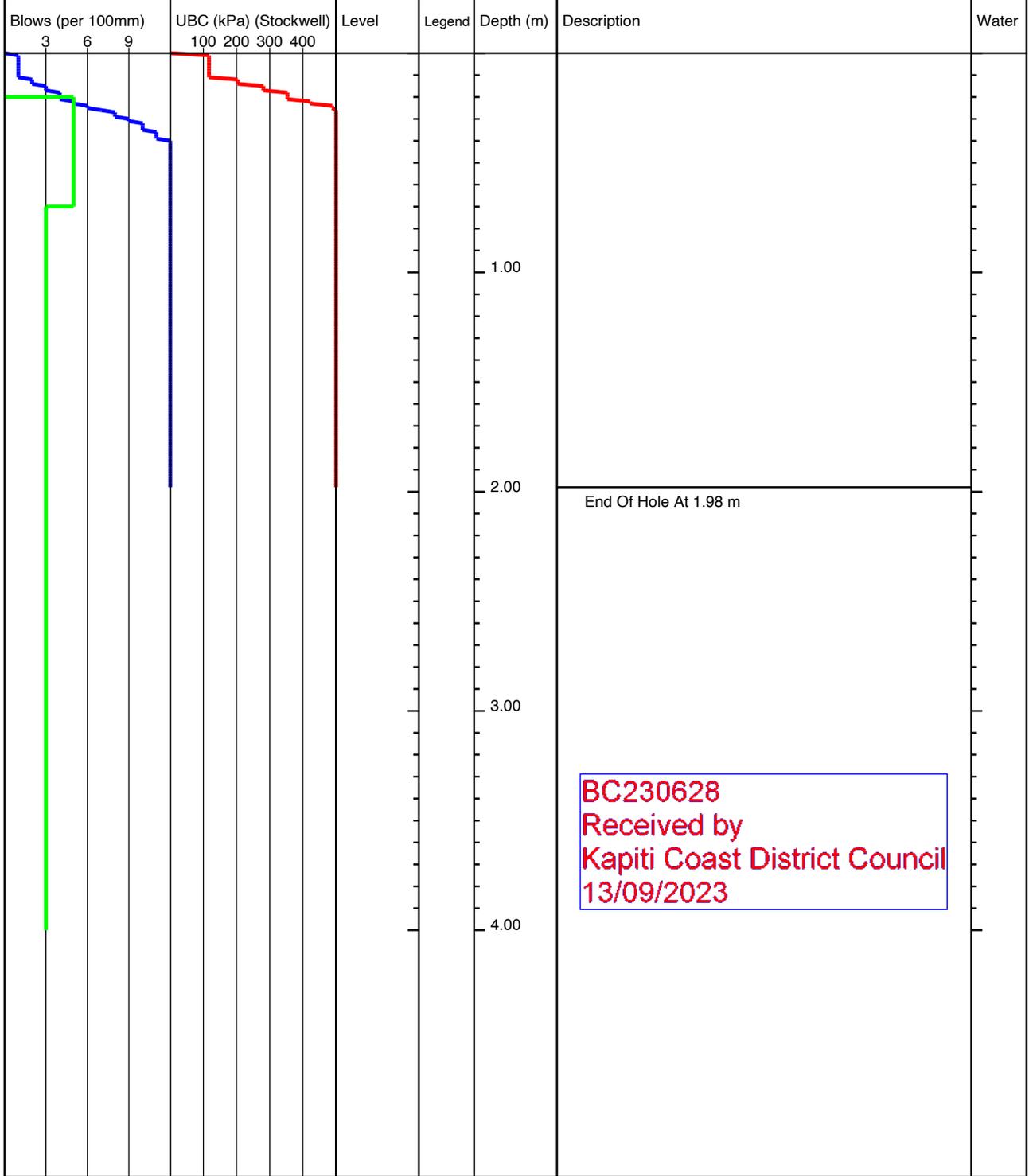
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot21-137
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870317	E Coord: 175.04929
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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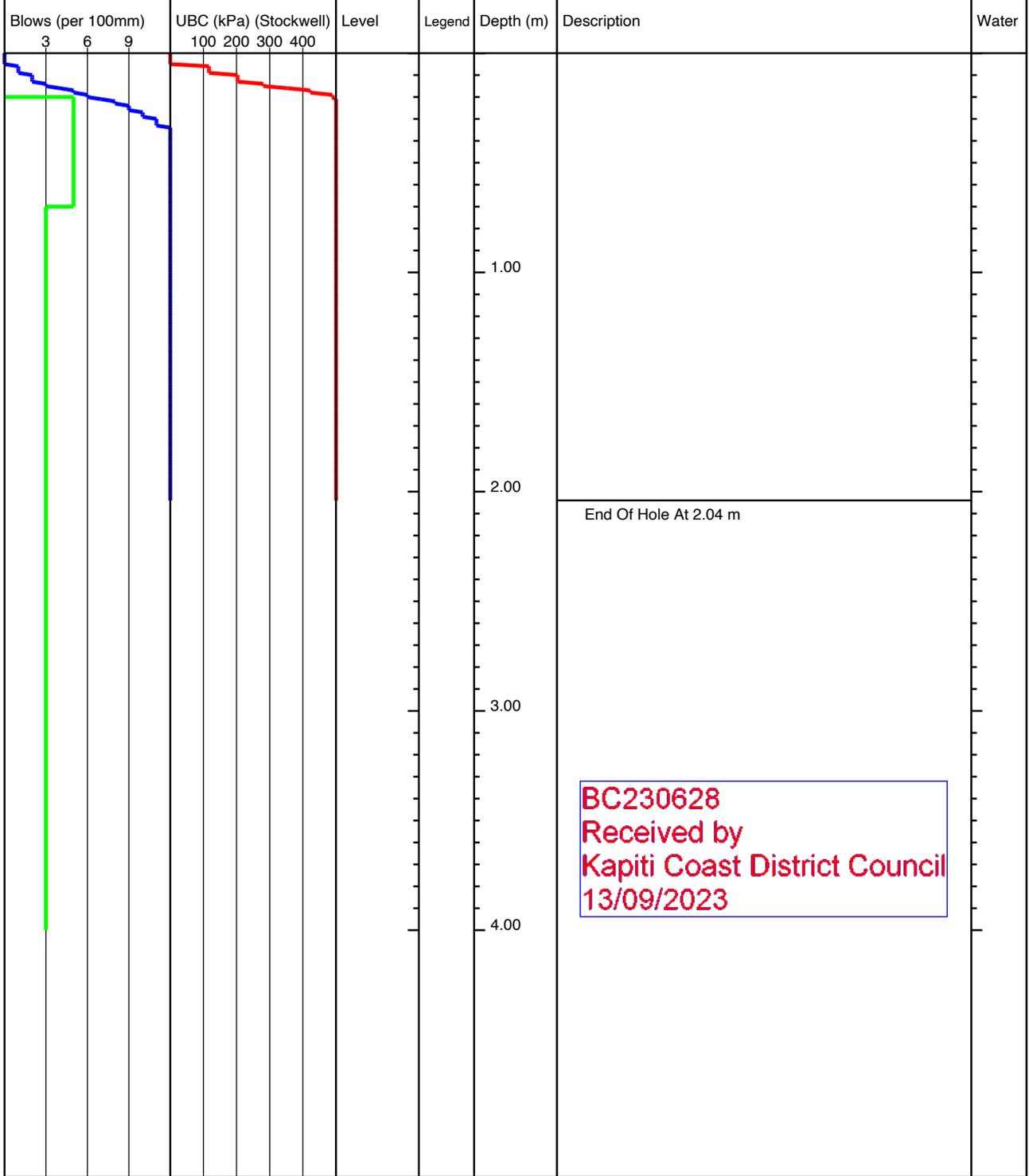
	Project Title: 110 Ngarara Rd, Waikanae		lot21-150
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870372	E Coord: 175.049245
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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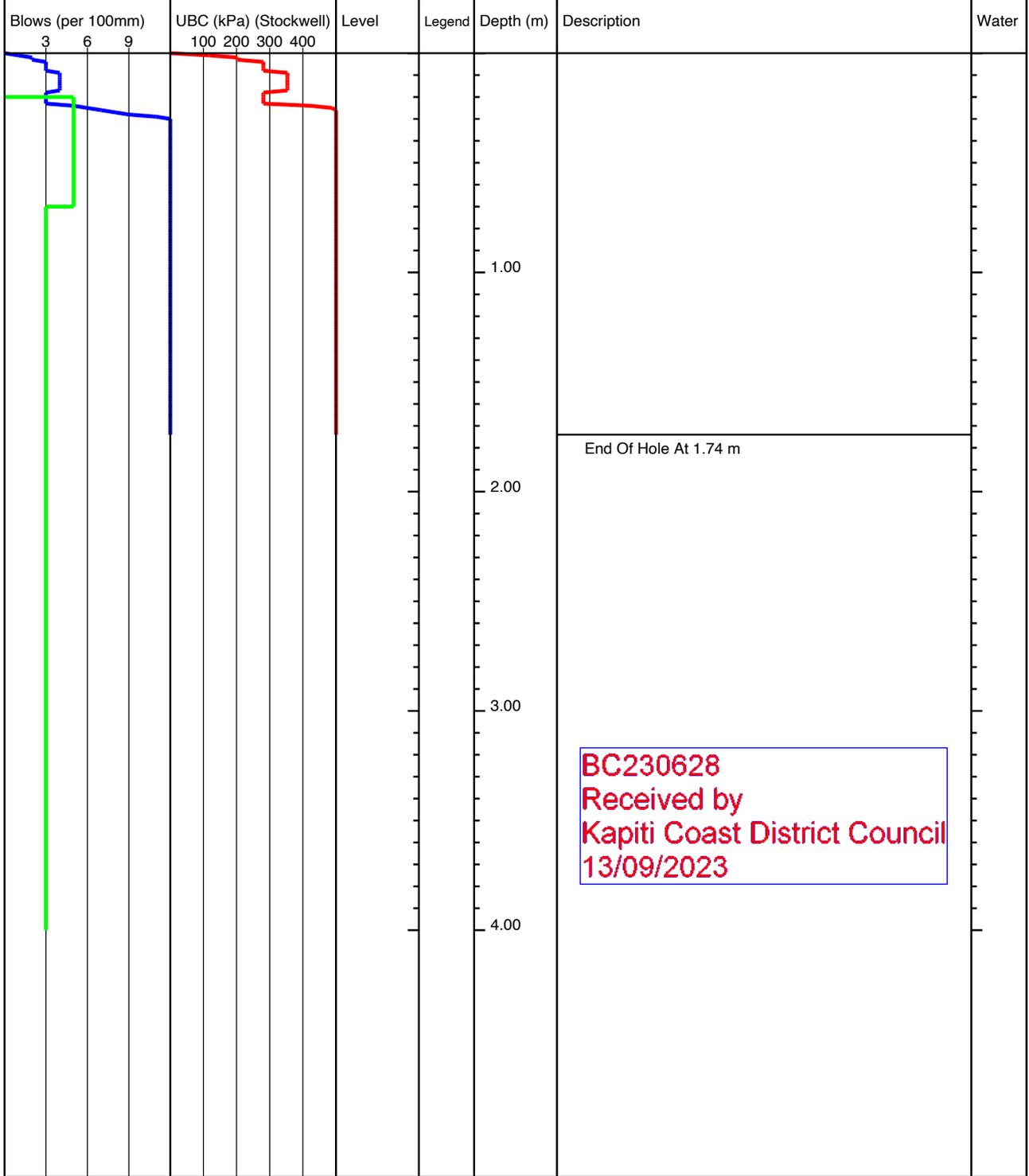
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870318	E Coord: 175.049118
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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 13/09/2023

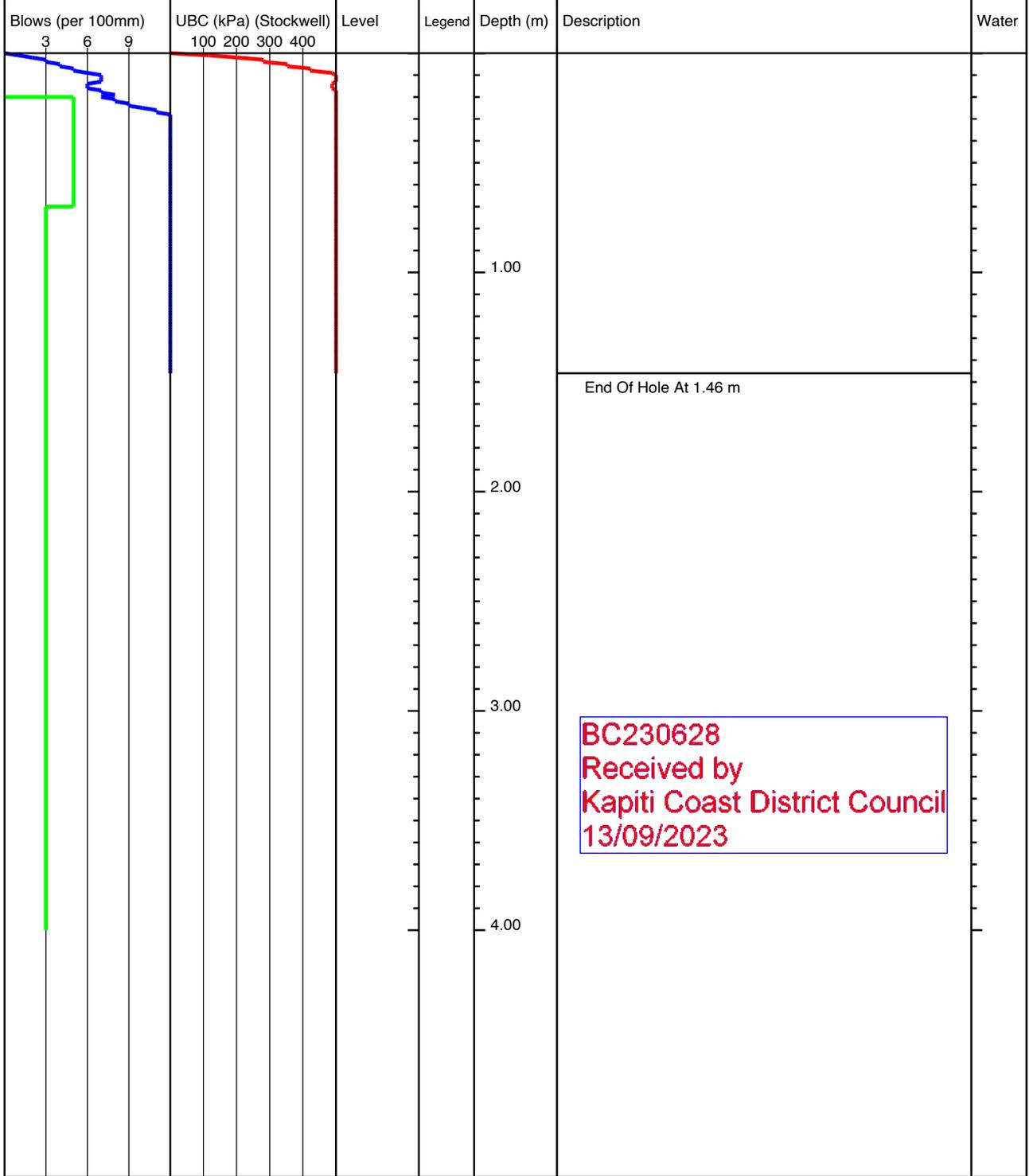
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot22-134
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870182	E Coord: 175.048973
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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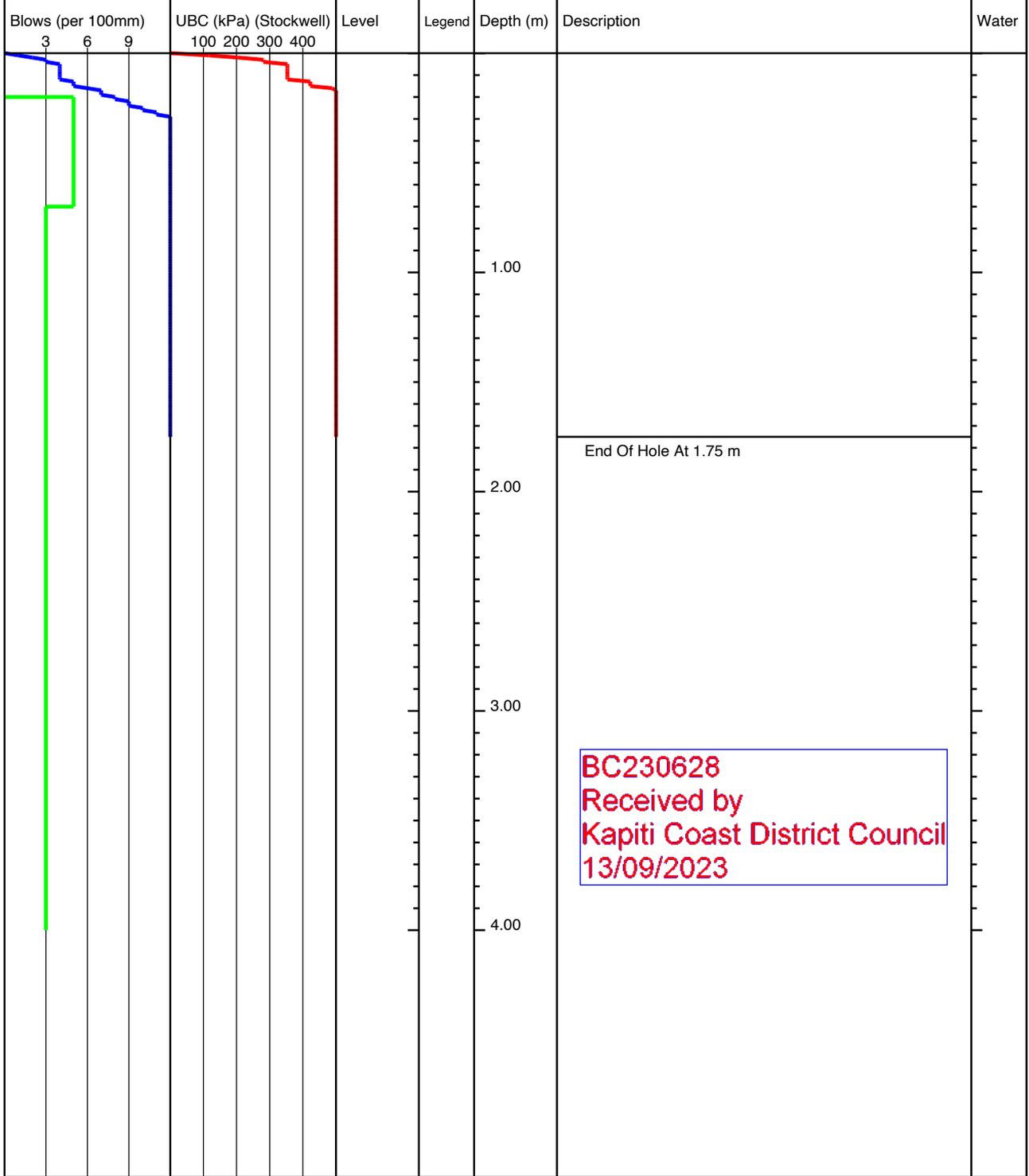
	Project Title: 110 Ngarara Rd, Waikanae		lot22-135
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870225	E Coord: 175.049055
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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**Kapiti Coast District Council**  
**13/09/2023**

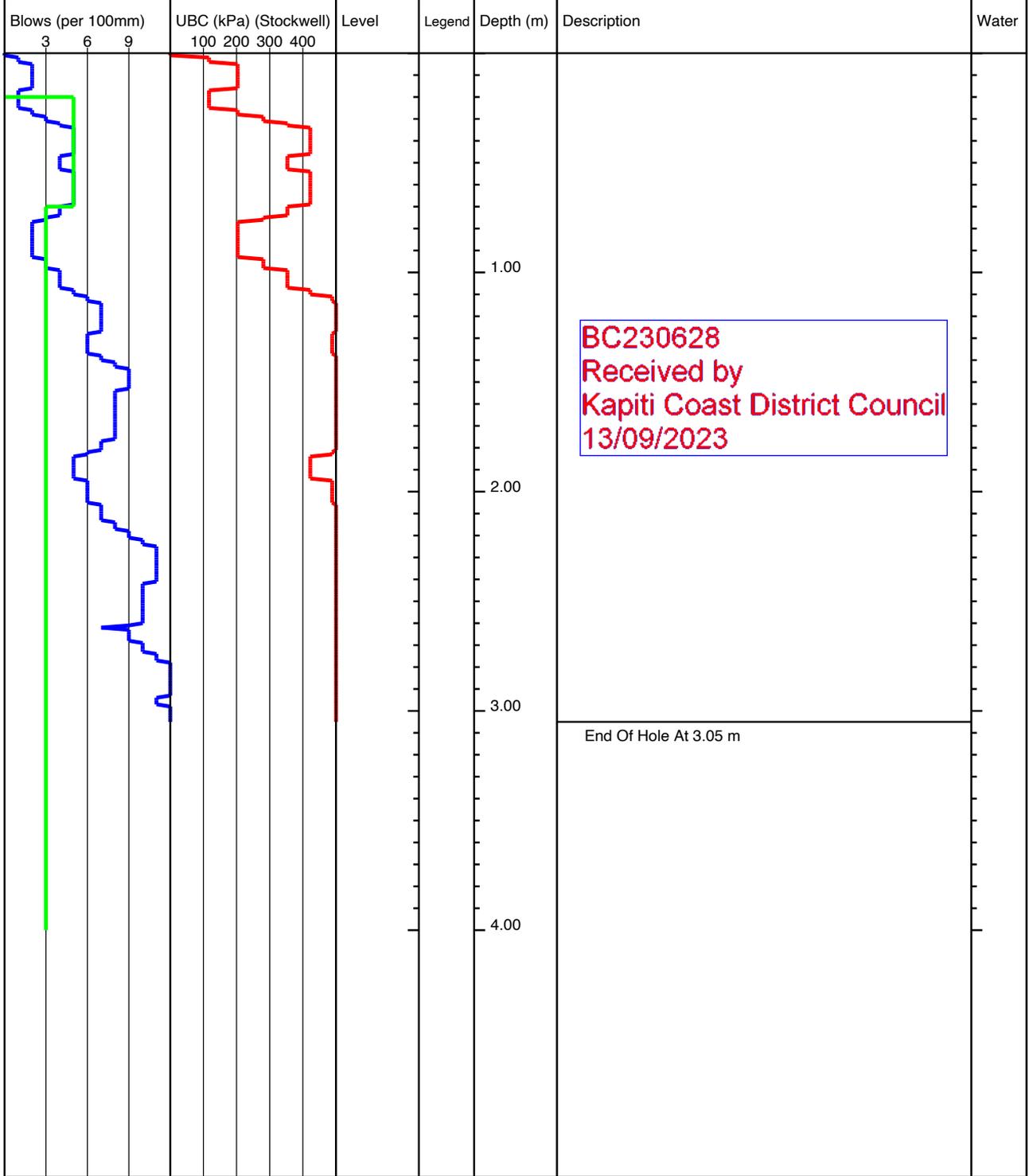
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot22-152
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870285	E Coord: 175.049025
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



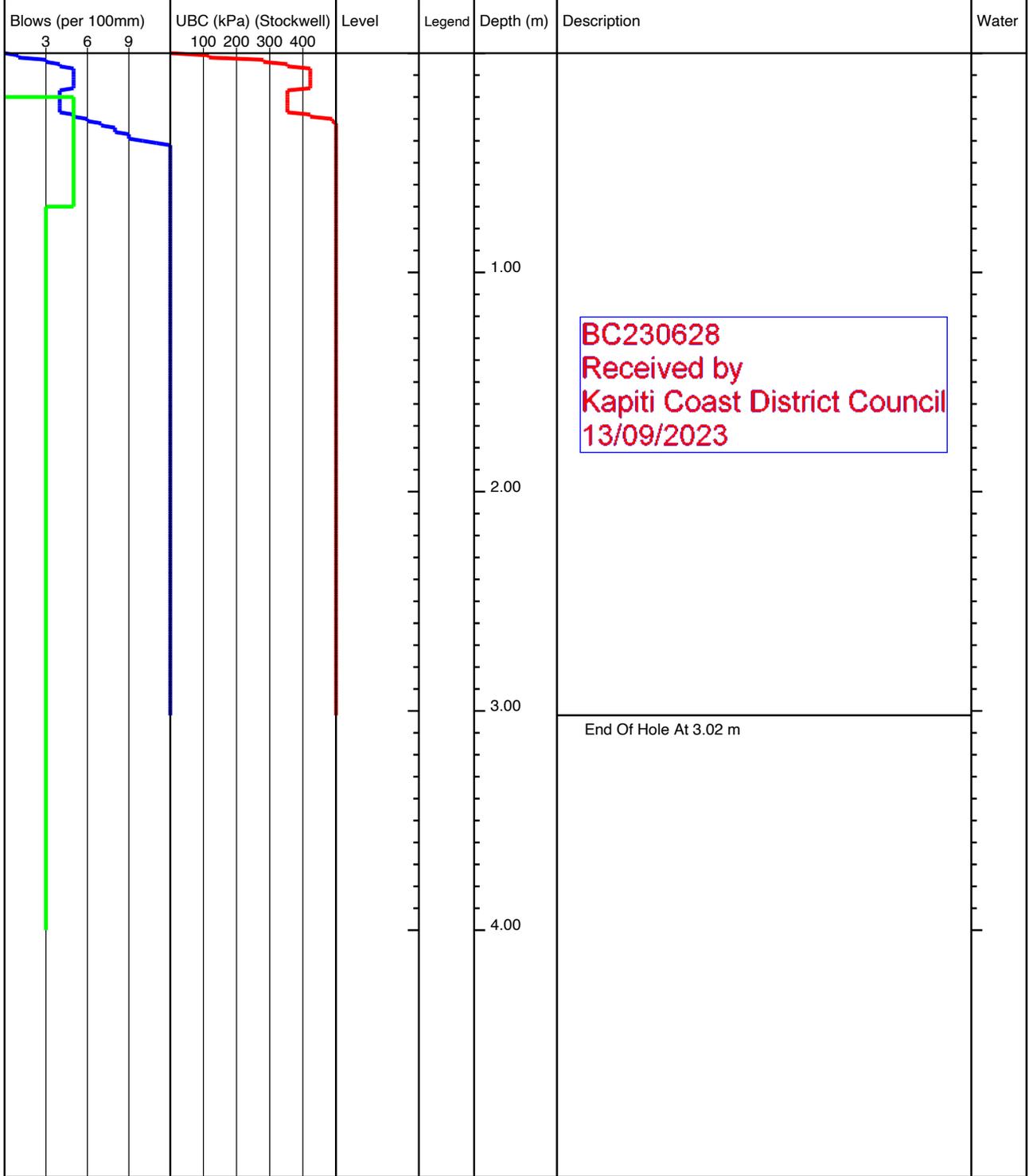
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot22-153
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870242	E Coord: 175.048905
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



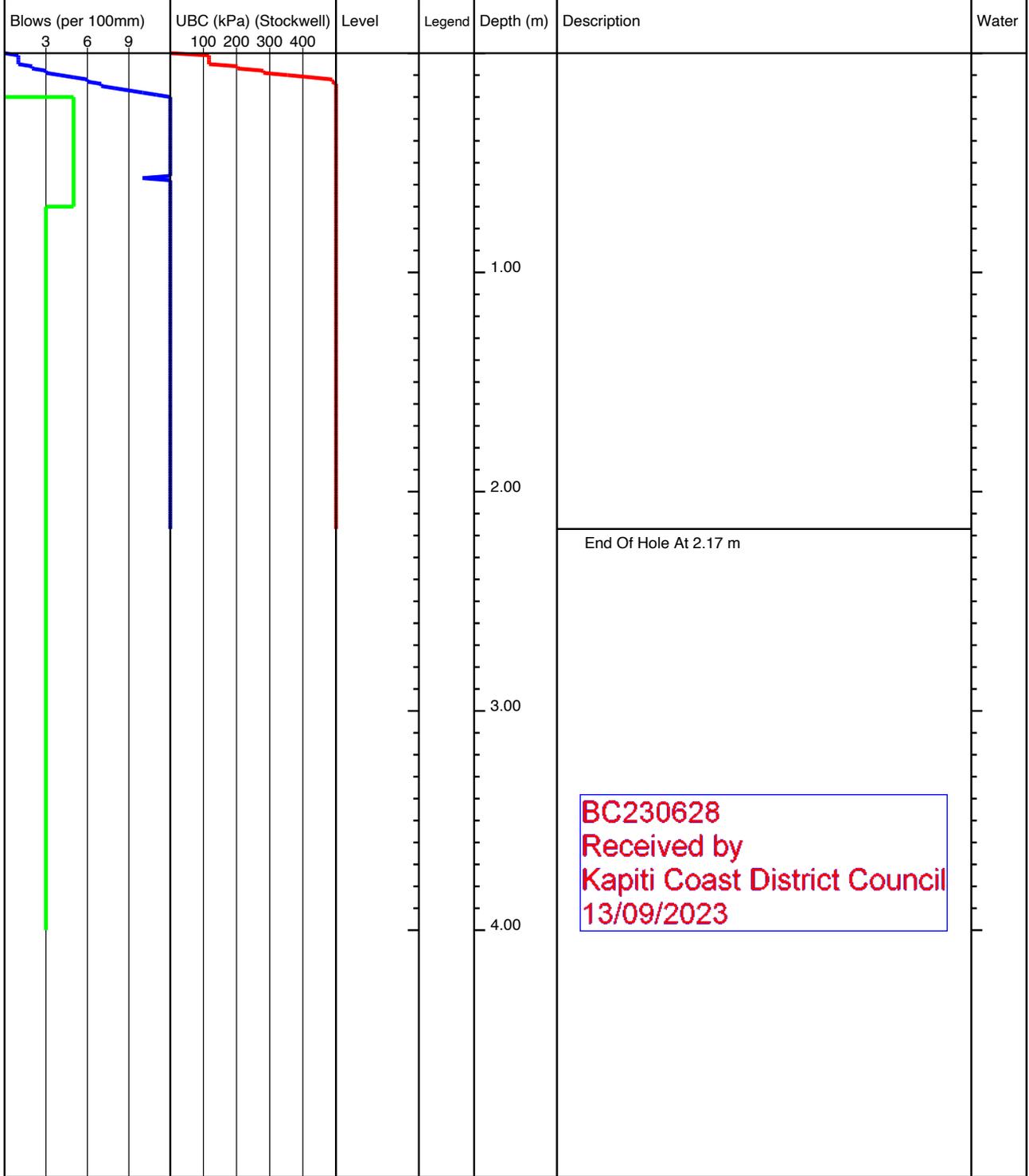
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot23-132
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870085	E Coord: 175.048785
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



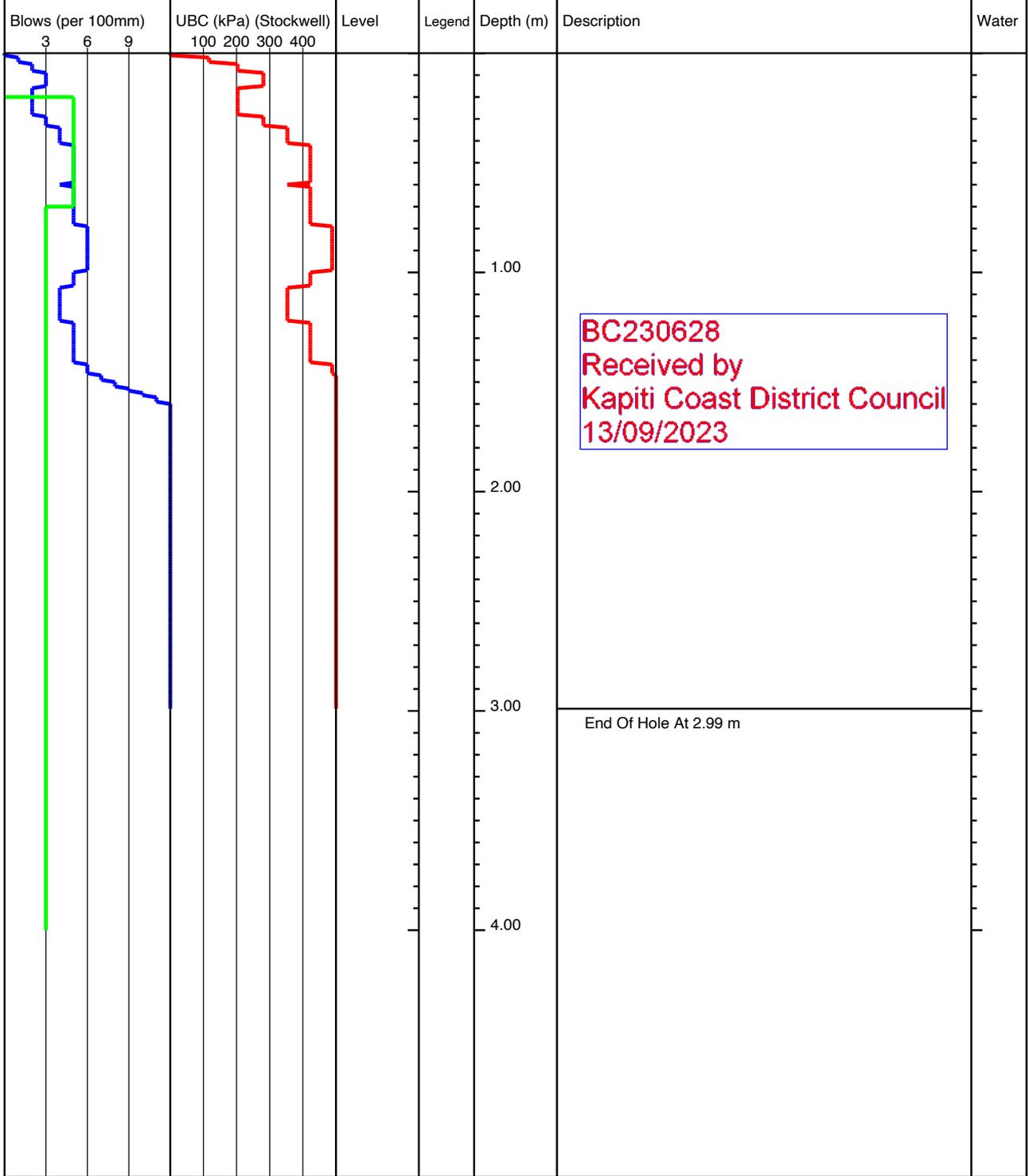
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot23-133
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870098	E Coord: 175.048865
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



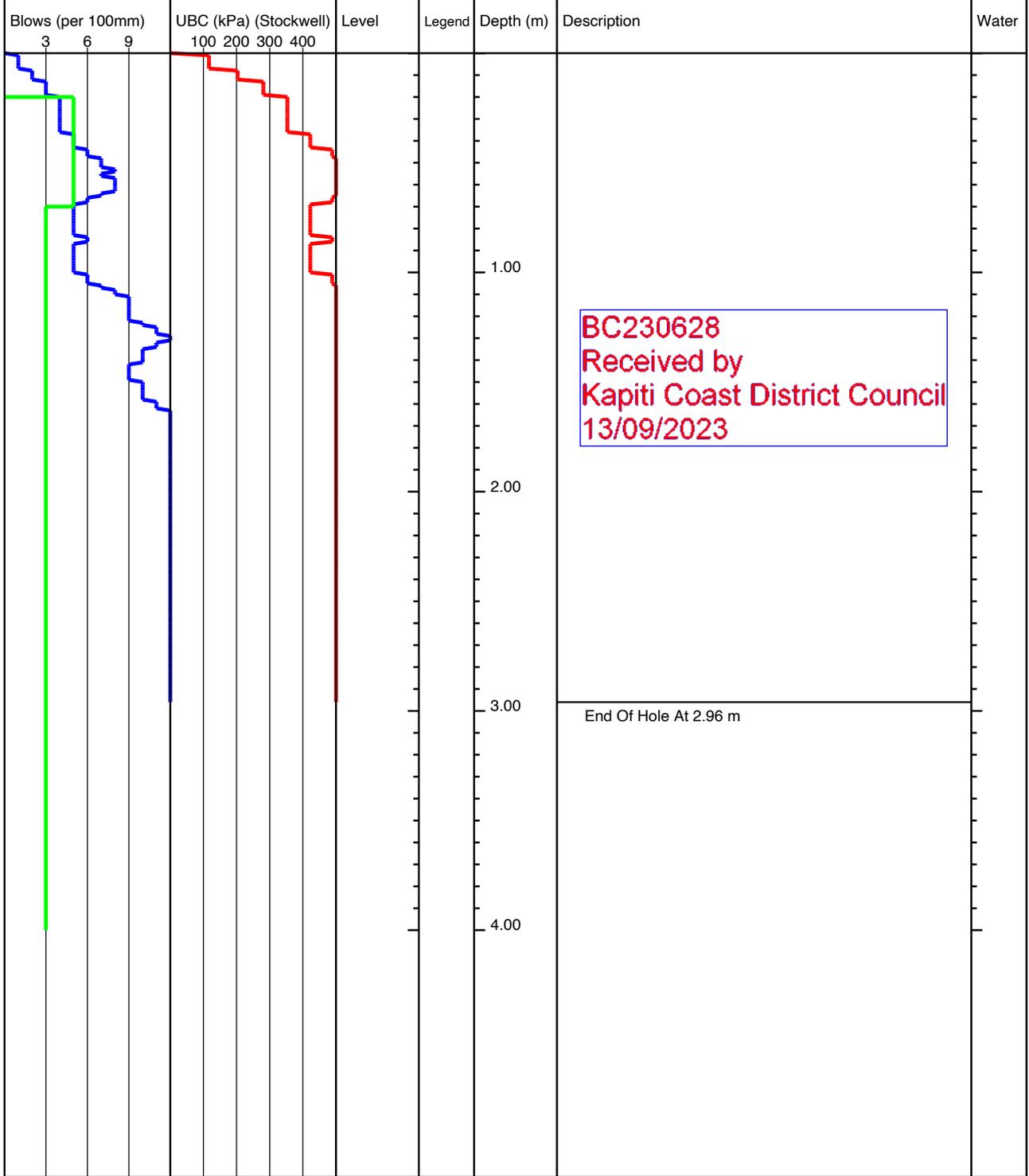
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot23-154
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870223	E Coord: 175.048787
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



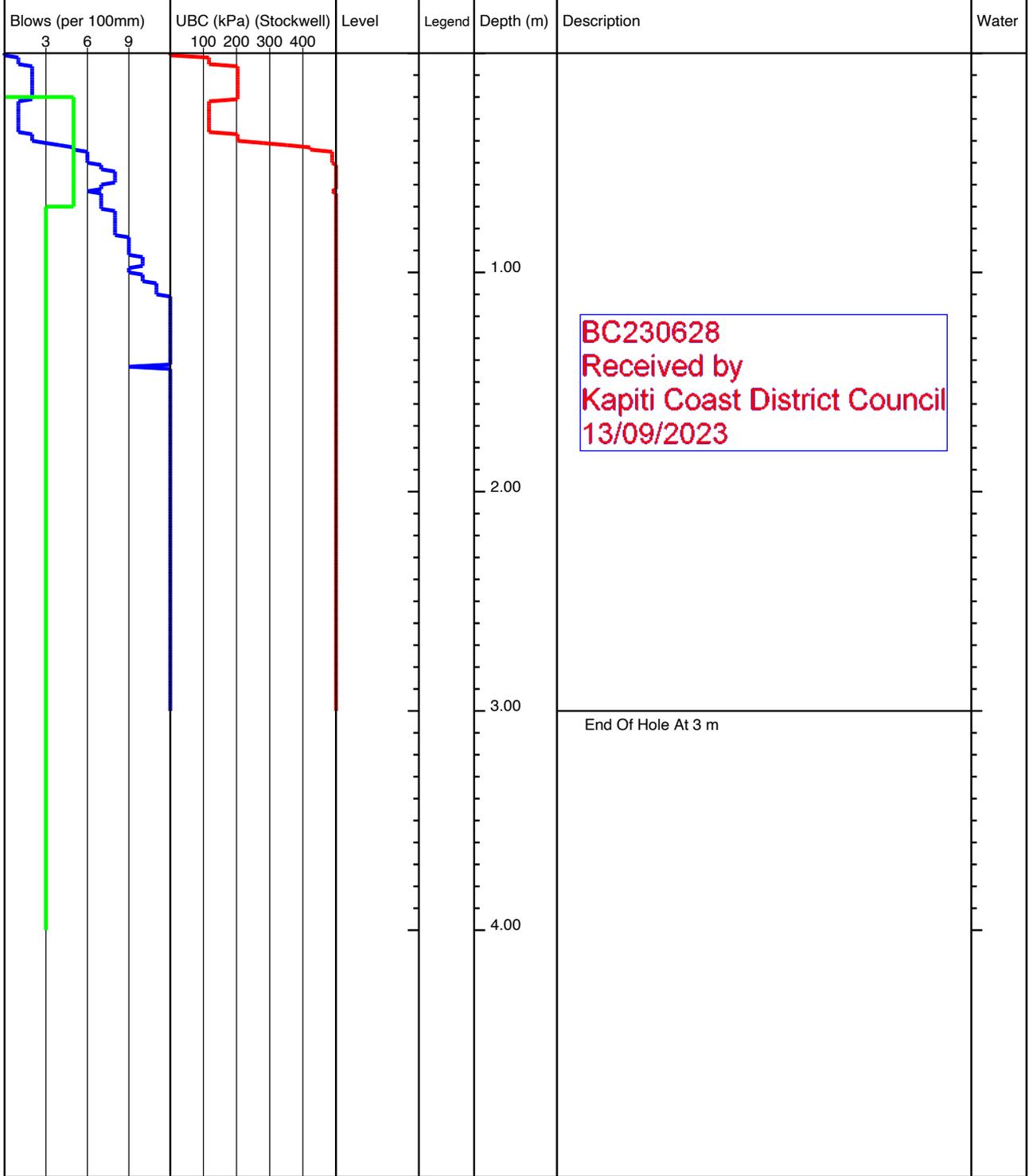
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot23-155
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870195	E Coord: 175.048697
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



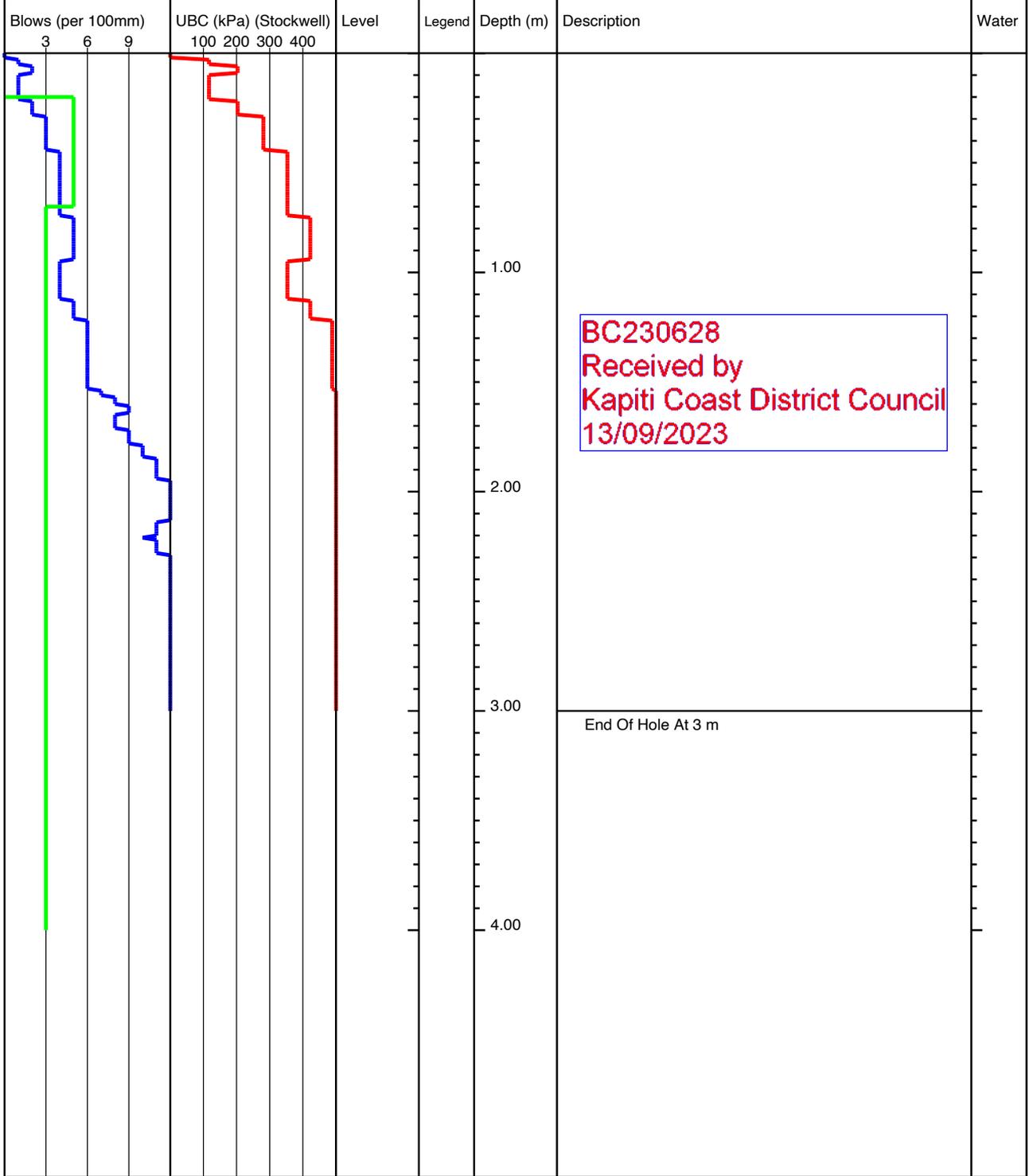
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot24-125
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869983	E Coord: 175.048605
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



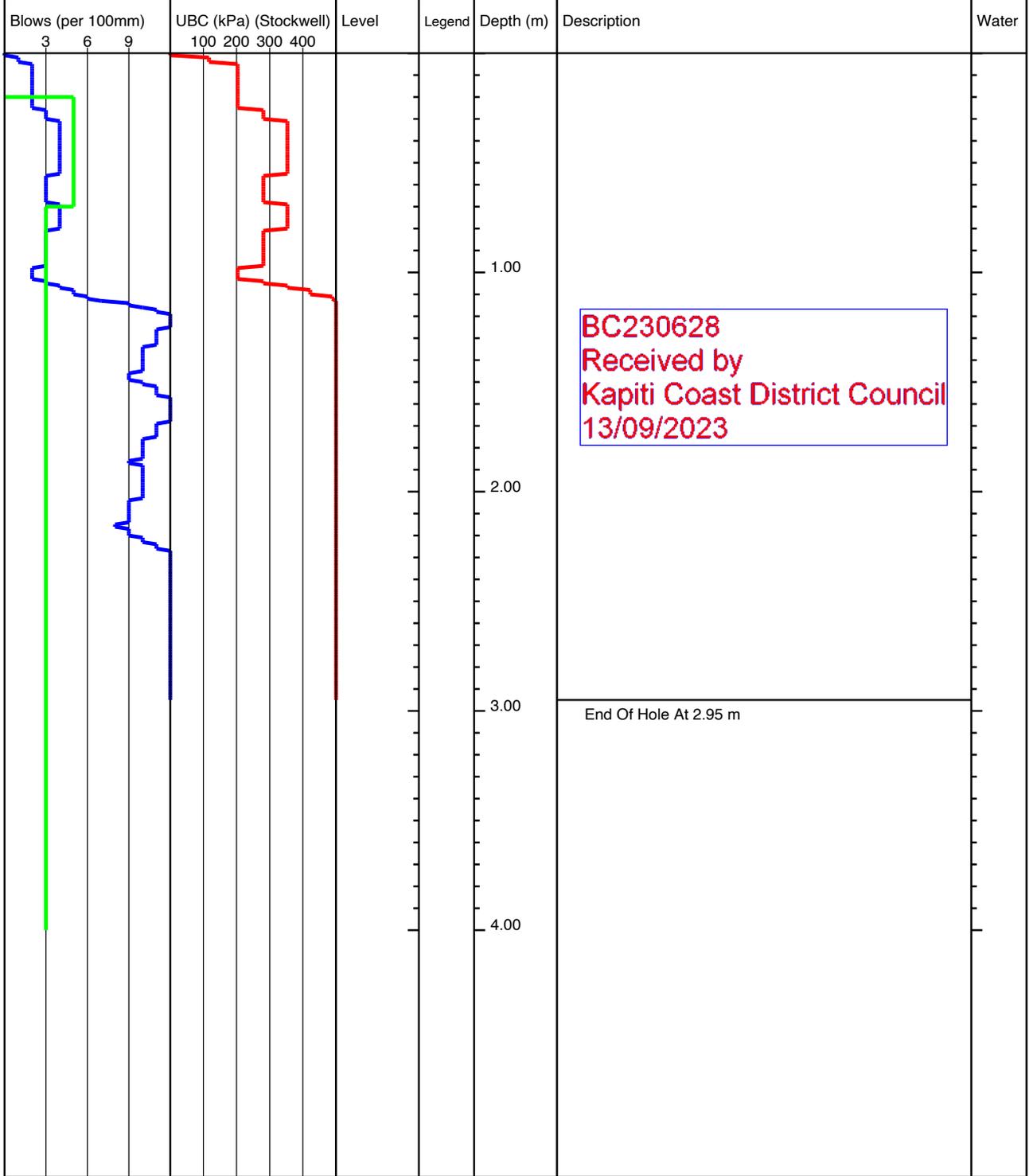
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot24-126
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870095	E Coord: 175.048512
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



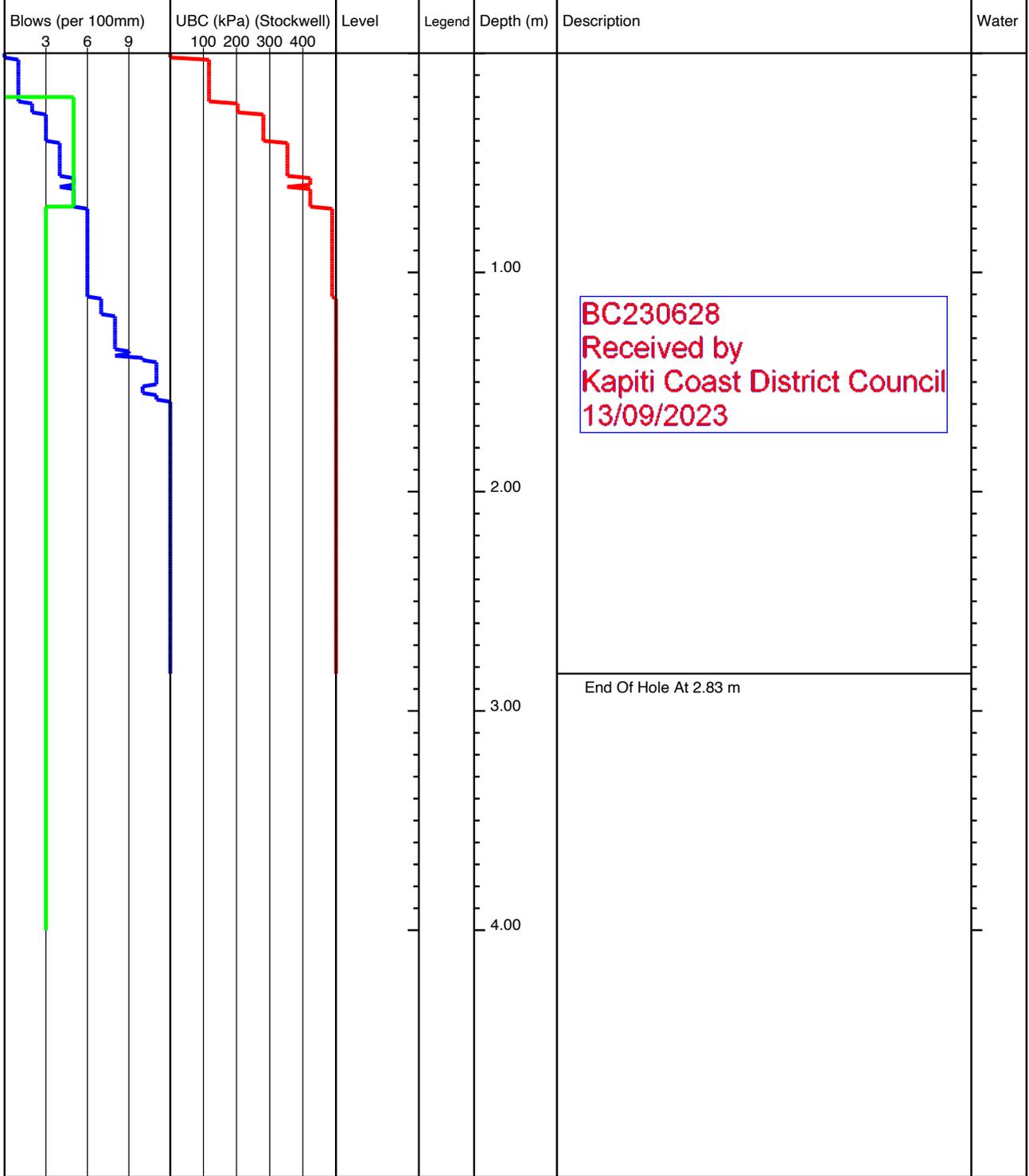
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot24-127
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870125	E Coord: 175.048593
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



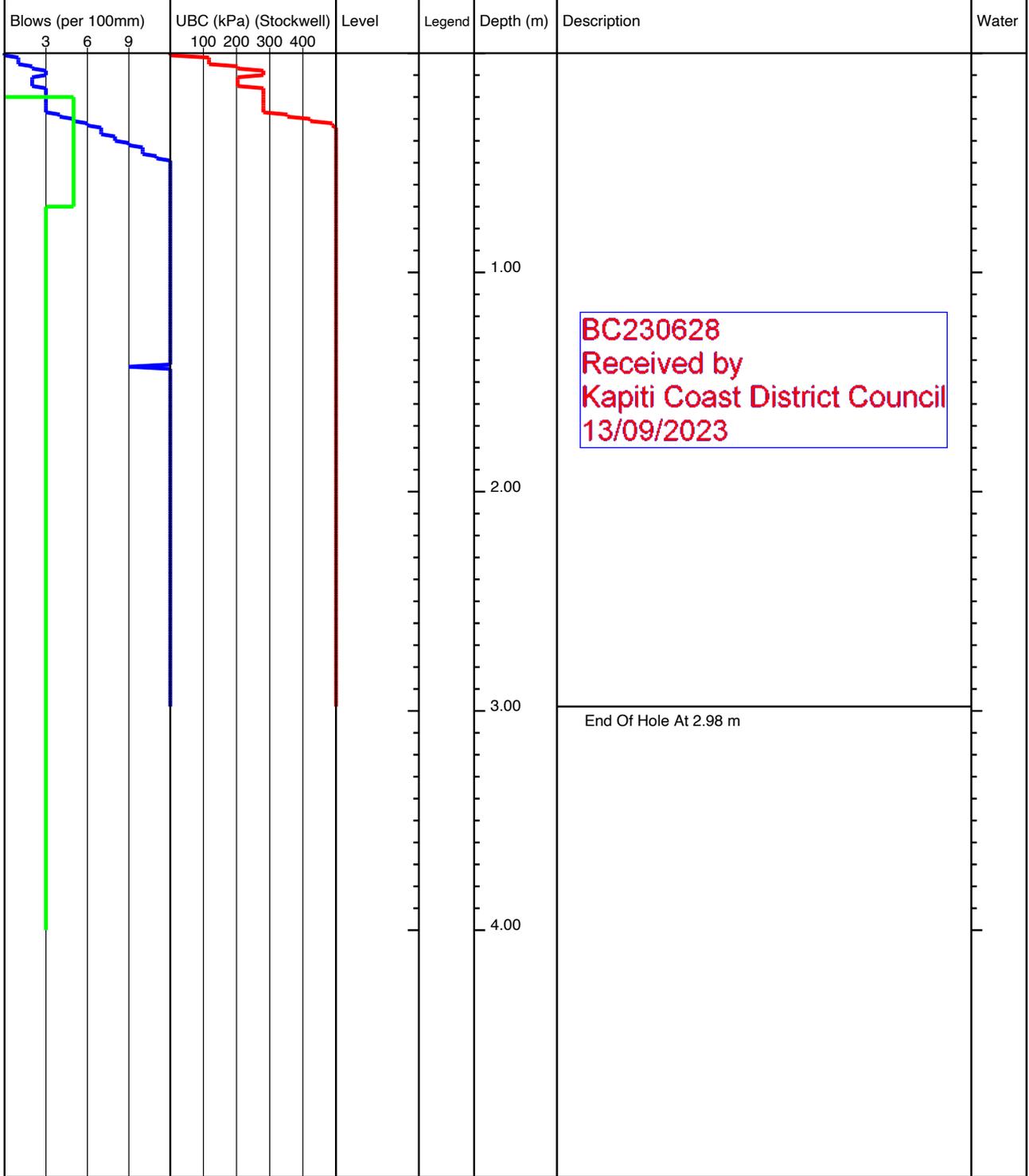
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot24-128
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869983	E Coord: 175.048508
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



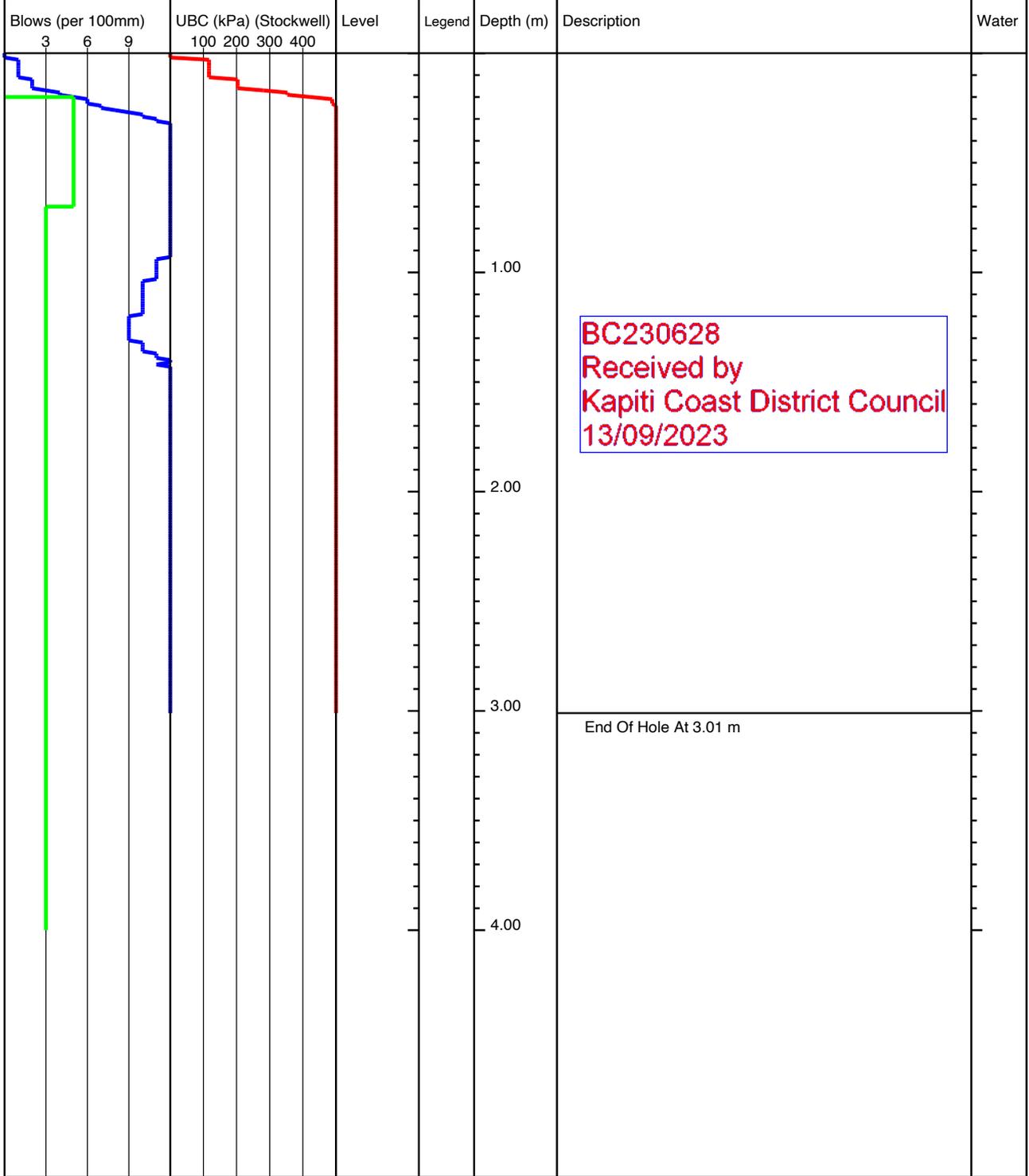
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot24-129
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.870053	E Coord: 175.048633
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



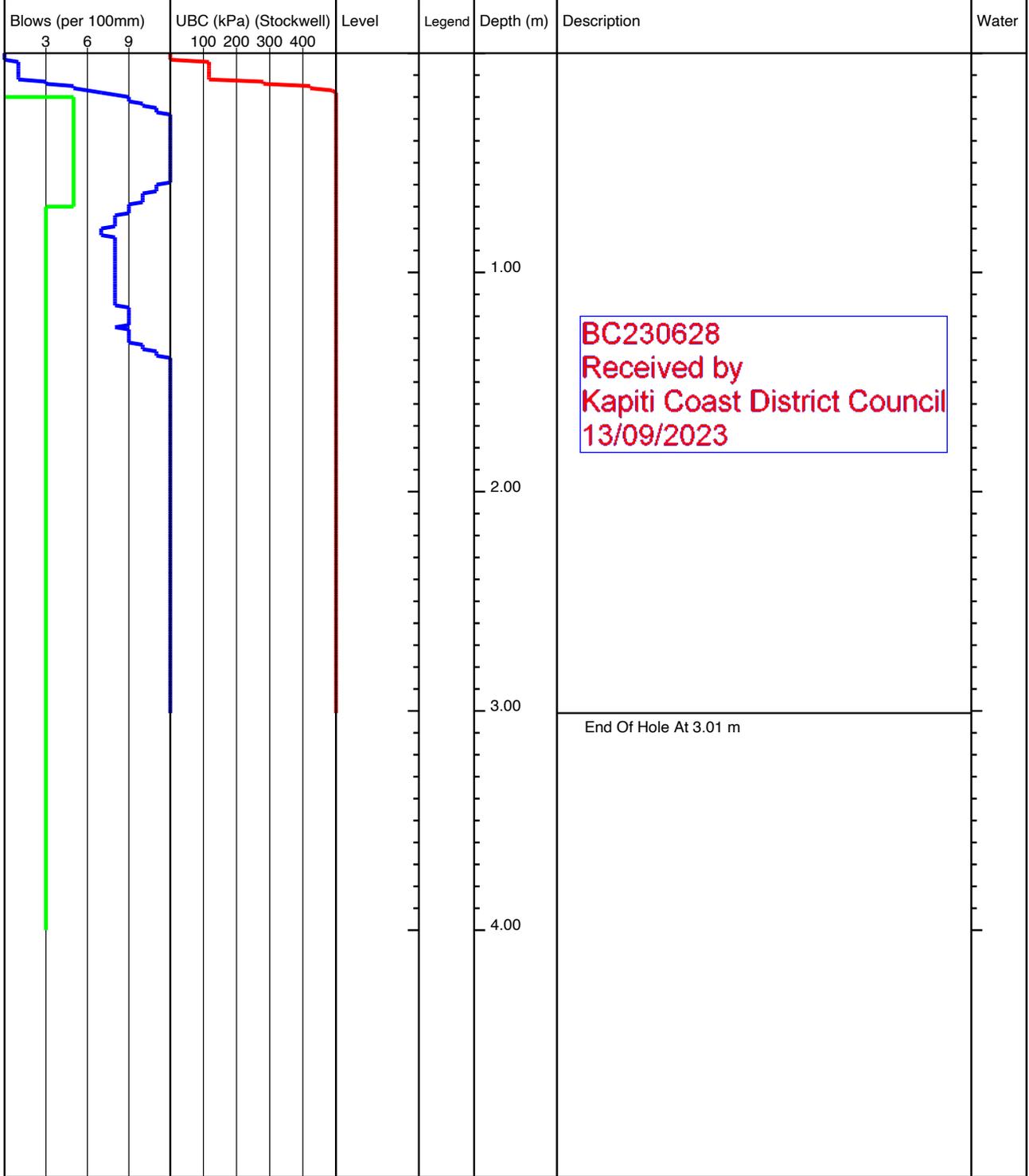
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot25-123
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869868	E Coord: 175.048847
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



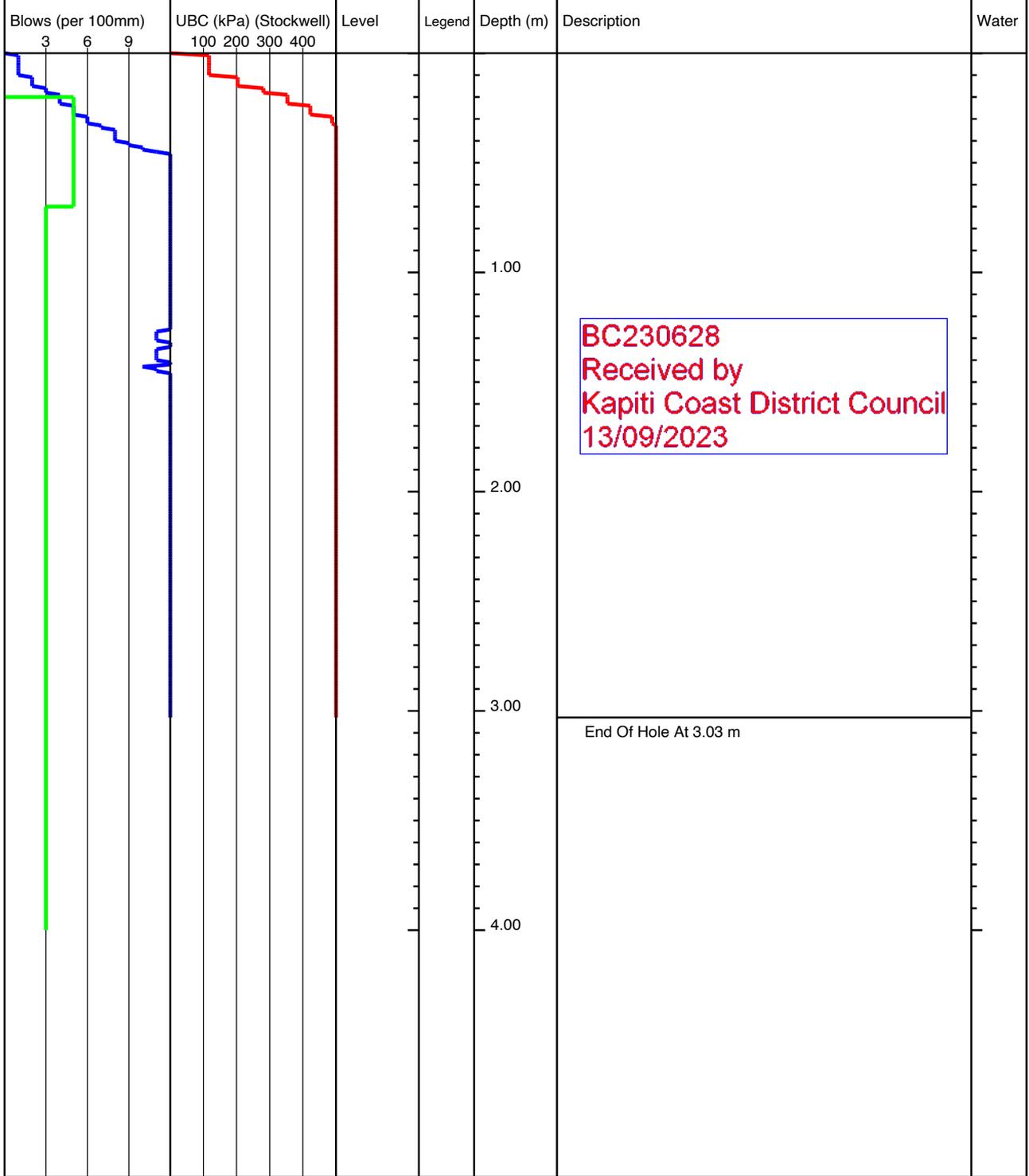
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot25-124
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869913	E Coord: 175.048702
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



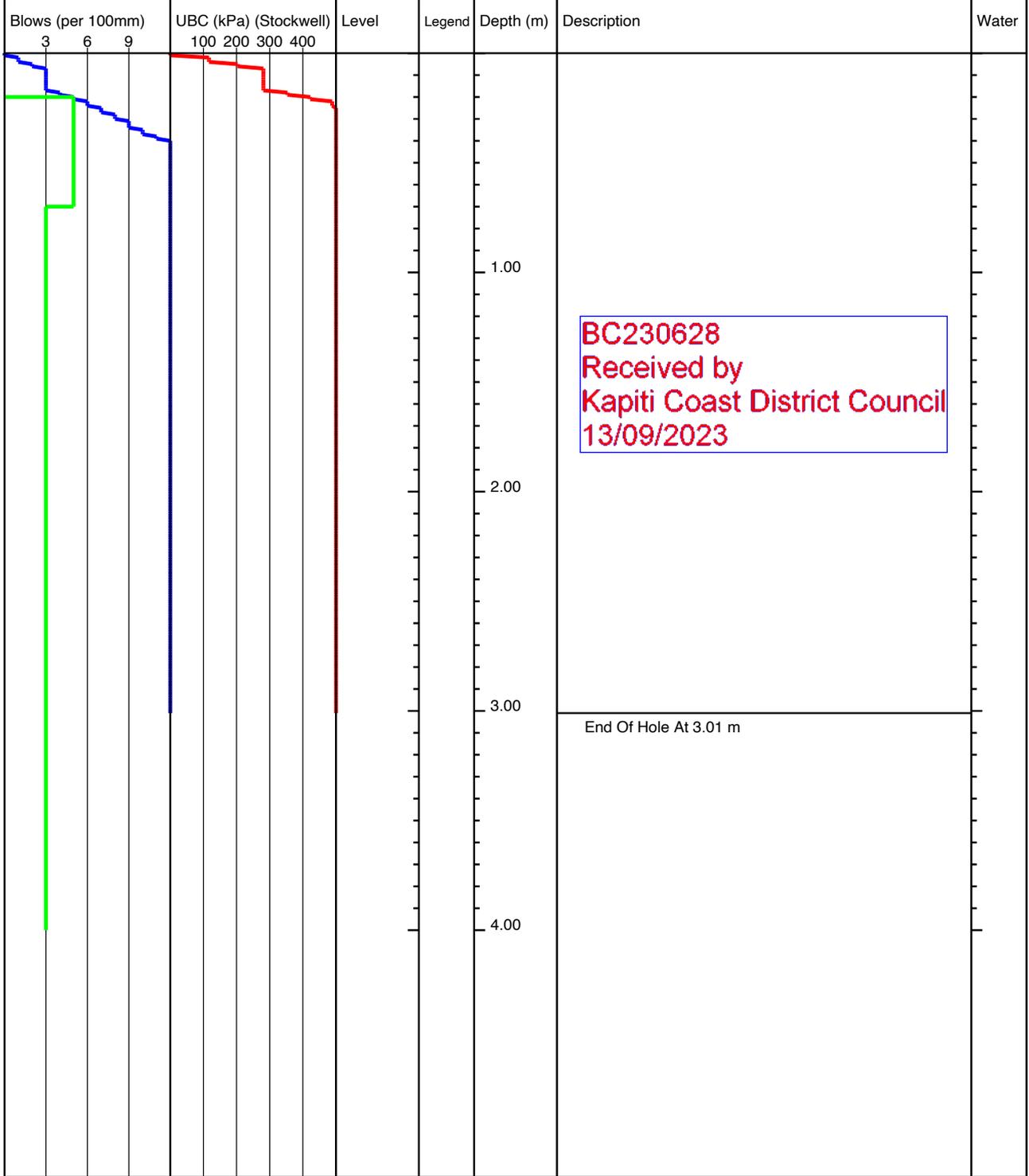
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot25-130
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869965	E Coord: 175.048715
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



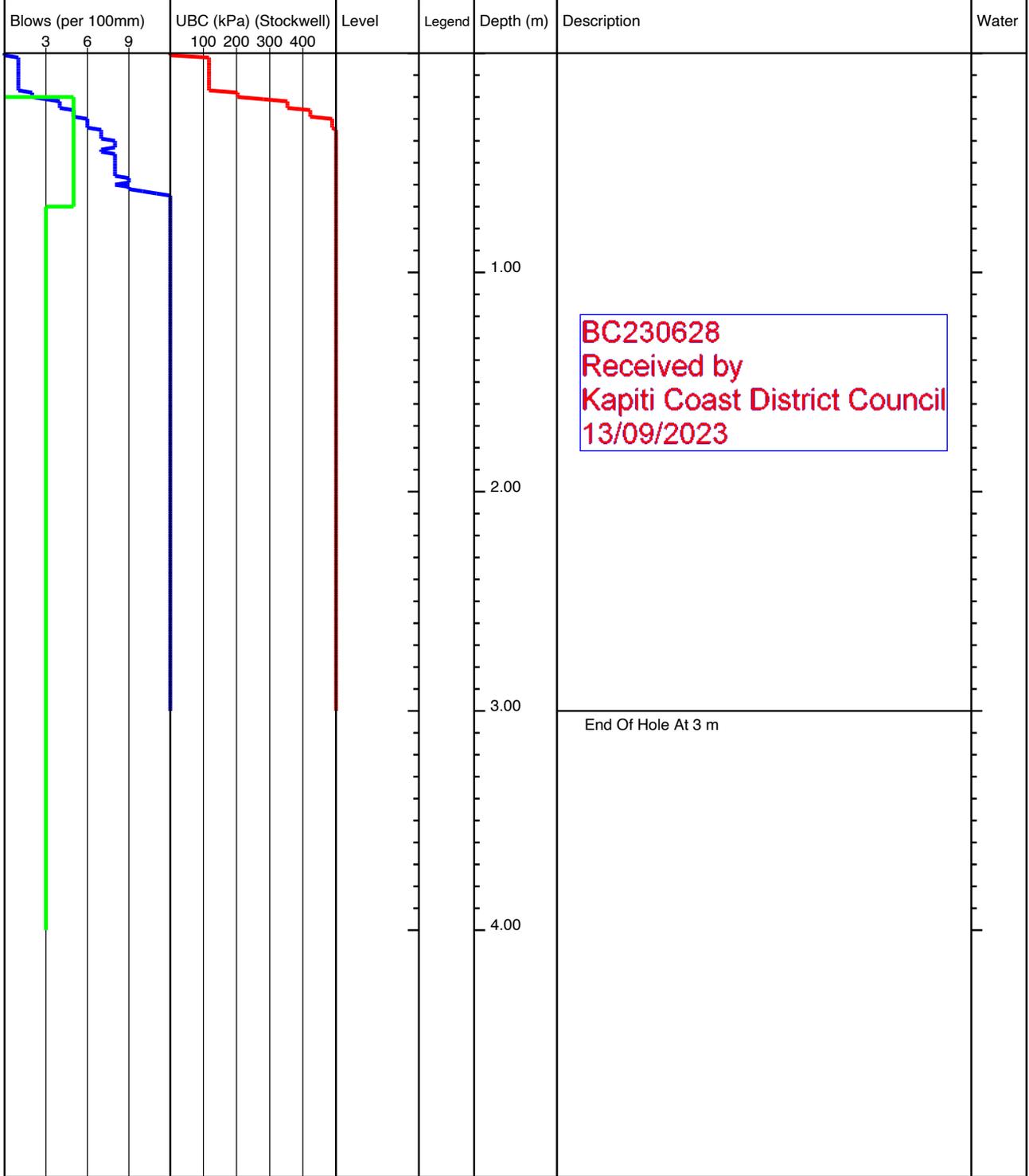
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot25-131
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86993	E Coord: 175.048858
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



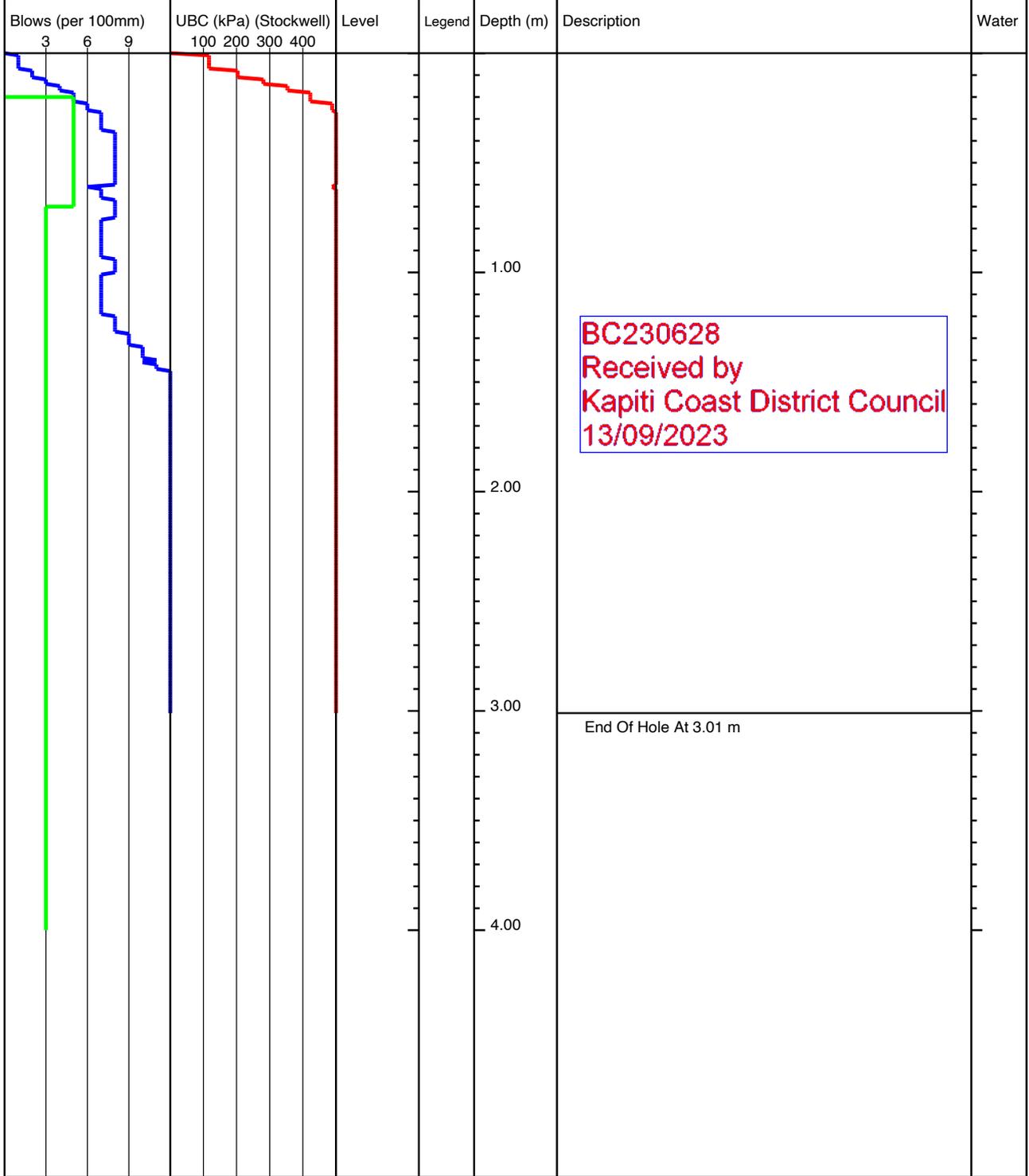
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot26-115
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869675	E Coord: 175.048722
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



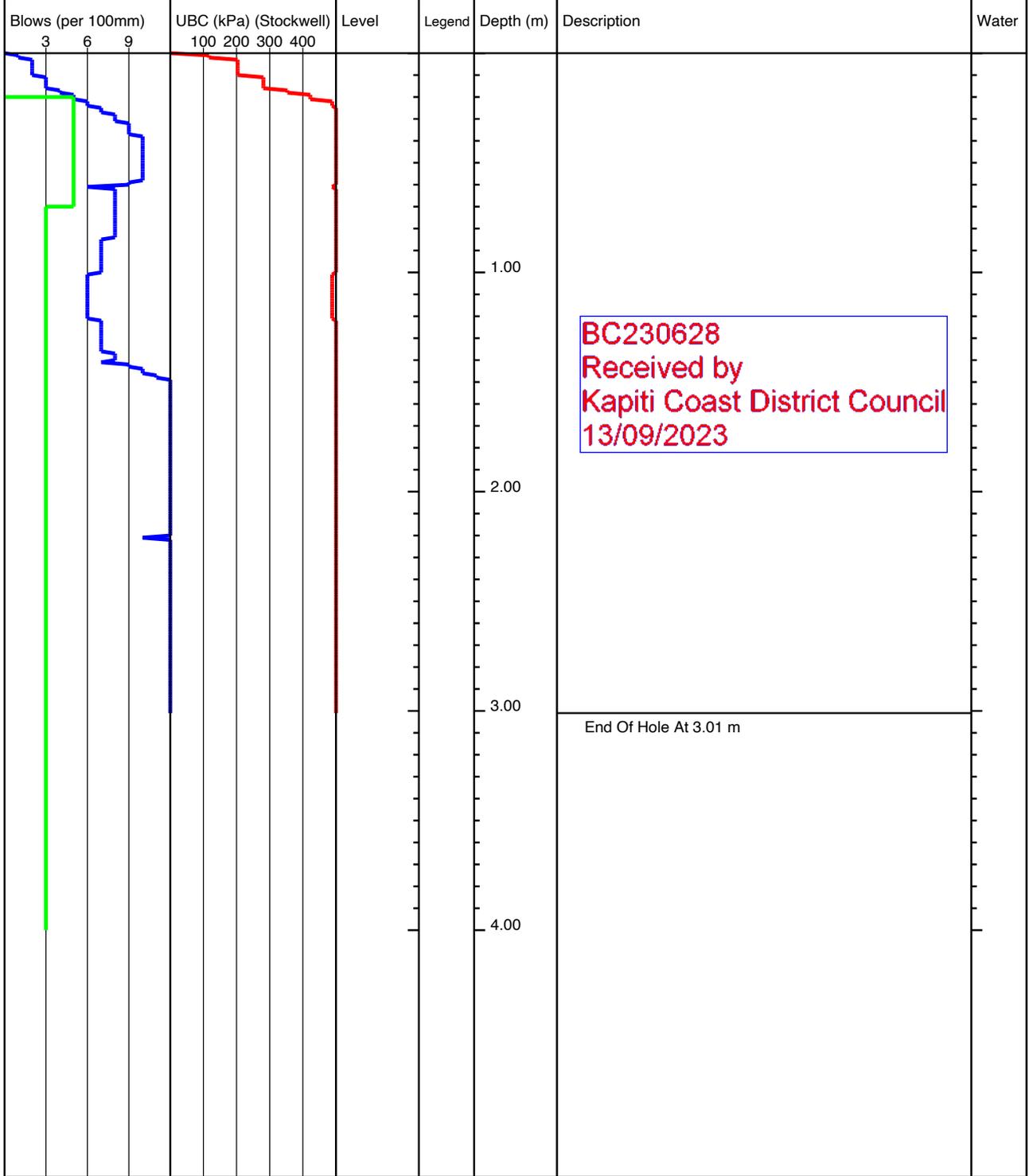
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot26-116
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86971	E Coord: 175.048603
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

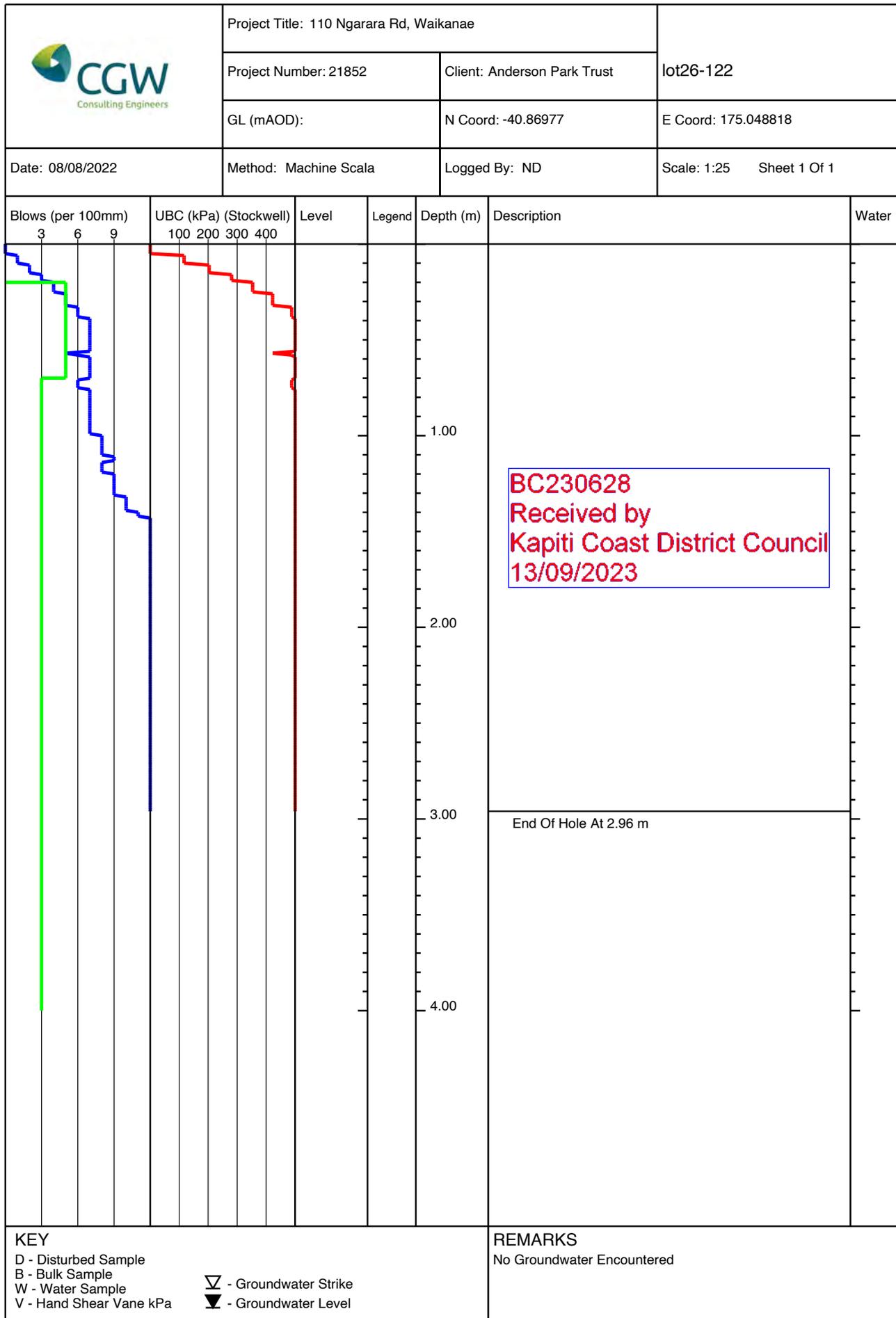


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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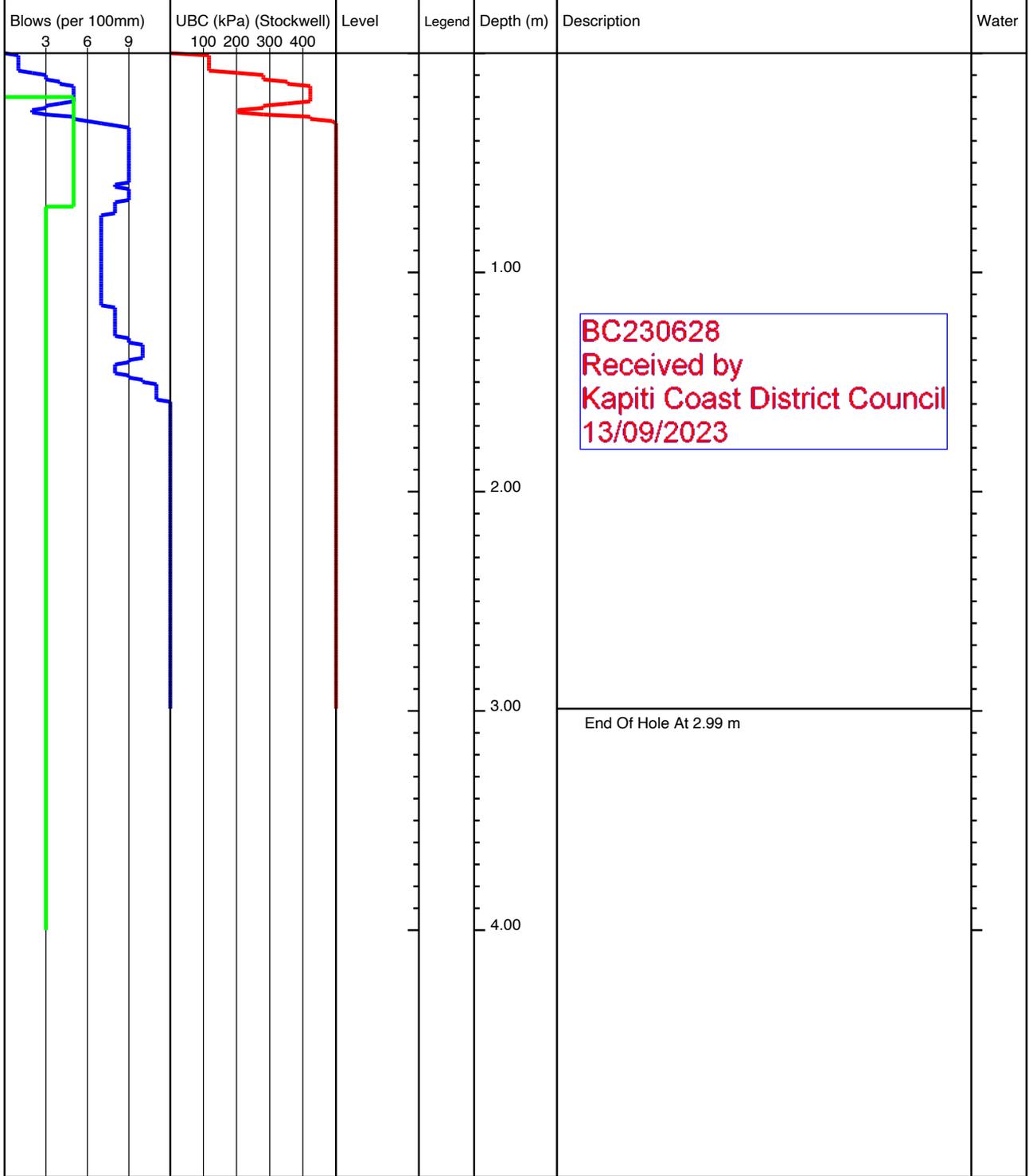
	Project Title: 110 Ngarara Rd, Waikanae		lot26-121
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869822	E Coord: 175.04873
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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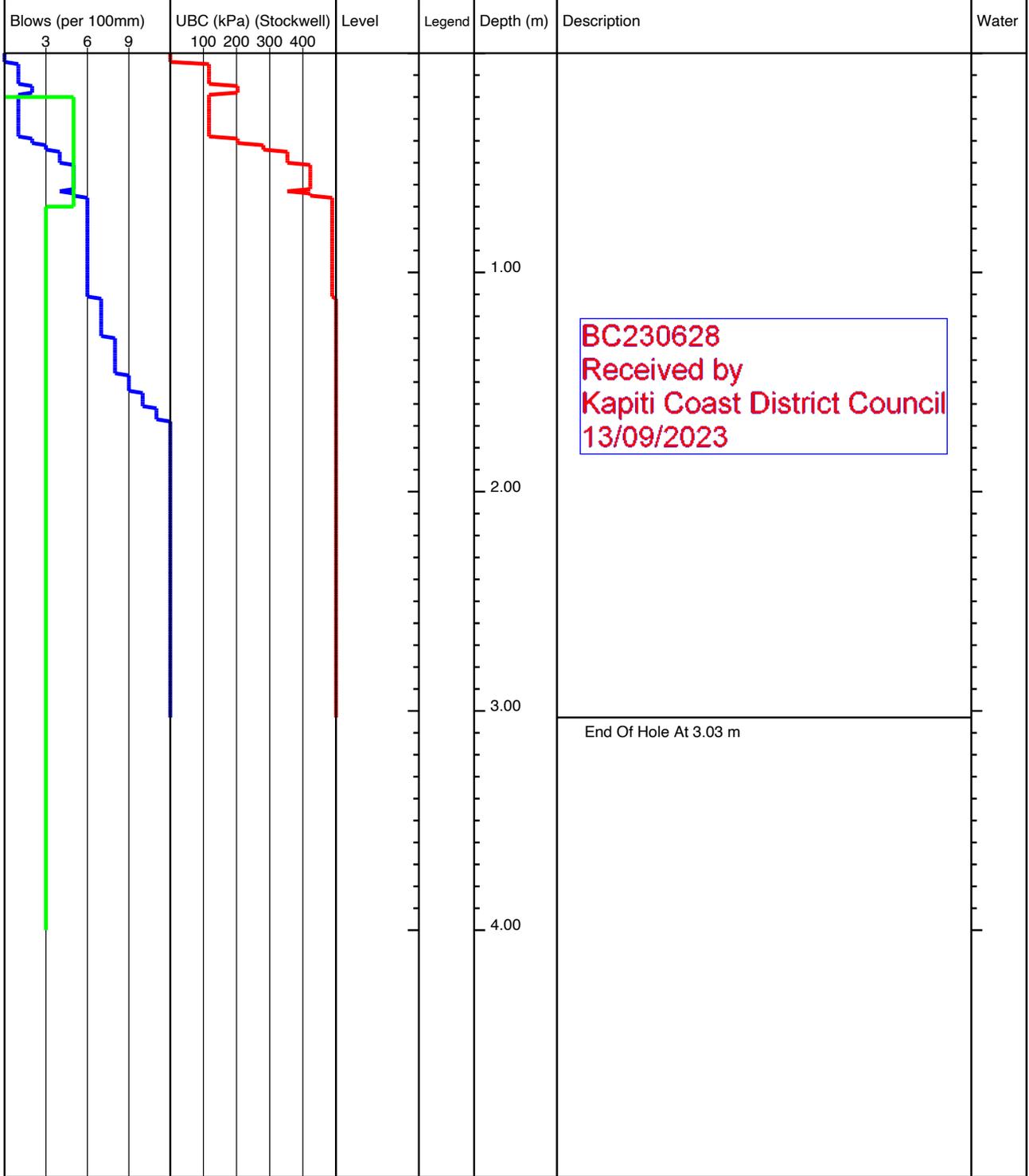


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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86975	E Coord: 175.048492
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



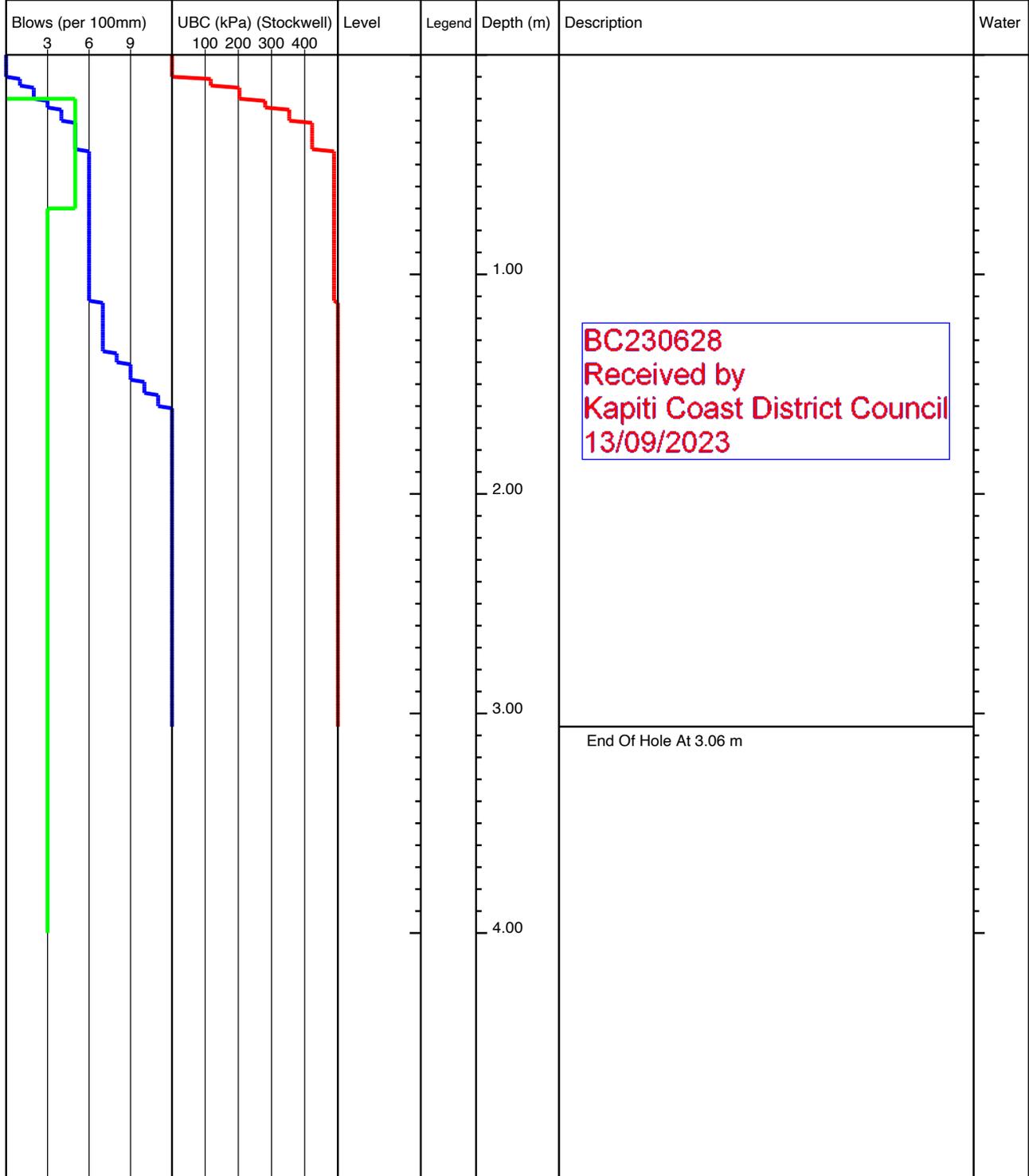
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot27-118
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869825	E Coord: 175.048452
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



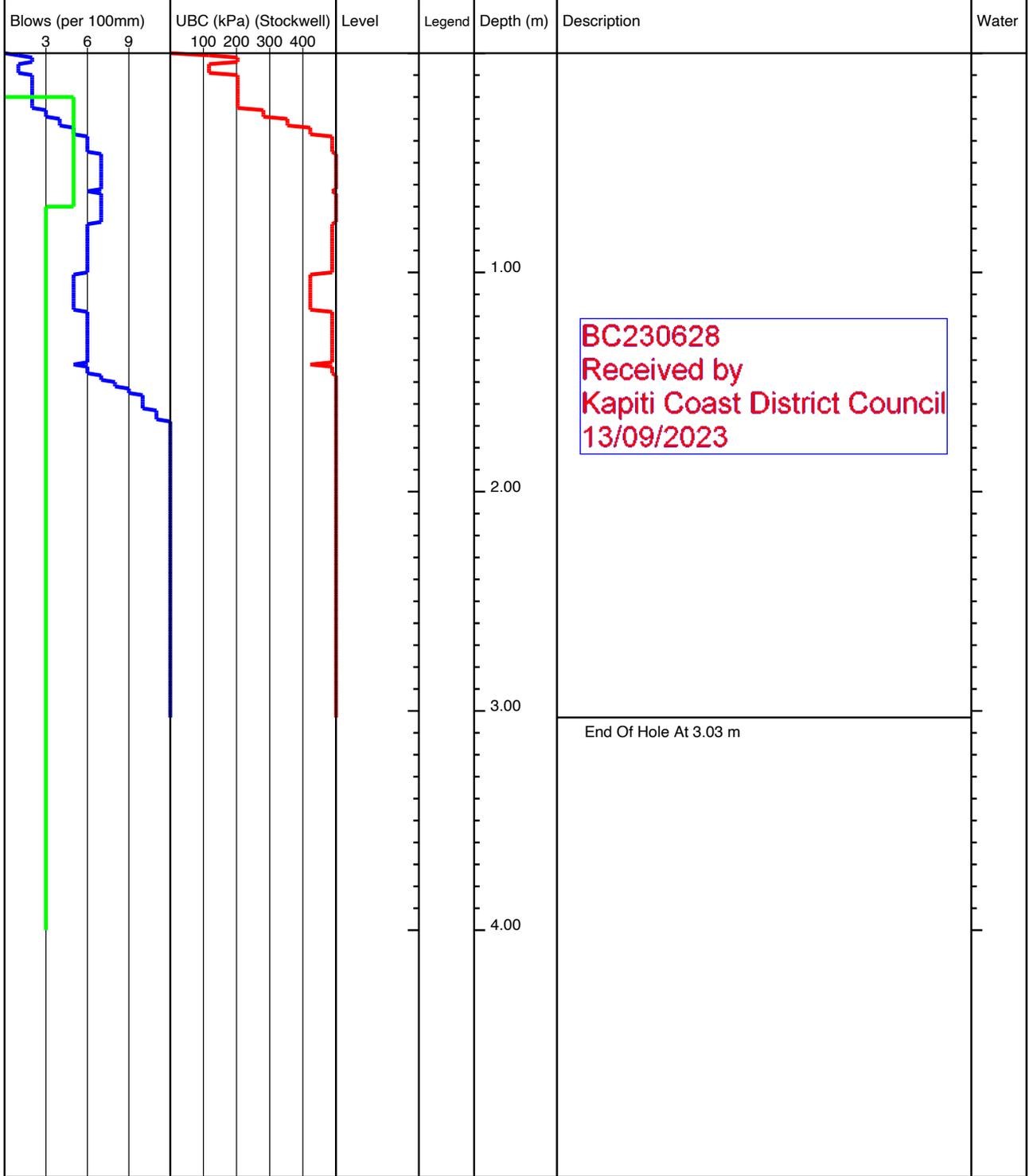
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot27-119
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869918	E Coord: 175.04851
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



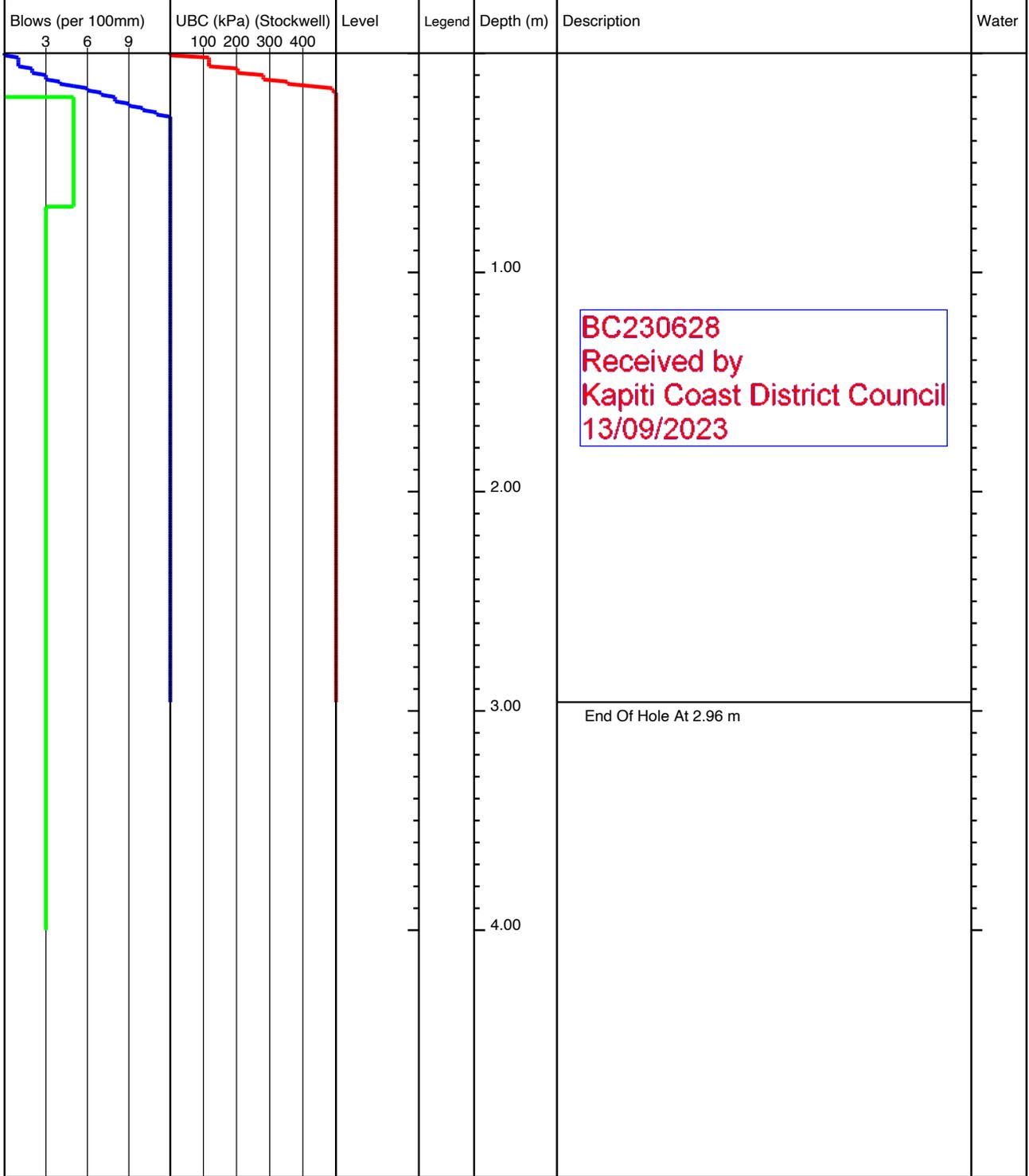
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot27-120
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869888	E Coord: 175.048658
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



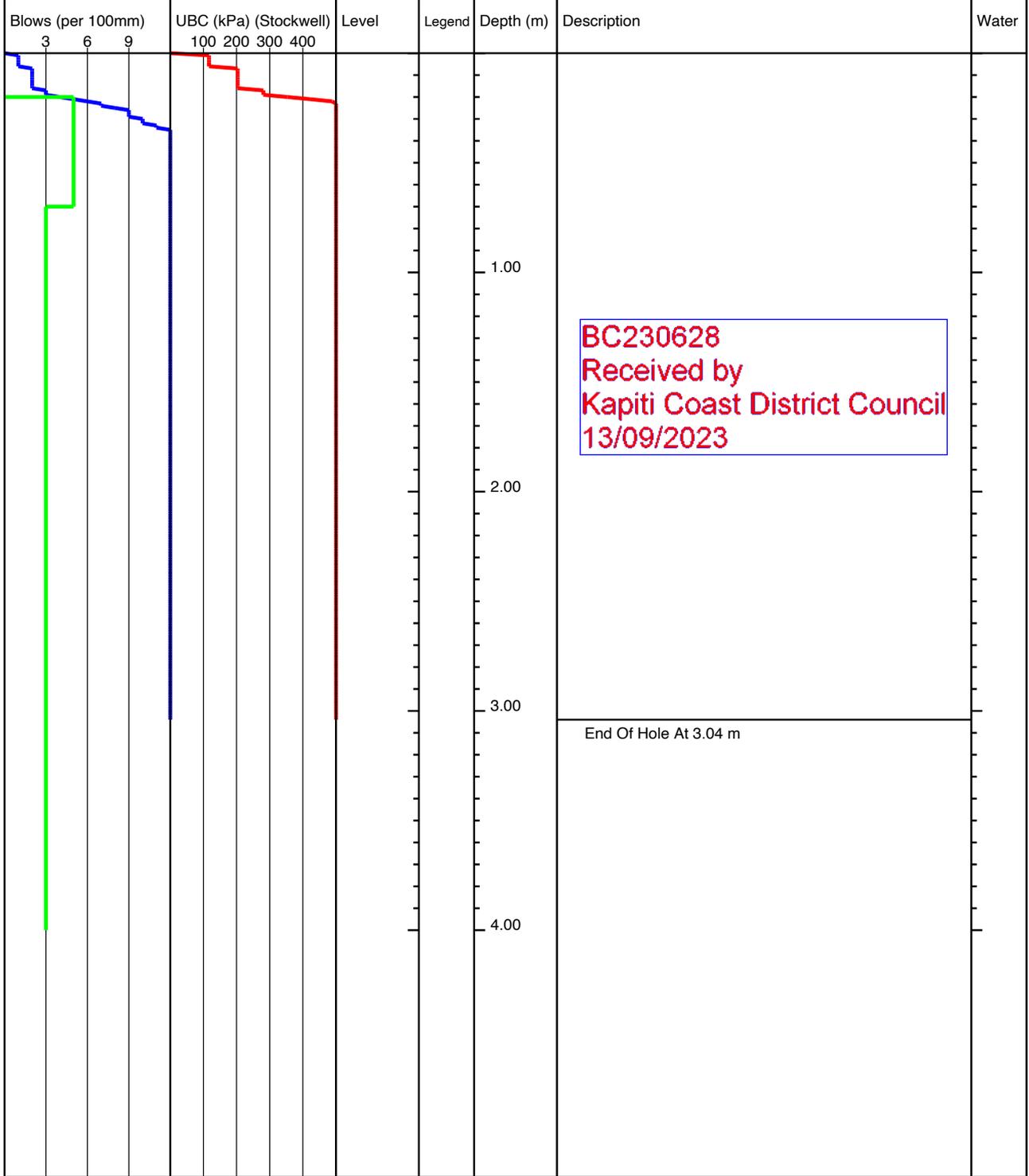
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot28-71
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869462	E Coord: 175.048597
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



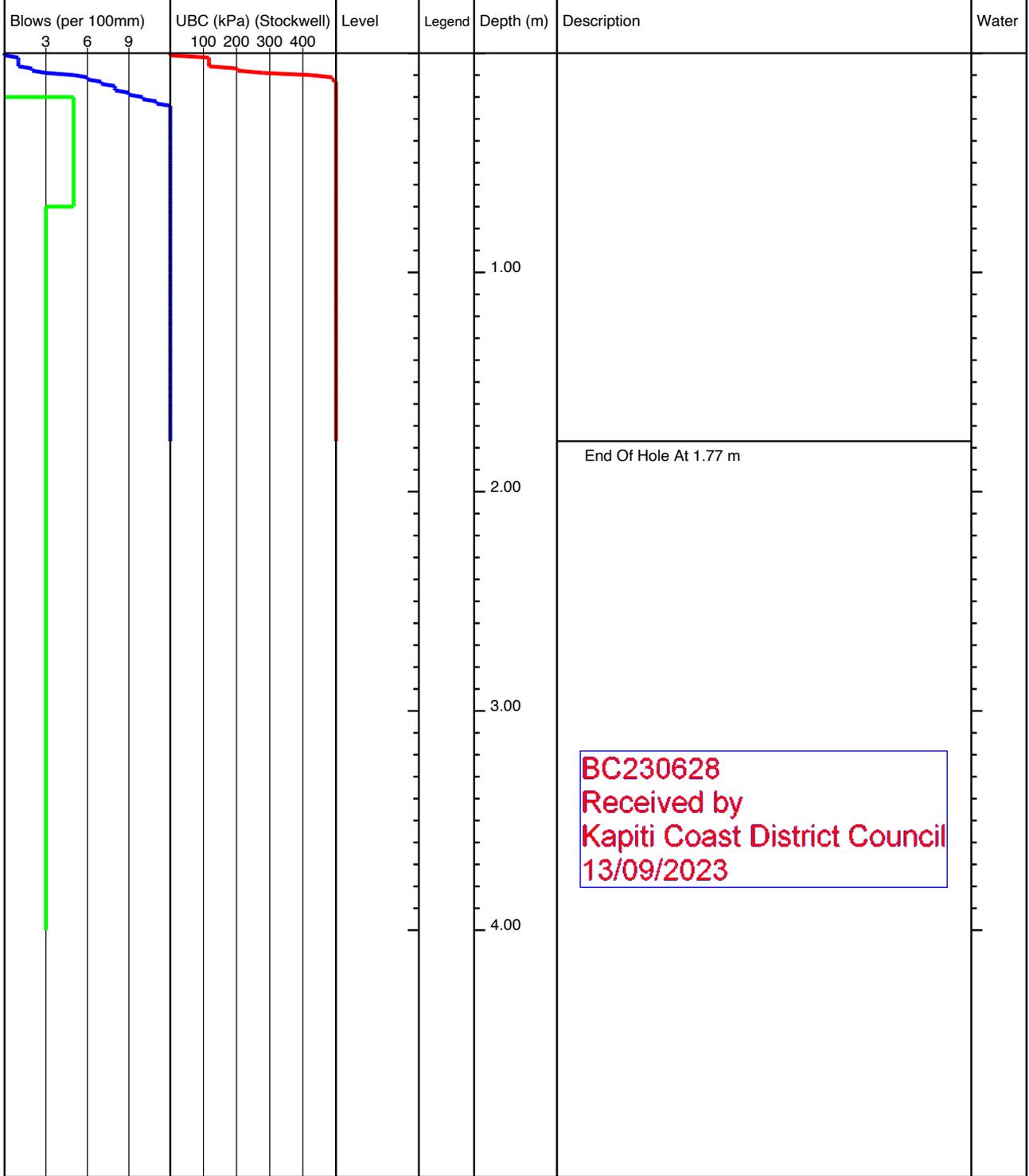
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot28-72
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869358	E Coord: 175.048575
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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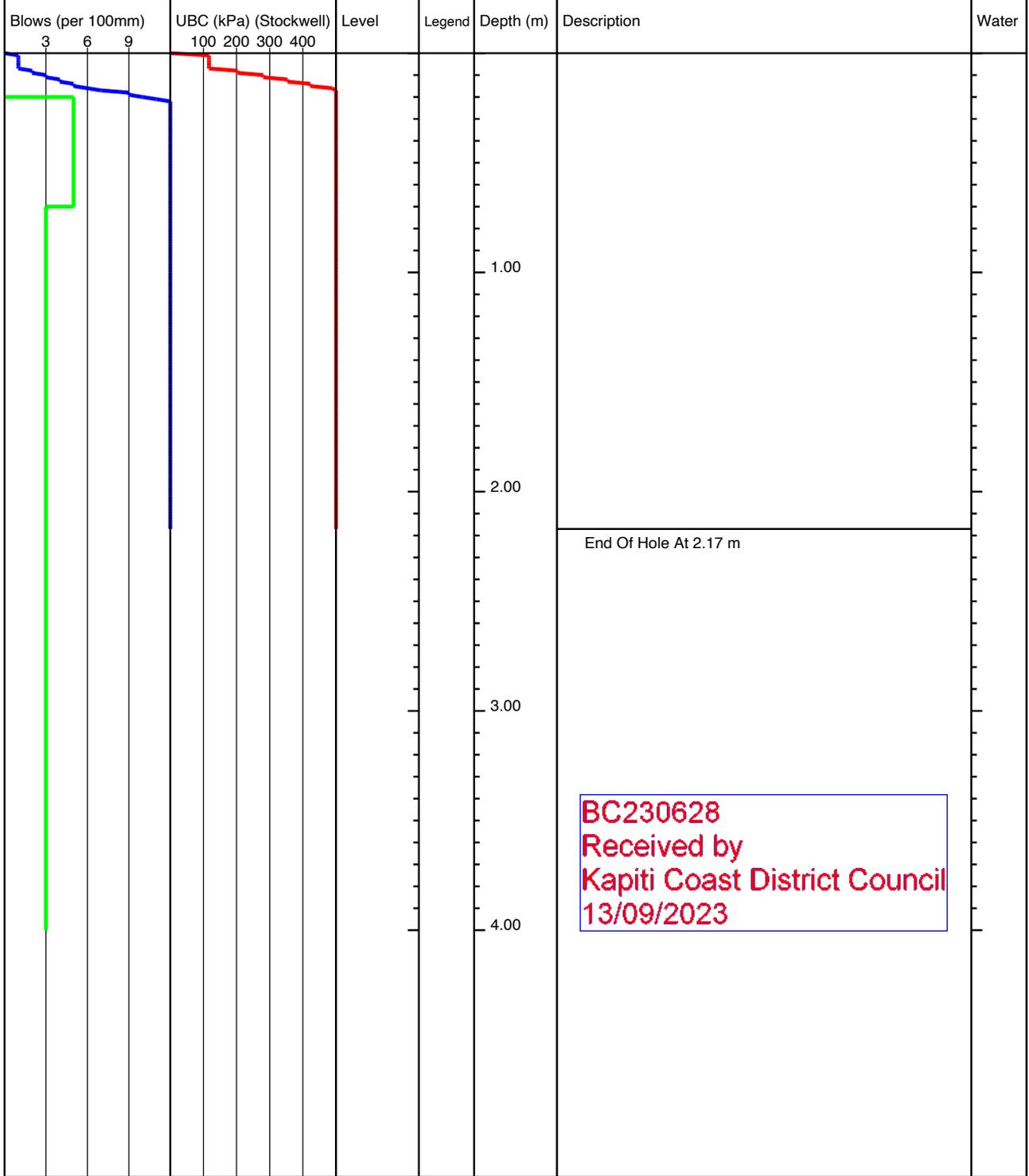
	Project Title: 110 Ngarara Rd, Waikanae		lot28-73
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869283	E Coord: 175.048617
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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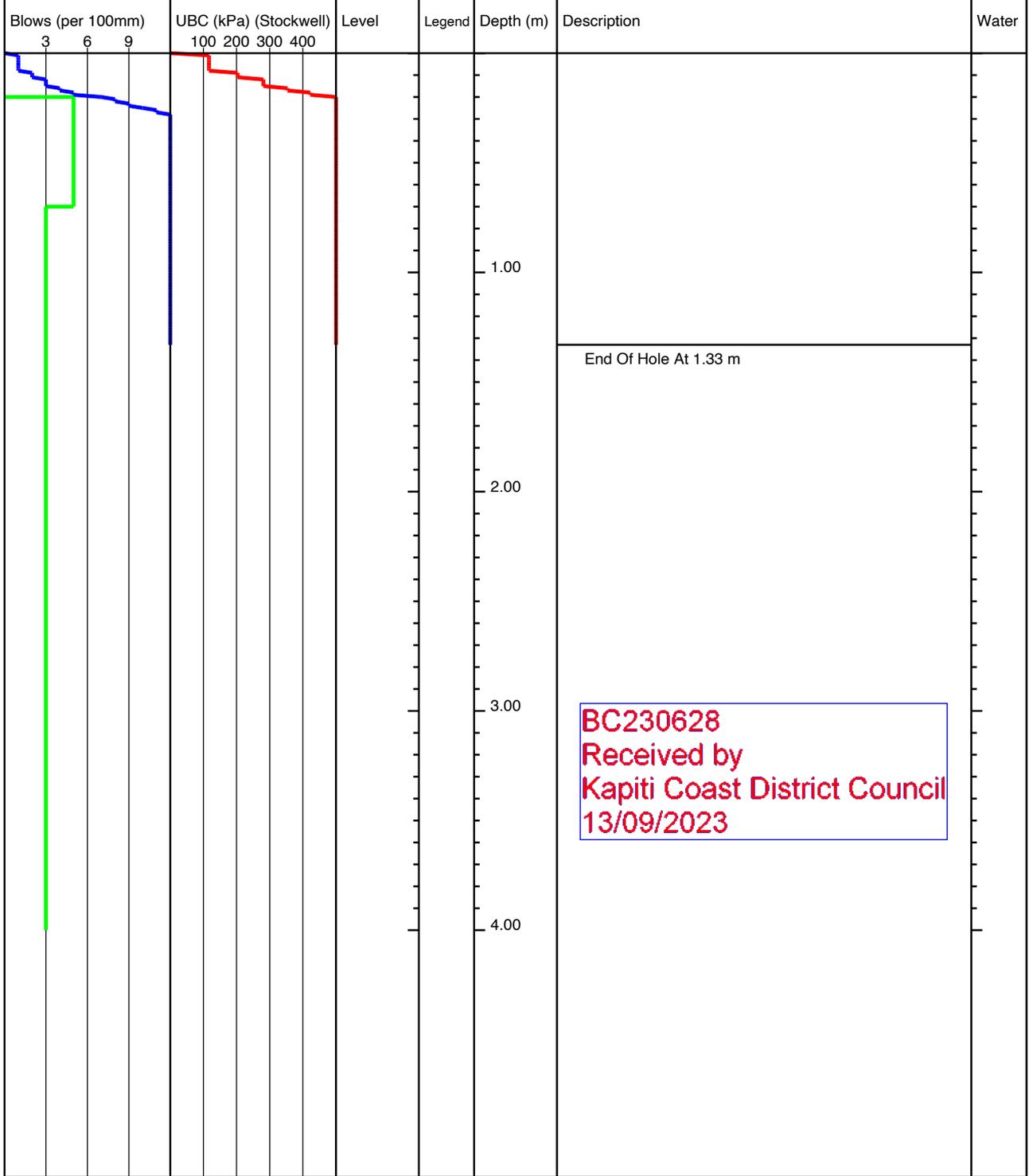
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869342	E Coord: 175.048742
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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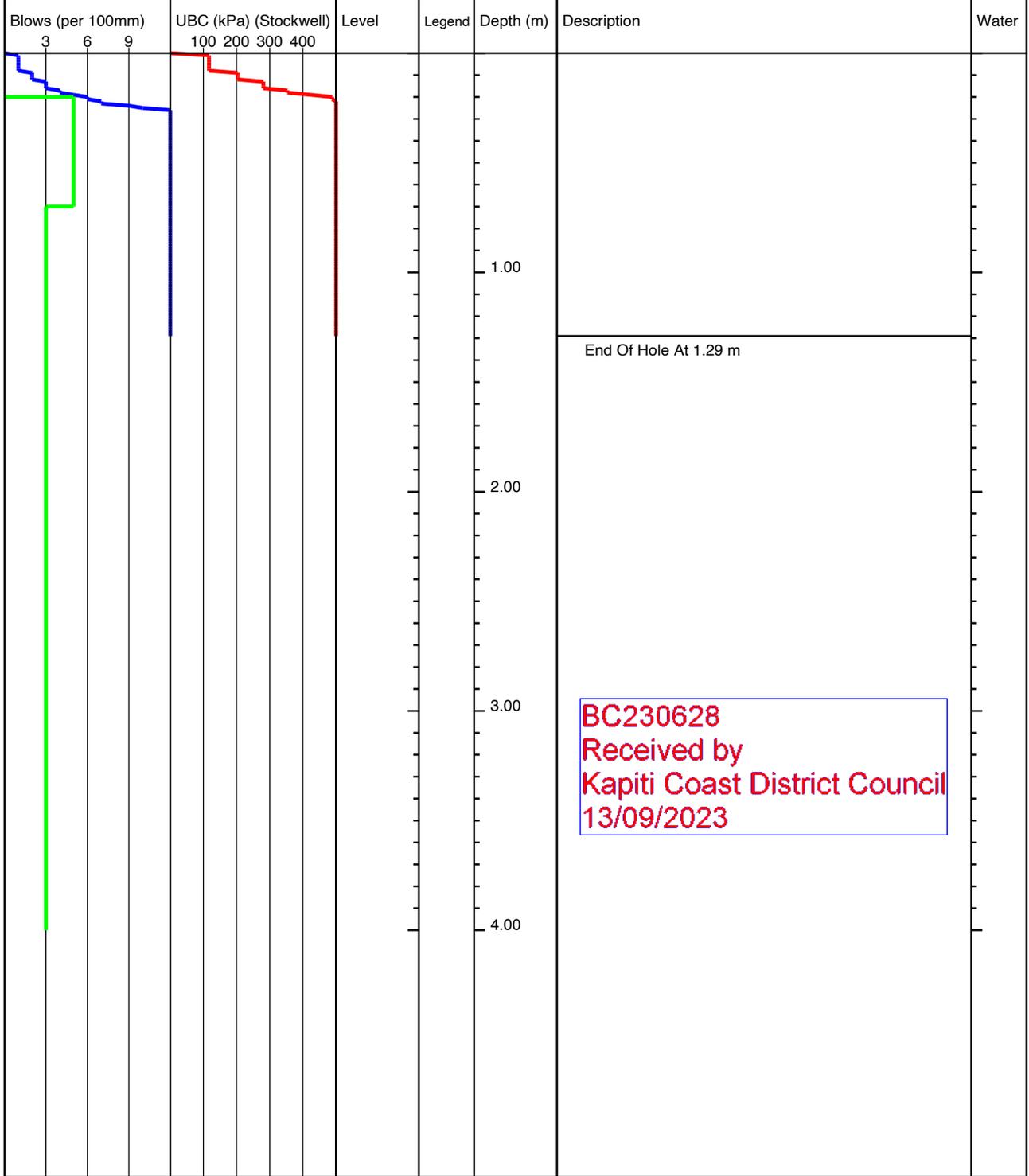
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		Lot29-87
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869133	E Coord: 175.048805
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



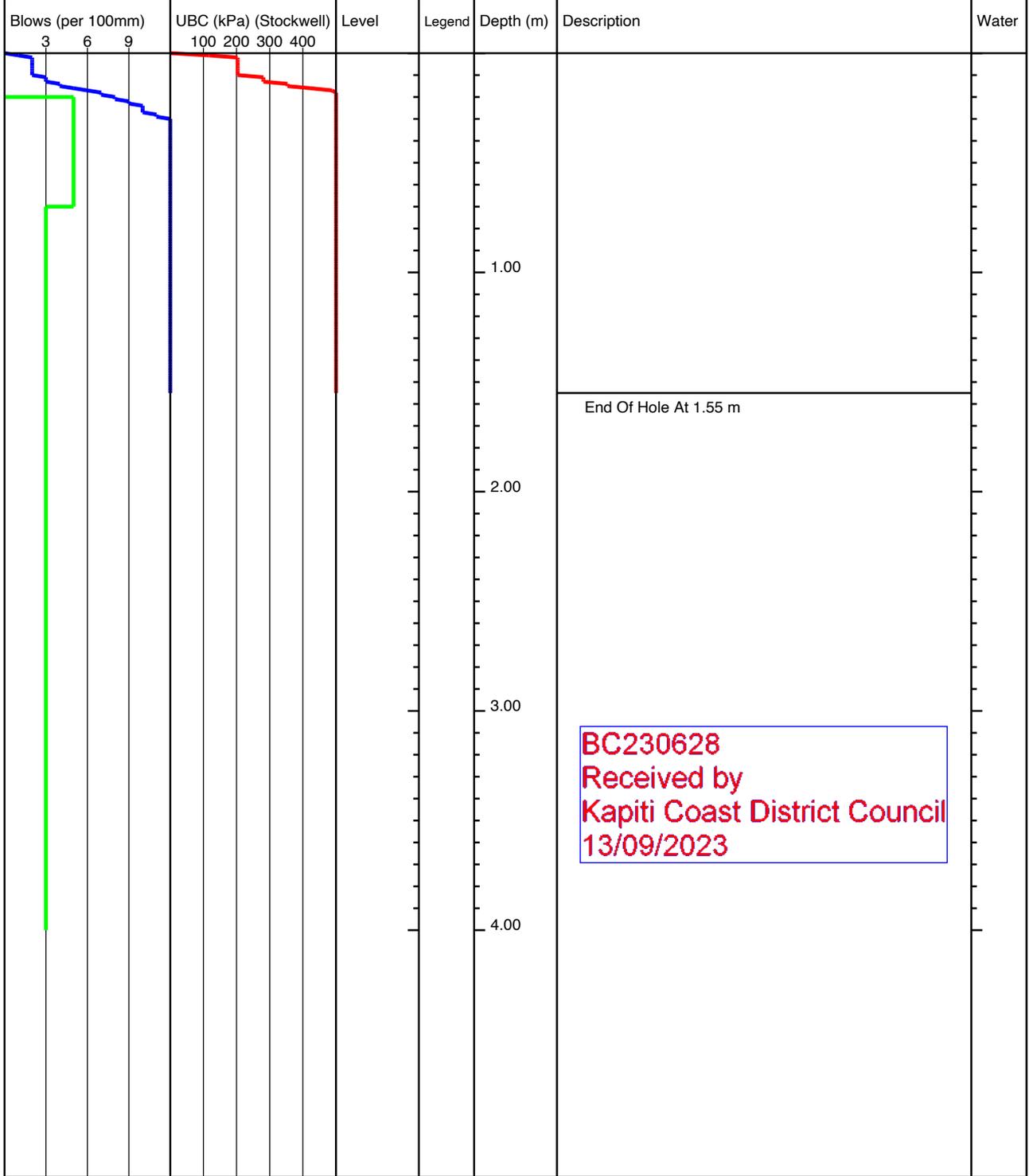
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot29-88
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869167	E Coord: 175.048878
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



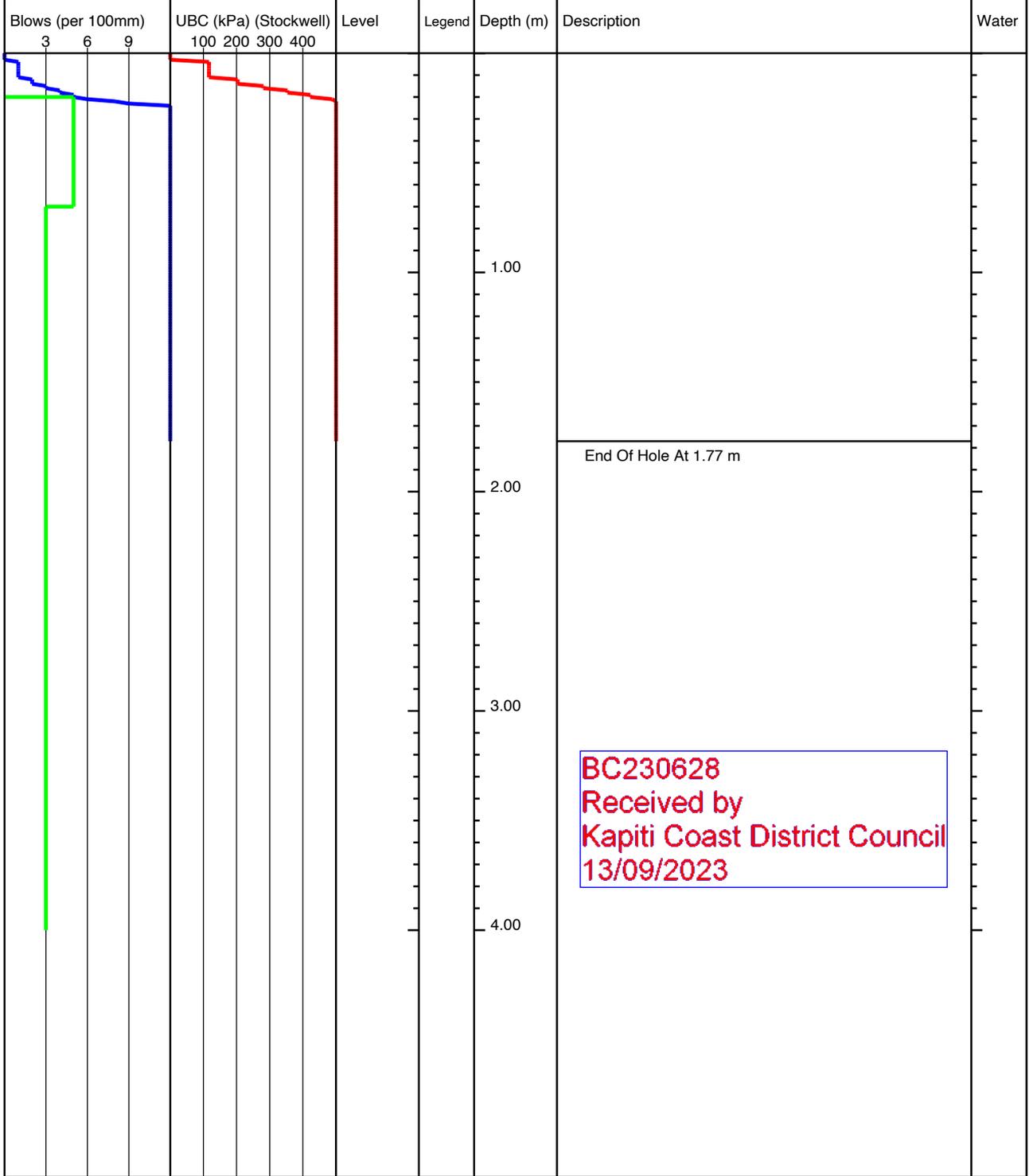
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot29-89
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869268	E Coord: 175.048823
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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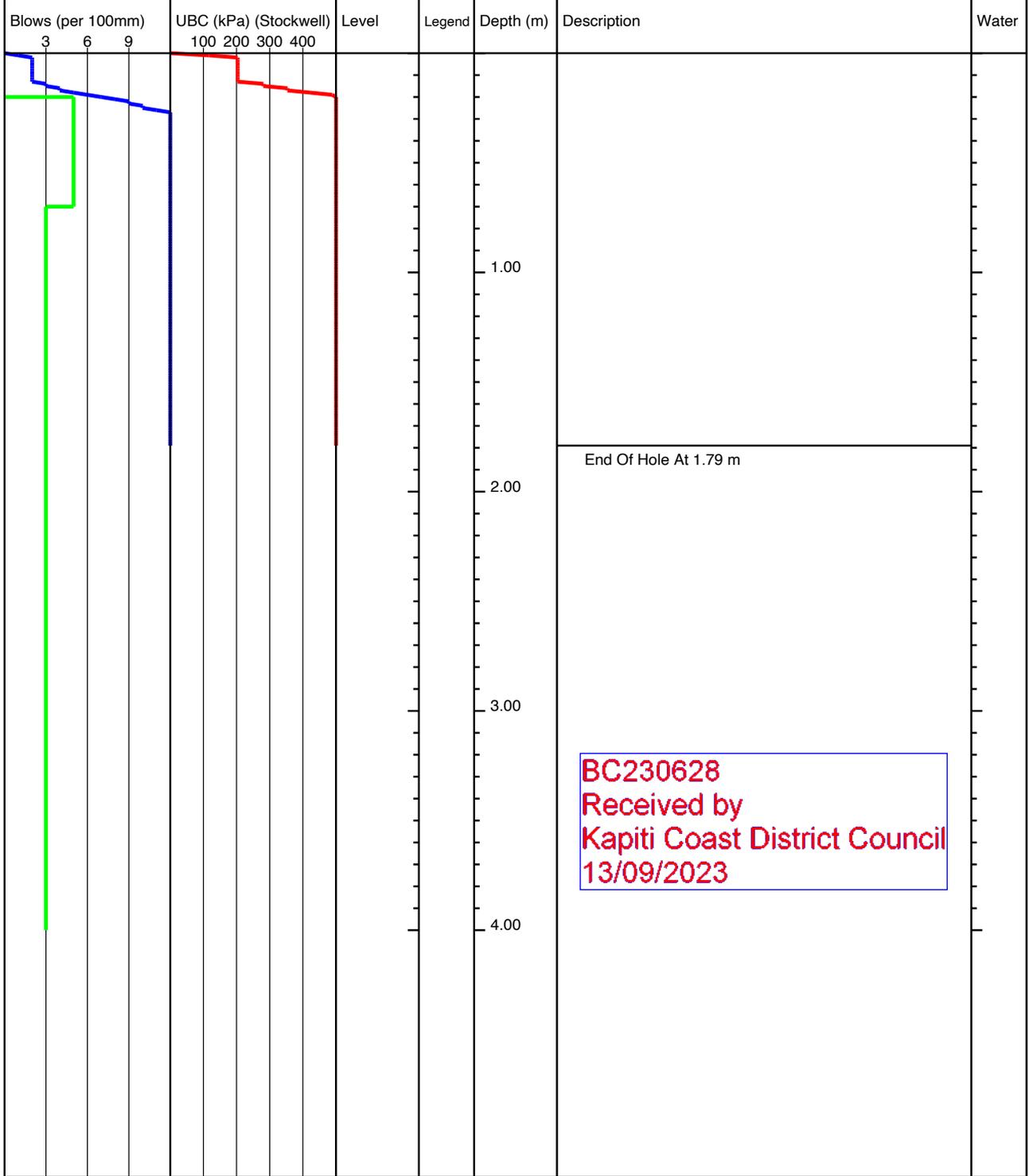
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869232	E Coord: 175.048695
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



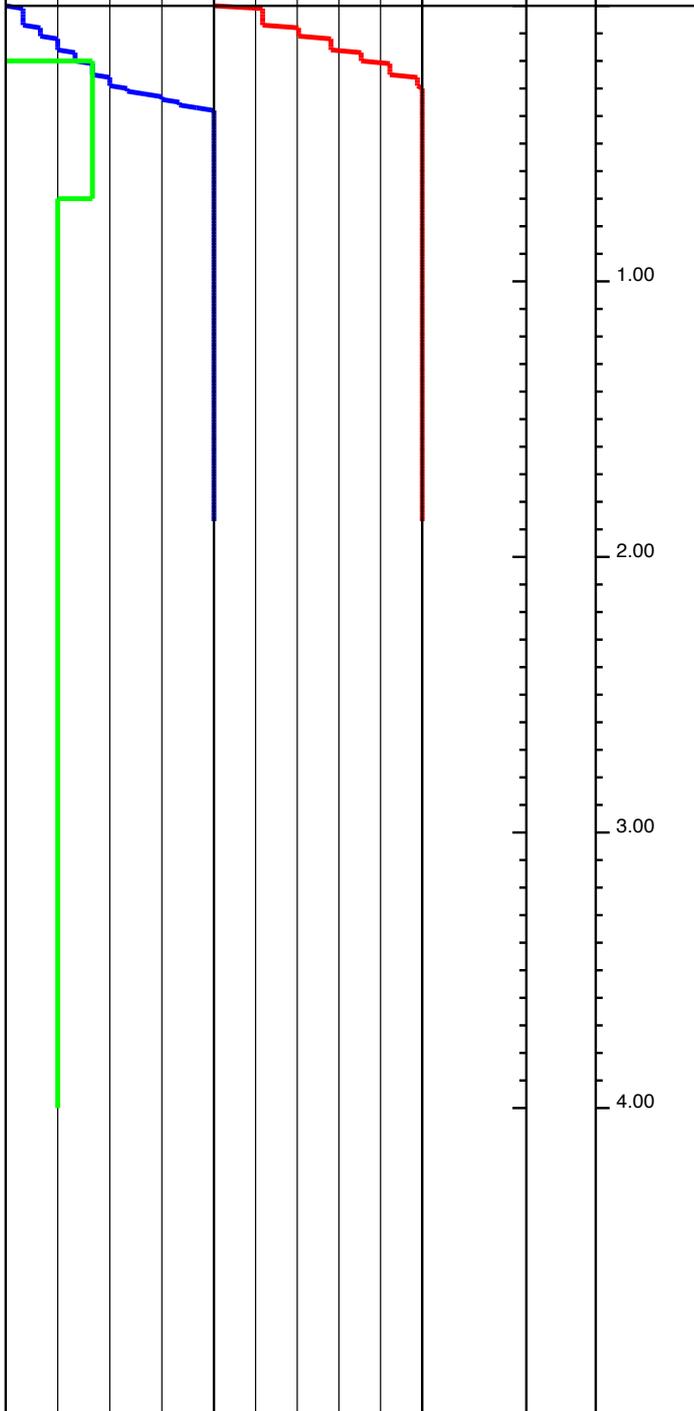
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<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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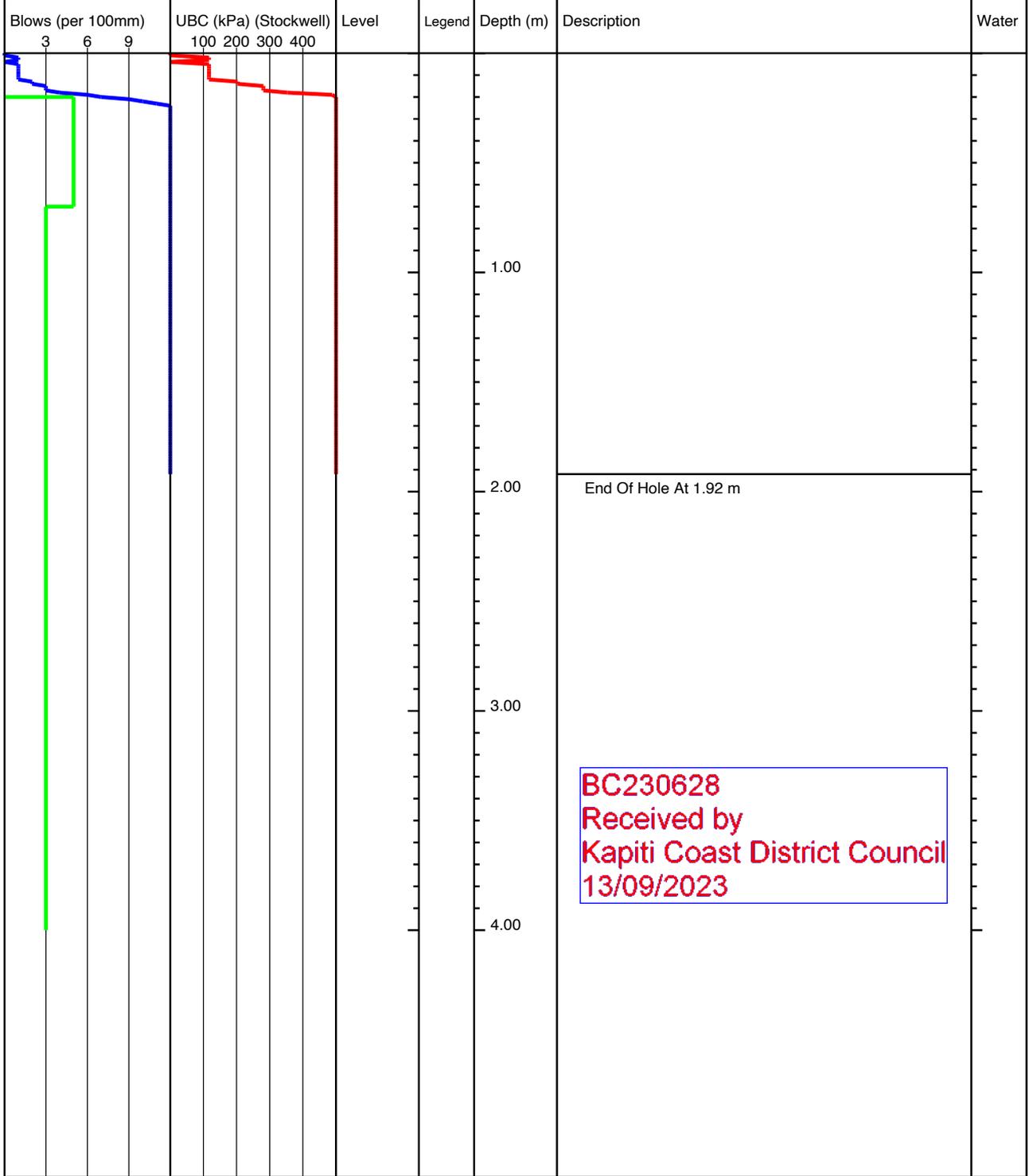
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869173	E Coord: 175.048582
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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		Project Title: 110 Ngarara Rd, Waikanae				
		Project Number: 21852		Client: Anderson Park Trust	lot30-75	
		GL (mAOD):		N Coord: -40.869113	E Coord: 175.048508	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1	
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<p>End Of Hole At 1.87 m</p> <div style="border: 1px solid red; padding: 5px; color: red; margin-top: 20px;"> <p>BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot30-85
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869033	E Coord: 175.048685
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

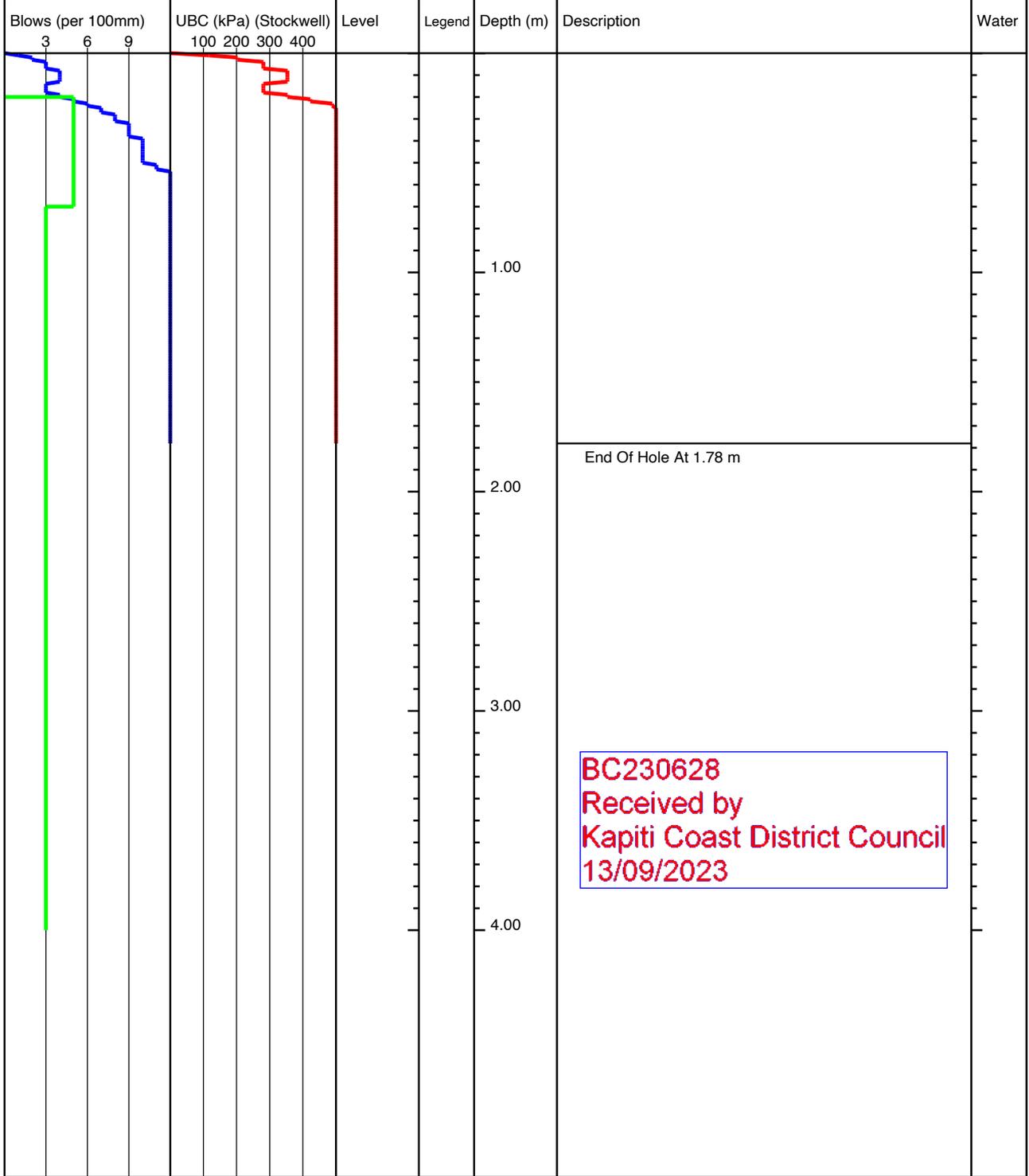


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<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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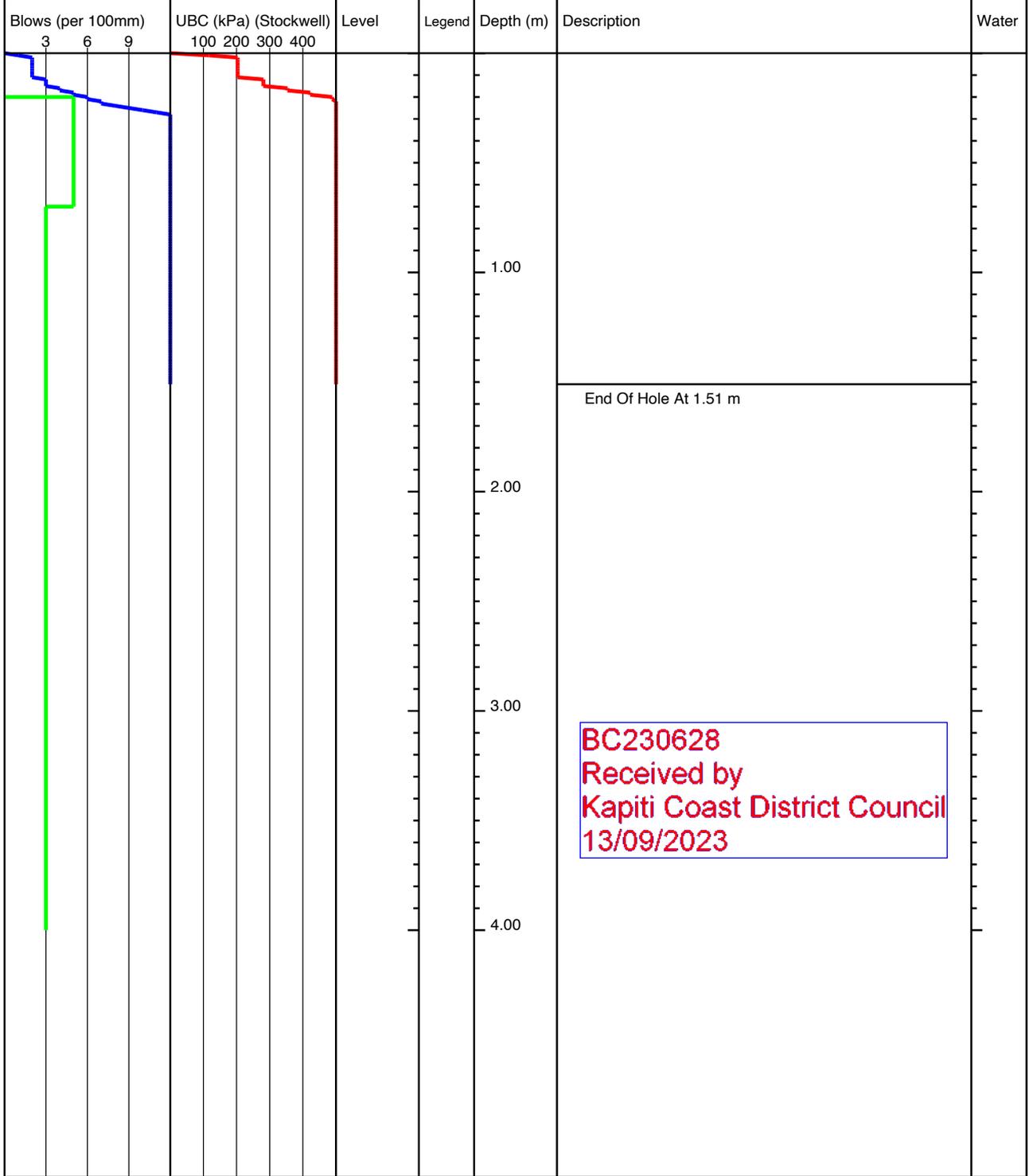


	Project Title: 110 Ngarara Rd, Waikanae		lot31-76
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.869052	E Coord: 175.048485
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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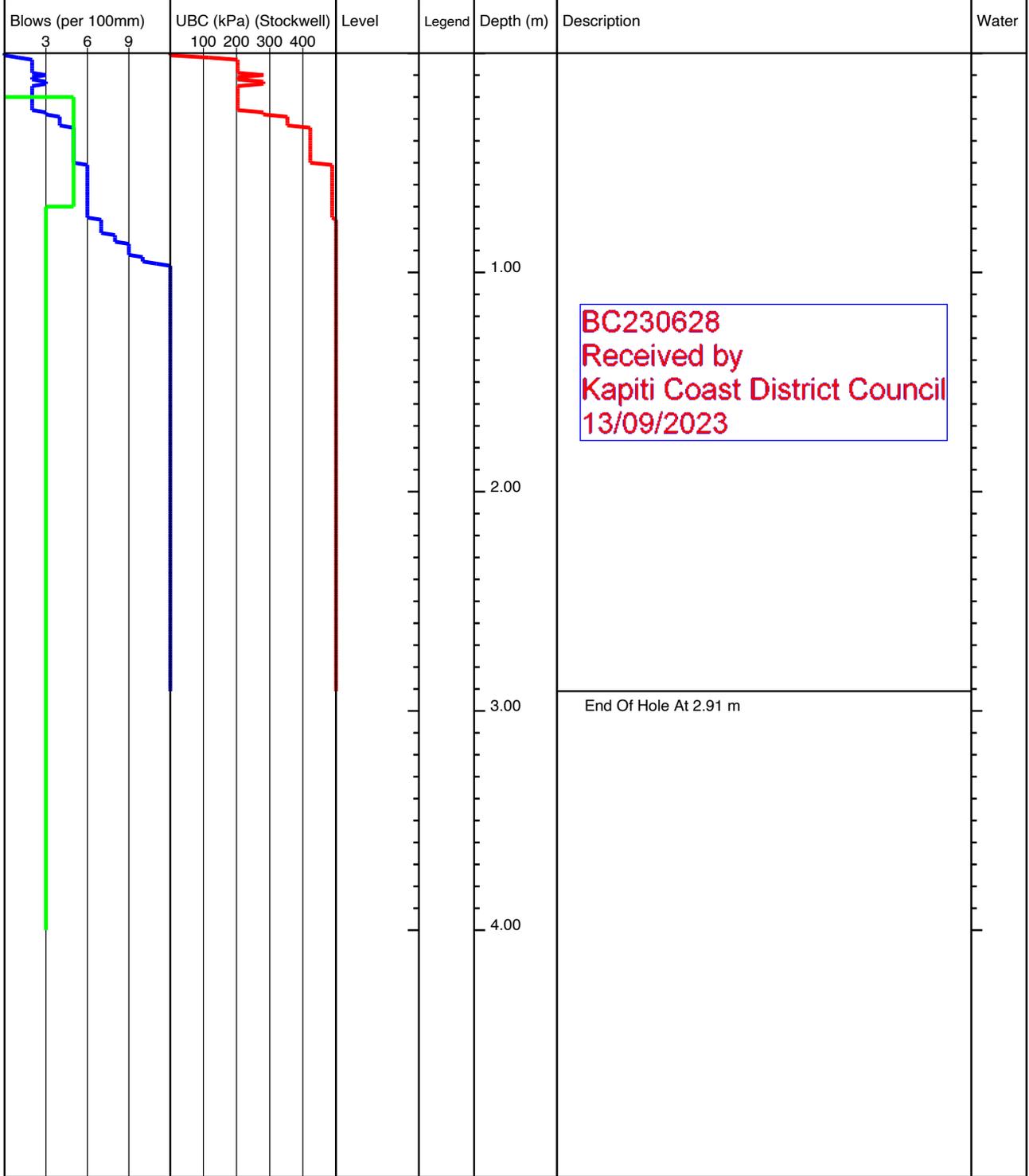
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	Project Number: 21852	Client: Anderson Park Trust	
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Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



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 Received by  
 Kapiti Coast District Council  
 13/09/2023

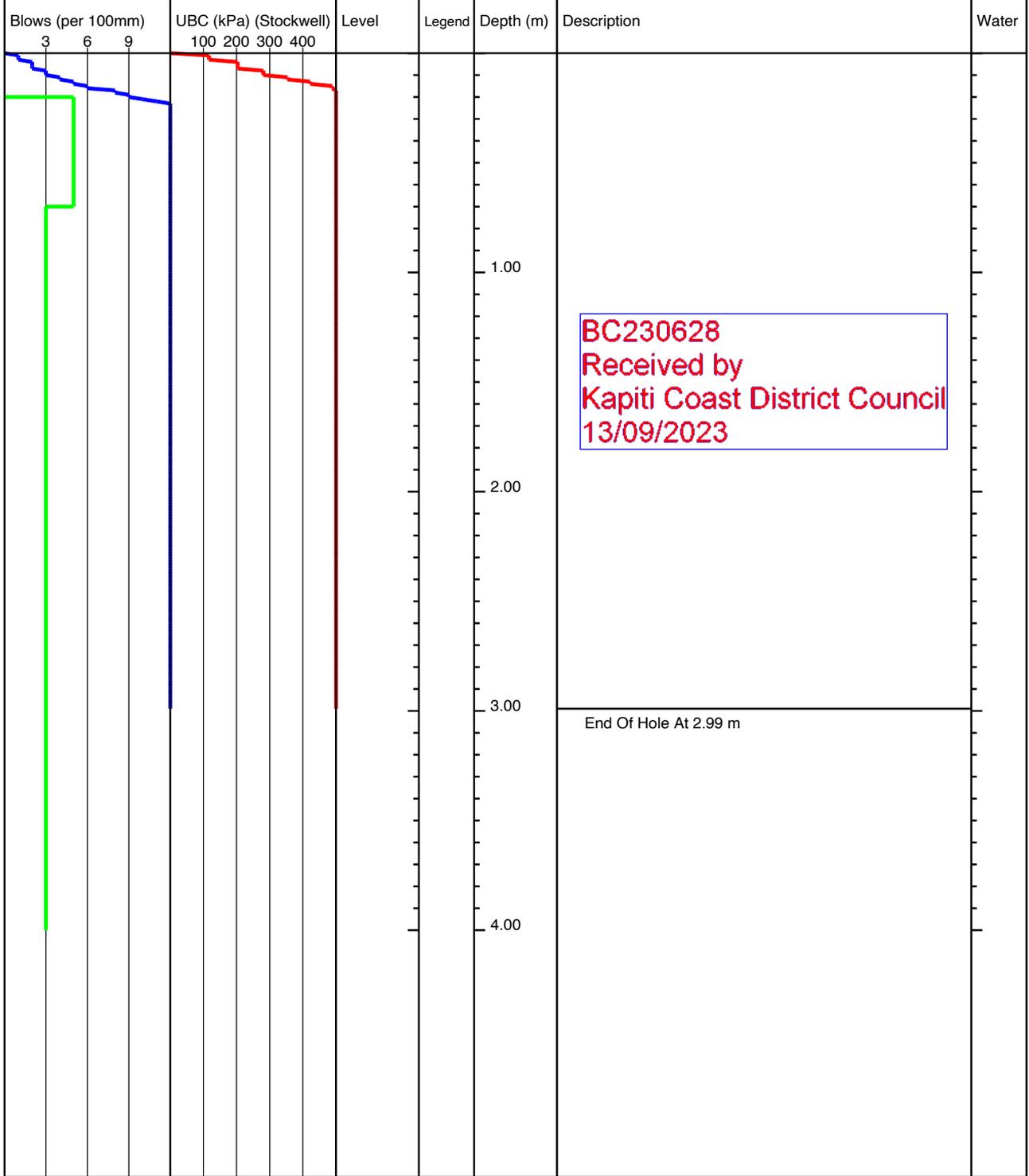
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot31-78
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868983	E Coord: 175.048413
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



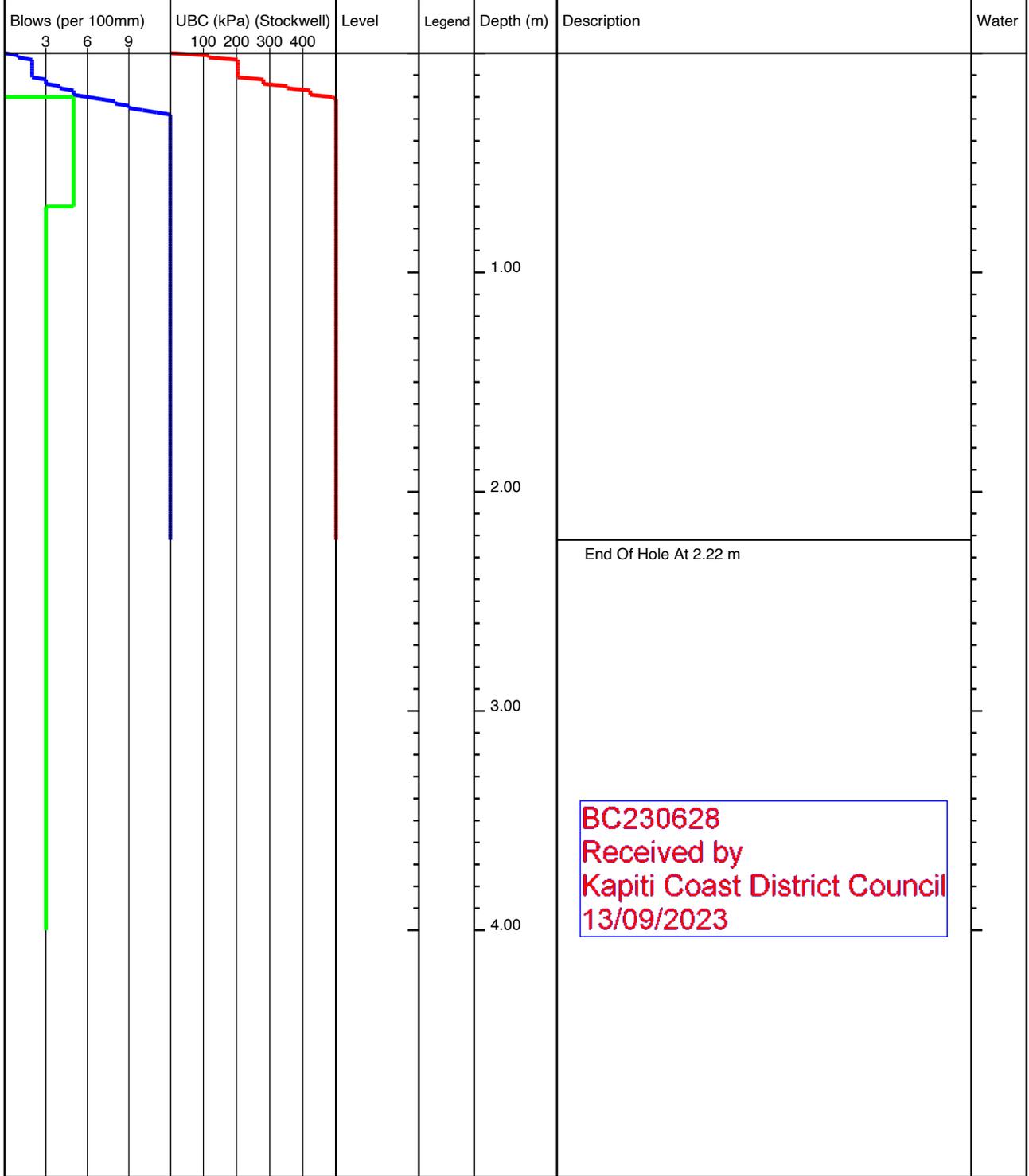
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot31-83
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868912	E Coord: 175.048607
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



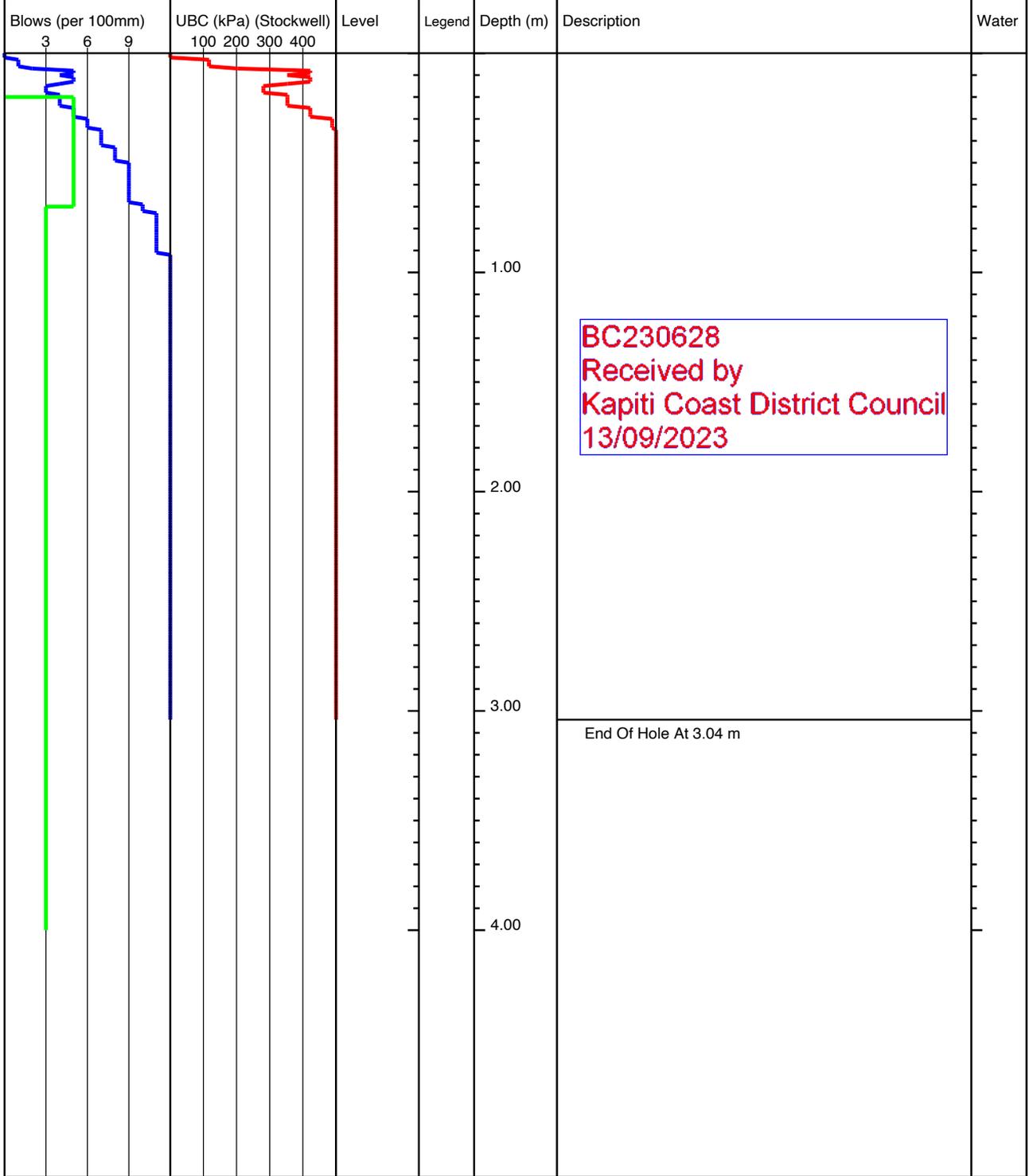
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot31-84
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868955	E Coord: 175.048627
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



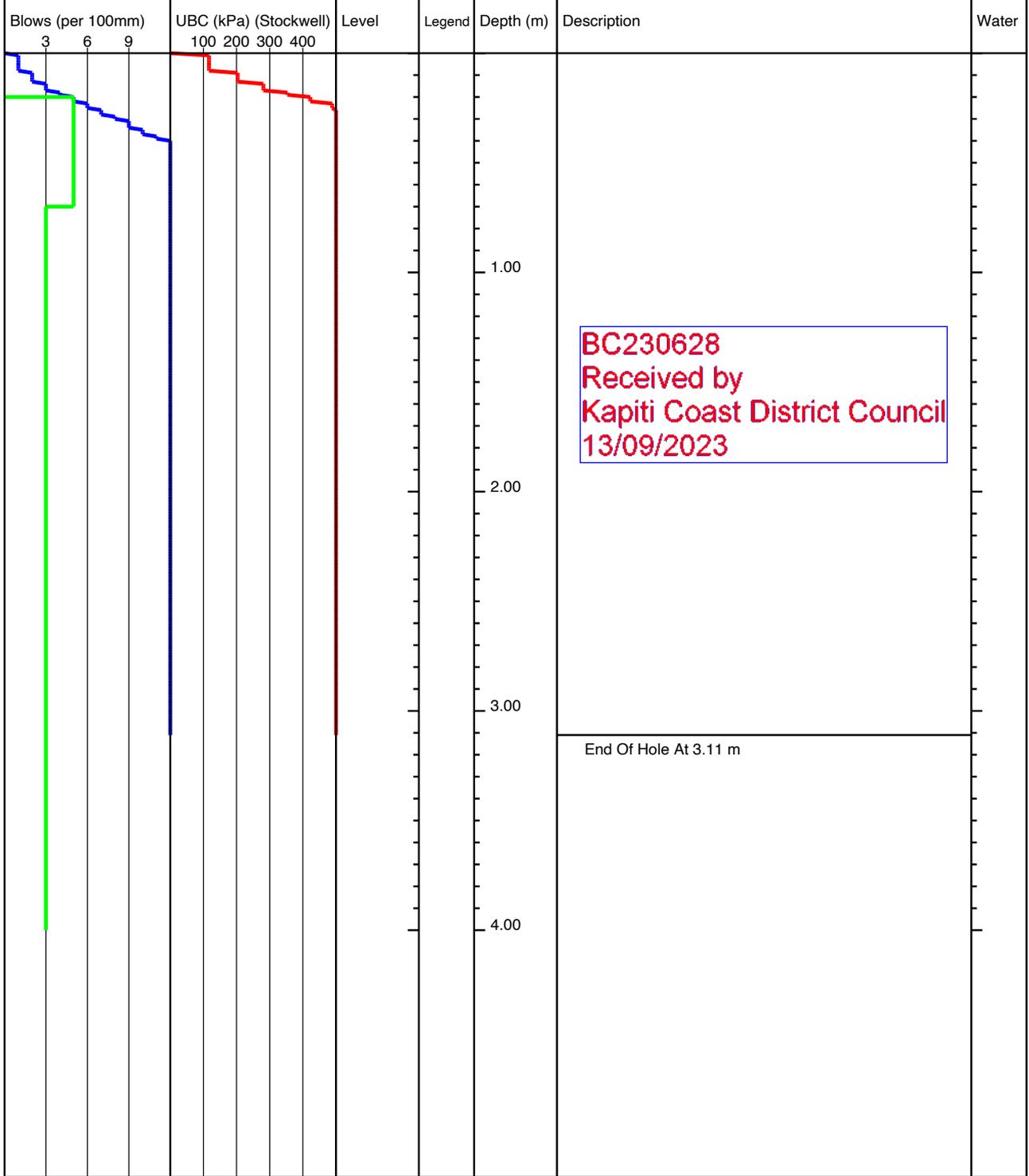
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot32-79
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868932	E Coord: 175.04838
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



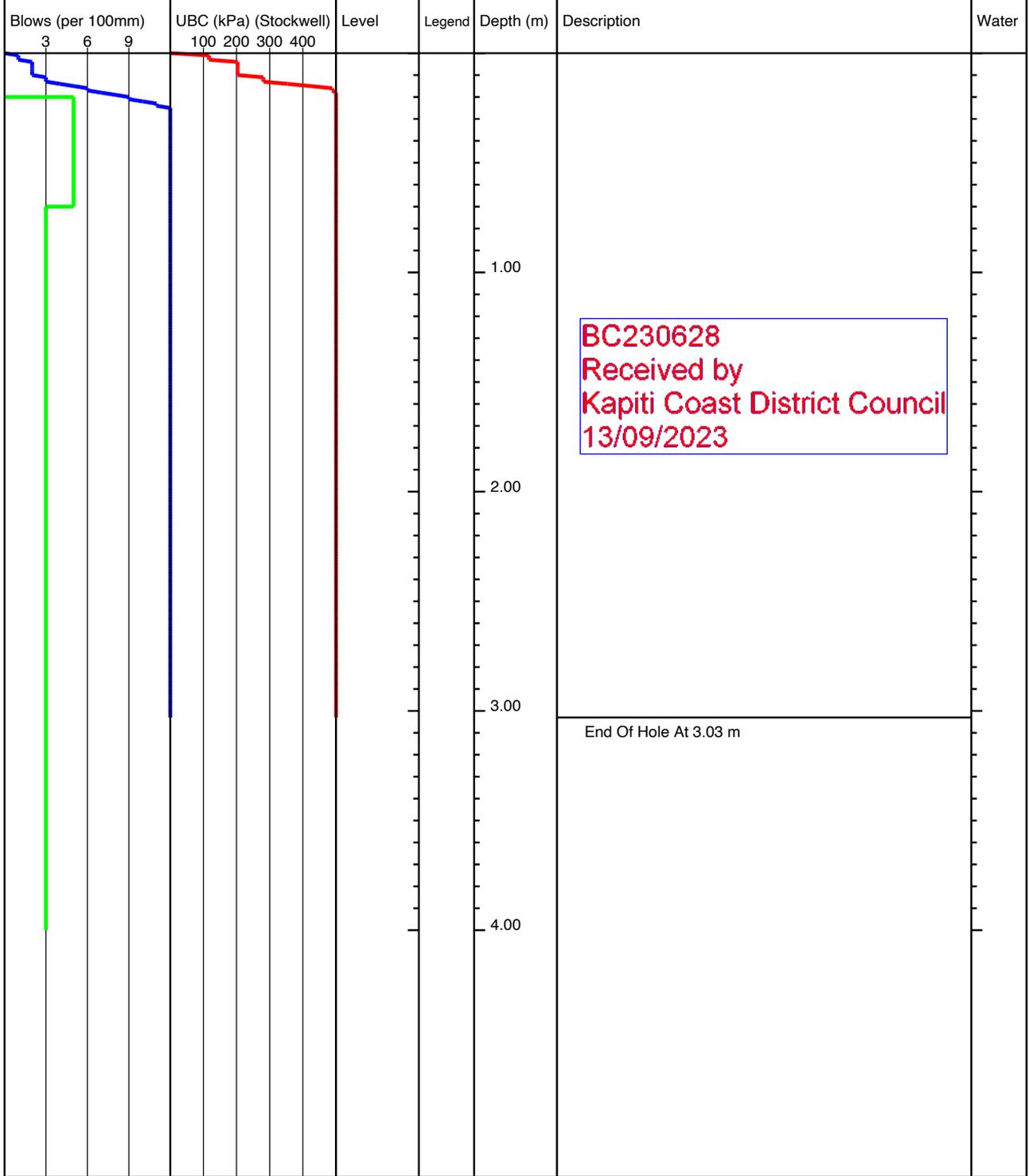
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot32-80
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86884	E Coord: 175.04837
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



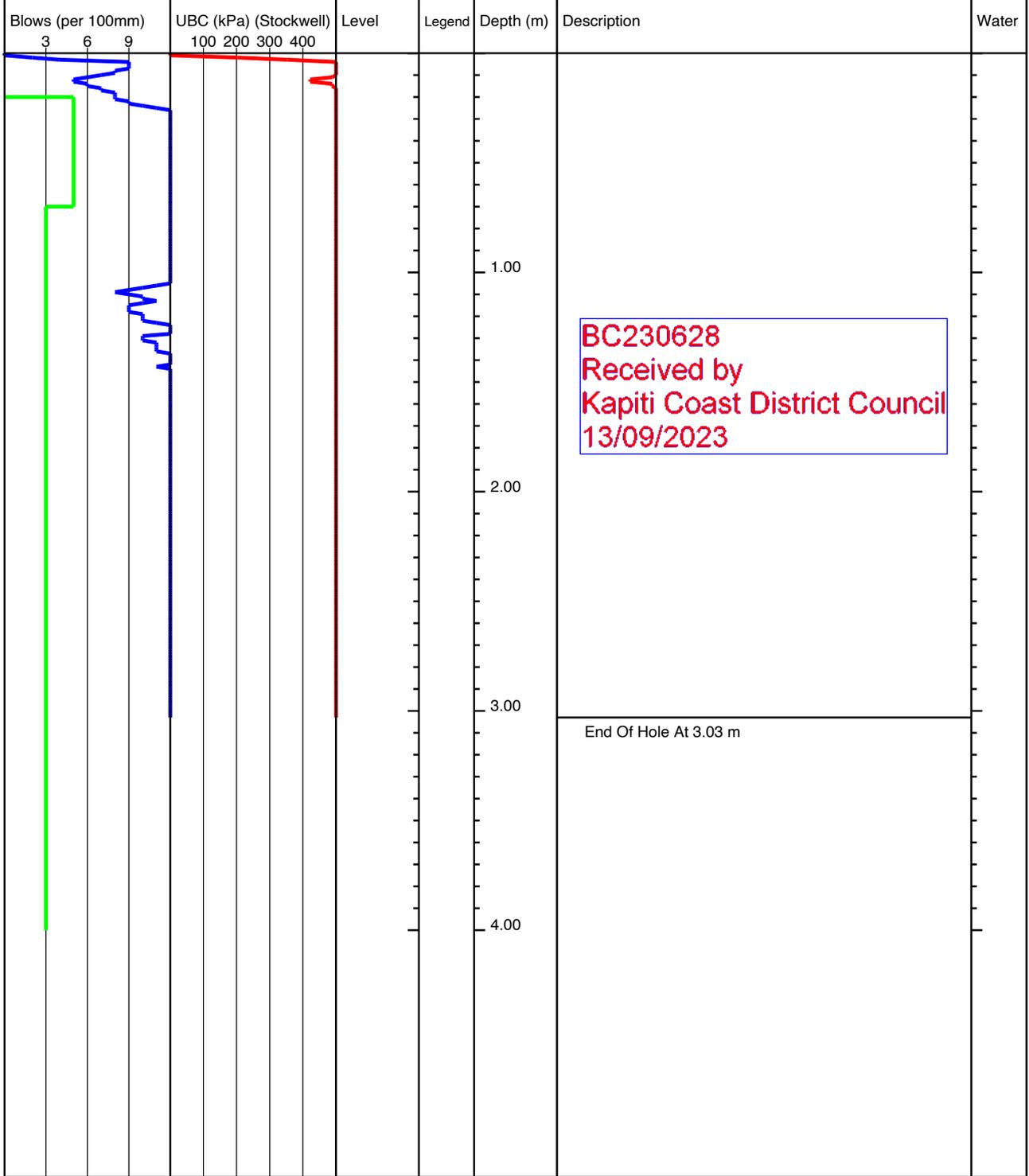
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot32-81
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86879	E Coord: 175.048477
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

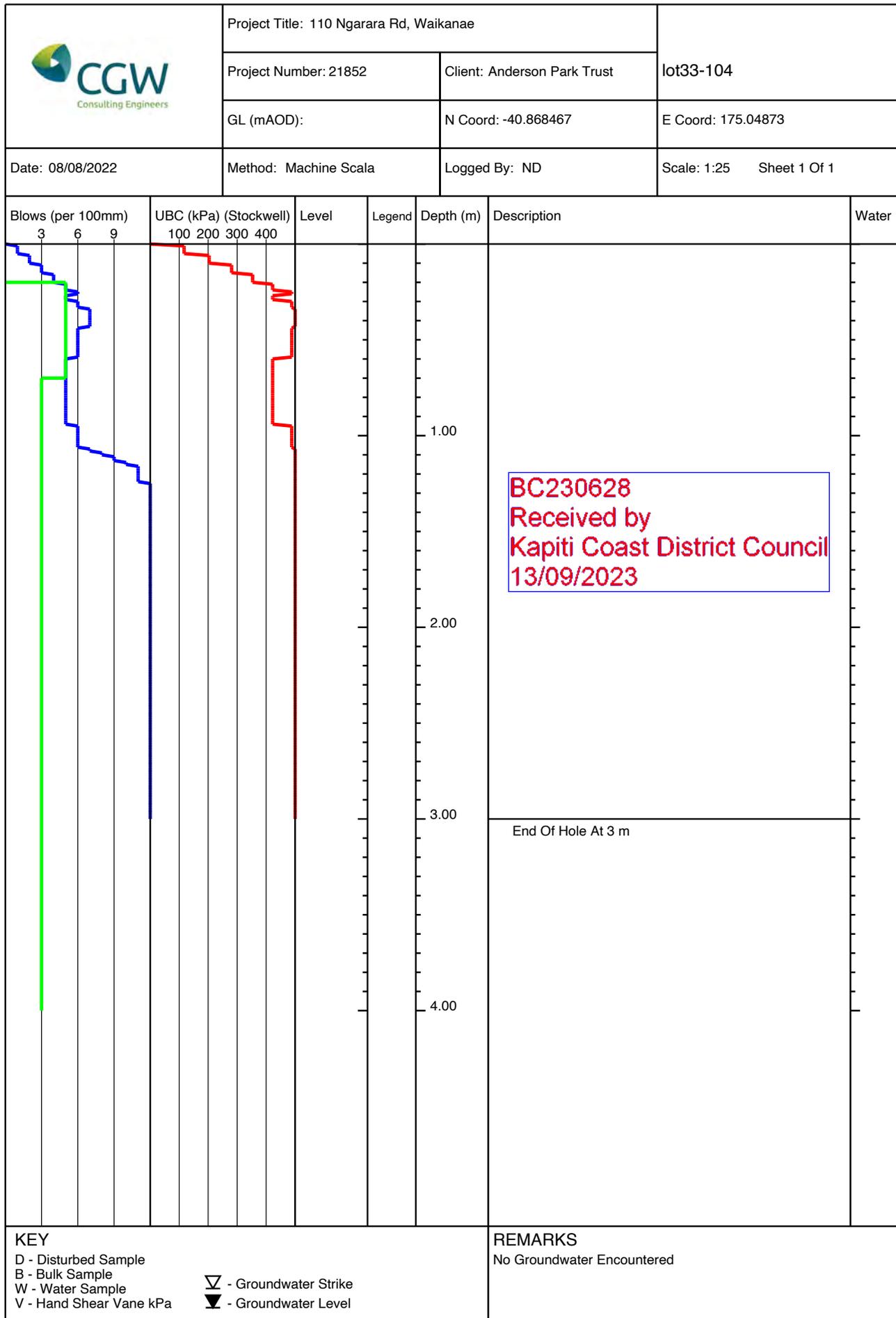


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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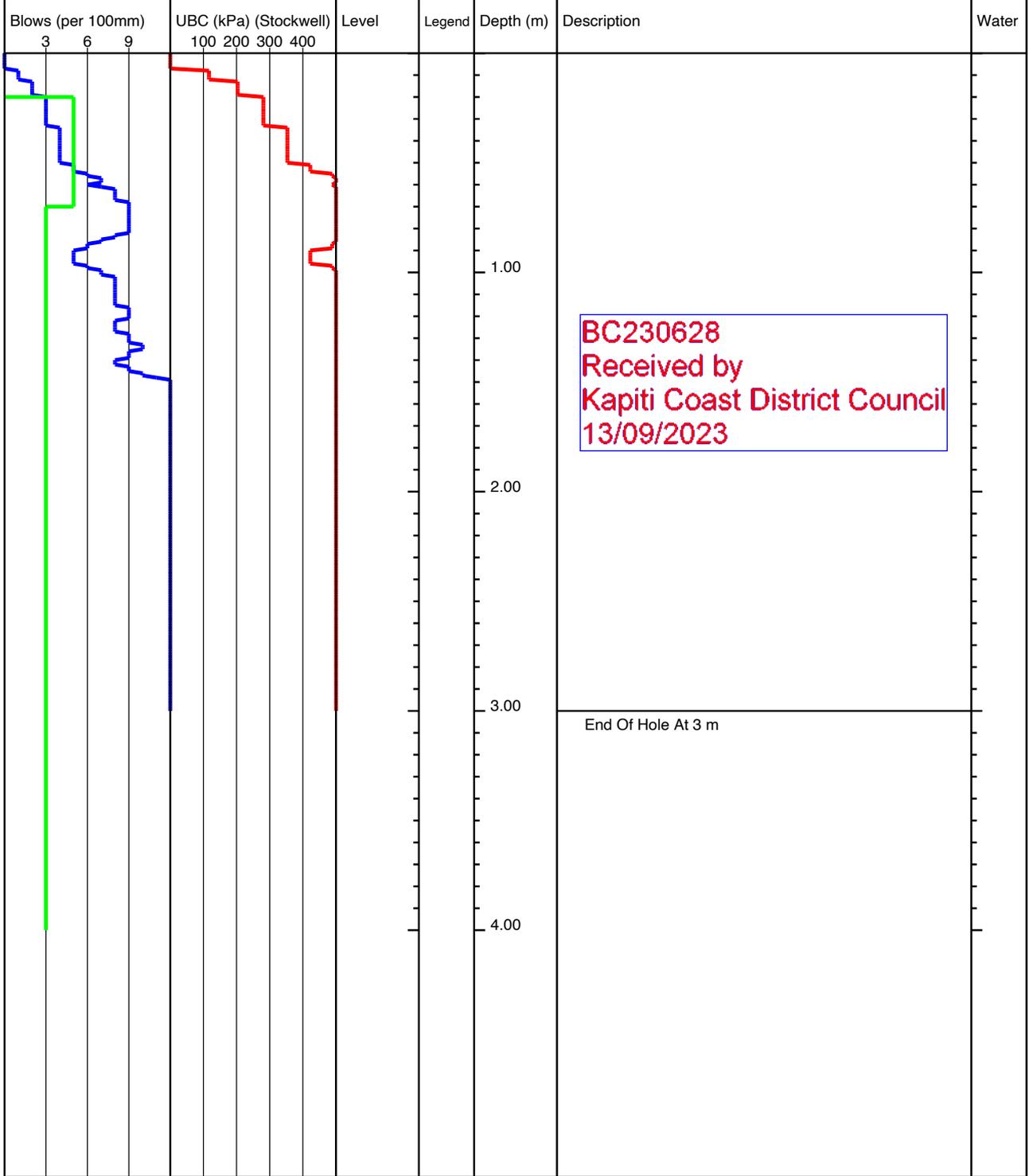
	Project Title: 110 Ngarara Rd, Waikanae		lot32-82
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868828	E Coord: 175.048565
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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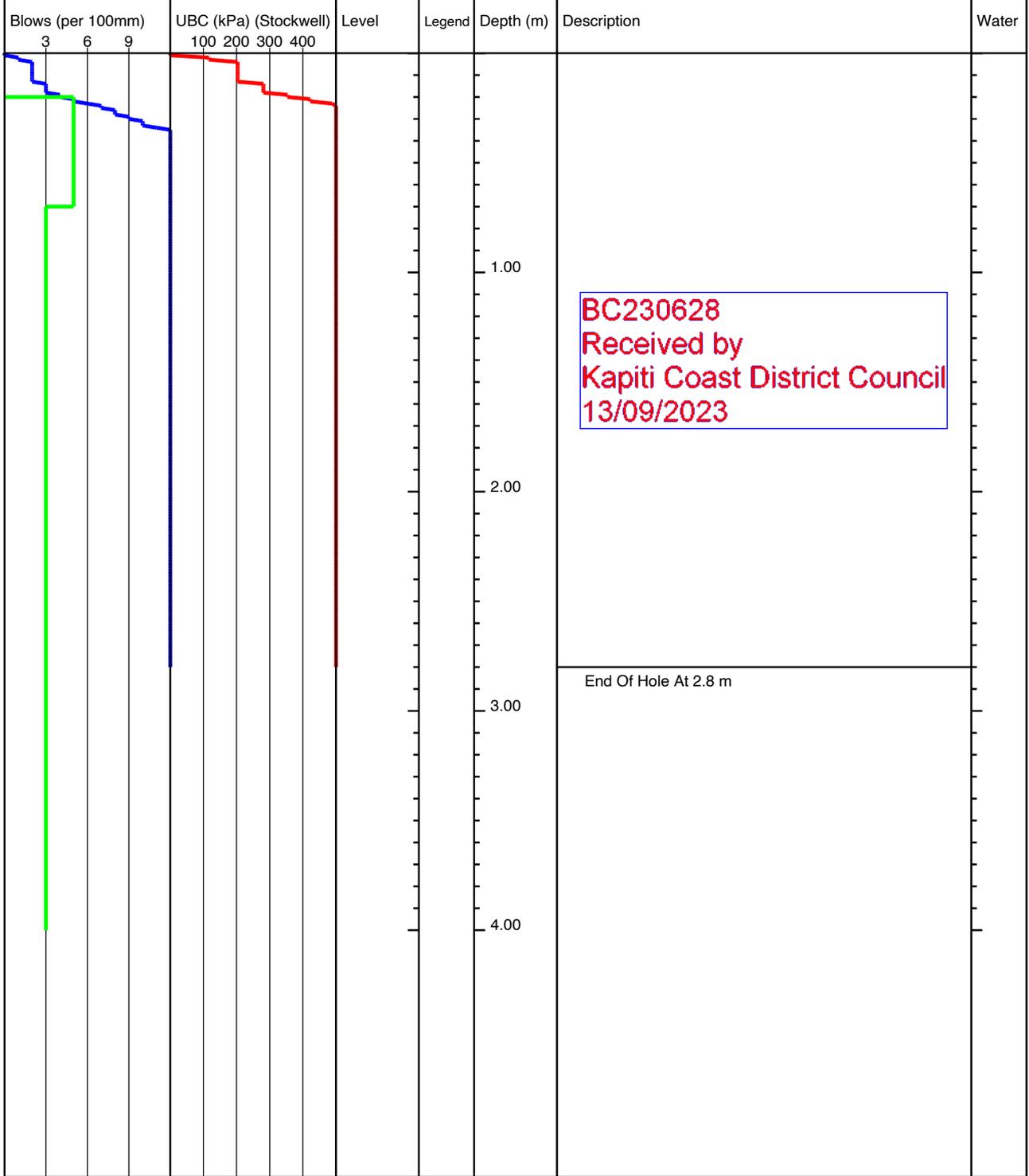


	Project Title: 110 Ngarara Rd, Waikanae		lot33-105
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86843	E Coord: 175.048628
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



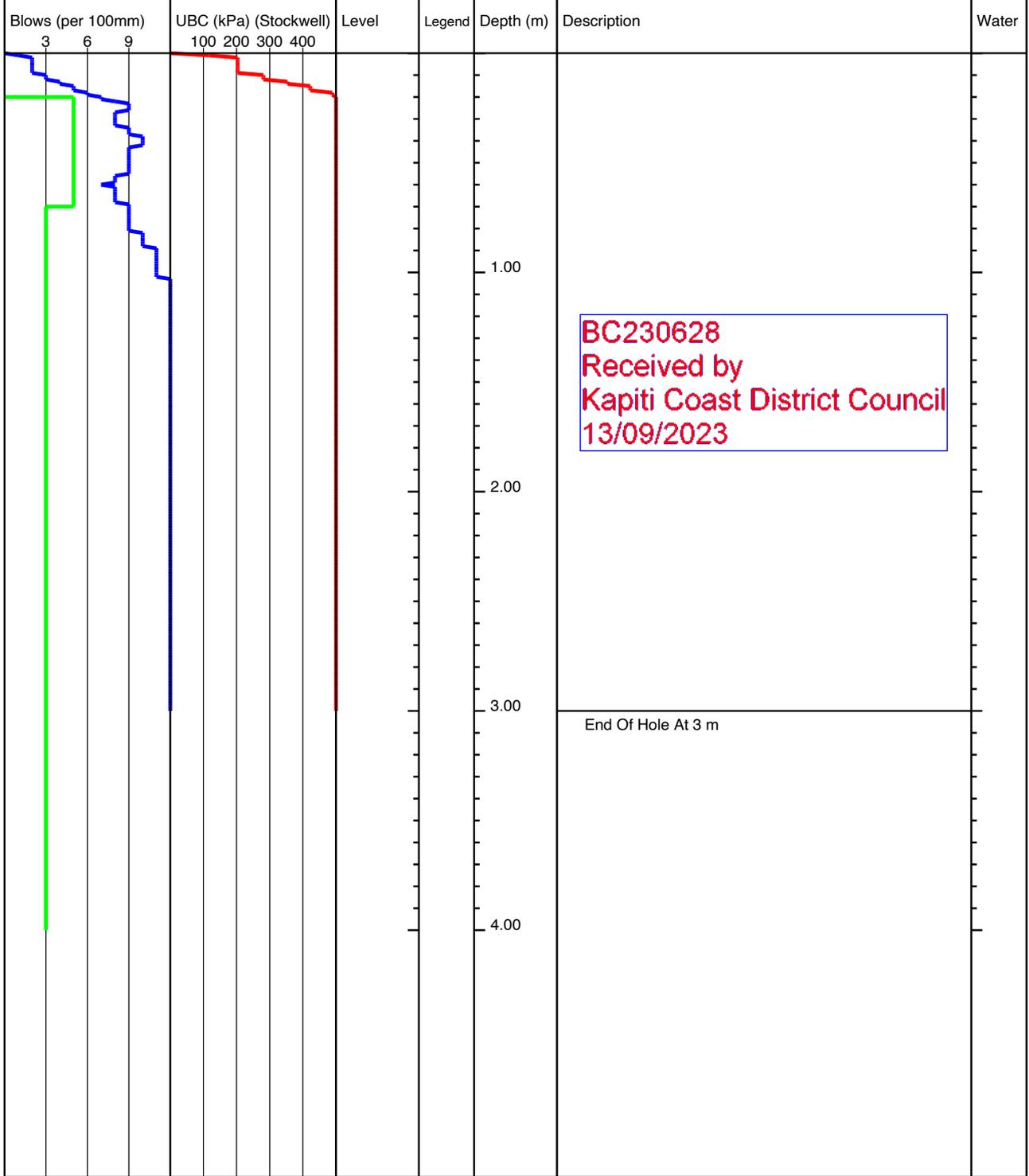
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot33-106
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868548	E Coord: 175.04857
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



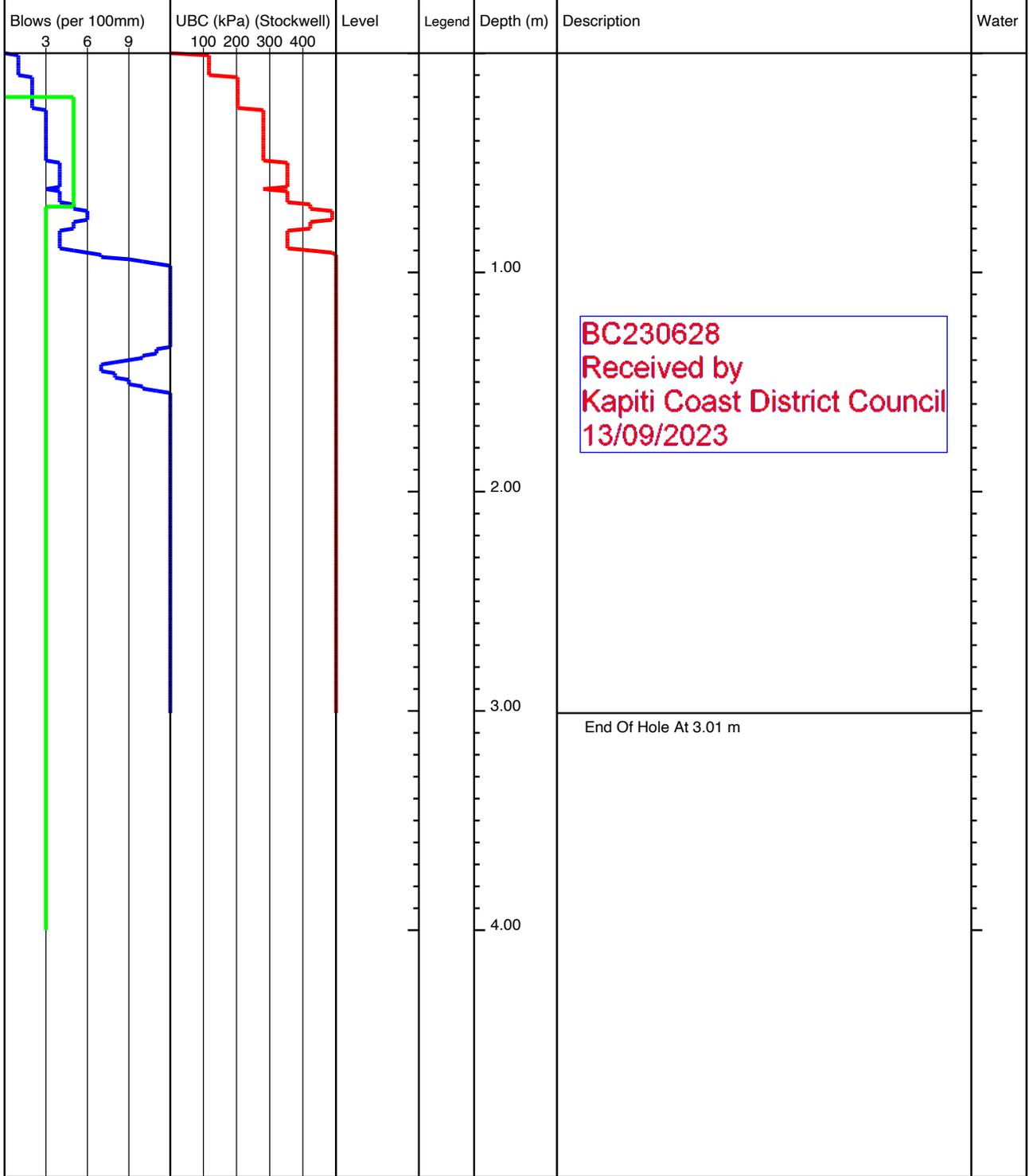
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot33-107
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86855	E Coord: 175.048682
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



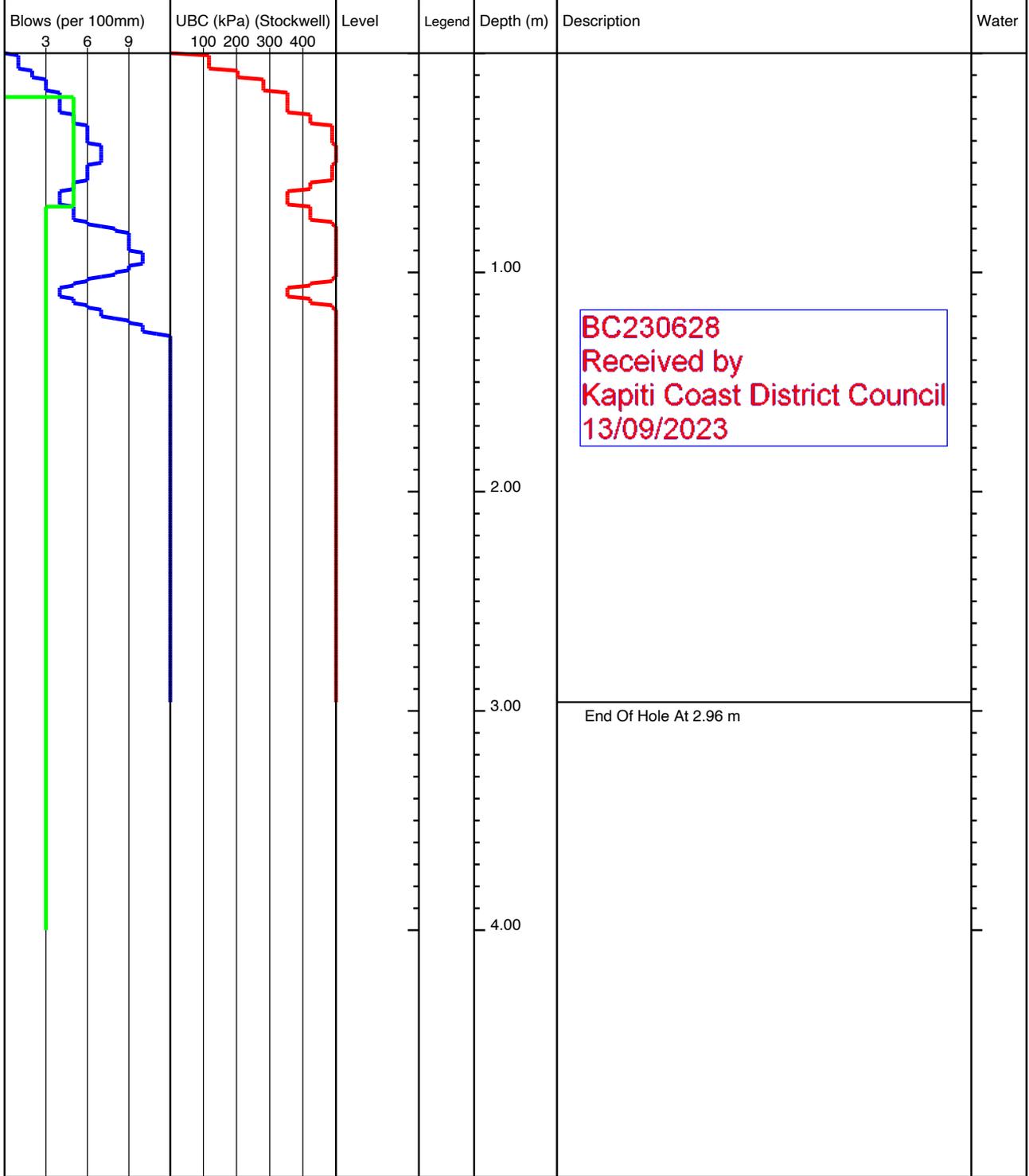
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot34-102
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868608	E Coord: 175.049045
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



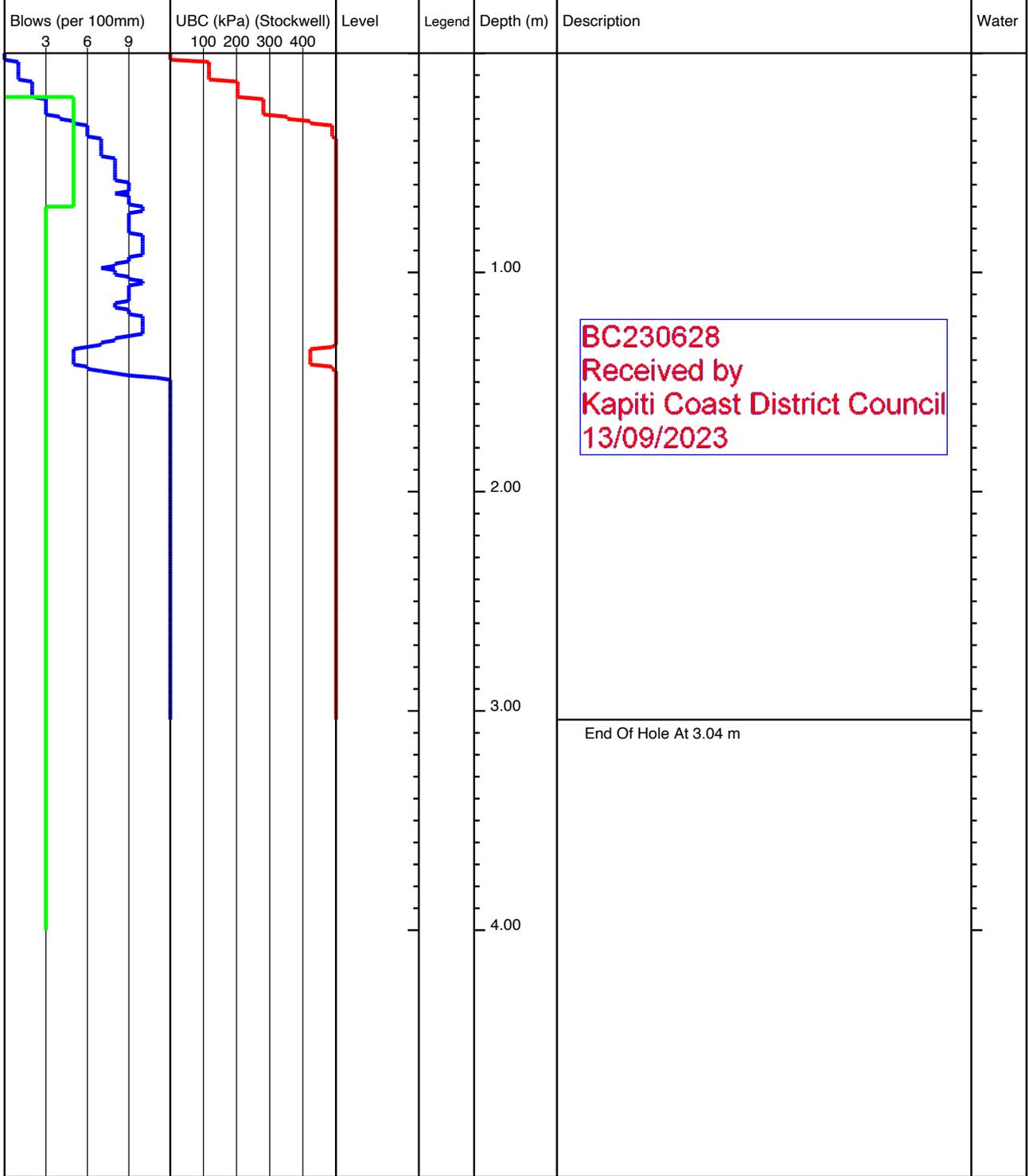
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot34-103
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868528	E Coord: 175.04888
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



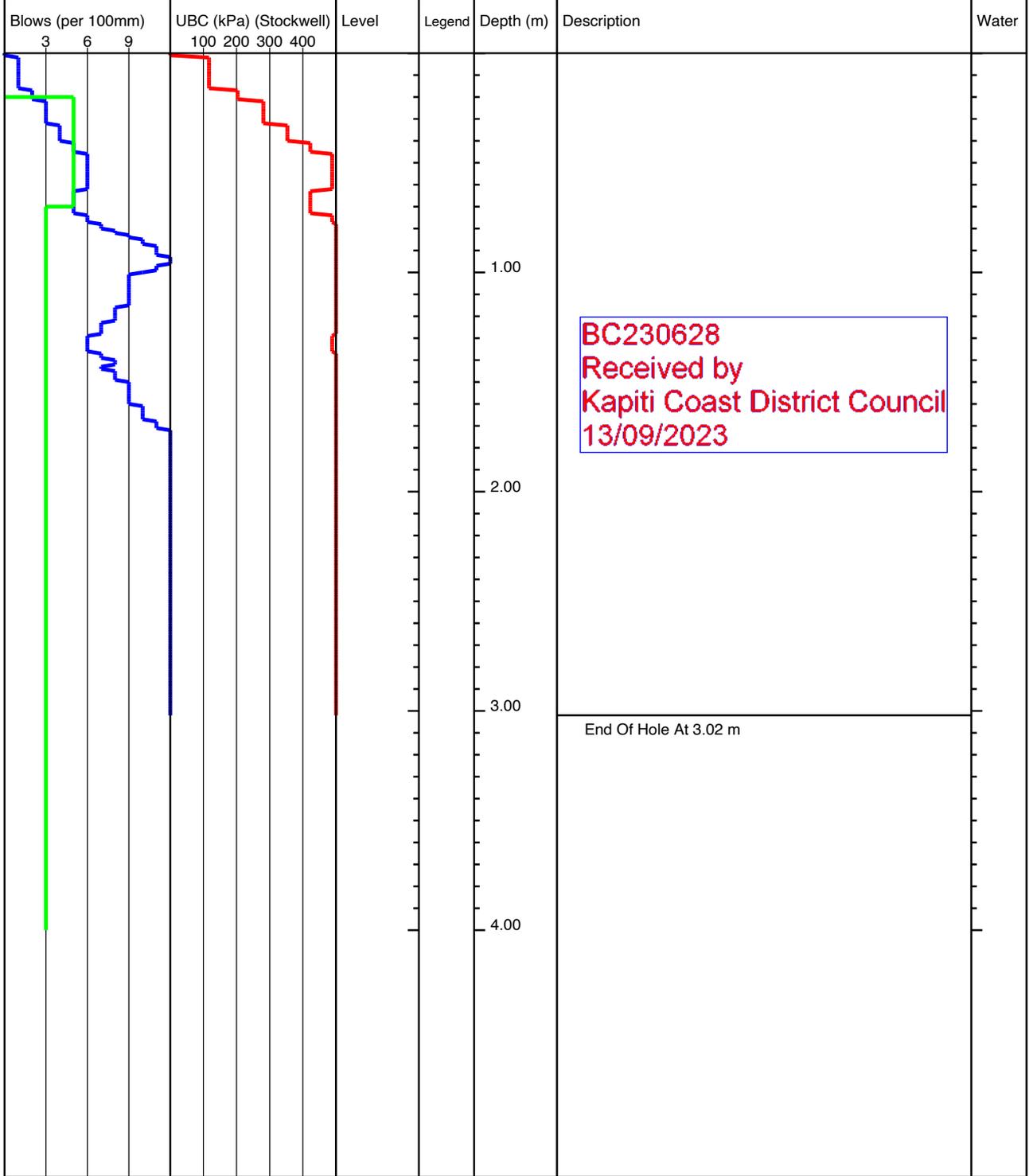
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot34-108
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86864	E Coord: 175.048745
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



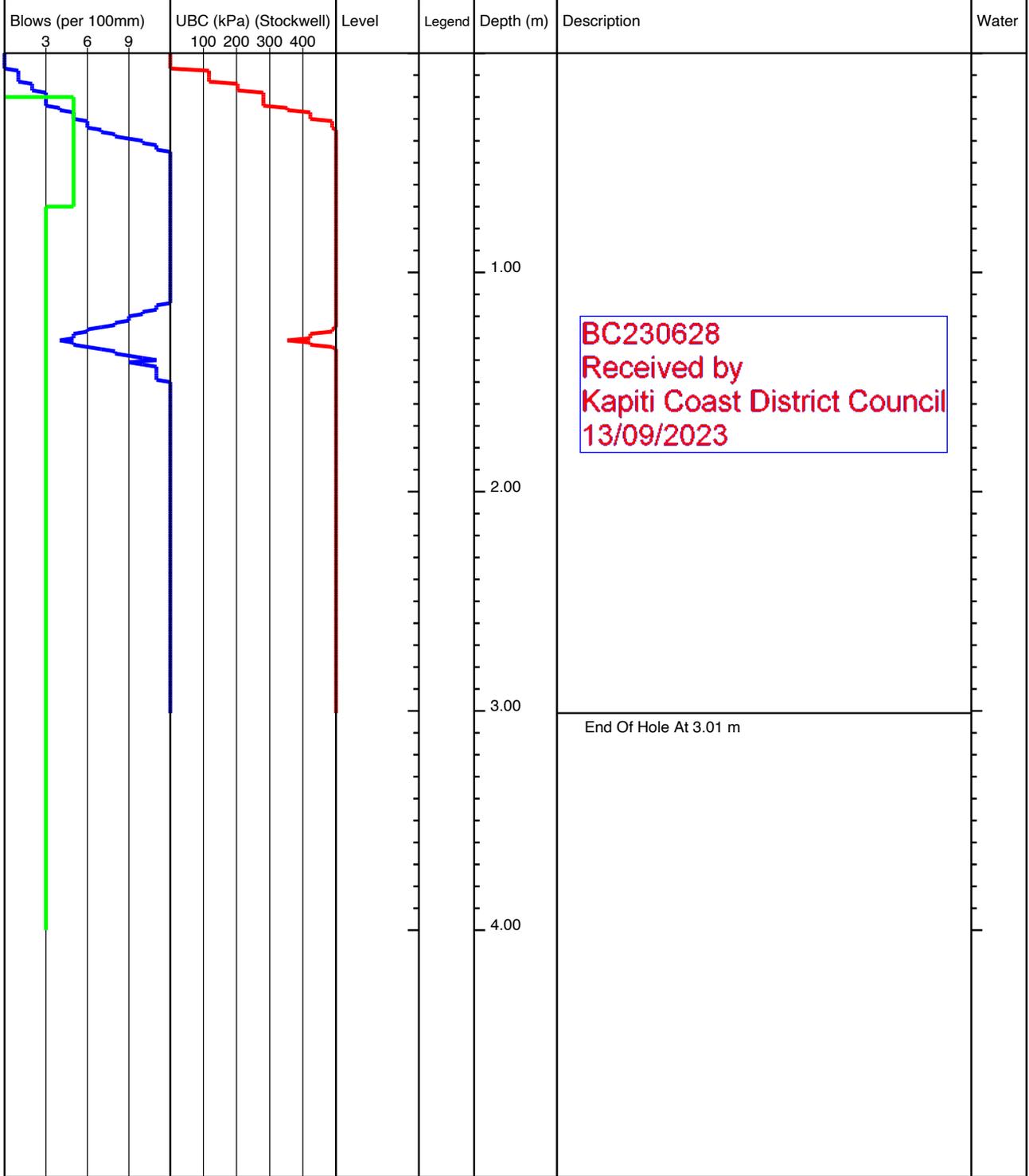
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot34-109
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868687	E Coord: 175.048993
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



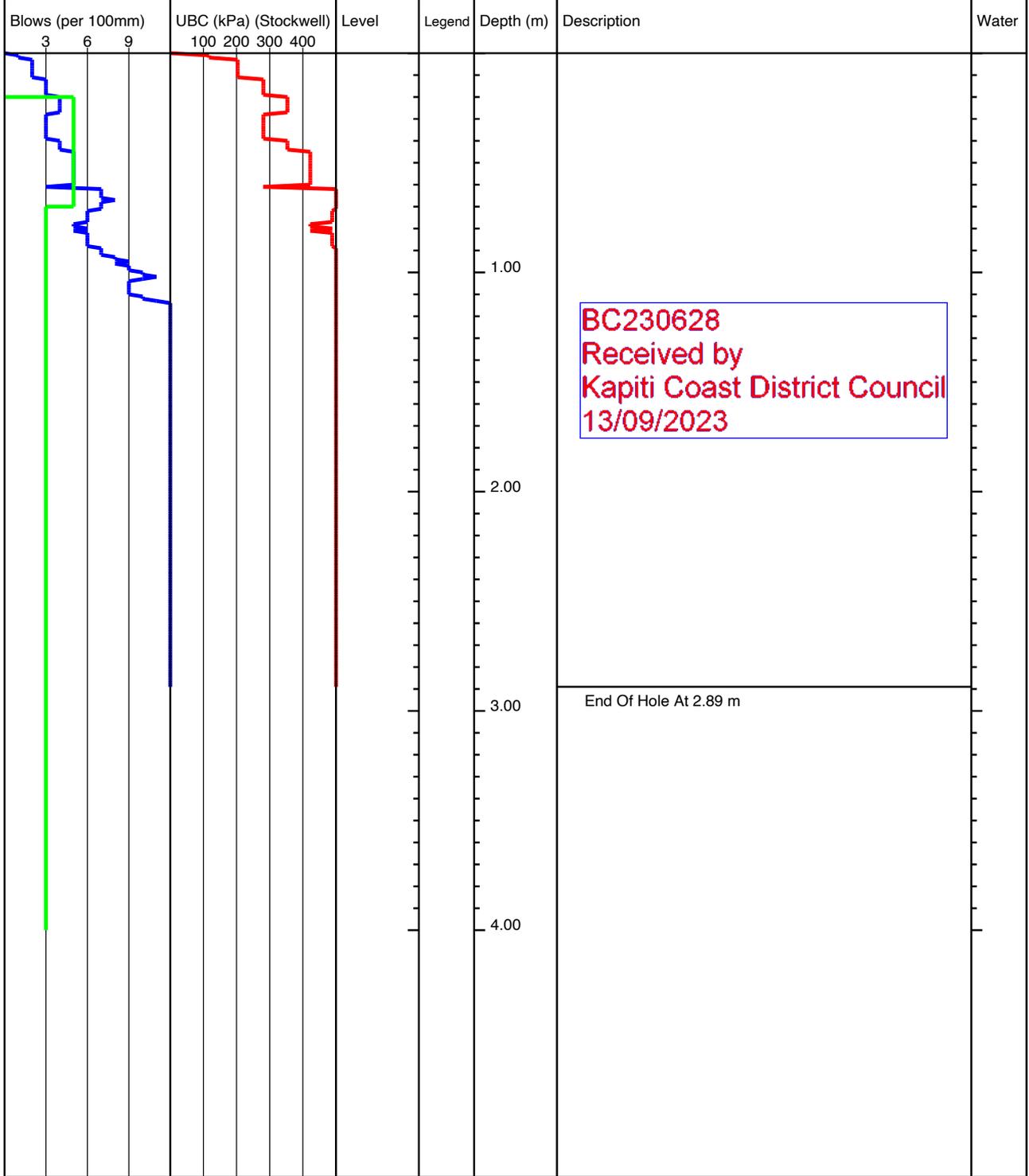
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot35-110
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868705	E Coord: 175.04896
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



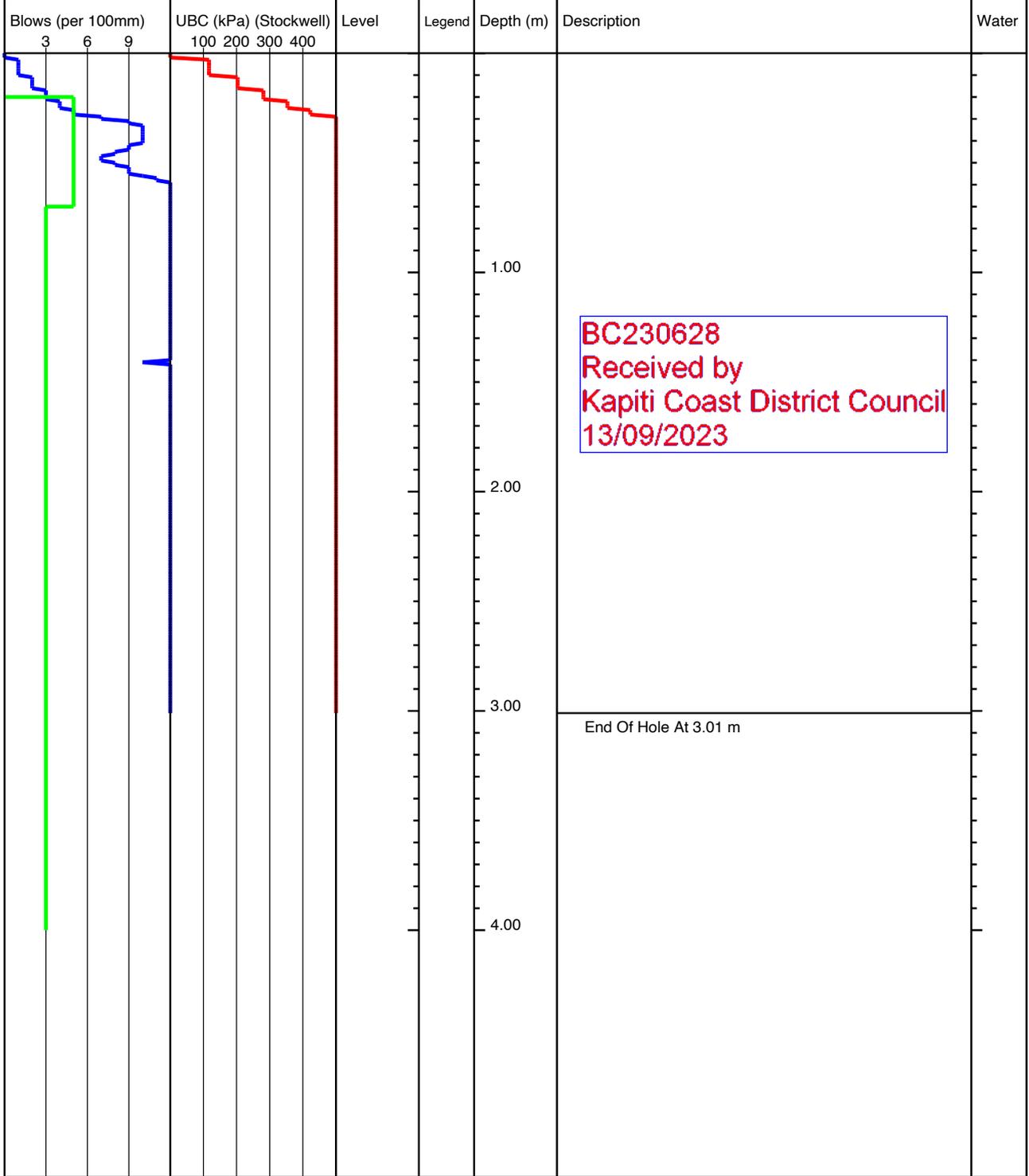
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot35-111
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868678	E Coord: 175.048855
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



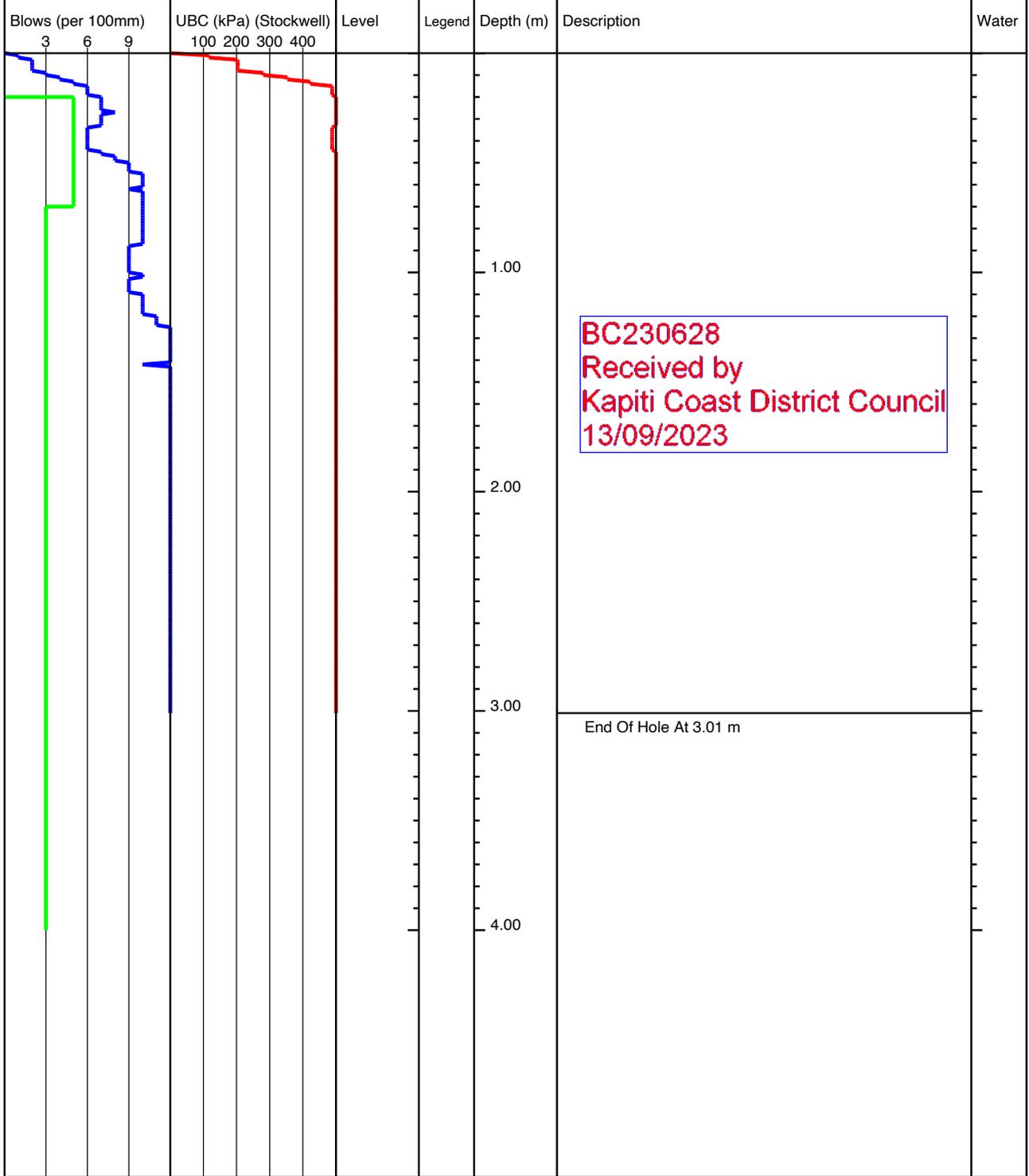
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot35-112
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86873	E Coord: 175.048778
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



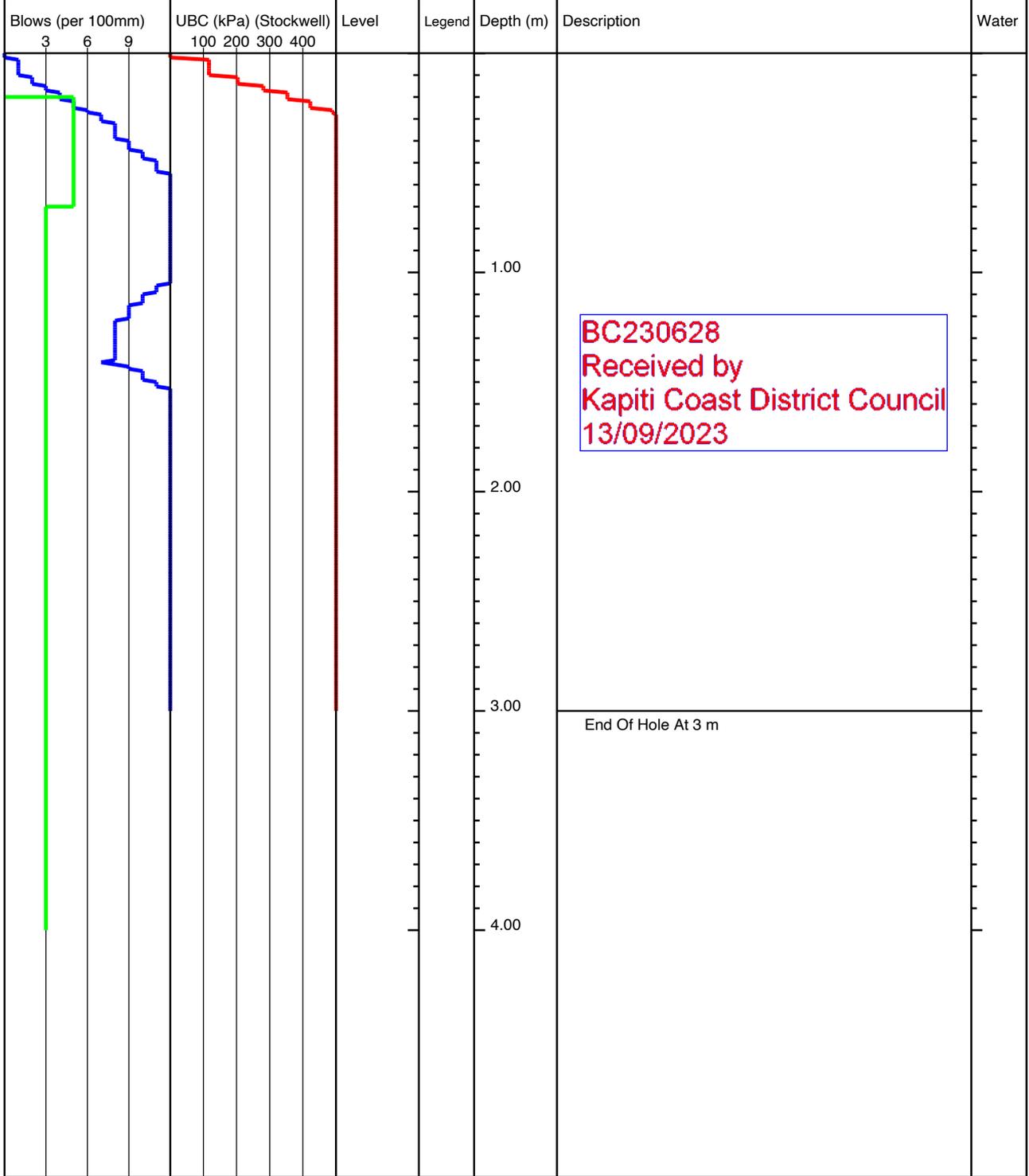
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot35-113
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868847	E Coord: 175.048775
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



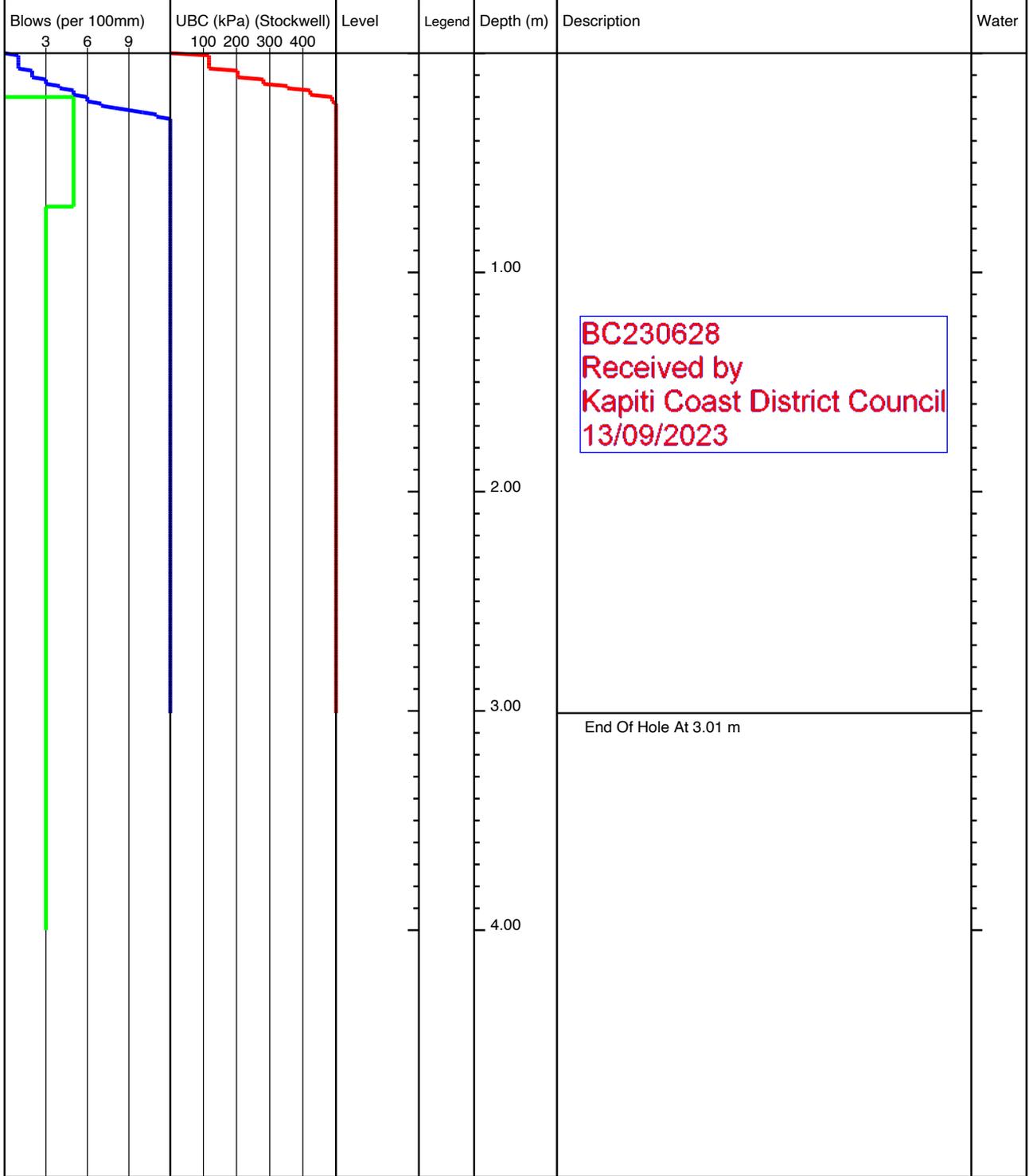
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot35-114
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868758	E Coord: 175.04884
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



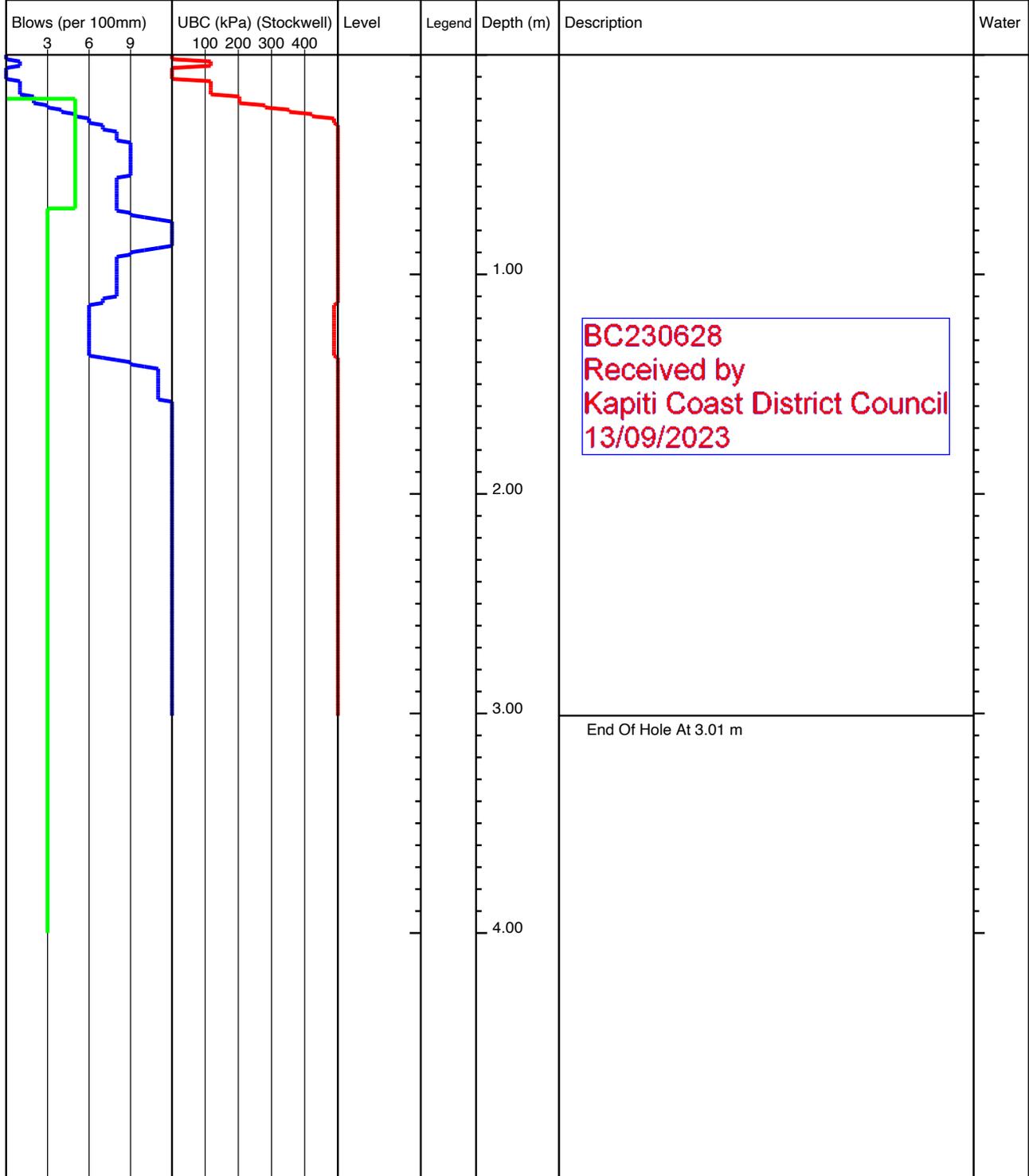
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot36-100
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868895	E Coord: 175.049052
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



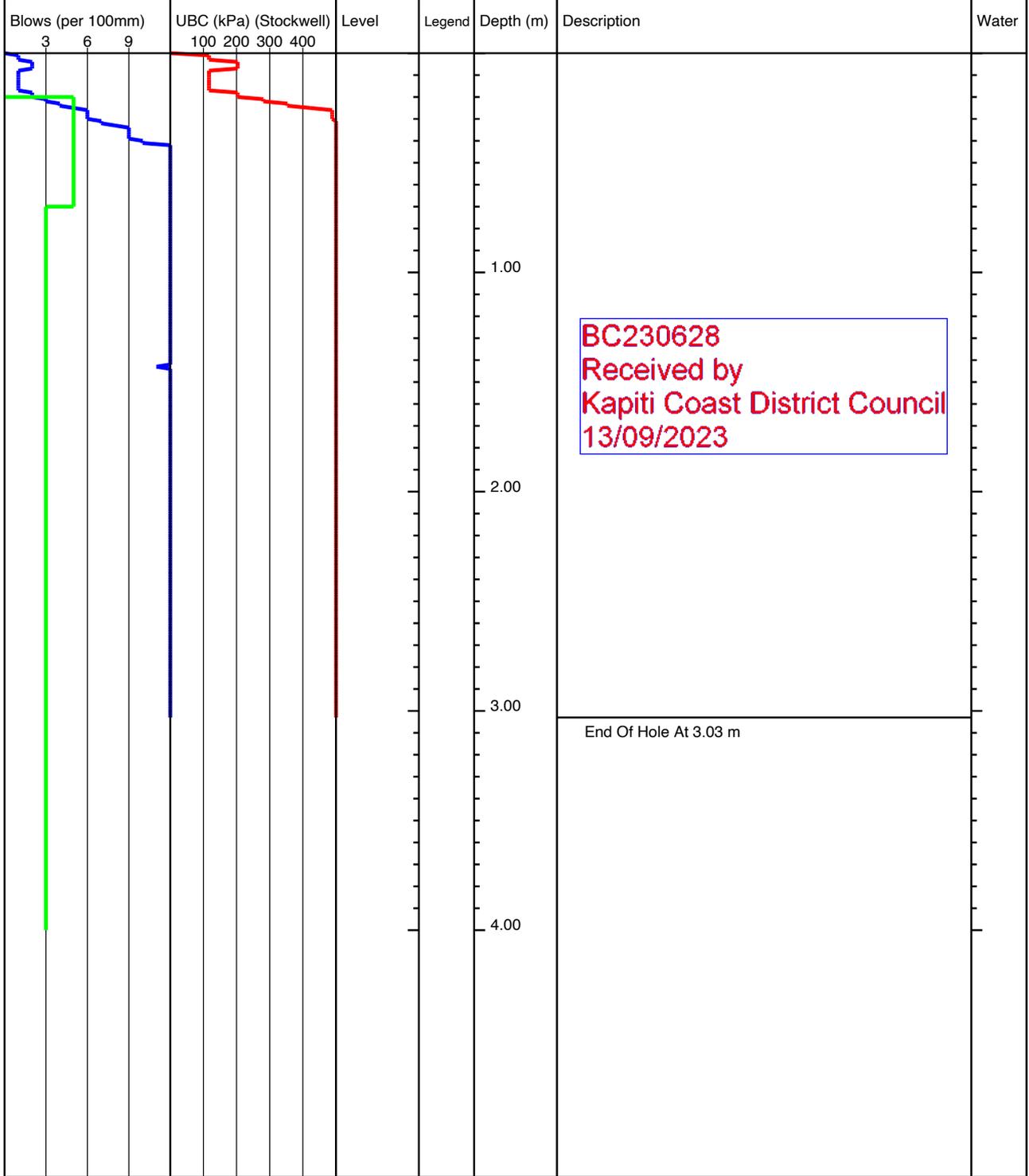
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot36-92
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868992	E Coord: 175.049057
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



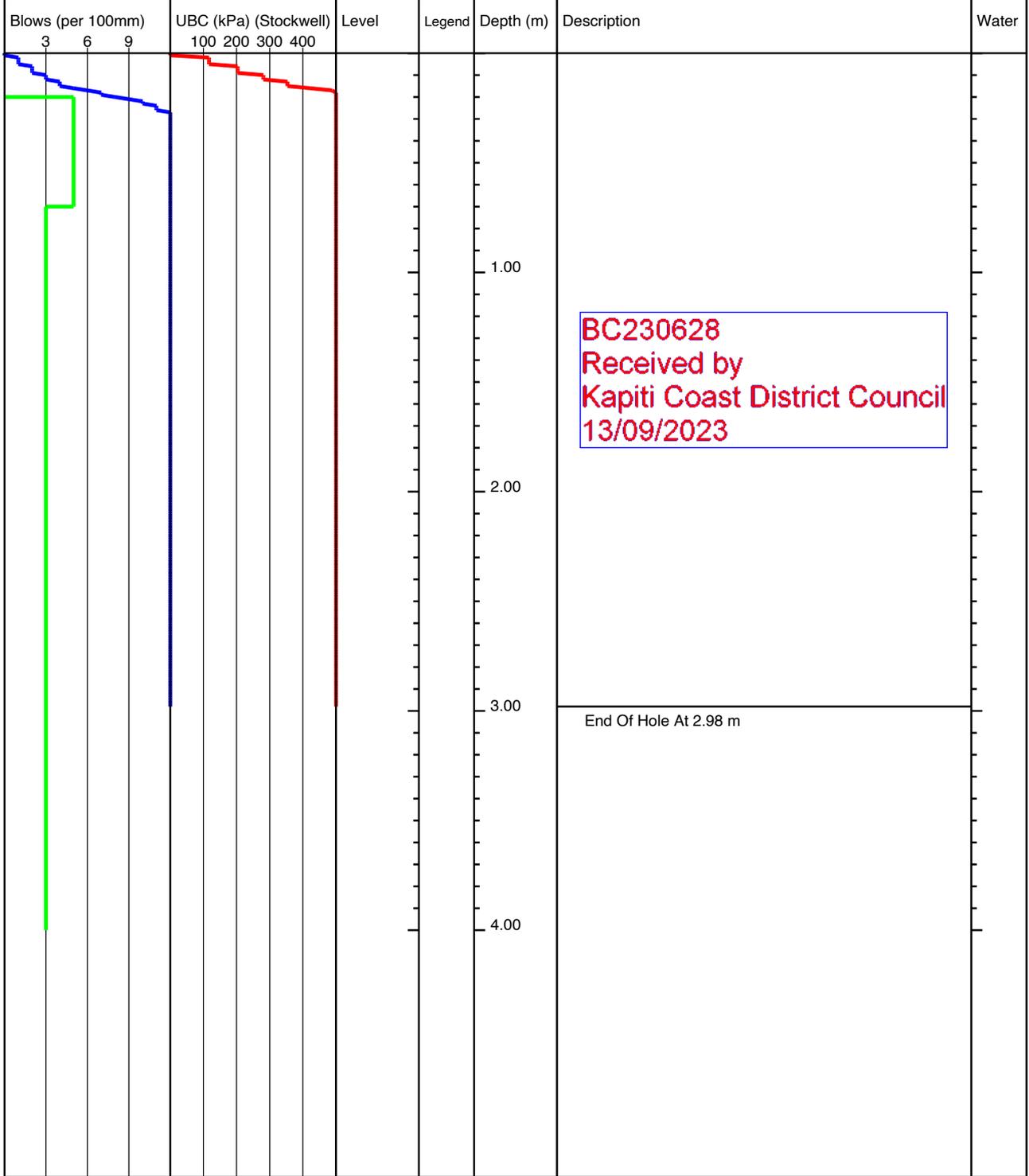
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot36-93
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868923	E Coord: 175.04914
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

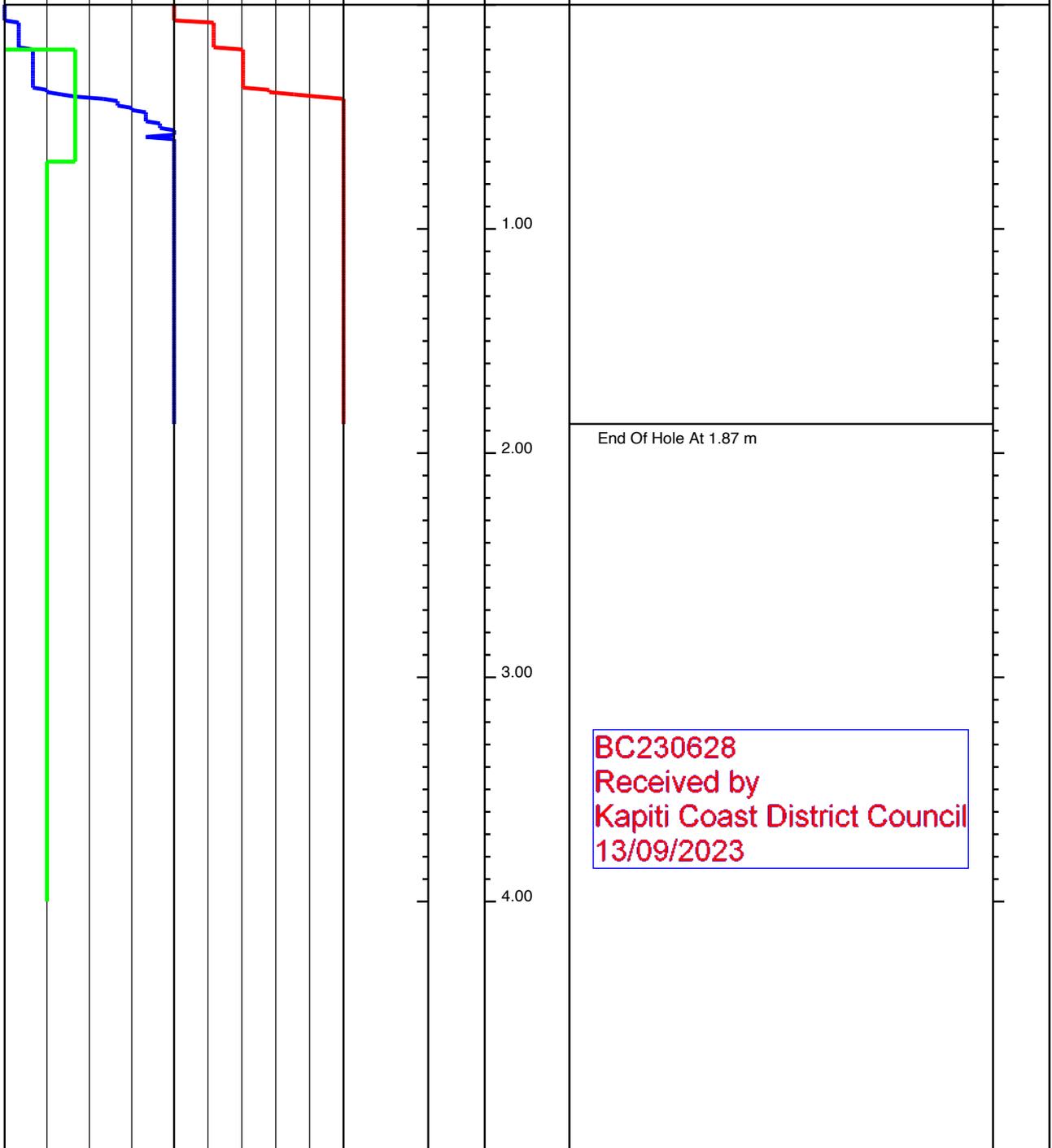


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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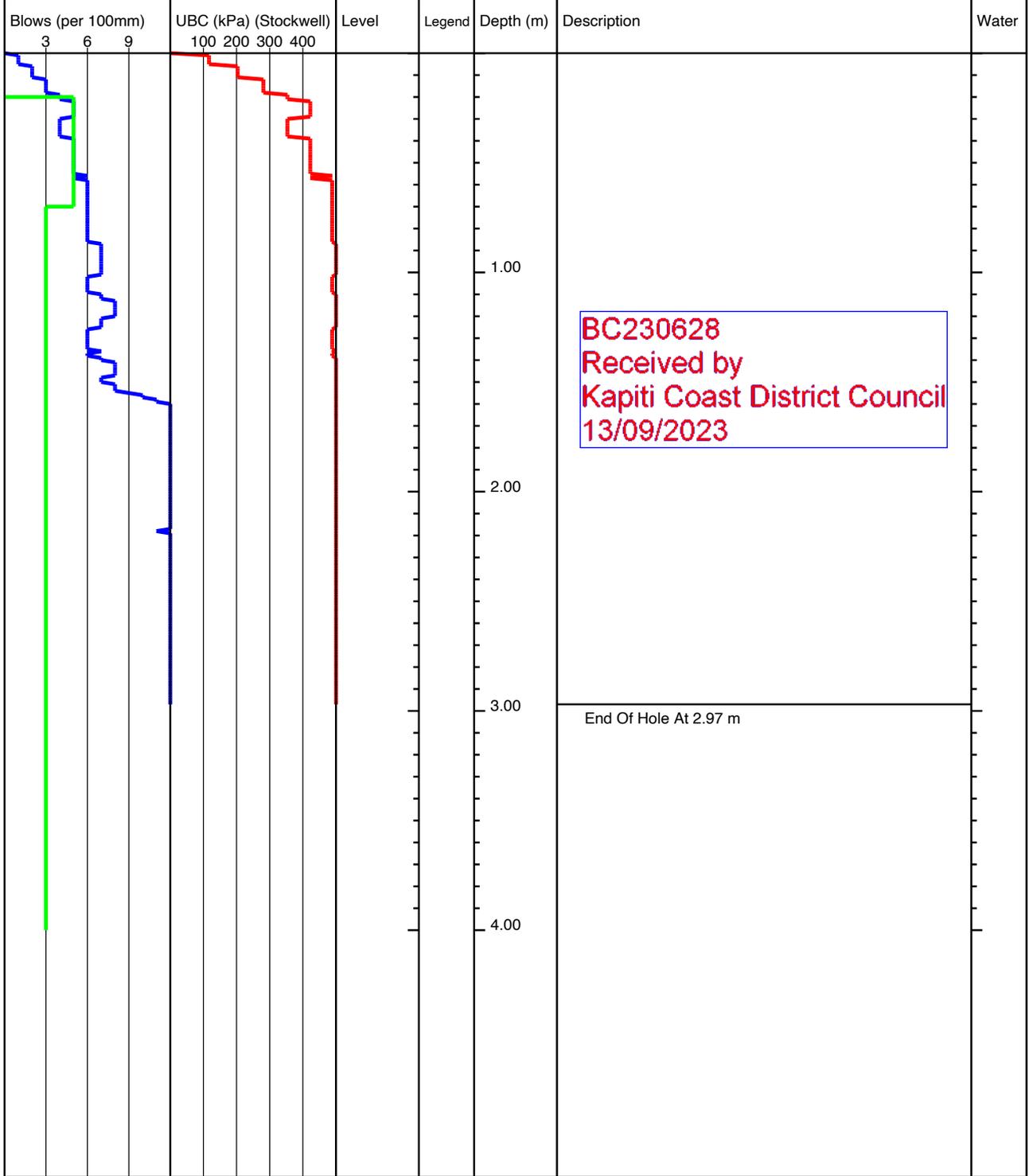
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	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868815	E Coord: 175.049065
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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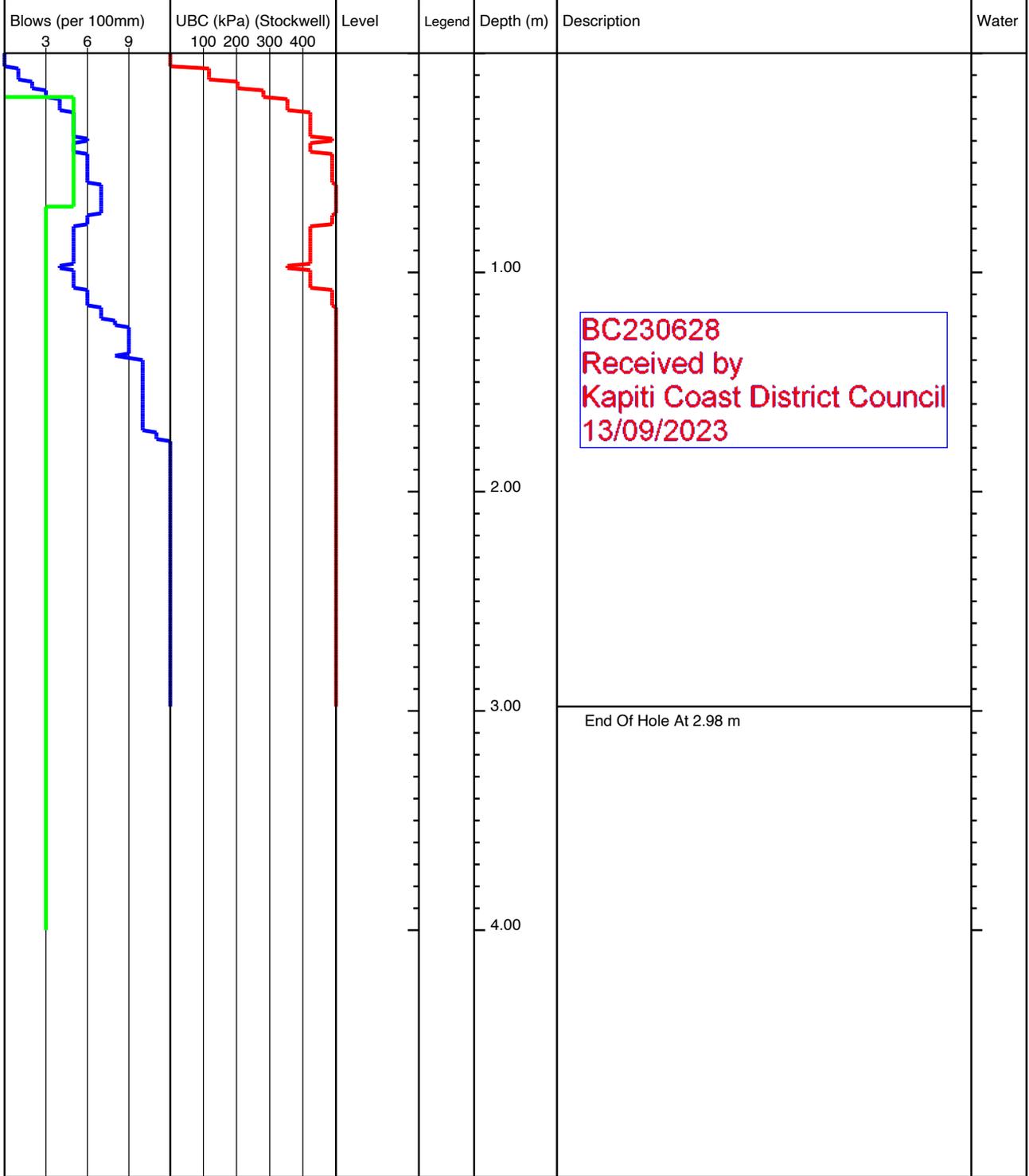
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		Project Number: 21852	Client: Anderson Park Trust		lot36-99	
		GL (mAOD):	N Coord: -40.868912		E Coord: 175.048993	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND		Scale: 1:25 Sheet 1 Of 1
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<p>End Of Hole At 1.87 m</p> <div style="border: 1px solid red; padding: 5px; color: red; margin-top: 20px;"> <p>BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot37-101
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868785	E Coord: 175.049258
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



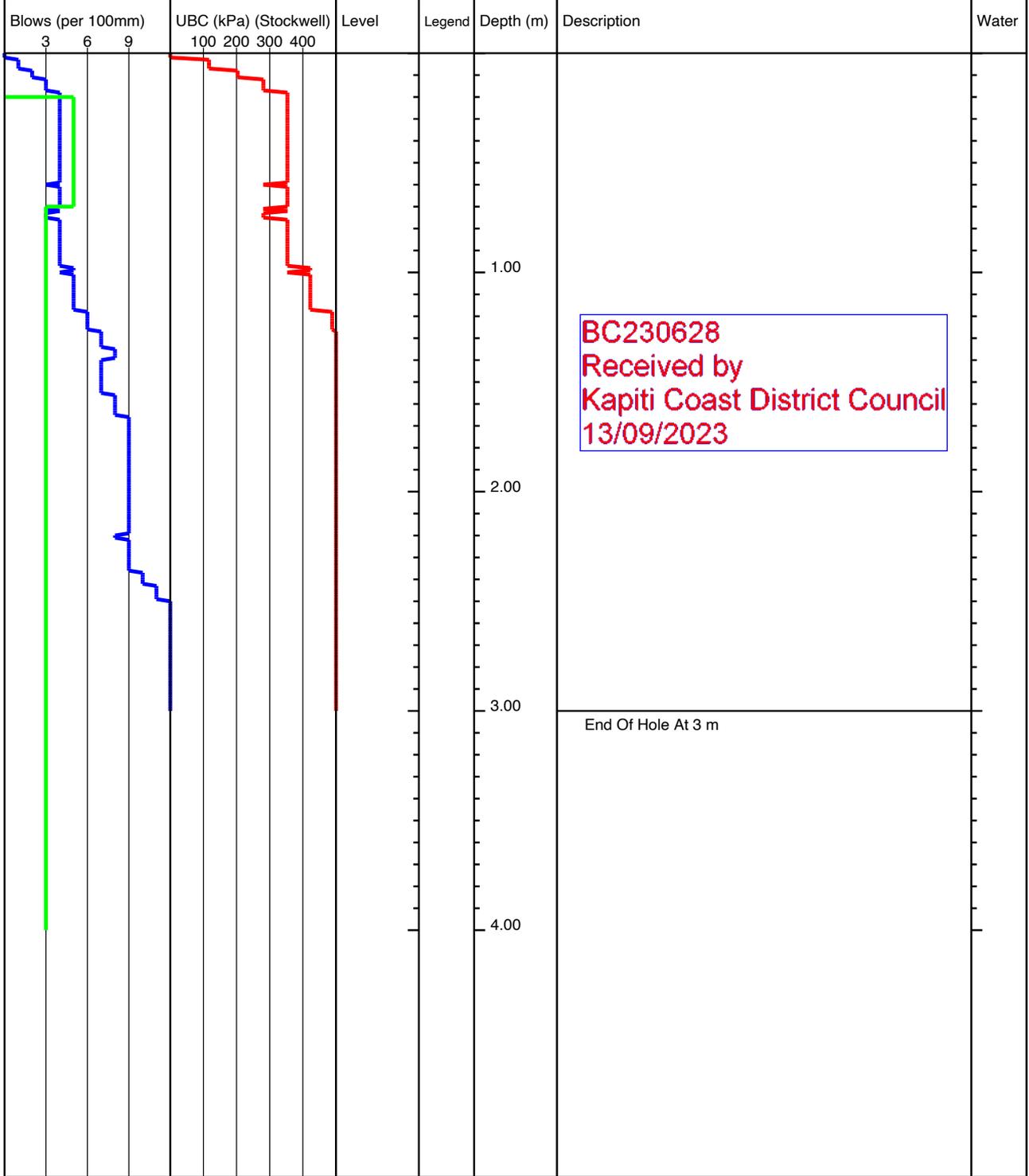
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot37-94
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868845	E Coord: 175.04926
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



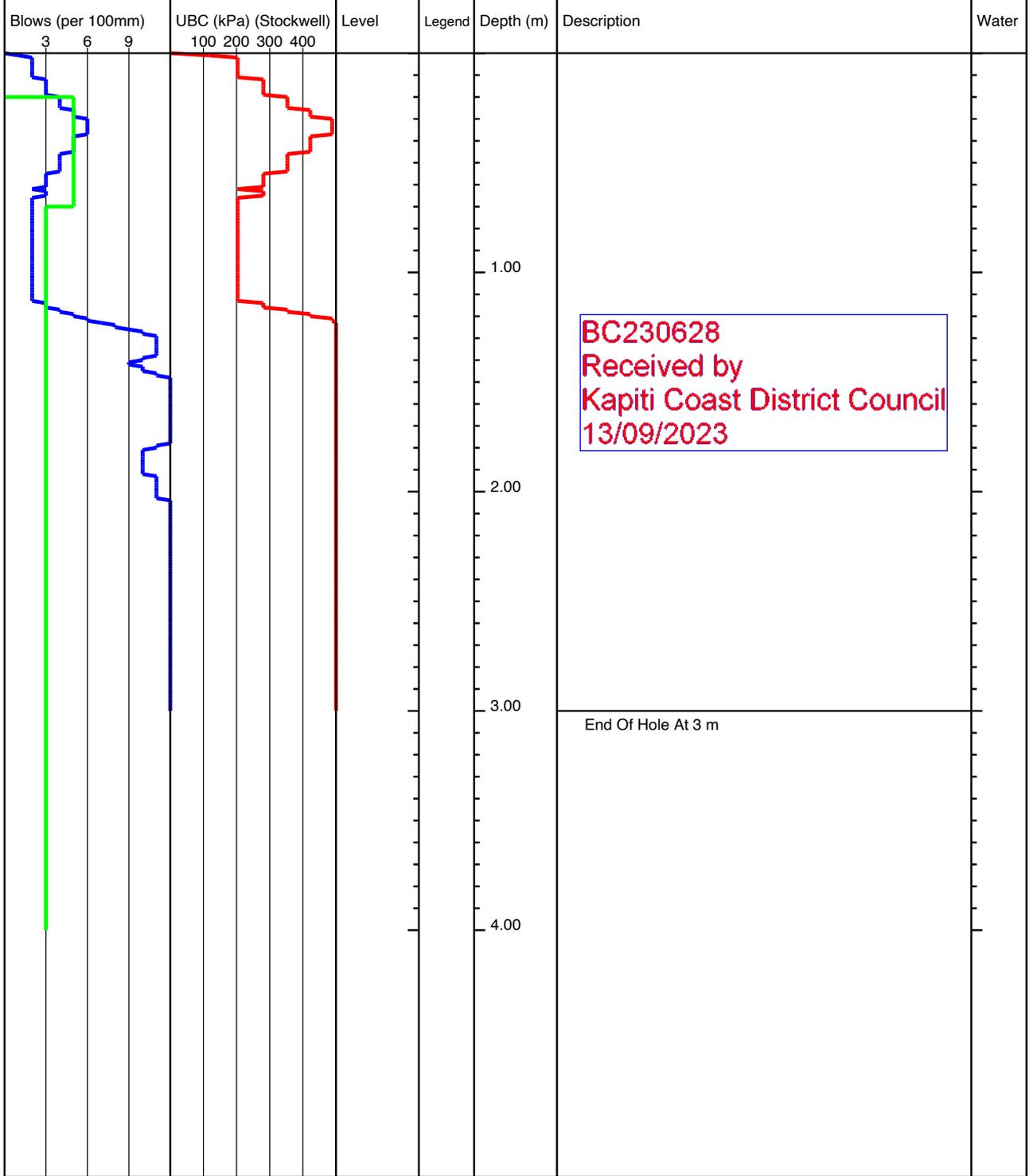
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot37-95
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868812	E Coord: 175.049425
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



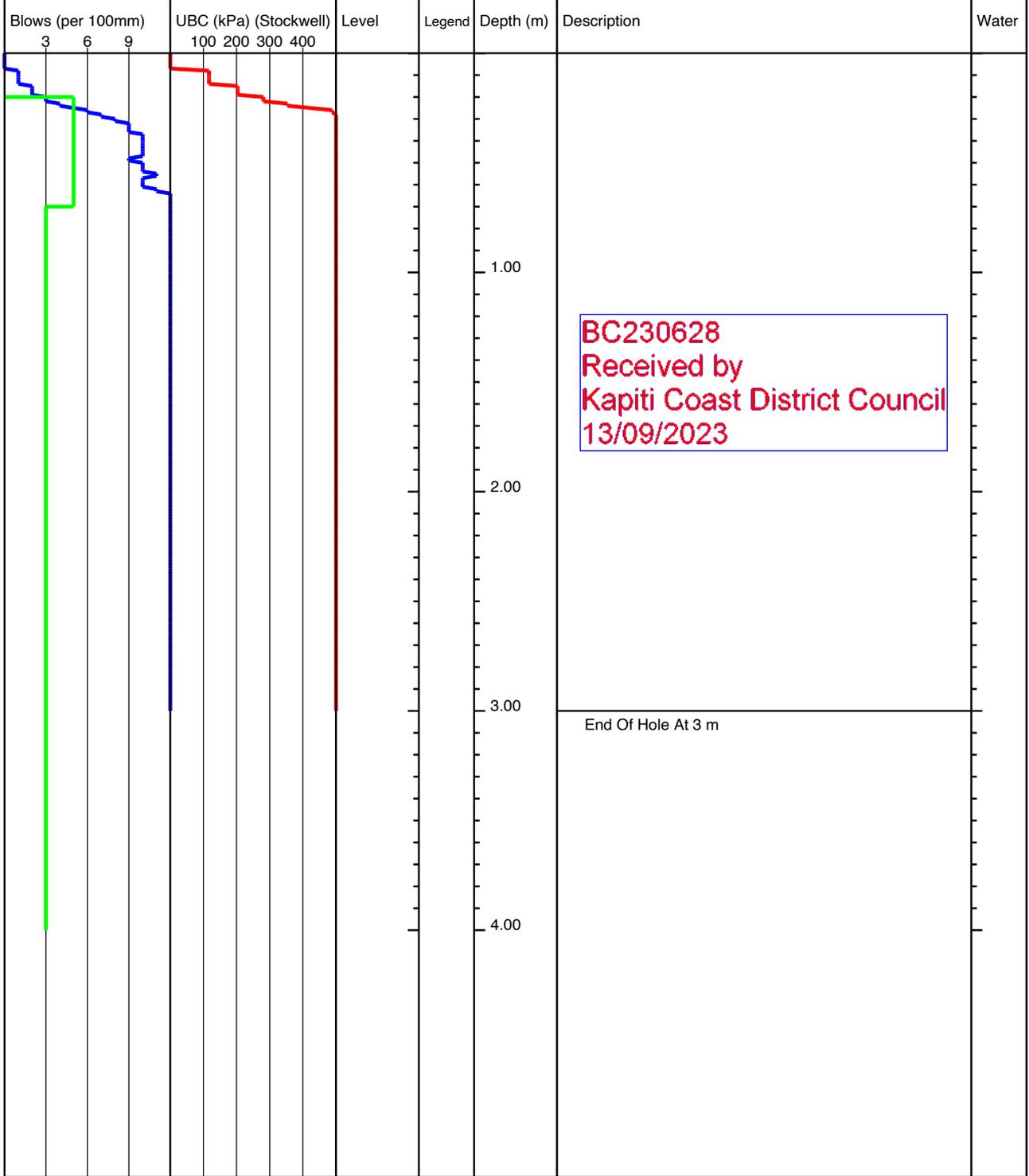
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot37-96
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868663	E Coord: 175.049155
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

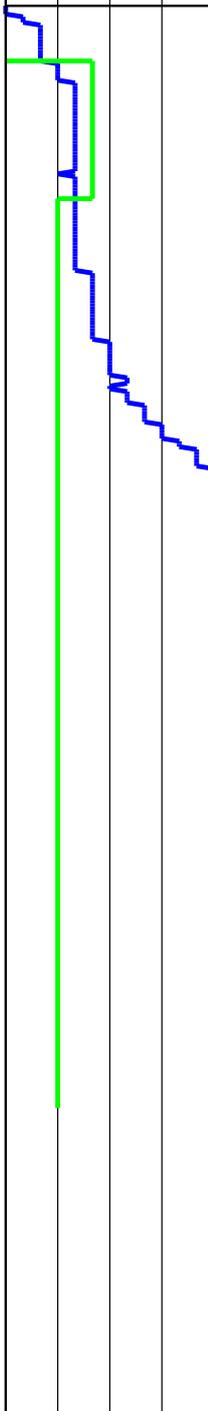
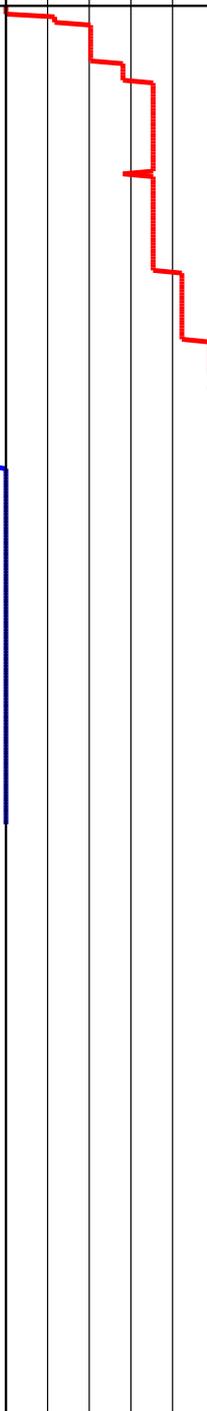
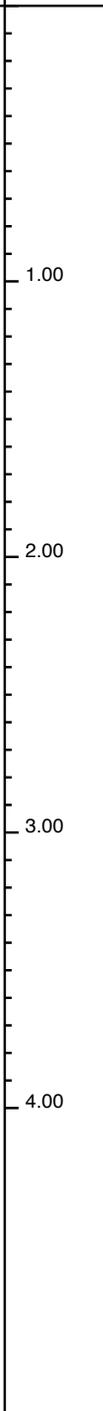


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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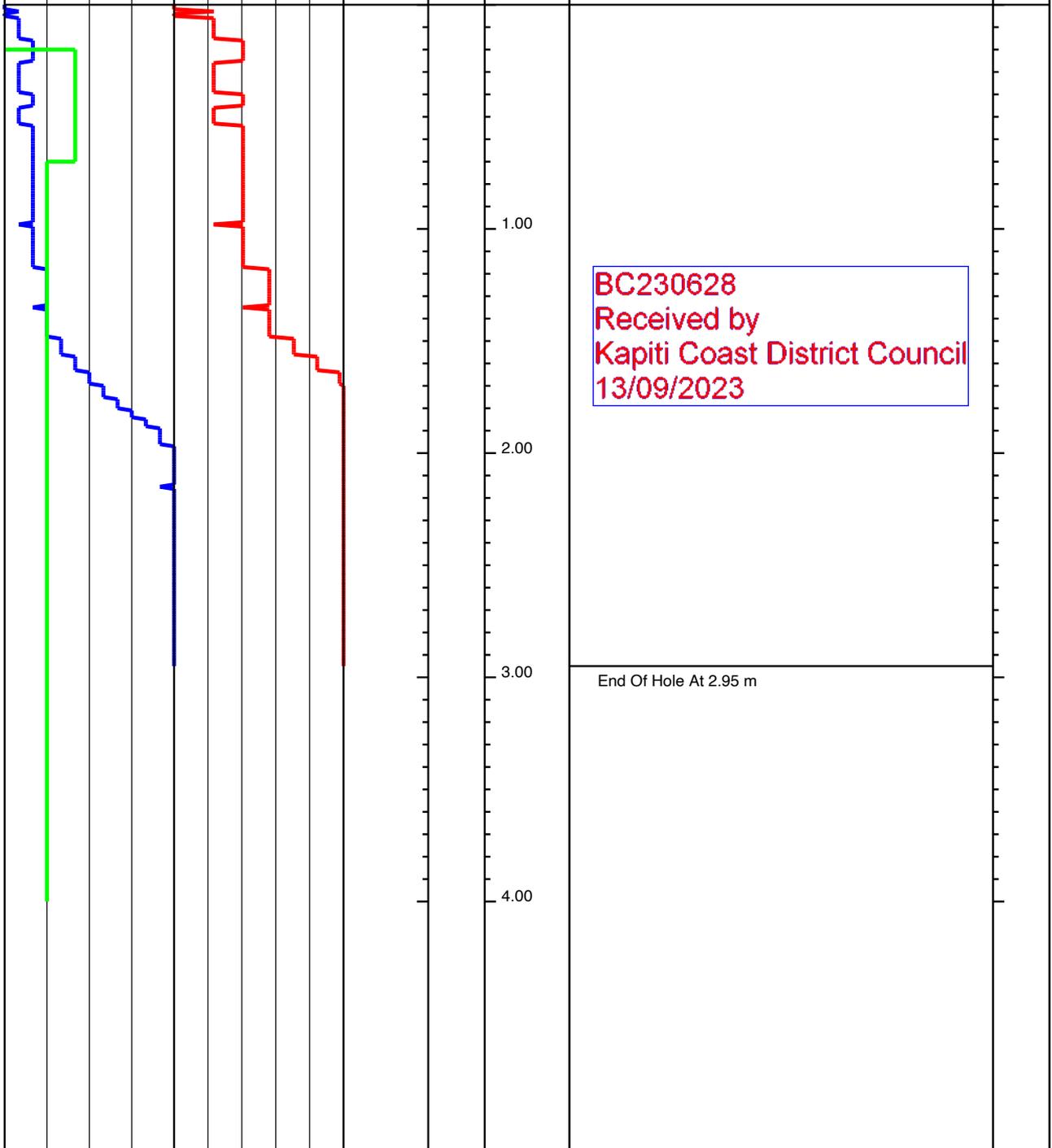
	Project Title: 110 Ngarara Rd, Waikanae		lot37-97
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868708	E Coord: 175.04912
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



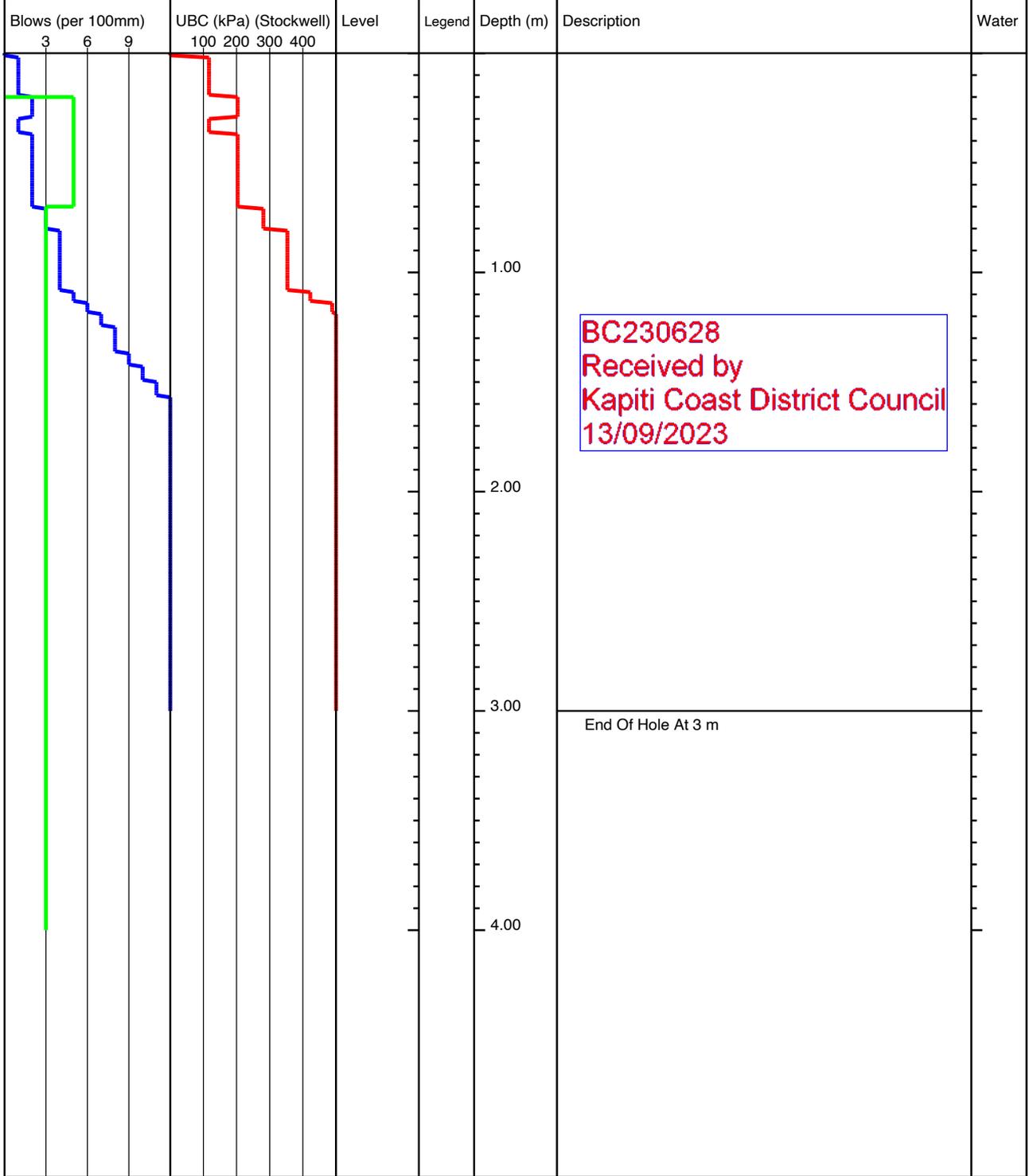
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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		Project Title: 110 Ngarara Rd, Waikanae						
		Project Number: 21852		Client: Anderson Park Trust	lot38-161			
		GL (mAOD):		N Coord: -40.868737	E Coord: 175.046705			
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1			
Blows (per 100mm)		UBC (kPa) (Stockwell)		Level	Legend	Depth (m)	Description	Water
3 6 9		100 200 300 400						
							<div style="border: 1px solid blue; padding: 5px; color: red; font-weight: bold;">           BC230628            Received by            Kapiti Coast District Council            13/09/2023         </div> <p>End Of Hole At 2.97 m</p>	
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level						<b>REMARKS</b> No Groundwater Encountered		



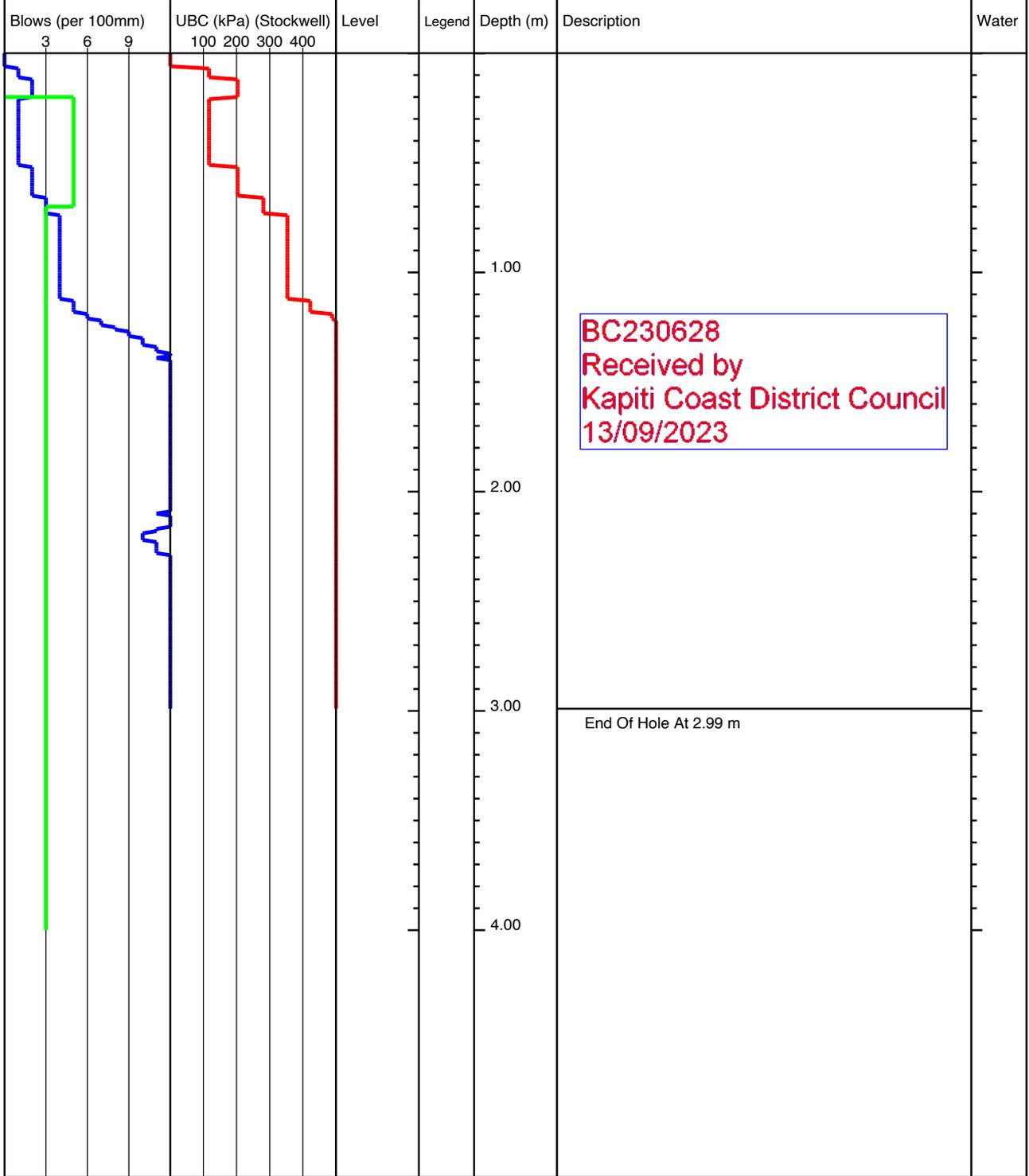
		Project Title: 110 Ngarara Rd, Waikanae				
		Project Number: 21852	Client: Anderson Park Trust		lot38-163	
		GL (mAOD):	N Coord: -40.868665		E Coord: 175.046428	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND		Scale: 1:25 Sheet 1 Of 1
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot38-164
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868613	E Coord: 175.046593
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



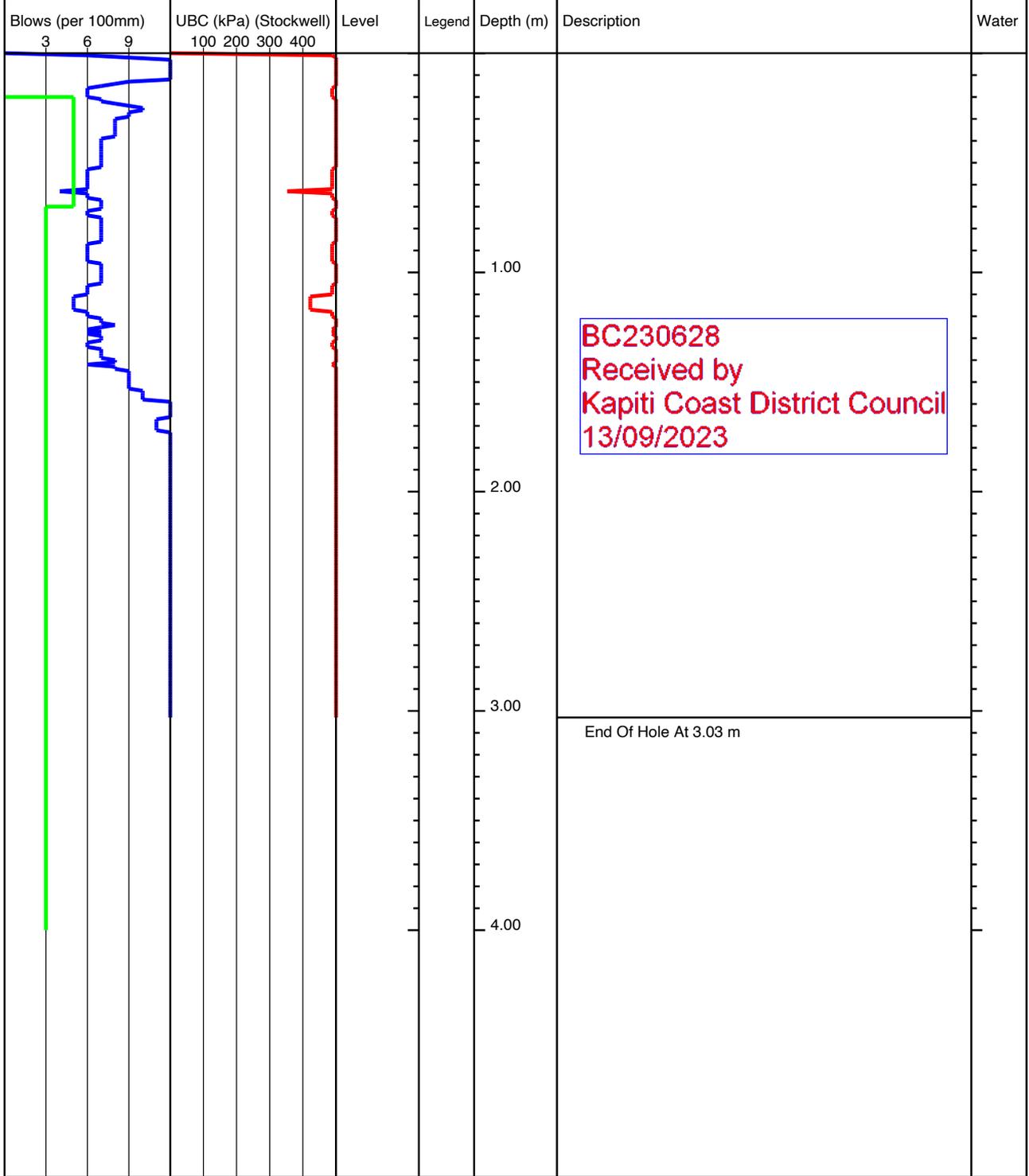
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot38-165
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868682	E Coord: 175.046528
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

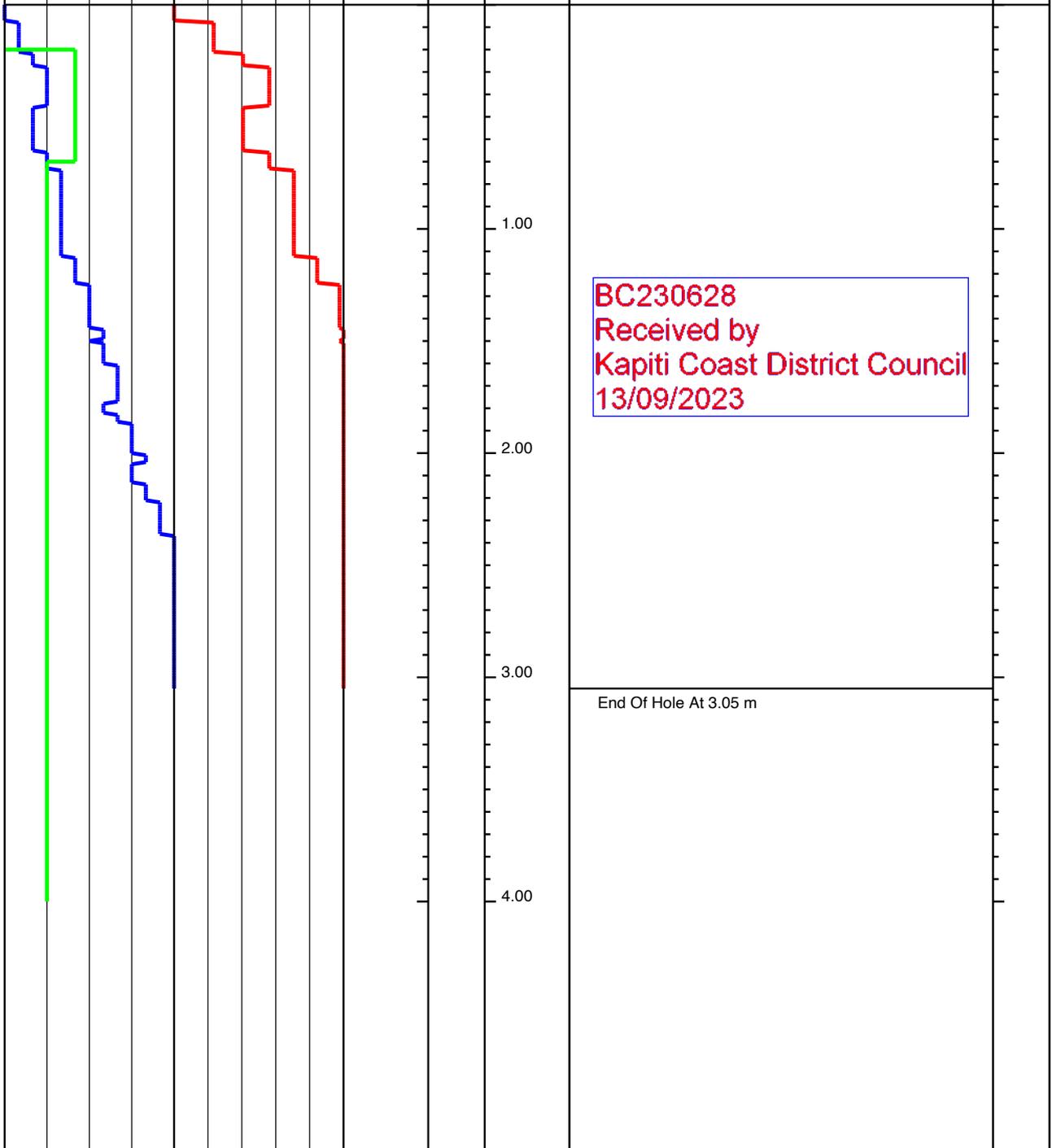


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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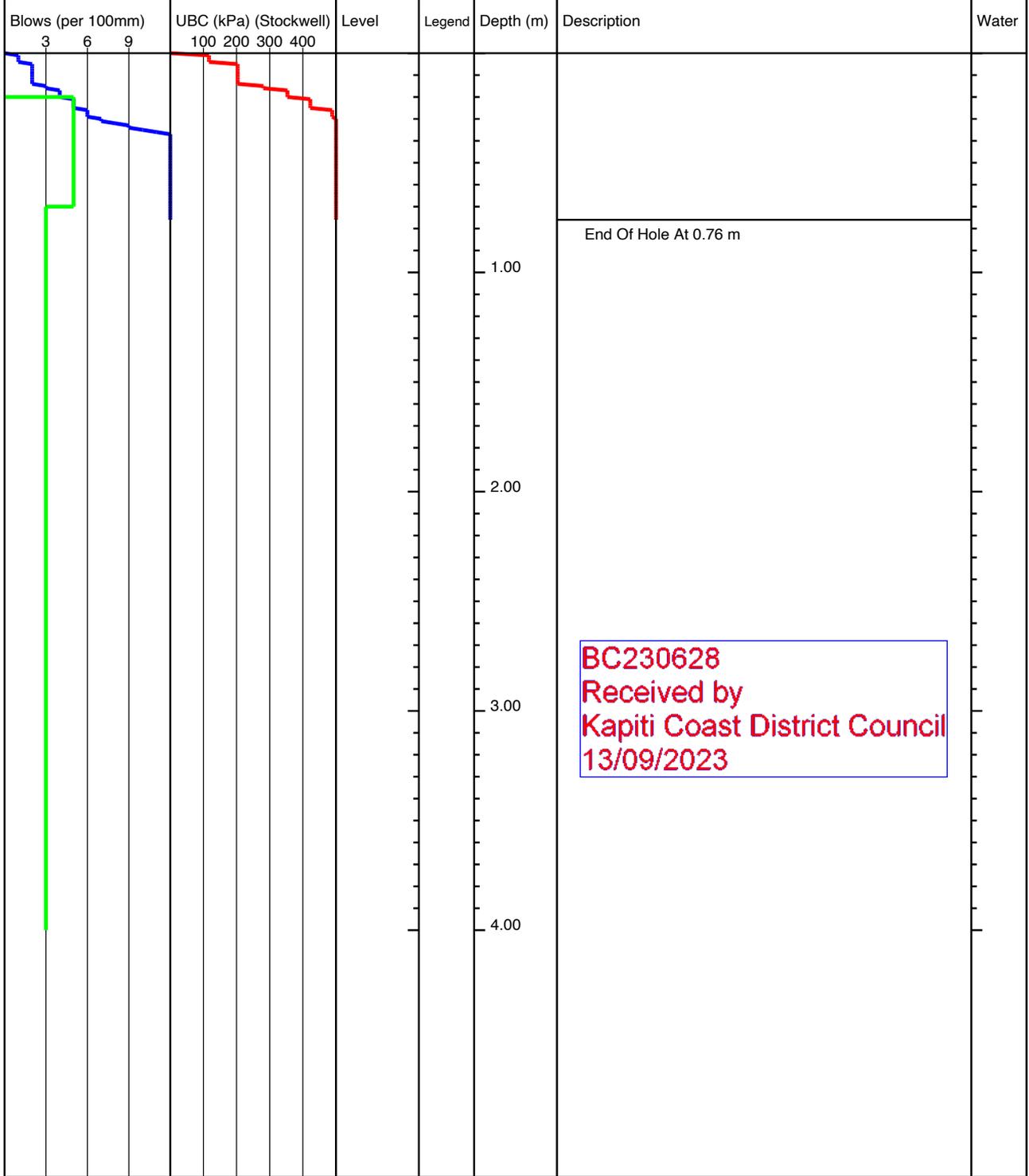
	Project Title: 110 Ngarara Rd, Waikanae		lot39-166
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868102	E Coord: 175.046738
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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		Project Title: 110 Ngarara Rd, Waikanae				
		Project Number: 21852	Client: Anderson Park Trust		lot39-167	
		GL (mAOD):	N Coord: -40.867762		E Coord: 175.046505	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND		Scale: 1:25 Sheet 1 Of 1
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

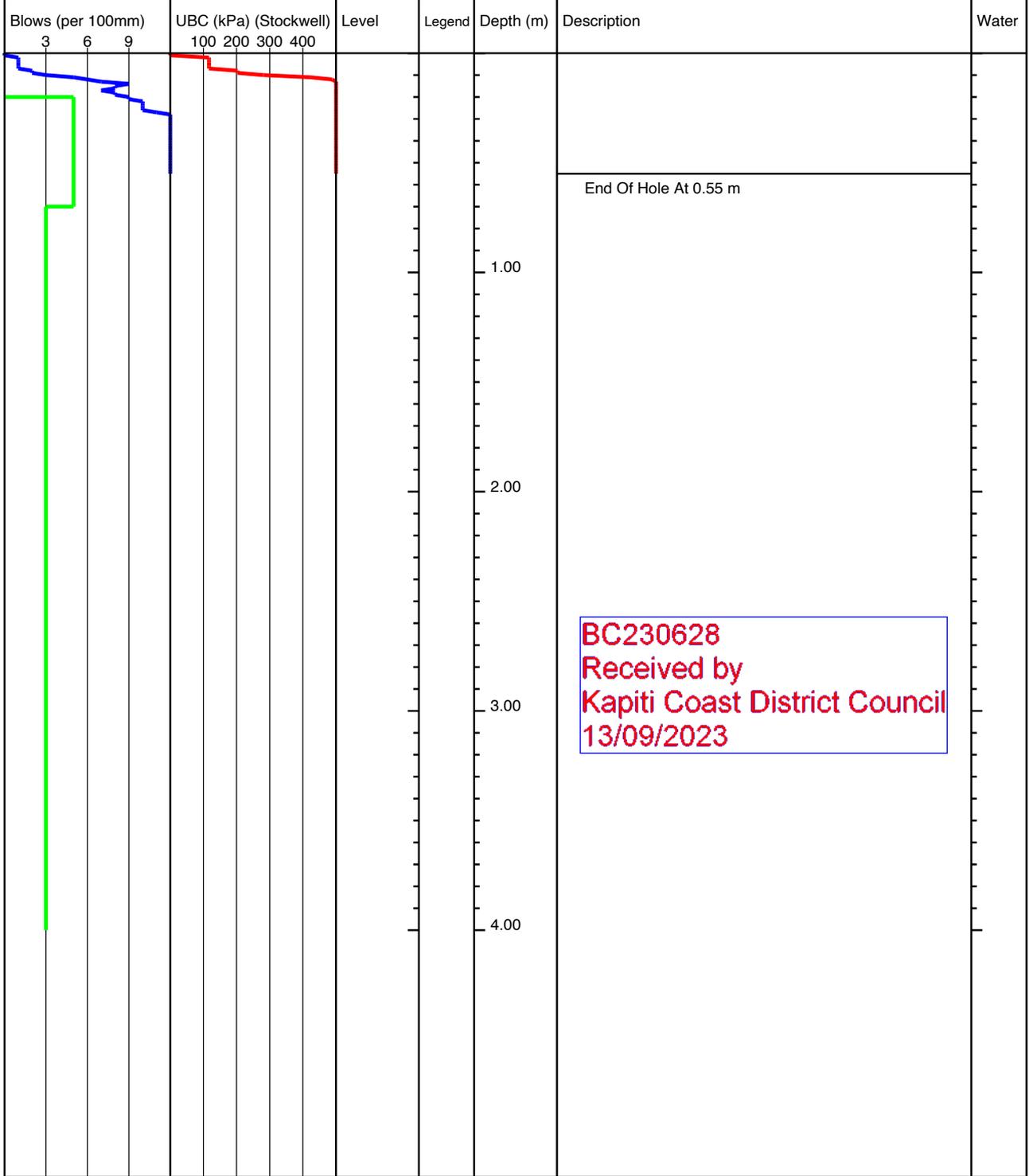
	Project Title: 110 Ngarara Rd, Waikanae		lot39-168
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.867612	E Coord: 175.046375
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



**BC230628**  
**Received by**  
**Kapiti Coast District Council**  
**13/09/2023**

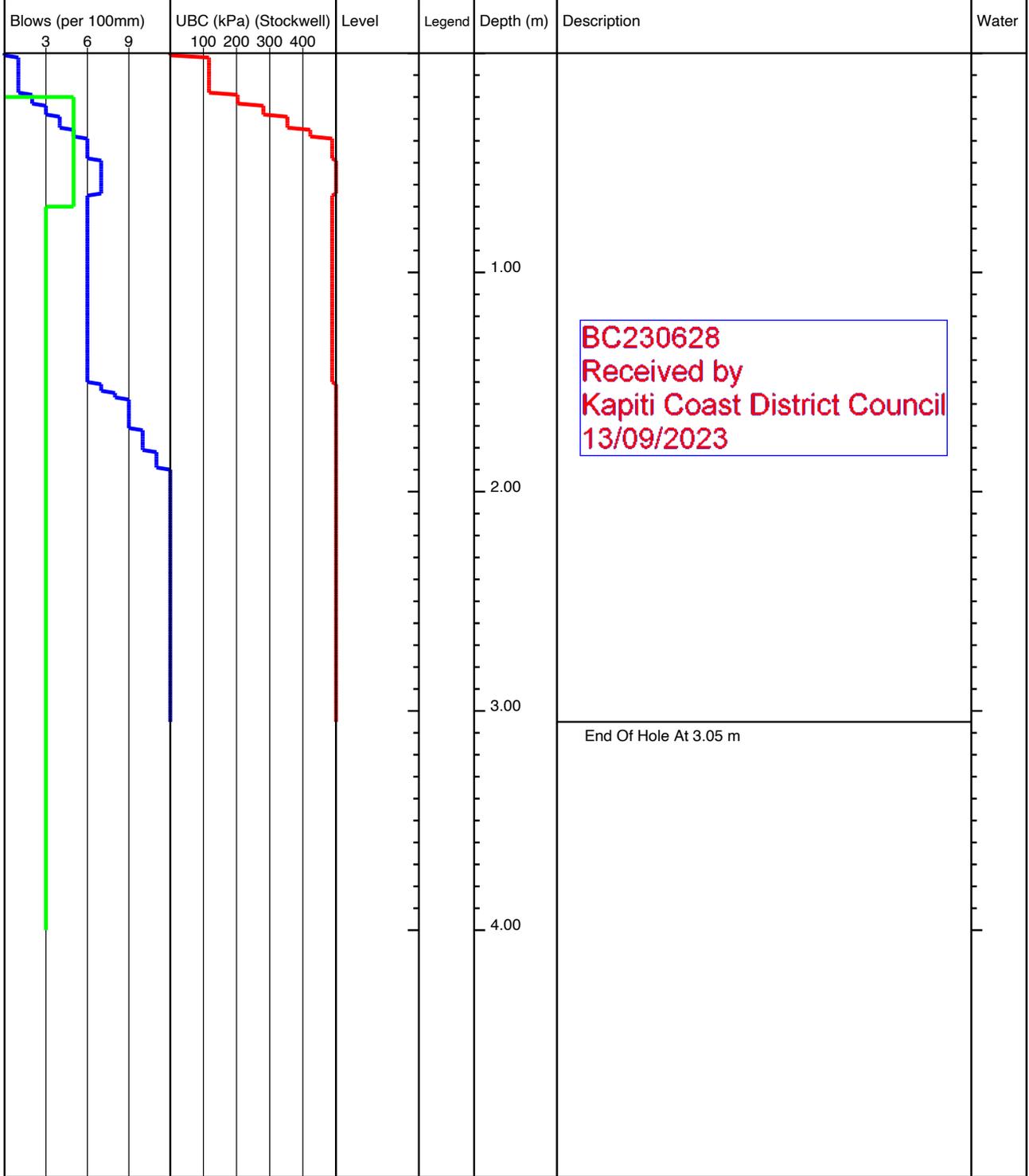
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot39-169
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.867657	E Coord: 175.046325
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



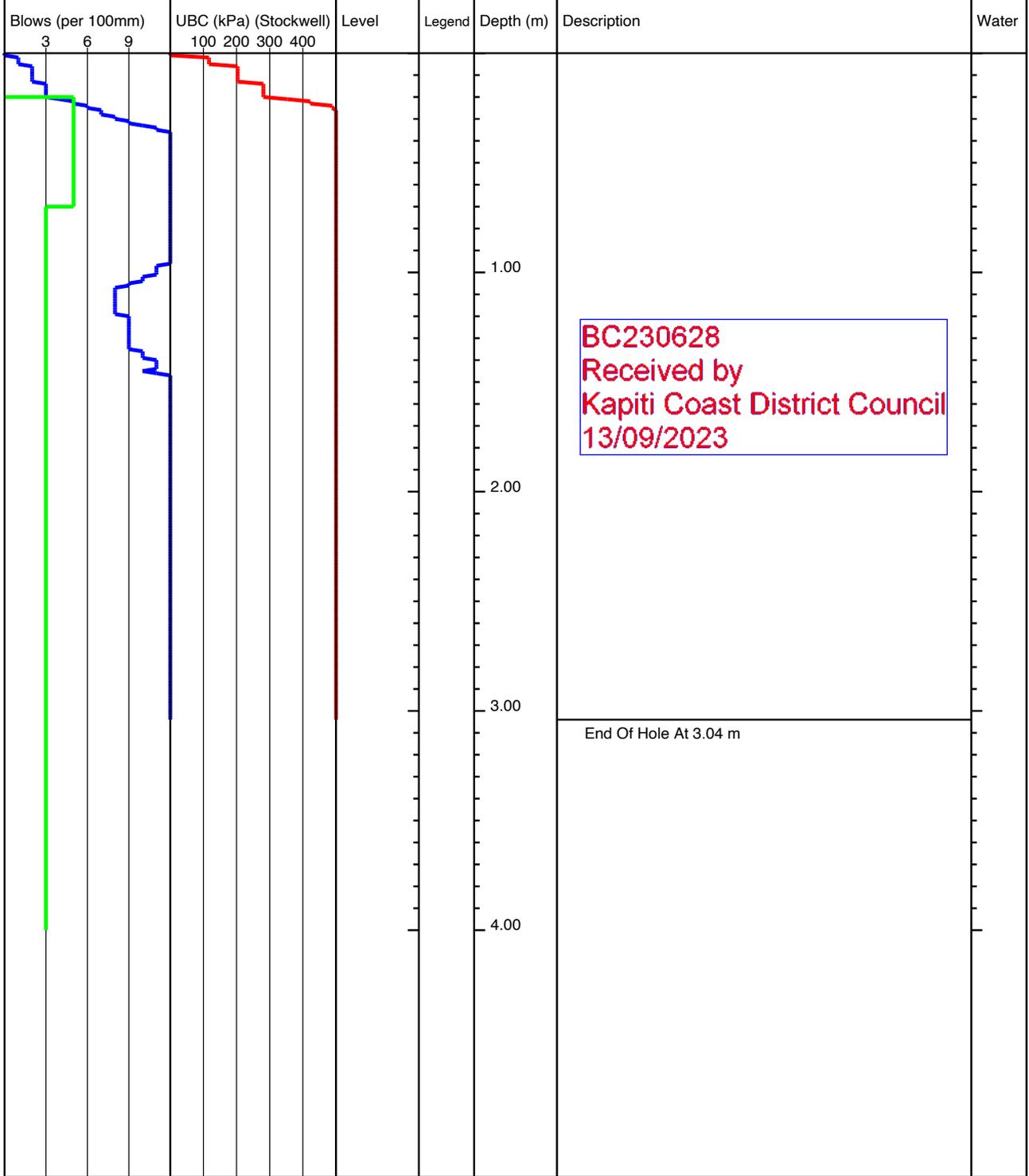
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot39-170
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.867912	E Coord: 175.04656
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



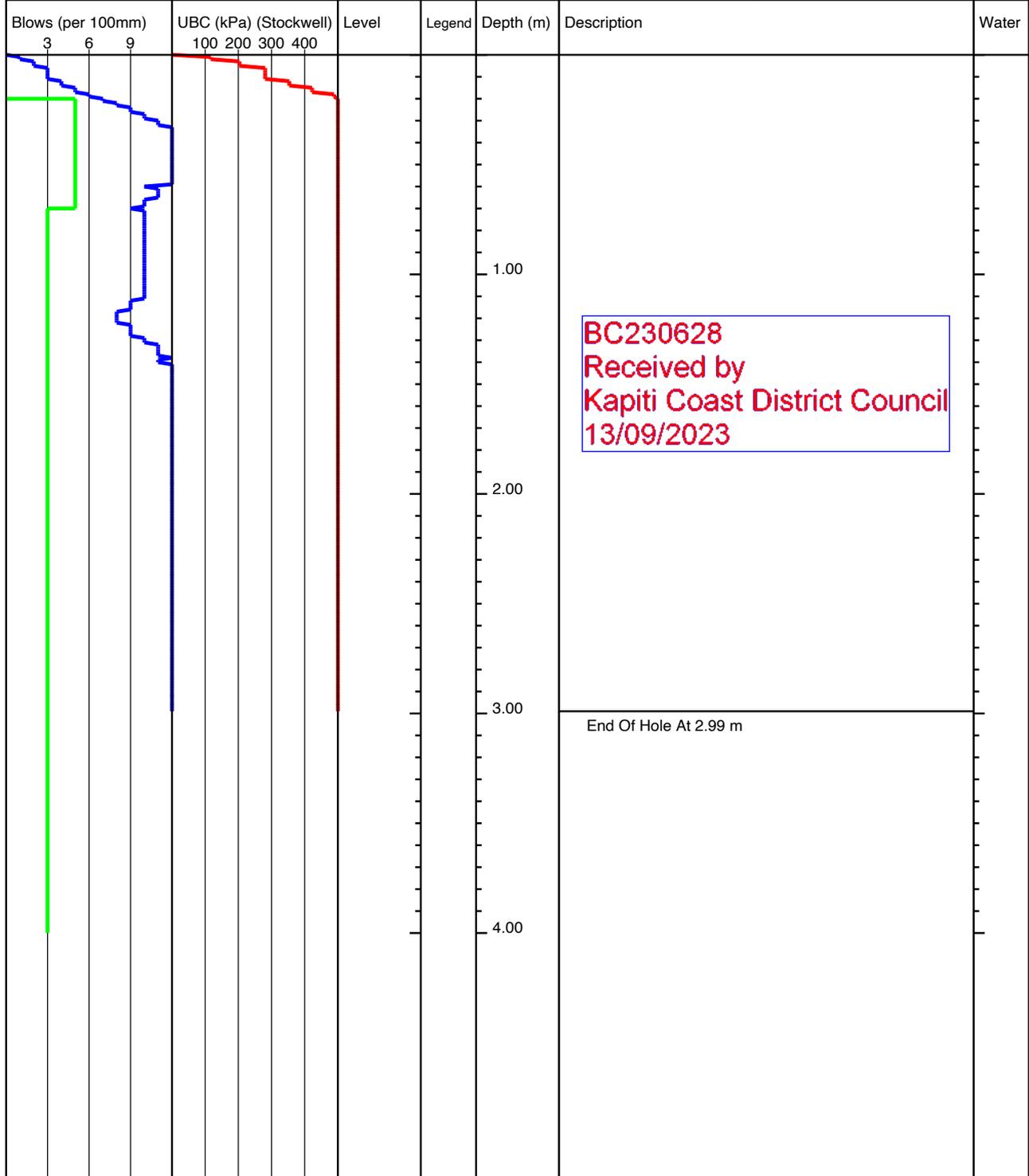
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot40-171
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868095	E Coord: 175.046602
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



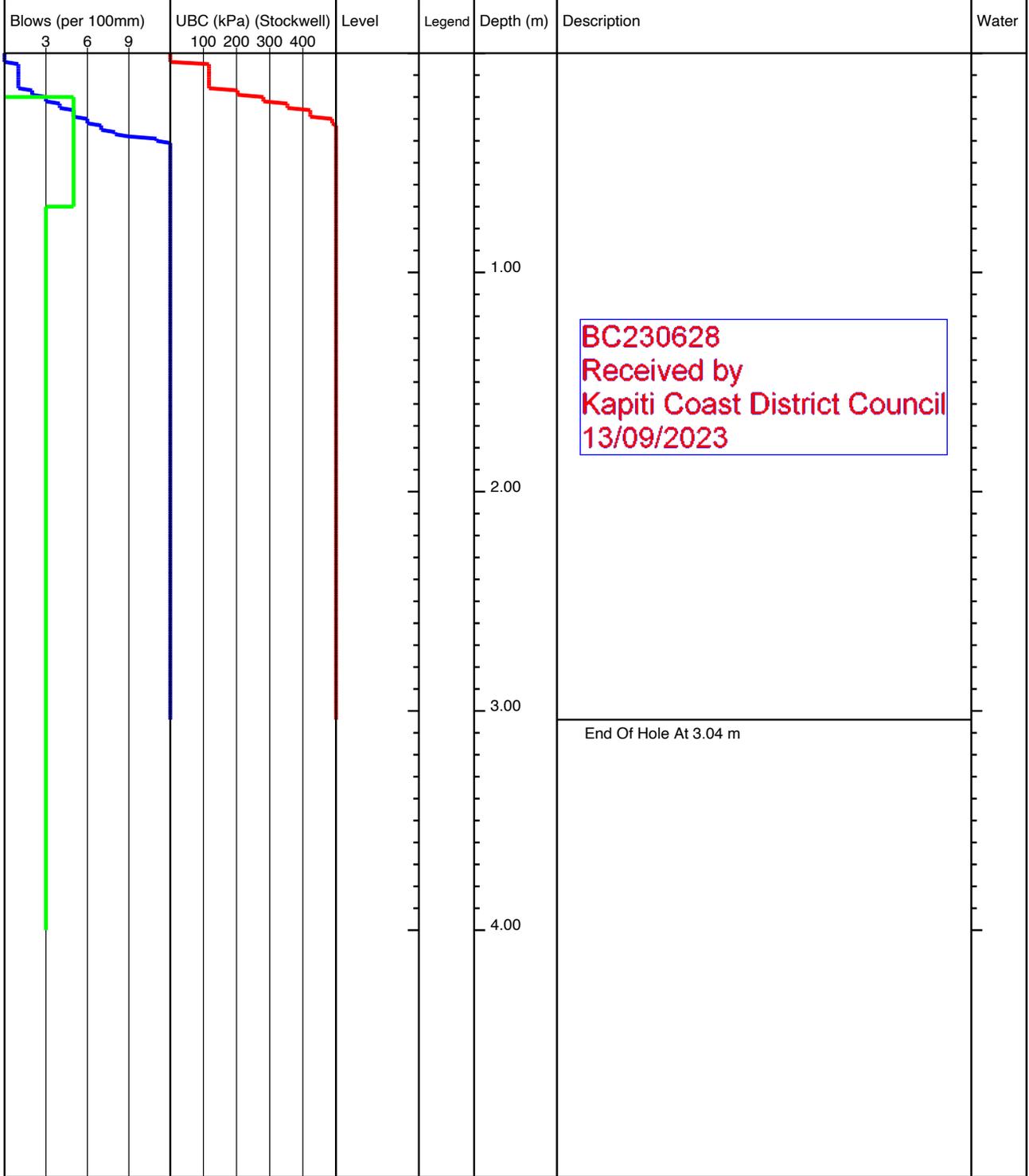
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot40-172
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868133	E Coord: 175.046545
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

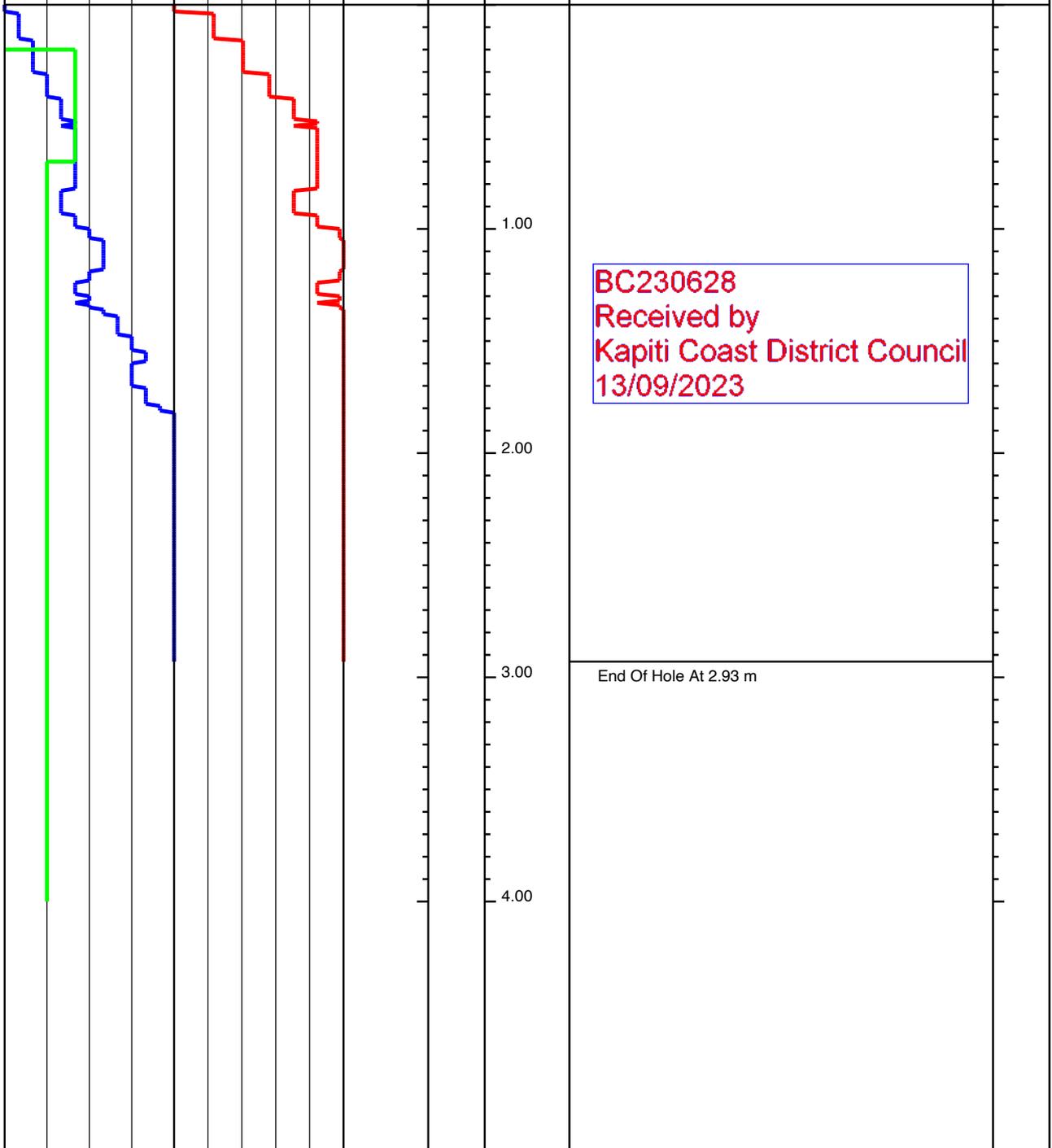


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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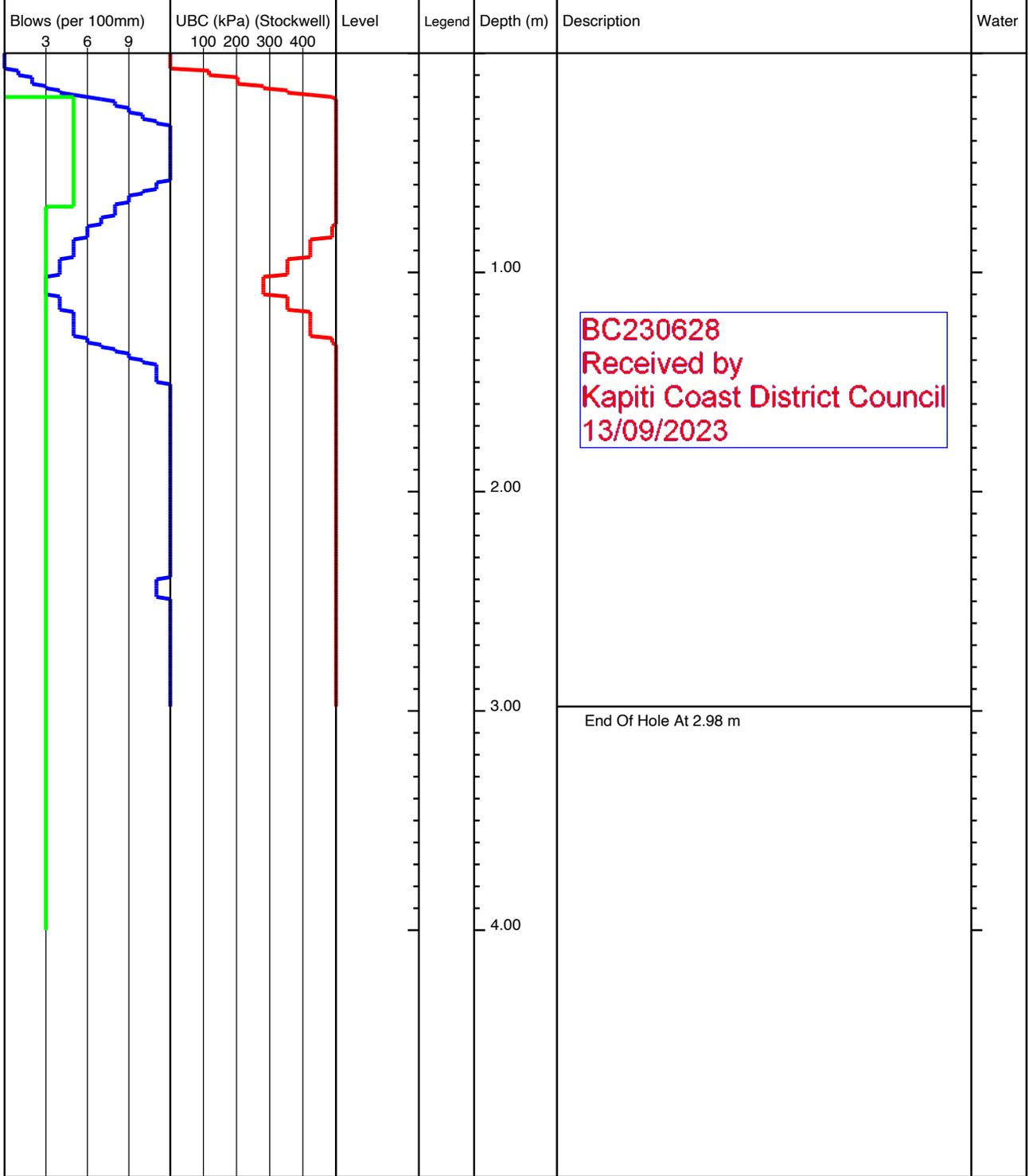
	Project Title: 110 Ngarara Rd, Waikanae		lot40-173
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868032	E Coord: 175.04638
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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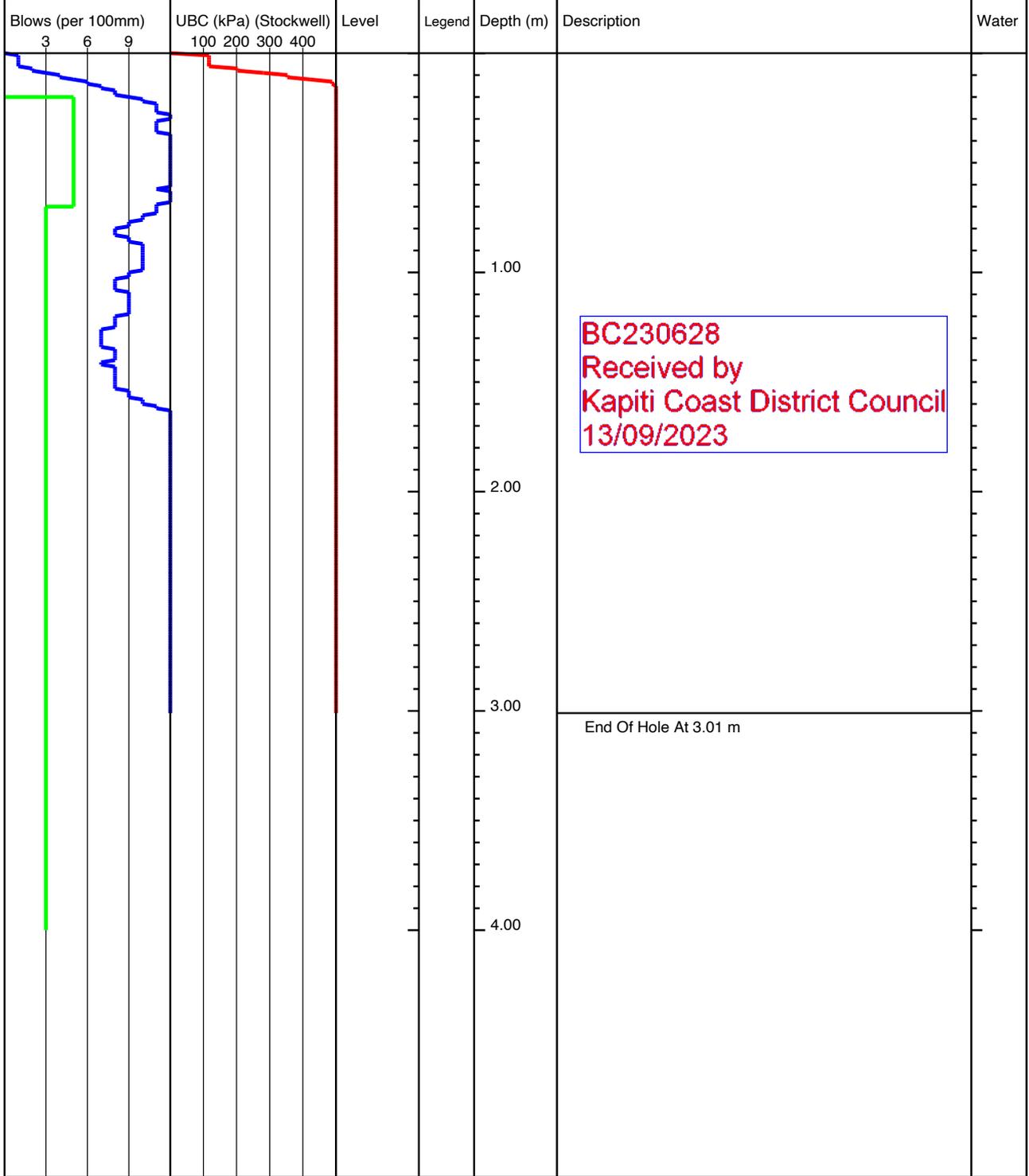
		Project Title: 110 Ngarara Rd, Waikanae				
		Project Number: 21852		Client: Anderson Park Trust	lot40-174	
		GL (mAOD):		N Coord: -40.868083	E Coord: 175.046272	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1	
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot40-175
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868118	E Coord: 175.046465
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



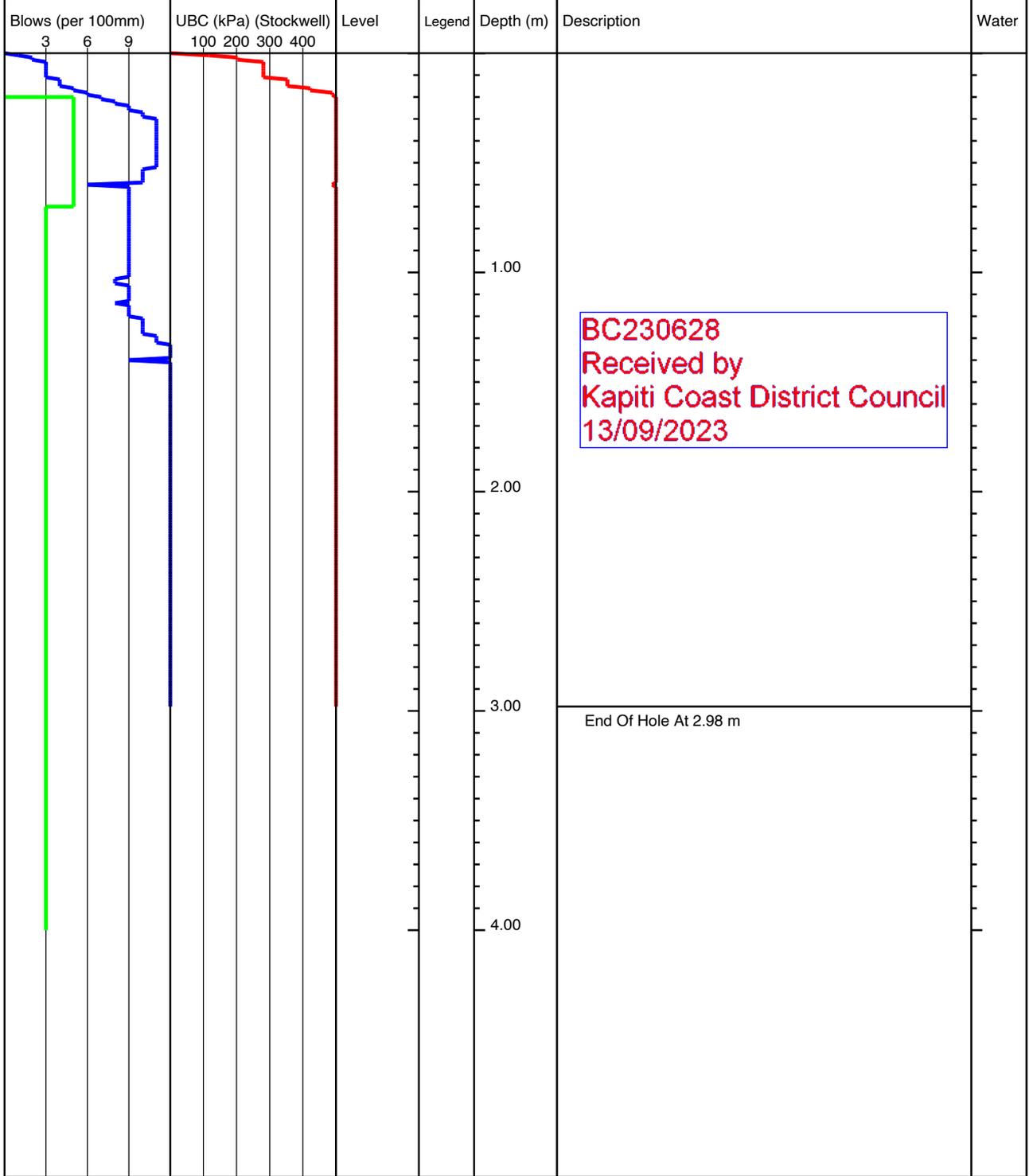
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot41-176
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868217	E Coord: 175.04649
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

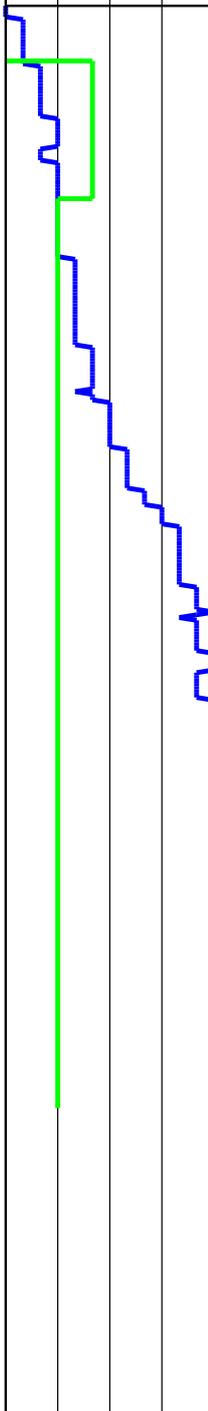
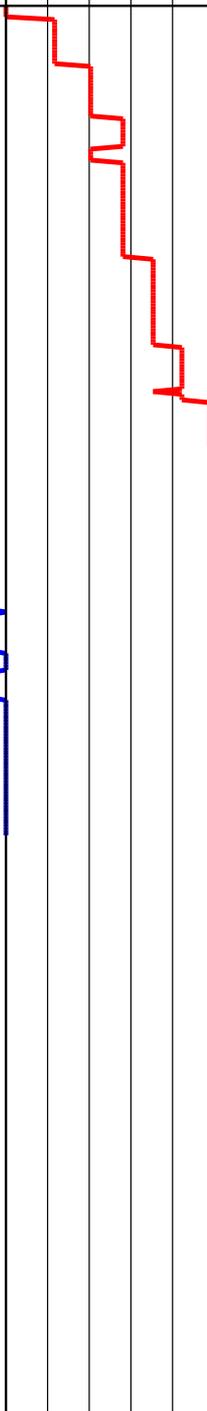


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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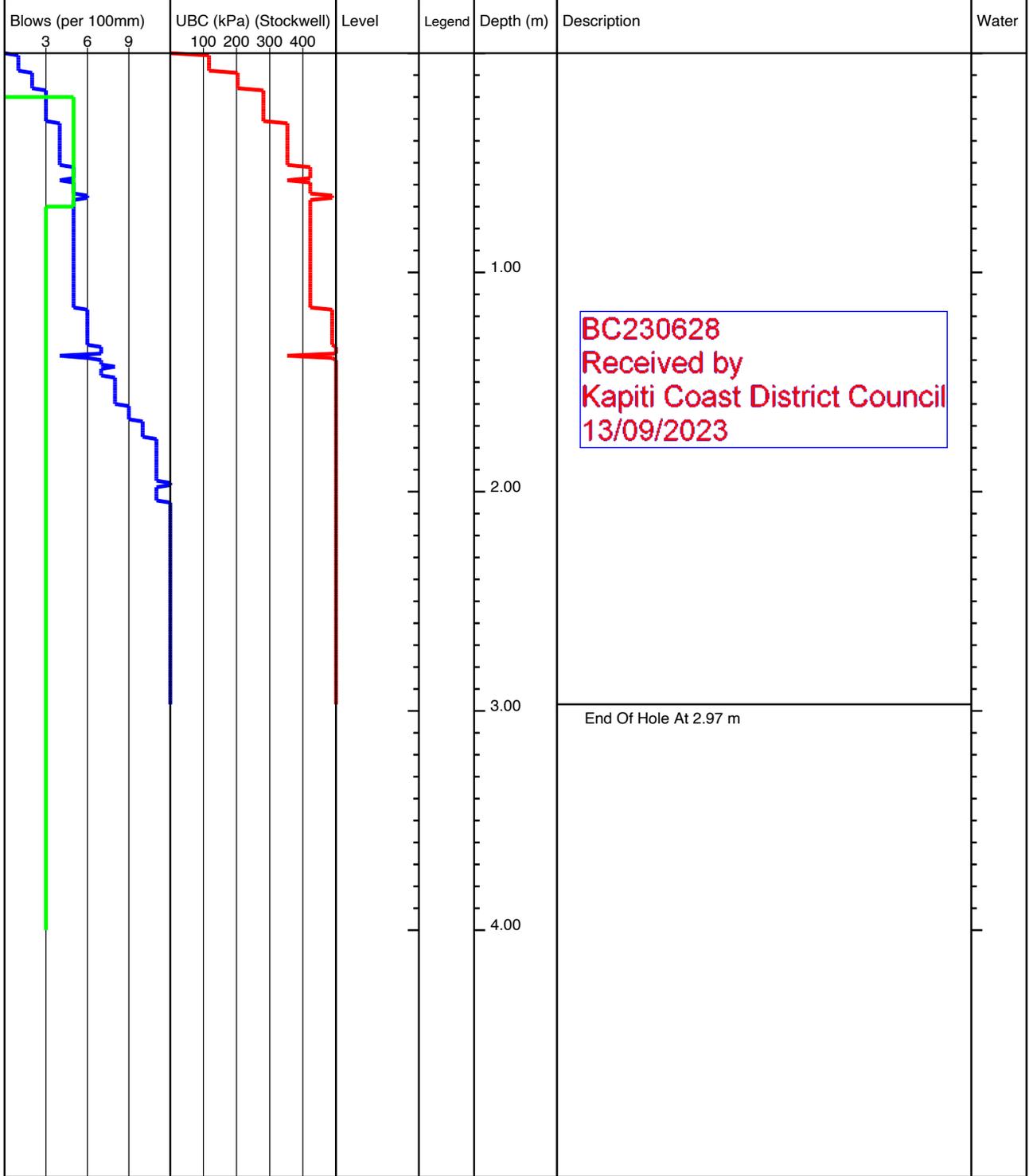
	Project Title: 110 Ngarara Rd, Waikanae		lot41-177
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868255	E Coord: 175.046382
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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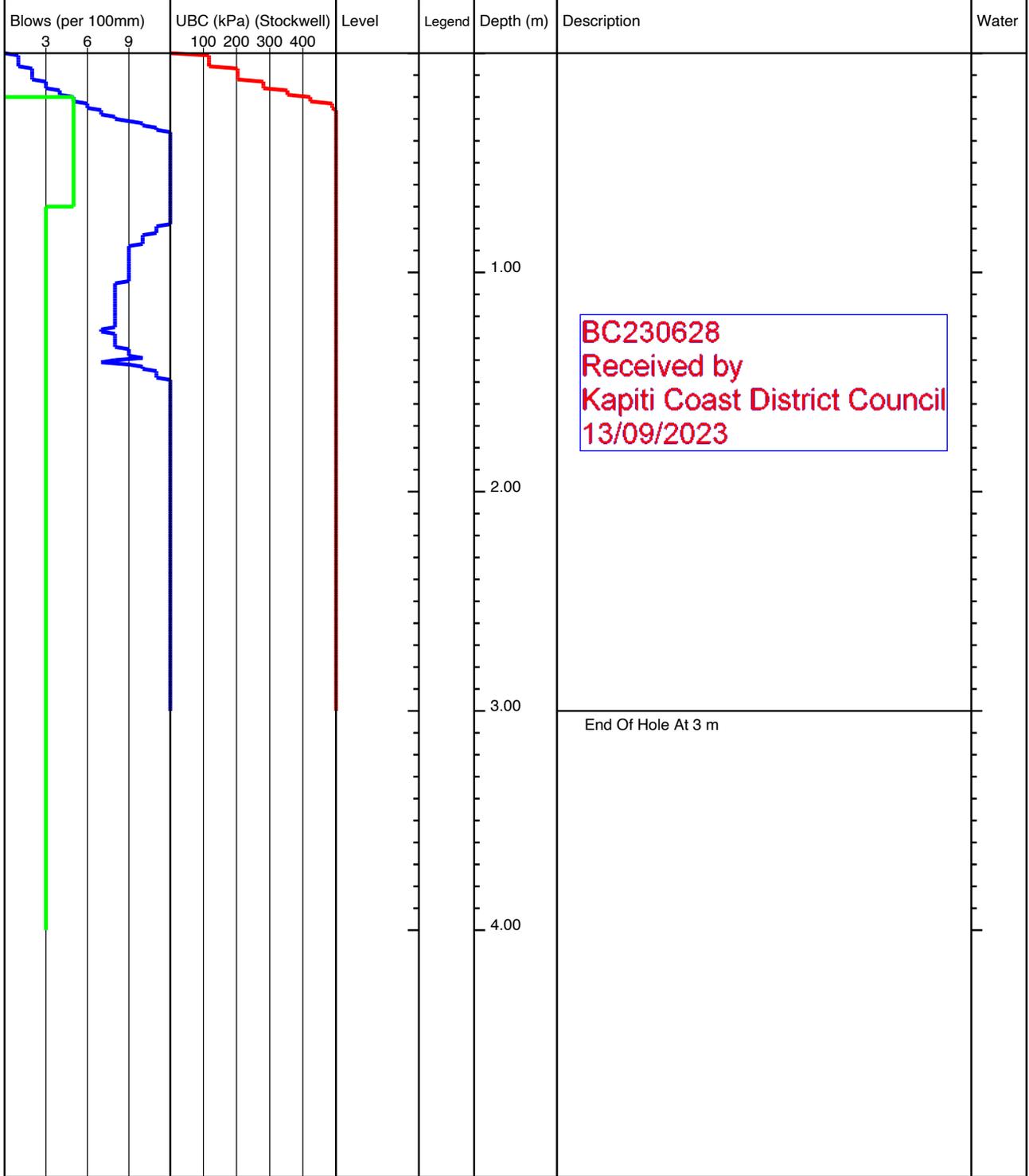
		Project Title: 110 Ngarara Rd, Waikanae						
		Project Number: 21852		Client: Anderson Park Trust	lot41-195			
		GL (mAOD):		N Coord: -40.86821	E Coord: 175.046058			
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1			
Blows (per 100mm)		UBC (kPa) (Stockwell)		Level	Legend	Depth (m)	Description	Water
3 6 9		100 200 300 400						
							<div style="border: 1px solid red; padding: 5px; color: red; text-align: center;"> <p>BC230628 Received by Kapiti Coast District Council 13/09/2023</p> </div>	
							End Of Hole At 3.01 m	
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level							<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot41-196
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868177	E Coord: 175.046137
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



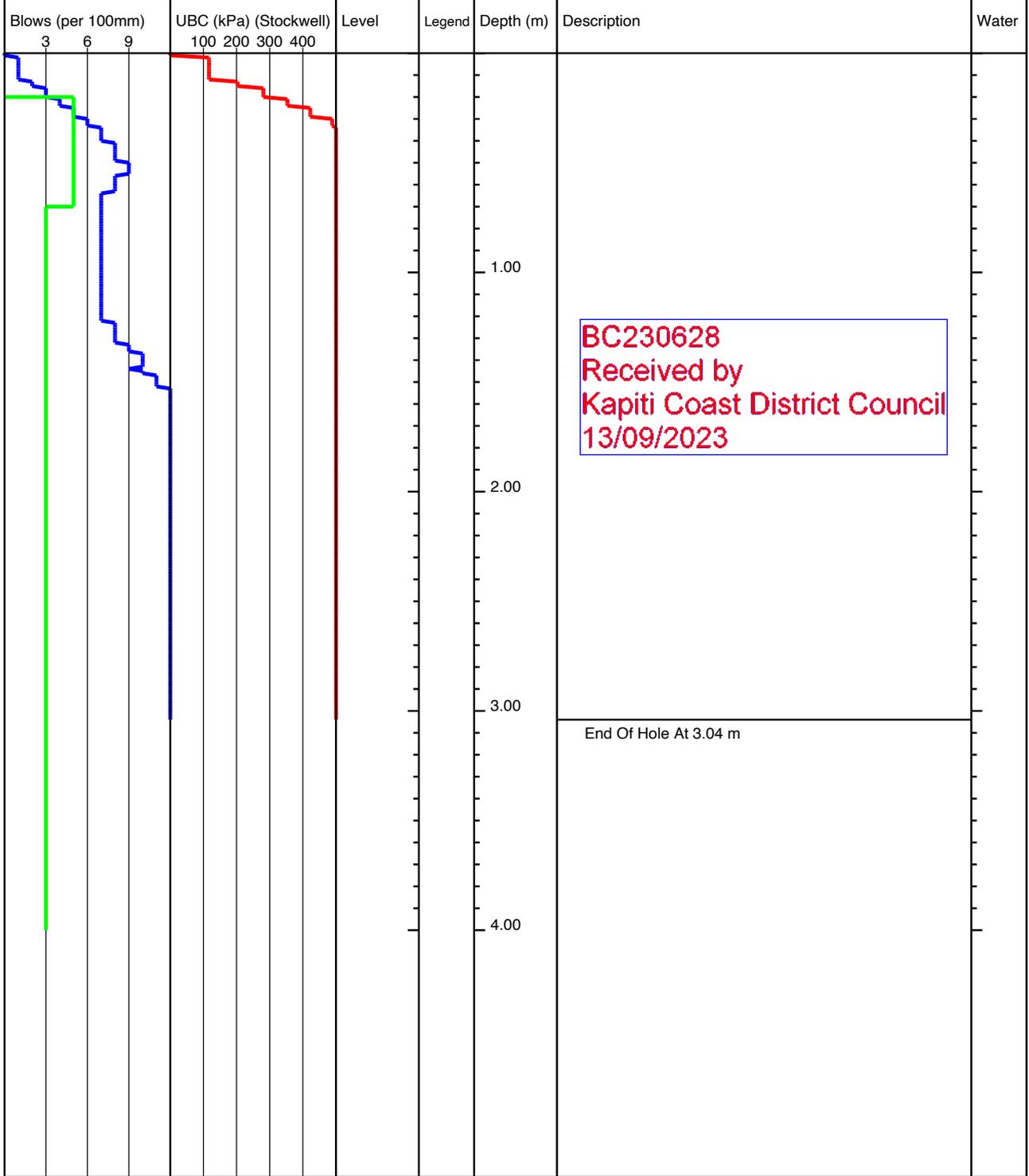
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot42-178
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868288	E Coord: 175.04624
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



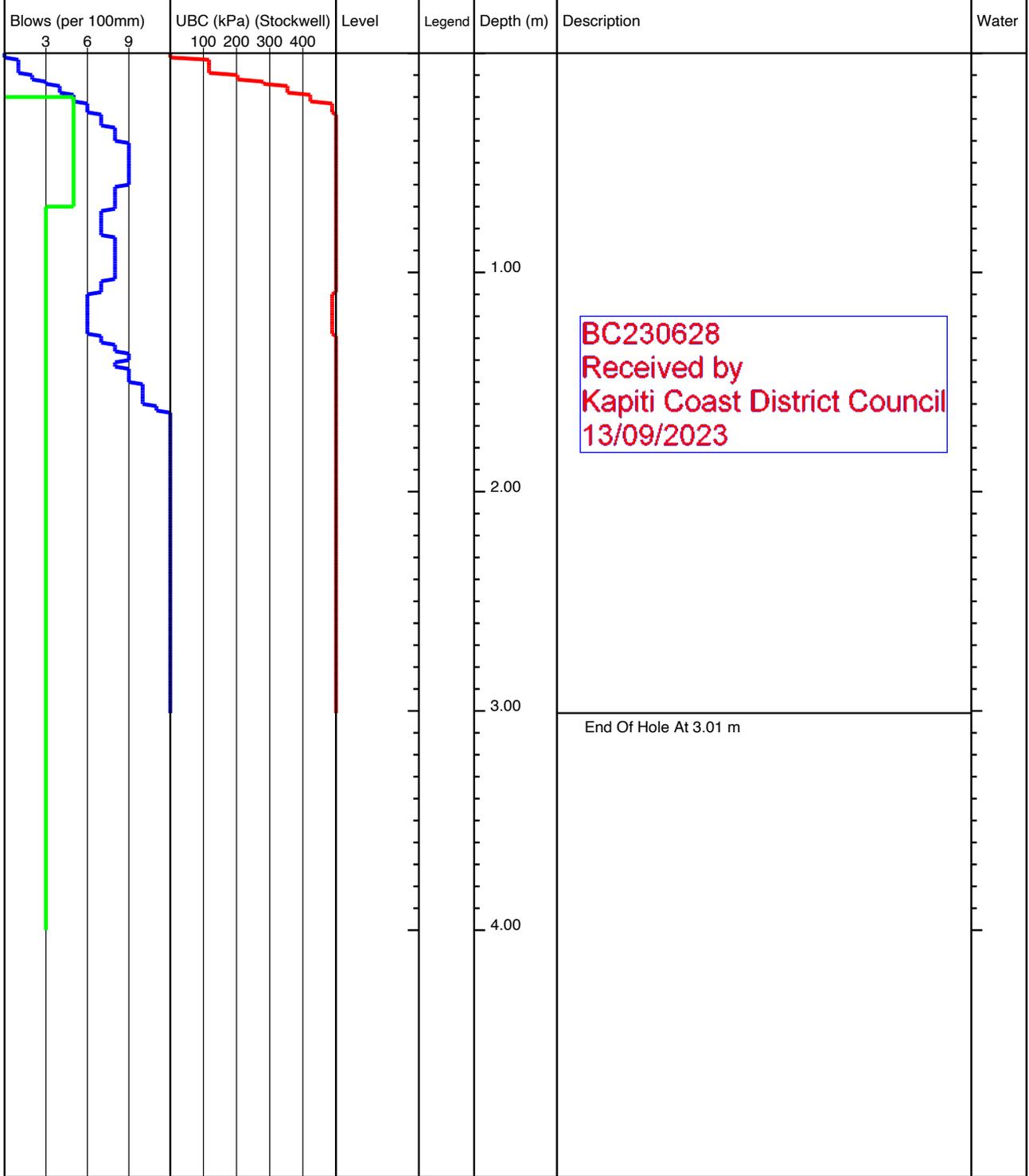
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot42-179
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868337	E Coord: 175.04609
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



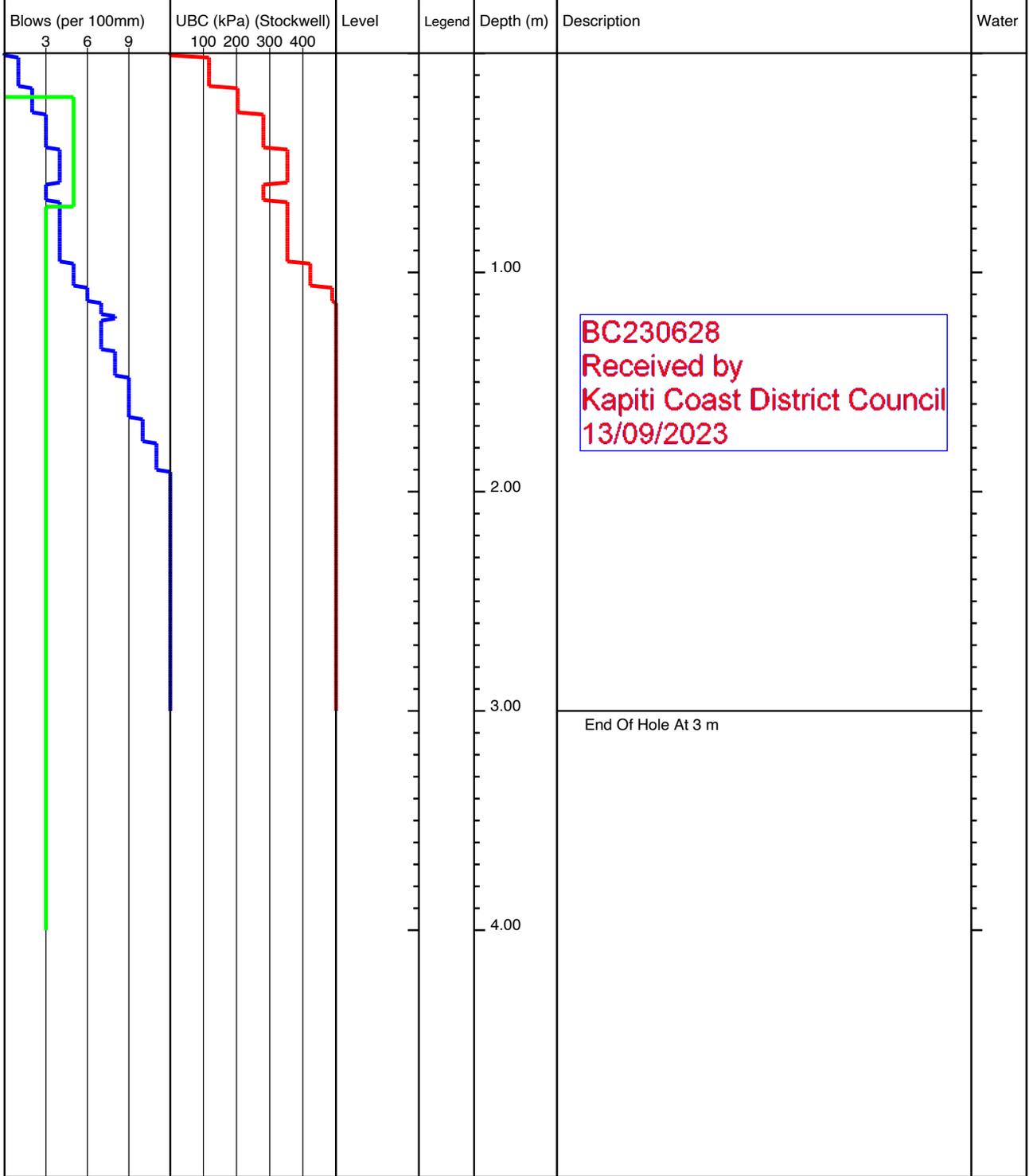
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot42-193
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86834	E Coord: 175.045963
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



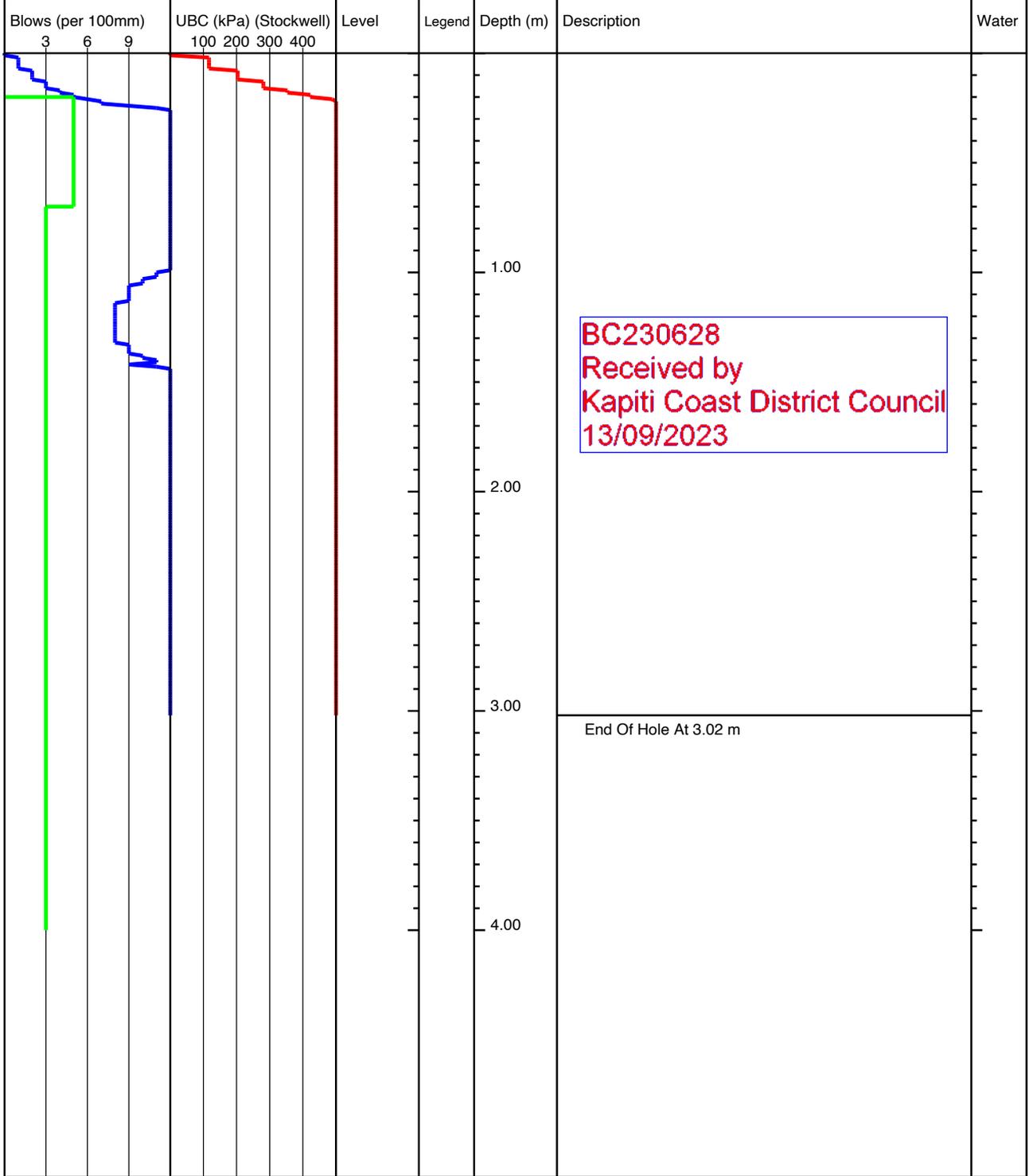
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot42-194
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86827	E Coord: 175.045995
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



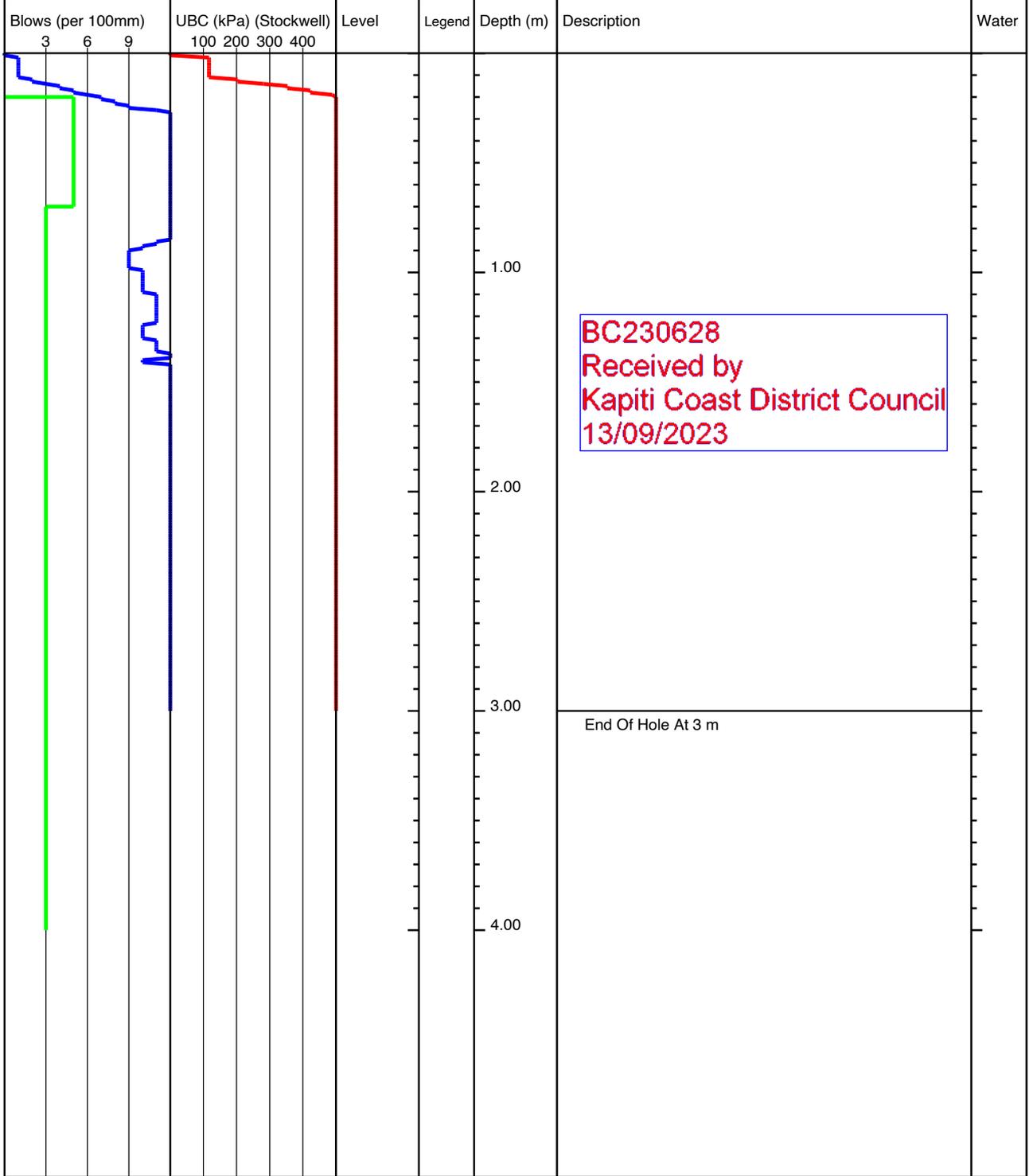
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot43-180
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86844	E Coord: 175.046047
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



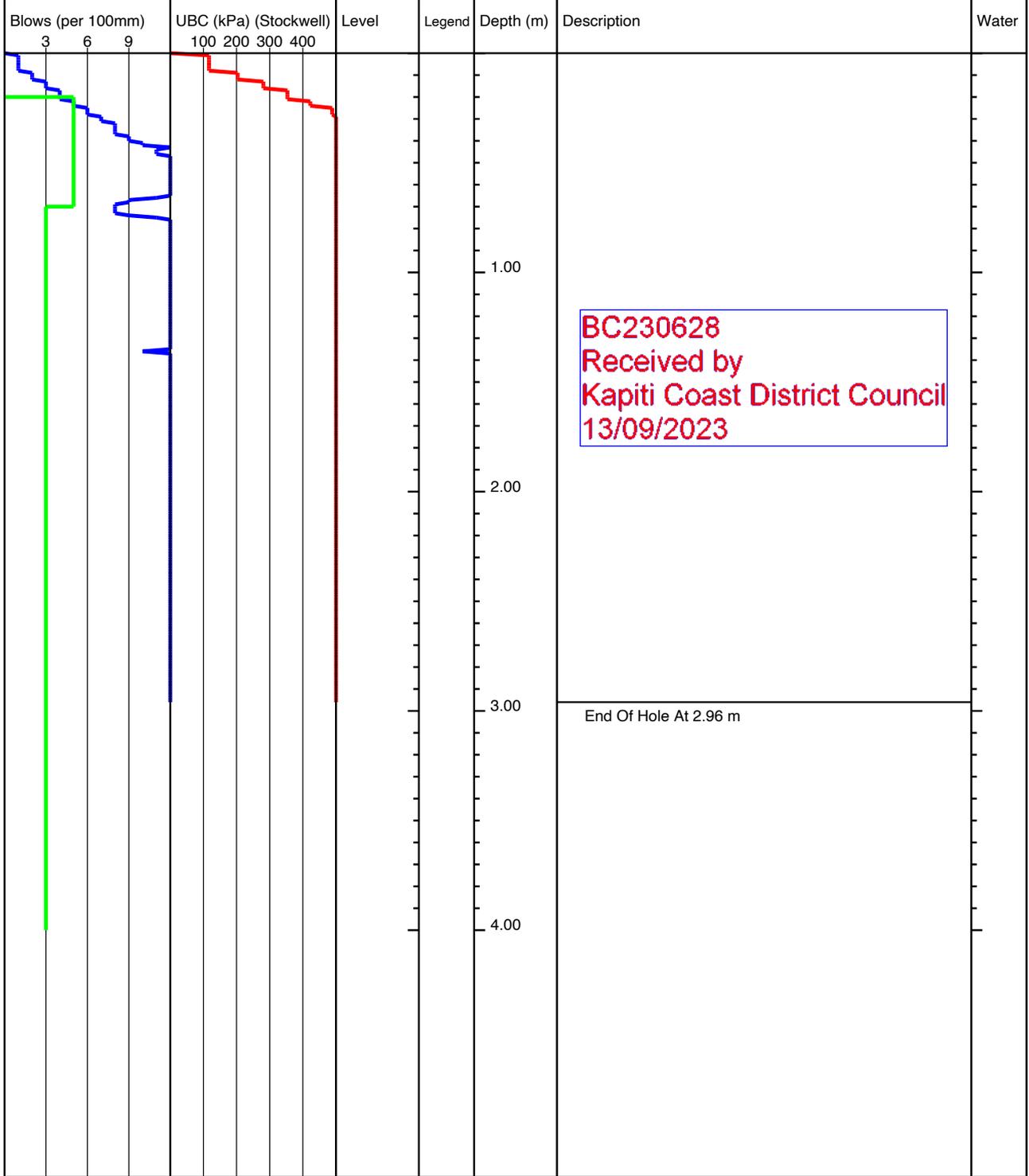
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot43-181
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868522	E Coord: 175.046048
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



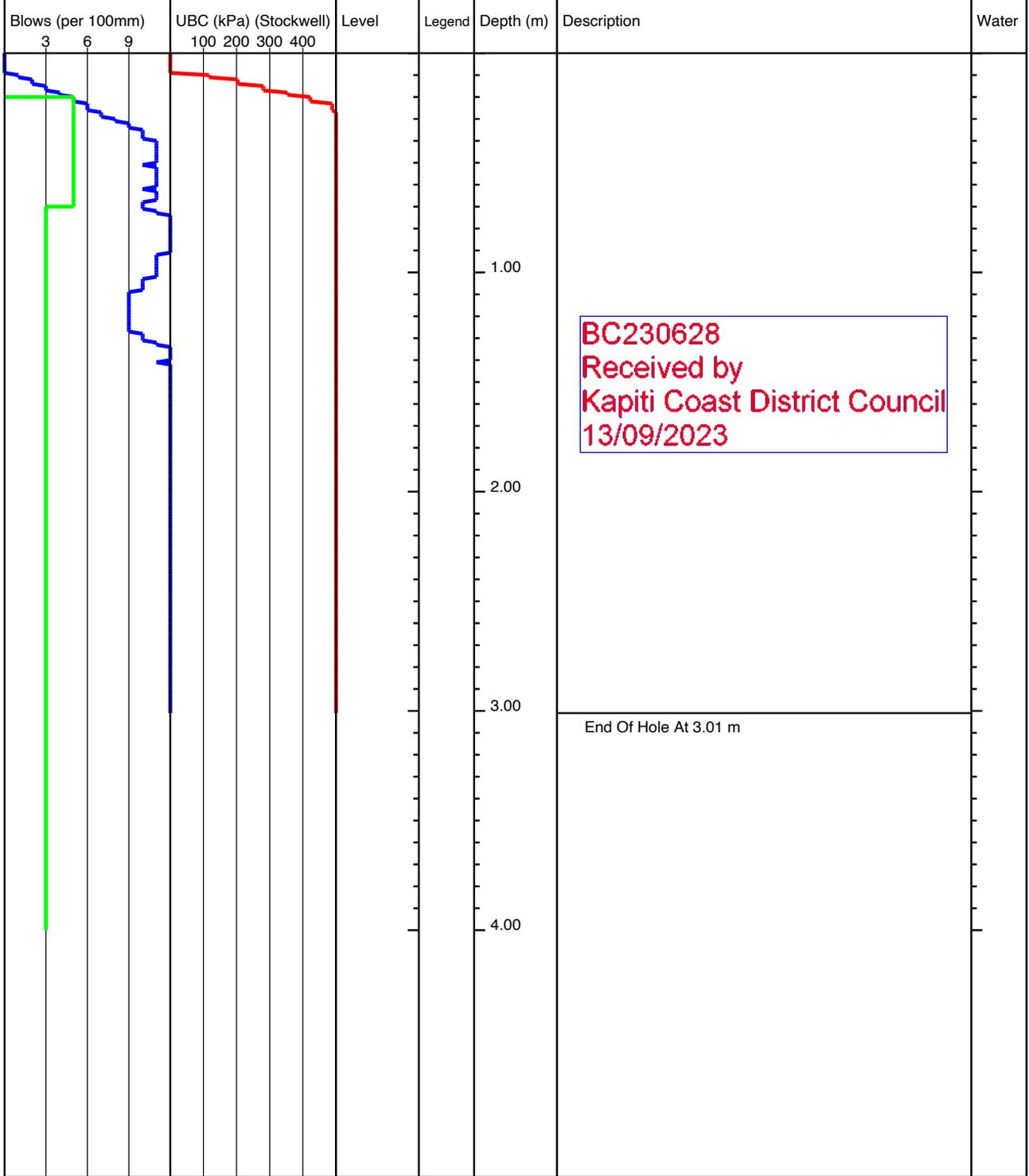
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot43-191
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868533	E Coord: 175.045942
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



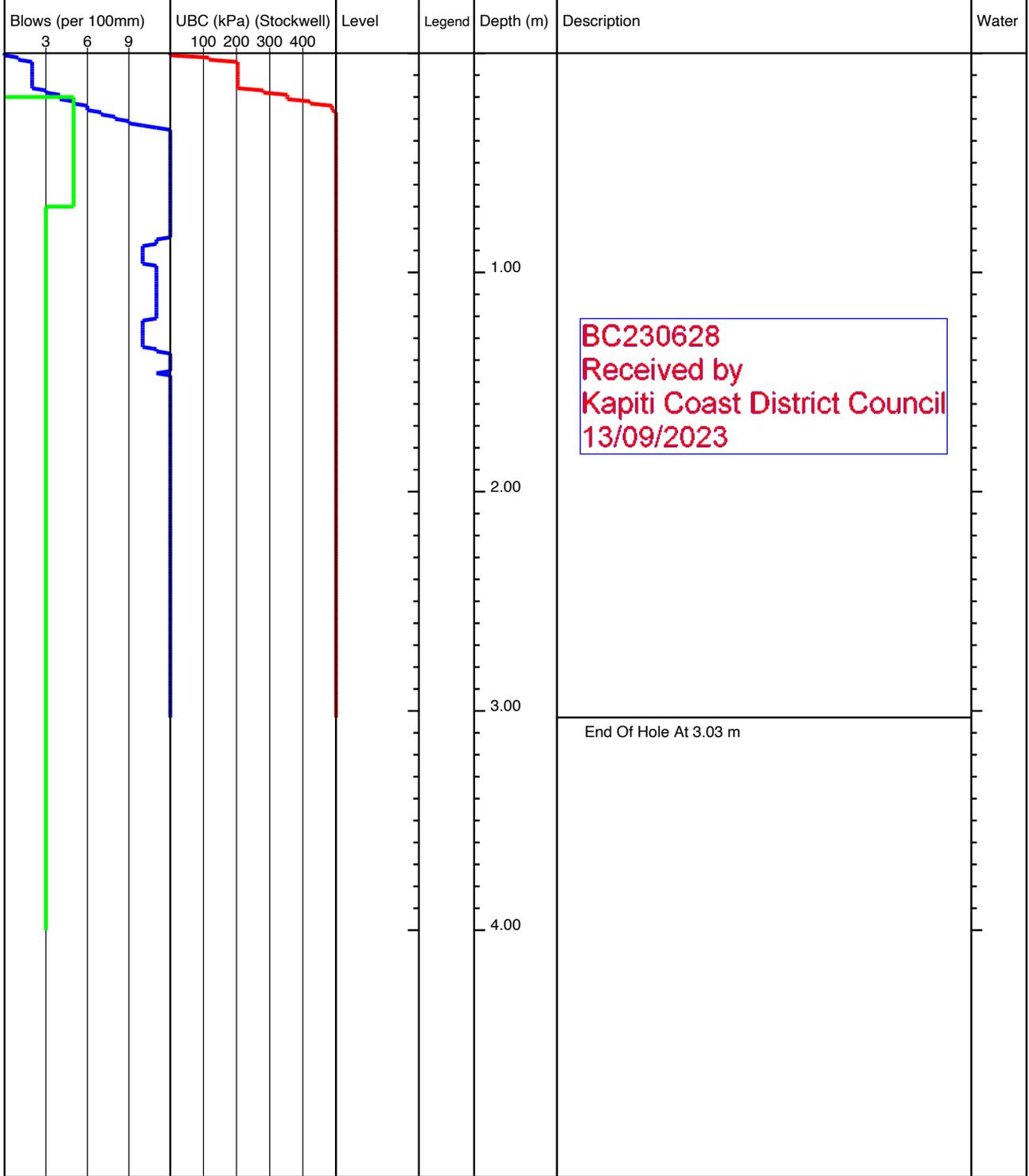
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot43-192
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.86844	E Coord: 175.045948
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



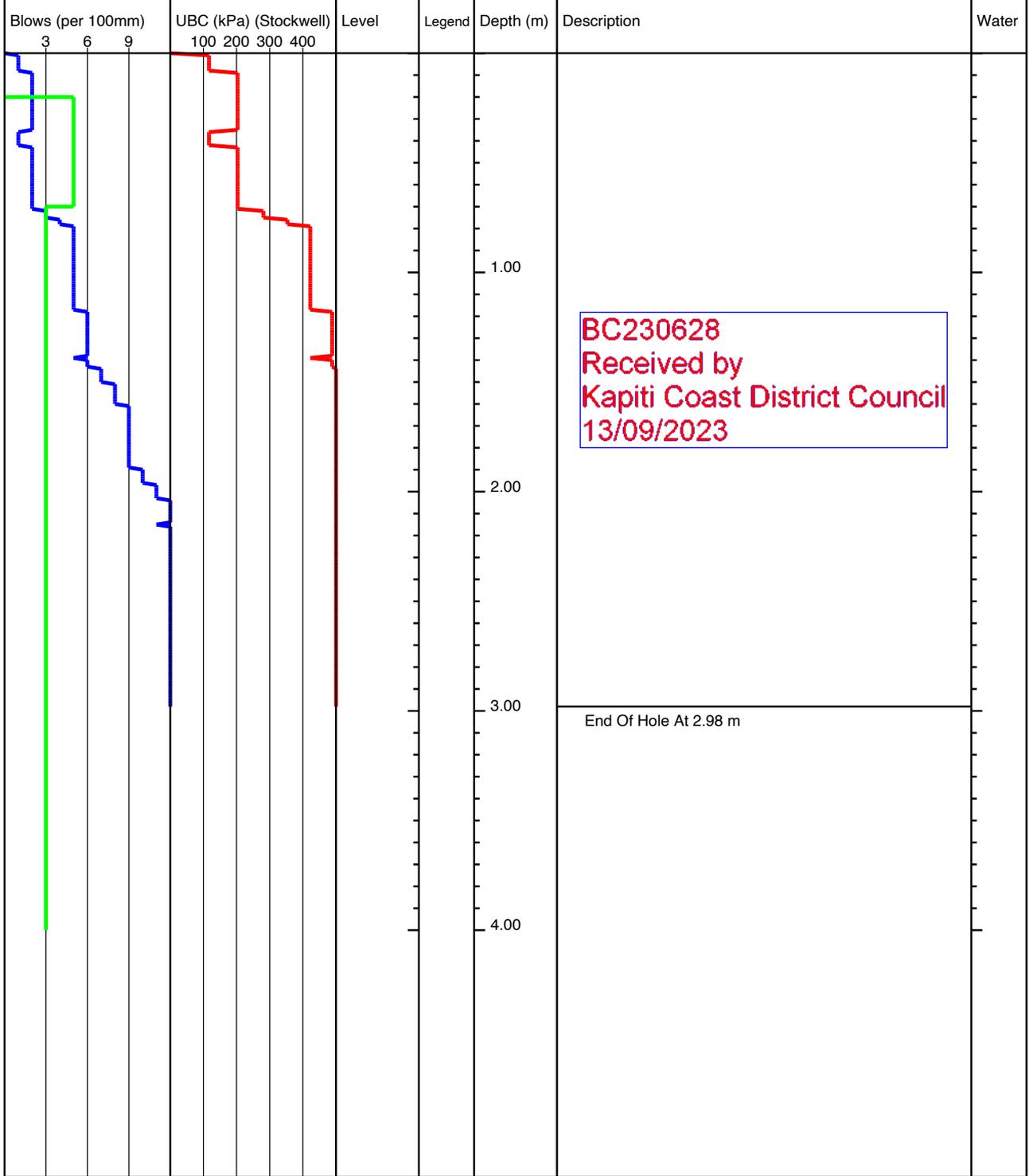
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot44-182
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868678	E Coord: 175.045932
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1

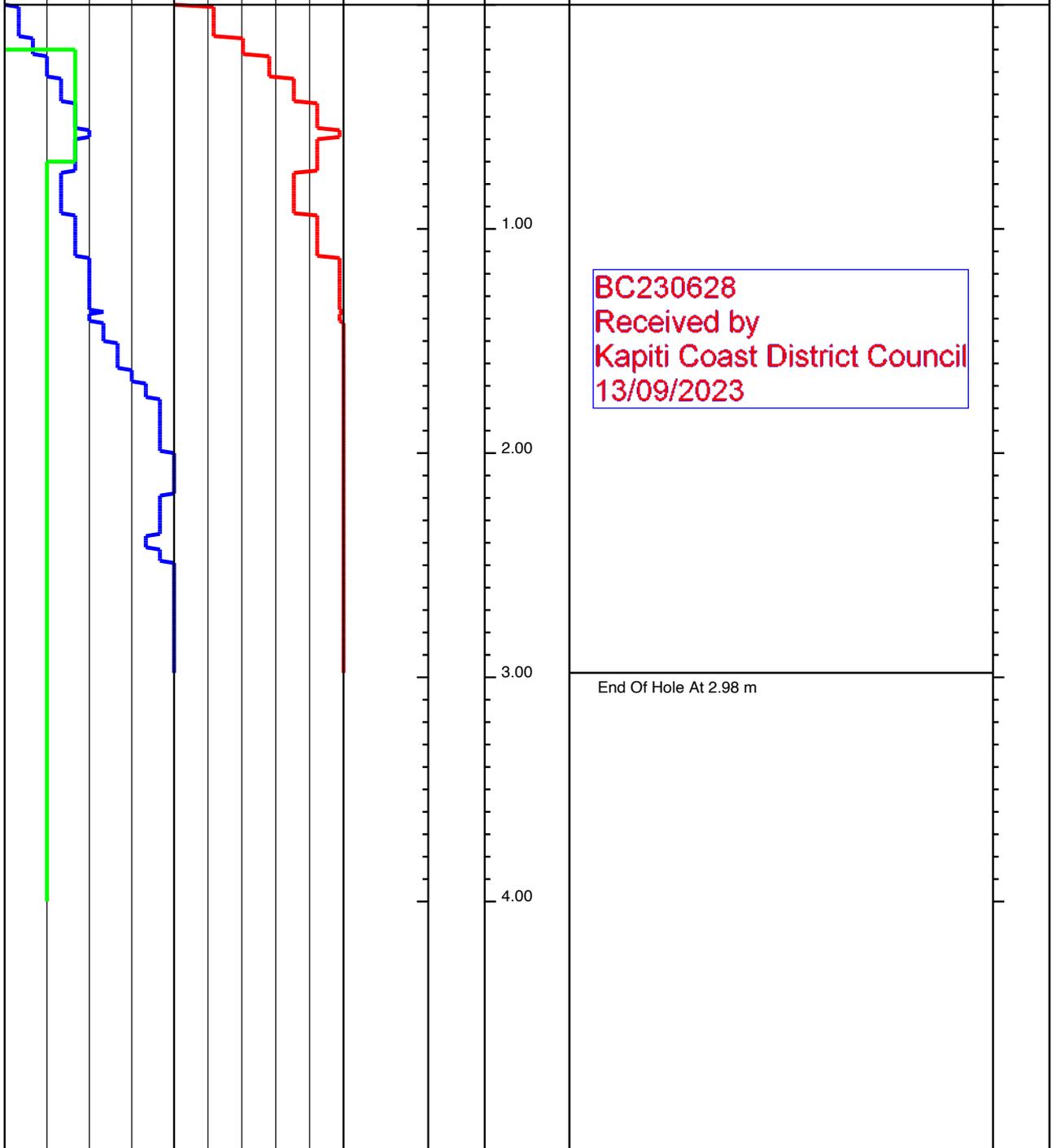


<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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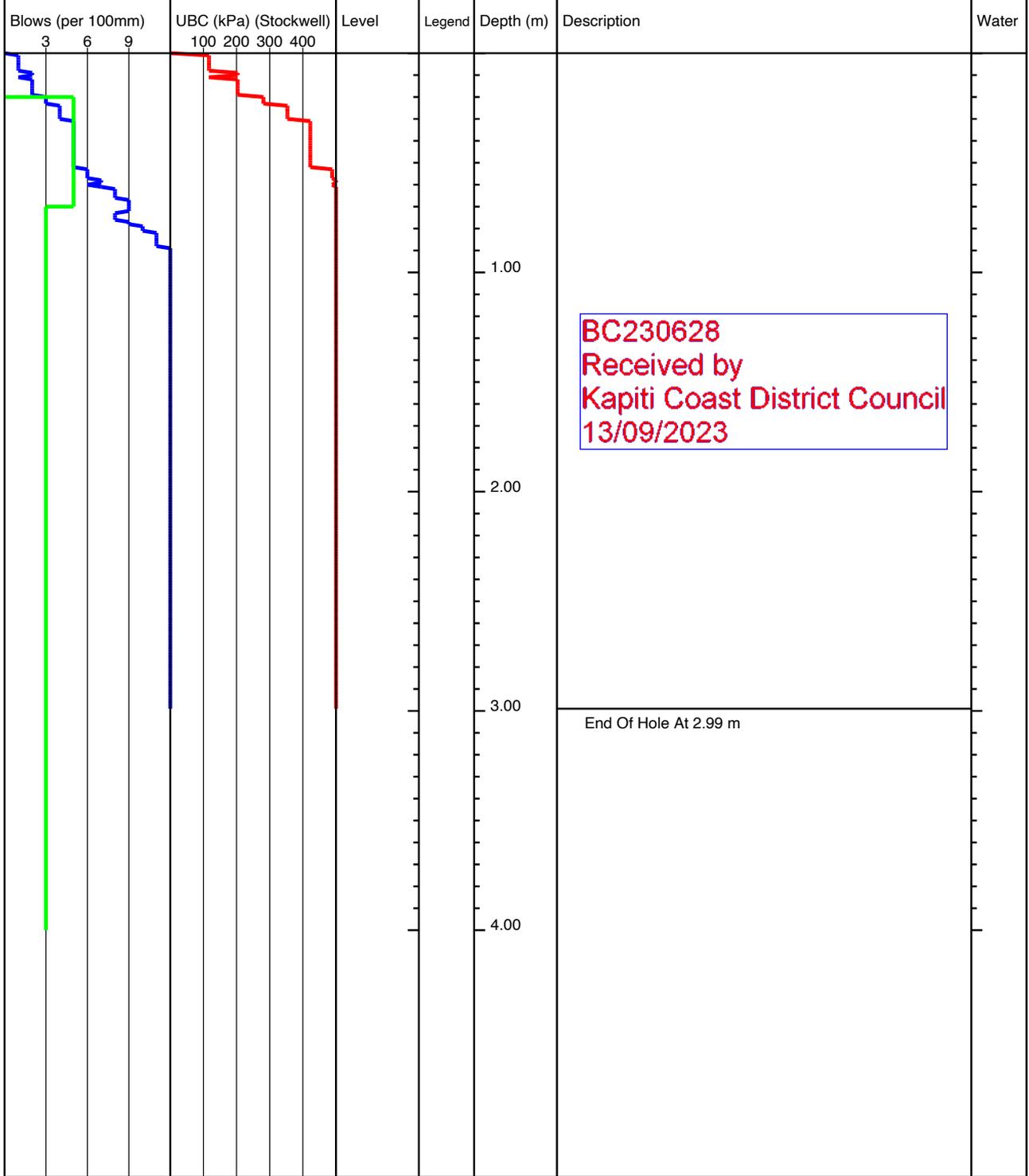
	Project Title: 110 Ngarara Rd, Waikanae		lot44-183
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868815	E Coord: 175.045775
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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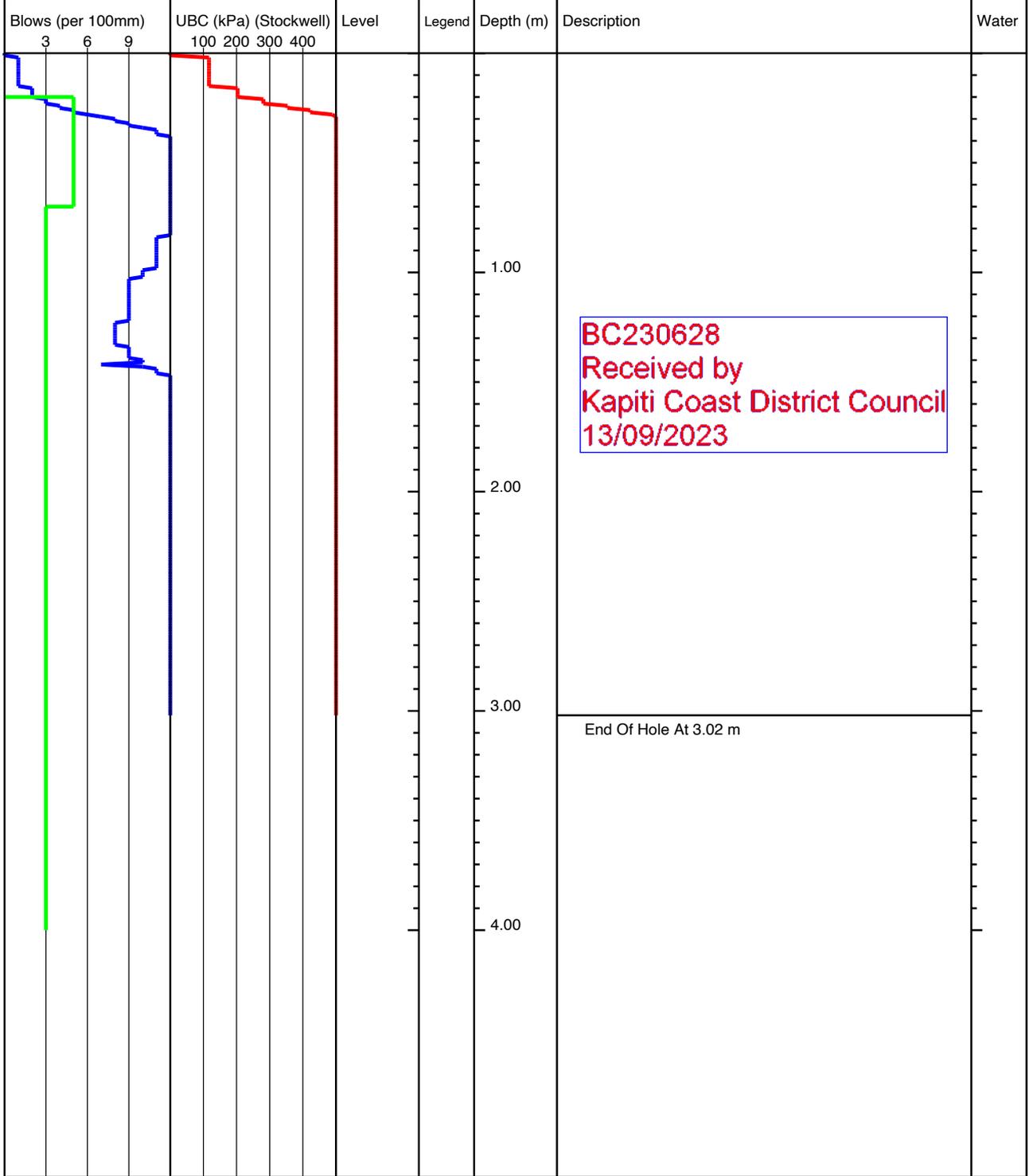
		Project Title: 110 Ngarara Rd, Waikanae				
		Project Number: 21852		Client: Anderson Park Trust	lot44-184	
		GL (mAOD):		N Coord: -40.868693	E Coord: 175.045687	
Date: 08/08/2022		Method: Machine Scala		Logged By: ND	Scale: 1:25 Sheet 1 Of 1	
Blows (per 100mm)	UBC (kPa) (Stockwell)	Level	Legend	Depth (m)	Description	Water
3 6 9	100 200 300 400					
						
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level					<b>REMARKS</b> No Groundwater Encountered	

	Project Title: 110 Ngarara Rd, Waikanae		lot44-185
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868647	E Coord: 175.045698
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



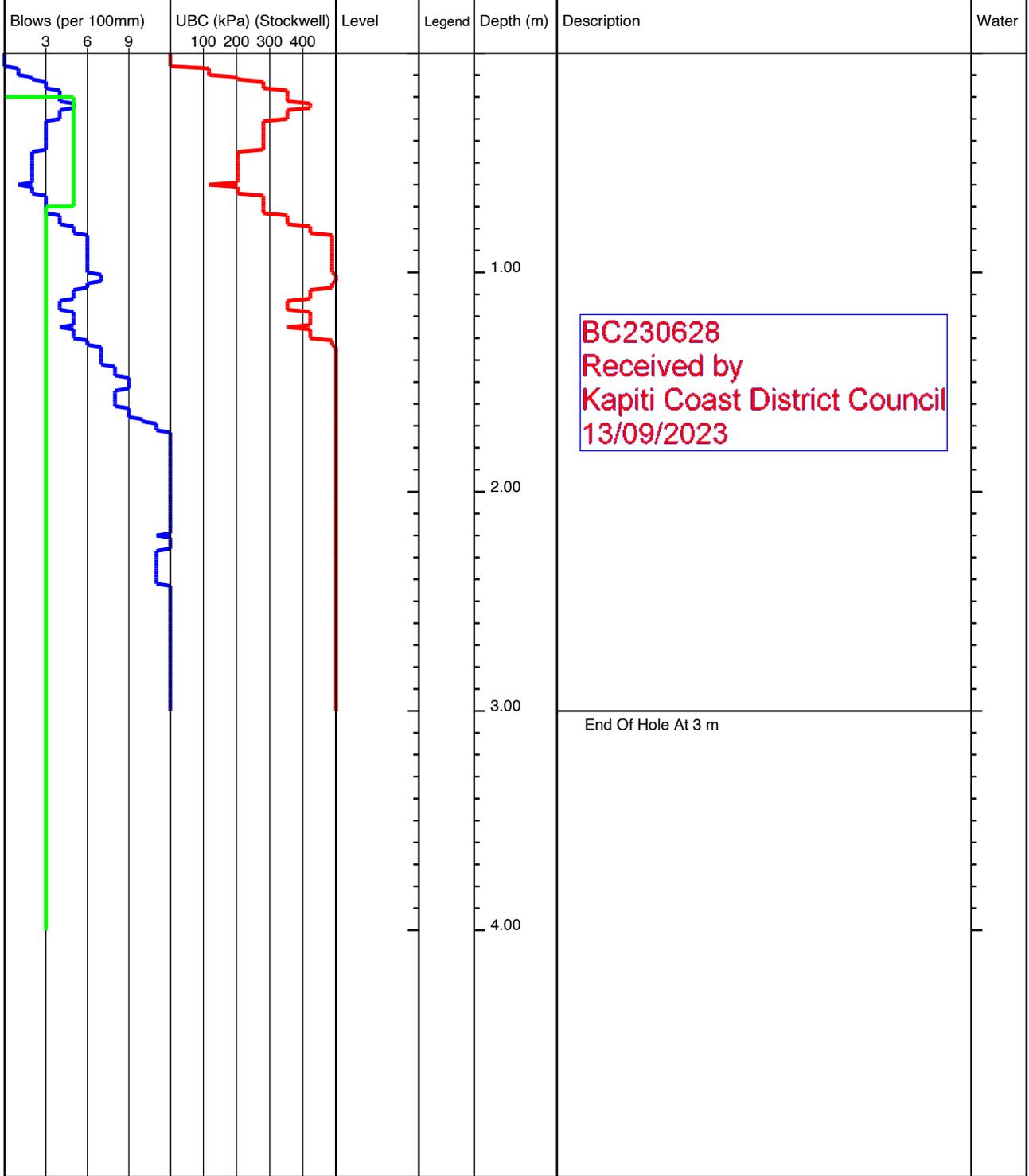
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot45-186
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868758	E Coord: 175.045905
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



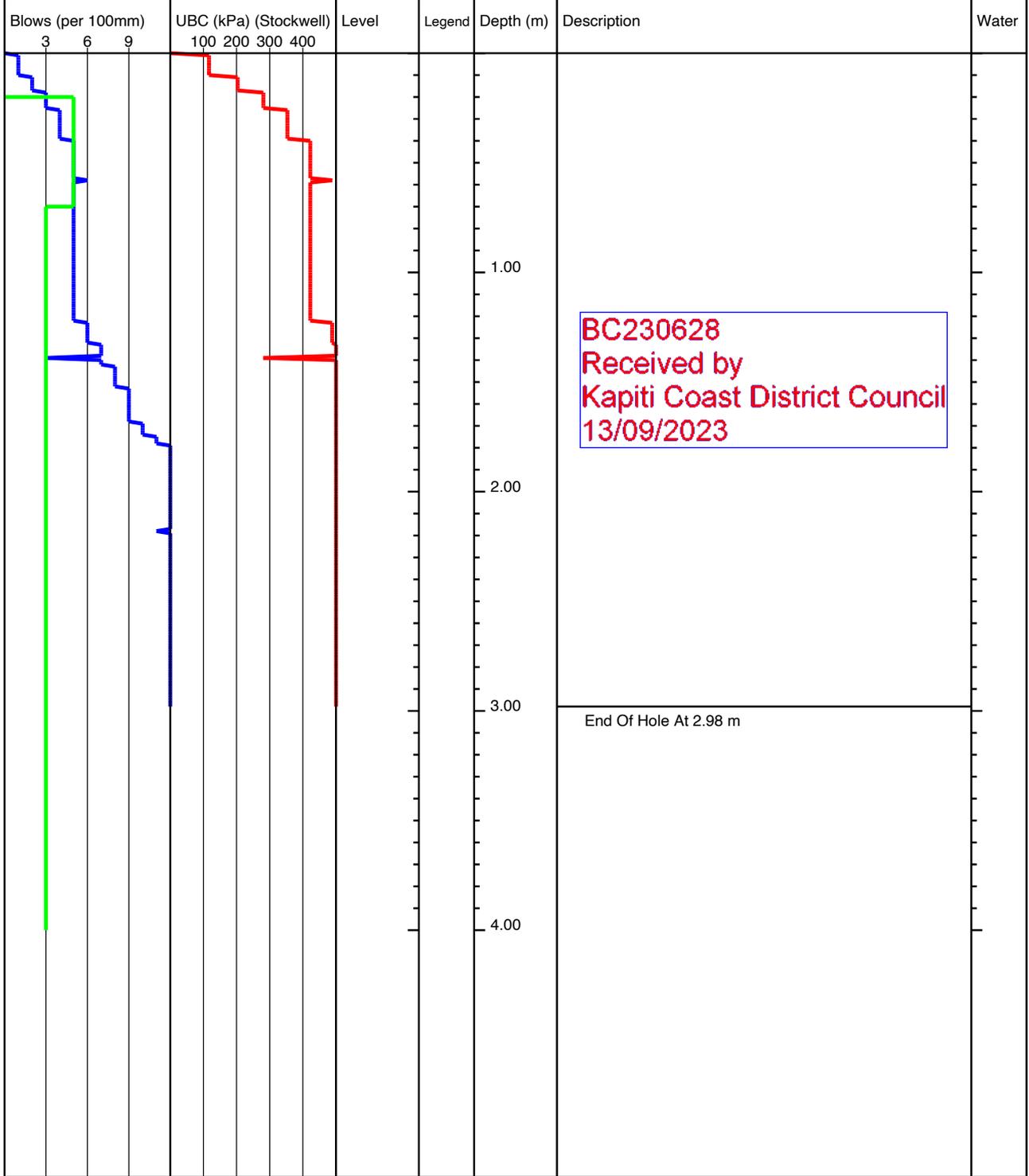
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot45-187
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868807	E Coord: 175.04602
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



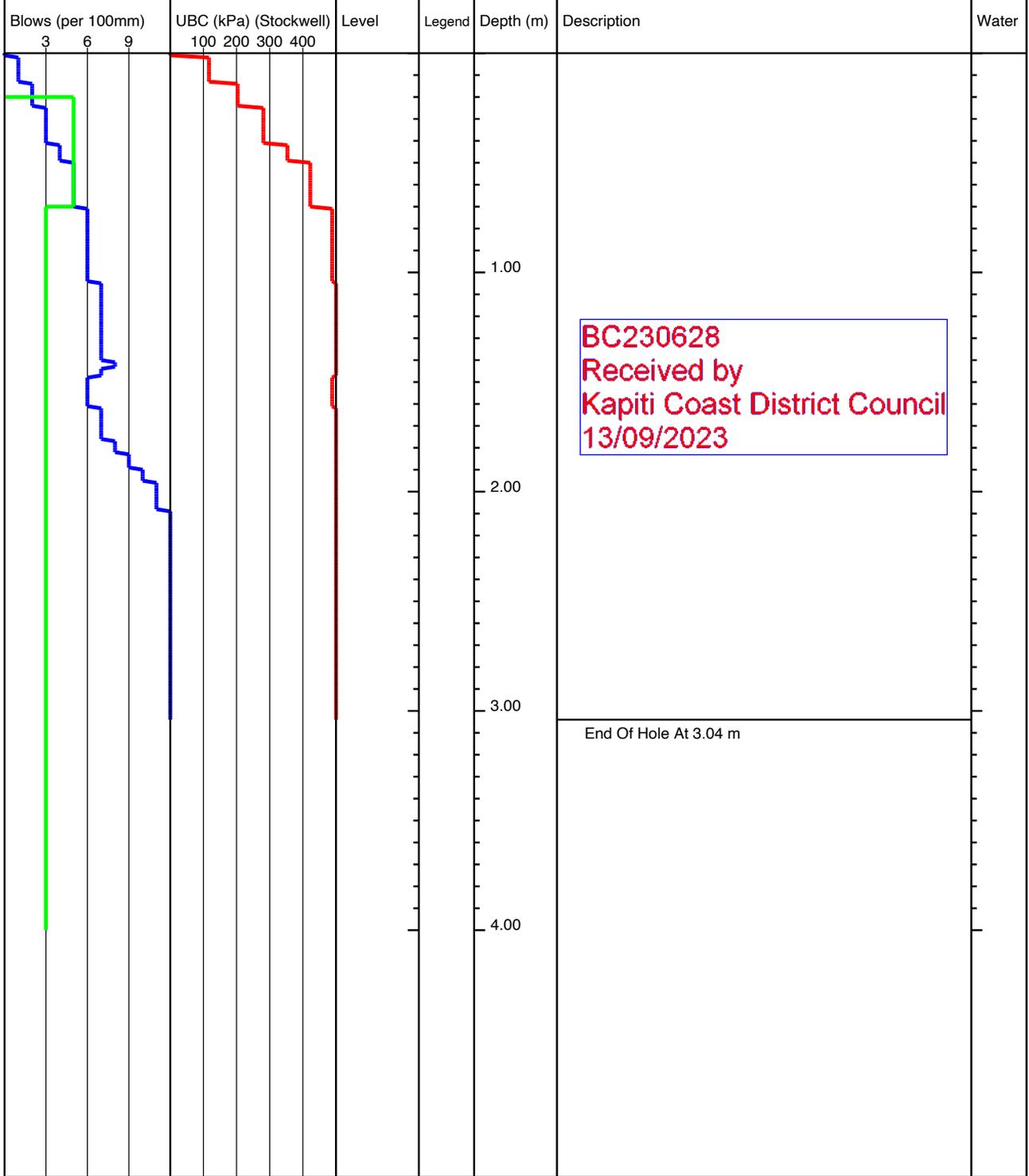
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot45-188
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868953	E Coord: 175.046005
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



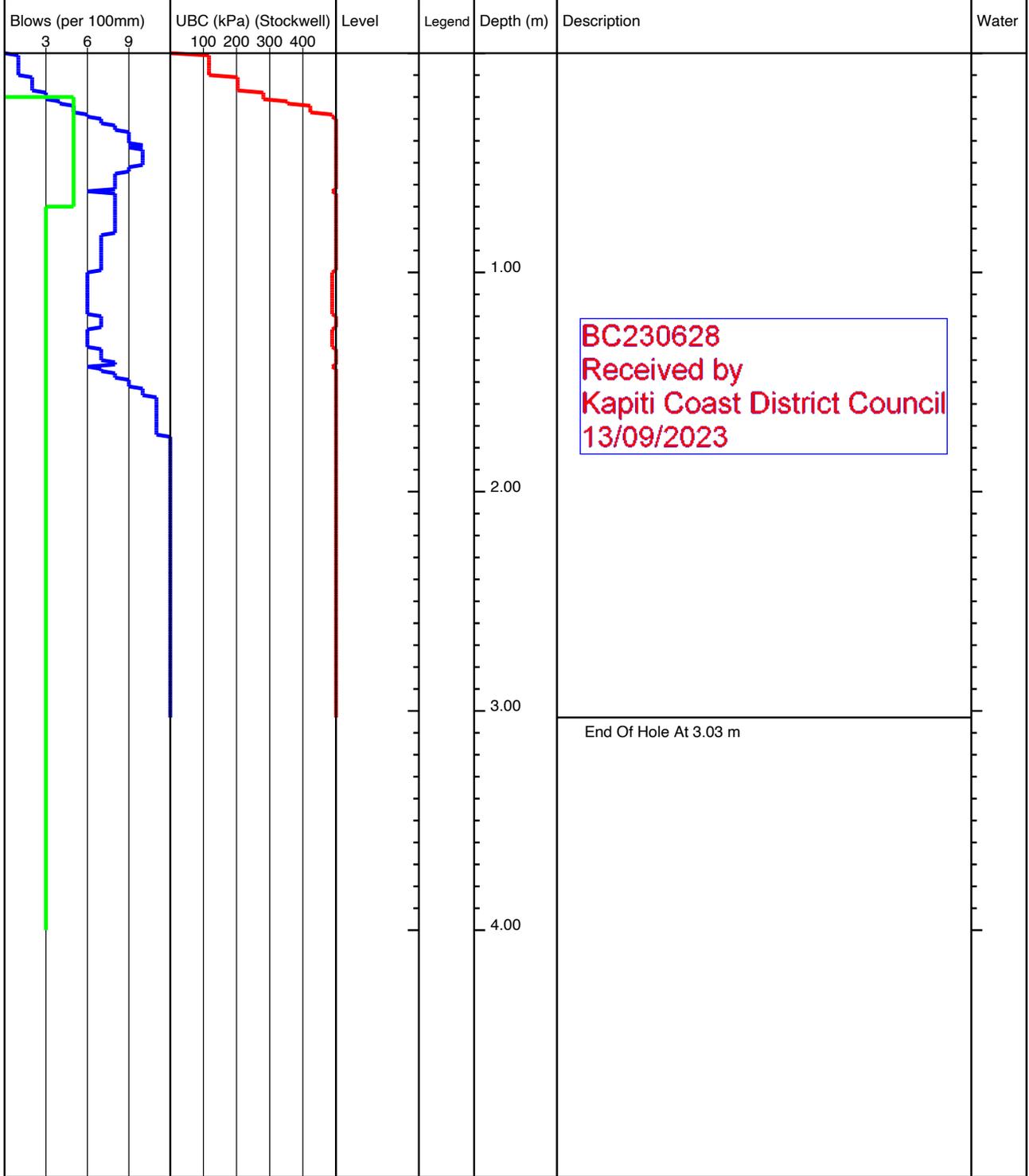
<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot45-189
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868912	E Coord: 175.045855
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
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	Project Title: 110 Ngarara Rd, Waikanae		lot45-190
	Project Number: 21852	Client: Anderson Park Trust	
	GL (mAOD):	N Coord: -40.868863	E Coord: 175.045935
Date: 08/08/2022	Method: Machine Scala	Logged By: ND	Scale: 1:25 Sheet 1 Of 1



<b>KEY</b> D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level	<b>REMARKS</b> No Groundwater Encountered
---	--

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## Appendix F: Statement of Professional Opinion on Suitability of Land and Earthfill for Building Construction

Development: Anderson Park Phase 2

Developer: Anderson Park Trust

Location: Waikanae

I, Martin Williams of CGW Consulting Engineers, hereby confirm that:

1. I am a geo-professional as defined in clause 1.2.2 of NZS 4404:2010 and Cameron Gibson and Wells Ltd (CGW) was retained by the developer as the geo-professional on the above development.
2. The extent of investigations are described in my reports numbered 20363-RPTGEO-001-A, dated 24 July 2020 and 21852-RPT-G-002-A dated 24th August 2022, the extent of inspections during construction are described in the latter report.
3. In the professional opinion of CGW not to be construed as a guarantee I consider that:
  - a. The earth fills shown on the attached plans outlined in this report have been placed in compliance with the terms of NZS 4431.
  - b. The completed works take into account land slope and foundation stability considerations subject to the conditions listed below in 6 to 8.
  - c. Subject to the conditions listed below in 6 to 8 the original ground and the filled ground are not subject to significant erosion, subsidence or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991.
4. This opinion is furnished to the Kapiti Coast District Council (KCDC) and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.
5. This certificate shall be read in conjunction with the reports listed above and shall not be copied or reproduced except in conjunction with the full geotechnical report.

In the opinion of the geo-professional the following special limitations should be observed.

6. Certain areas of the site (greater than 1V:3H) are considered unsuitable for construction and are indicated as 'no build areas'. An appropriate setback, say minimum 5m, should be maintained from steep slopes.



7. Grass cover is to be maintained to limit surface erosion.
8. A consent notice should be applied to all lots consistent with the following:
  - Lot specific foundation, earthworks and retention design should be carried out by a suitably experienced Chartered Professional Engineer (CPEng).
  - A suitably qualified professional should inspect the foundation excavations and earthworks in order to verify the actual ground conditions meet the design requirements and the absence of unsuitable material.

Signed

A handwritten signature in black ink, appearing to read 'Martin Williams', written over a light blue horizontal line.

Martin Williams  
Geotechnical Manager (CPEng: 1029431)  
On behalf of Cameron Gibson & Wells Ltd

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# Memorandum from licensed building practitioner: Certificate of design work

## Section 45 and section 30C, Building Act 2004

Please fill in the form as fully and correctly as possible.

If there is insufficient room on the form for requested details, please continue on another sheet and attach the additional sheet(s) to this form.

THE BUILDING	
Street address:	LOT 43 ANDERSON PARK
Suburb:	WAIKANAЕ
Town/City:	KAPITI COAST
	Postcode:
THE OWNER(S)	
Name(s):	T. ATKINSON
Mailing address:	LOT 43 ANDERSON PARK
Suburb:	WAIKANAЕ
	PO Box/Private Bag:
Town/City:	KAPITI COAST
	Postcode:
Phone number:	Email address:

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**BASIS FOR PROVIDING THIS MEMORANDUM**

I am providing this memorandum in my role as the: Please tick the option that applies

**sole** designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design work myself – no other person will be providing any additional memoranda for the project

**lead** designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and **no other** person will be providing any additional memoranda for the project

**lead** designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the **other** designers will provide their own memorandum relating to their specific RBW design

**specialist** designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

**IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)**

I GRANT BAXTER carried out / supervised the following design work that is restricted building work

PRIMARY STRUCTURE: B1			
Design work that is RBW	Description of RBW	Carried out or supervised	Reference to plans and specifications
Tick <input checked="" type="checkbox"/> if included. Cross <input checked="" type="checkbox"/> if excluded	If appropriate, provide details of the RBW	Tick <input checked="" type="checkbox"/> whether you carried out this design work or supervised someone else carrying out this design work	If appropriate, specify references
All RBW design work relating to B1 <input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Foundations and subfloor framing <input checked="" type="checkbox"/>	FIRTH RIBRAFT	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	

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Design work that is RBW	Description of RBW	Carried out or supervised	Reference to plans and specifications
Tick <input checked="" type="checkbox"/> if included. Cross <input checked="" type="checkbox"/> if excluded	If appropriate, provide details of the RBW	Tick <input checked="" type="checkbox"/> whether you carried out this design work or supervised someone else carrying out this design work	If appropriate, specify references
Walls	<input checked="" type="checkbox"/> TIMBER FRAMING TO NZS:3604:2011	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Roof	<input checked="" type="checkbox"/> TIMBER RAFTERS TO DESIGNIT CALCS (TRUSSES BY PRENSAVER)	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Columns and beams	<input checked="" type="checkbox"/> TIMBER LINTELS TO NZS:3604:2011 FITCH BEAMS TO PRYDA SPAN TABLES (STEEL BEAMS BY ENG)	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Bracing	<input checked="" type="checkbox"/> GIB BRACES TO GIB CALCS	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Other	<input type="checkbox"/>	<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	

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Design work that is RBW	Description of RBW	Carried out or supervised	Reference to plans and specifications
Tick <input checked="" type="checkbox"/> if included. Cross <input checked="" type="checkbox"/> if excluded	If appropriate, provide details of the RBW	Tick <input checked="" type="checkbox"/> whether you carried out this design work or supervised someone else carrying out this design work	If appropriate, specify references
<b>EXTERNAL MOISTURE MANAGEMENT SYSTEMS: E2</b>			
All RBW design work relating to E2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Damp proofing	<input checked="" type="checkbox"/> DPM & DPC	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Roof cladding or roof cladding system	<input checked="" type="checkbox"/> CORRUGATED	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Ventilation system (for example, subfloor or cavity)	<input checked="" type="checkbox"/> CAVITY	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Wall cladding or wall cladding system	<input checked="" type="checkbox"/> SHADOWCLAD WITH FEATURE B/B W/BD & MAXSTONE	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Waterproofing	<input checked="" type="checkbox"/> ARDEX WPM COI TO TILED SHOWER	<input checked="" type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Other	<input type="checkbox"/>	<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	

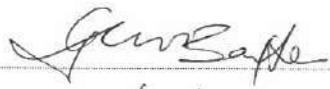
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Design work that is RBW	Description of RBW	Carried out or supervised	Reference to plans and specifications
Tick <input checked="" type="checkbox"/> if included. Cross <input checked="" type="checkbox"/> if excluded	If appropriate, provide details of the RBW	Tick <input checked="" type="checkbox"/> whether you carried out this design work or supervised someone else carrying out this design work	If appropriate, specify references
<b>FIRE SAFETY SYSTEMS: C1 - C6</b>			
Emergency warning systems Evacuation and fire service operation systems <input type="checkbox"/> Suppression or control systems Other		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
<b>Note:</b> The design of fire safety systems is only restricted building work when it involves small-to-medium apartment buildings as defined by the Building (Definition of Restricted Building Work) Order 2011.			

WAIVERS AND MODIFICATIONS	
Waivers or modifications of the Building Code are required. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
If Yes, provide details of the waivers or modifications below:	
Clause	Waiver/modification required
List relevant clause numbers of building code	Specify nature of waiver or modification of building code required

ISSUED BY	
Name and contact details of the licensed building practitioner who is licensed to carry out or supervise design work that is restricted building work.	
Name: GRANT BAXTER	LBP or Registration number: 110030
The practitioner is a: <input checked="" type="radio"/> Design LBP <input type="radio"/> Registered architect <input type="radio"/> Chartered professional engineer	
Design Entity or Company (optional): ONEBOARD & ONLINE LTD	
Mailing address (if different from below): PO BOX 74, PARAPARAUMU	
Street address/Registered office:	
Suburb:	Town/City: KAPITI COAST
PO Box/Private Bag:	Postcode: 5254
Phone number: 04 9021210	Mobile:
After hours: 04 9021210	Fax: 04 9021210
Email address: grant@onboard.co.nz	Website:

DECLARATION	
I, <u>GRANT BAXTER</u> LBP, state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:	
<ul style="list-style-type: none"> <li>• Complies with the building code, or</li> <li>• Complies with the building code subject to any waiver or modification of the building code recorded on this form</li> </ul>	
Signature:	
Date:	25/4/2023

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## Single Level Along Resistance Sheet

Wind	EQ
Demand	
412	734
Resistance	

Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	1380 335%	1258 171%
c	1	1.2		2.4	BL1-H	GIB®	154	125		
	2	3.6		2.4	GS1-N	GIB®	248	216		
	3	3.4		2.4	GS1-N	GIB®	235	204		
	4	0.9		2.4	EP1-0.6	ECOPLY	86	94		
	5	0.9		2.4	EP1-0.6	ECOPLY	86	94		
									808 OK	734 OK
d	1	1.2		2.4	BL1-H	GIB®	154	125		
	2	1.2		2.4	BL1-H	GIB®	154	125		
	3	1.5		2.4	EP1-1.2	GIB®	180	180		
	4	0.9		2.4	EP1-0.6	ECOPLY	86	94		
									573 OK	524 OK

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## Single Level Across Resistance Sheet

Wind	EQ
Demand	
1066	734
Resistance	

Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	1686 158%	1579 215%
m	1	1.3		3.8	BLP-H	GIB®	123	123		
										123 OK
n	3	0.4		2.55	BL1-H	GIB®	34	38		
										34 Check
o	4	0.7		2.55	BL1-H	GIB®	68	67		
	5	0.7		2.55	BL1-H	GIB®	68	67		
										137 OK
p	4	0.8		2.4	BL1-H	GIB®	87	82		
	5	4.3		2.4	BL1-H	GIB®	550	447		
										637 OK
q	1	6.3		2.4	EP1-1.2	GIB®	756	756		
										756 OK

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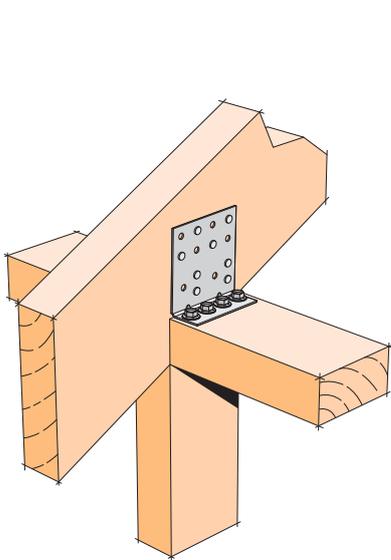


01/2017

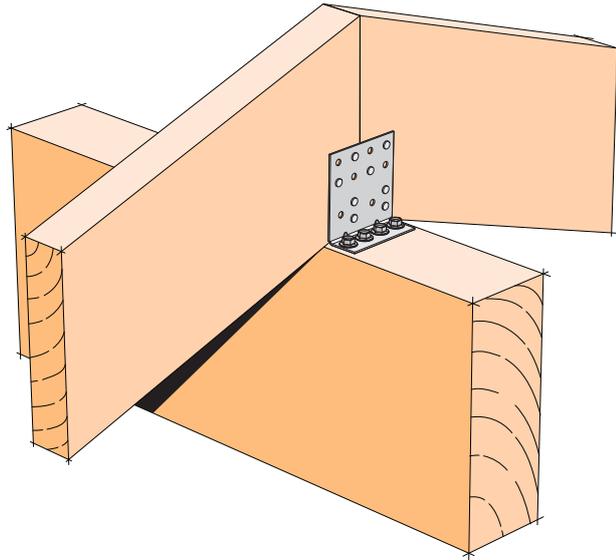
# CONCEALED PURLIN CLEATS

- ★ Quick and Easy to Apply
- ★ Resists High Wind Uplift

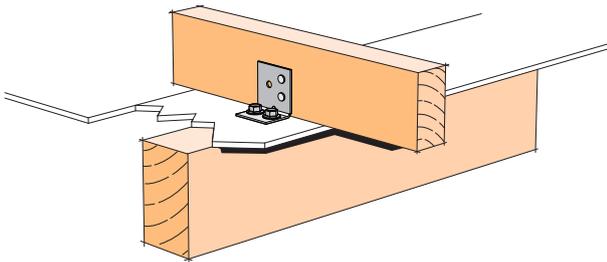
USE STAINLESS STEEL  
OPTION IN EXTERIOR  
SITUATIONS



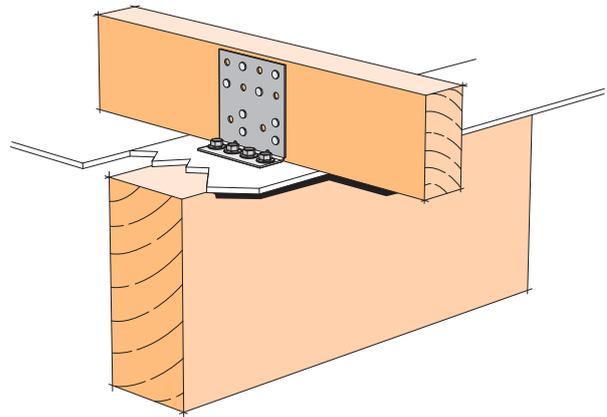
Exposed Rafter to Wall Fixing



Exposed Rafter to Ridge Beam Fixing



Purlin to Exposed Rafter Fixing  
CPC40S Shown



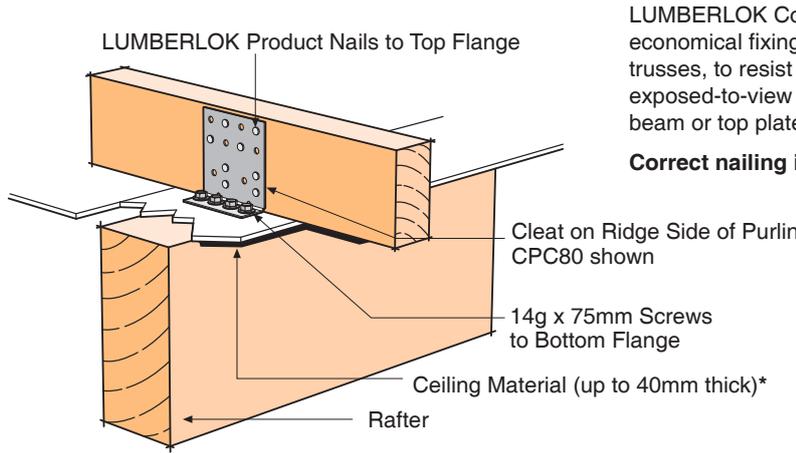
Purlin to Exposed Rafter Fixing  
CPC80 Shown



SCAN FOR  
INSTALLATION  
VIDEO

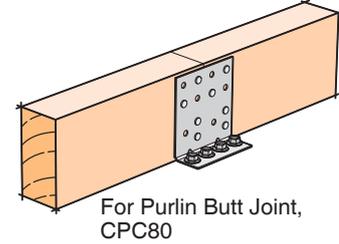
<https://vimeo.com/117350346>





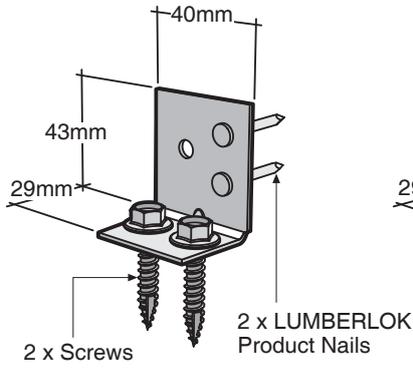
LUMBERLOK Concealed Purlin Cleats provide an economical fixing for purlins to exposed rafters or trusses, to resist wind uplift. They can also be used in exposed-to-view situations, such as a rafter to ridge beam or top plate situation.

**Correct nailing is most important. See below.**



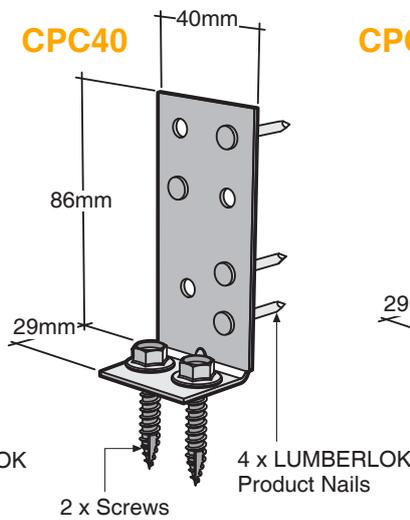
**DIMENSIONS AND NAILING**

**CPC40S (short)**



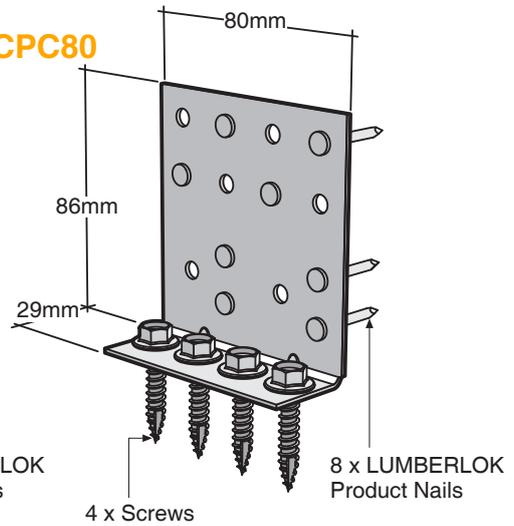
**Rafter Width (nominal) 50mm**

**CPC40**

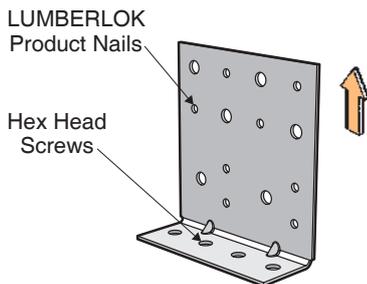


**50mm**

**CPC80**



**100mm**



Uplift Direction	CPC40S	CPC40	CPC80
Characteristic Load	-	8kN/pair	16kN/pair
Fix as shown with: LUMBERLOK Product Nails 30mm x 3.15 dia. Type 17-14g x 35mm Hex Head Screws*			

**FIXINGS:**

To Top Flange: LUMBERLOK Product Nails 30mm x 3.15 dia. or Type 17-14g x 35mm Hex Head Screws  
Bottom Flange: Type 17-14g x 35mm Hex Head Screws  
\*Note: with ceiling material use Type 17-14g x 75mm Screws

**Note: For Stainless Steel CPC use Stainless Steel screws and nails**

**MATERIAL:**

1.55mm G300 Z275 Galvanised Steel or 0.9mm Stainless Steel 304-2B (SSCPC40S)  
1.5mm Stainless Steel 304-2B (SSCPC40 and SSCP80)

**SCREWS AND NAILS NOT INCLUDED WITH PRODUCT**



**MiTek New Zealand Limited**

AUCKLAND  
PO Box 58-014, Botany 2163  
Phone: 09-274 7109  
Fax: 09-274 7100

CHRISTCHURCH  
PO Box 8387, Riccarton 8440  
Phone: 03-348 8691  
Fax: 03-348 0314

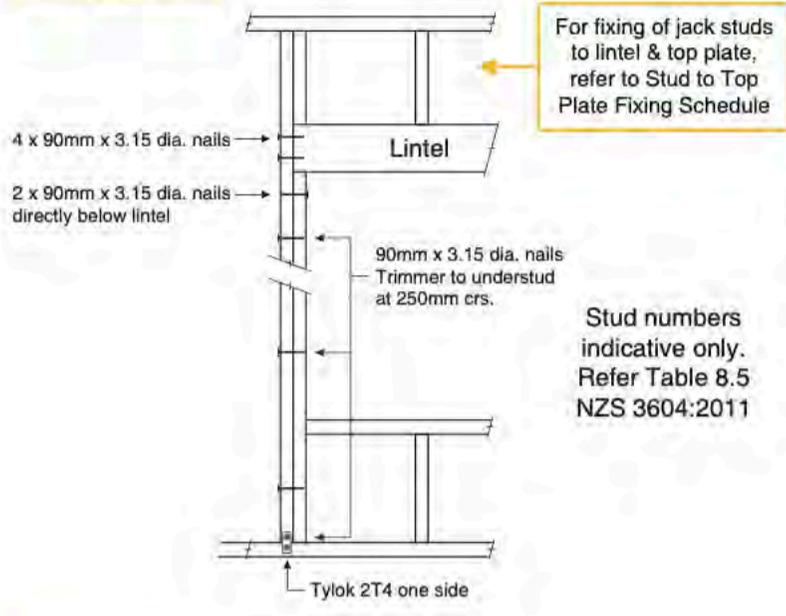
www.mitek.nz

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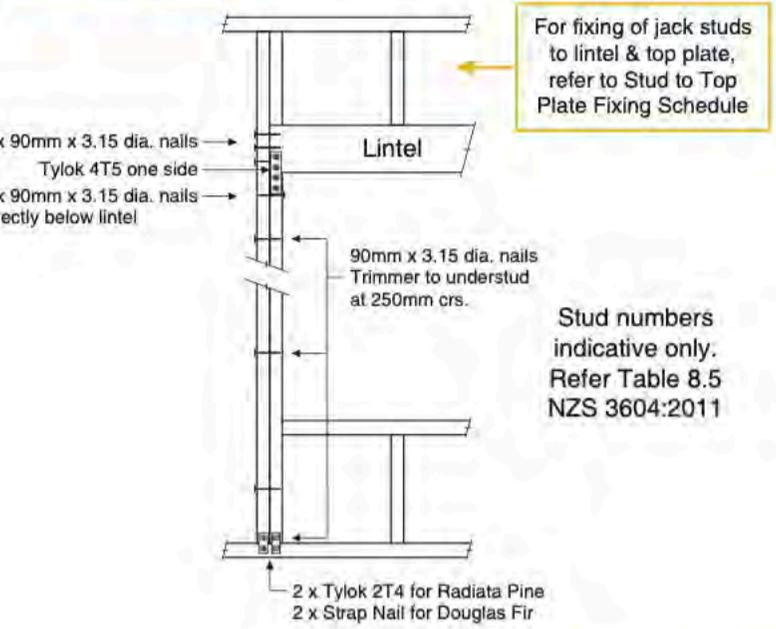


# LINTEL FIXING OPTIONS

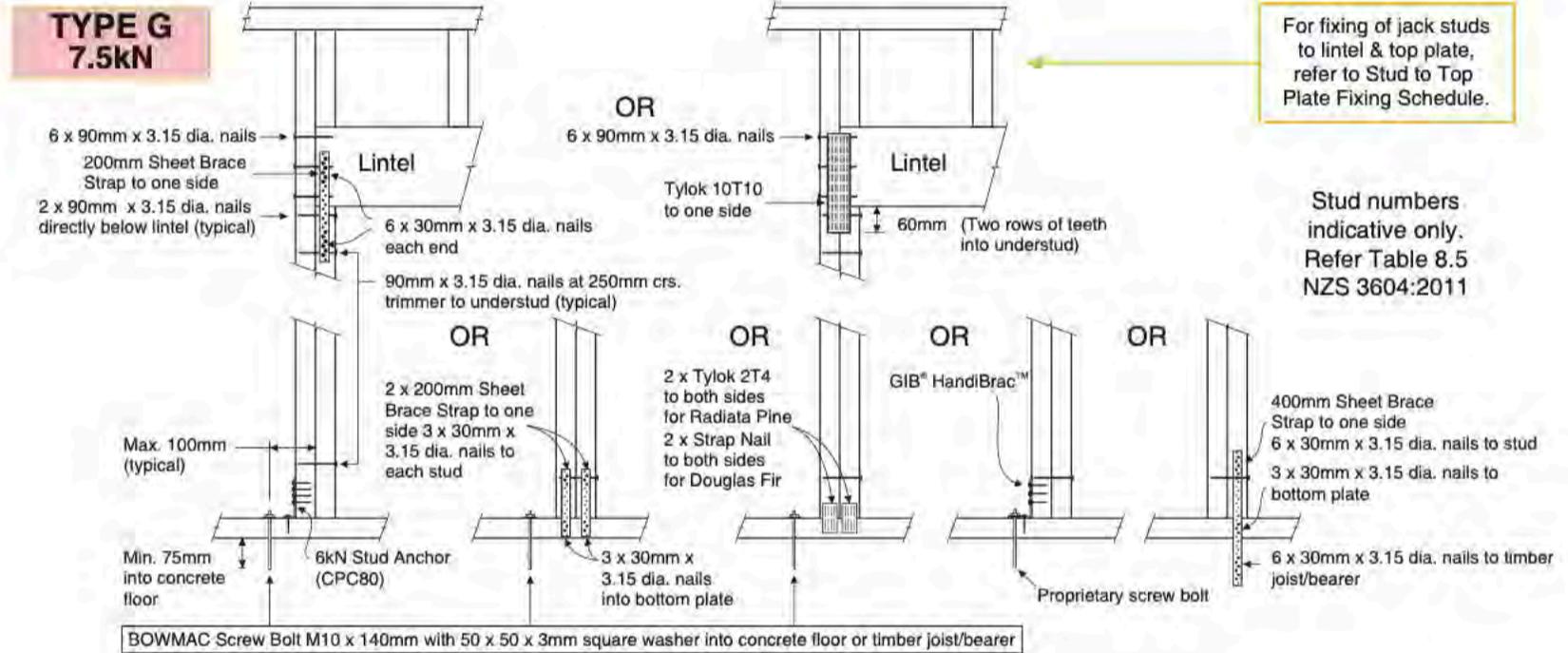
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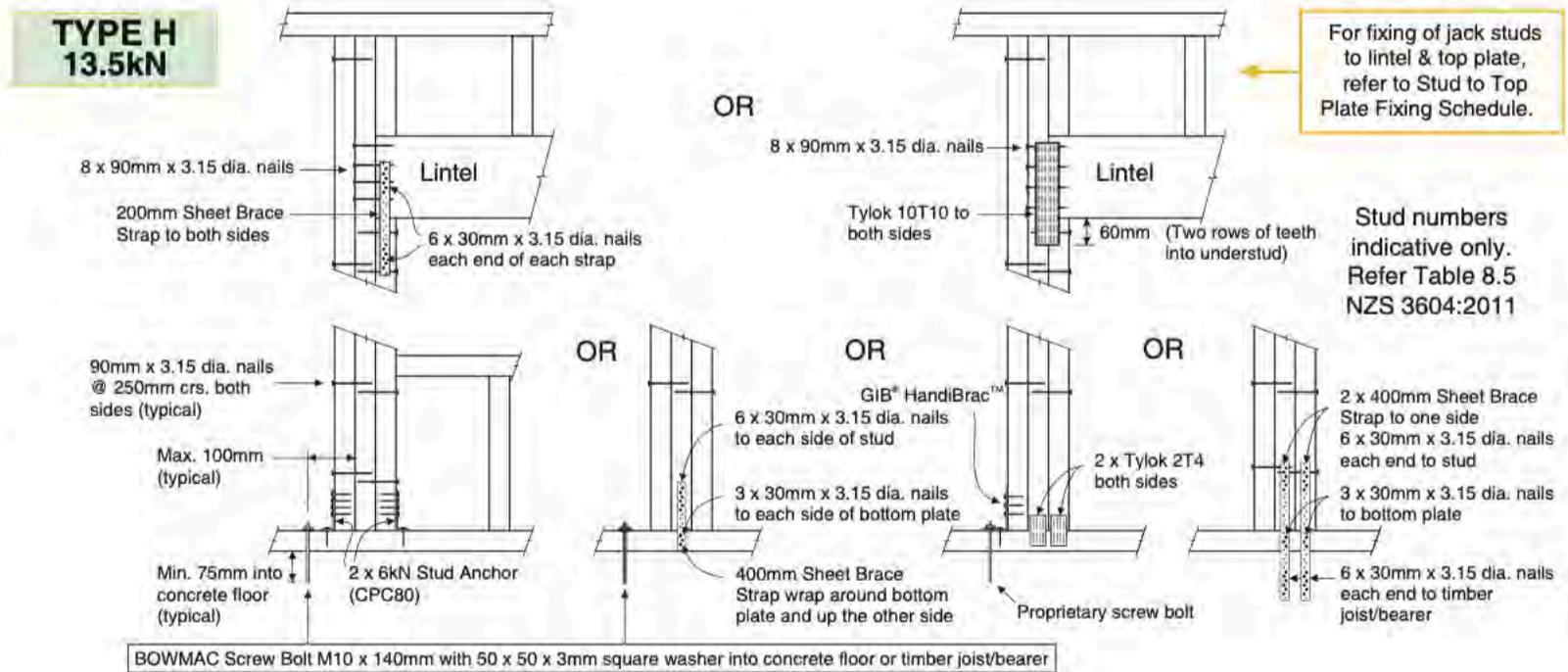
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## TYPE G 7.5kN



## TYPE H 13.5kN



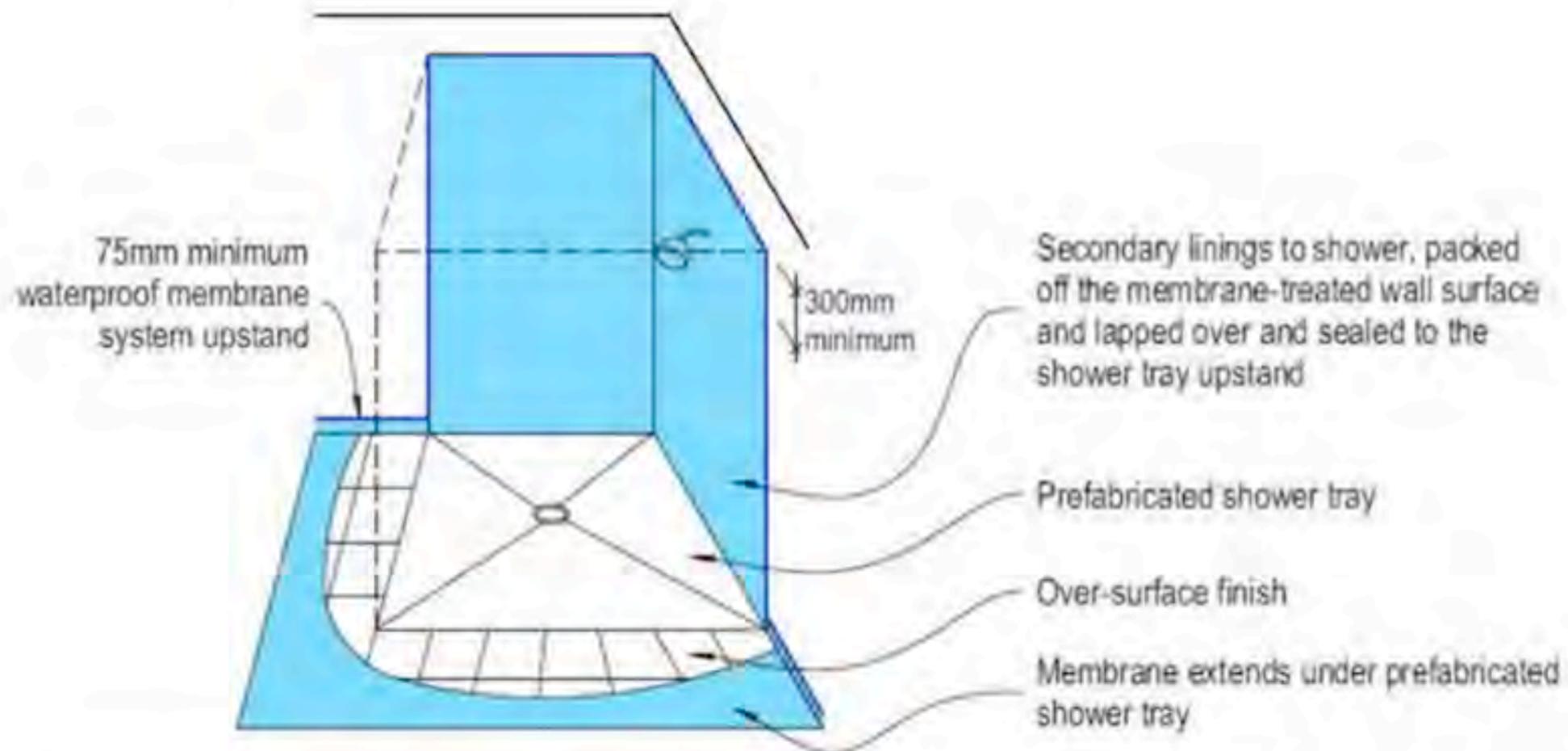
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PO Box 58-014, Botany 2163  
Phone: 09-274 7109  
Fax: 09-274 7100

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PO Box 8387, Riccarton 8440  
Phone: 03-348 8691  
Fax: 03-348 0314

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MITEK® LUMBERLOK® BOWMAC®

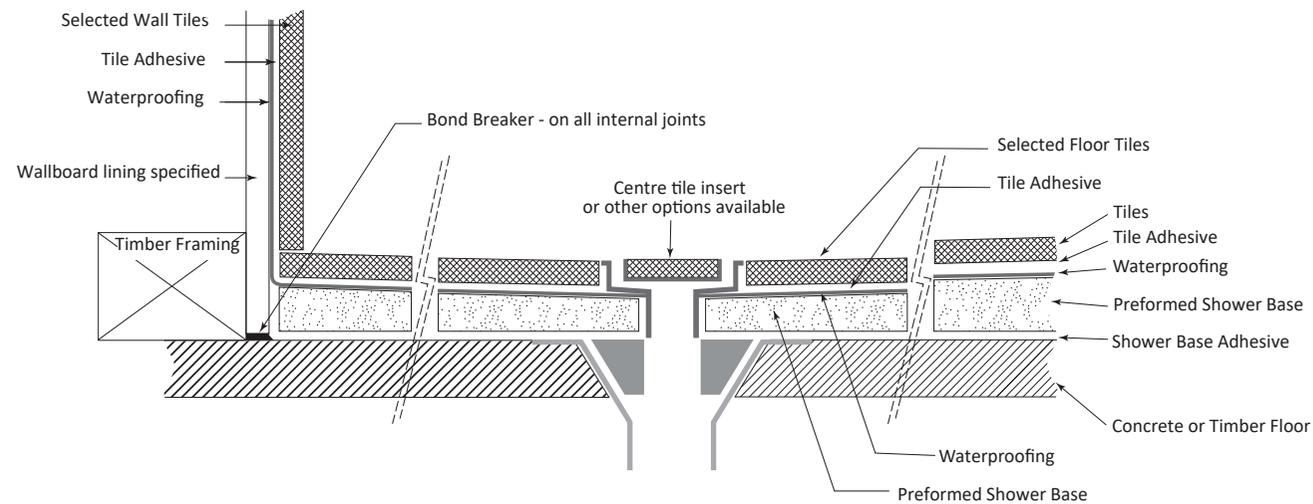


**Figure 12: Extent of waterproof membrane system for shower areas**

**Notes:**

1. Secondary linings, eg acrylic liner, self-finished sheet linings or sheet linings with secondary wet area membrane and any over-surface finish such as tiles, must be packed off the membrane-treated wall surface, and overlap and be sealed to the shower tray upstand. The waterproof membrane system must extend under the prefabricated shower tray and up the shower area walls (and the face of any hob) behind the secondary shower linings.
2. Alternatively, the waterproof membrane system (with over-surface finish as appropriate) could be used for the shower floor and walls, with the floor substrate constructed to falls.
3. Horizontal extent of waterproof membrane system extends to line of rigid shower screen and door, or 300mm past line of shower curtain, or 1500mm horizontally from shower rose for open shower areas, or 600mm beyond the maximum reach of the shower pick for a hand-held shower rose in an open shower area.
4. Minimum height of waterproofing to shower area walls is 1800mm above the surface of the shower floor or tray.
5. There is no need to apply waterproof membrane under an impervious lining.

## Cross Sections - Shower System



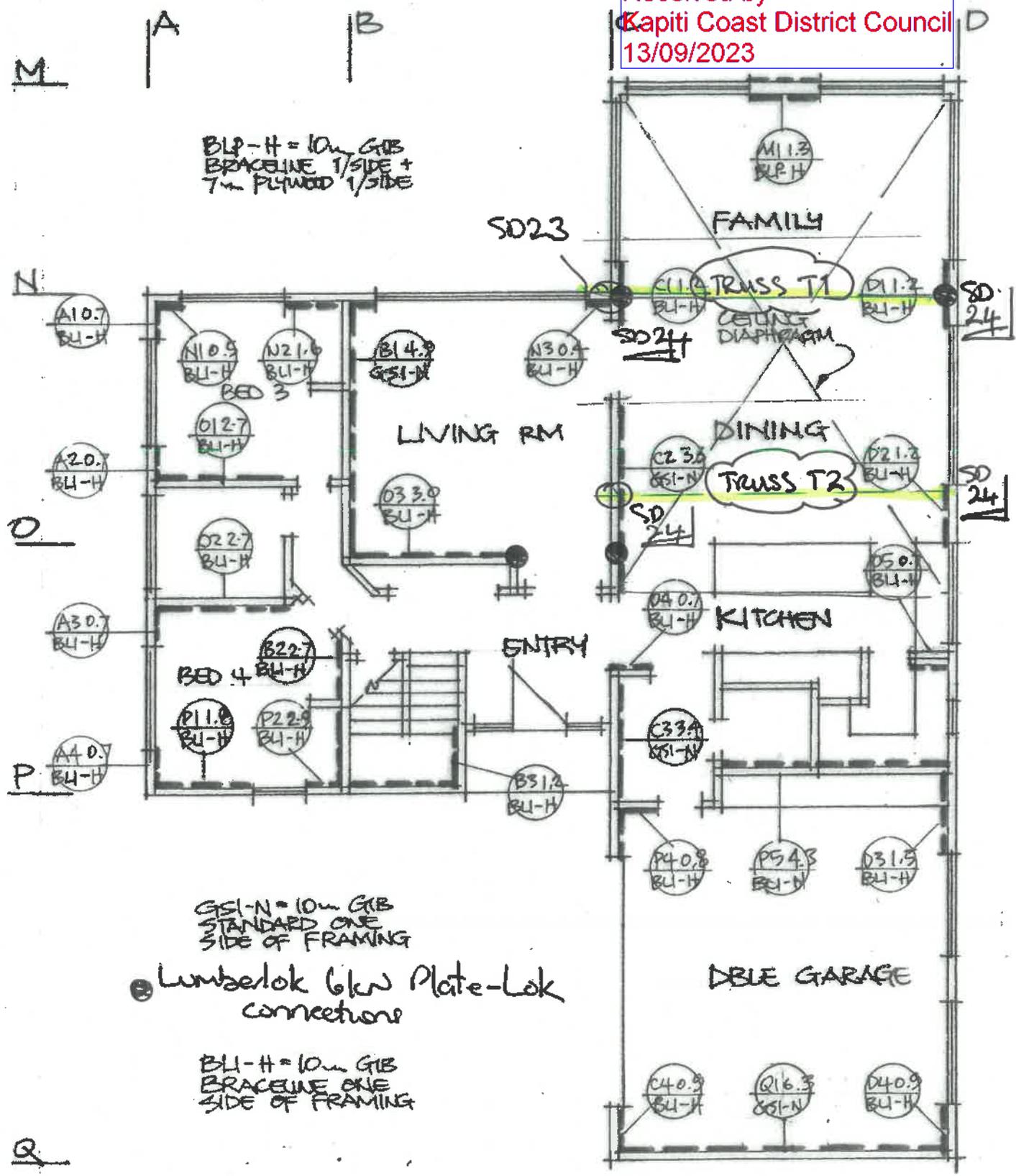
Centre Drain or Off Centre Drain

Scale - 1 : 2

Date: 10/06/2021

Detail

M02



BLP-H = 10m GIB  
 BRACELINE 1/SIDE +  
 7m PLYWOOD 1/SIDE

GSI-N = 10m GIB  
 STANDARD ONE  
 SIDE OF FRAMING

• Lumberlok Glw Plate-Lok  
 connections

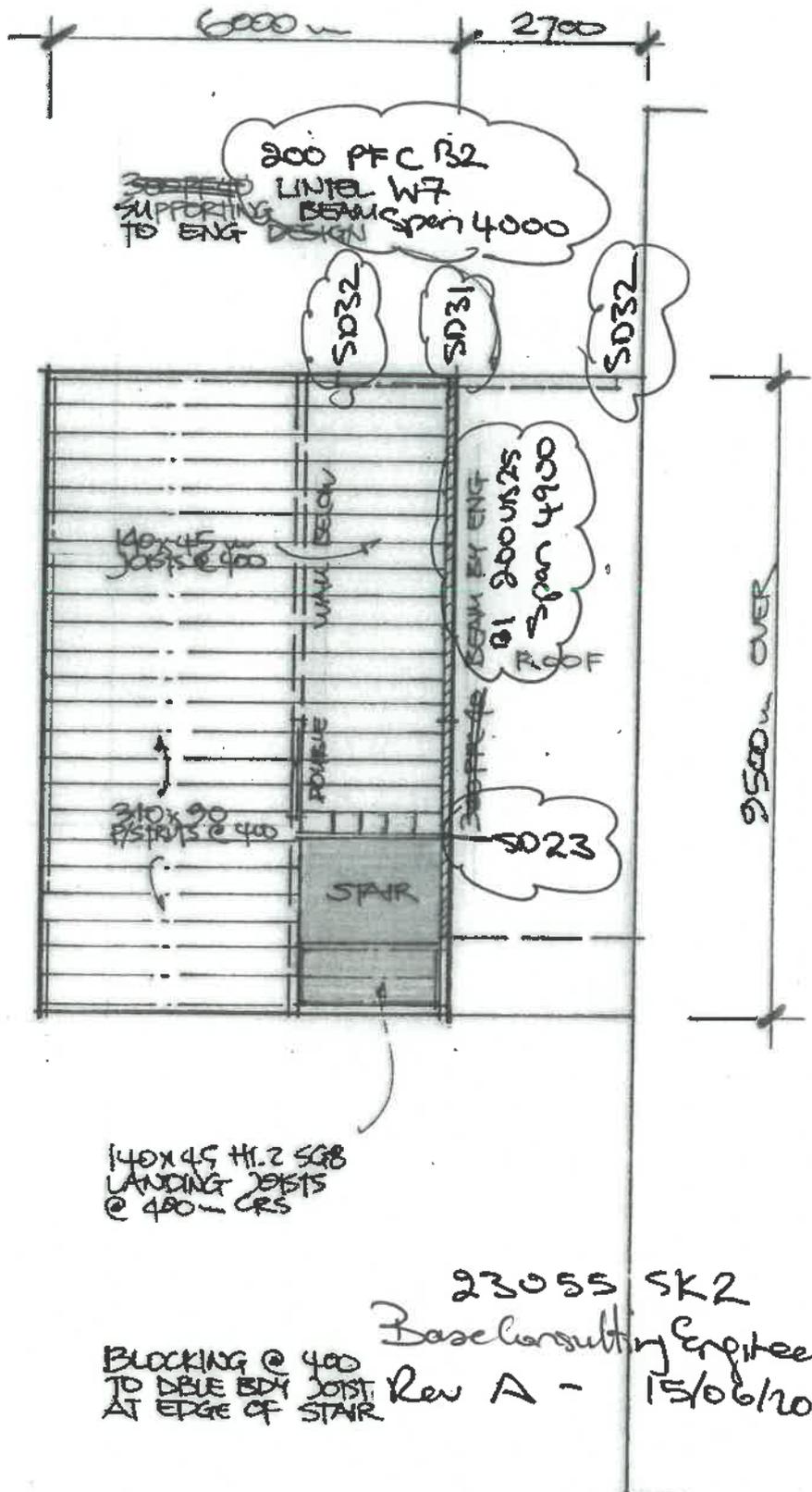
BLI-H = 10m GIB  
 BRACELINE ONE  
 SIDE OF FRAMING

**LOWER LEVEL BRACING**

23055-SK1

Base Consulting Engineers  
 Rev A - 15/06/2023





20mm PLYWOOD FLOORING (H3.2 IN ALL WET AREAS)

310x90 PLYDAKSPAN FLOOR JOISTS @ 400 BY PREVALIER

STEEL BEAMS & CONNECTIONS TO ENGINEER DESIGN

100mm CONC SLAB SEG2 W/ST ON DPM, SAND & COMPACT H/FIL

300 W X 305 D CONC PERIMETER WITH 3/H12 BARS

FIRTH RIBRAFT FLOOR SYSTEM TO FIRTH DETAILS

ENSURE FFL IS 225mm ABOVE GL OR 150mm ABOVE PAVING

140x45 H1.2 SGB LANDING JOISTS @ 400 CRS

BLOCKING @ 400 TO DEBE BDY JOIST AT EDGE OF STAIR

23055 SK2  
Base Consulting Engineers  
Rev A - 15/06/2023

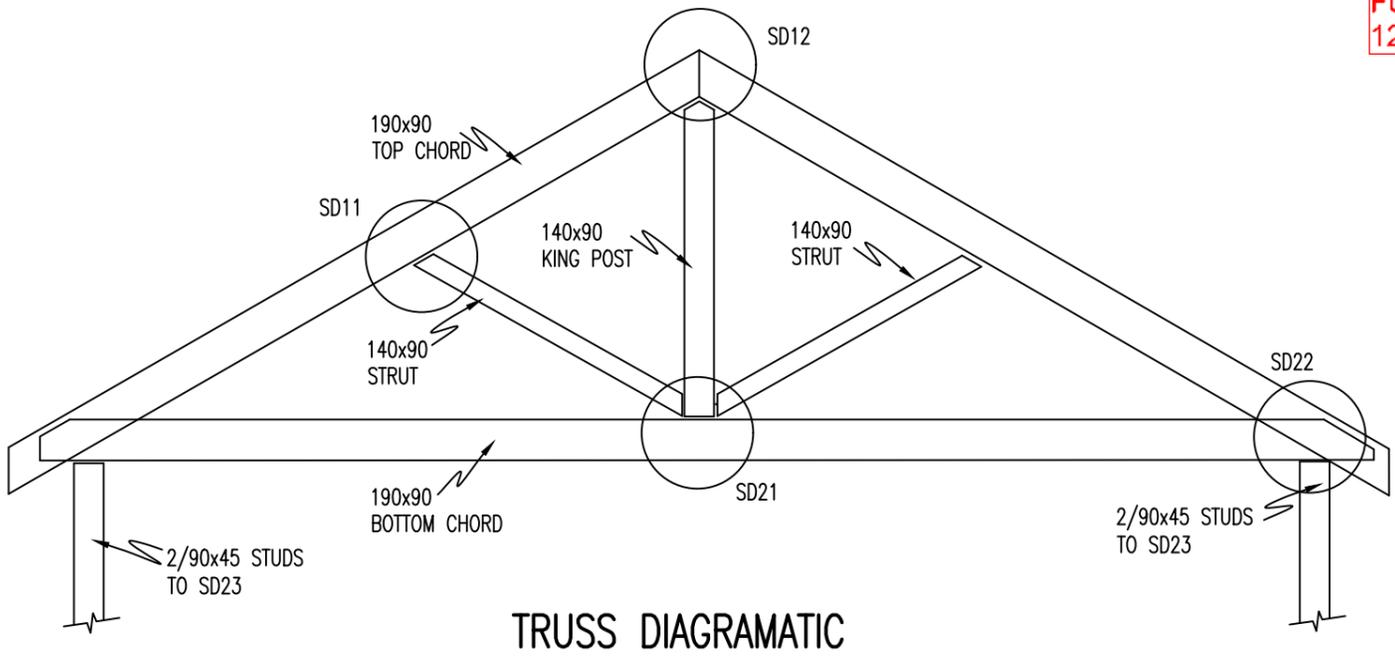
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# UPPER FLOOR JOISTS

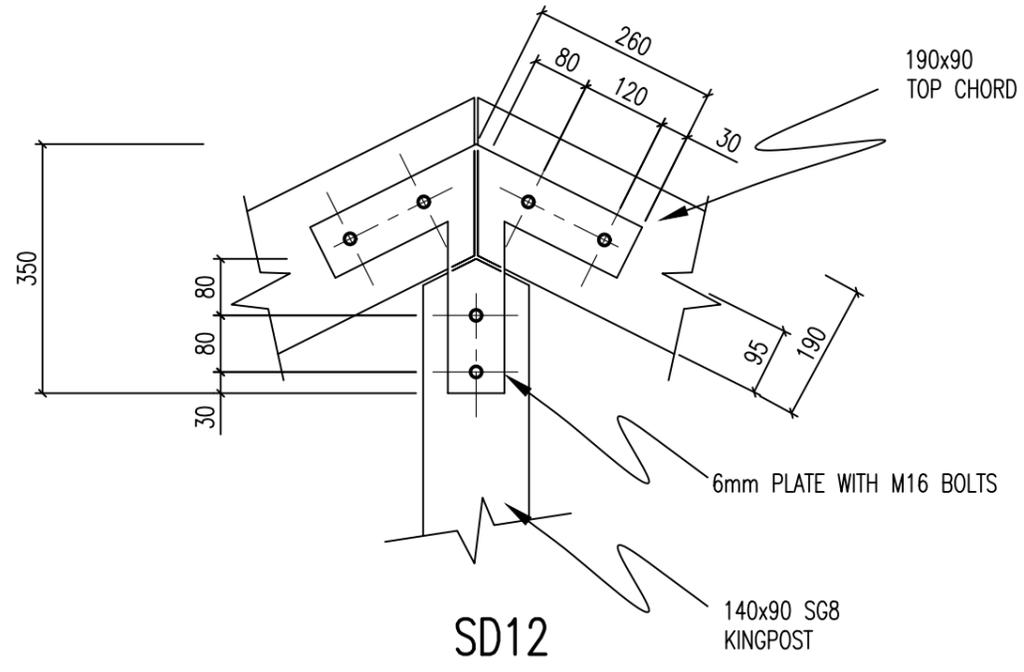
SCALE 1:100

<b>LOT 43 ANDERSON PARK, WAIKANAЕ</b>		<b>6</b>
JOB # 2023-04-3230	PROPOSED NEW HOUSE AT LOT 43 ANDERSON PARK, WAIKANAЕ, KAPITI COAST	26/04/2023

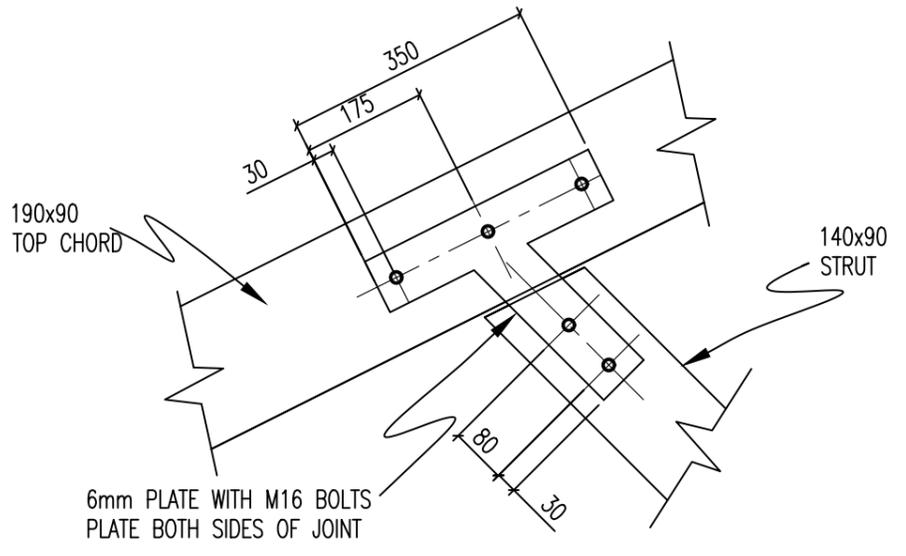
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12/10/23



TRUSS DIAGRAMATIC



SD12



SD11

No.	AMENDMENT	NAME	DATE
A	DRAFT	PB	15/06
B	CONSENT SS4	PB	11/10

NOTES:

REFER TO ONBOARD ARCHITECTURAL DESIGN PLANS FOR DETAILS AND DIMENSIONS

ANY DISCREPANCIES WITH THE ENGINEERS AND ARCHITECTS DRAWINGS SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING

ANY VARIATION FROM THESE DRAWINGS OR SUBSTITUTION OF SPECIFIED PRODUCTS SHALL REQUIRE ENGINEERS APPROVAL PRIOR TO PROCEEDING

ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CURRENT CODE OF PRACTICE

THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR

THE CONTRACTOR TO PROVIDE 24 HOURS NOTICE FOR ALL INSPECTIONS AT WHICH TIME ALL WORK TO BE INSPECTED SHALL BE COMPLETE

CONTRACTOR SHALL DETERMINE FROM THE TERTIARY AUTHORITY WHAT INSPECTIONS ARE REQUIRED BY THE ENGINEER

THE CLIENT SHALL PROVIDE A COPY TO THE TA AND RETAIN A COPY FOR THEIR OWN RECORDS

**Base Consulting Engineers Limited**



279 Oxford Street  
P O Box 434  
Levin 5540

Telephone Levin 06-367 0088  
Paraparaumu 04-297 0088  
Mobile 027 44 44 080

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**STRUCTURAL DETAILS**

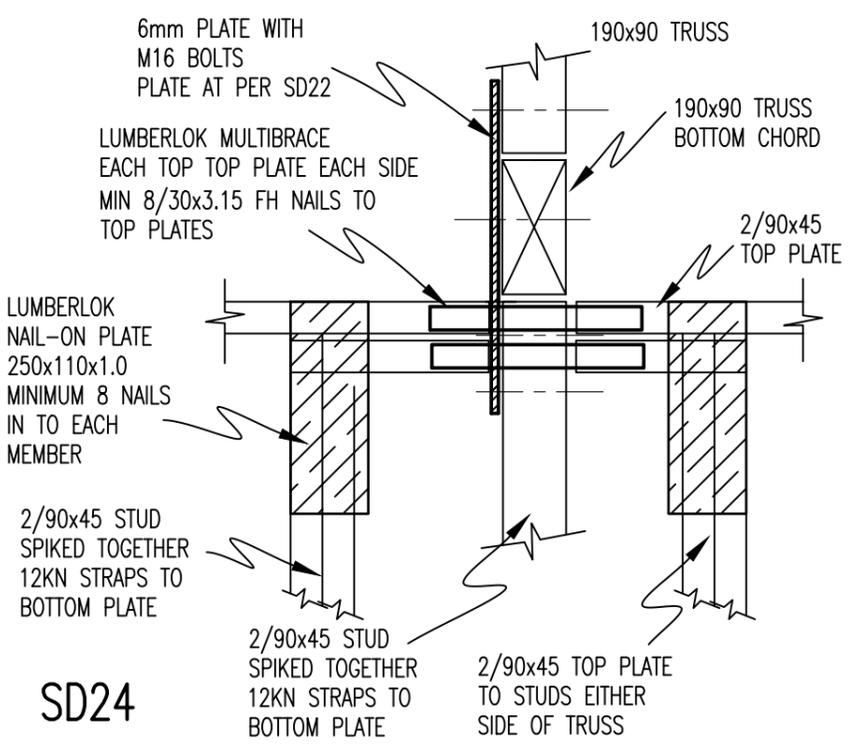
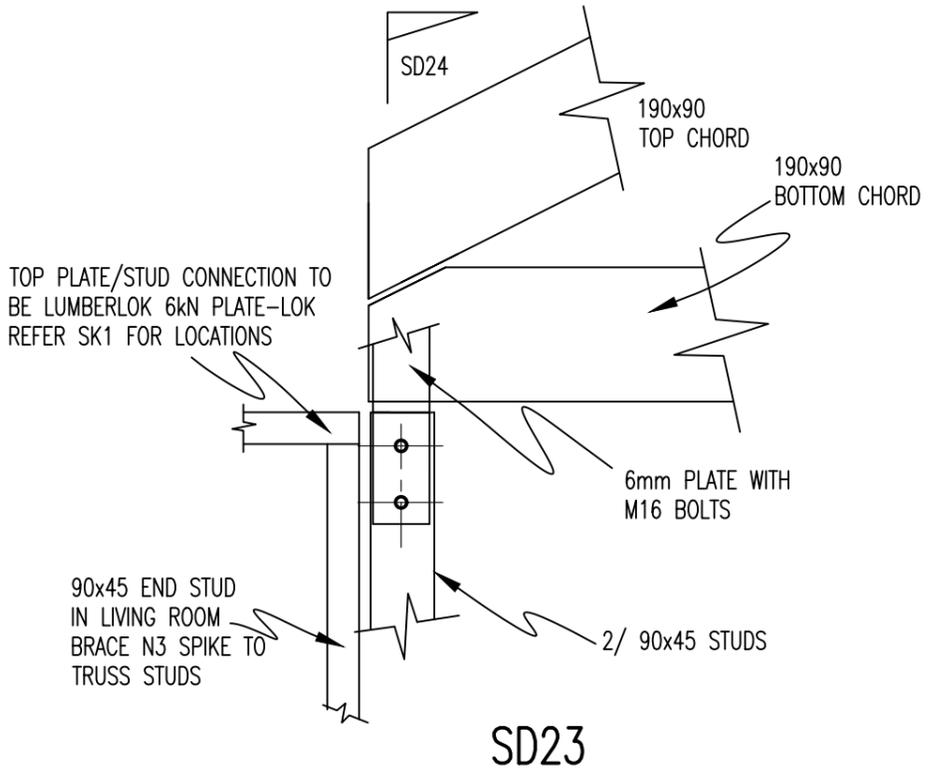
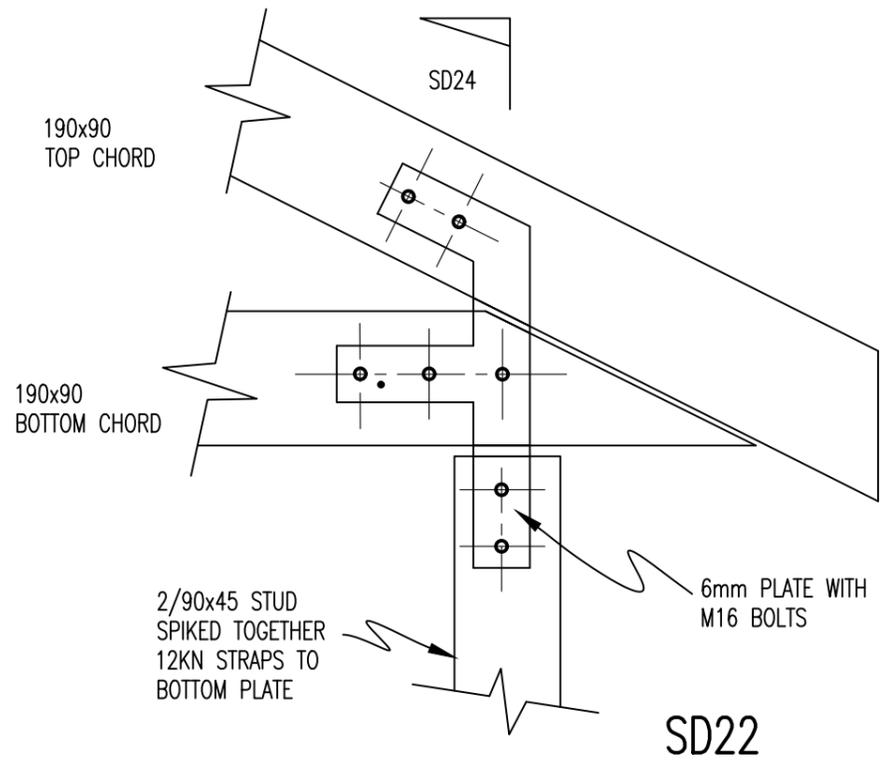
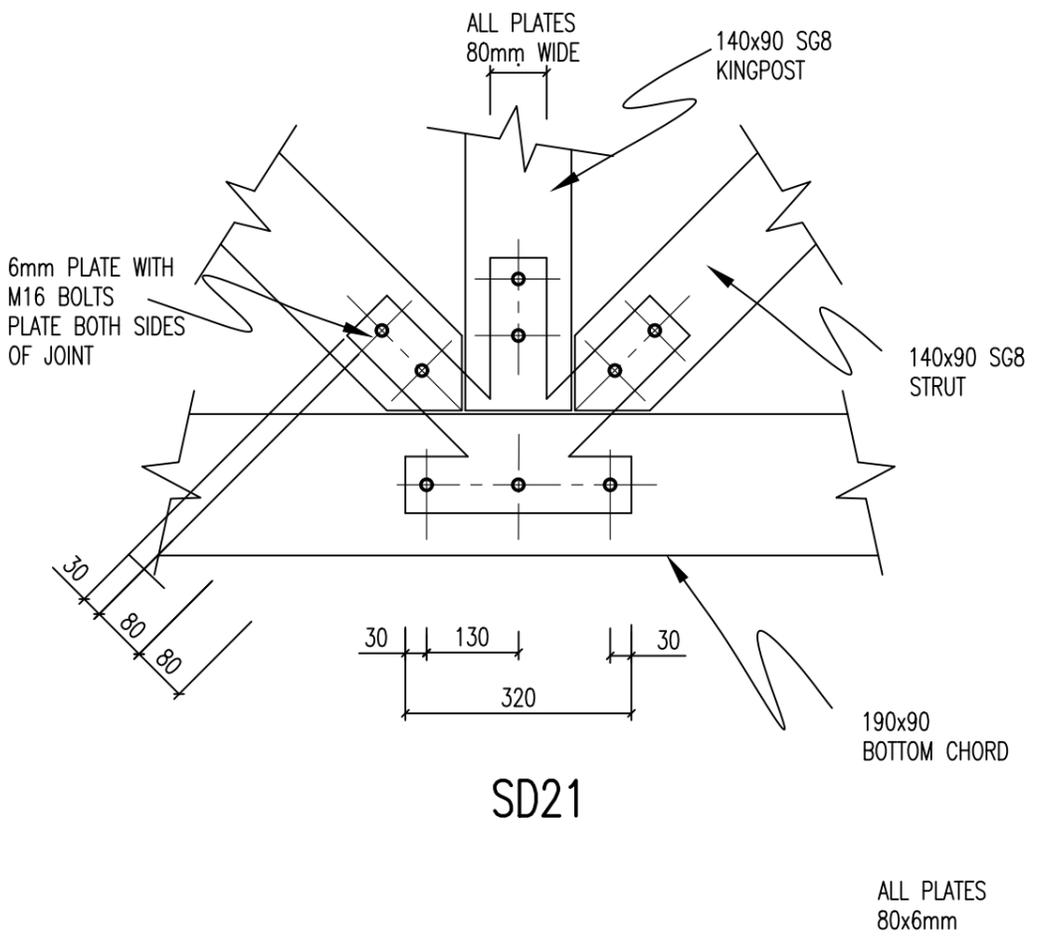
ATKINSON DWELLING  
Lot 43  
ANDERSON PARK  
WAIKANAE

SCALE  
AS SHOWN

	NAME	DATE	DRAWING NUMBER
FIELDWORK			23055 SS1
DESIGNED	PB	7/6/23	
DRAWN	PB	8/6/23	
CHECKED	PB	15/6/23	

SHEET 1 OF 4 SHEETS

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12/10/23



No.	AMENDMENT	NAME	DATE
A	DRAFT	PB	15/06
B	CONSENT SS4	PB	11/10

**NOTES**

REFER TO THE ONBOARD ARCHITECTURAL DRAWINGS FOR DIMENSIONS AND DETAILS.  
DO NOT SCALE OFF THIS DRAWING

CHECK ALL DIMENSIONS ON SITE PRIOR TO FABRICATION

ALL WORKMANSHIP AND MATERIALS SHALL COMPLY WITH NZS3602 AND NZS3603. LIGHT TIMBER FRAME CONSTRUCTION SHALL BE IN ACCORDANCE WITH NZS3604.  
CHEMICAL PRESERVATION OF ROUND AND SAWN TIMBER SHALL BE IN ACCORDANCE WITH 3640

ALL SAWN AND GLUE LAMINATED TIMBER TO BE GRADE SG8 UNLESS NOTED OTHERWISE

ALL BOLTED CONNECTIONS TO HAVE 50x50x3 WASHERS WHERE IN CONTACT WITH TIMBER

PROVIDE MINIMUM 24 HOURS NOTICE FOR INSPECTIONS BY ENGINEER AT WHICH TIME ALL WORK TO BE INSPECTED SHALL BE COMPLETED

PROPRIETARY FIXINGS AND TIMBER CONNECTORS SHALL BE SELECTED IN ACCORDANCE WITH NZS3604:20211 SECTION 4-DURABILITY

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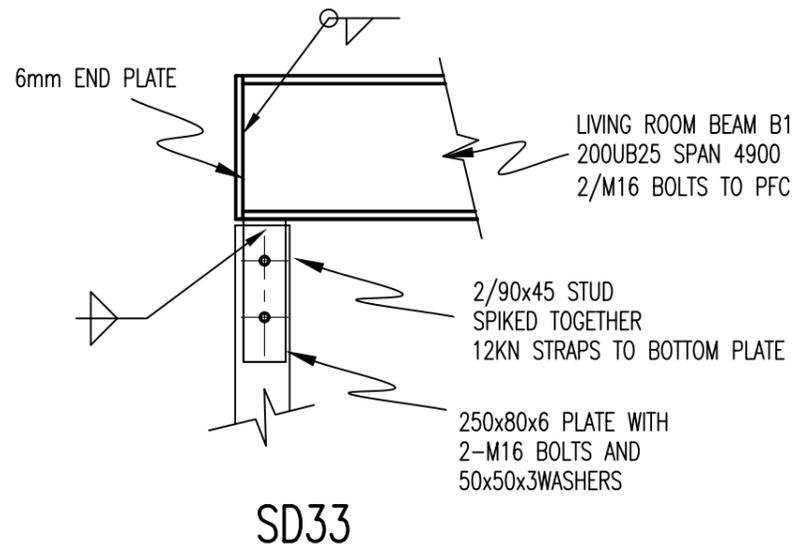
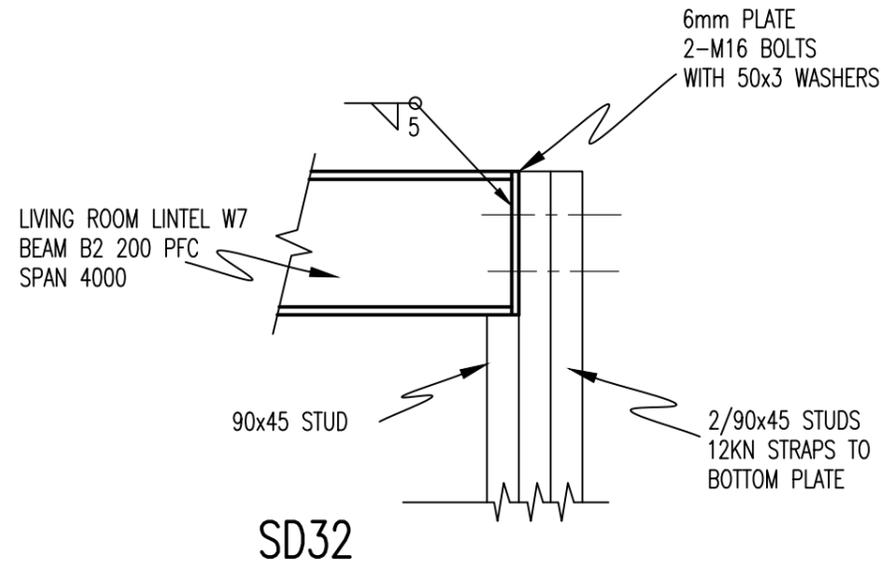
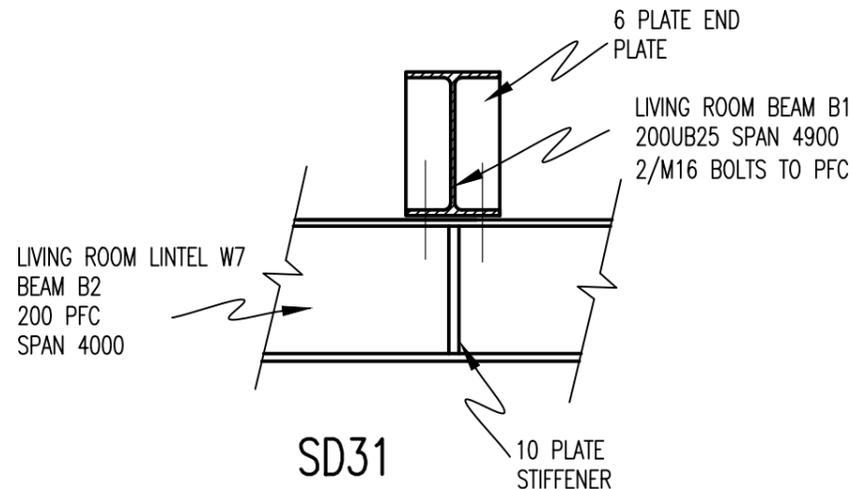
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P O Box 434  
Levin 5540

Telephone Levin 06-367 0088  
Paraparaumu 04-297 0088  
Mobile 027 44 44 080

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STRUCTURAL DETAILS			
ATKINSON DWELLING Lot 43 ANDERSON PARK WAIKANAE			
SCALE AS SHOWN			
	NAME	DATE	DRAWING NUMBER
FIELDWORK			23055 SS2
DESIGNED	PB	7/6/23	
DRAWN	PB	8/6/23	
CHECKED	PB	15/6/23	
			SHEET 2 OF 4 SHEETS

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12/10/23



PROPRIETARY FIXINGS AND TIMBER CONNECTORS SHALL BE SELECTED IN ACCORDANCE WITH NZS3604:2011 SECTION 4-DURABILITY

STEEL PROTECTION NOTES

INTERNAL STEELWORK TO HAVE PROTECTION TO NZS-TS-3404 TABLE 4. ABRASIVE CLEAN TO CLASS 2½ IZS1 SYSTEM OR EQUIVALENT

STEEL NOT ENCLOSED SHALL BE SAND BLASTED FOLLOWING WHICH SURFACE PREPARATION IS TO COMPRISE CORROSION PROTECTION TO BE RESENE ARMOURCOTE ACC6 IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATION.

REGULAR MAINTENANCE IS REQUIRED FOR ALL STRUCTURAL STEEL TO ENSURE COMPLIANCE IS TO NZ BUILDING CODE ACCEPTABLE SOLUTION B2/AS2.1.3 DURABILITY FOR CORROSION ZONE D

SERVICES AND SITE SAFETY

THE CONTRACTOR SHALL COMPLY WITH THE HEALTH AND SAFETY ACT AND SITE SAFE REQUIREMENTS

ANY EXISTING SERVICES SHALL BE LOCATED BY THE CONTRACTOR AND IF IN CONFLICT WITH THE STRUCTURE, SHALL NOTIFY THE ENGINEER

ALL NEW SERVICES IN TO THE STRUCTURE SHALL BE PROTECTED WITH FLEXIBLE CONNECTIONS

THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR

No.	AMENDMENT	NAME	DATE
A	DRAFT	PB	15/06
B	CONSENT SS4	PB	11/10

NOTES

REFER TO THE ONBOARD ARCHITECTURAL DRAWINGS FOR DIMENSIONS AND DETAILS.  
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**STRUCTURAL DETAILS**

ATKINSON DWELLING  
Lot 43  
ANDERSON PARK  
WAIKANAЕ

SCALE  
AS SHOWN

	NAME	DATE	DRAWING NUMBER
FIELDWORK			23055 SS3
DESIGNED	PB	7/6/23	
DRAWN	PB	8/6/23	
CHECKED	PB	15/6/23	

SHEET 3 OF 4 SHEETS



# MAXSTONE CLADDING SYSTEM TECHNICAL BULLETIN

## FIXING OF MAXSTONE CLADDING RANGE TO WALL SUBSTRATES

The following schematic diagrams give some guidance in relation to the fixing systems needed for the Maxstone Cladding range.

Please refer to individual product specifications for correct laying practices and technical data.

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Maxstone Cladding  
15 Year Guarantee



Sika Davco  
15 Year Waterproofing  
System Guarantee

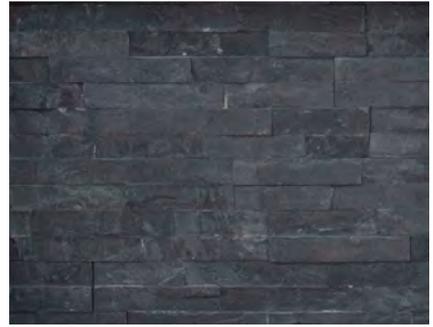
# MAXSTONE CLADDING OPTIONS



**Maxstone Strip Autumn**  
Cladding 150x550  
Corner 150x550



**Maxstone Strip Grey Stone**  
Cladding 150x550  
Corner 150x550



**Maxstone Strip Black Stone**  
Cladding 150x550  
Corner 150x550



**Maxstone Modular Cladding Autumn**  
Mixed sizing in box allows for body pieces and corners.

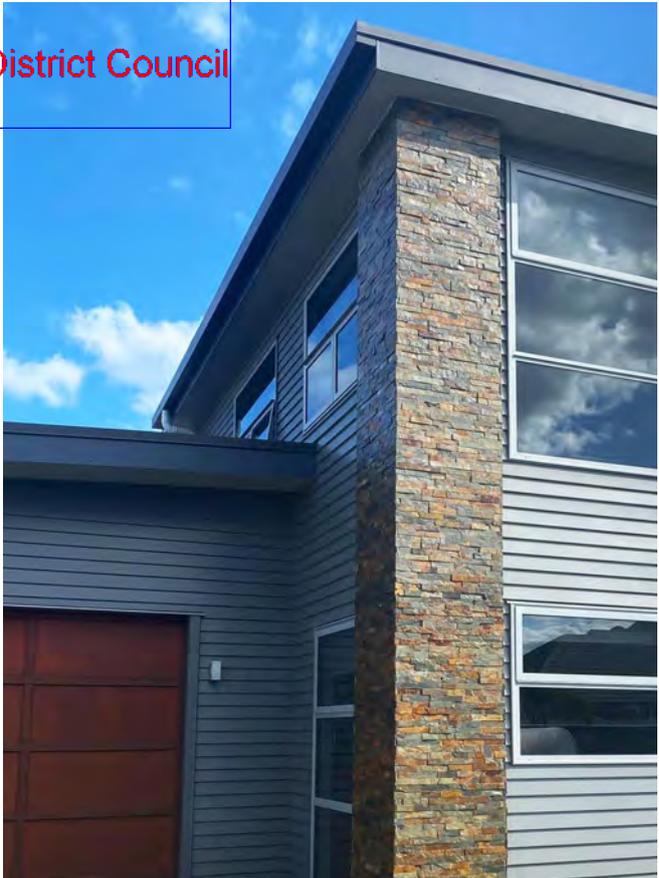


**Maxstone Modular Cladding Schist**  
Mixed sizing in box allows for body pieces and corners.



**Maxstone Modular Cladding Black**  
Mixed sizing in box allows for body pieces and corners.

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## MAXSTONE STRIP CLADDING LAYOUT

Please see below for the Maxstone Stone Strip cladding layout. These styles come in two parts, the main body piece and the corner piece.

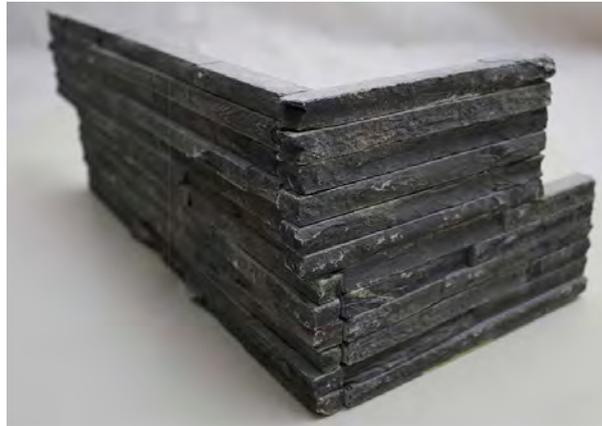
This product has a thickness of 5mm-25mm. Sizes are as follows:

Body Piece: 150x550mm

Interlocking Corner: 2 Pieces combined size 150x550mm

1 Piece - 400x150mm

1 Piece - 150x150mm



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Maxstone cladding features interlocking shape to give a natural look once installed. This natural stone has natural variation from piece to piece, no 2 pieces are the same. As each piece is pre-formed to install like tiles, it save labour costs for you.

Variation in shade and caliber and imperfect edges is a character of Natural Stone and adds to the authentic look.



## MAXSTONE MODULAR CLADDING LAYOUT

Please see below for the Maxstone Stone Modular Cladding layout - these pieces are designed to randomly lay and have finished edges for external corners.

Stone is a natural product presenting variations which need to be worked with from time to time. Should the stone not interlock properly, options are:

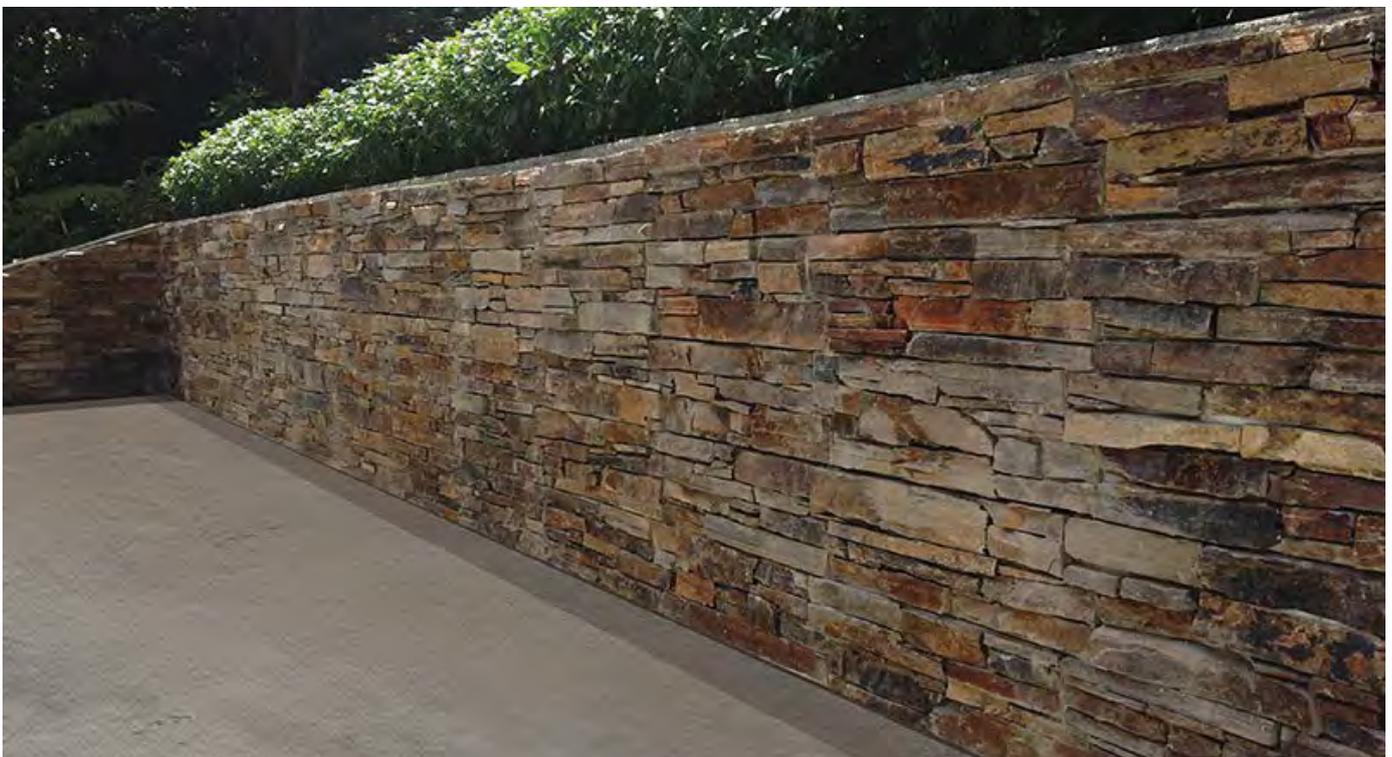
1. To trim the stone internal edge closing any visible gap.
2. Point with your grey adhesive or the closest possible grout colour.

This product has a thickness of 25-40mm. It is sold by the box and contains below:

- 2 pcs 550x200mm
- 2 pcs 330x200mm
- 2 pcs 220x200mm



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## MAXSTONE CLADDING FIXING SUBSTRATE OPTIONS

Please see a list below of approved substrate systems that can be used alongside the Maxstone Cladding system.



MAXSTONE STONE CLADDING: IBS BUILDING PRODUCTS  
PRIMAflex or PRIMAAqua 9mm only.  
[www.ibs.co.nz](http://www.ibs.co.nz)



MAXSTONE STRIP CLADDING: BGC PLASTER BOARD  
(Can be used for Maxstone Venetian/Strip Cladding only)  
BGC Stonesheet 9mm  
[www.bgcplaster.com](http://www.bgcplaster.com)

These systems must be installed in accordance with the manufacturers technical information. For full up-to-date specification and installation information please contact the manufacturer directly, or visit the above Websites.

## MAXSTONE CLADDING TECHNICAL DIAGRAMS

Maxstone Cladding technical diagrams are available on our website. These show all installation details which can be given to builders or passed on to the council with your building plans.

These are available in both .pdf and .cad formats and can be found at:  
[www.tilemax.co.nz/Maxstone\\_Cladding\\_Systems](http://www.tilemax.co.nz/Maxstone_Cladding_Systems)

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# SPECIFICATION FOR EXTERNAL TILE INSTALLATION MAXSTONE CLADDING

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## PRODUCTS:

Client: TileMax NZ  
Prepared by: Nick Collett & Ewen McDougall  
Version: 1  
Date: 16/02/2022

**Sika Australia Pty Limited**  
ABN 12 001 342 329  
Tel: 1300 22 33 48  
aus.sika.com

**BUILDING TRUST**



Davco products are available for purchase through Tilemax Limited. Please see page 13 for store contact information.

MAXSTONE CLADDING RANGE TECHNICAL BULLETIN - Version 7 2022

PAGE 6



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## Part 1 - General

### 1.1 Summary

- A. This specification describes the execution of the installation of tiles externally to a masonry substrate wall.
- B. The described procedure follows best practice procedures and the requirements of AS3958 Part 1 and Part2.
- C. This specification assumes that the structural substrate is structurally sound and fit for purpose.
- D. Substrates are nominated nominated by the Maxstone fixing guide as per the below information:
  - PRIMAFlex or PRIMAAqua 9mm [www.ibs.co.nz](http://www.ibs.co.nz)
  - BGC Stonesheet 9mm [www.bgcplaster.com](http://www.bgcplaster.com)
- E. This specification is for tiles that are, dimensionally stable, NOT moisture sensitive and fit for purpose.

### 1.2 Quality Assurance

- A. Manufacturing qualifications

The manufacturer of the specified product shall be ISO 9001:2008 certified and have in existence a recognized on going quality assurance program, independently audited on a regular basis.

- B. Contractor qualifications:

Contractor shall be qualified in the field of tile installation with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

- C. For installations where the stone is fixed above 2.4 meters high. This specification shall be used in conjunction with mechanical fixing designed and supplied by others. These installations shall be approved by a suitably qualified engineer.
- D. For installations over framed substrates the system shall be approved by a suitably qualified engineer to ensure the substrate(s) are engineered to accommodate the incumbent loads of the stone system.
- E. Materials should be installed in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets (MSDS) for complete handling recommendations.

### 1.3 Delivery, Storage, and Handling

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended in the PDS

### 1.4 Job Conditions

- A. Environmental Conditions: Do not apply material if it is raining or if such conditions appear to be imminent. Application temperature should be between 5°C and 35°C.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.



- C. All for all products to adequately cure in accordance with data sheets. Note in cold weather the curing process is prolonged. Finished works shall be protected during cold weather and in hot weather provide shade to areas being tiled.

#### 1.5 Submittals

- A. Submit two copies of manufacturer's literature including but not limited to: Product Data Sheets (PDS), and appropriate Material Safety Data Sheets (MSDS).

#### 1.6 Manufacturer

- A. Tile Adhesive – **SMP EVO mixed with Davco Davelastic additive** supplied by Sika Australia Pty Ltd is considered appropriate for these works
- B. Joint Sealant – **Sikaflex Pro** supplied by Sika Australia Pty Ltd is considered appropriate for these works
- C. Joint Sealant Primer – **Sika Primer -3N** supplied by Sika Australia Pty Ltd is considered appropriate for these works

### Part 2 - EXECUTION

#### 2.1 SURFACE PREPARATION

- i. The substrate shall be in a good sound condition and free from dust, oils and grease, loose or friable materials, laitance and other surface contamination and materials which will reduce bond.
- ii. If required fill any substrate imperfections i.e. voids and or blow outs with an appropriate Sika repair mortar.
- iii. The Areas to receive tiles shall be true to within 5mm in 3m. and be primed with **Davco PrimeX** and allow to dry.

##### General fixing notes:

- Maxstone system must be supported with a stainless steel metal angle, mechanically fastened to the wall before the first course is laid.
- The Maxstone should be stack laid on top of each other with no horizontal gaps.
- If constructed above 2.4 metres in height, stainless steel angles must be installed at intervals of maximum 2.4m, including suitable stainless steel fixings. **DO NOT** use aluminium, brass or galvanised steel supports and / or fixings. Consult an engineer and the manufacturer of the stack stone system for specific details and instructions.
- Check for contamination / epoxy coating on back of stack stone – if present it **MUST** be removed.
- Do not spot fix – 98% adhesive coverage is the minimum requirement.
- If there is any doubt, check / confirm the structural integrity and construction methods employed with a qualified façade engineer.
- All perimeter and expansion joints are to be sealed with a suitable Sika flexible sealant

**Framed substrates notes:** Please ensure all board substrate are designed to accommodate the incumbent loads and are specifically designed to receive a tile installation. Ensure substrates are installed as per the strict manufacturer instructions. Mechanical fixing and or shelving angles shall be designed by an suitable qualified engineer or referred to Maxstone fixing instructions

**Renderers:** for installation over brickwork or concrete masonry units (CMU) all surfaces must be thoroughly cleaned down and adequate mechanical keying provided where necessary. A splash coat must initially be applied to the face, which consists of:

- 1 Part Lanko Latex 751
- 1 part water
- 2 parts neat cement

The splash coat should be applied with a brush or broom and must not exceed 2mm in thickness. Whilst the splash coat is still moist and tacky, the render must be laid. It is required that 1 part Lanko 751, 3 parts water be used as an added mixture in the render mix in place of water. This enhances adhesion, flexibility, tensile

strength, impact/water resistance in the rendered wall. The use of plasticisers in the render mix is not permitted.

The render mixture should be:

- 1 part cement
- 3 - 4 parts clean washed sand

Renders shall be allowed to dry for 5-7 days prior to applications of waterproofing membrane or stone adhesives.

#### **WATERPROOFING MEMBRANE (WHERE REQUIRED)**

All framed substrates shall require a waterproofing membrane.

Apply a minimum 2 coat of Davco Dampfast membrane to required areas in accordance with the product datasheet.

Allow the waterproofing membrane to dry between coats.

Periodically check the membrane thickness to ensure adequate films are being achieved in accordance with the product datasheet requirements.

#### **2.2 STONE ADHESIVE INSTALLATION**

- i. Substrate that do NOT require a waterproofing membrane shall be primed with Davco PrimeX prior to fixing the stone
- ii. The adhesive shall be applied to the prepared substrate using a notch trowel to achieve a minimum 90% coverage to the substrate and the back of the tile. Use an appropriate size notched trowel to achieve a minimum adhesive layer of 3mm.
- iii. Back-buttering the stone with adhesive is required to achieve 98% coverage to both the tile and substrate. Ensure tiles are properly bedded and adhesive ridges are broken to adequately support the tile.
- iv. Clean any wet adhesive off the face of the stone prior to drying with clean water and a sponge while the adhesive is still wet.
- v. Periodically check for adequate adhesive coverage throughout installation

**Stone adhesive mixing ratio:** A 20kg bag of Davco SMP EVO shall be mixed with Davelastic Additive at a ratio of 1:1 with clean potable water. Refer product datasheet for additional mixing instructions.

#### **2.3 EXPANSION, PERIMETER AND MOVEMENT JOINTS**

- i. Existing joints in substrate shall be carried through tiling works
- ii. Install new movement and expansion joints in accordance with AS3958 as required
- iii. Expansion Joint size, dimensions and locations shall be designed by architect / engineer or suitably qualified person

END OF SIKA® SYSTEM SPECIFICATION



**Ewen McDougall**  
Specifications Consultant  
Sika Australia



**Nick Collett**  
Market Field Manager- Building Finishing  
Sika Australia

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The information contained herein and any other advice are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. The information only applies to the application(s) and product(s) expressly referred to herein and is based on laboratory tests which do not replace practical tests. In case of changes in the parameters of the application, such as changes in substrates etc., or in case of a different application, consult Sika's Technical Service prior to using Sika products. The information contained herein does not relieve the user of the products from testing them for the intended application and purpose. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

## MAXSTONE CLADDING BASE FIXING

Aluminium/stainless steel L-profile trim is to be used at the base point or second course of your installation as it will assist to hold the shear weight of the stone.

Maxstone Stone Cladding: 30mm x 50mm x 1.6mm

Maxstone Strip Cladding: 20mm x 20mm x 1.6mm

When installing the aluminium/ss L-Profiles: Please refer to Fig. 1 below.

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To fix the L-Profile, run a bead of neutral cure silicone around the back of the L-Profile (Picture framing it).

Fix to the wall with 65mm stainless steel screws at 400mm centres along the length of the trim in the studs. After drilling the holes, fill first with neutral cure silicone before inserting the screws.

Mix and use waterproofing/adhesive as per supplier installation procedure.

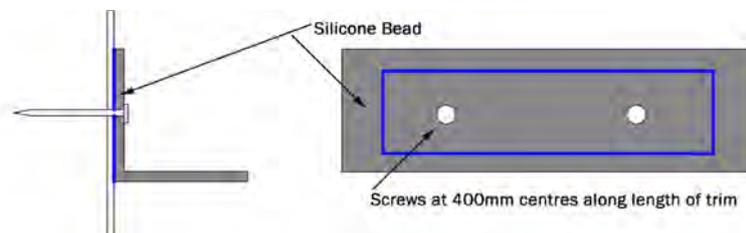
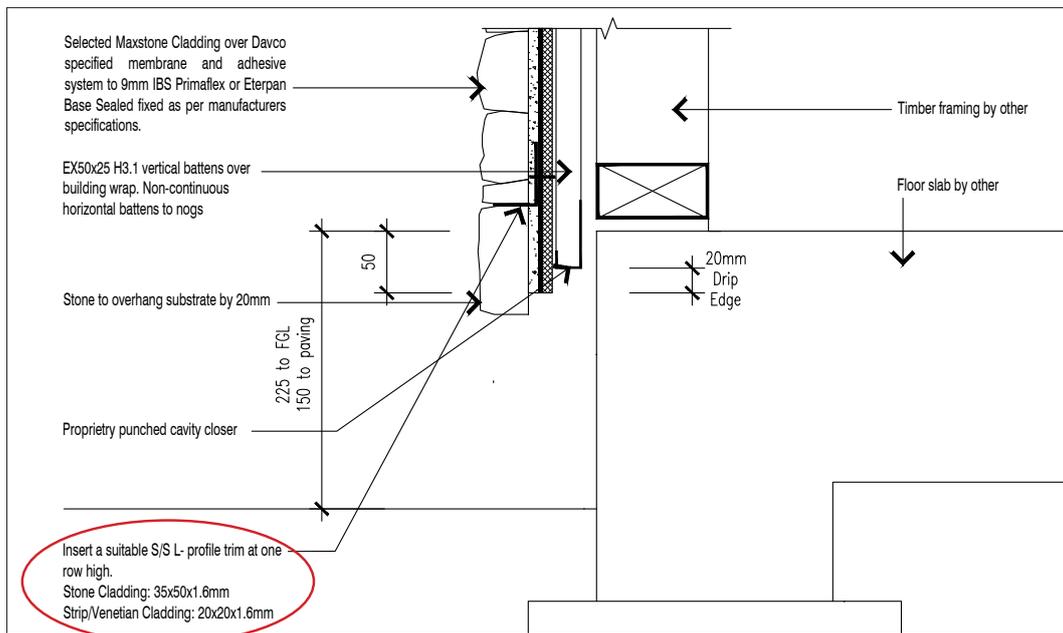


Fig. 1: L-Angle fixing diagram



NB:

- For Paved Surfaces, cladding must finish 100mm above the ground to allow for a weep hole (As per NZS 3604 or NZBC E2, Clause 9.1.3.2)

- For Non-Paved Surfaces (eg. Grass), the cladding needs to finish 150mm above the ground to allow for a weep hold (As per NZS 3604 or NZBC E2, Clause 9.1.3.2)

- For situations where a flush threshold is required or the standard distance to paved ground cannot be met, Accrete Design ([www.accrete.co.nz](http://www.accrete.co.nz)) will be able to supply a grate and drain to suit the cladding system if required for specification. This is called: level threshold two stage system.

## MAXSTONE CLADDING INSTALLATION METHOD

When installing your Stone facade, it is important to take the time to bed your stone correctly. Please use the following method to ensure correct stone adhesion.

1. Correct adhesion is achieved by first burning adhesive into the substrate and finishing it with a flat screed (Fig. 1 + 2).
2. The flat surface is then to be notched with a 12 or 15mm trowel.
3. Generously back butter your stone (Fig. 3).
4. As you bed each piece of stone, push it down and move the product from left to right. This motion will ensure coverage and see adhesive mold around the edge of the stone. This will bond the Z-lock stone pieces as they come together (Fig 4).
5. A wet paint brush should be used to smooth any product over flow ensuring all joints are evenly filled with mortar. If the joints are not fully filled, then pipe or gun additional mortar in the joints - **Do not leave joints unfilled** (Fig. 5).



Fig. 1: Adhesive on trowel to be burnt into the substrate.



Fig. 2: Flat screed the adhesive.



Fig. 3: generously back butter the stone.



Fig. 4: Bed each piece of stone, letting adhesive come though.



Fig. 4: Ensure all joints are evenly filled with adhesive - no gaps.

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## TILEMAX STORE CONTACT INFORMATION

### East Tamaki - AKL

**Phone:** (09) 273 0151  
**Email:** easttamaki@showerwell.co.nz  
**Address:**  
 Showerwell Home Products,  
 21 Neilpark Drive,  
 East Tamaki

### Albany - AKL

**Phone:** (09) 443 5633  
**Email:** takapuna@showerwell.co.nz  
**Address:**  
 Showerwell Home Products,  
 14a Tawa Drive,  
 Albany

### St. Lukes - AKL

**Phone:** (09) 845 8212  
**Email:** sales@showerwell.co.nz  
**Address:**  
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 15 Gordon Road,  
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**Address:**  
 5a MacDonald Street,  
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### Petone - Hutt City

**Phone:** (04) 568 5570  
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 Frankton  
 Queenstown

### Dunedin

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 South Dunedin,  
 Dunedin



See the full range at: [www.tilemax.co.nz](http://www.tilemax.co.nz)

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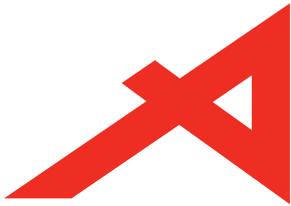
#### IMPORTANT:

This technical bulletin provides guideline information only and is not intended to be interpreted as a general specification for the application/installation of the IBS PRIMAFlex or the BGC Stonesheet. It is however, an official specification for SIKA Davco adhesives (official documentation can be obtained from Tilemax). Since each project potentially differs in exposure/condition, specific requirements may vary from the information contained herein. For recommendations for specific applications/installations, please contact your nearest Tilemax Store.

#### DISCLAIMER:

The information presented in this technical bulletin is, to the best of our knowledge, true and accurate. No warranty is implied or given to its accuracy in describing the installation of the PRIMAFlex product (this can be found at [www.ibs.co.nz](http://www.ibs.co.nz)). The information on the Davco product is warrantable as per the above paragraph. Users are asked to check that the literature in their possession is the latest issue.

This specification is subject to change.  
 Current information is supplied from February 2022



**BRANZ Appraised**  
Appraisal No. 764 [2017]

## SHADOWCLAD® VENTILATED CAVITY CLADDING SYSTEM

**Appraisal No. 764 [2017]**

This Appraisal replaces BRANZ  
Appraisal No. 764 [2011]

Amended 1 March 2021



### BRANZ Appraisals

Technical Assessments of  
products for building and  
construction.



### Carter Holt Harvey Plywood Ltd

Private Bag 92-106  
Auckland

Tel: 0800 326 759

Fax: 09 633 1582

Web: [www.chhply.co.nz](http://www.chhply.co.nz)



### BRANZ

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RD1, Porirua 5381  
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## Product

- 1.1 Shadowclad® Ventilated Cavity is a cavity-based external wall cladding system for residential and light commercial type buildings where domestic construction techniques are used.
- 1.2 The system consists of Shadowclad® sheets, timber cavity battens, flashings and accessories and is finished with either an acrylic paint system or penetrating, or film forming stain.
- 1.3 Shadowclad® Ventilated Cavity incorporates a primary and secondary means of weather resistance [first and second line of defence] against water penetration by separating the cladding from the external wall frame with a nominal 20 mm drained cavity.

## Scope

- 2.1 Shadowclad® Ventilated Cavity has been appraised as an external wall cladding for buildings within the following scope:
  - the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
  - constructed with timber framing complying with the NZBC; and,
  - with a risk score of 0-20, calculated in accordance with NZBC Acceptable Solution E2/AS1, Table 2; and, The use of dark colours with an LRV of less than 50 and failure to adequately maintain them increases the risk of aesthetic related issues such as face checking. For this reason CHH Plywood does not support the use of dark colours on Shadowclad exterior cladding.
  - situated in NZS 3604 Wind Zones up to, and including Extra High; and,
  - with a building height of ≤ 10 m and at a distance of ≥ 1.0 m to the relevant boundary.
- 2.2 Shadowclad® Ventilated Cavity has also been appraised as an external wall cladding for specifically designed buildings within the following scope:
  - the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
  - constructed with timber framing complying with the NZBC; and,
  - situated in specific design wind pressures up to a maximum design differential ultimate limit state (ULS) of 2.5 kPa; and,
  - with a building height of ≤ 10 m and at a distance of ≥ 1.0 m to the relevant boundary.
- 2.3 Shadowclad® Ventilated Cavity is appraised for use with aluminium window and door joinery that is installed with vertical jambs and horizontal heads and sills. *[The Appraisal of Shadowclad® Ventilated Cavity relies on the joinery meeting the requirements of NZS 4211 for the relevant Wind Zone or wind pressure.]*

## Building Regulations

### New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Shadowclad® Ventilated Cavity, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the NZBC:

**Clause B1 STRUCTURE:** Performance B1.3.1, B1.3.2 and B1.3.4. Shadowclad® Ventilated Cavity meets the requirement for loads arising from self-weight, wind, impact and creep [i.e. B1.3.3 (a), (f), (j) and (q)]. See Paragraphs 9.1 – 9.3.

**Clause B2 DURABILITY:** Performance B2.3.1 (b), 15 years, and B2.3.2. Shadowclad® Ventilated Cavity meets these requirements. See Paragraphs 10.1 – 10.5.

**Clause E2 EXTERNAL MOISTURE:** Performance E2.3.2. Shadowclad® Ventilated Cavity meets this requirement. See Paragraphs 14.1 – 14.5.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. Shadowclad® Ventilated Cavity meets this requirement and will not present a health hazard to people.

## Technical Specification

4.1 System components and accessories supplied by Carter Holt Harvey Plywood Limited are as follows:

### Shadowclad® Sheets

- Shadowclad® sheets are nominal 12 mm thick structural plywood sheets manufactured from New Zealand pinus radiata veneers. They are 1216 mm wide and either 2440 mm or 2745 mm long. They have a textured surface finish on the exposed face.
- Shadowclad® sheets are available as either Shadowclad® Natural or Shadowclad® Ultra finish. Shadowclad® Natural is an uncoated panel for use with penetrating stains, film forming stains and paints. Shadowclad® Ultra has a factory applied powder coat exterior primer for use with paints and film forming stain topcoats. Shadowclad® Ultra is not suitable for use with penetrating stains.
- Shadowclad® Natural and Shadowclad® Ultra are both available as Texture and Texture Groove surface finish. Texture Groove has 9 mm wide by 5 mm deep grooves at 150 mm centres running vertically down the outside face of the sheet.
- Shadowclad® Natural sheets are available as Hazard Class H3.1 treated only. Shadowclad® Ultra sheets are available in either H3.1 or H3.2 CCA treated.

### Shadowclad® Accessories

- Shadowclad® flashings:** horizontal 'Z' flashing, inter-storey 'Z' flashing, internal 90° angle, internal 'W' angle, large internal 'W' angle, external box angle, large external box angle and flat flashing for vertical negative detail. Shadowclad® flashings are available in extruded aluminium and folded stainless steel.
  - Cavity vent strip:** manufactured from aluminium or stainless steel, available in 3600 mm lengths.
- 4.2 Accessories used with Shadowclad® Ventilated Cavity which are supplied by the building contractor are:
- Shadowclad® sheet fixings:** 60 x 2.8 mm hot-dip galvanised or ring shank stainless steel flat head nails, 8 gauge x 65 mm AS 3566 Corrosion Class 4 mechanically zinc plated wood screws or 8 gauge x 65 mm stainless steel wood screws. *[Note: Stainless steel fixings must be Grade 316 and hot-dip galvanising must comply with AS/NZS 4680].*
  - Exterior Battens:** 65 mm wide x 18 mm thick timber batten, dressed or bandsawn, treated to Hazard Class H3.1 and with 6 x 6 mm weathergrooves.
  - Cavity battens:** nominal 45 mm wide x 20 mm thick or 75 mm wide x 20 mm thick merchant grade timber treated to Hazard Class H3.1.
  - Cavity batten fixings:** 40 x 2.5 mm hot-dip galvanised or stainless steel ring shank flat head nails.

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- **Flexible wall underlay:** wall underlay complying with NZBC Acceptable Solution E2/AS1, Table 23, or breather-type membranes covered by a valid BRANZ Appraisal for use as wall underlay.
- **Rigid wall underlay:** sheet complying with NZBC Acceptable Solution E2/AS1, Table 23, or rigid sheathing covered by a valid BRANZ Appraisal for use as rigid air barrier systems.
- **Brush on timber preservative:** brush on timber preservatives as listed in the Technical Literature for Shadowclad® Ventilated Cavity.
- **Flexible flashing tape:** flexible flashing tapes complying with NZBC Acceptable Solution E2/AS1, Paragraph 4.3.11, or flexible flashing tapes covered by a valid BRANZ Appraisal for use around window and door joinery openings.
- **Window and door trim cavity air seal:** air seals complying with NZBC Acceptable Solution E2/AS1, Paragraph 9.1.6, or self-expanding, moisture cure polyurethane foam air seals covered by a valid BRANZ Appraisal suitable for use around window, door and other wall penetration openings.
- **Joinery head flashings:** folded from aluminium or galvanised steel to suit the window or door trim opening. Refer to NZS 3604, Section 4 and NZBC Acceptable Solution E2/AS1, Table 20 for durability requirements.
- **Flexible sealant:** sealant complying with NZBC Acceptable Solution E2/AS1, or sealant covered by a valid BRANZ Appraisal for use as a weather sealing sealant for exterior use.

#### Finishing System Specification

- 4.3 Paint and stain systems are not supplied by Carter Holt Harvey Plywood Limited and have not been assessed by BRANZ and are therefore outside the scope of this Appraisal.
- 4.4 All exposed faces, including top edges at sills and all bottom edges of Shadowclad® sheets must be finished with a latex exterior paint system complying with any of Parts 7, 8, 9, or 10 of AS 3730, or at least two coats of a film forming or penetrating stain to protect the Shadowclad® and give the desired finish colour to the exterior walls.

*[Note: Carter Holt Harvey Plywood Limited does not recommend that Shadowclad® is left uncoated when used as an exterior cladding. Using dark colours with an LRV of less than 50%, and failure to adequately maintain the surface coating of the cladding increases the risk of aesthetic related issues such as face checking. For this reason, Carter Holt Harvey Plywood Limited does not support the use of dark colours on Shadowclad® exterior cladding.]*

#### Handling and Storage

- 5.1 Handling and storage of all materials supplied by Carter Holt Harvey Plywood Limited or the building contractor, whether on-site or off-site, is under the control of the building contractor. Shadowclad® sheets must be stacked flat, clear of the ground on at least three evenly spaced timber bearers. They must be kept dry at all times either by storing within an enclosed building or under cover when stored externally. Care must be taken to avoid damage to edges, ends and the primed surfaces.
- 5.2 Accessories must be stored so they are kept clean, dry and undamaged. All accessories must be used within the maximum storage period recommended by the manufacturer.

#### Technical Literature

- 6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for Shadowclad® Ventilated Cavity. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

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## Design Information

### Framing

#### Timber Treatment

- 7.1 Timber wall framing behind Shadowclad® Ventilated Cavity must be treated as required by NZBC Acceptable Solution B2/AS1.

#### Timber Framing

- 7.2 Timber framing must comply with NZS 3604 for buildings or parts of buildings within the scope limitations of NZS 3604. Buildings or parts of buildings outside the scope of NZS 3604 must be to a specific design in accordance with NZS 3603 and AS/NZS 1170. Where specific design is required, the framing must be of at least equivalent stiffness to the framing provisions of NZS 3604. In all cases studs must be at maximum 600 mm centres. Dwargs must be fitted flush between the studs at maximum 800 mm centres.
- 7.3 Additional framing may be required at soffits, internal and external corners and window and door openings for the support and fixing of cavity battens and Shadowclad® Ventilated Cavity.
- 7.4 Timber wall framing and cavity battens must have a maximum moisture content of 20% at the time of the cladding application. *[Note: If Shadowclad® is fixed to framing with a moisture content of greater than 20% problems may occur at a later date due to excessive timber shrinkage.]*

### General

- 8.1 When Shadowclad® Ventilated Cavity is used for specifically designed buildings up to 2.5 kPa design differential ULS wind pressure, only the weathertightness aspects of the cladding and maximum framing centres are within the scope of this Appraisal. All other aspects of the building need to be specifically designed and are outside the scope of this Appraisal.
- 8.2 Punchings in the cavity vent strip provide a minimum ventilation opening area of 1000 mm<sup>2</sup> per lineal metre of wall in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.8.3 [b].
- 8.3 The ground clearance to finished floor levels as set out in NZS 3604 must be adhered to at all times. At ground level, paved surfaces such as footpaths must be kept clear of the bottom edge of the cladding system by a minimum of 100 mm, and unpaved surfaces by 175 mm in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Table 18.
- 8.4 At balcony, deck or roof/wall junctions, the bottom edge of Shadowclad® Ventilated Cavity must be kept above the top surface of any adjacent roof flashing by a minimum of 35 mm in accordance with NZBC Acceptable Solution E2/AS1, Paragraph 9.1.3.
- 8.5 All external walls of buildings must have barriers to airflow in the form of interior linings with all joints stopped for wind zones up to and including Very High, and rigid underlays for buildings in the Extra High wind zone and specifically designed buildings up to 2.5 kPa design differential ULS wind pressure. Unlined gables and walls must incorporate a rigid sheathing or an air barrier which meets the requirements of NZBC Acceptable Solution E2/AS1, Table 23. For attached garages, wall underlays must be selected in accordance with NZBC Acceptable Solution E2/AS1, Paragraph 9.1.3.4. Where rigid underlays are used, the cavity batten fixing lengths must be increased by a minimum of the thickness of the underlay.
- 8.6 Where cladding penetrations are wider than the cavity batten spacing, allowance must be made for airflow between adjacent cavities by leaving a minimum gap of 10 mm between the bottom of the cavity and the flashing to the opening.
- 8.7 Where the system abuts other cladding systems, designers must detail the junction to meet their own requirements and the performance requirements of the NZBC. These details have not been assessed and are outside the scope of this Appraisal.

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### Inter-storey Junctions

- 8.8 Inter-storey junctions must be constructed in accordance with the Technical Literature. Inter-storey joints must be provided to limit continuous cavities to the lesser of 2-storeys or 7 metres in height, in accordance with the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 9.1.9.4 (b).

### Structure

#### Mass

- 9.1 The mass of Shadowclad® Ventilated Cavity is approximately 6.6 kg/m<sup>2</sup> at equilibrium moisture content. The system is therefore considered a lightweight cladding in terms of NZS 3604.

#### Impact Resistance

- 9.2 Shadowclad® Ventilated Cavity has good resistance to impact loads likely to be encountered in normal residential use. The likelihood of impact damage to Shadowclad® Ventilated Cavity when used in light commercial situations should be considered at the design stage, and appropriate protection such as the installation of bollards and barriers should be considered for vulnerable areas.

#### Wind Zones

- 9.3 Shadowclad® Ventilated Cavity is suitable for use in all Building Wind Zones of NZS 3604, up to and including Extra High where buildings are designed to meet the requirements of NZBC Acceptable Solution E2/AS1, Paragraph 1.1, or up to 2.5 kPa design differential ULS wind pressure where buildings are specifically designed.

### Durability

- 10.1 Shadowclad® Ventilated Cavity meets the performance requirements of NZBC Clause B2.3.1 (b), 15 years for the Shadowclad® and flashings when used as a non-structural cladding installed in accordance with the Technical Literature.
- 10.2 Shadowclad® is envelope preservative treated. Where sheets are cut, all cuts must be coated with a brush on timber preservative specified in the Technical Literature for Shadowclad® Ventilated Cavity. Failure to correctly apply preservative to these areas may negatively affect the durability of the cut sheets.

#### Serviceable Life

- 10.3 Shadowclad® Ventilated Cavity installations finished with penetrating stain or non-penetrating film forming stain, are expected to have a serviceable life of at least 15 years provided they are maintained in accordance with this Appraisal. *[Note: This opinion only covers serviceability with regards to structural and weathertightness performance. It does not cover appearance, which may deteriorate significantly, especially when proper and regular maintenance is not carried out. Carter Holt Harvey Plywood Limited does not recommend that Shadowclad be left uncoated when used as an exterior cladding.]*
- 10.4 The use of dark colours with an LRV of less than 50 and failure to adequately maintain the coating increases the risk of aesthetic related issues such as face checking. For this reason Carter Holt Harvey Plywood Limited does not support the use of dark colours on Shadowclad® exterior cladding.
- 10.5 Coastal locations can be very corrosive to fasteners, especially locations within distances of up to 500 m from the sea including harbours, or 100 metres from tidal estuaries and sheltered inlets, and otherwise as shown in NZS 3604, Figure 4.2. These coastal locations are defined in NZS 3604 as Zone D. It is recommended that Shadowclad® sheets be fixed with stainless steel fasteners in these situations.
- 10.6 When using CCA treated Shadowclad®, aluminium extrusions must be coated in accordance with the requirements of NZBC E2/AS1, Table 20, and are not suitable for use in NZS 3604 Corrosion Zone D. When used with CCA treated Shadowclad®, horizontal Z-flashings must be manufactured from stainless steel in all Corrosion Zones.

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- 10.7 Microclimatic conditions, including geothermal hot spots, industrial contamination and corrosive atmospheres, and contamination from agricultural chemicals or fertilisers can convert a mildly corrosive atmosphere into an aggressive environment for fasteners. The fixing of Shadowclad® sheets in areas subject to microclimatic conditions requires specific design in accordance with NZS 3604, Paragraph 4.2.4, and is outside the scope of this Appraisal.

### Maintenance

- 11.1 Regular maintenance is essential to ensure the performance requirements of the NZBC are continually met and to ensure the maximum serviceability of the system.
- 11.2 Regular cleaning [at least annually] of the paint coating is required to remove grime, dirt and organic growth and to maximise the life and appearance of the coating. Grime may be removed by brushing with a soft brush, warm water and detergent. Paint systems must be recoated at approximately 7 – 10 yearly intervals in accordance with the paint manufacturer's instructions. Penetrating and non-penetrating stains must be recoated every 2 – 3 years in accordance with the stain manufacturer's instructions.
- 11.3 Annual inspections must be made to ensure that all aspects of the cladding system, including the selected finishing system, flashings and any sealed joints remain in a weatherproof condition. Any damaged areas or areas showing signs of deterioration which would allow water ingress must be repaired immediately. Sealant and paint coatings must be repaired in accordance with the relevant manufacturer's instructions.
- 11.4 Minimum ground clearances as set out in this Appraisal and the Technical Literature must be maintained at all times during the life of the system. *[Failure to adhere to the minimum ground clearances given in this Appraisal and the Technical Literature will adversely affect the long term durability of Shadowclad® Ventilated Cavity installations.]*

### Control of External Fire Spread

- 12.1 Shadowclad® Ventilated Cavity has not been assessed for a peak heat release or total heat released rating. Refer to NZBC Acceptable Solutions and Verification Methods C/AS1, C/AS2 and C/VM2 for requirements for fire rating and exterior surface finish requirements of external walls..

### Prevention of Fire Occurring

- 13.1 Separation or protection must be provided to Shadowclad® Ventilated Cavity from heat sources such as fire places, heating appliances, flues and chimneys. Part 7 of NZBC Acceptable Solutions C/AS1, C/AS2 and NZBC Verification Method C/VM1 provide methods for separation and protection of combustible materials from heat sources.

### External Moisture

- 14.1 Shadowclad® Ventilated Cavity, when installed in accordance with this Appraisal and the Technical Literature will prevent the penetration of moisture that could cause undue dampness or damage to building elements.
- 14.2 The cavity must be sealed off from the roof and sub-floor space to meet code compliance with NZBC Clause E2.3.5.
- 14.3 Shadowclad® Ventilated Cavity allows excess moisture present at the completion of construction to be dissipated without permanent damage to building elements to meet code compliance with NZBC Clause E2.3.6.
- 14.4 The details given in the Technical Literature for weather sealing are based on the principle of having a first and second line of defence against moisture entry for all joints, penetrations and junctions. The ingress of moisture must be excluded by detailing joinery and wall interfaces as shown in the Technical Literature. Weathertightness details that are developed by the designer are outside the scope of this Appraisal and are the responsibility of the designer for compliance with the NZBC.
- 14.5 Shadowclad® Ventilated Cavity, where there is a designed cavity drainage path for moisture that penetrates the cladding, does not reduce the requirements for junctions, penetrations, etc to remain weather resistant.

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### Internal Moisture

- 15.1 Buildings must be constructed with an adequate combination of thermal resistance and ventilation, and space temperature must be provided to all habitable spaces, bathrooms, laundries and other spaces where moisture may be generated or may accumulate.

### Water Vapour

- 15.2 Shadowclad® Ventilated Cavity is not a barrier to the passage of water vapour, and when installed in accordance with this Appraisal will not create a risk of moisture damage resulting from condensation.

## Installation Information

### Installation Skill Level Requirements

- 16.1 Installation must always be carried out in accordance with the Shadowclad® Ventilated Cavity Technical Literature and this Appraisal by, or under the supervision of, a Licensed Building Practitioner [LBP] with the relevant Licence Class.

### Shadowclad® Ventilated Cavity Installation

#### Wall Underlay and Flexible Sill and Jamb Tape Installation

- 17.1 The selected wall underlay and flexible sill and jamb tape system must be installed by the building contractor in accordance with the underlay and tape manufacturers' instructions prior to the installation of the cavity battens and the rest of the Shadowclad® Ventilated Cavity system. Flexible wall underlay must be installed horizontally and be continuous around corners. Underlay must be lapped 75 mm minimum at horizontal joints and 150 mm minimum over studs at vertical joints. Generic rigid underlay materials must be installed in accordance with NZBC Acceptable Solution E2/AS1 and be overlaid with a flexible wall underlay. Proprietary systems shall be installed in accordance with the manufacturer's instructions. Particular attention must be paid to the installation of the wall underlay and sill and jamb tapes around window and door openings to ensure a continuous seal is achieved and all exposed wall framing in the opening is protected.

#### Cavity Batten Installation

- 17.2 The cavity battens must be installed over the wall underlay to the wall framing at maximum 300 mm horizontal centres where the studs are at 600 mm centres or at 400 mm centres when studs are at 400 mm centres.
- 17.3 Cavity battens are fixed in place with 40 x 2.5 mm hot-dip galvanised or stainless steel ring shank flat head nails at 300 mm centres when over studs or plates, and to the top and bottom plates and dwangs when between studs.

#### Shadowclad® Sheet Installation

- 17.4 Shadowclad® sheets may be cut on site by power or hand saw. Holes and cut-outs may be formed by using a hole saw.
- 17.5 Shadowclad® is envelope preservative treated. Where sheets are cut, all cuts must be coated with a brush on timber preservative specified in the Technical Literature for Shadowclad® Ventilated Cavity. Failure to correctly apply preservative to these areas may negatively affect the durability of the cut sheets.
- 17.6 Shadowclad® sheets must be dry prior to installation. Before the sheets are installed, cut edges must be sealed with a brush-on timber preservative. The bottom edges and back of the Shadowclad® sheets to a height of 150 mm must be primed or stain coated at ground level and where the sheets are installed above apron flashings on roofs.
- 17.7 Shadowclad® sheets must be installed starting at the bottom of the wall. The bottom of the Shadowclad® sheets must overhang the bottom plate by a minimum of 50 mm.
- 17.8 Before the Shadowclad® sheets are installed, the corner detail must be prepared to suit the selected option, e.g. external box angle or boxed corner. The necessary flashings must be installed before commencing sheet fixing.

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- 17.9 The Shadowclad® sheets are fixed with 60 x 2.8 mm hot dip galvanised or ring shanked stainless steel flat head nails, or 8 gauge x 65 mm mechanically zinc plated or stainless steel wood screws at 150 mm centres around the edge of the sheets starting at the corners and at 300 mm centres in the body of the sheet. The fasteners must be no closer than 7 mm to the sheet edges, and on the rebated edge the fasteners must be inside the weather groove.

#### **Aluminium Joinery Installation**

- 17.10 Aluminium joinery and associated head flashings must be installed by the building contractor in accordance with the Technical Literature. A 7.5 – 10 mm nominal gap must be left between the joinery reveal and the wall framing so a PEF rod and air seal can be installed after the joinery has been secured in place.

#### **Finishing**

- 17.11 The coating manufacturer's instructions must be followed at all times for application of the paint or stain finish. Shadowclad® Sheets must be painted or stained as soon as practicable following fixing and must be clean and dry before commencing. If Shadowclad® sheets are exposed to the weather for more than 3 months, the surfaces must be washed with a mild detergent solution to remove any dirt, dust, mould or sea spray prior to coating. Allow the recommended drying time between coats and follow the temperature limitations for application. Carter Holt Harvey Plywood Limited does not recommend Shadowclad® be left uncoated when used as an exterior cladding.
- 17.12 The use of dark colours with an LRV of less than 50 and failure to adequately maintain the coating increases the risk of aesthetic related issues such as face checking. For this reason Carter Holt Harvey Plywood Limited does not support the use of dark colours on Shadowclad® exterior cladding.
- 17.13 Coatings should be applied by brush to ensure adequate coating film build is achieved. Application via roller or spray is not recommended.

#### **Inspection**

- 17.14 The Technical Literature must be referred to during the inspection of Shadowclad® Ventilated Cavity installations.

#### **Health and Safety**

- 18.1 Cutting of Shadowclad® sheets must be carried out in well ventilated areas and eye and hearing protection must be worn.
- 18.2 Safe use and handling procedures for the components that make up Shadowclad® Ventilated Cavity are provided in the relevant manufacturer's Technical Literature.

## **Basis of Appraisal**

The following is a summary of the technical investigations carried out:

#### **Tests**

- 19.1 The following testing has been completed by BRANZ:
- BRANZ expert opinion on NZBC E2 code compliance for Shadowclad® Ventilated Cavity was based on testing and evaluation of all details within the scope and as stated within this Appraisal. Shadowclad® Ventilated Cavity details were tested to E2/VM1. The testing assessed the performance of the foundation detail, window head, jamb and sill details, vertical and horizontal Shadowclad® joints, internal and external corners. In addition to the weathertightness test, the details contained within the Technical Literature have been reviewed, and an opinion has been given by BRANZ technical experts that the system will meet the performance levels of Acceptable Solution E2/AS1 for cavity-based plywood claddings.
  - Wind face load and fastener slip testing for Shadowclad® Ventilated Cavity. BRANZ determined design wind suction pressures, and by comparing these pressures with the NZS 3604 design wind speeds and AS/NZS 1170 pressure coefficients, the fixing requirements given in the Technical Literature were confirmed as suitable for timber framed walls.

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### Other Investigations

- 20.1 Structural and durability opinions have been provided by BRANZ technical experts.
- 20.2 The performance and testing of plywood wall cladding products in New Zealand and Australia has been considered, including the structural and weathertightness performance, durability and non-hazardous nature.
- 20.3 Site inspections have been carried out by BRANZ to examine the practicability of installation.
- 20.4 The Technical Literature for Shadowclad® Ventilated Cavity has been examined by BRANZ and found to be satisfactory.

### Quality

- 21.1 The manufacture of Shadowclad® has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.
- 21.2 The quality of materials, components and accessories supplied by Carter Holt Harvey Plywood Limited is the responsibility of Carter Holt Harvey Plywood Limited. The quality control system for the manufacture of Shadowclad® has been assessed and registered as meeting the requirements of AS/NZS 2269 by the Engineered Wood Products Association of Australasia, and ISO 9001 by Telarc SAI.
- 21.3 The treatment of Shadowclad® to H3.1 and 3.2 has been independently assessed and certified as meeting the requirements of AS/NZS 1604.3.
- 21.4 Quality of installation on site of components and accessories supplied by Carter Holt Harvey Plywood Limited and the building contractor is the responsibility of the installer.
- 21.5 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing solutions and joinery, wall underlays, flashing tapes, cavity battens, airseals and Shadowclad® sheets in accordance with the instructions of Carter Holt Harvey Plywood Limited.
- 21.6 Building owners are responsible for the maintenance of Shadowclad® Ventilated Cavity in accordance with the instructions of Carter Holt Harvey Plywood Limited.

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### Sources of Information

- AS 3730: 2006 Guide to the properties of paints for buildings.
- AS/NZS 1170: 2002 Structural design actions.
- AS/NZS 1604.3: 2012 Specification for preservative treatment - Part 3: Plywood.
- AS/NZS 2269: 2012 Plywood - Structural.
- AS/NZS 4680: 2006 Hot-dip galvanized [zinc] coatings on fabricated ferrous articles.
- NZS 3602: 2003 Timber and wood-based products for use in building.
- NZS 3603: 1993 Timber Structures Standard.
- NZS 3604: 2011 Timber-framed buildings.
- NZS 4211: 2008 Specification for performance of windows.
- Acceptable Solutions and Verification Methods for New Zealand Building Code External Moisture Clause E2, Ministry of Business, Innovation and Employment, Third Edition July 2005 [Amendment 7, 01 January 2017].
- Ministry of Business, Innovation and Employment Record of amendments - Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.



**BRANZ Appraisal**  
Appraisal No. 764 [2017]  
21 September 2017

SHADOWCLAD® VENTILATED  
CAVITY CLADDING SYSTEM

## Amendments

### Amendment No.1, dated 5 September 2018.

This Appraisal has been amended to include the timber preservative treatment.

### Amendment No. 2, dated 1 March 2021

This Appraisal has been amended to clarify coating requirements.

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**BRANZ Appraisal**  
Appraisal No. 764 [2017]  
21 September 2017

SHADOWCLAD® VENTILATED  
CAVITY CLADDING SYSTEM



In the opinion of BRANZ, the **Shadowclad® Ventilated Cavity Cladding System** is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Carter Holt Harvey Plywood Limited**, and is valid until further notice, subject to the Conditions of Appraisal.

### Conditions of Appraisal

1. This Appraisal:
  - a) relates only to the product as described herein;
  - b) must be read, considered and used in full together with the Technical Literature;
  - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
  - d) is copyright of BRANZ.
2. **Carter Holt Harvey Plywood Limited:**
  - a) continues to have the product reviewed by BRANZ;
  - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
  - c) abides by the BRANZ Appraisals Services Terms and Conditions;
  - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
  - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
  - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
  - c) any guarantee or warranty offered by **Carter Holt Harvey Plywood Limited**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Carter Holt Harvey Plywood Limited** or any third party.

For BRANZ

**Chelydra Percy**

Chief Executive

Date of Issue:

21 September 2017

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shadowclad®

SHADOWCLAD®  
STRUCTURAL  
Natural  
GROOVE

SHADOWCLAD®  
STRUCTURAL  
Natural  
TEXTURE

SHADOWCLAD®  
STRUCTURAL  
Ultra  
GROOVE

SHADOWCLAD®  
STRUCTURAL  
Ultra  
TEXTURE

SHADOWCLAD®  
FLASHINGS

# SHADOWCLAD® SPECIFICATION & INSTALLATION GUIDE

**FOR CAVITY CONSTRUCTION**

MARCH 2021



**CHH PLY**

Information contained within is specific to Shadowclad® structural plywood products and must not be used with any other plywood products, no matter how similar they may appear.

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Kapiti Coast District Council  
13/09/2023

# shadowclad®

CAVITY CONSTRUCTION

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## 1.0 SHADOWCLAD® PRODUCT RANGE

Manufactured in New Zealand by Carter Holt Harvey Plywood (CHH Ply), Shadowclad® panels are suitable for use as an exterior wall cladding when using H3 treated panels or as an internal wall or ceiling lining when using untreated panels.

Shadowclad is manufactured under a third party audited quality control programme to monitor compliance with AS/NZS 2269 Plywood Structural. All Shadowclad products carry Engineered Wood Products Association of Australasia (EWPAA) Joint Accreditation System – Australia and New Zealand (EWPAA/JAS-ANZ) certification.

Shadowclad has been BRANZ appraised as a cladding material for cavity wall construction. To view the BRANZ Appraisal No. 764 (2017) visit [www.shadowclad.co.nz](http://www.shadowclad.co.nz).

For specific information regarding the use of Shadowclad with weatherboard, solid plaster or brick vertical junctions refer to the Shadowclad Specification and Installation Guide for mixed cladding systems on cavity construction.

Our other plywood products:

- For specific information on plywood as a rigid air barrier, and/or bracing, refer to the current Ecoply® Barrier Specification and Installation Guide.
- For information relating to Ecoply structural plywood and applications other than exterior cladding, refer to the current Ecoply Specification and Installation Guide.

These are all available for download from [www.chhply.co.nz](http://www.chhply.co.nz).

The Shadowclad for cavity construction BRANZ Appraisal No. 764 (2017) does not cover:

- Shadowclad used as an interior lining.
- Handiply® Utilityclad™ plywood products.
- Shadowclad in direct fix cladding applications.

Shadowclad products must be competently installed in accordance with good building practices and sound design principles to satisfy the requirements of the Building Act 2004, the New Zealand Building Code (NZBC), and applicable New Zealand Standards. This is the responsibility of building owners and the design professionals and builders that they engage. This Shadowclad Specification and installation guide for cavity construction contains information, limitations, and cautions regarding the properties, handling, installation, usage, and the maintenance of Shadowclad products. However, to the maximum extent permitted by law, CHH Ply assumes no legal liability to you in relation to this information.

*The information contained in this document is current as at March 2021. It is your responsibility to ensure you have the most up to date information available.*

*The information contained in this publication relates specifically to Shadowclad structural plywood products manufactured by CHH Ply and must not be used with any other plywood manufacturer's products no matter how similar they may appear.*

*Alternative plywood products can differ in a number of ways which may not be immediately obvious and substituting them for Shadowclad structural plywood products is not appropriate, and could in extreme cases lead to premature failure and/or buildings which do not meet the requirements of the NZBC.*



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## 1.1 TECHNICAL INFORMATION & CAD DETAILS

When specifying or installing any Shadowclad product visit [www.shadowclad.co.nz](http://www.shadowclad.co.nz) or call 0800 326 759 to ensure you have current specification material and any relevant technical notes.

For buildings containing mixed cladding solutions with Shadowclad refer Shadowclad Specification and Installation Guide for mixed cladding systems on cavity construction.

**Having trouble installing Shadowclad? Visit [www.shadowclad.co.nz](http://www.shadowclad.co.nz) or download the Shadowclad APP to view the installation animations of common Shadowclad junctions.**

## 1.2 PRODUCT DESCRIPTION & RANGE

Shadowclad structural plywood panels are manufactured from radiata pine wood veneers. The veneers are placed at right angles to each other for maximum strength and stability then bonded together with synthetic phenolic (PF) resin to form a strong and permanent Type A bond.

Shadowclad is available in panel sizes 2440/2745 x 1216mm (to provide 1200mm cover) and features a unique textured (bandsawn) appearance which also helps to diffuse UV rays for increased aesthetic performance when exposed to weather.

Shadowclad is available as a Textured or Grooved profile and in either Natural or Ultra finishes. The Selection, application and maintenance of coatings is the responsibility of the building owners and the professionals that they engage. For advice on specific coating systems and their suitability for use with Shadowclad Natural or Shadowclad Ultra, always refer to the coating manufacturer.

### Shadowclad Natural

Shadowclad Natural is an uncoated panel suitable for use with penetrating stains, film forming stains and paint systems. If Shadowclad is left uncoated or is clear coated in exterior applications the long term aesthetics of the board will be significantly reduced. While the product will meet NZBC Clauses B2 and E2 durability and weather tightness requirements for cladding, a high visual appearance will not be achieved in the long term.

### Shadowclad Ultra

Shadowclad Ultra features a factory applied exterior grade performance coating suitable for use with most paint and film forming stain systems. Using a unique powder coating process on the panel face and edges means Ultra panels can be immediately top coated on site, eliminating (in most cases) the need for expensive and time consuming wet primers.

CHH Ply recommends the use of Shadowclad Ultra where suitable paint or film forming stains are being used.

Shadowclad Ultra features:

- High 60-80 microns film build, can be up to 2-3 times thicker than traditional wet primers.
- Continuous powder coated surface forms an effective moisture barrier for a drier more consistent painting surface.
- Saves time and money as traditional wet primers are not normally required.
- Panel surface, edges and bottom 150mm of sheet factory coated for increased panel durability.
- Once installed Shadowclad Ultra can be exposed to weather for up to 3 months prior to application of finishing coats.
- Low volatile organic compound (VOC) primer coating.

Shadowclad Ultra is available H3 treated for use as an exterior cladding. It is available H3.1 LOSP treated for residential and commercial applications or H3.2 CCA if required. H3.2 CCA treatment is only available in the Ultra finish and is not available with Natural finish products.

Shadowclad Ultra is not suitable for use with penetrating stains.

**Table 1: Surface Finishes**

Natural		Ultra	
Texture	Groove	Texture	Groove
			
Shadowclad Natural is an uncoated panel suitable for staining and painting. Untreated panels can be clear coated for internal, dry applications.		Shadowclad Ultra features a performance coated surface ready for top coating saving time and money when using paints and film forming stains. It is suitable for use in exterior applications only.	

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**Table 2: Shadowclad Product Range**

	Texture	Groove
<b>Finish</b>	Natural or Ultra	Natural or Ultra
<b>Sheet Length</b>	2440 and 2745mm	2440 and 2745mm
<b>Width (Overall)</b>	1216mm	1216mm
<b>Width (Effective)</b>	1200mm	1200mm
<b>Cover/Width Tolerance</b>	+/- 1mm	+/- 1mm
<b>Nominal Thickness</b>	12mm	12mm
<b>Weight (kg/m<sup>2</sup>)</b>	6.6	6.6
<b>R-value (m<sup>2</sup>.C/W)</b>	0.104	0.104
<b>Groove Profile</b>	N/A	9mm wide, 5mm deep at 150mm centres
<b>Edge Profile</b>	Ship lap with weather groove	Ship lap with weather groove
<b>Treatment Available</b>	<ul style="list-style-type: none"> <li>• H3.1 LOSP (Azole)</li> <li>• H3.2 CCA (Ultra finish only)</li> <li>• Untreated – internal dry applications (Natural finish only)</li> </ul>	<ul style="list-style-type: none"> <li>• H3.1 LOSP (Azole)</li> <li>• H3.2 CCA (Ultra finish only)</li> <li>• Untreated – internal dry applications (Natural finish only)</li> </ul>

### Shadowclad Exterior Flashing Range

Manufactured from extruded aluminium or folded from 0.5mm thick G304 stainless steel, the Shadowclad flashings range is purpose designed to complement Shadowclad panels used in exterior applications.

Independently tested for weathertightness and compliant with Table 20 of E2/AS1, Shadowclad flashings achieve 50 year durability in all NZS 3604 exposure zones including zone D (sea spray).

**Note: Stainless steel fasteners should not have contact with or pierce aluminium flashings. Where stainless steel fasteners are to pierce flashings stainless steel flashings should be used.**

The range includes internal and external angles, Horizontal and inter-storey 'Z' flashings and a cavity base closure.

Aluminium horizontally installed flashings come in 3600mm lengths and vertically installed angles are available in 3000mm and 6000mm lengths - refer Table 4. Stainless Steel flashings are available in 3000mm lengths - refer Table 5.

The information, details and performance statements provided in this guide are based on Shadowclad plywood panels and Shadowclad flashings being used together as a system. CHH Ply does not recommend that Shadowclad plywood panels be installed with non-CHH Ply flashings. Flashings not supplied by CHH Ply must, as a minimum, comply with E2/AS1 specifications and be compatible for use with H3.1 LOSP or H3.2 CCA treated plywood. It is the Designer's responsibility to ensure that any non-CHH Ply flashings are fit for purpose and compatible

with Shadowclad products and any other building materials or components of the exterior wall.

### Aluminium Flashing Finishes

Shadowclad aluminium flashings are available in either natural anodised finish (silver colour) or in mill finish for powder coating.

### Exterior Flashings & H3.2 CCA Treated Shadowclad

#### Exposure Zone B & C

H3.2 CCA treated Shadowclad in exposure zones B and C (where flashings are exposed to weather) must use mill finished flashings which must be powder coated to the desired colour or use stainless steel flashings.

H3.2 CCA treatment contains copper. As such, some form of isolation between aluminium flashings and H3.2 CCA treated panels such as powder coating of the flashings is required. Refer to Table 21 "Compatibility of Materials in Contact" in E2/AS1 for more information.

#### Exposure Zone D (Sea Spray)

In exposure zone D (sea spray) flashings exposed to weather must be stainless steel for H3.2 CCA treated Shadowclad.

#### H3.2 CCA Treated Shadowclad

Uncoated aluminium flashings are not permitted to be in direct contact in any zone with H3.2 CCA treated Shadowclad under any circumstances.

**Table 3: Flashing Durability for Shadowclad**

Sheet Finish	Treatment	Exposure Zone (refer to section 4 of NZS 3604)	Flashing Material/Finish required
<b>Shadowclad Natural/Ultra</b>	H3.1 LOSP	Zones B and C	Aluminium Anodised, or Stainless Steel
		Zone D (Sea spray)	Stainless Steel*
<b>Shadowclad Ultra</b>	H3.2 CCA	Zones B and C	Stainless Steel#
		Zone D (Sea spray)	Stainless Steel

\* Aluminium Powder Coated flashings may be used in Exposure Zone D where they are not pierced by Stainless Steel fasteners. Where stainless steel fasteners are to pierce flashings stainless steel flashings should be used.

# Aluminium Powder Coated flashings may be used in Exposure Zones B and C where they are not pierced by Stainless Steel fasteners. Where stainless steel fasteners are to pierce flashings stainless steel flashings should be used.

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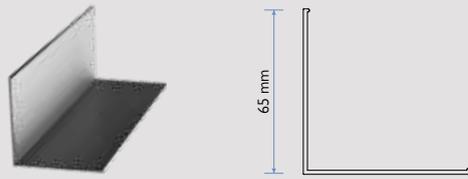
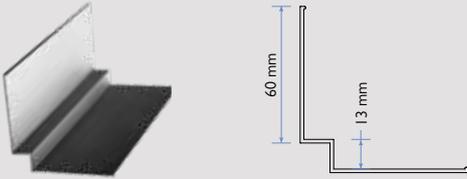
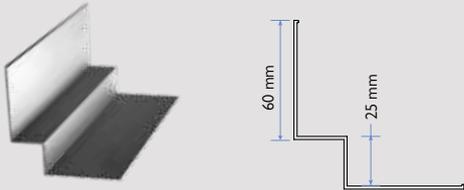
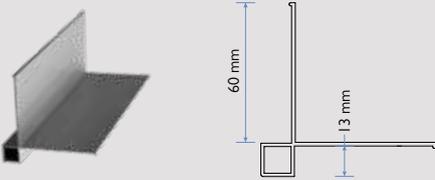
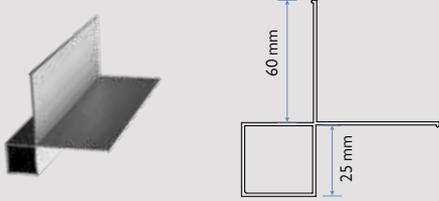
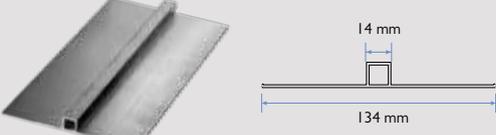
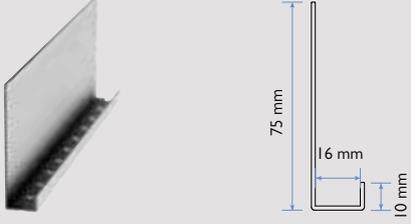
Table 4		Aluminium	Shadowclad Flashings Range		
Flashing	Line Drawing	Description	Finish Available	Length (mm)	
Internal 90° Angle		Back flashing for internal corners	Natural Anodised	3000 or 6000	
Internal 'W' Angle		'W' back flashing for internal corners providing a flush finish with panels (13mm x 13mm)	Natural Anodised or Mill	3000 or 6000	
Large Internal 'W' Angle		'W' back flashing for internal corners (25mm x 25mm) <b>Design Tip:</b> Use a Large 'W' where a flush junction between the Horizontal 'Z' flashing and corner flashing is desired	Natural Anodised or Mill	3000 or 6000	
External Box Angle		Box corner for external corners providing a flush finish with panels	Natural Anodised or Mill	3000 or 6000	
Large External Box Angle		Box corner for external corners (25mm x 25mm) <b>Design Tip:</b> Use Large External Box where a flush junction between the Horizontal 'Z' flashing and corner flashing is desired	Natural Anodised or Mill	3000 or 6000	
Vertical Top Hat		Vertical sheet joint flashing	Natural Anodised or Mill	3000 or 6000	
Cavity Base Closure		Restricts vermin from accessing the cavity space	Natural Anodised	3600	

Table 4		Aluminium	Shadowclad Flashings Range		
Flashing	Line Drawing	Description	Finish Available	Length (mm)	
Horizontal 'Z' Flashing		Horizontal 'Z' flashing for horizontal joints between panels	Natural Anodised or Mill	3600	
Inter-Storey 'Z' Flashing		Horizontal 'Z' flashing for horizontal joints between panels when limiting continuous cavities to a height of two storeys or 7 metres	Natural Anodised or Mill	3600	
Horizontal 'Z' Back Flashing		Back flashing for junction of butt jointed Horizontal 'Z' flashing	Mill	300	
Inter-storey 'Z' Back Flashing		Back flashing for junction of butt joint 'Z' Flashing inter-storey	Mill	300	

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Table 5		Stainless Steel	Shadowclad Flashings Range		
Flashing	Line Drawing	Description	Finish Available	Length (mm)	
Internal 90° Angle		Back flashing for internal corners	Stainless Steel	3000	
Large Internal 'W' Angle		'W' back flashing for internal corners (25mm x 25mm)	Stainless Steel	3000	
Large External Box Angle		Box corner for external corners (25mm x 25mm)	Stainless Steel	3000	
Cavity Base Closure		Restricts vermin from accessing the cavity space	Stainless Steel	3000	

Table 5		Stainless Steel	Shadowclad Flashings Range		
Flashing	Line Drawing	Description	Finish Available	Length (mm)	
Horizontal 'Z' Flashing		Horizontal 'Z' flashing for horizontal joints between panels	Stainless Steel	3000	
Inter-Storey 'Z' Flashing		Horizontal 'Z' flashing for horizontal joints between panels when limiting continuous cavities to a height of two storeys or 7 metres	Stainless Steel	3000	

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### 1.3 BUILDING MATERIALS FOR USE WITH SHADOWCLAD (EXTERIOR CLADDING)

**Table 6: Materials Available from CHH Ply**

	Description	Treatment	Size/Length
<b>Frame Flashing Tape<sup>1</sup></b>	For a secure and permanent seal of all Ecoply Barrier openings (Use in conjunction with Sill Tape)	-	150mm/200mm x 30m
<b>Sealing Tape<sup>1</sup></b>	For a secure and permanent seal of all Ecoply Barrier vertical joints	-	60mm x 30m
<b>Sill Tape<sup>1</sup></b>	One piece stretchable sill tape for window and door sills. 2 rolls per box	-	150mm/200mm x 20m
<b>Ecoply® Barrier<sup>1</sup></b>	Rigid Air Barrier System	H3.2 CCA	2440mm/2745mm x 1200mm
<b>Cavity Batten</b>	45 x 20mm (nominal)	H3.1 LOSP	Random
<b>Flashings</b>	Aluminium and stainless steel flashings range	Refer Tables 4 and 5	Refer Tables 4 and 5

1. Please refer to the Ecoply Barrier Specification and Installation Guide for more information.

#### Building Materials Supplied by Other Manufacturers

- Fasteners (i.e. nails or screws) in accordance with Table 9: Fastener Lengths for Shadowclad fixing.
- Building underlay compliant with Table 23 of E2/AS1.
- Window/door head flashings supplied by window joinery company.
- Paint in accordance with paint manufacturer's recommendations (refer to 5.3 Coating Selection for more details).

### 1.4 PRESERVATIVE TREATMENT

Shadowclad is available either H3 treated for use as an exterior cladding or untreated (Natural finish products only) for interior wall and ceiling linings. H3 treated Shadowclad is treated in accordance with AS/NZS 1604.3 with the standard treatment for Shadowclad panels being H3.1 LOSP (Azole). H3.2 CCA treatment is available for Shadowclad Ultra panels if required.

**Shadowclad is envelope preservative treated. Where sheets are cut, cuts must be coated with a brush on timber preservative in accordance with the relevant manufacturer's instructions. Soudal® Metalex® Concentrated Timber Preservative Clear (Soudal® Metalex® Clear) is recommended. Failure to properly apply preservative to cut edges will negatively affect the durability of the cut panels.**

#### H3.1 LOSP Treatment

H3.1 LOSP treatment is the standard treatment for Shadowclad panels as it does not discolour the panel surface and does not

use water in the treatment process allowing panels to remain at uniform dimensions.

When coating H3.1 LOSP treated plywood some residual solvent may be present on the sheet surface from the treatment process. Sheets feeling greasy to touch should be placed in a well ventilated area and allowed to flash off to ensure proper adhesion of paints and stains to the sheet surface.

Mechanical fasteners are required to fix H3.1 LOSP treated Shadowclad to framing. Do not glue Shadowclad to frames.

#### H3.2 CCA Treatment

H3.2 CCA uses water during the treatment process and may leave panel surfaces with a slight green colour. For this reason H3.2 CCA treatment is available only in the Shadowclad Ultra finish.

**Table 7: Preservative Treatment Options**

	Untreated	H3.1 LOSP (Azole)	H3.2 CCA
<b>Preservative Carrier</b>	N/A	Light organic oil (white spirits)	Water
<b>Colour</b>	Natural	Natural	Green
<b>Fungicide</b>	Heat treated dry wood	Propiconazole and Tebuconazole	Copper
<b>Insecticide</b>	Heat treated dry wood	Permethrin	Arsenate
<b>Other Chemicals</b>	N/A	Butyl Oxitol (co-solvent to assist active stability)	Chrome (to fix preservative in water)
<b>Mouldicide</b>	N/A	IPBC	Copper (limited efficiency)
<b>Notes</b>	Plywood for dry interior use, supplied ex mill at <15% moisture content	Solvent does not affect dimensions. Solvent smell disappears when exposed to air flow	Dried after treatment to average 18% moisture content
<b>Applications (Refer NZS3602)</b>	Interior dry protected	Exterior (service performance subject to detailing and coatings used)	Exterior (service performance subject to detailing and coatings used)

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## 1.5 SUSTAINABILITY

Shadowclad is manufactured from radiata pine. It is grown on tree farms which are tended and harvested to provide wood for plywood manufacture. The crop is managed on a sustainable basis to yield millable trees. New Zealand plantations are managed in compliance with the New Zealand Forest Accord.

Shadowclad is manufactured in New Zealand at CHH Ply Tokoroa plywood mill.

Shadowclad is available Forestry Stewardship Council (FSC) (FSC-C012019) certified upon request.

## 1.6 PRODUCT IDENTIFICATION

In accordance with AS/NZS 2269, every sheet of Shadowclad plywood has the following information marked on the back:

- Brand name: e.g. SHADOWCLAD®.
- Intended application: e.g. STRUCTURAL.
- Glue bond: e.g. A BOND.
- Formaldehyde emission class: e.g. E0.
- Australasian Standard: e.g. AS/NZS 2269:2012.
- Treatment Standard (if applicable) e.g. AS/NZS 1604.3:2012.
- Date and time of manufacture: e.g. 01/12/15 12:34:56.
- The Engineered Wood Products Association of Australasia (EWPPAA) brand and mill number: e.g. 911 (Tokoroa mill).

### Treated Example

SHADOWCLAD® STRUCTURAL A  
BOND E0 AS/NZS 2269.0:2012  
AS/NZS 1604.3:2012 400 64 H3 E LOSP  
RETREAT CUTS PAT 01/12/15 12:23:45



## 2.0 DESIGN CONSIDERATIONS

### 2.1 DESIGN RESPONSIBILITY

Design responsibility lies with the building owner and the professionals that they engage. The specifier for the project must ensure that the details in the specification for their individual projects are appropriate for the intended application. The specifier must also ensure that additional detailing is provided for specific design or any areas that fall outside the scope and specifications of this literature. It is the specifier's responsibility to ensure that non-CHH Ply products are fit for purpose, and compatible with Shadowclad products.

Good detailing which avoids moisture or dust accumulation on the sheet surface can help increase durability and aesthetics. Roof overhangs contribute to performance as they offer shade and will protect walls from rain and dust. Trims should be bevelled to shed moisture and flashings should be detailed with gaps that do not trap water at the panel edges.

### 2.2 LITERATURE SCOPE

Shadowclad can be used for those structures which fall within the scope of Acceptable Solution E2/AS1 - External Moisture. Shadowclad is recommended for a drained and ventilated cavity, where the cladding is fixed onto timber battens fixed over the

timber frame and building underlay.

Shadowclad is not recommended where a risk score >20 in accordance with E2/AS1 is established.

### 2.3 CODE COMPLIANCE

Shadowclad on a cavity wall system is tested in accordance with E2/VM1 and AS/NZS 4284 "Testing of Building Facades" for compliance with the NZBC Clause E2 - External Moisture.

### 2.4 SITE & FOUNDATIONS

The site on which the building is situated must comply with the Acceptable Solution E1/AS1 of the Approved Document for the NZBC Clause E1 - Surface Water.

## 2.5 GROUND CLEARANCES

The bottom edge of each Shadowclad sheet must be a minimum of 50mm above decks and verandahs, 100mm above paved ground and a minimum of 175mm above unprotected ground.

Shadowclad must overhang the bottom plate on a concrete slab by a minimum of 50mm as required by NZS 3604 and E2 - External Moisture. Maximum distance from the bottom of the sheet to the fixing shall not exceed 75mm.

For garage door openings, refer Paragraph 9 "Openings to garages" in Acceptable Solution E2/AS1.

## 2.6 MOISTURE MANAGEMENT

It is the responsibility of the specifier to identify moisture related risks associated with any particular building design and site exposure.

Wall construction design must effectively manage moisture, accounting for both the interior and exterior environments of the building. This is particularly important in buildings that have a higher risk of wind driven rain penetration or that are artificially heated or cooled.

Where a deck is attached to the building and the Shadowclad extends below the deck to cover the framing, keep decking clear of the Shadowclad surface and detail to avoid moisture entrapment.

All wall openings, penetrations, junctions, connections, window sills, heads and jambs must incorporate Shadowclad flashings for waterproofing. Materials, components and the installation used to manage moisture in framed wall construction must, at a minimum, comply with the requirements of the NZBC.

## 2.7 WIND LOADING

Shadowclad is suitable for use in all wind zones up to and including extra high (55m/s) as defined by NZS 3604 and specific

design wind pressures up to design differential ultimate limit state (ULS) of 2.5kPa.

## 2.8 DURABILITY

The durability level applicable to Shadowclad is dependent upon the application and coating applied. Detailing, treatment and installation methods need careful consideration to satisfy the requirements of the NZBC.

### Exterior Cladding – 15 Year Durability

**CHH Ply does not recommend Shadowclad is left uncoated when used as an exterior cladding.**

The NZBC Clause B2 requires claddings to achieve a minimum structural durability level of 15 years.

Shadowclad coated with stains or paints (regardless of colour choice) will meet this requirement. However, if using dark colours (colours with an LRV of less than 50%) homeowners

should expect an increased level of coating maintenance over the life of the cladding than would normally be expected where lighter colours are used.

**Using dark colours with an LRV of less than 50% and failure to adequately maintain the surface coating of the cladding increases the risk of aesthetic related issues such as face checking. For this reason, CHH Ply does not support the use of dark colours on Shadowclad exterior cladding.**

#### Additional Notes:

For further advice on coatings refer to section 5.0: Coating and Application – Exterior Cladding.

## 2.9 TEXTURED VS. SMOOTH FINISHED PLYWOOD AS EXTERIOR CLADDING

Structurally, some smooth faced plywood products may meet the requirements of E2/AS1 however in CHH Ply opinion smooth faced plywood does not retain a high visual appearance when directly exposed to weathering.

Where a high visual appearance is desired (such as exterior cladding) CHH Ply recommends the use of Shadowclad rather than smooth faced plywood.

Shadowclad features a textured (bandsawn) face which reduces the visibility of natural face checking which can occur in any wood based product which has been exposed to weather for a prolonged period.

Face checks are not considered a manufacturing fault as they are part of a natural process and are merely an indication that it is time to re-apply the surface coating on the product.

## 2.10 HEALTH & SAFETY

Shadowclad should be installed and used as per the Safety Data Sheet (SDS) which can be downloaded from [www.shadowclad.co.nz](http://www.shadowclad.co.nz).

Always wear safety glasses or non-fogging goggles when cutting Shadowclad panels and flashings.

If wood dust exposures are not controlled when machining

(sawing, routing, planing, drilling etc.) a class P1 or P2 replaceable filter or disposable face piece respirator should be worn.

Wear comfortable work gloves to avoid skin irritation and the risk of splinters. Wash hands with mild soap and water after handling panels.

## 2.11 STORAGE & HANDLING

### Shadowclad Panels:

- Keep Shadowclad® panels dry.
- Store under cover.
- Handle and stack with care to avoid damage.
- Stack flat; clear of ground, on at least three evenly spaced bearers.
- Store in well-ventilated areas away from sources of heat, flames or sparks.

### Shadowclad Flashings:

- Keep dry. Should a shipment of Shadowclad flashings arrive in a wet condition, they should be immediately dried before storing.
- When storing flashings avoid contact with other metals which may cause scratches or marks. The use of shelving or racks faced with dry wood is recommended.
- Keep away from caustics, nitrates and acids.

## 3.0 INTERIOR LININGS

The use of untreated plywood is acceptable under NZS 3604, NZBC for internal wall and ceiling linings where NZS 3602 allows the use of untreated plywood.

For detailed installation advice for plywood used as an internal lining refer to [www.chhply.co.nz](http://www.chhply.co.nz).

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## 4.0 INSTALLATION – EXTERIOR CLADDING

### 4.1 FRAMING – DURABILITY

Refer to NZBC Acceptable Solution B2/AS1 "Durability". External timber framing must be treated to a minimum H1.2 treatment. For timber treatment and allowable moisture content,

refer to NZS 3602 as well as framing manufacturer's literature (e.g. Laserframe®). The current Laserframe Product Guide can be downloaded from [www.chhwoodproducts.co.nz](http://www.chhwoodproducts.co.nz).

### 4.2 FRAMING – CONSTRUCTION

Use kiln dried framing such as Laserframe in accordance with timber framing manufacturer's specifications and treated in accordance with NZS 3602. The current Laserframe Product Guide can be downloaded from [www.chhwoodproducts.co.nz](http://www.chhwoodproducts.co.nz).

Timber frame sizes and set out must comply with NZS 3604 (or specifically designed to NZS 3603) and with stud and nog centres and timber width required by this specification.

All Shadowclad sheet edges must be fully supported by framing.

- Studs must not exceed 600mm centres.
- Nogs must be provided at a maximum of 800mm centres.
  - When using vertical cover battens nogs at maximum 600 centres.
- An extra stud is required at internal corners for ventilated cavities.
- Refer to NZS 3602 for moisture content requirements as a guide, frame and cavity batten moisture content should be no greater than 20%.
- Framing must be kept as dry as possible at all times.
- Single spans of Shadowclad should not exceed 600mm (e.g. below windows or balustrades).

### 4.3 PREPARATION – BUILDING UNDERLAY & RIGID AIR BARRIER

The use of building underlay compliant with Table 23 of E2/AS1 or an alternative solution rigid air barrier must be provided over framing prior to the installation of exterior cladding.

- Barriers to air flow are required.
- Rigid air barriers are required in extra high wind zones and above.

- Rigid air barriers are also required in high wind zones and above for Ministry of Education school properties.

For more information on rigid air barriers refer to the current Ecoply Barrier Specification and Installation Guide which can be downloaded from [www.ecoplybarrier.co.nz](http://www.ecoplybarrier.co.nz).

### 4.4 PREPARATION – CAVITY CONSTRUCTION

#### Cavity Construction

A Shadowclad cavity base closure must be installed at the bottom of all walls and above window heads, this provides vermin proofing to ventilation openings. The holes in the cavity base closure must be kept clear to enable ongoing drainage and ventilation of the cavity.

#### Cavity Battens

Cavity battens provide an air space between the frame and the sheet and are considered a "packer" when installed in accordance with Acceptable Solution E2/AS1.

The battens must be fixed over the building underlay or a rigid air barrier.

All timber battens must: be nominal 20mm thick (between limits of 18mm and 25mm in thickness); at least the same width as the stud; and minimum H3.1 LOSP treated in accordance with NZS 3640.

Polystyrene battens **must not** be used with H3.1 LOSP treated Shadowclad panels, as they may melt in contact with solvents.

Battens must be fixed over the building underlay/rigid air barrier to all studs, as follows.

If studs are at 600mm centres:

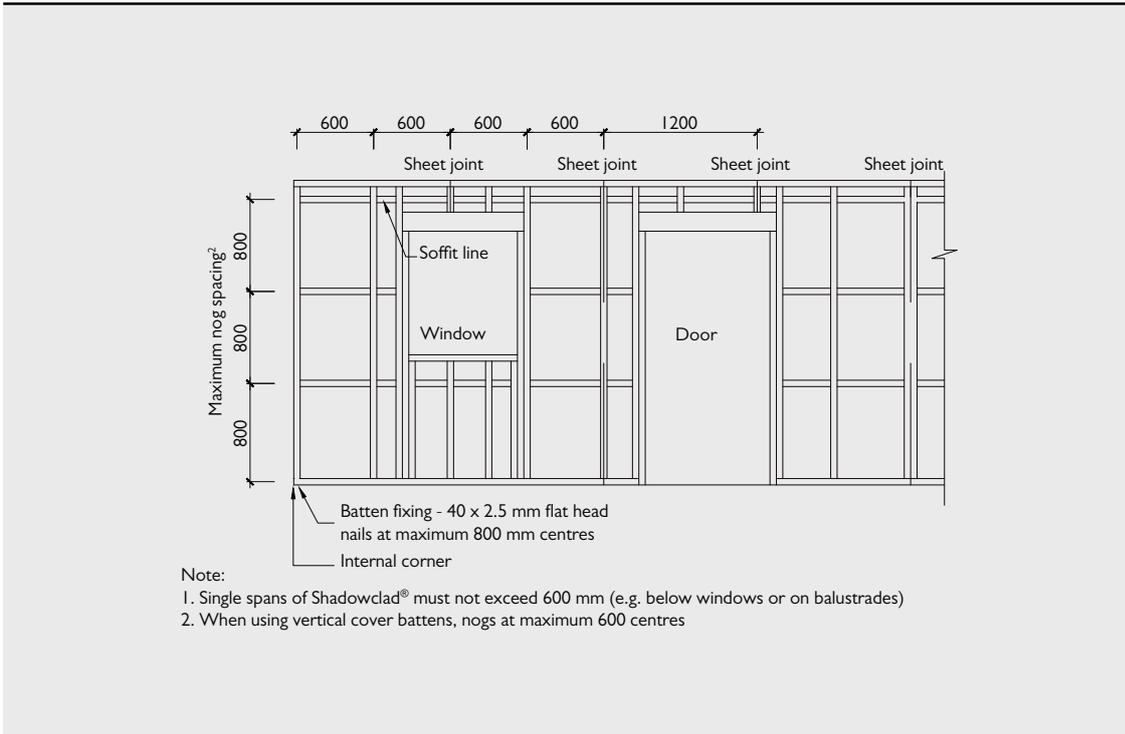
- Battens must be fixed vertically at 300mm centres (i.e. a batten on studs and one in between the two studs fixed to top and bottom plates and nogs).
- Battens fixed to studs are to support Shadowclad and restrain building underlay and insulation from bulging into the cavity.
- The Shadowclad must not be fixed to these cavity battens where there is no framing behind them.

If studs are at 400mm centres battens may be fixed on studs only.

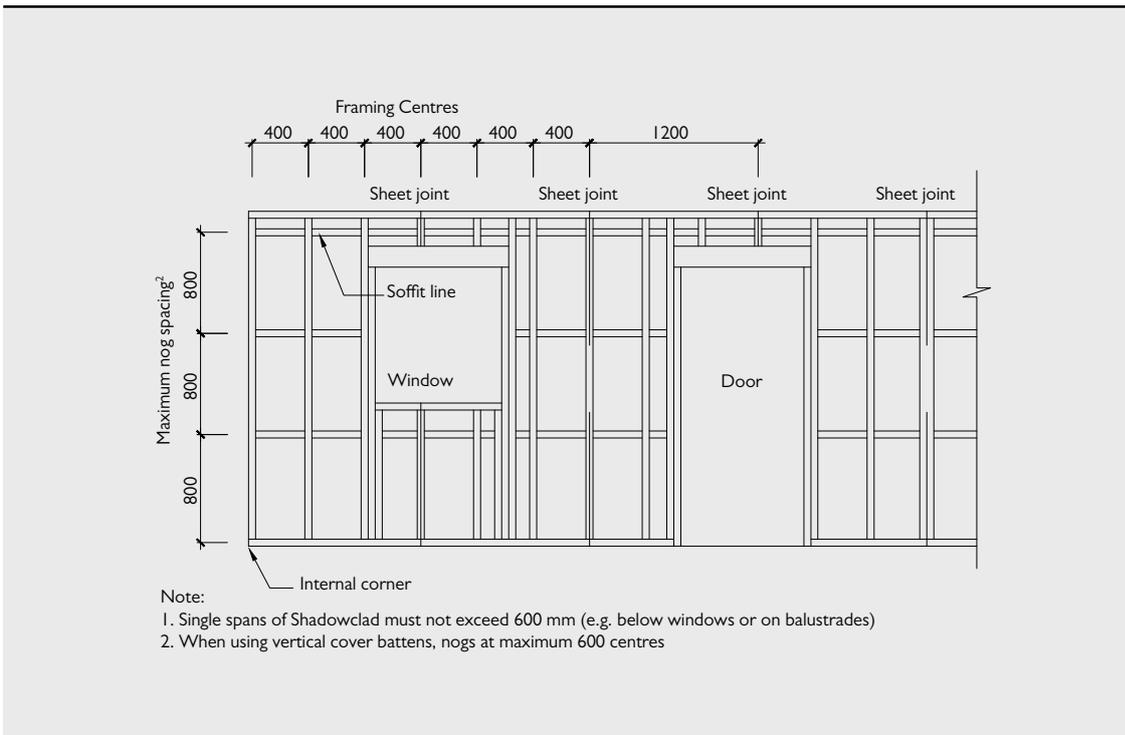
Horizontal battens must be used at the top of the wall to block the top of the cavity from venting into the roof space.

Cavity spacers (i.e. short pieces of cavity batten) may be used to support the bottom sheet edge (or provide intermediate support where required e.g. above window openings) but must allow water drainage to the outside. The cavity spacers must be fixed at a 5° minimum slope with a 50mm minimum air gap at either side.

**SC001: Typical Framing Setout (without Battens) Studs at 600 Centres**

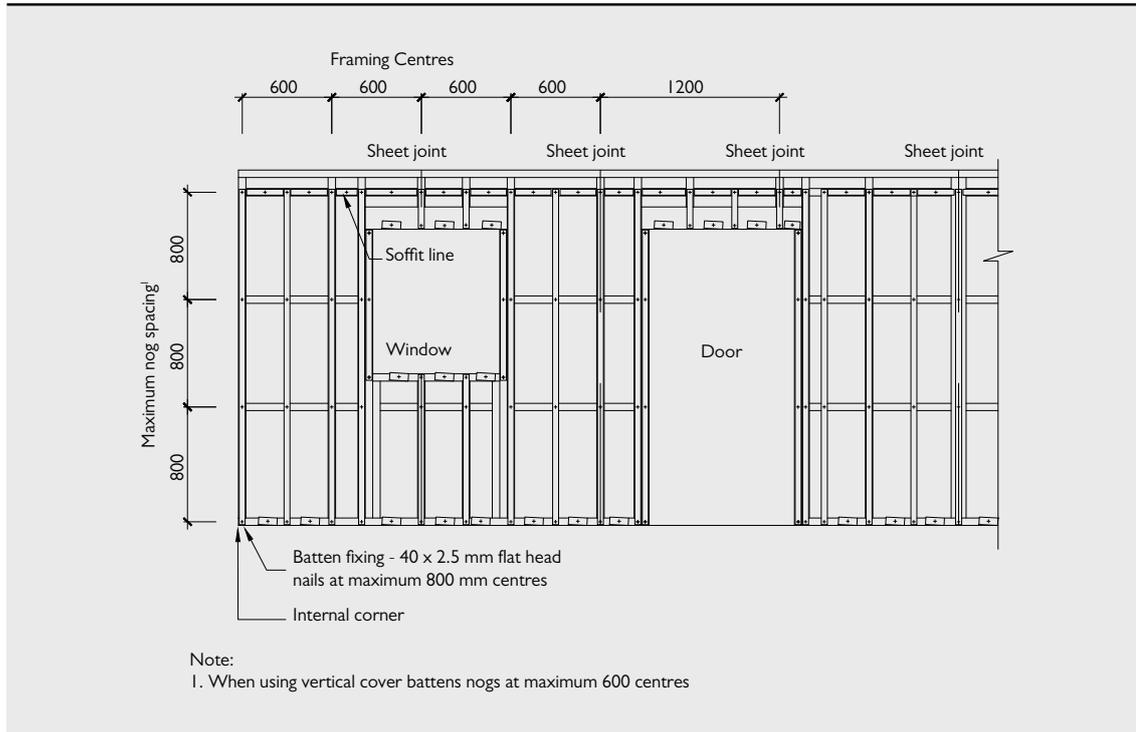


**SC001A: Typical Framing Setout (without Battens) Studs at 400 Centres**

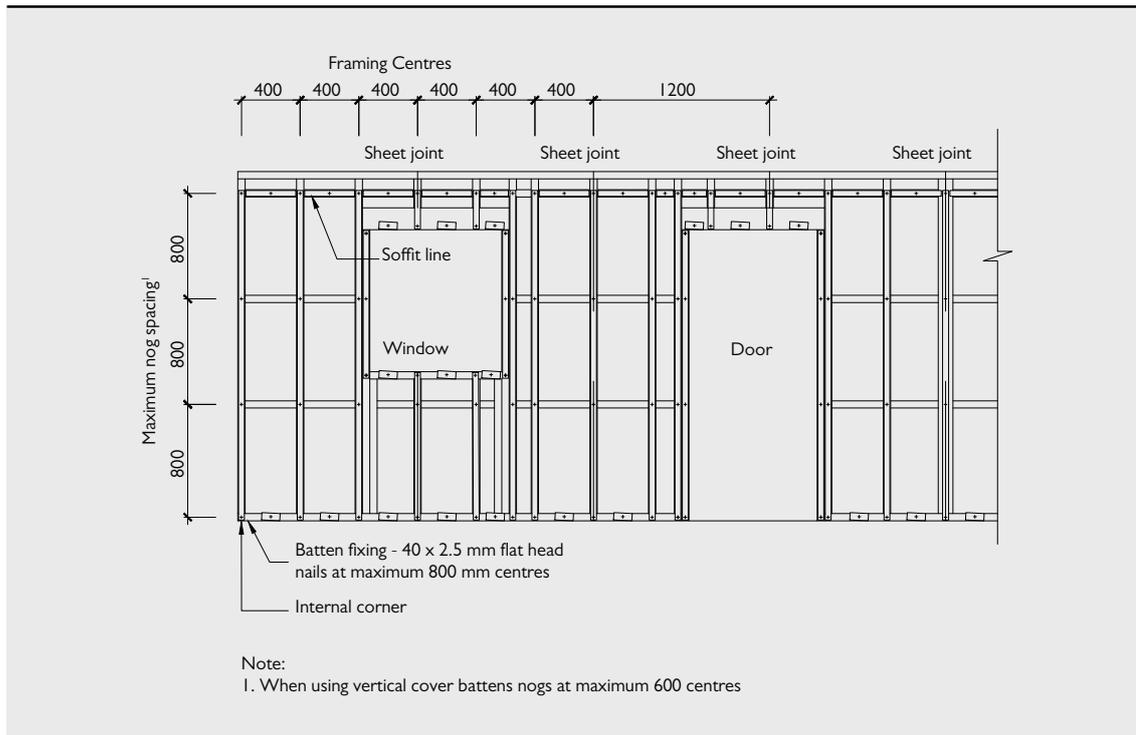


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**SC002: Typical Framing Setout (with Battens) Studs at 600 Centres**



**SC002A: Typical Framing Setout (with Battens) Studs at 400 Centres**



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## 4.5 SHEET LAYOUT

A sheet layout should form part of architectural drawings and be used from the basis of stud/framing layout.

- Sheet edges must be supported by the framing.
- Sheets are designed to be vertically fixed. **Do not fix sheets horizontally.**
- When laying up on to framing, start at framing corners and work across the wall.
- All treated Shadowclad panels are envelope preservative treated. Where sheets are cut, edges **must** be coated with a brush on timber preservative such as Soudal® Metalex® Clear.
- Cut edges **must** be placed at the top of the sheet to avoid rain drips soaking in to cut end grains.
- Priming the bottom edges and the back (rear) of the sheets to a height of 150mm is required.
  - Shadowclad Ultra sheets are coated on the rear to a height of 150mm (minimum) to meet this requirement.

## 4.6 FIXINGS – FASTENER DURABILITY

**Table 8: Fastener Durability for Shadowclad**

Finish	Treatment	Exposure Zone (Refer to Section 4 of NZS 3604)	Material Required
Shadowclad Natural/Ultra	H3.1 LOSP	Zones B and C	Minimum hot dipped galvanised or better
		Zone D (sea spray)	Stainless Steel
Shadowclad Ultra	H3.2 CCA	All Zones	Stainless Steel

## 4.7 FIXINGS – FASTENER SIZE & LAYOUT

**Table 9: Fastener Lengths for Shadowclad**

Minimum Fastener Length and Size (Cavity Fix)	
Nails in Timber	60 x 2.8mm
Screws in Timber	8g x 65mm

Shadowclad **must** be nailed or screwed to timber as per below:

- Use flat head (full round head) nails or rose head nails with timber framing. Rose head nails should be considered where a more decorative fastener is desired.
- Standard fixing pattern: fasten sheet edges at 150mm centres and within the panel on all supports at 300mm centres.
- Do not fix to battens that are not installed over studs as the nails will puncture the building wrap.
- Fasten no closer than 7mm to sheet edges except on edge with top lap (weather groove lap), **do not nail through top lap.**
- Fasten Ship lap joints independently to ensure natural sheet expansion is not restricted.
- When using a rigid air barrier the Shadowclad fastener lengths should be increased by the thickness of the panel to ensure required fastener pull out loadings are achieved.
- Drive nails and screws flush.
- Do not nail through the grooves in Shadowclad Groove panels.

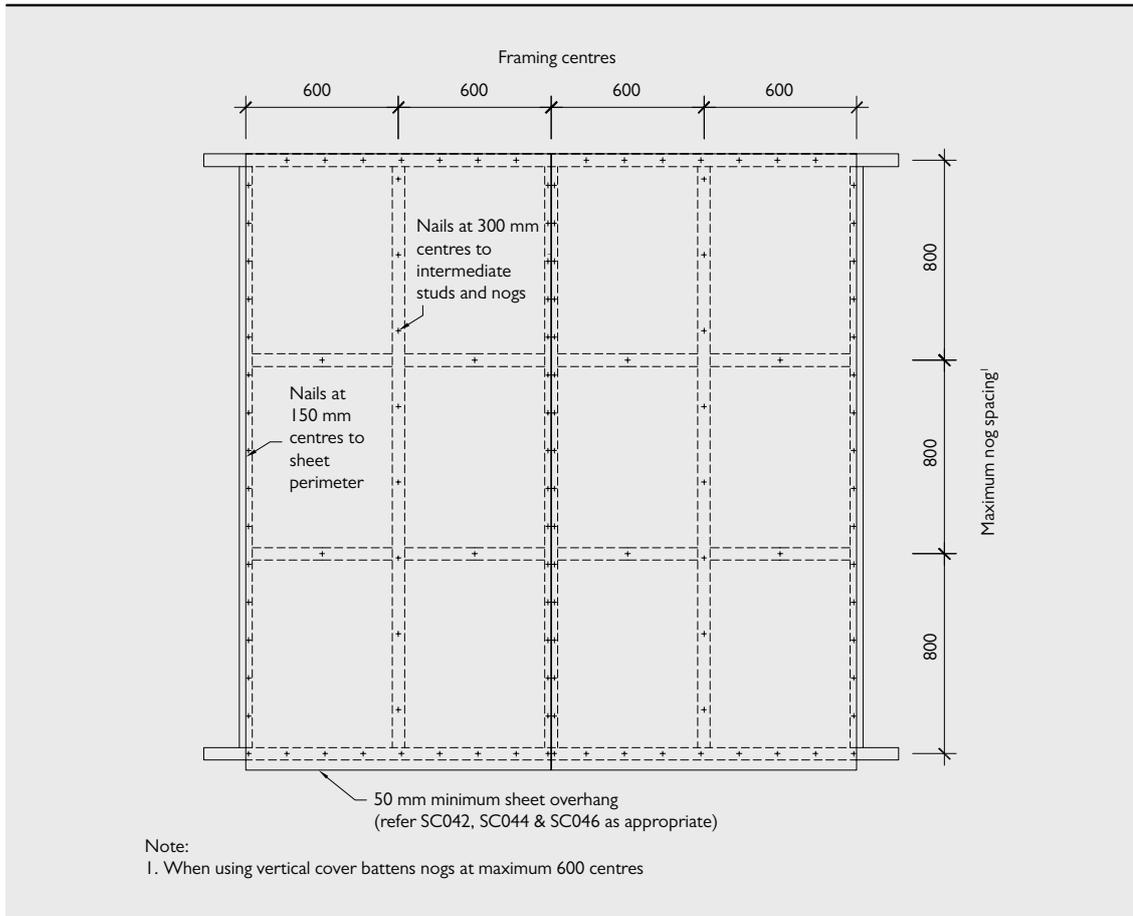
### Power Driven Fastening

- Best practice is to hand drive nails as better control of nail depth is achieved.
- Paslode Impulse Nailers may be used to fire power driven nails. Refer to Paslode for suitable fasteners as per the minimum lengths stated in Table 9.
- Do not overdrive nails into the sheet.

### Fixings at Vertical Sheet Join

Shadowclad Sheets must be fastened off independently to each other. SC006A and SC008A show specific fastener locations to accommodate the Ship lap joint. For Shadowclad Texture and Shadowclad Groove respectively fasten underlap 13mm from sheet edge, with overlap fasten 23mm from sheet edge as detailed.

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**SC003: Shadowclad Fastener Layout (Studs at 600 Centres Shown)****4.8 INSTALLATION TOOLS FOR SHADOWCLAD®**

Correct installation and maintenance of Shadowclad® is necessary to ensure that compliance with the New Zealand Building Code, durability, structural integrity and weathertightness are maintained. CHH Ply have developed two installation tools to compliment the Shadowclad Specification and Installation Guides. These products are an extension of the Specification and Installation Guides and are available by contacting CHH Ply directly via [www.shadowclad.co.nz](http://www.shadowclad.co.nz) or by calling 0800 326 759.

**Shadowclad® sITe APP**

The Shadowclad sITe APP is a tool for all building practitioners to aid in the installation of Shadowclad in accordance with the CHH Ply Specification and Installation Guides. The APP includes a context sensitive Key Design Points and Installation Checklist,

access to all current literature, installation details, maintenance and other key installation requirements.

**Shadowclad Stick**

The Shadowclad Stick is an installation tool for Shadowclad. This tool removes the need for builders to develop their own 'jigs' to aid in ensuring that critical clearances, nail spacing's, etc. are applied during the installation of Shadowclad sheets. Section 11 of this literature provides information in relation to the use of the Shadowclad stick.

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## 4.9 SHADOWCLAD KEY INSTALLATION & DESIGN POINTS

The following tasks are provided to installers to point out key installation and design factors when used as an exterior cladding. These do not detract from the requirements to read and understand this literature as a whole.

Task	Tick when checked
<b>Prior to Specification and Installation</b>	
Read the Shadowclad Specification and Installation Guide in its entirety	<input type="checkbox"/>
<b>Framing Plan</b>	
Framing setout drawings to suit Shadowclad fixing and installation guidelines	<input type="checkbox"/>
<b>Sheet Cuts</b>	
Coat all sheet cuts with a preservative timber treatment such as Soudal® Metalex® Clear	<input type="checkbox"/>
After applying Soudal® Metalex® Clear, apply the surface coating (e.g. paint or stain) to cut edges	<input type="checkbox"/>
Place uncut edge to bottom	<input type="checkbox"/>
<b>Fastener Material Type</b>	
Galvanised fasteners or better used (Stainless steel annular groove nails required in sea spray zones and with H3.2 CCA treated Shadowclad Ultra)	<input type="checkbox"/>
<b>Sheet Fastener Pattern</b>	
Around sheet edge – maximum 150mm centre spacing	<input type="checkbox"/>
Within sheet body – maximum 300mm centre spacing	<input type="checkbox"/>
<b>Horizontal Sheet Joints</b>	
Minimum 9mm separation gap between sheets above all Horizontal 'Z' flashings	<input type="checkbox"/>
Prime the bottom of the sheet edge and 150mm up the back (rear) of the sheets	<input type="checkbox"/>
50mm strip of neutral cure silicon sealant or stop ends at all 'Z' flashing terminations excluding terminations at Shadowclad metal corner flashings	<input type="checkbox"/>
Back flashings or 150mm overlap to all flashing butt joints	<input type="checkbox"/>
<b>Expansion Gaps Between Sheets (Vertical Sheet Joints)</b>	
Texture Profile Sheets - 2mm gap between vertical edges of sheets	<input type="checkbox"/>
Groove Profile Sheets - 9mm gap (i.e. full groove space) between vertical edges of sheets	<input type="checkbox"/>
Note: Expansion gaps required between vertical edges of sheets to accommodate natural expansion and contraction of sheets	
<b>Ground Clearances</b>	
Paved/Sealed Ground - minimum 100mm distance from the ground to sheet bottom	<input type="checkbox"/>
Broken Ground - minimum 175mm distance from the ground to sheet bottom	<input type="checkbox"/>
Prime the bottom of the sheet 150mm up the back (rear) of the sheet	<input type="checkbox"/>

Refer to the current Shadowclad® Specification and Installation Guide for full installation specifications and suggested details.

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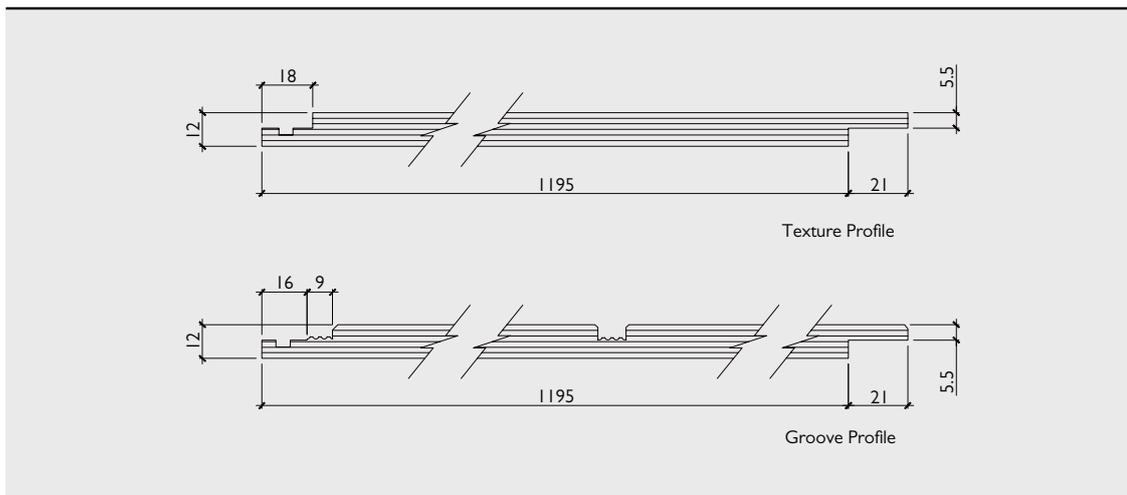
## 4.10 VERTICAL SHEET JOINTS

Shadowclad sheets have a built-in Ship lap joint and weather groove on the long edges of all sheets.

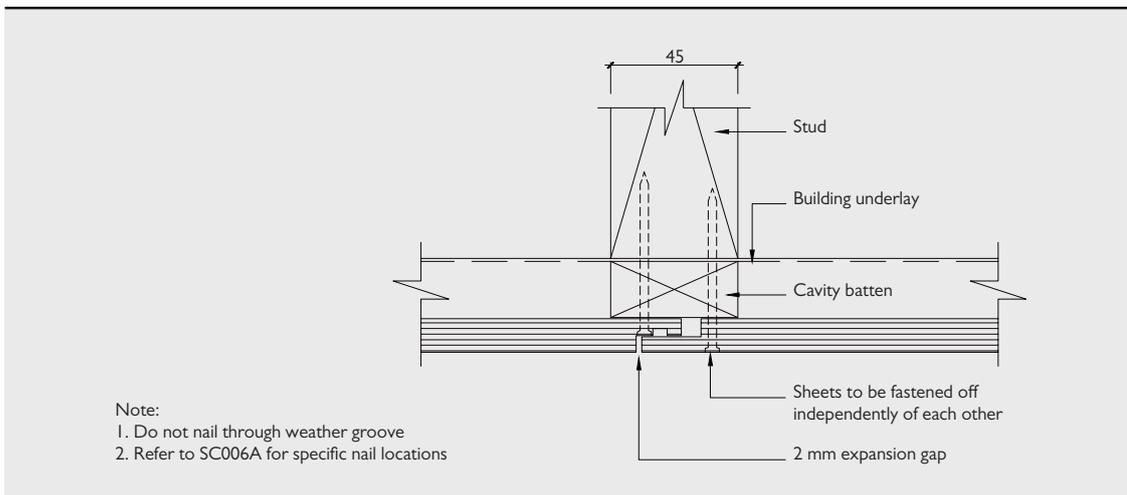
When installing Shadowclad Groove profile sheets, use a 9mm temporary spacer in the groove alongside Ship lap joint to establish correct expansion gap.

**Shadowclad is envelope preservative treated. Where sheets are cut, ends must be coated with a brush on timber preservative in accordance with the relevant manufacturer's instructions. Soudal® Metalex® Clear is recommended. Failure to properly apply preservative to cut edges will negatively affect the durability of cut panels.**

### SC004: Shadowclad Texture and Groove Sheet Dimensions



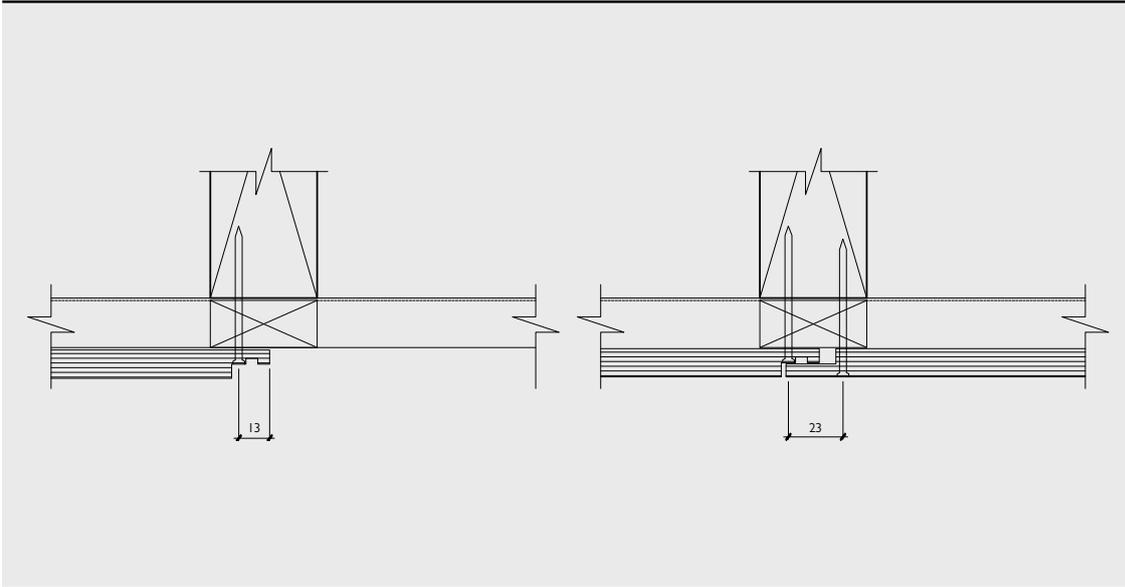
### SC006: Shadowclad Texture Vertical Joint (Cavity)



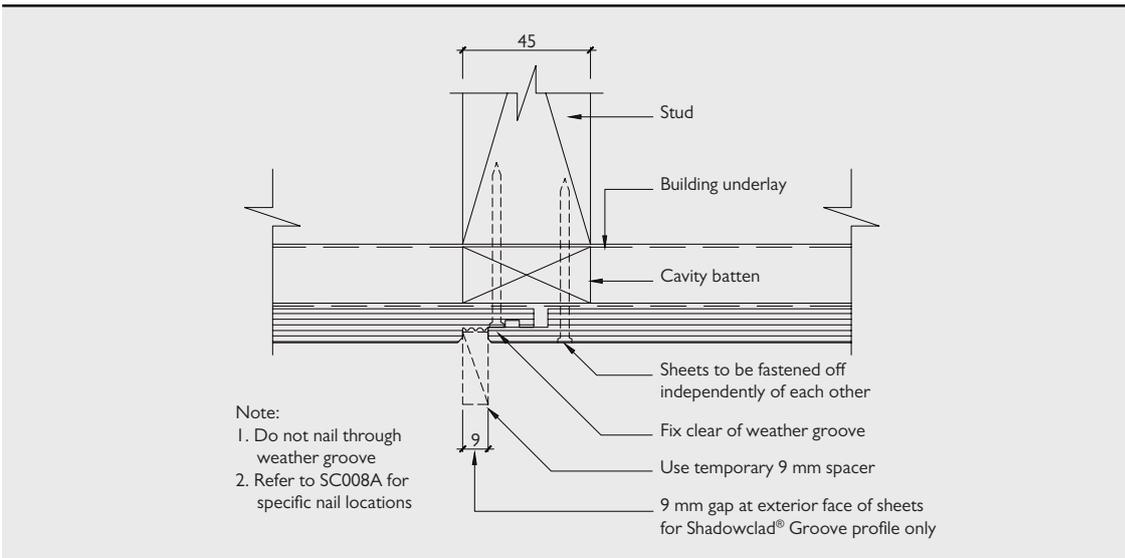
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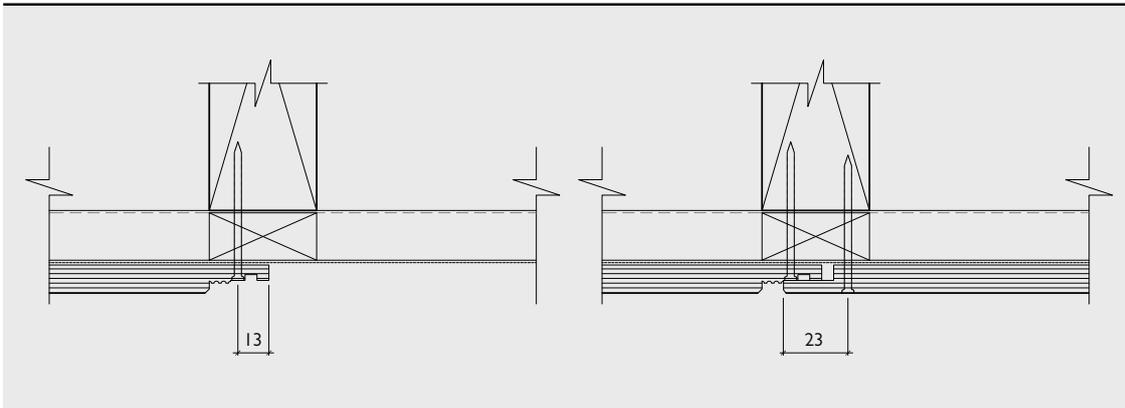
**SC006A: Shadowclad Texture Vertical Joint Fastener Locations (Cavity)**



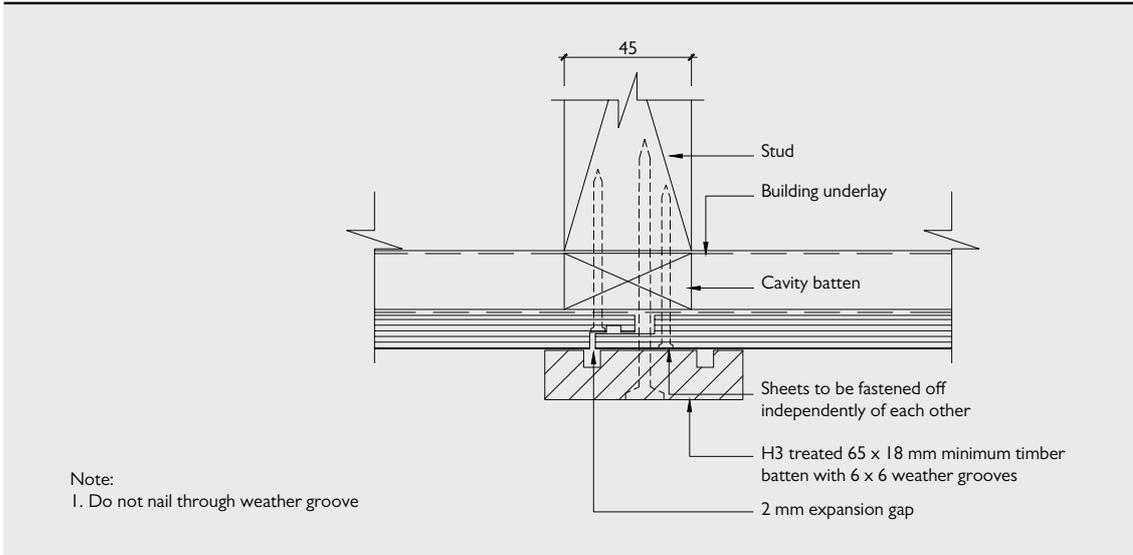
**SC008: Shadowclad Groove Vertical Joint (Cavity)**



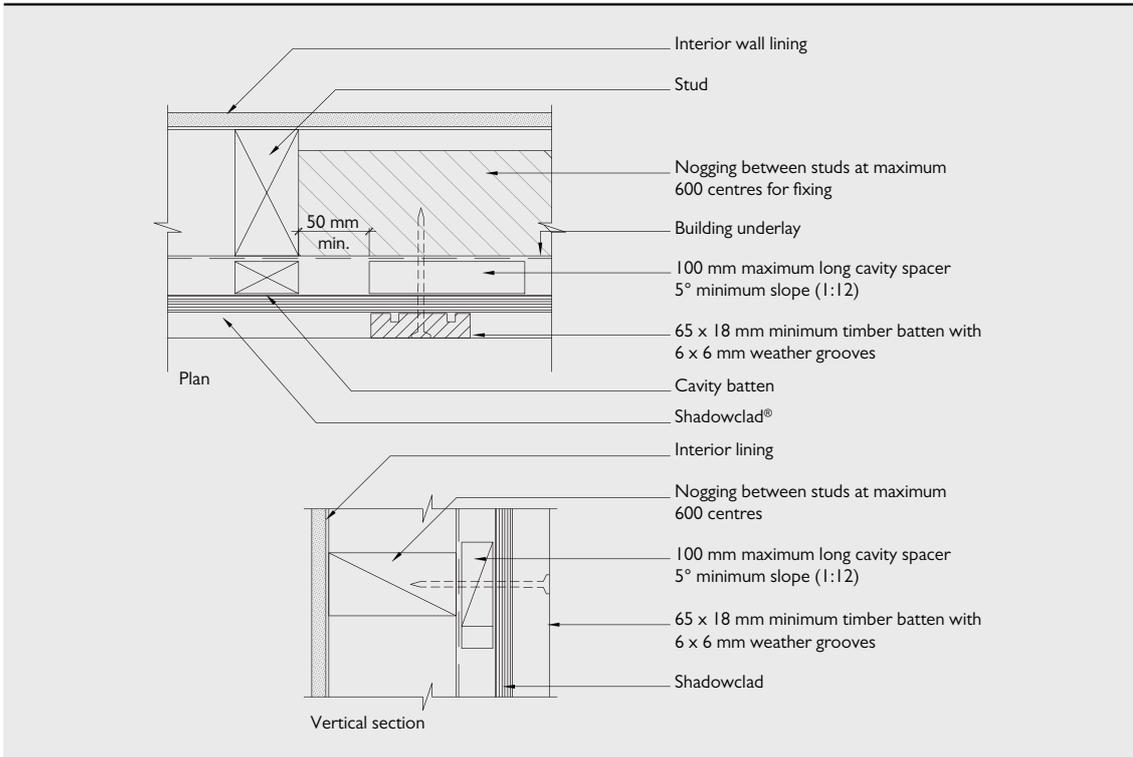
**SC008A: Shadowclad Groove Vertical Joint Fastener Locations (Cavity)**



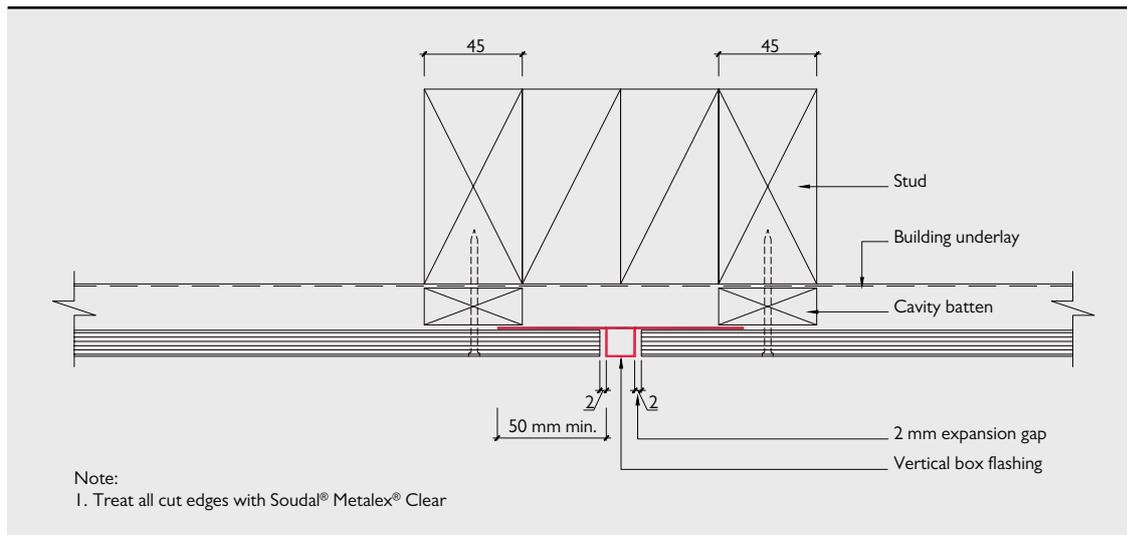
**SC010: Shadowclad Vertical Joint with Optional Cover Batten (Cavity)**



**SC012: Shadowclad Nogging for Vertical Cover Batten Between Studs (Cavity)**



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**SC014: Shadowclad Vertical Joint with Top Hat Flashing (Cavity)****4.11 HORIZONTAL SHEET JOINTS**

At floor joist level a horizontal joint must be provided to accommodate the movement resulting from timber joist shrinkage and settlement.

A Shadowclad Horizontal 'Z' flashing should be used for horizontal sheet joints.

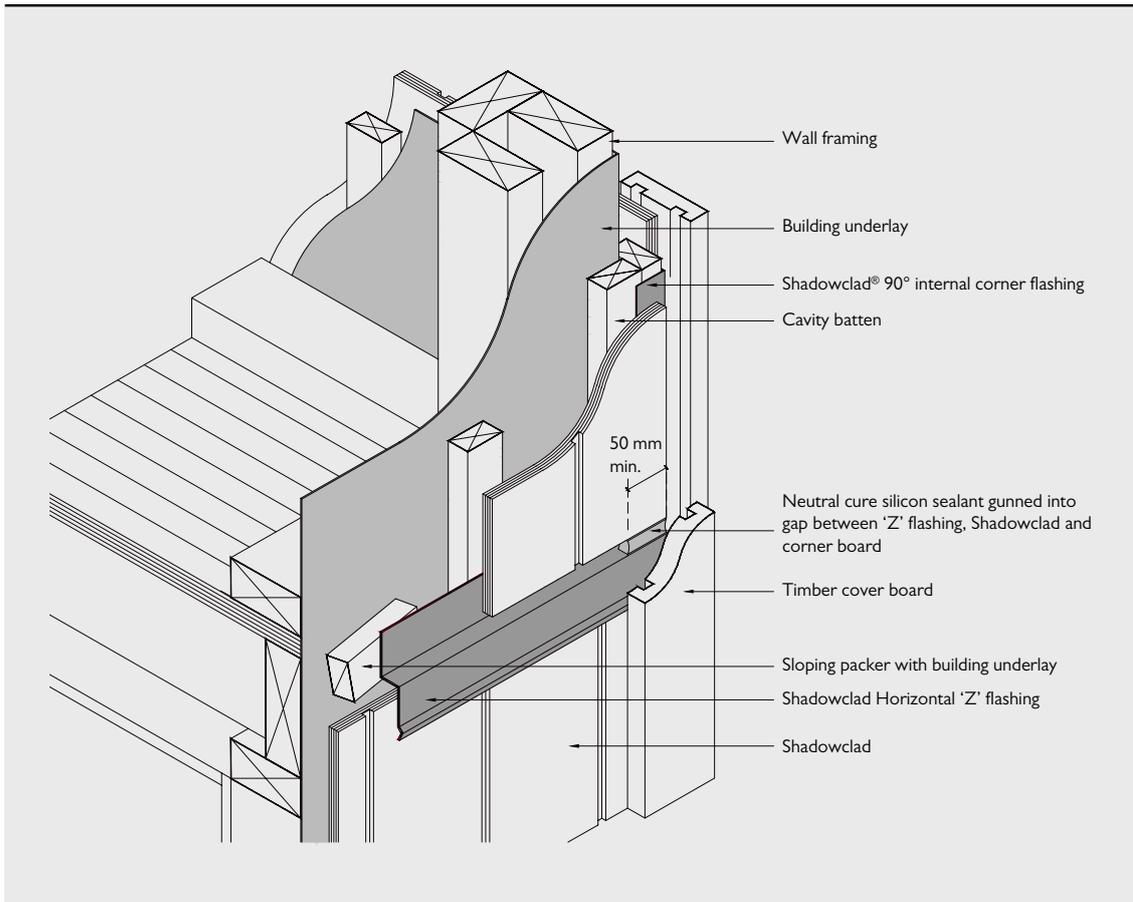
Acceptable Solution E2/AS1 requires drained cavities to be limited to a height of two storeys.

If aluminium 'Z' flashings are being used, all butt joints must include proprietary back flashings. Stainless steel flashings should be lapped by a minimum 150mm at joints.

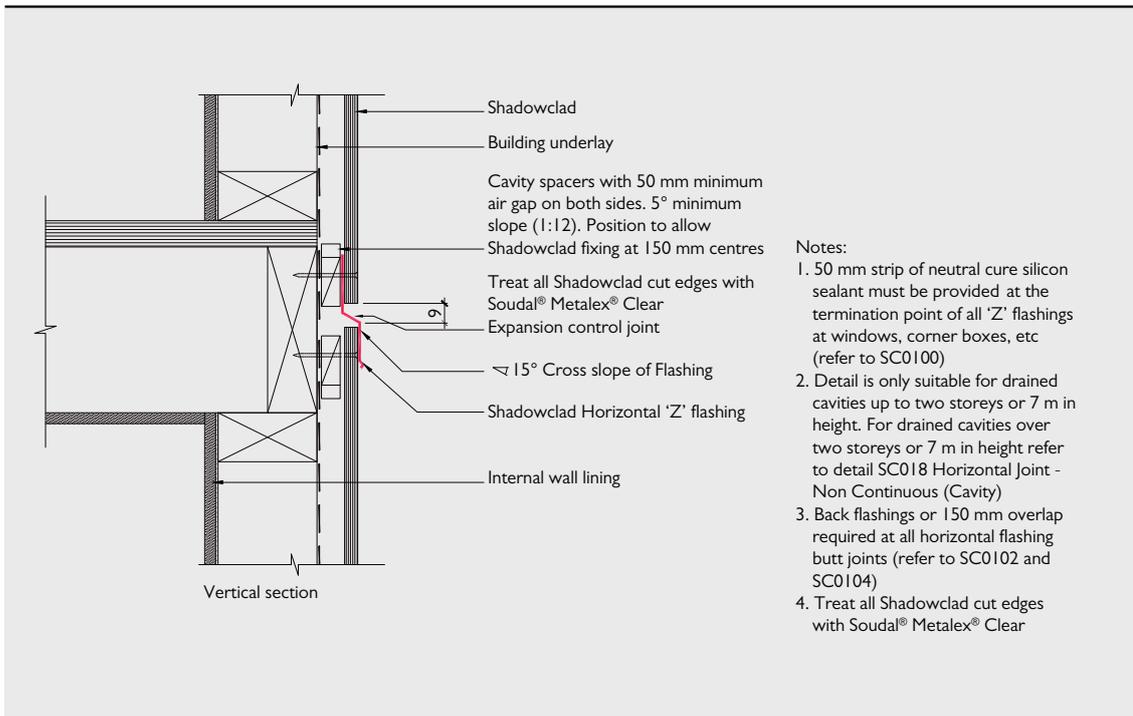
A 50mm strip of neutral cure silicon (refer to SC0100 General Silicon Sealing of Horizontal 'Z' Flashings) or stop ends (as applicable) required at all 'Z' flashing terminations excluding terminations at Shadowclad metal corner flashings.

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### SC0100: Shadowclad General Silicon Sealing of Horizontal 'Z' Flashings

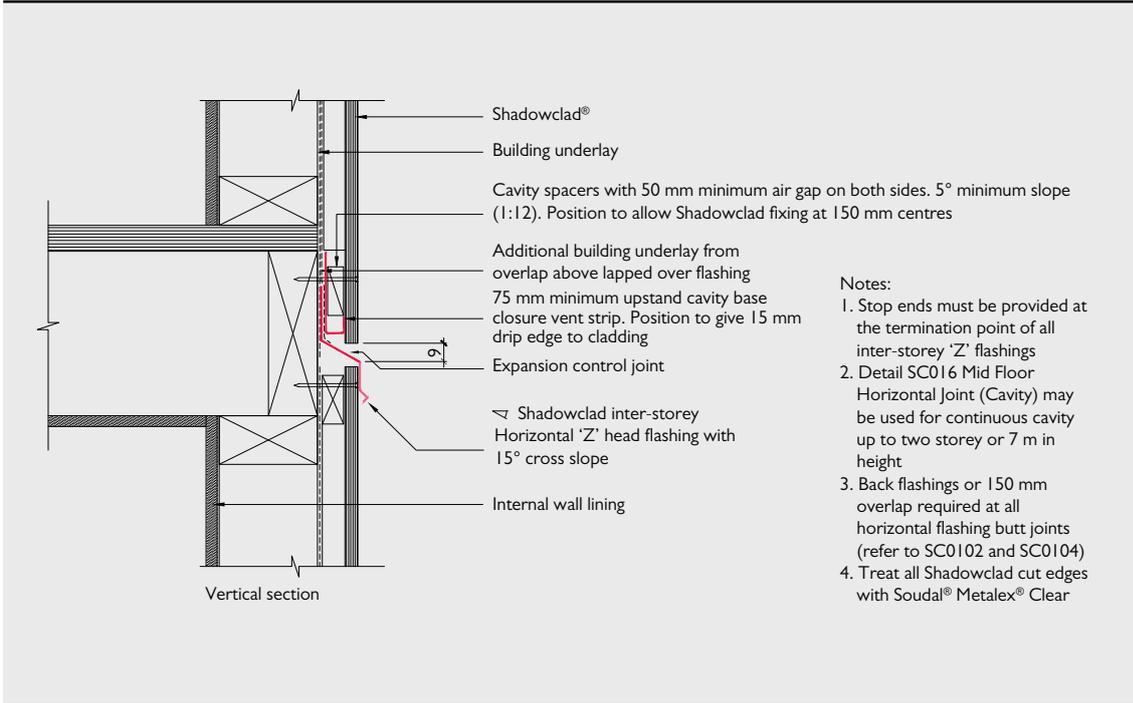


### SC016: Shadowclad Mid Floor Horizontal Joint (Cavity)



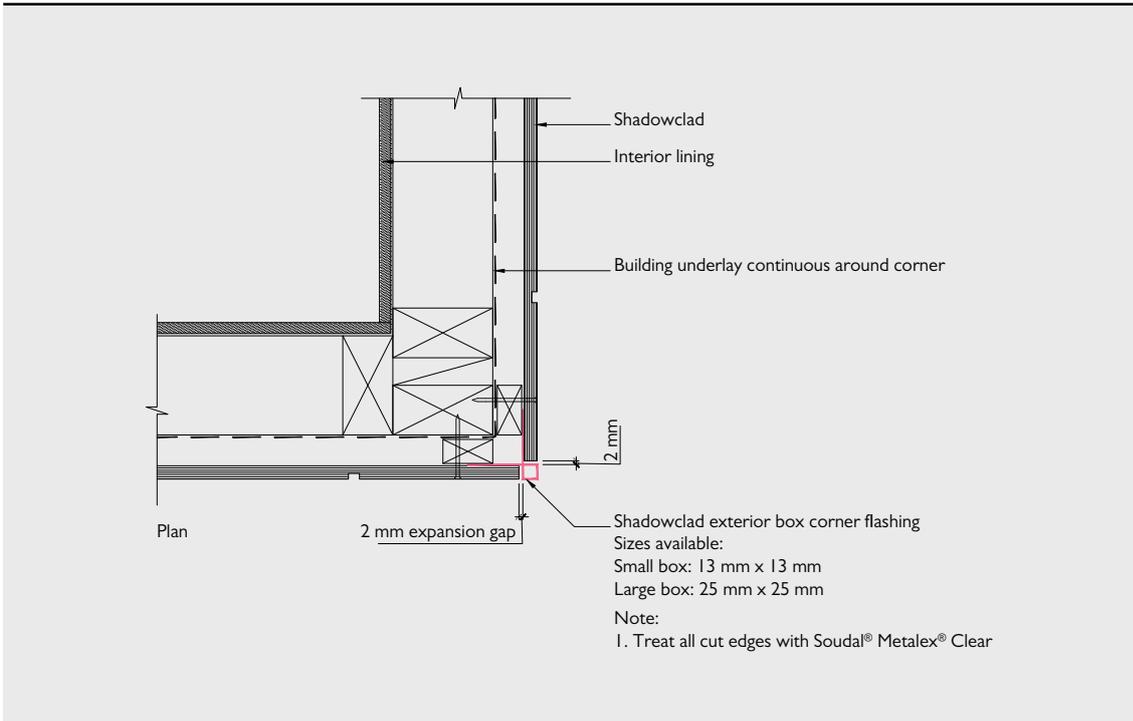
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**SC018: Shadowclad Mid Floor Horizontal Joint – Non Continuous (Cavity)**

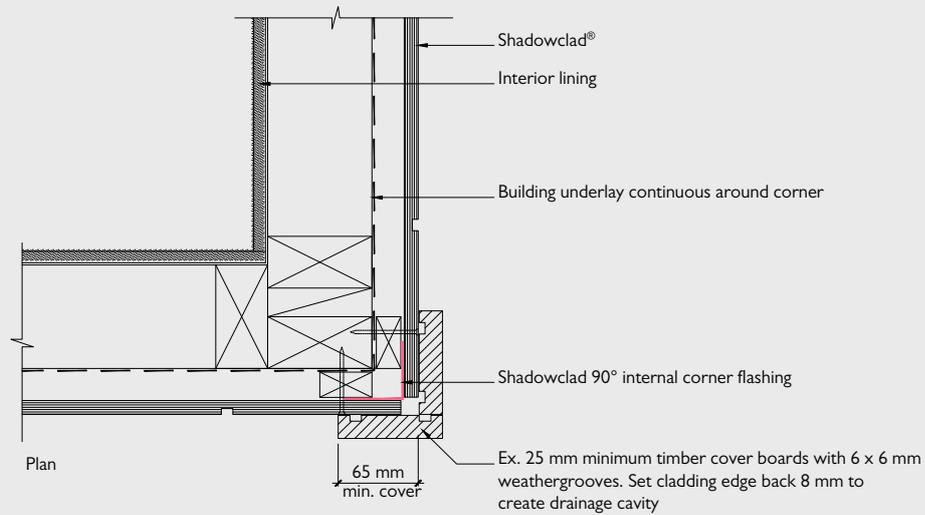


4.12 EXTERNAL CORNERS

**SC020: Shadowclad External Corner with External Box Flashing (Cavity)**



### SC022: Shadowclad External Corner with Cover Boards (Cavity)

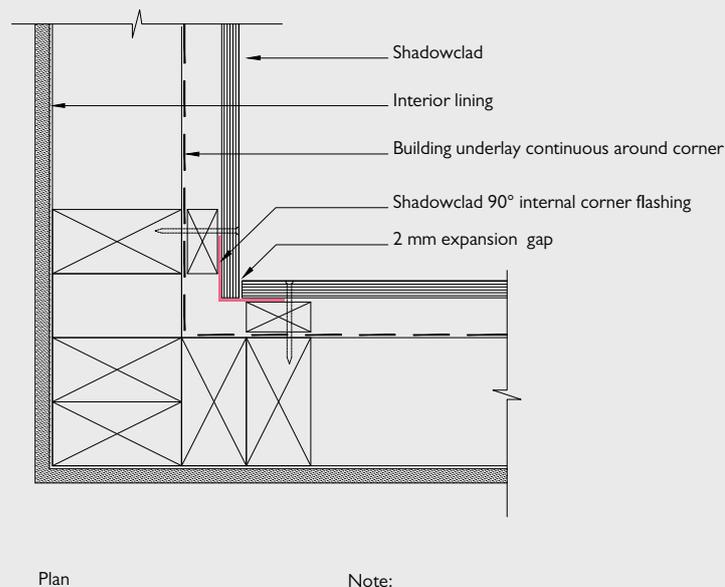


Note:

1. Treat all cut edges with Soudal® Metalex® Clear
2. 50 mm strip of sealant must be provided at the termination point of all 'Z' flashings at windows, corner boxes, etc. (refer to SC0100)

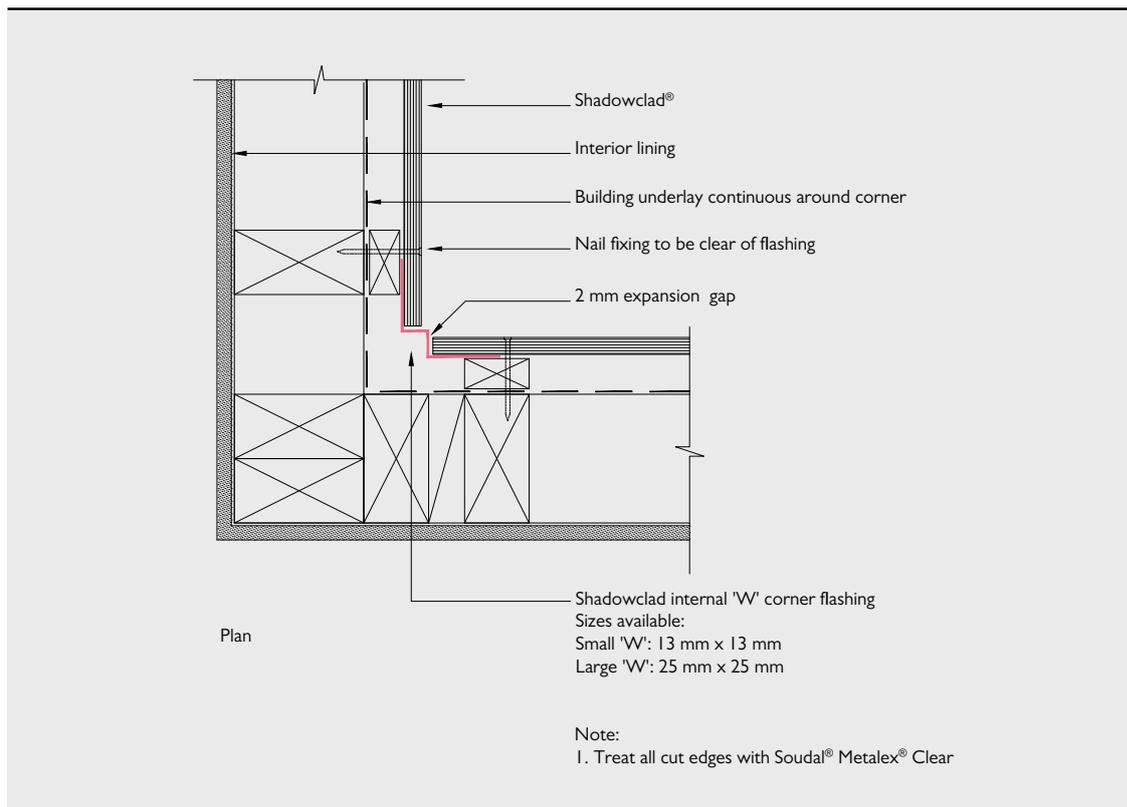
## 4.13 INTERNAL CORNERS

### SC024: Shadowclad Internal Corner with 90° Flashing (Cavity)



Note:

1. Treat all cut edges with Soudal® Metalex® Clear

**SC026: Shadowclad Internal Corner with 'W' Flashing (Cavity)****4.14 SHADOWCLAD FLASHING JUNCTION POINTS**

Flashings should have expansion joints where necessary to provide adequate allowance for thermal expansion as set out below.

- Expansion joints to be provided for joined flashings when their combined length exceeds 8 metres.
- Even if less than 8 metres in length, where both ends of a flashing are constrained and fixed, allowance should be made for expansion.

**Cavity Base Closure**

Fix Shadowclad cavity base closures to bottom plates through the upstand with 40 x 2.5mm, hot dipped galvanised or stainless steel (as appropriate) flat head nails at 300mm centres.

The cavity base closure should be positioned to allow a minimum drip edge to the wall cladding of 15mm at the base of walls, and 15mm above window head flashings.

**Internal and External Flashings**

Internal and external angles and 'Z' flashings can be nominally fixed with hot dipped galvanised or stainless steel (as applicable) flat head nails and then permanently fixed with the Shadowclad fasteners penetrating the flashing wings/upstands.

**Horizontal 'Z' Flashings**

Horizontal aluminium 'Z' flashings should be butted together with a back flashing to create a weathertight joint (refer to SC0102).

Stainless steel back flashings should overlap by a minimum of 150mm at joints to create weathertight joints where horizontal flashings meet (refer to SC0104).

**'Z' Flashings Terminations**

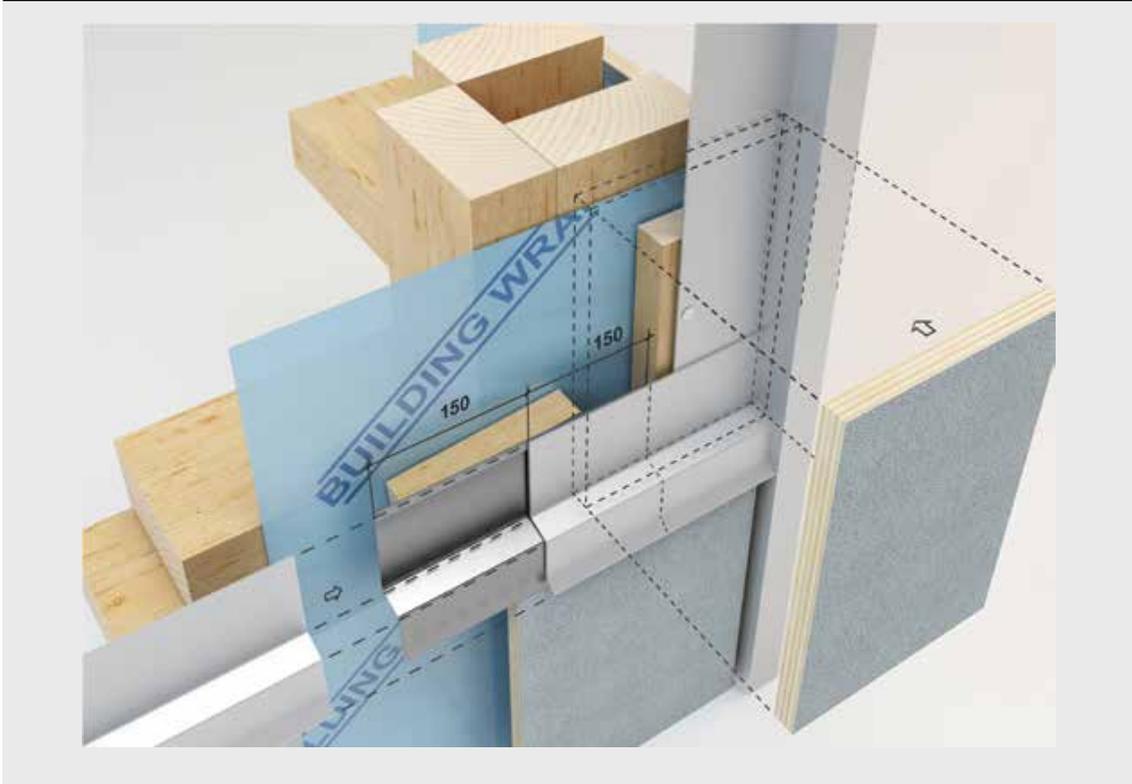
Where inter-storey 'Z' flashings terminate stop ends must be installed.

A 50mm strip of neutral cure silicon (refer to SC0100 General Silicon Sealing of Horizontal 'Z' Flashings) or stop ends (as applicable) required at all 'Z' flashing terminations excluding terminations at Shadowclad metal corner flashings.

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**SC0102: Shadowclad Aluminium Flashing Junctions and Connections (Cavity)**



**SC0104: Shadowclad Stainless Steel 'Z' Flashing Joins (Cavity)**



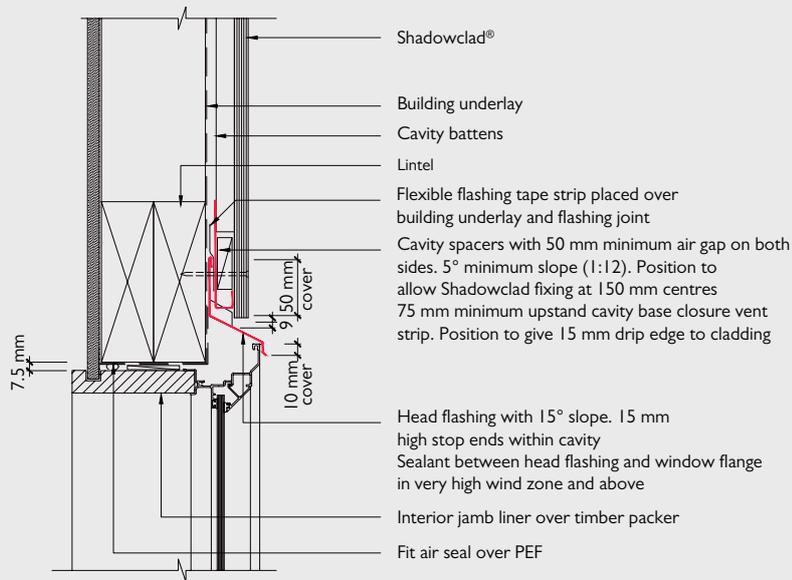
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### 4.15 WINDOW PENETRATIONS

Window joinery flashings (i.e. head and sill flashings) should be sourced from the joinery fabricator to meet the requirements of Acceptable Solution E2/AS1 or an Alternative Solution such

as the Window Association of New Zealand Window Installation System (WANZ WIS) which can be downloaded at [www.wanz.org.nz](http://www.wanz.org.nz).

#### SC028: Shadowclad Window Head Detail (Cavity)

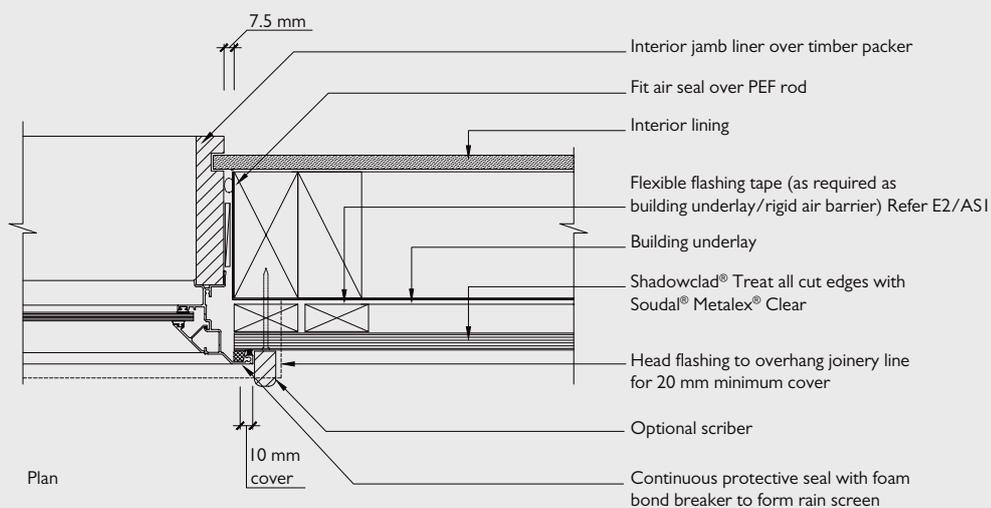


- Note:
1. Treat all cut edges with Soudal® Metalex® Clear
  2. Stop ends to head flashing terminations



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### SC030: Shadowclad Jamb Detail (Cavity)



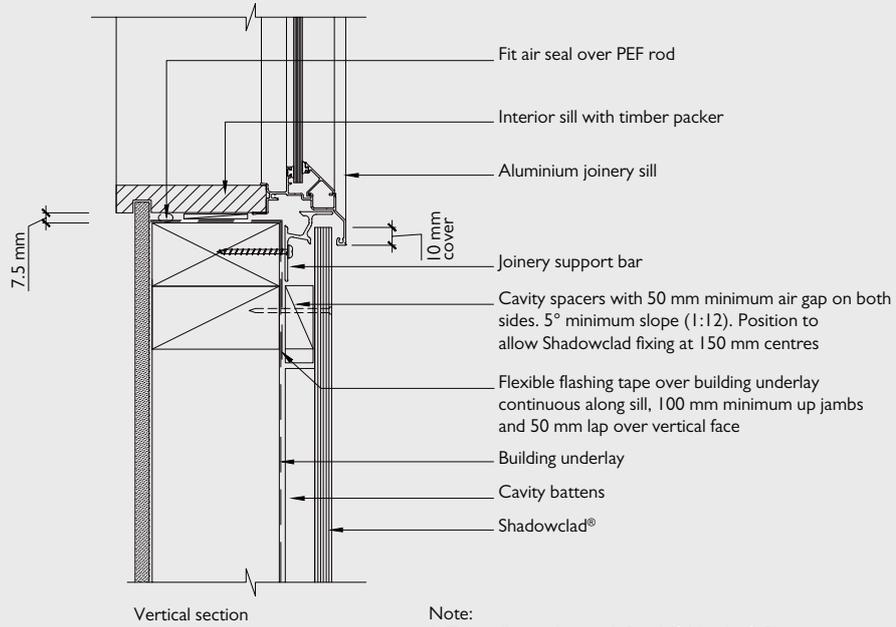
Note:

1. Treat all Shadowclad cut edges with Soudal® Metalex® Clear
2. 50 mm strip of sealant must be provided at the termination point of all 'Z' flashings at windows, corner boxes, etc



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SC032: Shadowclad Window Sill Detail (Cavity)

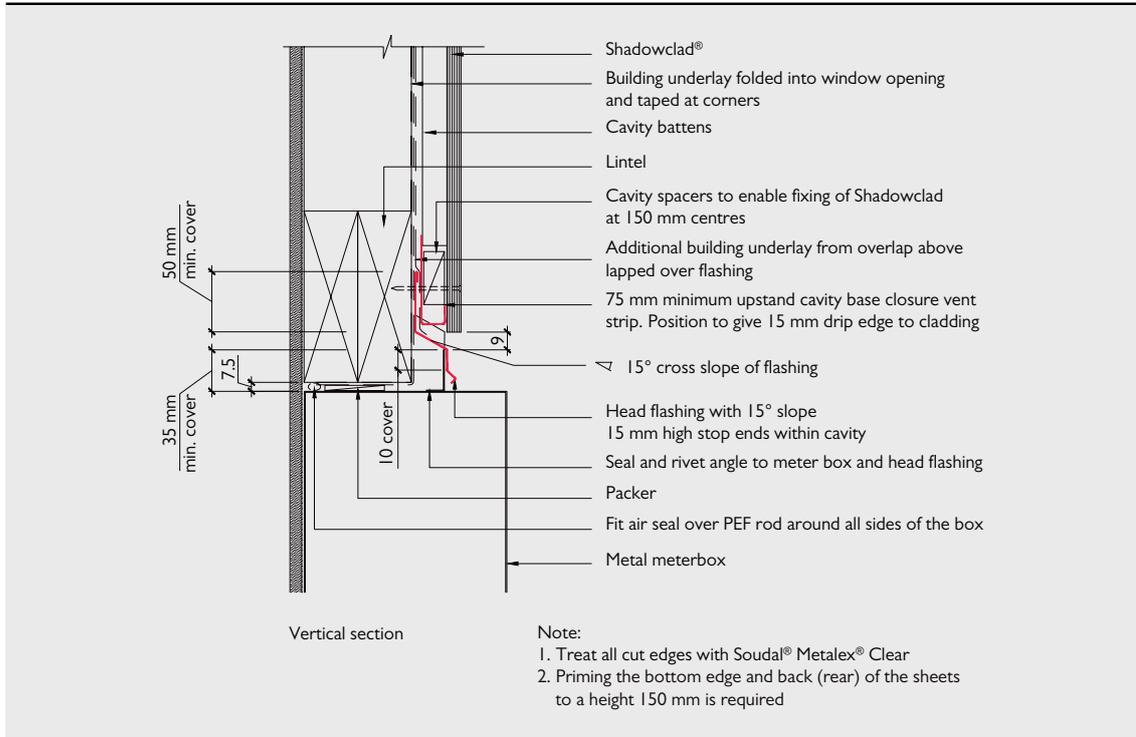


Note:  
1. Treat all cut edges with Soudal® Metalex® Clear

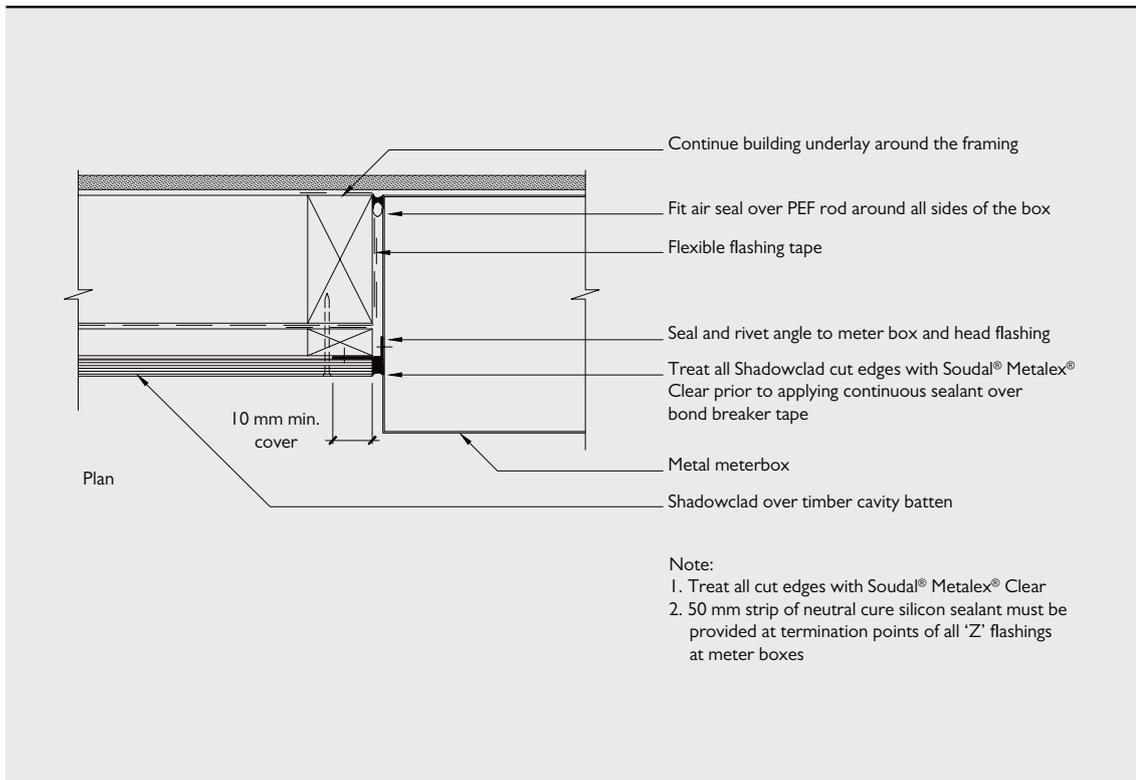


4.16 WALL PENETRATIONS

**SC034A: Shadowclad Meterbox Vertical Cross Section (Cavity)**

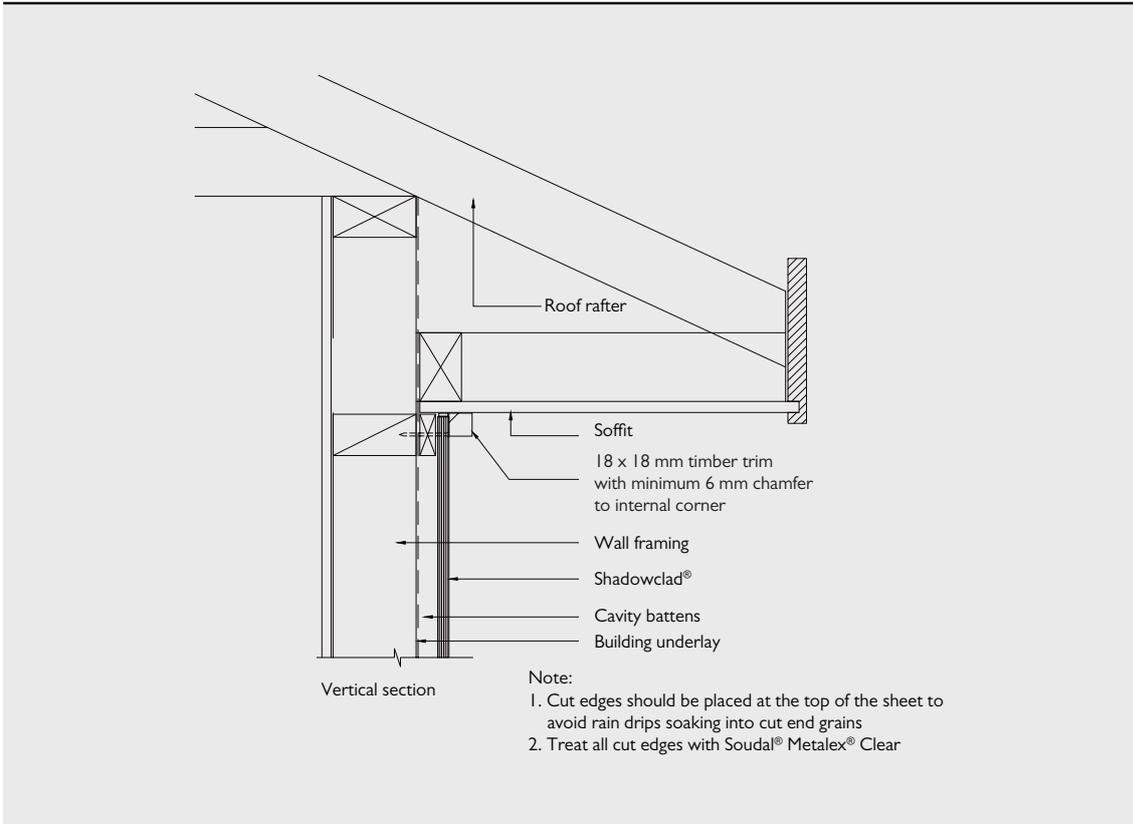


**SC034B: Shadowclad Meterbox Horizontal Cross Section (Cavity)**

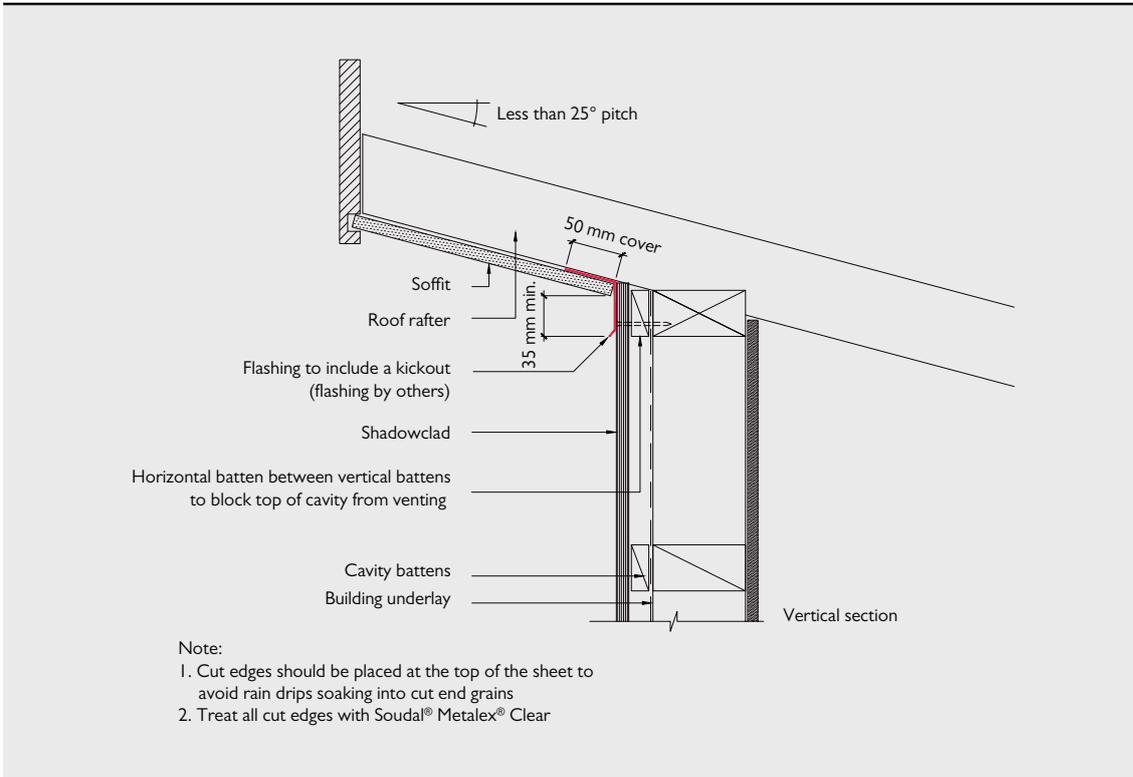


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**SC036: Shadowclad Soffit Detail (Cavity)**

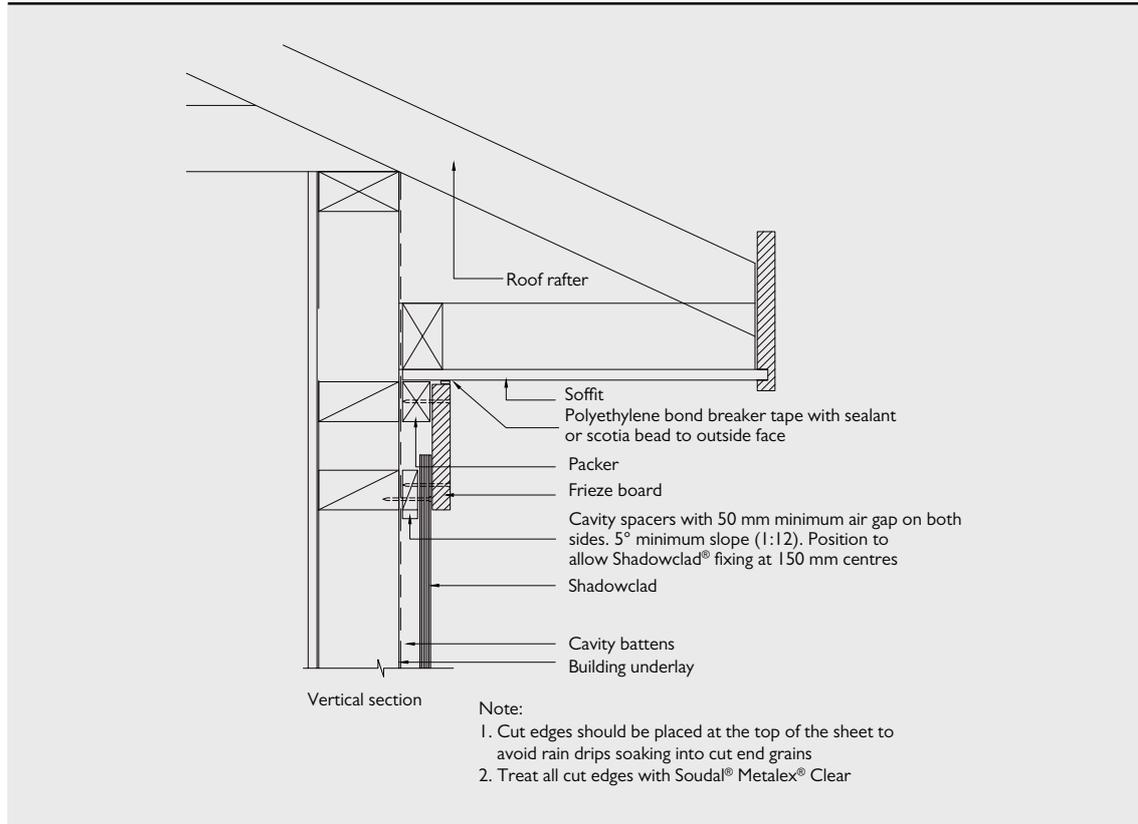


**SC036A: Shadowclad Alternative Soffit Detail (Cavity)**

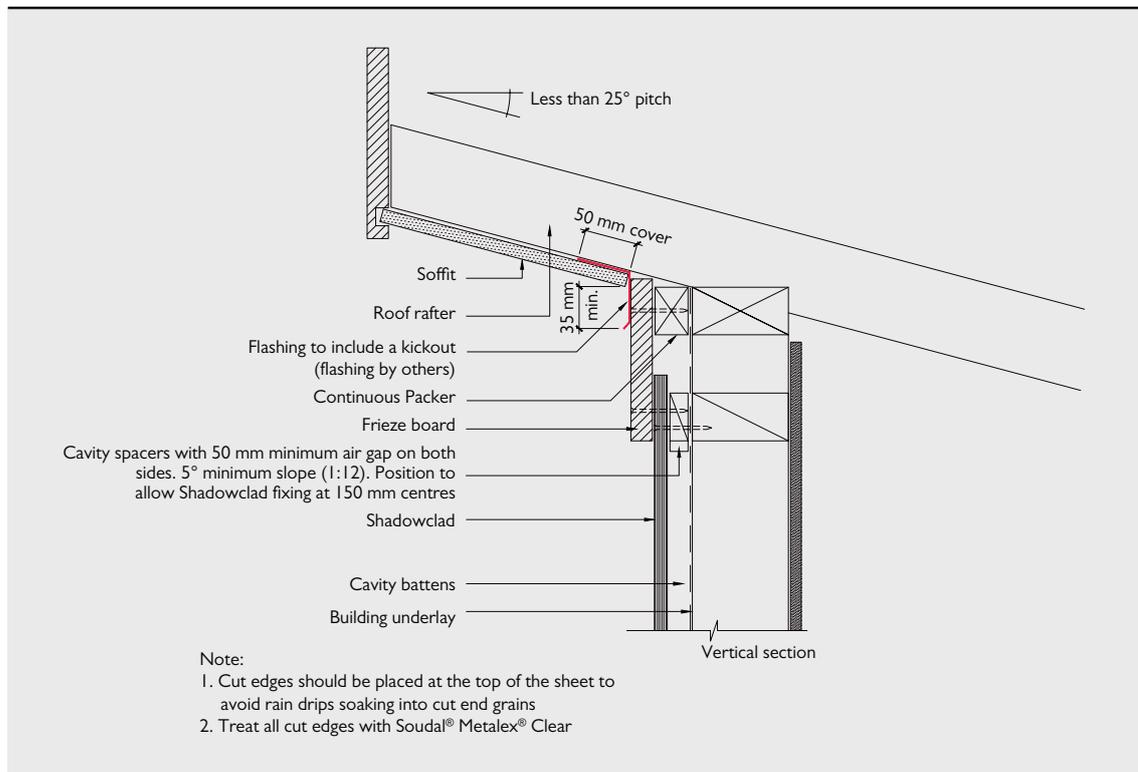


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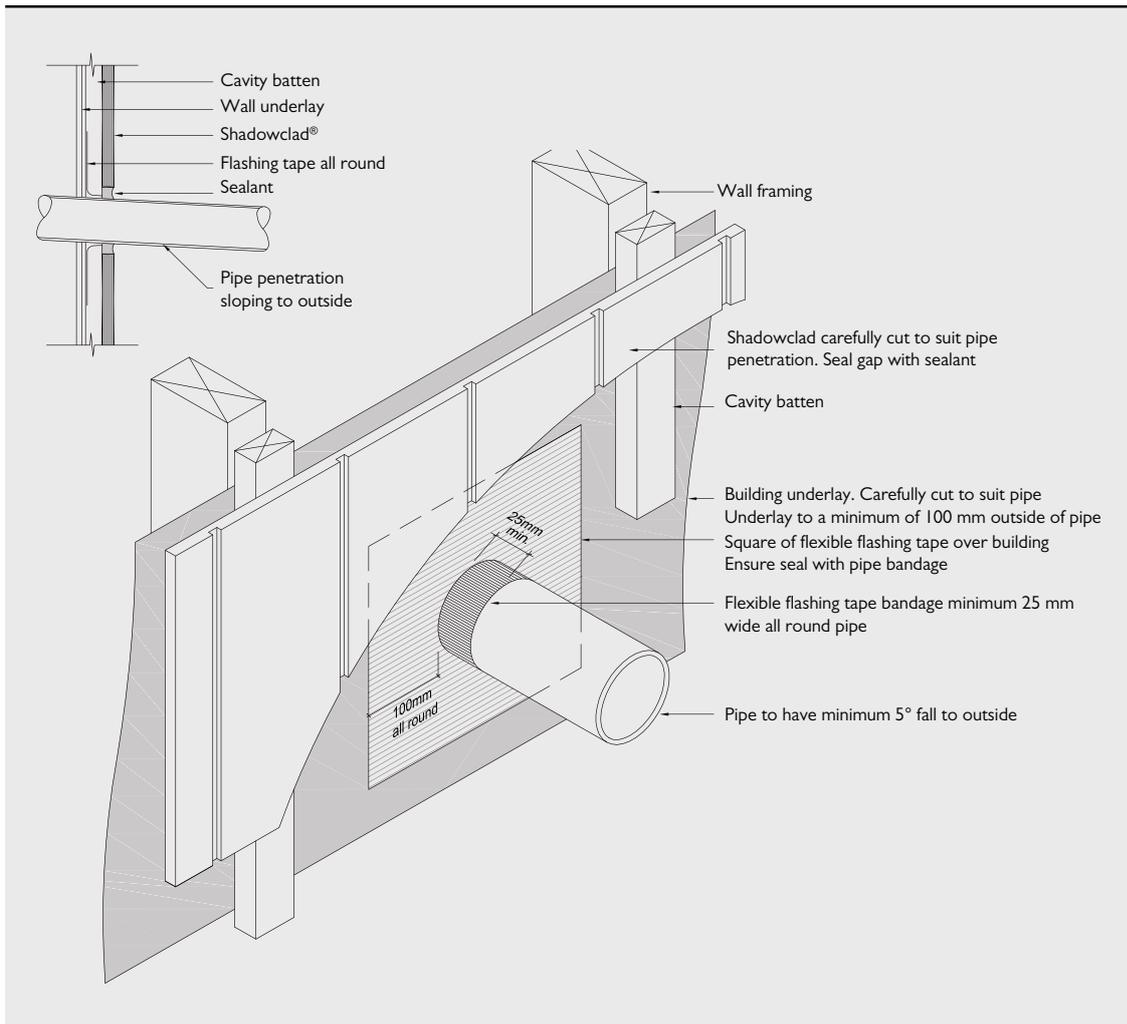
**SC038: Shadowclad Soffit Alternative Detail (Cavity)**



**SC038A: Shadowclad Alternative Soffit Detail (Cavity)**



### SC040: Shadowclad Pipe Penetration (Cavity)



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## 4.17 SHEET CLEARANCES

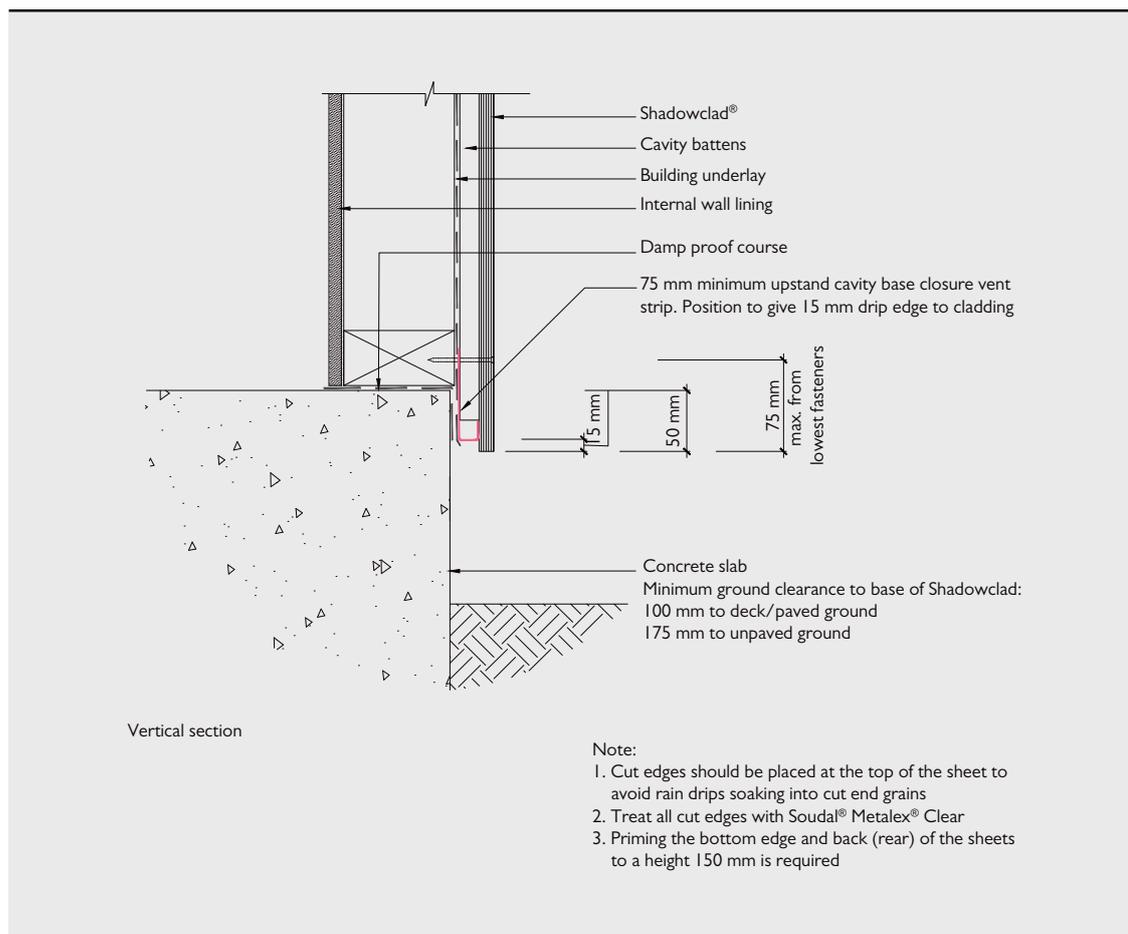
### Ground Clearances

Shadowclad must overhang the bottom plate on a concrete slab by a minimum of 50mm as required by NZS 3604 and E2 - External Moisture. Maximum distance from the bottom of the sheet to the fixing shall not exceed 75mm.

The bottom edge of the Shadowclad sheet must be a minimum of 50mm above decks and verandahs, 100mm above paved ground and a minimum of 175mm above unprotected ground.

For garage door openings, refer Paragraph 9 "Openings to garages" in Acceptable Solution E2/AS1.

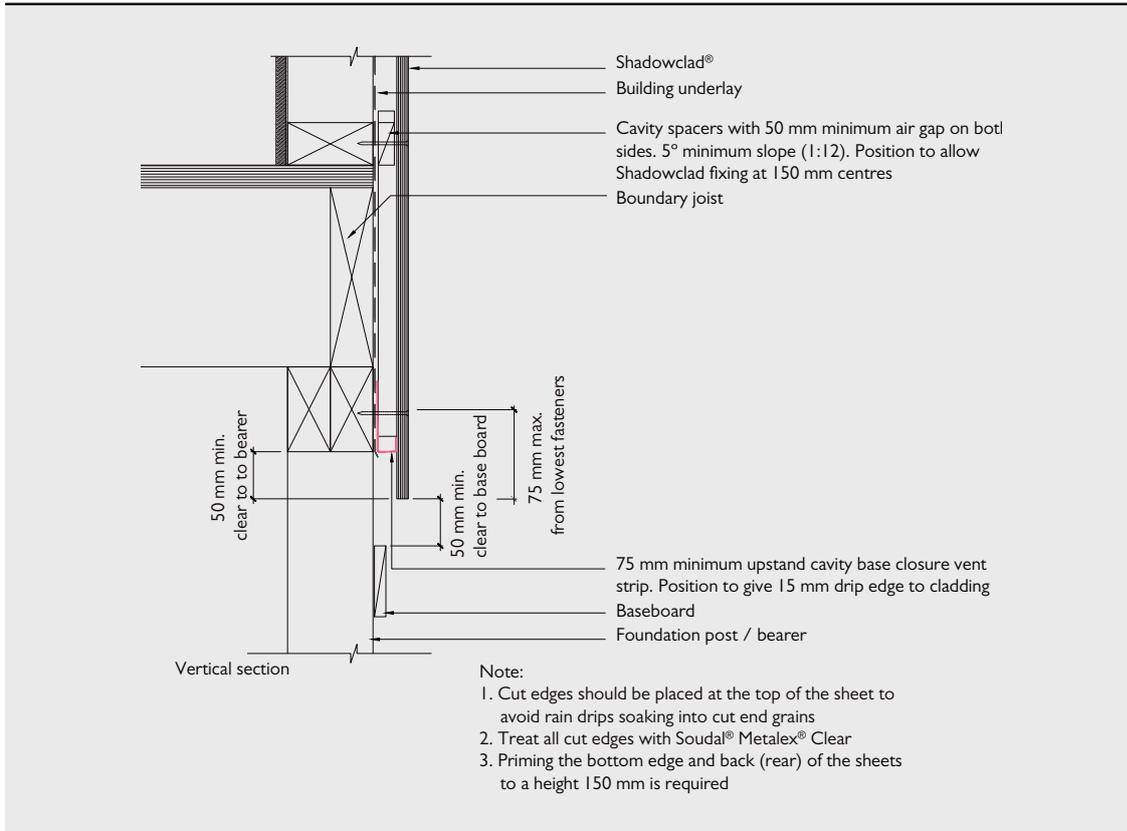
### SC042: Shadowclad Overhangs and Ground Clearances (Cavity)



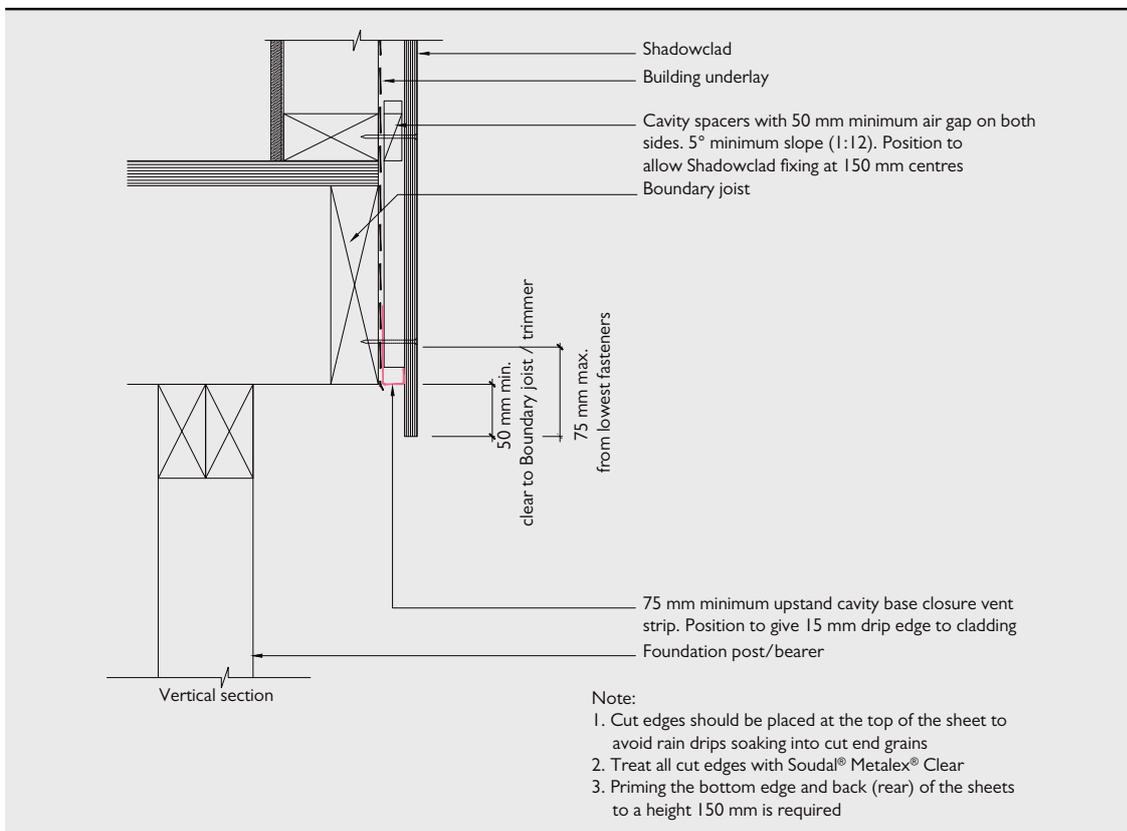
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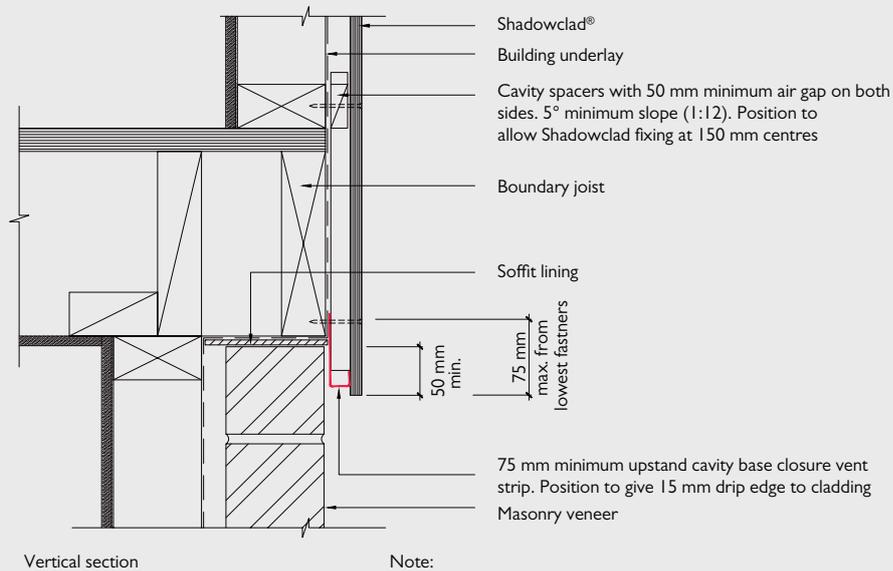
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**SC042A: Shadowclad Overhang for Timber Ground Floor to Non-Cantilevered Wall**



**SC042B: Shadowclad Overhang for Timber Ground Floor to Cantilevered Wall**



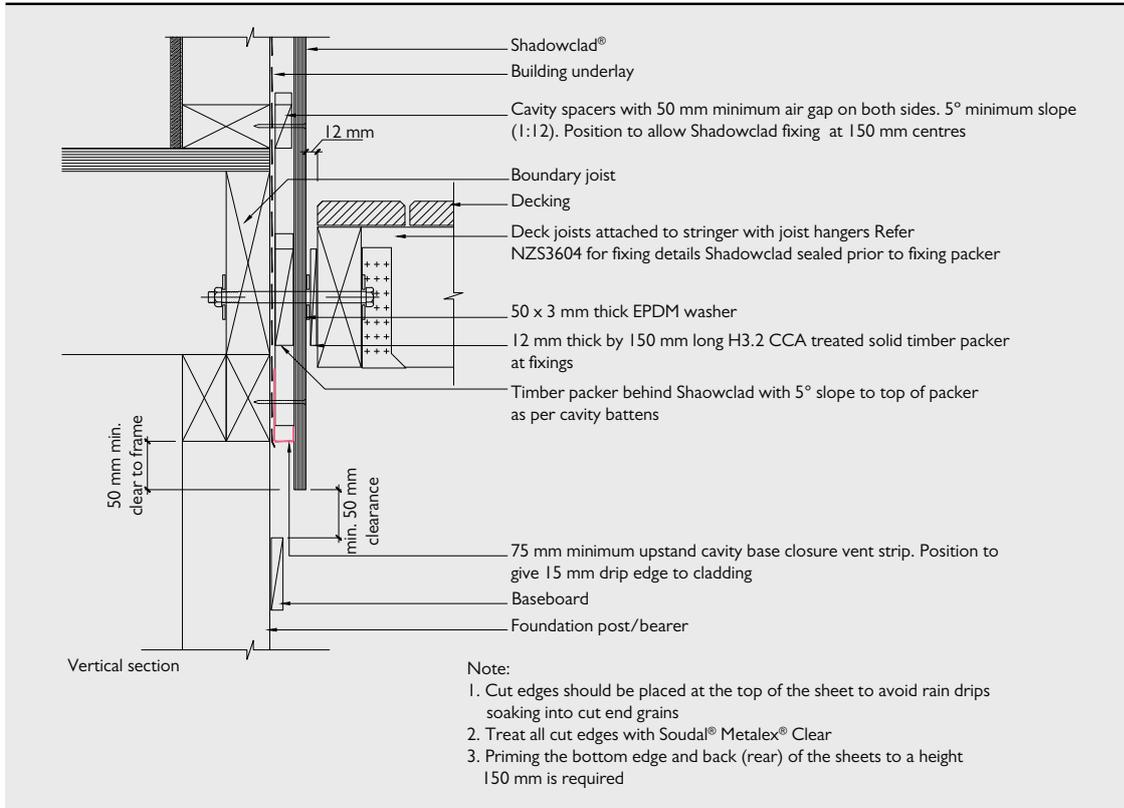
**SC044: Shadowclad Upper Storey to Masonry Lower Storey (Cavity)****Note:**

1. Cut edges should be placed at the top of the sheet to avoid rain drips soaking into cut end grains
2. Treat all cut edges with Soudal® Metalex® Clear
3. Priming the bottom edge and back (rear) of the sheets to a height 150 mm is required

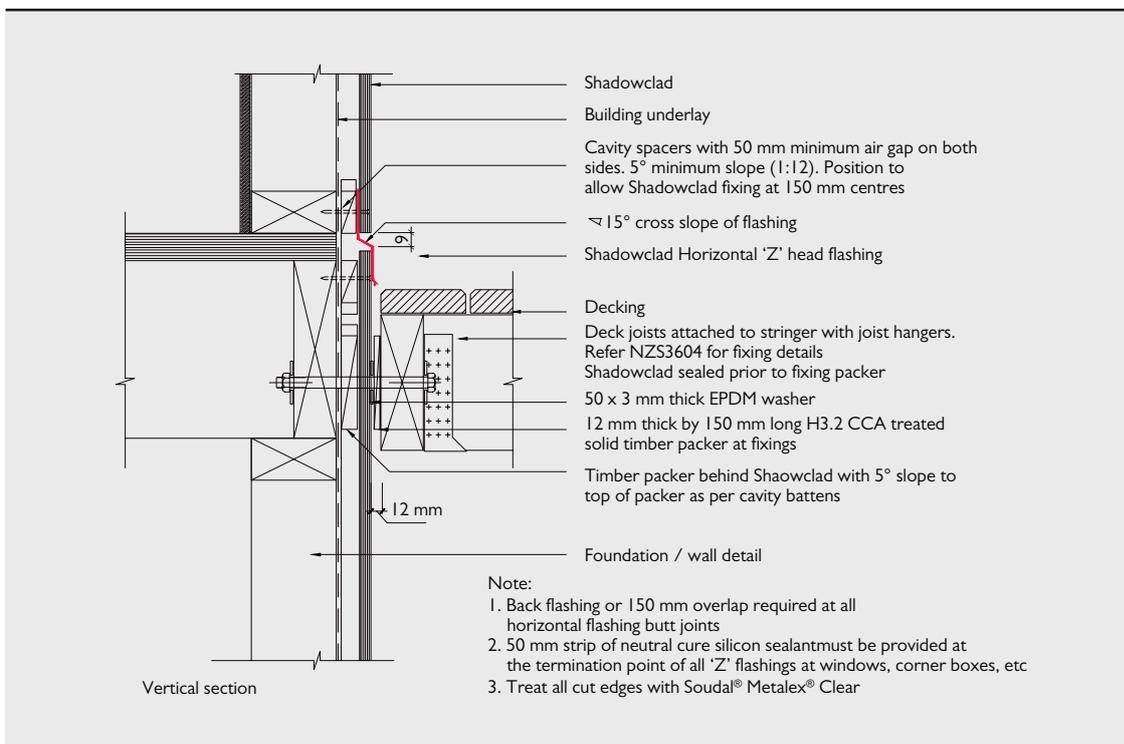
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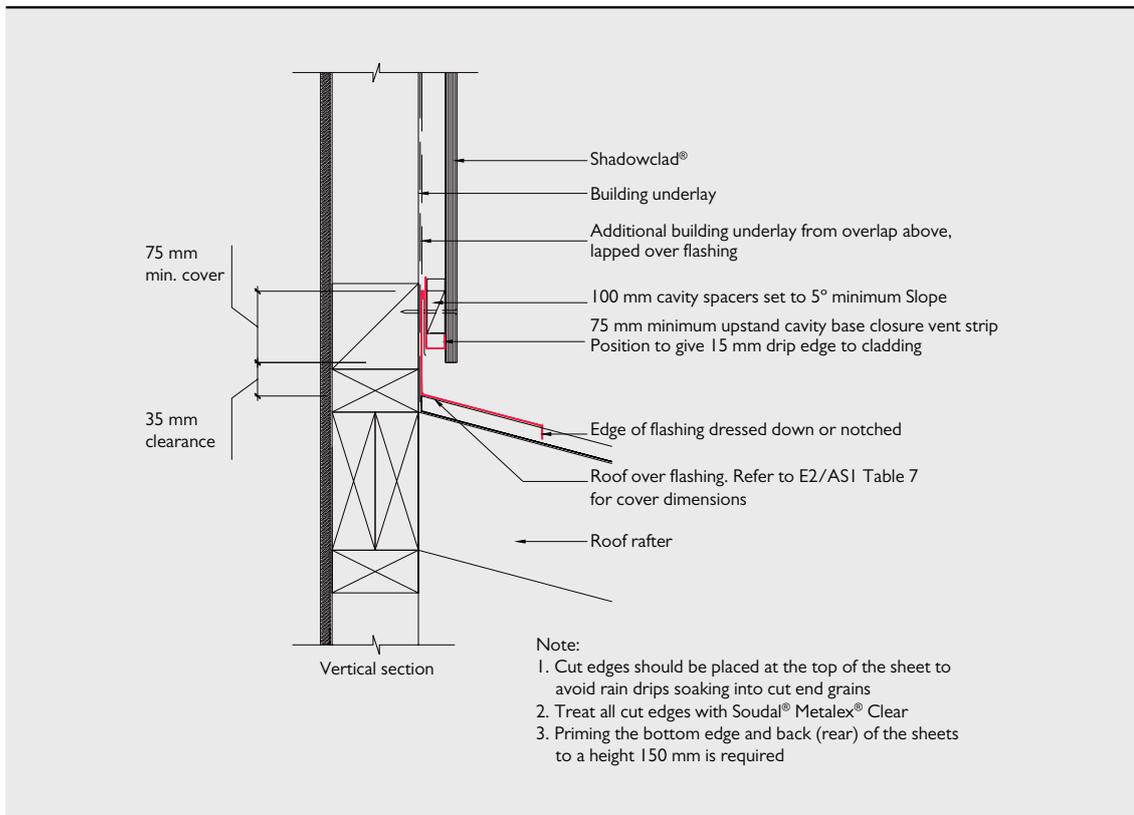
4.18 OTHER DETAILS

**SC046: Shadowclad® Timber Ground Floor to Non-Cantilevered Deck (Cavity)**



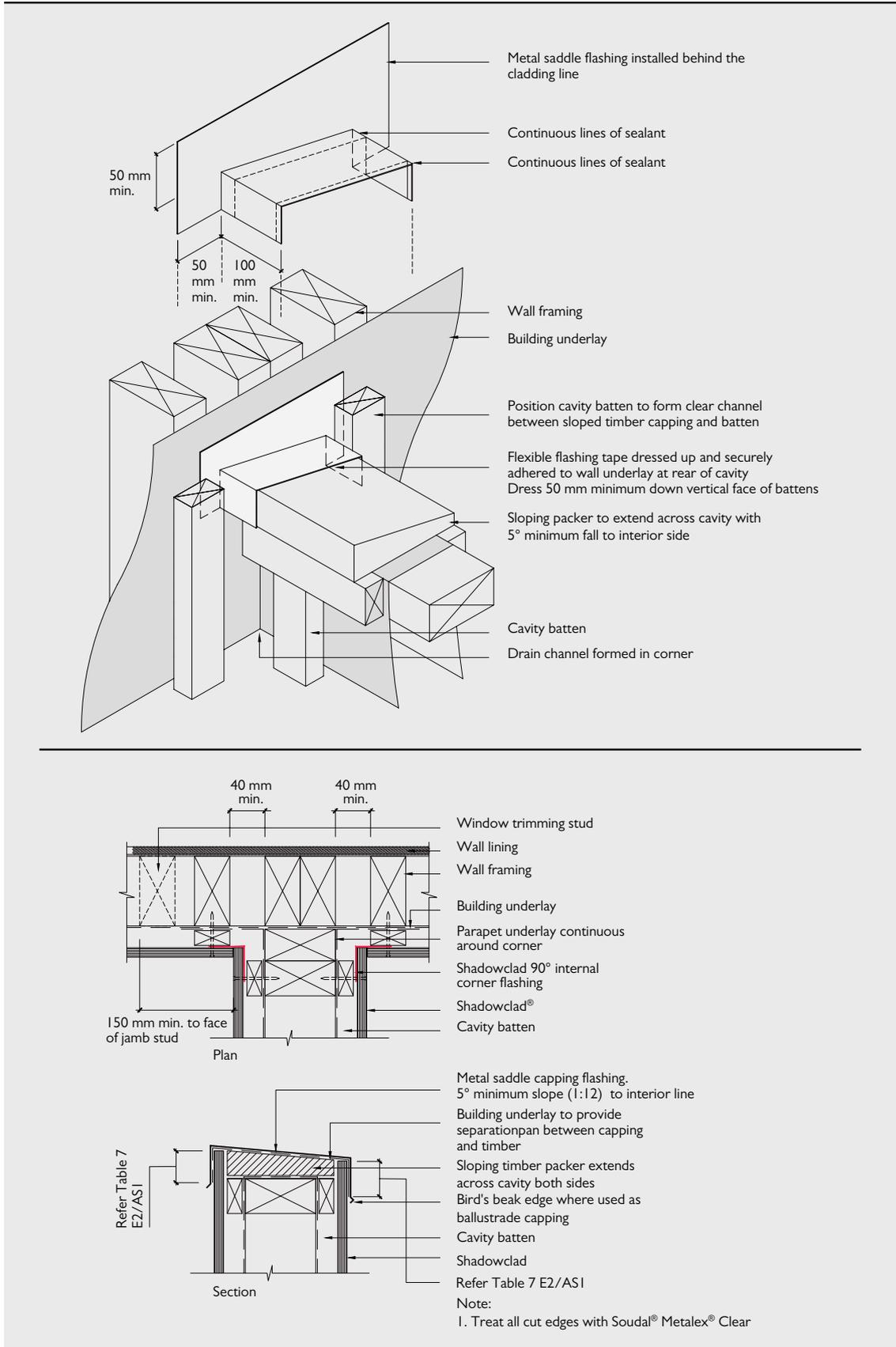
**SC048: Shadowclad Mid Floor to Non-Cantilevered Deck (Cavity)**



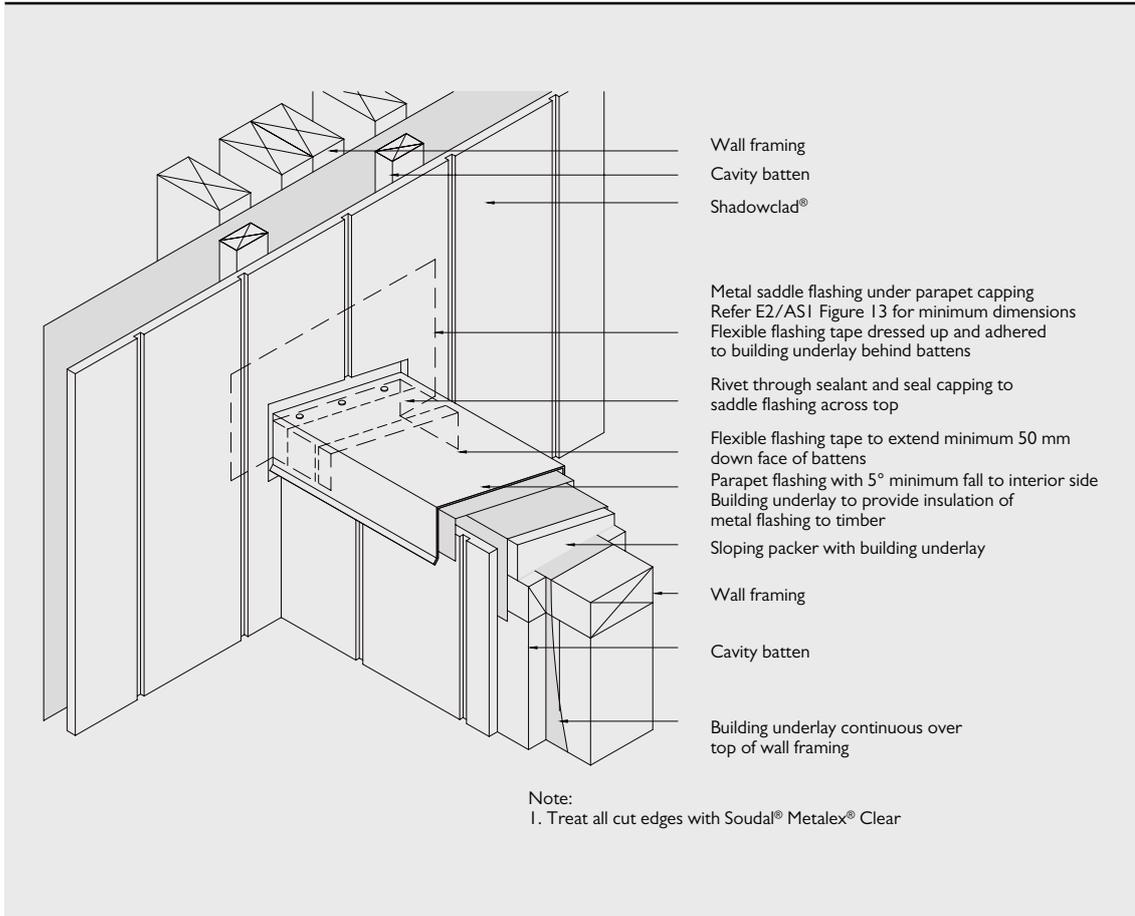
**SC050: Shadowclad Basic Apron Flashing (Cavity)**

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SC052: Shadowclad Balustrade to Wall Junction (Cavity)

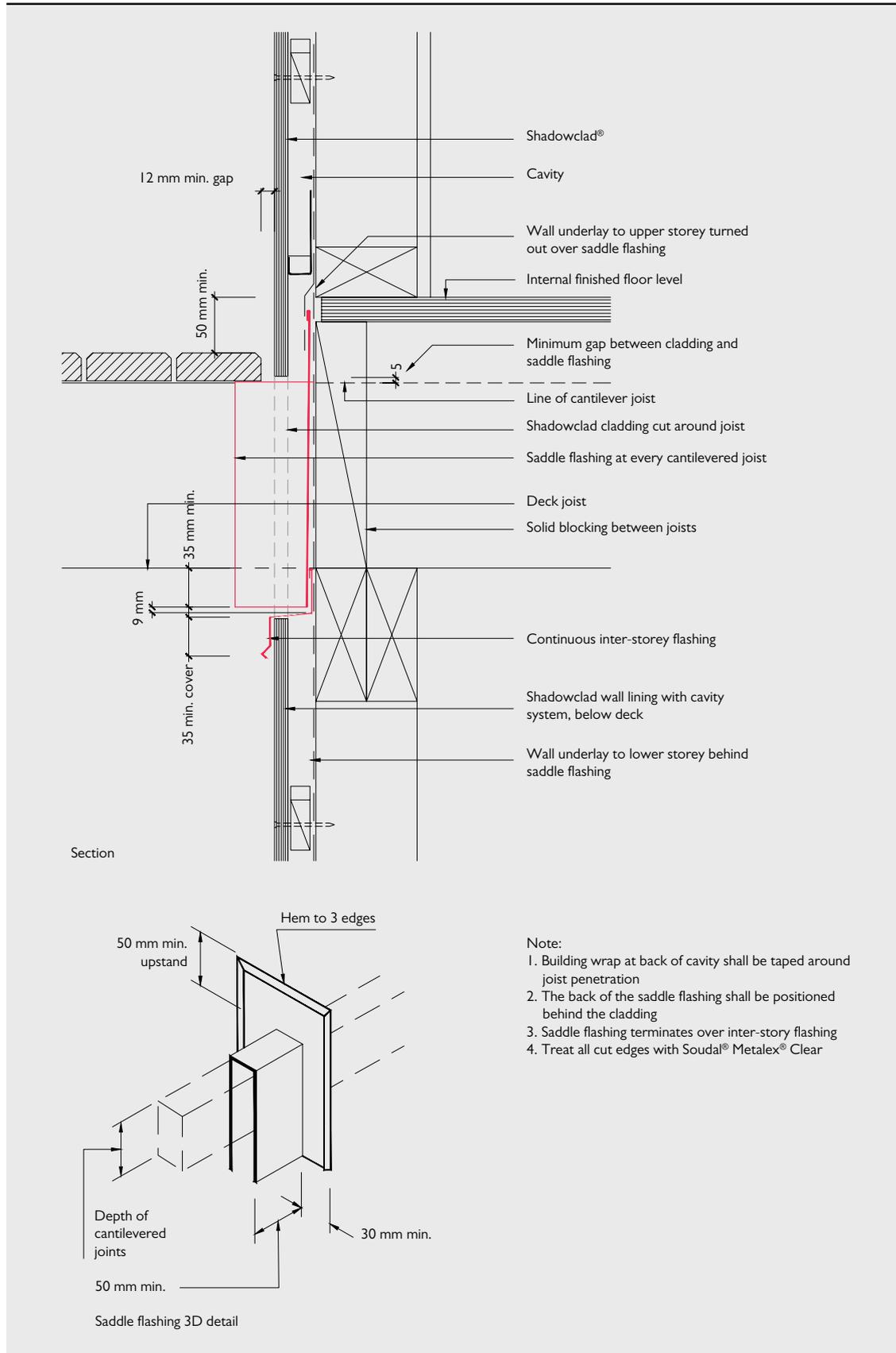


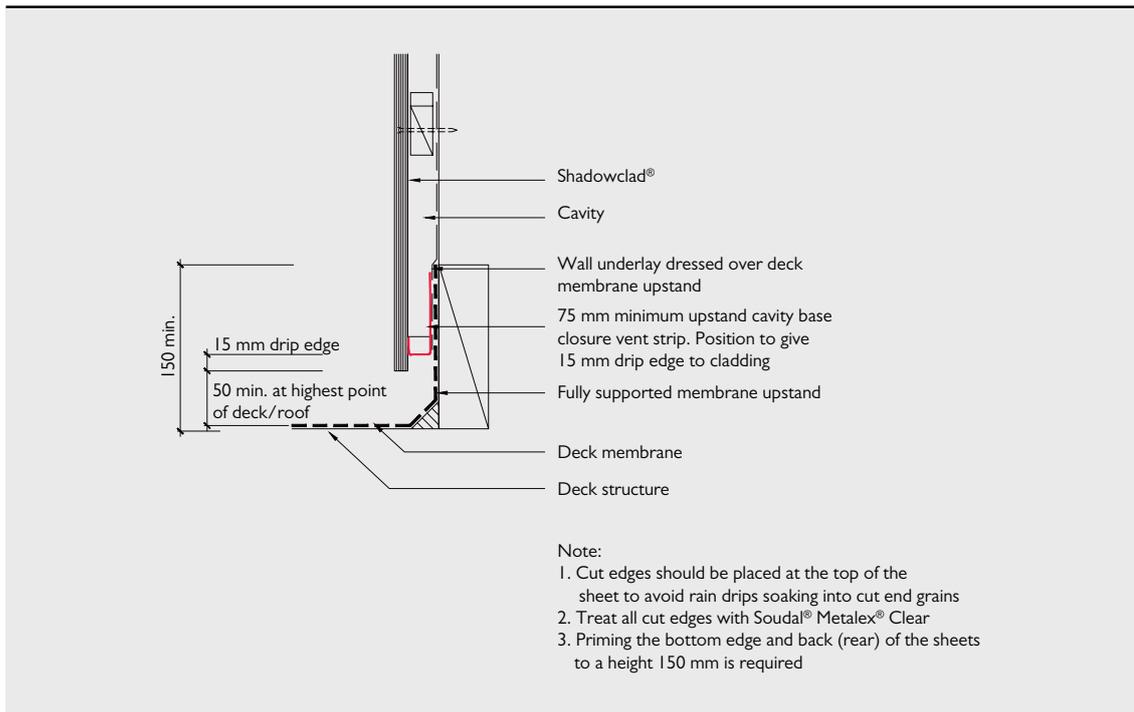
**SC054: Shadowclad Balustrade to Wall Junction (Cavity)**



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SC056: Shadowclad Junction with Wall for Cantilevered Deck (Cavity)



**SC058: Shadowclad Detailing for Enclosed Balustrade (Cavity)**

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## 5.0 COATING & APPLICATION – EXTERIOR CLADDING

### 5.1 SURFACE PREPARATION

- Shadowclad is manufactured, treated and stored in dry conditions at CHH Ply manufacturing facilities. The H3 treatment provides temporary repellence to mould prior to on site coating, however it remains the applicators responsibility to ensure the surface is dry and free from dust and mould prior to coating.
- If Shadowclad has been exposed to external weathering for over 3 months wash surfaces with a mild detergent solution to remove any dirt, dust, mould or sea spray prior to coating.
- If recoating, remove loose, flaking or unsound coatings and wash walls prior to recoating.
- The Shadowclad surface must be dry prior to applying any surface coating.

### 5.2 COATING APPLICATION

- If sheets feel greasy to touch, separate and place in a dry, well ventilated area to allow any residual solvents from the treatment process to flash off prior to applying coatings.
- **Shadowclad is envelope preservative treated. Where sheets are cut, cut edges must be coated with a brush on timber preservative in accordance with the relevant manufacturer's instructions. Soudal® Metalex® Clear is recommended. Failure to properly apply preservative to cut edges will negatively affect the durability of cut panels.**
- Coatings should be applied by brush to ensure adequate coating film build is achieved. Application via roller or spray is not recommended.
- Shadowclad Natural panels should be coated within 3 months of installation.
- Priming of sheet edges and on the rear of the sheet to a height of 150mm is considered good practice, and required at the base of all sheets including above window and door joinery and horizontal flashings.
  - Shadowclad Ultra sheets are coated on the rear to a height of 150mm (minimum) to meet this requirement.
- A minimum total coating system film build of 90 microns is recommended when painting or using film forming stains, including a minimum 30 micron thickness per coat, being mindful of achieving an adequate coating in the decorative grooves.
- For detailed advice on surface preparation, coating product suitability and general coating practice always refer to the coating manufacturer prior to application.

### 5.3 COATING SELECTION

The following coating information should be treated as a generic guide to coating systems typically used with Shadowclad exterior cladding. The selection, application and maintenance of coatings is the responsibility of building owners and the professionals that they engage. For advice on specific coating products and their suitability for use on Shadowclad always refer to the coating manufacturer.

It is important to note regardless of the cladding materials selected there will always be a level of coating maintenance required to ensure the cladding material is sufficiently protected from the elements and maintains the desired appearance.

#### Paints & Film Forming Stains

Three coats (1 undercoat, 2 top coats) of a good quality, 100% acrylic paint system with a light reflectance value (LRV) of 50% or greater (i.e. light colours) which is regularly maintained will provide the highest level of protection and durability for Shadowclad and is likely to require the least amount of coating maintenance over the life of the cladding.

Dark colours (LRV of below 50%) increase heat and stress on the panel surface, reducing the panels overall lifespan and increasing the level of coating maintenance required to maintain an acceptable visual appearance. For this reason CHH does not support the use of dark colours on Shadowclad exterior cladding.

Some film forming stains (i.e. coatings with the consistency of paint but with an appearance similar to penetrating stains) may

offer similar protection qualities to paints however advice and assurance should be sought from the coating manufacturer as to their suitability for use with Shadowclad prior to application.

Where paints or film forming stains are to be used, Shadowclad Ultra is recommended. Shadowclad Ultra features a factory applied performance coating which in most cases eliminates the use of time consuming wet primers. (Refer Table 10).

Shadowclad Natural can also be used with paint however a conventional wet primer is required as part of the coating manufacturers overall system specification.

#### Penetrating Stains

Penetrating stains show the natural texture and character of timber and are widely used on Shadowclad exterior cladding. Penetrating stains offer less protection for panels from exterior weathering than paints and film forming stains which are considerably thicker in surface film build. Due to their translucency, penetrating stains are likely to require additional coating maintenance during the panel's life to maintain an acceptable visual appearance. Penetrating stains should only be used on Shadowclad Natural and are not recommended for use on Shadowclad Ultra.

CHH Ply does not recommend the use of linseed oil based coating which have the potential to promote mould growth in this product.

### Clear Coatings & Uncoated Shadowclad

If Shadowclad is left uncoated or is clear coated in exterior applications the long term aesthetics of the board will be significantly reduced. While the product will meet durability and weather tightness requirements under E2/AS1 a high visual appearance will not be achieved in the long term.

### Face Checking

Face checks are lengthwise separations of wood fibres in the face veneer of the plywood. They result from the normal swelling and shrinking of wood as it gains and loses moisture which is exacerbated by darker colours. It is important to realise that these checks are superficial, being confined to the face veneer. They do not alter the structural integrity of the plywood in any way. If you are the specifier, it is important to discuss these issues with your client before finalising colour choice. If checking occurs, repaint with a good quality, 100% acrylic exterior house paint in accordance with the manufacturer's instructions, thoroughly working paint into the face checks with a paint brush.

**Table 10: Coating System for Shadowclad Ultra**

<b>Within 3 Months of Erection</b>	<b>Ensure the panel is clean and dry prior to top coating. Top coat with two coats of premium 100% acrylic exterior house paint.</b>
<b>OR</b>	
<b>Within 3 to 6 Months of Erection</b>	<b>Wash the surface with a mild detergent solution to remove any chalky material prior to top coating. Top coat with two coats of premium 100% acrylic exterior house paint.</b>

Note: For best results.

i/ allow 24 hours between coats.

ii/ use a light coloured paint system, LRV above 50%.

iii/ Recommend panel be washed down prior to painting to remove any sea salt spray or dirt deposits.

iv/ Minimum total coating film build of 90 microns is recommended, including a minimum 30 microns per coat.

## 5.4 COATING REQUIREMENTS IF RUN OFF IS USED FOR DRINKING WATER

Chemical manufacturers recommend that any run-off from treated surfaces should not be used for drinking water. Unsealed (e.g. unpainted) plywood claddings should not be used in situations where run-off directly from such claddings

is collected in water tanks for drinking water. Ensure selected coatings act as a sealant and refer to the coating manufacturer's Safety Data Sheets to confirm specified coatings are suitable for use in these applications.

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## 6.0 MAINTENANCE

All cladding materials, including Shadowclad, require careful and regular product maintenance by the building owner throughout the cladding's normal service life to ensure long term durability and to maintain visual aesthetics.

Maintenance is the responsibility of the building owner. CHH will not be responsible for rectifying issues arising from a failure to carry out required maintenance in accordance with the guidance below.

### Claddings:

At a minimum, Shadowclad should be maintained by:

- Regularly washing it down (at least annually) with a mild detergent or solution to remove surface dirt, moss, mould, and sea spray.
- Inspect on at least a yearly basis paying particular attention to sheet joints, corners and bases.
- Keep dirt, soil or leaf build-up at least 150mm away from the base of panels.
- Clean spouting and downpipes as required, so that stormwater is not overflowing onto the cladding.
- Repaint as soon as the first sign of coating deterioration is identified in accordance with the coating manufacturer's specifications (including edges and sheet bottoms).
- Panel recoating requirements may vary depending on climate, orientation to the sun, coating type and coating colour selected.
- Maintain the exterior envelope and connections including joints, penetrations, flashings, heat pumps, and sealants that may provide a means of moisture entry beyond exterior cladding to comply with the requirements of the NZBC Clause E2 - External Moisture.
- Prune back vegetation which is close to or touching the building as well as ensuring the NZBC ground clearance requirements are maintained especially where gardens are concerned.
- **Do not** use water blasters to wash down the cladding.

### Flashings:

- Flashings should be periodically cleaned on a similar basis to the glass in windows.
- Clean Shadowclad flashings with a diluted solution of mild liquid detergent avoiding excessively hot solutions. Use a soft bristle brush. **Do not** use abrasive tools or cleaners on the coating.
- After cleaning, rinse thoroughly with fresh water. **Do not** use strong solvent type cleaners. Where the use of solvents is required, such as cleaning paint spills, use nothing other than methylated spirit. Ensure contact time is as short as possible, and rinse the solvent cleaner thoroughly from the surface with copious amounts of quality drinking water.
- Where cavity base closures are installed, ensure drainage holes are kept clear.

**Also, refer to the Shadowclad Information Bulletin: Shadowclad Maintenance March 2021.**

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## 7.0 FREQUENTLY ASKED QUESTIONS

**Q:** Where can Shadowclad be used?

**A:** Shadowclad can be used as both exterior cladding or as an internal lining (moisture free areas only). For interior linings untreated Shadowclad should be used. For exterior cladding H3 treated Shadowclad is required.

**Q:** Do I have to re-treat cut edges of Shadowclad panels?

**A:** H3 treated Shadowclad is envelope preservative treated. All cuts made in treated plywood **must** have a brush on preservative treatment applied fully to the cut area. CHH Ply recommends the use of Soudal® Metalex® Clear.

**Q:** When used as an exterior cladding what are the durability expectations of Shadowclad?

**A:** Under the NZBC Shadowclad (when used as an exterior cladding) is required to meet a 15 year minimum durability level.

To achieve a 15 year durability Shadowclad must be:

- H3 preservative treated.
- Uncoated Shadowclad will meet the durability and weathertightness requirements, but a high visual appearance will not be achieved in the long term.
- Coated with a good quality penetrating stain, film forming stain or paint system.
- Coatings must be regularly maintained as part of a normal building maintenance program throughout the life of the building.

**Shadowclad is not recommended to be left uncoated when used as an exterior cladding.**

**Note** – durability according to the NZBC refers to the products ability to continue to perform its primary function as protection for the building structure. Appearance including the performance of the coating product is not covered under the NZBC durability requirements.

**Q:** Can Shadowclad, when used as an exterior cladding, be coated in dark colours?

**A:** While dark colours (coatings with an LRV of below 50%) will achieve a 15 year durability however customers must expect an increased level of recoat and general product maintenance compared to where light coating colours are used. For this

reason CHH does not support the use of dark colours on Shadowclad exterior cladding.

The greatest level of cladding protection and least amount of coating maintenance can be achieved by using a good quality paint system (applied as per the coating manufacturers specifications) with an LRV of 50% or greater and a minimum total coating system film build of 90 microns, including a minimum 30 micron thickness per coat. For further information on coatings always refer to the applicable coating manufacturer's specification material.

**Q:** Does Shadowclad comply with the NZBC Requirements?

**A:** Shadowclad has been tested in accordance with E2/VMI and AS/NZS 4284 "Testing of Building Facades" for compliance with the NZBC requirements and has been BRANZ appraised for use in cavity fix construction.

**Q:** In the Shadowclad exterior flashing range can I colour the flashings to match the colour of my building?

**A:** Shadowclad aluminium exterior flashings are available in either anodised or mill finishes. Anodised flashings are silver in colour and can be installed immediately. Mill finished flashings can be powder coated to specific colours by the customer.

**Q:** Does face checking affect the performance of Shadowclad?

**A:** Face checks are lengthwise separations of wood fibres in the face veneer of the plywood. They result from the normal swelling and shrinking of wood as it gains and loses moisture which is exacerbated by darker coloured coatings. These checks are superficial, being confined to the face veneer. They do not alter the structural integrity of the plywood in any way.

**Q:** Where can I download the Shadowclad Installation APP?

**A:** The Shadowclad Installation APP can be downloaded from [www.chhply.co.nz/site-app](http://www.chhply.co.nz/site-app) or the respective device APP procurement marketplace.

**Q:** Where can I get a Shadowclad Stick from?

**A:** Shadowclad Sticks may be ordered by contacting CHH Ply direct by phoning 0800 326 759 or ordering via the Shadowclad APP, the Shadowclad website: [www.shadowclad.co.nz](http://www.shadowclad.co.nz), or contacting your local merchant.

## 8.0 GLOSSARY OF TERMS

**Sealant:** A flexible neutral cure sealant for filling of spaces/gaps and weatherproofing that complies with NZBC Acceptable Solution E2/AS1, or sealant covered by a valid BRANZ Appraisal for use as a weather sealing sealant for exterior use. It is the designers' and builders' responsibility to ensure that sealants are fit for purpose and compatible with Shadowclad products and any other building materials or components used within the Shadowclad installation.

**Air Seal:** A continuous seal fitted between a window or door reveal and the surrounding wrap and associated tape enclosing wall framing to prevent the flow of air into the building interior. Air seal must be weathertight so that moisture is not able to access the structure. Refer to NZBC E2/AS1 for further detail.

**Foam Bond Breaker:** A tape that is polyethylene backed that prevents "3-Point" adhesion mating surfaces that ensures that the sealant only attaches to two surfaces (and not the third which would create an anchor point preventing the sealant moving as its designed to).

**PEF Rod:** A foam formed polyethylene "noodle" that is designed to be inserted between two surfaces. Should have a 25-33% larger diameter than the gap/space you are inserting it into.

**Soudal® Metalex® Clear:** A supplementary preservation treatment that preserves the treatment envelope of timbers with a Class H3.1 and above.

## 9.0 REFERENCES & SOURCES OF INFORMATION

- New Zealand Building Code (NZBC).
- AS/NZS 2269:2012 "Plywood Structural".
- AS/NZS 1604.3:2010 "Specification for Preservative Treatment, Part 3: Plywood".
- NZS 3602:2003 "Timber and Wood-Based Products for use in Buildings".
- AS/NZS 4284:2008 "Testing of Building Facades".
- NZS 3603:1993 "Timber Structures Standard".
- NZS 3604:2011 "Timber Framed Buildings".
- AS 3715:2002 "Metal Finishing – Thermoset powder coating for architectural application of aluminium and aluminium alloys".
- NZBC Clause E1 Surface Water.
- NZBC Acceptable Solution, E1/AS1.
- NZBC Clause E2 External Moisture.
- NZBC Acceptable Solution, E2/AS1.
- NZBC Clause E3 Internal Moisture.
- NZBC Acceptable Solution, E3/AS1.
- NZBC Clause B2 Durability.
- NZBC Acceptable Solution, B2/AS1.
- Product Technical Statement.  
– Shadowclad® for Cavity Construction.
- Ecoply® Specification and Installation Guide.
- Ecoply® Barrier Specification and Installation Guide.
- CHH Ply technical notes – downloadable from [www.chhply.co.nz/librarytools/](http://www.chhply.co.nz/librarytools/).
- Safety Data Sheet.
  - SDS Shadowclad Azole Treated Plywood.
  - SDS Shadowclad CCA Treated Plywood.
  - SDS Stainless Steel flashings.
  - SDS Aluminium flashings.
  - SDS Shadowclad Ultra CCA Pre-primed Treated Plywood.
  - SDS Shadowclad Ultra LOSP Pre-primed Treated Plywood.
- Producer Statement – Compliance for Surface Treated Aluminium Products.
- Window Association of New Zealand ([www.wanz.org.nz](http://www.wanz.org.nz)).
- APA ([www.buildabetterhome.org](http://www.buildabetterhome.org)).
- EWPA ([www.ewp.asn.au](http://www.ewp.asn.au)).
- BRANZ Appraised 764 – Shadowclad® Cavity Fixed Cladding System.
- BRANZ Recommendations for Building Maintenance.

Standards can be purchased online at [www.standards.co.nz](http://www.standards.co.nz).

Building Code Compliance Documents can be downloaded free of charge at [www.building.govt.nz/building-code-compliance/](http://www.building.govt.nz/building-code-compliance/).

Line drawings within this literature can be downloaded from [www.chhply.co.nz/librarytools/](http://www.chhply.co.nz/librarytools/).

## 10.0 LIMITATIONS

The information contained in this document is current as at February 2021 and is based on data available to CHH Ply at the time of going to print.

All photographic images are intended to provide a general impression only and should not be relied upon as an accurate example of Shadowclad products installed in accordance with this document or the NZBC compliance documents.

This publication replaces all previous CHH Ply design information and literature relating to Shadowclad structural plywood products and flashings installed using a drained and vented cavity. CHH Ply reserves the right to change the information contained in this document without prior notice. It is your responsibility to ensure that you have the most up to date information available, including at the time of applying for a building consent. You can call toll free on 0800 326 759 or visit [www.chhply.co.nz](http://www.chhply.co.nz) to obtain current information.

**CHH Ply has used all reasonable endeavours to ensure the accuracy and reliability of the information contained in this document. However, to the maximum extent permitted by law, CHH Ply assumes no responsibility or liability for any inaccuracies, omissions or errors in this information nor for any actions taken in reliance on this information.**

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## 11.0 SHADOWCLAD STICK USER GUIDE

CHH Ply developed the Shadowclad Stick, an installation tool for Shadowclad, to remove the need for builders to develop their own 'jigs' and ensure that critical clearances, nail spacings, etc. are applied during the installation of Shadowclad sheets.

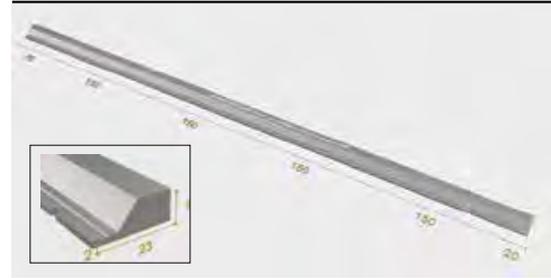
The Shadowclad Stick does not replace the need to follow good building practice and the requirement to read and understand the Shadowclad Specification & Installation Guides and the NZBC.

### 11.1 THE COMPONENTS OF THE SHADOWCLAD STICK

The Shadowclad Stick has been developed specifically to deal with expansion gaps, catering for both Shadowclad texture and Shadowclad groove as well as horizontal and vertical joints. The Shadowclad Stick also provides guidance around nail spacings to suit:

- 150 mm spacing around sheet edges and 300 mm to intermediate studs and nog;
- 75 mm distance for the bottom of the sheet; and
- 20 mm for the top of the sheet.

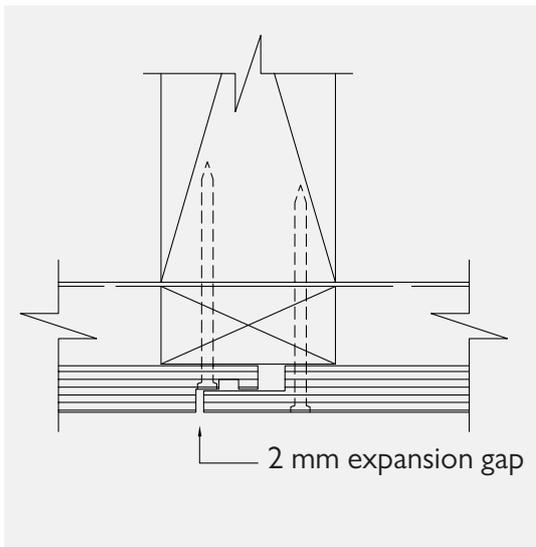
**Figure 1: The Shadowclad Stick**



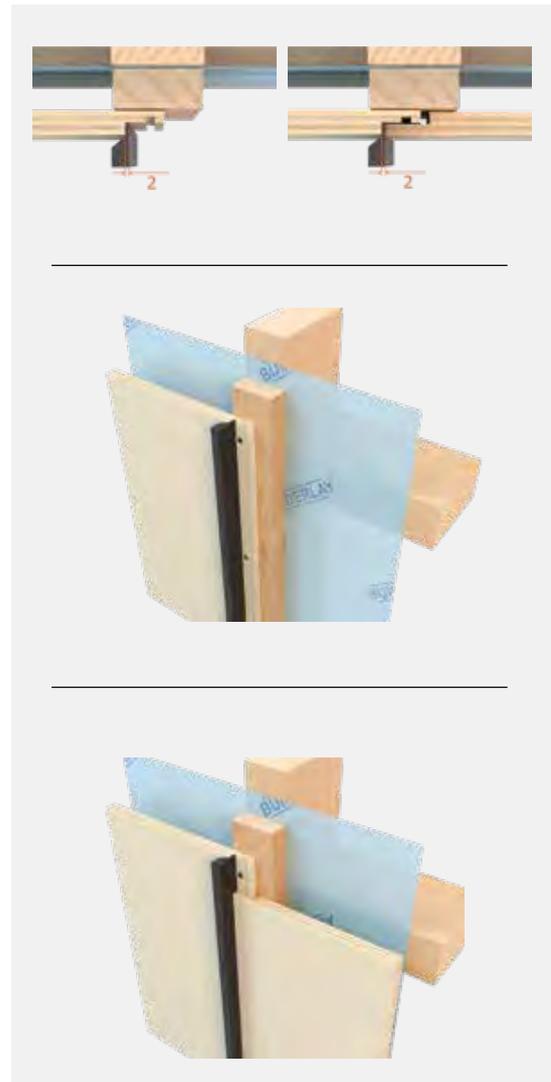
### 11.2 VERTICAL JOINTS

The Shadowclad Stick is contoured to be 2 mm thick on one edge and 9 mm thick on the other. At 695 mm long, the Shadowclad Stick can be placed in the middle of sheets to provide minimum clearance requirements. Figure 2 illustrates the 2 mm expansion gap required for Shadowclad texture together in use with the Shadowclad Stick. Figure 3 illustrates the 9 mm expansion gap required for Shadowclad Groove, together in use with the Shadowclad Stick.

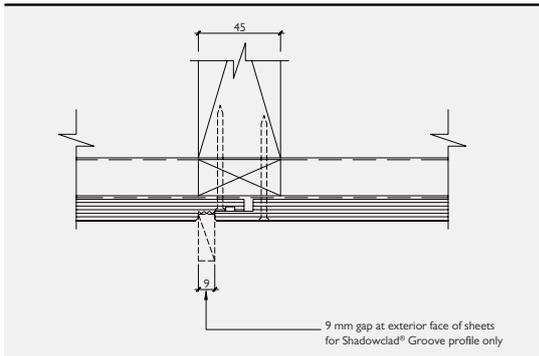
**Figure 2: Shadowclad Texture - 2 mm Vertical Expansion Gap**



Refer to SC006 for the installation detail



**Figure 3: Shadowclad Groove - 9 mm Vertical Expansion Gap**

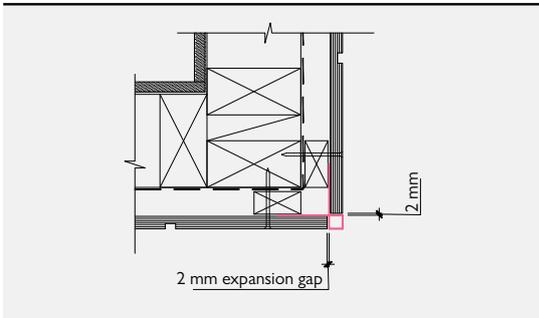


Refer to SC008 for the installation detail



The 2 mm thick edge of the Shadowclad Stick can also be used to measure the 2 mm expansion gap required between vertical flashings and Shadowclad as detailed in Figure 4 (Vertical Top Hat Flashing and 'W' Flashing similar).

**Figure 4: 2 mm Vertical Expansion Gap on Shadowclad External Box Corner**



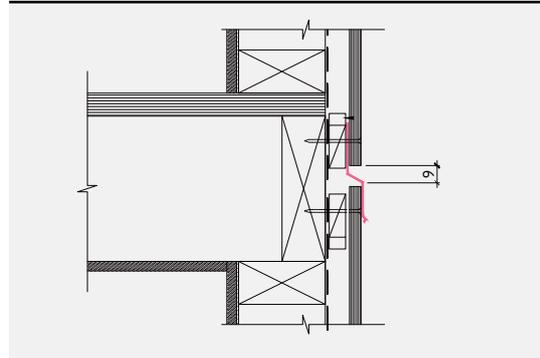
Refer to SC020 for the installation detail



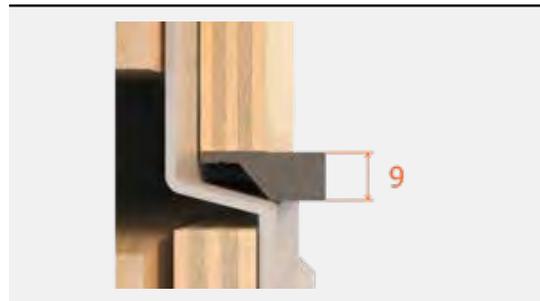
### 11.3 HORIZONTAL JOINTS

The 9 mm thick edge on the Shadowclad Stick can also be used to provide the appropriate clearance between the top of the horizontal flashings and bottom of sheets as detailed in Figure 5 (Window head and metre box similar) as noted in the detail SC016.

**Figure 5: Shadowclad 9 mm Gap at Horizontal 'Z' Flashing**



Refer to SC016 for the installation detail



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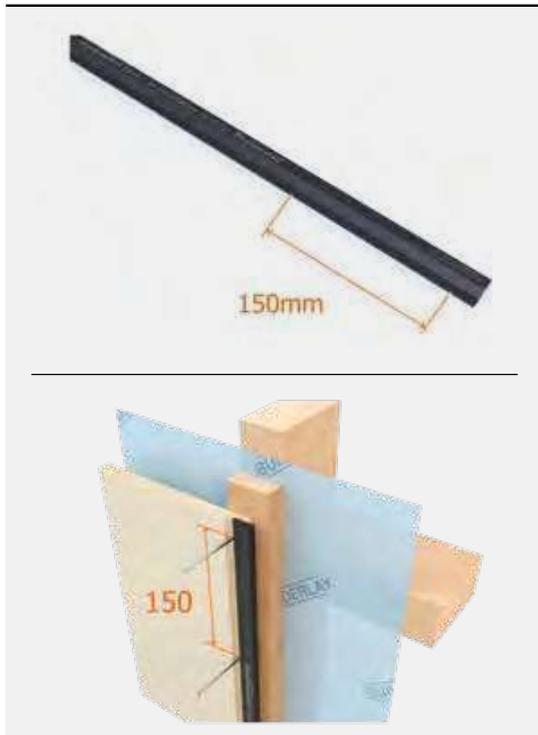
## 11.4 FASTENER LOCATIONS

The Shadowclad Stick has been detailed to support the correct placement of fastenings corresponding to the Shadowclad Specification & Installation Guides.

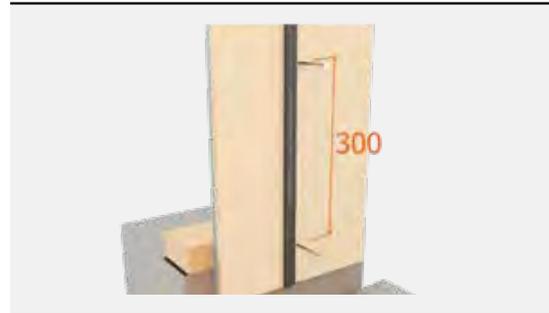
## 11.5 NAIL SPACING'S

Section 4.7 notes "Standard fixing pattern: fasten sheet edges at 150mm centres and within the panel on all supports at 300mm centres". Figure 6 details the use of the Shadowclad Stick at sheet edges with 150 mm nail spacing provided for between half rounds spaced at exactly 150 mm centres. Figure 7 details the use of the Shadowclad Stick at the centre of the sheet to provide fixings at 300 mm centres, whilst figure 8 provides a pictorial representation of the Shadowclad fastener layout.

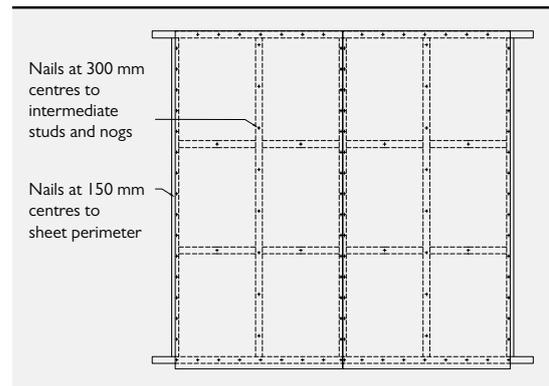
**Figure 6: Sheet fastening around sheet edges at 150 mm**



**Figure 7: Sheet fastening within the panel at 300 mm**



**Figure 8: Pictorial representation of nail spacings for sheet edges and intermediate supports**

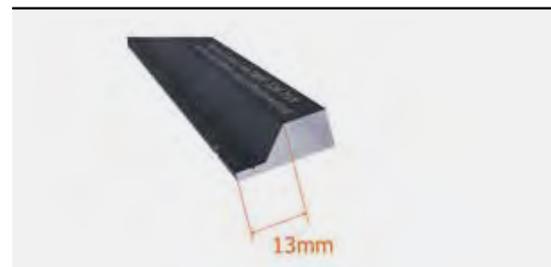


## 11.6 NAILING OF THE SHIP LAP

Nailing of the ship lap is an important step in ensuring the Shadowclad system's weathertightness. Each Shadowclad sheet is independently nailed off to allow for expansion and contraction of the sheets over their service life, whilst maintaining a weathertight connection. The Shadowclad Stick has two distinct locating devices for the ship lap joint. Figure 9 illustrates the location of the ridge, exactly 13 mm from the edge of the Shadowclad Stick, in combination with the diameter 3 mm half round provides the exact location for nails within the underlap portion of the ship lap. The ridge should be lined up with the edge of the underlap edge of the sheet. Figure 10 details the use of the Shadowclad Stick in this application.

The Shadowclad Stick is exactly 23 mm wide as detailed in Figure 11. To ensure that the Shadowclad sheets are fixed independently of each other, the top of the ship lap should be fixed 23 mm from the edge. The Shadowclad Stick should be placed along the sheet and nailed at 150 mm centres as detailed in Figure 12.

**Figure 9: Shadowclad Stick 13 mm dimension**

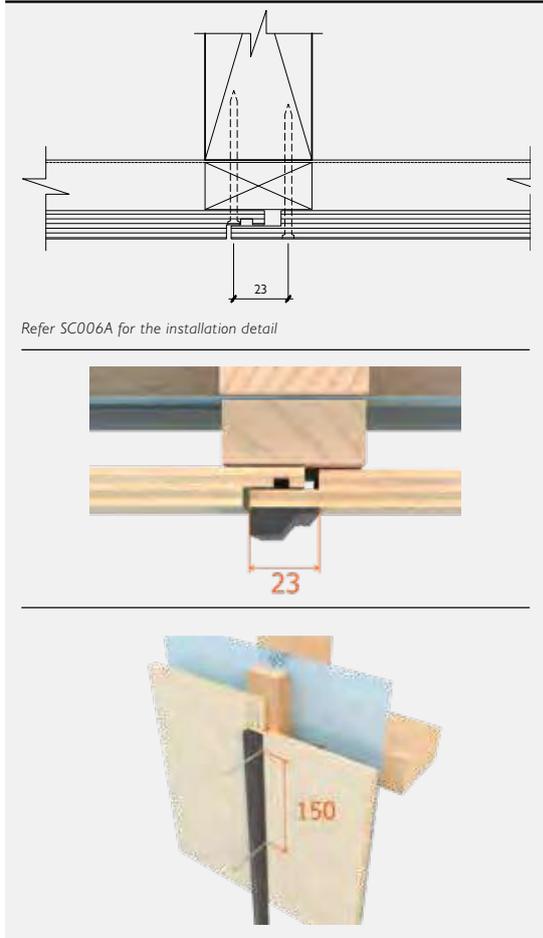


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Figure 11: Shadowclad Stick 23 mm dimension



Figure 12: Shadowclad Stick and ship lap nailing



Refer SC006A for the installation detail

### 11.7 END DISTANCE FASTENER LOCATIONS

Compliance with the end distance nailing is an important step in achieving the weathertight solution. The Shadowclad Stick has two end of sheet identifiers, including a 75 mm edge distance from the bottom of the Shadowclad Stick to the first nail locator as detailed in Figure 13. The top of the Shadowclad Stick has a 20 mm end distance from the top of the Shadowclad Stick to the first nail locator, to suit nailing of the top of the sheet to the centre of the top plate, as detailed in Figure 14.

### 11.8 END DISTANCE FASTENER LOCATIONS

Compliance with the end distance nailing is an important step in achieving the weathertight solution. The Shadowclad Stick has two end of sheet identifiers, including a 75 mm edge distance from the bottom of the Shadowclad Stick to the first nail locator as detailed in Figure 13. The top of the Shadowclad Stick has a 20 mm end distance from the top of the Shadowclad Stick to the first nail locator, to suit nailing of the top of the sheet to the centre of the top plate, as detailed in Figure 14.

Figure 13: 75 mm end distance



Refer to SC042 for the installation detail

Figure 14: 20 mm end distance



### 11.9 SHADOWCLAD SPECIFICATION & INSTALLATION GUIDE & SHADOWCLAD APP

The Shadowclad Stick has been developed to compliment the Shadowclad Specification & Installation Guides and the Shadowclad APP all of which are available to download from [www.shadowclad.co.nz](http://www.shadowclad.co.nz).

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## SHADOWCLAD KEY INSTALLATION & DESIGN POINTS

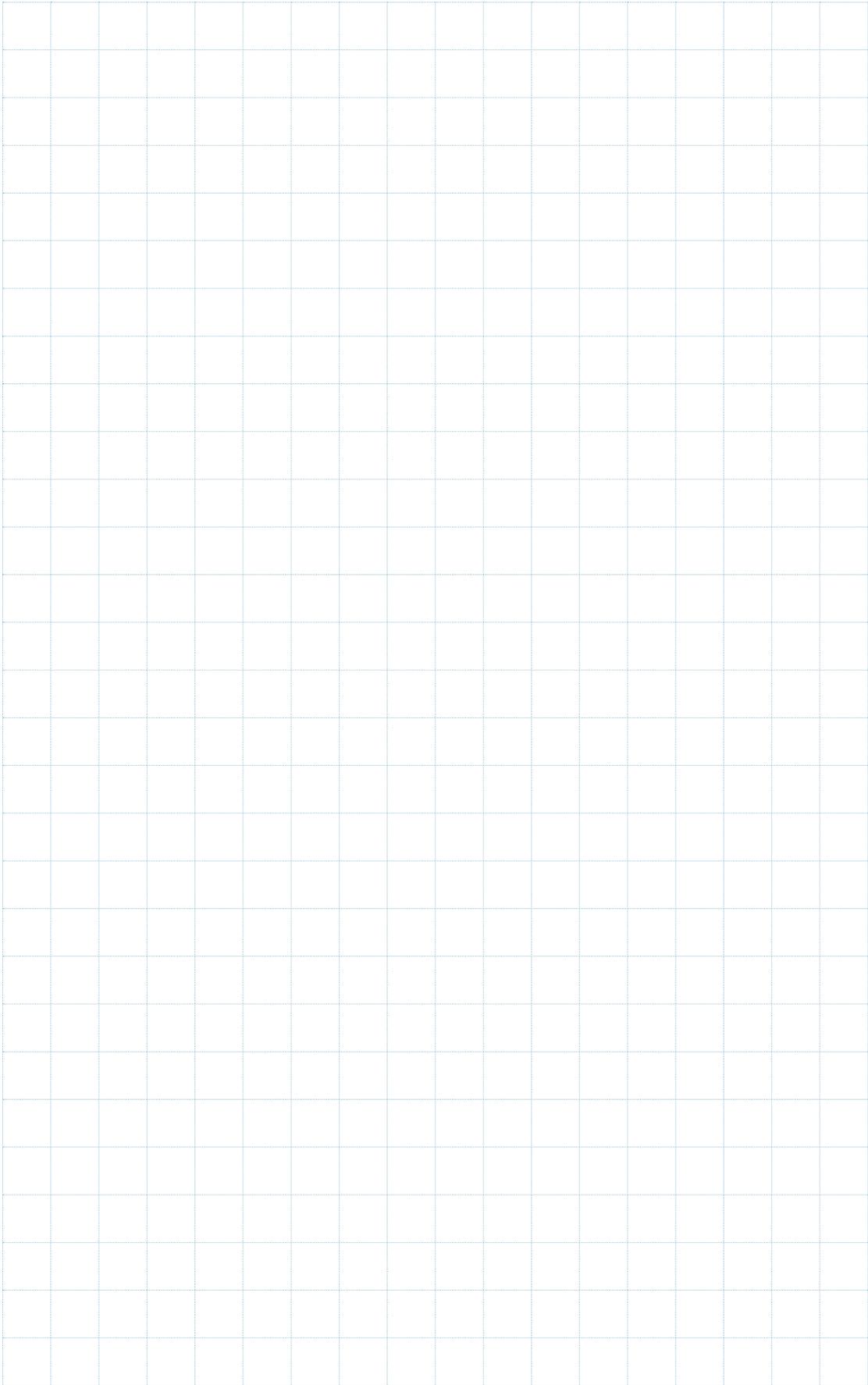
### EXTERIOR CLADDING APPLICATIONS

The following tasks are provided to installers to point out key installation and design factors when used as an exterior cladding. These do not detract from the requirements to read and understand this literature as a whole.

Task	Tick when checked
<b>Prior to Specification and Installation</b>	
Read the Shadowclad Specification and Installation Guide in its entirety	<input type="checkbox"/>
<b>Framing Plan</b>	
Framing setout drawings to suit Shadowclad fixing and installation guidelines	<input type="checkbox"/>
<b>Sheet Cuts</b>	
Coat all sheet cuts with a preservative timber treatment such as Soudal® Metalex® Clear	<input type="checkbox"/>
After applying Soudal® Metalex® Clear, apply the surface coating (e.g. paint or stain) to cut edges	<input type="checkbox"/>
Place uncut edge to bottom	<input type="checkbox"/>
<b>Fastener Material Type</b>	
Galvanised fasteners or better used (Stainless steel annular groove nails required in sea spray zones and with H3.2 CCA treated Shadowclad Ultra)	<input type="checkbox"/>
<b>Sheet Fastener Pattern</b>	
Around sheet edge – maximum 150mm centre spacing	<input type="checkbox"/>
Within sheet body – maximum 300mm centre spacing	<input type="checkbox"/>
<b>Horizontal Sheet Joints</b>	
Minimum 9mm separation gap between sheets above all Horizontal 'Z' flashings	<input type="checkbox"/>
Prime the bottom of the sheet edge and 150mm up the back (rear) of the sheets	<input type="checkbox"/>
50 mm strip of neutral cure silicon sealant or stop ends at all 'Z' flashing terminations excluding terminations at Shadowclad metal corner flashings	<input type="checkbox"/>
Back flashings or 150 mm overlap to all flashing butt joints	<input type="checkbox"/>
<b>Expansion Gaps Between Sheets (Vertical Sheet Joints)</b>	
Texture Profile Sheets - 2mm gap between vertical edges of sheets	<input type="checkbox"/>
Groove Profile Sheets - 9mm gap (i.e. full groove space) between vertical edges of sheets	<input type="checkbox"/>
Note: Expansion gaps required between vertical edges of sheets to accommodate natural expansion and contraction of sheets	
<b>Ground Clearances</b>	
Paved/Sealed Ground - minimum 100mm distance from the ground to sheet bottom	<input type="checkbox"/>
Broken Ground - minimum 175mm distance from the ground to sheet bottom	<input type="checkbox"/>
Prime the bottom of the sheet 150mm up the back (rear) of the sheet	<input type="checkbox"/>

Refer to the current Shadowclad Specification and Installation Guide for full installation specifications and suggested details.

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March 2021  
 SHADOWCLAD\_V2.0321





**CODEMARK**

Certificate No: BRANZ-CM-1002-Rev 2

Date of Issue: 17 February 2022

Expiry Date: 17 February 2025

**CERTIFICATE HOLDER**

**Thermakraft**

**Thermakraft Limited**

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**Client signature**

*William Lin*

Customer Name William Lin

Customer Position Head of

Engineering and Inventory

Thermakraft Limited

**CERTIFICATION BODY**



**BRANZ Limited**

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*Chelvra Percy*

**Chelvra Percy**

Chief Executive Officer

BRANZ Limited

# PRODUCT CERTIFICATE

## THIS IS TO CERTIFY

### WATERGATE PLUS WALL UNDERLAY

#### KEY INFORMATION

##### 1. DESCRIPTION OF BUILDING METHOD OR PRODUCT

1.1 Watergate Plus is a white coloured flexible synthetic wall underlay. The product is printed with the Watergate Plus logo repeated along the length of the roll.

##### 2. USE OF BUILDING METHOD OR PRODUCT

2.1 Watergate Plus is for use as a flexible wall underlay for buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1 for timber framed buildings; or,
- the scope limitations of NASH Building Envelope Solutions, Paragraph 1.1 for steel framed buildings; and
- with direct fixed wall claddings, or with wall claddings installed over a drained cavity, or,
- with masonry veneer in accordance with NZBC Acceptable Solution E2/AS1 for timber framed buildings or in accordance with NASH Building Envelope Solutions for steel framed buildings; and,
- situated in NZS 3604: 2011 Wind Zones up to and including Very High when fixed directly to framing, and Extra High when fixed over a rigid air barrier.

2.2 Watergate Plus is also for use:

- as an air barrier in accordance with NZBC Acceptable Solution E2/AS1 or NASH Building Envelope Solutions Paragraph 9.1.4 (c); or,
- as a non-rigid backing material for stucco plaster in accordance with the requirements of NZBC Acceptable Solution E2/AS1 or NASH Building Envelope Solutions, Paragraph 9.3.5.1, or;
- as a slip layer over a rigid backing for stucco cladding in accordance with NZBC Acceptable Solution E2/AS1 or NASH Building Envelope Solutions, Paragraph 9.3.3.1 (b).

##### 3. COMPLIES WITH THE FOLLOWING PROVISIONS OF THE NEW ZEALAND BUILDING CODE (NZBC)

**Clause B2 DURABILITY:** Performance B2.3.1 (a), not less than 50 years (for when the cladding durability requirement is not less than 50 years), B2.3.1 (b), 15 years (for when the cladding durability requirement is 15 years) and B2.3.2 (a).

**Clause C3 FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE:** Performance C3.4 (c).

**Clause E2 EXTERNAL MOISTURE:** Performance E2.3.2 (contributes to), E2.3.5 (contributes to) and E2.3.7.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1.



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The Certificate Holder must maintain compliance with the conditions set out in Regulation 15 of the Building (Product Certification) Regulations 2008.

This Certificate is issued by BRANZ Limited, an independent certification body accredited by the product certification body appointed by the Chief Executive of the Ministry of Business, Innovation and Employment (MBIE) under the Building Act 2004. MBIE does not in any way, warrant, guarantee or represent that the building method or product the subject of this certificate conforms with the New Zealand Building Code, nor accept any liability arising out of the use of the building method or product. MBIE disclaims to the extent permitted by law all liability (including negligence) for claims of losses, expenses, damages and costs arising as a result of the use of the building method(s) or product(s) referred to in this certificate.

It is advised to check that this Product Certificate is currently valid and not withdrawn, suspended or superseded by a later issue, by referring to the MBIE website: [www.mbie.govt.nz](http://www.mbie.govt.nz)

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**Client signature**

*William Lin*

Customer Name William Lin

Customer Position Head of

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*Chelva Percy*

**Chelva Percy**

Chief Executive Officer

BRANZ Limited

**4. CONDITIONS AND LIMITATIONS OF USE**

- 4.1 Watergate Plus Wall Underlay must not be exposed to the weather or ultra violet light for more than 90 days before being covered by the wall cladding.
- 4.2 Framing studs must be at a maximum of 600 mm centres. Timber framing must be in accordance with NZS 3604: 2011 or to a specific design. Steel framing must be in accordance with NASH Standard Part Two: May 2019.

**5. HEALTH AND SAFETY INFORMATION**

- 5.1 Watergate Plus is a synthetic wall underlay. The supplier's instructions and typical practices for working with and handling synthetic wall underlays should be observed.

**6. REFERENCE DOCUMENTS**

- 6.1 This Product Certificate must be read in conjunction with:
  - BRANZ Appraisal No. 695 Watergate Plus Wall Underlay.
  - Technical Literature: Product Data Sheet Watergate Plus, Issue 9, dated September 2021; and,
  - Technical Literature: Installation Guide Watergate Plus, Issue 4, dated September 2021.

**SCHEDULE: INFORMATION THAT SUPPORTS KEY INFORMATION**

**7. SUPPORTING INFORMATION ABOUT DESCRIPTION OF THE BUILDING METHOD**

**PRODUCT SPECIFICATION**

- 7.1 Watergate Plus is for use as a flexible wall underlay fixed over timber or steel framed walls to limit the entry of wind into building cavities, and to act as a secondary barrier to wind-driven rain.
- 7.2 Watergate Plus is suitable for use under wall claddings as a wall underlay as called up in NZBC Acceptable Solution E2/AS1 Table 23 for timber framed buildings and NASH Building Envelope Solutions Table 23 for steel framed buildings. This includes non-absorbent wall claddings such as vinyl and metal-based weatherboards in direct fixed situations.
- 7.3 Watergate Plus is a synthetic building underlay manufactured from a film coated, non-woven, laminated flexible synthetic fabric. Watergate Plus is coloured white on the top and bottom faces and is printed with the Watergate Plus logo, and can also be co-branded with custom printing.
- 7.4 The product is supplied in rolls 1.370 m wide x 18.5 m, 37.0 m and 73.0 m long; 2.740 m wide x 18.5 m and 36.5 m long. The rolls are wrapped in clear polythene film.



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 Customer Name William Lin  
 Customer Position Head of  
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**Chelvra Percy**  
 Chief Executive Officer  
 BRANZ Limited

TABLE 1: NZBC E2/AS1 TABLE 23 (NZS 2295:2006) REQUIREMENTS

NZBC E2/AS1 Table 23 (NZS 2295: 2006) Wall Underlay Properties	Property Performance Requirement	Actual Property Performance
Vapour Resistance	≤ 7 MN s/g	Pass
Absorbency	≥ 100 g/m <sup>2</sup>	Pass
Water Resistance	≥ 20 mm	Pass
pH of Extract	≥ 6.0 and ≤ 9.0	Pass
Shrinkage	≤ 0.5%	Pass
Mechanical	Edge tear and tensile strength	Edge tear (Average): Machine direction = 77 N (Note 1) Cross direction = 56 N (Pass)  Tensile strength (Average): Machine direction = 2.5 kN/m (Pass) Cross direction = 1.8 kN/m (Pass)
Flammability Index	≤ 5	Fire retardant
Air Resistance	≥ 0.1 MN s/m <sup>3</sup>	Pass

Note 1: Pass of BRANZ criteria for edge tear resistance.

**8. SUPPORTING INFORMATION ABOUT INTENDED USE OF THE PRODUCT**

**DESIGN REQUIREMENTS**

8.1 Separation or protection must be provided to Watergate Plus Wall Underlay from heat sources such as fire places, heating appliances, flues and chimneys. Part 7 of NZBC Acceptable Solutions C/AS1, C/AS2 and NZBC Verification Method C/VM1, provide methods for separation and protection of combustible materials from heat sources.

**INSTALLATION REQUIREMENTS**

8.2 Installation must be carried out in accordance with the following:  
 • Technical Literature: Product Data Sheet Watergate Plus, Issue 9, dated September 2021, and,  
 • Technical Literature: Installation Guide Watergate Plus, Issue 4, dated September 2021.  
 • NZBC Acceptable Solution E2/AS1, or



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*Chelvra Percy*

**Chelvra Percy**  
Chief Executive Officer  
BRANZ Limited

- NASH Building Envelope Solutions.

**MAINTENANCE REQUIREMENTS**

8.3 No maintenance can be performed on Watergate Plus once the cladding is installed.

**BUILDING CODE**

**B1 STRUCTURE**

8.4 Watergate Plus is suitable for use in all Wind Zones of NZS 3604: 2011 up to, and including, Very High when used as a stand-alone flexible wall underlay and all Wind Zones of NZS 3604: 2011 up to, and including, Extra High when used as an overlay for rigid building underlays.

**B2 DURABILITY**

8.5 Watergate Plus meets code compliance with NZBC Clause B2.3.1 (a), not less than 50 years for building underlays used where the cladding durability requirement or expected serviceable life is not less than 50 years, e.g. behind masonry veneer, and code compliance with NZBC Clause B2.3.1 (b), 15 years for building underlays used where the cladding durability requirement is 15 years. Watergate Plus is expected to have a serviceable life equal to that of the cladding.

**C3 FIRE AFFECTING AREAS BEYOND THE FIRE SOURCE**

8.6 Watergate Plus has an AS 1530 - 1993 Part 2 flammability index of not greater than 5 and therefore meets the requirements of NZBC Acceptable Solution C/AS2, Paragraph 4.1.7.8 b) for suspended flexible fabric used as an underlay to exterior cladding that is exposed to view in occupied spaces.

**E2 EXTERNAL MOISTURE**

8.7 Watergate Plus must be used behind claddings that meet the requirements of the NZBC, such as those covered by NZBC Acceptable Solution E2/AS1 or NASH Building Envelope Solutions.

**9. SUPPORTING INFORMATION ABOUT CONDITIONS AND LIMITATIONS OF USE**

9.1 All conditions and limitations provided as stated in this Product Certificate.

**10. BASIS FOR CODEMARK CERTIFICATION**

10.1 The following tests have been carried out on Thermakraft Watergate Plus Wall Underlay in accordance with NZBC Acceptable Solution E2/AS1, Table 23:

- tensile strength, edge-tear resistance and resistance to water vapour transmission in accordance with AS/NZS 4200.1:1994
- shrinkage in accordance with AS/NZS 4201.3:1994
- resistance to water penetration in accordance with AS/NZS 4201.4:1994
- surface water absorbency in accordance with AS/NZS 4201.6:1994
- pH of extract in accordance with AS/NZS 1301.421s:1998
- air resistance to BS 6538.3:1987.

10.2 Ultraviolet (UV) light ageing of wall underlays is a critical evaluation requirement to verify a products continued performance after site construction exposure. UV ageing of Watergate Plus equivalent to 90 days construction site exposure was completed and the range of tests detailed above were repeated after aging.

10.3 The Flammability Index of Thermakraft Watergate Plus Wall Underlay has been tested in accordance with AS 1530.2 - 1993.

10.4 BRANZ Expert Judgement (Materials Scientist) confirmation of compliance to the NZBC Clause B2 Durability Performance Requirements.

10.5 The practicability of installation of Thermakraft Watergate Plus Wall Underlay has been assessed by BRANZ and found to be satisfactory.



The Certificate Holder must maintain compliance with the conditions set out in Regulation 15 of the Building (Product Certification) Regulations 2008.

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**Client signature**

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*Chelvra Percy*  
**Chelvra Percy**  
 Chief Executive Officer  
 BRANZ Limited

10.6 The referenced Technical Literature has been examined by BRANZ and found to be satisfactory.

**11. RESPONSIBILITIES FOR USE OF CERTIFIED PRODUCT**

- The quality of supply to the market is the responsibility of Thermakraft Limited.
- Building designers are responsible for the design of the building, and for the incorporation of the wall underlay into their design in accordance with the instructions of Thermakraft Limited.
- Quality of installation is the responsibility of the installer in accordance with the instructions of Thermakraft Limited.

**12. DOCUMENTATION SUPPORTING CERTIFICATION**

- AS 1530.2 – 1993 Test for flammability of materials.
- AS/NZS 1301.421.s:1998 Determination of the pH value of aqueous extracts of paper, board and pulp – cold extraction method.
- AS/NZS 4200.1: 1994 Pliable building membranes and underlays – materials.
- AS/NZS 4201.1: 1994 Pliable building membranes and underlays – Methods of test – Resistance to dry delamination.
- AS/NZS 4201.2: 1994 Pliable building membranes and underlays – Methods of test – Resistance to wet delamination.
- AS/NZS 4201.3: 1994 Pliable building membranes and underlays – Methods of test – Shrinkage.
- AS/NZS 4201.4: 1994 Pliable building membranes and underlays – Methods of test – Resistance to water penetration.
- AS/NZS 4201.6: 1994 Pliable building membranes and underlays – Methods of test – Surface water absorbency.
- ASTM E96: 2005 Standard test methods for water vapor transmission of materials.
- ASTM G1.55:2013 Standard practice for operating xenon arc light apparatus for exposure of non-metallic underlays.
- BS 6538.3: 1987 Method for determination of air permeance using the Garley apparatus.
- MASH Building Envelope Solutions: 2019 Light Steel Framed Buildings.
- MASH Standard Part Two: 2019 Light Steel Framed Buildings.
- NZS 2695: 2006 Pliable, permeable building underlays.
- NZS 3604: 2011 Timber-framed buildings.
- TAPPI T470:1986 Edge tearing resistance of paper (Edge-tear stirrup method)
- Ministry of Business, Innovation and Employment Record of amendments – Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.

**13. CONDITIONS RELATING TO NOTIFICATION**

- 13.1. The certificate holder Thermakraft Ltd must notify the product certification body (BRANZ) in writing, of any intended change to any of the following particulars:
- The name, address, or contact details of the certificate holder;
  - Any address of a location where a certified product is produced or manufactured.
- 13.2. The certificate holder shall notify the Product Certification body in writing of any intended change, modification, or alteration to any of the following:
- The certified building method or product;
  - The method of its production or manufacture;
  - The Product Quality Plan prepared in respect of the certified building method or product;



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Certificate No: **BRANZ-CM-1002-Rev 2**

Date of Issue: 17 February 2022

Expiry Date: 17 February 2025

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*Chelva Percy*

**Chelva Percy**  
Chief Executive Officer  
BRANZ Limited

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NOVEMBER 2021

# +RIBRAFT® X-POD®

INSTALLERS  
GUIDE



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1 SCOPE

This installation guide has been developed for the exclusive use of Firth customers who are experienced in the construction of residential concrete foundation systems. The Building Act requires that only suitably qualified persons, who are Licensed Building Practitioners, (LBP) or working under the supervision of a LBP, can construct foundations systems. Experience in the placing finishing and early age care of concrete in accordance with NZS3109 is mandatory.

The RibRaft® X-Pod® foundation is a specifically designed systems and as such all details shall be provided in the project drawings. These drawing will have been reviewed as part of the building consent process. Any errors or omissions should be brought to the designers attention for instruction.

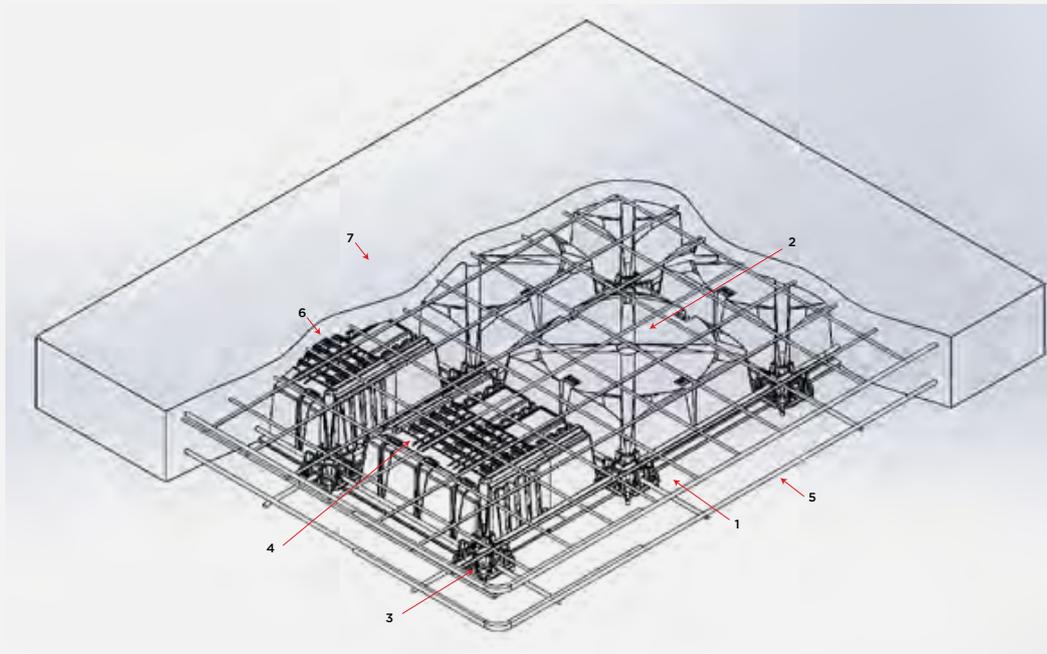
Contact your local Firth Representative for supply of Firth RibRaft® X-Pod®s. Pods shall be released to site upon confirmation of the placement of an order for the appropriate Firth concrete mix code (see section 2.1).

2 DESCRIPTION OF THE SYSTEM

The Firth RibRaft® X-Pod® flooring system comprises of:

- Firth concrete mix IP2019X or IP2519X, refer section 2.1
- A matrix of RibRaft® X-Pod® formers to create typically a total floor thickness of 300mm with ribs at 750 or 1500mm centres and a 85mm minimum topping above the RibRaft® X-Pod®s. Note refer to the project drawings as designers have differing preferences for topping thickness, refer section 2.2
- Firth RibRaft® Keystones which lock the X-Pod®s into place
- Mesh in the topping, refer section 2.3
- Reinforcement typically in the form of DH10s or larger diameter in the ribs, perimeter, and load bearing beams, section 2.4
- DPM providing a vapour barrier between ground and flooring system, section 2.5
- Dependent upon soil conditions the flooring system may sit on a compacted gravel raft, section 2.6
- The system is compatible with Firth HotEdge® should slab edge insulation be specified, section 2.7

FIGURE 1 - THE RIBRAFT® X-POD® SYSTEM



- 1 DPM
- 2 RibRaft® X-Pod® (215/750 or 215/1500)
- 3 RibRaft® Keystone 8/16
- 4 RibRaft® Mini Pod 215/300 and MP Extender 215/400.600

- 5 Steel reinforcing (bars)
- 6 Steel reinforcing (mesh)
- 7 Firth Concrete (mix code IP2019X or IP2519X)

## 2.1 CONCRETE

RibRaft® X-Pod® Foundation systems require a specific Firth designed concrete mix. Choose one of the following:

- 1 X-Pod® Mix IP2019X** - a 20MPa 100mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix
- 2 X-Pod® Mix IP2519X** - a 25MPa 120mm slump mix available as a pump mix suitable for 100mm pump lines available in either a 13mm or more usually a 19mm nominal aggregate size, or as a structural (non-pump) mix. This mix shall be specified for buildings constructed in the 'sea spray zone' (i.e. within 500m of the sea including harbours, within 100m of tidal estuaries or inlets, on offshore islands and elsewhere as defined as exposure zone D in 4.2.3.3 of NZS3604).

The X-Pod® system is available across most of NZ, where there is a Firth Concrete plant available to supply the X-Pod® special mix concrete. However in some parts of the county, X-Pod® isn't available including Kaitaia, Wairarapa, Kaikoura, Motueka and Golden Bay, where there is no Firth Plant or a Firth Plant is too far away to make the supply of X-Pod® concrete feasible. In these cases, please talk to your local Firth rep for more information and to discuss a suitable alternative foundation design.

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FIGURE 2 - TYPICAL RIBS LAYOUT OBTAINED WITH RIBRAFT® X-POD®S 215/750

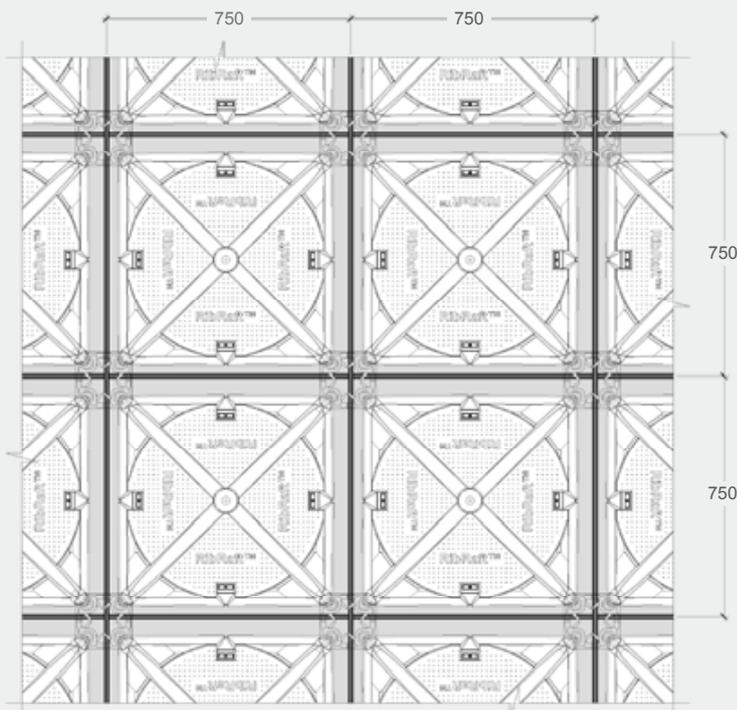


Illustration: © Cresco.co.nz

## 2.2 PODS

The Firth RibRaft® X-Pod® flooring system comprises of 4 pod options which are linked using the X-Pod® Keystone clip to create an efficient and strong flooring system. The pod options are:

- **RibRaft® X-Pod® 215/750.** These units, when laid out and linked with the X-Pod® Keystone create a grid with 100mm ribs at 750 centres. The height of the pods are 215mm which when combined with 85mm of concrete topping give a total floor thickness of 300mm. **See Figure 2.**
- **RibRaft® X-Pod® 215/1500.** These units, when laid and linked with the X-Pod® Keystone create a grid with 100mm ribs at 1500 centres. The units are designed to form a cross shaped concrete column in the centre of the 1500mm rib grid. The height of the pods are 215mm which when combined with 85mm of concrete topping give a total floor thickness of 300mm. **See Figure 3.**
- **RibRaft® Mini Pod (215/300 and Mini Pod Extender 215/400.600).** These units can be used when the required spacing between beams and ribs is less than 750mm. The Mini Pod forms a 300mm void. When combined with the MP EXT 215/400.600 unit, voids of between 400 to 600mm can be filled. **Figure 4 illustrates the units.**



FIGURE 3 - TYPICAL RIBS LAYOUT OBTAINED WITH RIBRAFT® X-POD®S 215/1500

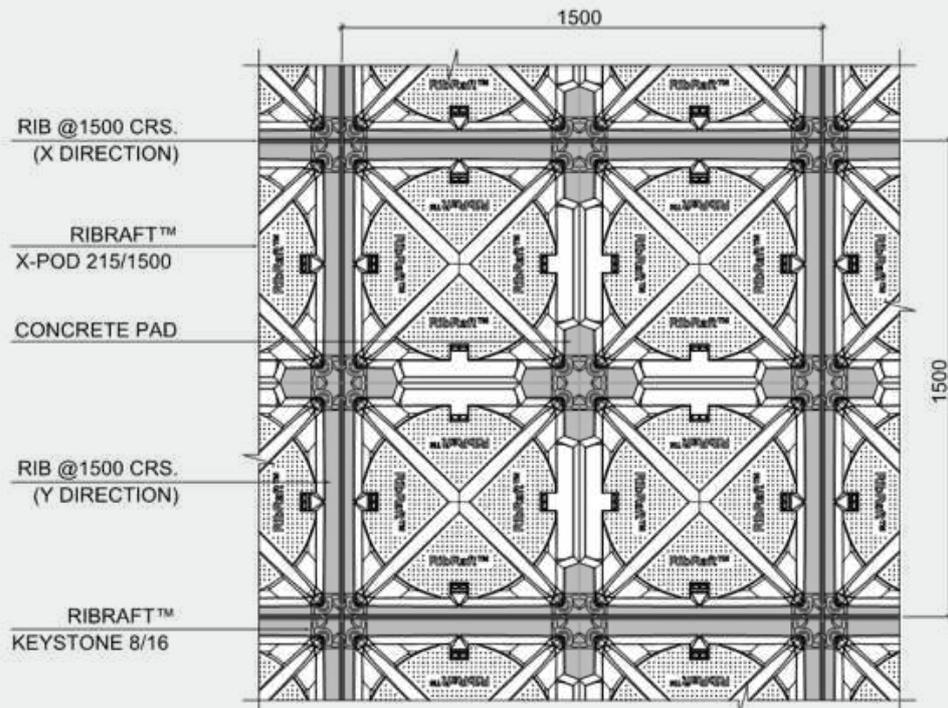
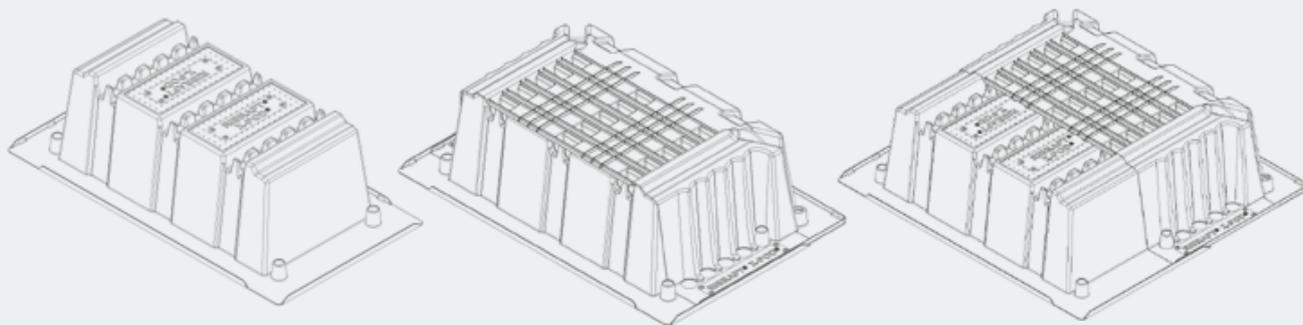


Illustration: © Ribraftdesign.co.nz

FIGURE 4 - RIBRAFT® X-POD® TWO PART ADJUSTMENT PODS



RibRaft® Xpod Mini Pod 215/300

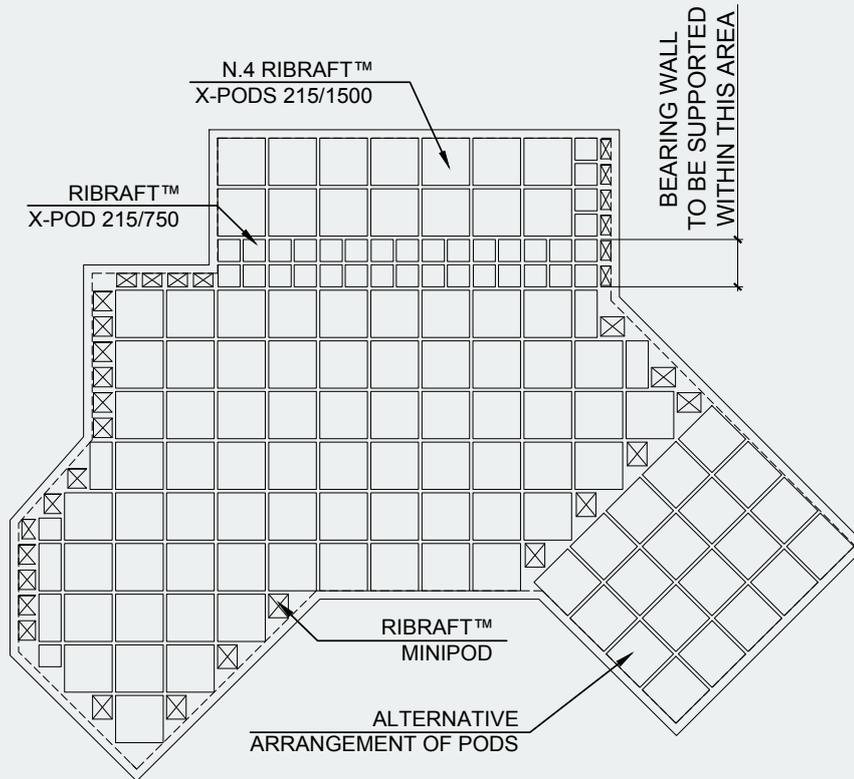
RibRaft® Xpod Mini Pod 215/300 and MP Extender 215/400.600

Firth RibRaft® X-Pod®s are placed directly on levelled ground and are arranged in such a way as to form a reinforced concrete floor slab with a grid of reinforced concrete ribs and edge beams when concrete is placed onto them. The RibRaft® ADJ Series X-Pod®s may be used to suit specific architecture layout and also to accommodate services.

**Figure 5** shows how the various X-Pod® components might be utilised on a complex floor arrangement where liquefaction or expansive soils are not a consideration.

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FIGURE 5 - EXAMPLE OF HOW THE VARIOUS X-POD® COMPONENTS CAN BE UTILISED ON A COMPLEX SHAPED FLOOR



### 2.3 MESH

Mesh shall be Grade 500 and comply with AS/NZS 4671:2001. Typically the mesh will be 665 mesh (Class L) or SE62 ductile mesh (Class E). The Design Engineer shall specify the required mesh.

Class L mesh can be used when the sole purpose is limitation of crack widths and the ground conditions are defined as good in terms of NZS3604. The Class E reinforcing bars in the ribs and beams provides adequate ductility of the system which allow the use of Class L mesh. Class E shall be used when the mesh performs a structural function such as a slab on ground prone to liquefaction or expansive soils.

Mesh shall be lapped in accordance with NZS3101.

Two options are available for supporting the mesh which shall be defined on the drawings:

- 1 The mesh can be supported on mesh chairs to achieve cover to the top surface of 35mm. This methodology minimises the cover and therefore enhances the crack width limiting ability of the mesh.
- 2 The mesh can alternatively be laid on upstands provided in the corners of the pods. The 15mm upstands on the pods mean that cover from the concrete surface to the mesh (SE62) is 58mm and slightly less at mesh overlaps.

### 2.4 STEEL

The reinforcing bars in the ribs and edge beams shall conform to AS/NZS 4671:2001 Grade 500, Class E "Steel Reinforcing Materials". The volume of reinforcement shall be documented on the approved building consented drawings.

The Firth RibRaft® X-Pod® Keystones hold the reinforcement in position without the need for tying. The X-Pod® Keystone can accommodate up to two DH16 bars at a lap position.

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## 2.5 DPM

The damp proof membrane (DPM) material shall be polyethylene sheet in accordance with NZS 3604:2011. The DPM shall be laid over the entire building platform directly on top of a sand blinding layer, extending to the outside of the edge beam. The joints shall be lapped not less than 50mm and sealed with pressure sensitive tape not less than 50mm wide. All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with pressure sensitive tape. The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork.

Where enhanced thermal performance is required, ThermoX DPM can be used as the DPM.

## 2.6 OPTIONAL GRAVEL RAFT

Often a gravel raft is not required below the DPM where ground bearing conditions permit, although a sand blinding layer may be required to provide puncture resistance to the DPM. Where ground conditions are soft, a compacted gravel raft can be provided to reduce the bearing pressures in the natural ground to acceptable levels. Details of any gravel raft shall be provided on the project drawings.

## 2.7 FIRTH HOTEDGE®

Where additional thermal efficiency is required, Firth HotEdge® can be incorporated into the design. Refer Firth web page for more information.



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## 3 INSTALLATION OF THE SYSTEM

The following provides an overview of the installation of the Firth RibRaft® X-Pod® system. Where conflict exists between the information provided in this document and the approved building consent drawing set, the drawings shall take precedence.

However, it is mandatory that the concrete used is supplied by Firth Industries to allow management of quality control.

### 3.1 SITE/EARTH WORKS

The building footprint shall be excavated to a suitable depth to ensure all organic material is removed (top soil, roots etc). Excavation shall extend beyond the footprint a distance shown on the drawings which is typically twice the depth of compacted hardfill beneath the concrete slab. Precautions shall be taken to prevent silt laden runoff from leaving the site should rain occur.

### 3.2 PLUMBING

Various Territorial Authorities have their own preferences for plumbing details so always check with the local council.

#### Two options exist for running plumbing:

- The pipes are installed in the ground below the slab and then rise up through the slab at the desired location within the building, referred to as “below slab installation”. This is the preferred option in most situations.
- The pipes run within the plane of the X-Pod® flooring system, referred to as “in floor installation”.

#### 3.2.1 BELOW SLAB PLUMBING INSTALLATION METHODOLOGY

This option is applicable for most situations but should not be used on liquefaction sites for which lateral spread is expected. In most situations this is the norm and most cost effective solution.

For this option, pipes shall be conveyed underground to their plan location then brought up through the X-Pod® and the concrete floor slab. The trenching, placing and bedding of the pipes/ducts and the backfilling shall conform to the requirements of the consent documentation. Services shall not be placed within any concrete except to cross that section of concrete i.e. services shall not run along ribs or edge beams. In accordance with AS/NZS3500.4:2015 pipes penetrating through concrete shall be:

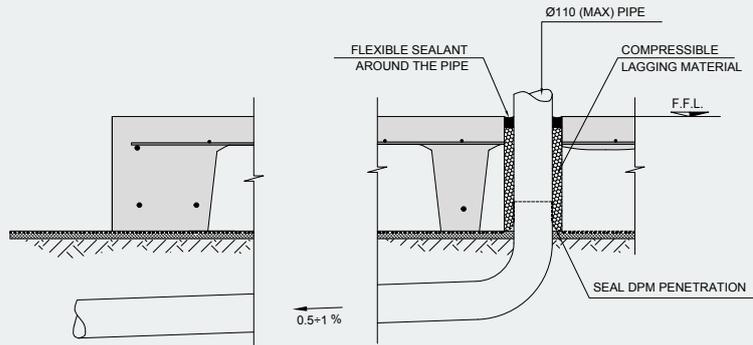
- Installed at right angles to the slab surface
- Lagged with an impermeable material for the full depth of the concrete penetration
- Lagging must be at least 6mm thick

Any services horizontally crossing ribs or the edge beams shall be placed only within the middle third of the member. At no stage shall any of the reinforcement bars be relocated or cut to allow for the services (it is acceptable, however to cut the mesh). In some instances this will dictate the location of the pods.

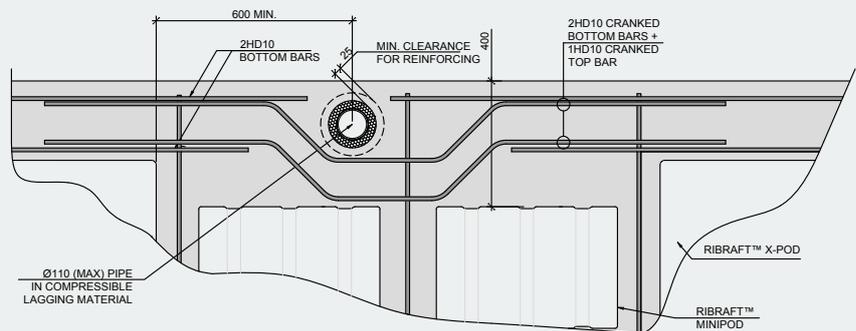
The Xpod® Mini Pods spacers can be used to trim around plumbing penetrations if required.

TYPICAL DETAILS ARE SHOWN BELOW

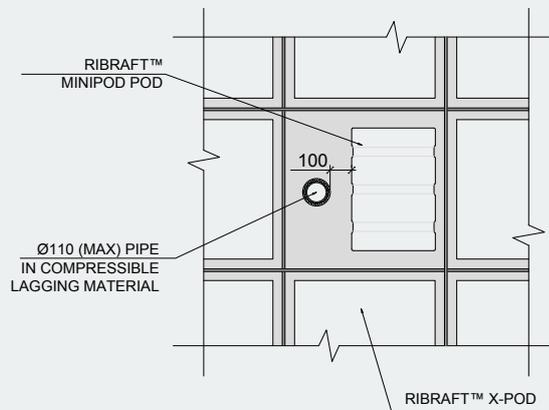
Below slab installation showing lagging of pipes



Details where large diameter pipe required through perimeter beam



Use of Xpod® Mini Pods to create zone for pipes to penetrate slab.



Illustrations: © Cresco.co.nz

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3.3 IN FLOOR PLUMBING INSTALLATION METHODOLOGY

This is the preferred methodology for sites where lateral spread associated with liquefaction is expected as it provides enhanced protection for the pipes compared to the below slab methodology. However, it can be used for all ground conditions.

Pipes services can be run within the plane of the RibRaft® X-Pod®s either exiting out of the side of the perimeter ring beam or going underground near the edge beam. Pipes shall be laid at a fall to comply with NZBC G13/AS1. For pipe up to 65mm diameter the minimum gradient is typically 1 in 40, while for 100mm pipes its 1 in 60, however greater falls may be required dependent upon the required number of discharge units. Table 1 provides distances from the edge of the slab to pipe surface penetration to achieve minimum pipe gradients. Where gradients cannot be achieved, then services will be required to be run under the slab.

Pipes shall either be:

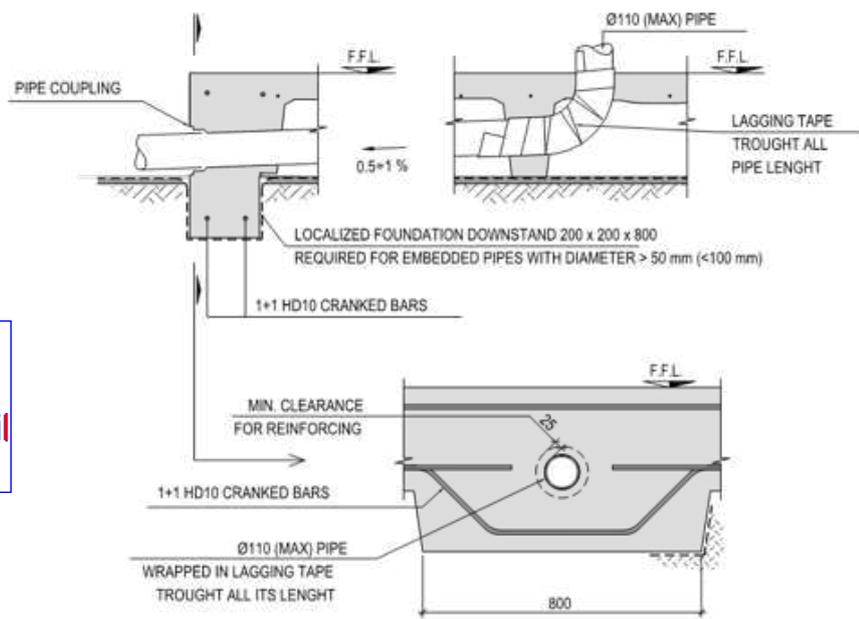
- 1 Located to pass perpendicular to the ribs and beams and shall not be laid along the length of ribs or beams. X-Pod®s can be cut and sealed as required to achieve the required fall and position.
- 2 The Xpod® Mini Pods spacers can be used to create beams to run services through. Pipes shall be laid to ensure 15mm concrete cover between pipe and reinforcement in the perimeter beam. The width of the rib containing the pipes shall be greater than the specified rib width (typically 100mm) plus the pipe diameter. This ensures the rib width is maintained even though plumbing pipes run through it. All pipes in contact with concrete shall be lagged with an impermeable material of at least 6mm thickness.

TABLE 1 MAXIMUM DISTANCE FROM EXTERIOR TO ENTRANCE POINT OF PLUMBING PIPES

Pipe Diameter (ID)mm	Gradient	Maximum distance to edge with 215mm thick pod
40	1 in 40	3400
50	1 in 40	3000
65	1 in 40	2400
100	1 in 60	1200

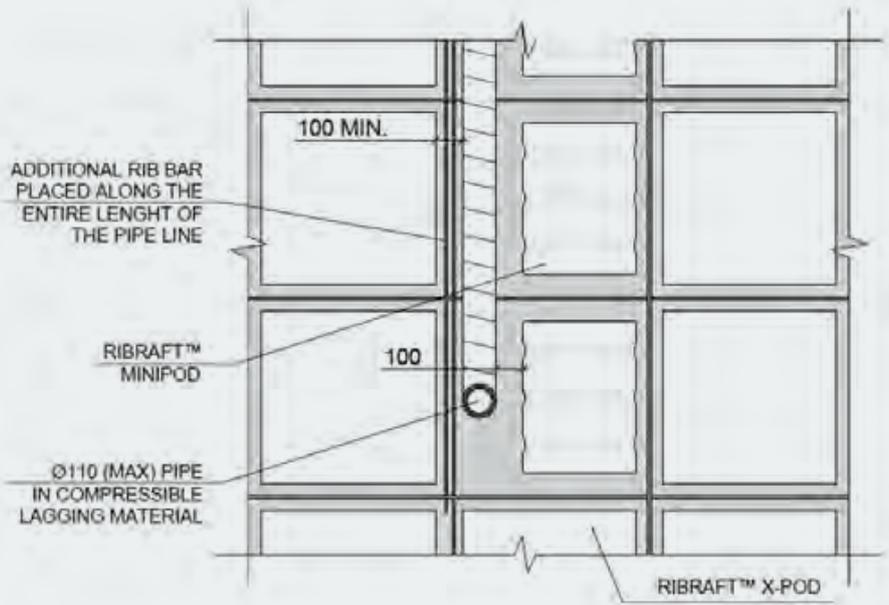
TYPICAL DETAILS ARE SHOWN BELOW

In slab installation pipes cut through rib walls



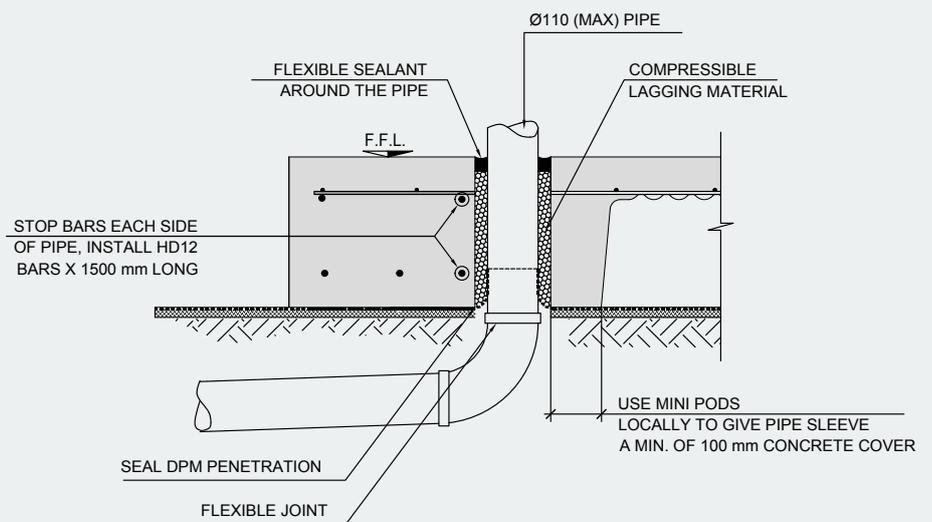
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Use of Xpod® Mini Pods to create zone for pipes to run without compromising the ribs



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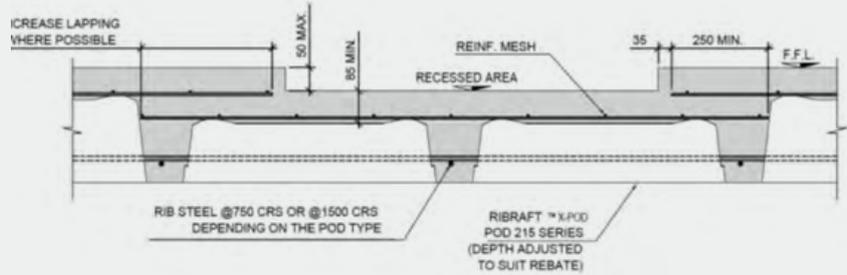
Typical drop down detail for sewer line to prevent it being visible at exterior of slab



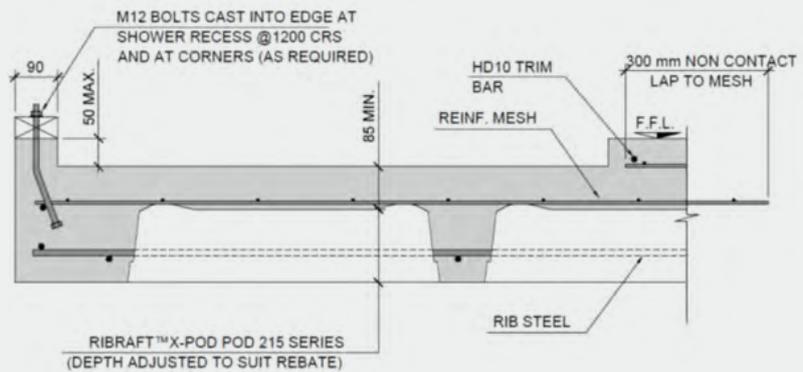
3.4 RECESSES FOR SHOWERS

The following figures provide typical details for recesses and large penetrations.

Shower recess distant from slab edge

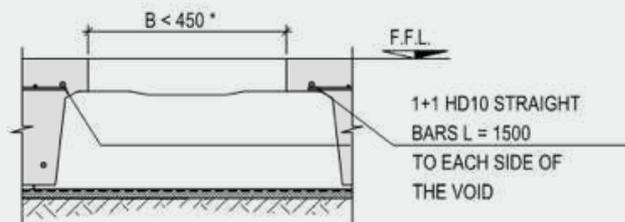


Shower recess close to slab edge



Large penetration through slab

LARGE PENETRATION THROUGH SLAB



(\* IF B > 450 mm PLACE 2 HD10 CRACK CONTROL BARS @ 200 L = 2000 AT EACH CORNER OF THE PENETRATION

### 3.5 SUB-BASE/SUBGRADE

Excavated material shall be replaced with hardfill material compacted in maximum layers of 150mm or as specified by the design engineer. Refer specific project drawings/specification for minimum hardfill layer under slab. A blinding layer of 0-5 mm sand or crusher dust shall cover base material to a maximum thickness of 25mm (for final hand screeding). The finished level of compacted hardfill shall be determined specifically by the designer for each site. The subgrade/sub-base should be inspected by the design engineer when this is a condition of the building consent, or where concerns exist that the ground conditions are not those implied by the design.

### 3.6 FORMWORK SETUP

Perimeter shutters shall be set to profiles or string lines with top edge at Finished Floor level. Setting level of shutters must allow for variation across prepared base and final hand screed of sand blinding layer (to +/- 5mm). Shutters shall be adequately braced to ensure minimal movement occurs under full load of wet vibrated concrete and construction loadings. Forms shall prevent the leakage of grout at joints which can result in a bony surface finish.

**The finished floor level shall ensure that the height above ground level satisfies the greater requirements of:**

- E1/AS1, refer section 2 in particular
- E2/AS1, refer section 9.1 in particular
- any local flood management clearance criteria

The specified levels shall be shown on the project drawings.

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### 3.7 DPM PLACEMENT

The DPM shall be laid over the entire building platform directly on top of a sand blinding layer, extending to the outside of the edge beam. The joints shall be lapped not less than 50mm and sealed with pressure sensitive tape not less than 50mm wide. All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with pressure sensitive tape. The DPM may extend beyond the edge of the slab i.e. underneath the formwork, or may be folded and stapled up the inside of the formwork. The minimum requirement is that the DPM extends to the outside of the edge beam. It is very important that the DPM is not bunched up at the formwork.

ThermoX DPM is highly reflective and sunglasses should be used when installing on sunny days. The reflective side is placed upwards.

### 3.8 POD INSTALLATION

The drawing should be reviewed to determine whether the symmetrical RibRaft®.

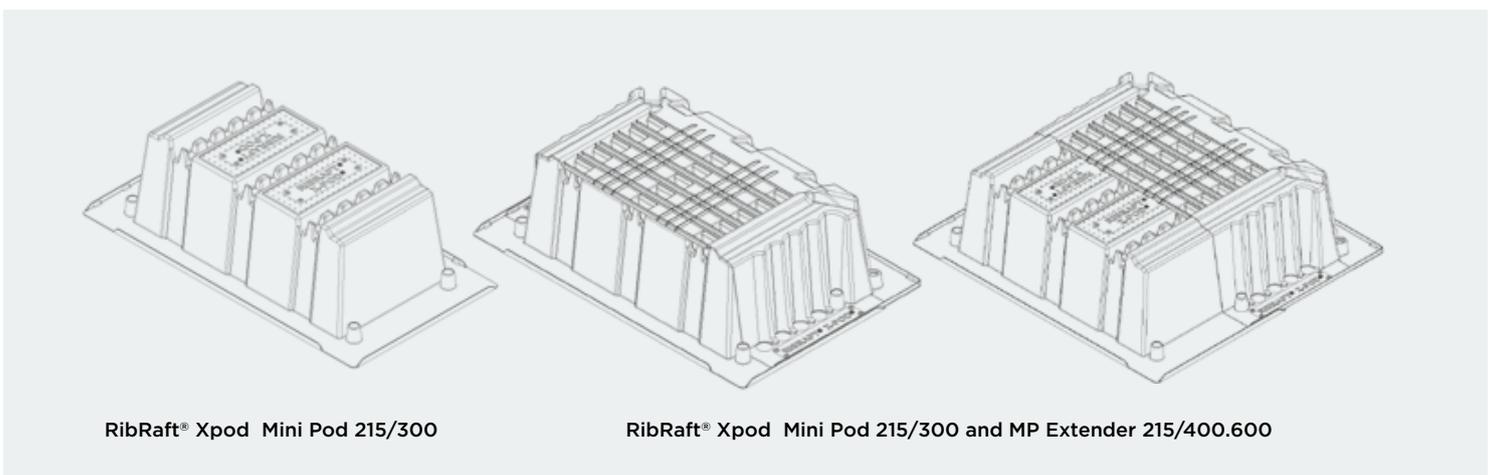
X-Pod® 750/215 is specified or the non-symmetrical

1500/215 pod. Review of the 1500/215 pod will show that only two of the sides only will create a 100mm rib.

Place a row of RibRaft® X-Pod®s the specified distance away from the formwork (refer consent drawings). Click in X-Pod keystone along perimeter beam to secure in place. Align second row of X-Pod®s and clip together in groups of four pods with X-Pod® Keystone in the holes provided. The X-Pod® Keystones click into place. Continue placing X-Pod®s and clicking together with X-Pod® Keystones. Note the pods are securely held together and modest realignment can occur by pushing. However, take care to avoid damage to the DPM.

Where adjustment pods are specified, or where required to frame around a plumbing penetration, follow the following procedure, *refer Figure 6*.

FIGURE 6 RIBRAFT® X-POD® TWO PART ADJUSTMENT PODS



RibRaft® Xpod Mini Pod 215/300

RibRaft® Xpod Mini Pod 215/300 and MP Extender 215/400.600

Where a 300mm gap needs filling use the Mini Pod 215/300. Simply clip the Mini Pod to the full pod with the Xpod® Keystones creating a 100mm rib between the full pod and mini pod.

For extension requirements of 400 to 600mm overlay the Mini Pod Extender to achieve the required extension.

The holes on the sides of the extension pods are designed to accommodate the X-Pod® Keystone if required.

### 3.9 REINFORCEMENT PLACEMENT

The X-Pod® Keystones have been designed to securely hold reinforcement in position without the need for tying. Place reinforcement in the location and to the details shown on the drawing. Clip reinforcement into place in X-Pod® Keystones.

Mesh can either be placed on reinforcement chairs or supported on the upstands in the corner of each X-Pod®. Refer to the drawings to determine which mesh support mechanism is specified for a particular project to determine the preference of the design engineer.

### 3.10 CONCRETE PLACEMENT

Firth concrete mix IP2019X or IP2519X are the most commonly specified mix designs for X-Pod® floors. The volume of the concrete floor above the pods can be estimated by calculating the overall volume including the pods (typically 750x750x300) and deducting the volume of the X-Pod®s provided in Table 2.

TABLE 2 VOLUME OF RIBRAFT® X-POD®S

Type of X-Pod®	Volume (litres)
215/750	83
215/1500	91

The Firth concrete mix is designed to have a suitable strength at a higher slump. The mix has been formulated to achieve appropriate filling of the X-Pod® foundation system. Pumping concrete is the recommended method of delivering the fresh concrete to the work face. Other methods of delivery may be suitable however approval from Firth or project engineer is required. For placing and finishing guidelines refer below and to CCANZ's posters number 3 and 5.

- 1 It is generally preferable to start pour at the garage (allows a harder, flatter finish) and work away. Controlling the flow from the pump nozzle is important to ensure even coverage.
- 2 Follow behind pour face with immersion (spud) type vibrator to all concrete (beams, ribs and top slab).
- 3 Care must be taken around plumbing to ensure damage, or movement does not occur.
- 4 Following vibration, normal concrete finishing techniques shall be carried out (refer poster number 5). Screed off concrete using normal screeding tools or vibrating screeds. Bull float to push down aggregates left at the surface during the screeding operation. Finish the edges with steel trowel and the interior of the slab surface with troweling machines. It is important that final troweling does not commence until all the bleed water has evaporated as premature commencement of troweling can lead to surface delamination or dusting.

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5 Hot and/or windy conditions present during pouring/finishing require steps be taken for the protection of the concrete to prevent plastic cracking. Protection measures include:

- a Aliphatic alcohol sprays
- b Water vapour misting over surface (ie from water blaster directed upward, and wind carrying mist over slab surface). However this water must be fully evaporated from the surface before commencing trowelling.
- c Positioning wind breaks

6 Curing the slab is crucial to ensure strength gain of concrete and protection from early age cracking. Suitable methods of curing include:

- a Water spraying/ponding
- b Curing membrane sprays
- c Polythene covering

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7 If environmental conditions forecast greater than 12 degrees variation of day time to overnight temperatures, then measures to protect slab from thermal shock shall be employed, these include:

- a Planning the pour time to minimise the temperature variations the concrete will experience
- b Covering surface with fabric, plastic covers or polythene
- c Using early entry saws

Forms shall not be struck on the day of the pour, and consideration should be given to leaving forms in place for 2-3 days following pour in very cold or shaded locations.

### 3.11 SHRINKAGE CONTROL JOINTS

Shrinkage control joints reduce the risk of unwanted cracks, and their placement needs to be carefully considered where uncontrolled cracking could be unacceptable. Two types are described here, saw cut joints (which are tied joints) and free joints.

#### 3.11.1 SAW CUT JOINTS

Saw cuts are located at positions in which the concrete is likely to crack due to stresses induced by restrained shrinkage.

The aim of providing them is for the concrete to crack at the bottom of the saw cut thus minimizing the potential for a visible crack wandering over the surface. The level of reinforcement provided in a RibRaft® X-Pod® flooring system mean that cracks have no structural implications being only an aesthetics issue. Factors to consider are the type of floor finish, the location of ribs and ground beams.

When warm sunny days are followed by cool nights, the change in temperature can cause cracking. Hence preference should be given to using early entry saws which are used immediately after finishing. Shrinkage control joints cut using diamond blades shall be cut as early as possible which is typically within 24 hours of hardening in summer, and 48 hours in winter. They shall be cut to a depth of 25mm. Shrinkage control joints do not guaranteed to eliminate all visible or unwanted cracks.

Joints shall be positioned to coincide with major changes in floor plan. Where concrete is to be exposed, for example in a garage, or brittle covering placed over, the maximum intermediate bay sizes shall be limited to 5m. Bay dimensions formed by shrinkage control joints shall be limited to a maximum ratio of length:width of 1.5:1. Where a shrinkage control joint runs along the line of a load bearing rib, then the joint shall be located directly above one edge of that rib.

In order to limit the width of cracks at re-entrant, or internal corners, extra steel is often specified and is placed on top of the mesh. These are typically 2-HD12 bars (grade 500E), 1200mm long tied to the top of the mesh at 200mm centres, with 50mm cover to the internal corner – refer Building Consent drawing for details.

#### 3.11.2 FREE JOINTS

For large plan areas the designer may specify free joints. These are typically joints which allow unrestrained movement, but are doweled to prevent vertical movement. If specified then follow details shown on the building consent drawings.

### 3.12 FINISH EXPECTATIONS

The Building Amendment Act 2013 introduced new consumer protection measures which became effective on

1 January 2015. MBIE has developed guidance to the industry on what constitutes a defect and the definition of acceptable/unacceptable defects. The MBIE guidance document suggest that for a concrete floor it is recognised that some cracking in concrete is common and not necessarily a sign of poor workmanship. The document suggests that cracks up to 3mm wide are acceptable.

It also recognises that the levelness of the floor is important. NZS3114 requires an even plane within 35mm for every 3m direction for a carpeted floors and 33mm for tiled and vinyl floors. Individual mounds should be less than 3mm high and depressions less than 3mm deep. In additional no abrupt deviations greater than specified in NZS3114 should exist.

Visible reinforcing or bony concrete should not exist along the slab edge.

Concrete is a natural material and shade variation can be expected. Often slight colour variations will fade with time.

## 4 INSTALLATION DOCUMENTATION

When requested, the installation contractor shall provide a PS3 for the installation of the Firth RibRaft® X-Pod® floor. Confirming that construction was in accordance with the project drawings and that the concrete used for the project was supplied by Firth Industries.



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POSTER No. 3

# PLACING AND COMPACTING

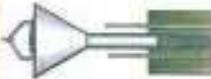
## PLACING

- Make sure you can see what you are doing.
  - Lights may be needed for thin and/or deep formwork
- Concrete mixers, skips and pumps can easily place the concrete exactly where it is needed
- Make sure that you order the right type of concrete with the correct slump for your placing method because you should not add water to a mix on site
  - A different type of concrete is used for pumping than is used for placing with a skip for example
  - Only small amounts of water may be added to a mix on site to make up for loss of water during travel, and may only be authorised by the Ready Mix supplier
- Placing must be done at the correct speed
  - Too fast and the compacting gang will not be able to keep up
  - Too slow and the mix will stiffen making compaction very difficult
- Concrete should be placed in layers to make sure that it is compacted properly
  - With poker vibrators the layers shouldn't be deeper than the length of the head
  - With vibrating beams layers shouldn't be deeper than 150 mm
- When dropping concrete from a height use tubes and/or baffle boards to prevent damage to the formwork

## 1 CONCRETT MIXERS CAN PLACE THE CONCRETE EXACTLY WHERE IT IS NEEDED



## 2 TREES ATTACHED TO FORMS CAN AIR THE CONCRETE IN THE RIGHT DIRECTION



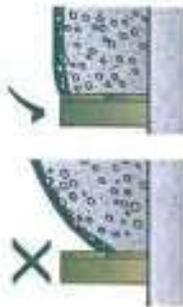
## 3 CONCRETE PUMPS CAN DIRECT THE CONCRETE LONG DISTANCES TO WHERE IT IS NEEDED



## 4

SLUMP	ON SITE
<p>Check the slump is right for the job</p>	<p>Ready mix suppliers may add up to 10 litres/m<sup>3</sup> to adjust the slump</p>

## 5 DON'T PLACE CONCRETE IN TOO BIG A CHUTE - USE LAYERS



## 6 ALWAYS MAKE THE SECOND LAYER 10% THICKER - BUT NEVER MORE THAN 100mm INTO THE FIRST LAYER



## 7 BEAM PUMPERS PROTECT YOU FROM RAIN AND SPILLAGE BY DUMPING CONCRETE



## 8 FOR THE BEST USE A BEAM PUMP FOR COLUMNS, WALLS AND THICK SLABS USE POKER VIBRATORS



## 9 ALWAYS HAVE A SURCHARGE OF CONCRETE AT THE END OF EVERY VIBRATION



## 10 MOBILE BEAM VIBRATORS REQUIRE NO TIEBACKS OR SQUEEZE



## 11 FOR BEST RESULTS UP TO 15mm FROM A BEAM VIBRATE AS A RULE



## 12 POKER VIBRATORS SHOULD BE USED ALONG THE EDGES OF SLABS TO COMPACT THE WIRE & GRAVEL



## COMPACTING

- Air is always trapped in concrete when it is being mixed.
- The aim of compaction is to remove as much of this air as possible.
- Why does getting rid of the air matter?
  - Air holes reduce the strength of concrete.
  - If you don't compact concrete, it may only be half as strong as it should be.
  - Air holes in the concrete stop a good bond forming between the concrete and the reinforcing steel making the structure weaker.
  - Large air holes can cause ugly marks on the surface.
- Use the right compaction equipment for each job.
  - Poker vibrators for beams, columns, walls and deep slabs.
  - Beam vibrators for thin layered slabs.
  - Clamp-on vibrators can be used on special formwork, especially in the precast industry.
- Always have spare compacting equipment in case of a breakdown. For more information on the use of poker vibrators see Poster No 4 "Using a Poker Vibrator".



**SAFETY ON SITE:** Suitable protective clothing should be worn when handling wet concrete

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POSTER No. 5

# METHODS OF FINISHING CONCRETE

## PLANNING

### Labour Resources

Make sure you have enough labour for the job size. Typical finishes have the following labour output production.

### Finishing

- Wood float - 3 to 4 m<sup>2</sup>/hour
- Hand steel float 5 to 4m<sup>2</sup>/hour
- Power float - 6 to 8m<sup>2</sup>/hour

### Power Trowelling

- 1 pass - 6 to 8m<sup>2</sup>/hour
- 2 passes - 10 to 12 m<sup>2</sup>/hour

### Equipment

Make sure you have enough equipment for the job. Make sure you know where to get replacement gear for power equipment.

### Typical gear list:

- Square Mouthed shovels.
- Concrete Rakes
- Straightedge
- Edging trowels
- Power Finishing
  - Float
  - Trowel
  - Hand finishing
  - Bull float
  - Wood float
  - Steel Trowels
- Special broom to suit a textured finish.
- Special finishes: you will need to check you have all the special gear, such as imprinting stamps, etc.

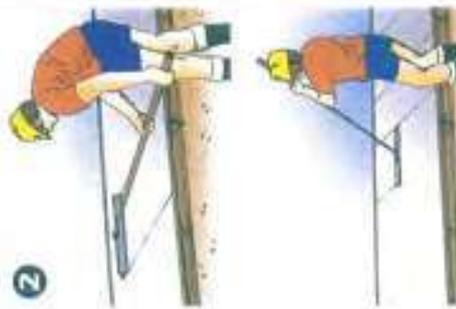
## WEATHER

- Do not concrete slabs that are exposed to the weather if rain is forecast. It is virtually impossible to repair a rain-damaged surface.
- Have some sheets of polythene available to cover the slab if you do get caught by a shower of rain.



1

**SCREED FINISH (U1):** This is the simplest finish to produce - the surface is formed with a hand tamping beam during the placement and compaction of the concrete.



2

**FLOATED FINISH (U2):** Concrete surface being levelled with a "bull float". On the forward stroke the float is pushed with handle forward, on the return stroke the float is pushed with the handle raised.



3

**BLEED WATER:** Water known as bleed water will come onto the surface of concrete within 15 minutes of compacting the concrete. No finishing work can start until this water has evaporated.



4

**WAITING TIME**  
WHY?  
• In cold weather the waiting period could be up to 5 hours.  
• The wetter the concrete, you use the longer the wait.

### Surface

- In hot weather, the waiting time could be two hours.
- If it is drying faster than two hours, then plastic surface cracking is likely to occur.
- To stop the rapid drying, mist spray with water or an aliphatic alcohol special mixers onto the plastic surface of the concrete. This should extend the drying time to 2 hours which will allow the plastic to escape through the still plastic upper surface.



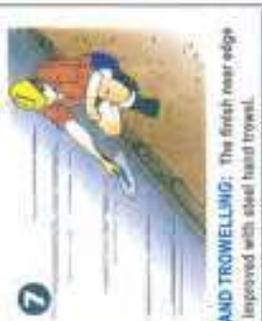
5

**FOOTPRINT** Concrete is ready for power floating when standing on the concrete creates an imprint not deeper than 3-3mm.



6

**POWER FLOATING** a slab surface.



7

**HAND TROWELLING:** The finish near edge is improved with steel hand trowel.



8



**POWER TROWELLING** can start when the surface has dried and is not sticky to the palm of the hand. The close-up view is of the trowel blades tilted during final stages.

## THE PROCESS

- The basic steps are shown in the numbered sequence 1 to 4.
- There must be a waiting period for bleed water to evaporate from the slab surface.
- Be warned that in the summer, evaporation can be too rapid leading to plastic cracking.
- In the summer, surface stiffening may still leave the lower parts of the slab in a plastic state. This can lead to problems of a rolling surface while trying to finish.
- As soon as the concrete has hardened enough to avoid surface marking, usually after 2 passes of steel trowelling, start the curing process, using for example a membrane spray. See Curing Poster No 4

## TYPES OF FINISHES

Make sure you understand the specification requirements in NZS 3114 before you start. The finish designations in NZS 3114 are:

- U1 Screeded Finish - see Step 1
- U2 Floated Finish - typically bull floating after the U1 finish.
- U3 Trowelled Finish - developed from a U2 finish after bleed water on the surface has evaporated.
- U4 Vibrating steel beam - surface left untouched from beams.
- U499 Broom finishes - different textures.
- U51 Early Age Grinding - usually applied to a U2 finish 36-48 hours after completing.

Note: there are other special finishes in NZS 3114. Please refer to the table E in Exposed Aggregate Booklet.

## SLAB PROTECTION

- Have the curing process decided before you start the job - See Curing Poster No 6
- In summer, make sure you can apply a mist spray of water or a special aliphatic alcohol to slow down the surface evaporation of water. This is very important with special concretes often used on commercial/industrial floors.
- In winter or in summer where there can be a big change in temperature between day and night, make sure you cover the slab



**SAFETY ON SITE:** Suitable protective clothing should be worn when handling wet concrete

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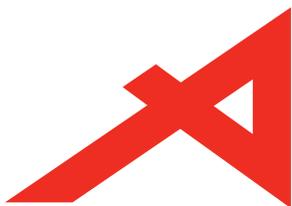
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## BRANZ Appraised

Appraisal No. 472 [2022]

### ARDEX UNDERTILE INTERNAL LIQUID WATERPROOFING MEMBRANES

Appraisal No. 472 [2022]

This Appraisal replaces BRANZ  
Appraisal No. 472 [2017]



#### BRANZ Appraisals

Technical Assessments of  
products for building and  
construction.



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## Product

- 1.1 ARDEX Undertile Liquid Membranes are premixed and two-part liquid-applied waterproofing membranes for use under ceramic or stone tile finishes in internal wet areas.

## Scope

- 2.1 ARDEX Undertile Liquid Membranes have been appraised for use as waterproofing membranes for the internal wet areas of buildings, within the following scope:
- on floor substrates of concrete, reconstituted wood panel flooring, plywood, compressed fibre cement sheet and fibre cement sheet tile underlay, and on wall substrates of concrete, concrete masonry, wet area fibre cement sheet lining systems and wet area plasterboard lining systems; and,
  - when protected from physical damage by ceramic or stone tile finishes; and,
  - where floors are designed and constructed such that deflections do not exceed 1/360<sup>th</sup> of the span.
- 2.2 The use of ARDEX Undertile Liquid Membranes on concrete slabs where hydrostatic or vapour pressure is present from below is outside the scope of this Appraisal.
- 2.3 Movement and control joints in the substrate must be carried through the membrane and tile finish. The design and construction of the substrate and movement and control joints is specific to each building, and is therefore the responsibility of the building designer and building contractor and is outside the scope of this Appraisal.
- 2.4 The ceramic or stone tile finishes are outside the scope of this Appraisal.
- 2.5 The membranes must be installed by trained installers, approved by ARDEX New Zealand Limited.

## Building Regulations

### New Zealand Building Code [NZBC]

- 3.1 In the opinion of BRANZ, ARDEX Undertile Internal Liquid Waterproofing Membranes, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the NZBC:
- Clause B2 DURABILITY:** Performance B2.3.1 [b] 15 years and B2.3.2. ARDEX Undertile Liquid Membranes meet these requirements. See Paragraph 9.1.
- Clause E3 INTERNAL MOISTURE:** Performance E3.3.6. Internal wet area floors and walls incorporating ARDEX Undertile Liquid Membranes meet this requirement. See Paragraphs 11.1-11.6.
- Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. ARDEX Undertile Liquid Membranes meet this requirement.

## Technical Specification

- 4.1 Materials supplied by ARDEX New Zealand Limited are as follows:
- **ARDEX WPM 001** is a one-part, polymer-based, ready-to-use, liquid-applied membrane containing micro-fibres. It is supplied as a light blue thixotropic paste in 20 kg (approximately 15 L) pails.
  - **ARDEX WPM 002** is a fast drying, two-part, flexible, cementitious-based, liquid-applied membrane containing micro-fibres. It is supplied as ARDEX WPM 002 Part A Liquid in 20 kg pails and ARDEX WPM 002 Part B Powder in 10 kg multi-wall bags. When dry, the membrane is light grey in colour.
  - **ARDEX WPM 155 Rapid** is a one-part, water-based polyurethane acrylic, ready-to-use, liquid-applied, rapid setting membrane. It is supplied as a blue colour in 4 and 15 L pails.
  - **ARDEX STB Tape** is an uncured butyl tape with a fleece layer that is used in the ARDEX WPM 155 Rapid under tile waterproofing system.
  - **ARDEX Multiprime** is a water-based primer used to seal substrates and enhance the adhesion of the membranes. It is supplied as a red coloured liquid in 1, 4 and 20 L plastic containers.

## Handling and Storage

- 5.1 All materials must be stored inside, up off concrete floors, in dry conditions, out of direct sunlight and freezing conditions. The membrane products have a shelf life of 12 months from date of manufacture in the original unopened packaging. Once opened, the products must be used within 3 months.

## Technical Literature

- 6.1 This Appraisal must be read in conjunction with:
- ARDEX WPM 001 Superflex Bathroom and Balcony Premixed, March 2012.
  - ARDEX WPM 002 Superflex Bathroom and Balcony Two Part, Jan 2022.
  - ARDEX WPM 155 Rapid, May 2013.
- 6.2 All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

## Design Information

### General

- 7.1 ARDEX Undertile Liquid Membranes are for use in buildings where an impervious waterproof membrane is required to floors and walls to prevent damage to building elements and adjoining areas.
- 7.2 ARDEX WPM 002 and ARDEX WPM 155 Rapid are designed to be used where a quicker curing time is required, such as in cool or humid conditions.
- 7.3 The membrane must be protected from physical damage by the application of ceramic or stone tile finishes.
- 7.4 Movement and control joints may be required depending on the shape and size of the building or room, and the tile finish specified. Design guidelines can be found in the BRANZ Good Practice Guide: Tiling.
- 7.5 Timber framing systems must comply with NZS 3604, or where specific engineering design is used, the framing shall be of at least equivalent stiffness to the framing provisions of NZS 3604, or comply with the serviceability criteria of AS/NZS 1170. In all cases, framing must be provided so that the maximum span of the substrate as specified by the substrate manufacturer is met and all sheet edges are fully supported. Timber framing systems supporting the substrates must be constructed such that deflections do not exceed 1/360<sup>th</sup> of the span. Where NZS 3604 is used, the allowable joist spans given in Table 7.1 shall be reduced by 20%.

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## Substrates

### Plywood

- 8.1 Plywood must be a minimum of 17 mm thick complying with AS/NZS 2269, CD Grade Structural with the sanded C face upwards and treated to H3 [CCA treated]. LOSP treated plywood must not be used.
- 8.2 The plywood must be supported with dwangs or framing with a maximum span of 400 mm in each direction, fixed with 10 g x 50 mm stainless steel countersunk head screws at 150 mm centres along the sheet edges and 200 mm centres through the body of the sheets.

### Fibre Cement Compressed Sheet/ Fibre Cement Sheet Tile Underlay

- 8.3 Fibre cement compressed sheet and tile underlay must be manufactured to comply with the requirements of AS/NZS 2908.2 and must be specified by the manufacturer as being suitable for use as a wet area membrane substrate. Installation must be carried out in accordance with the instructions of the manufacturer.

### Reconstituted Wood Panel Flooring

- 8.4 Non-oriented strand board panels that are bonded with PMDI resin, are water-repellent, have an average density of 680 kg/m<sup>3</sup>, are treated to H3 with a waterborne treatment not LOSP, and are suitable for use as the timber substrate under wet area waterproof membrane systems.

### Concrete and Concrete Masonry

- 8.5 Concrete and concrete masonry substrates must be to a specific engineering design meeting the requirements of the NZBC, such as concrete construction to NZS 3101, concrete slab-on-ground to NZS 3604 or NZS 4229, and concrete masonry to NZS 4229 and NZS 4230.

### Wet Area Wall Linings

- 8.6 Plasterboard wall linings must be manufactured to comply with AS/NZS 2588 and be suitable for use in internal wet areas.
- 8.7 Fibre cement sheet must be suitable for use in wet areas and comply with AS/NZS 2908.2.
- 8.8 Installation of plasterboard or fibre cement wall linings must be carried out in accordance with the instructions of the manufacturer.

## Durability

### Serviceable Life

- 9.1 ARDEX Undertile Liquid Membranes, when subjected to normal conditions of environment and use, are expected to have a serviceable life of at least 15 years and be compatible with ceramic or stone tile finishes with a design serviceable life of 15-25 years.

### Maintenance

- 10.1 No maintenance of the membrane will be required provided significant substrate movement does not occur and the tile finish remains intact. Regular checks must be made of the tiled areas to ensure they are sound and will not allow moisture to penetrate. Any cracks or damage must be repaired immediately by repairing the tiles, grout and sealant.
- 10.2 In the event of damage to the membrane, the tiling must be removed and the membrane repaired by removing the damaged portion and applying a patch as for new work.
- 10.3 Drainage outlets must be maintained to operate effectively, and tile finishes must be kept clean.

### Internal Moisture

- 11.1 ARDEX Undertile Liquid Membranes are impervious to water, and when appropriately designed and installed will prevent water from penetrating behind linings or entering concealed spaces.
- 11.2 Surfaces must be finished with ceramic or stone tiles. A means of compliance with NZBC Clauses E3.3.3 and E3.3.4 is given in NZBC Acceptable Solution E3/AS1 Paragraph 3.1.1 b), 3.1.2 b) and 3.3.1 b).

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- 11.3 Falls in showers and shower areas must be a minimum of 1 in 50. In unenclosed showers, falls must extend a minimum of 1,500 mm out from the shower rose. Floor wastes and drainage flanges must be provided and the floor must fall to the outlet.
- 11.4 ARDEX Undertile Liquid Membranes are suitable for use to contain accidental overflow to meet NZBC Clause E3.3.2. A means of compliance for overflow is given in NZBC Acceptable Solution E3/AS1, Section 2.
- 11.5 The waterproofing membranes must completely cover shower bases, and for unenclosed showers it must extend a minimum of 1,500 mm out from the shower rose. Further design guidance on waterproofing wet areas, including waterproofing walls and junctions can be obtained from AS 3740, the BRANZ Good Practice Guide: Tiling, and the flooring and wall lining manufacturers.
- 11.6 Where water-resistant wall finishes such as prefinished sheet materials are used, they must overlap the membrane a minimum of 30 mm.

## Installation Information

### Installation Skill Level Requirement

- 12.1 Installation of the membranes must be completed by trained installers, approved by ARDEX New Zealand Limited.
- 12.2 Installation of substrates must be completed by, or under the supervision of, Licensed Building Practitioners [LBP] with the relevant Licence Class, in accordance with instructions given within the ARDEX New Zealand Limited Technical Literature and this Appraisal.

### Preparation of Substrates

- 13.1 Substrates must be dry, clean and stable before installation commences. Surfaces must be even and free from nibs, sharp edges, dust, dirt or other materials such as oil, grease or concrete formwork release agents.
- 13.2 The relative humidity of concrete substrates must be 75% or less before membrane application. The concrete can be checked for dryness by using a hygrometer as set out in BRANZ Bulletin No. 585.
- 13.3 All voids, cracks, holes, joints and excessively rough areas must be filled to achieve an even and uniform surface. Junctions of substrate abutments, such as at wall/floor and wall/wall junctions must have reinforcements installed as set out in the Technical Literature.
- 13.4 The moisture content of reconstituted wood flooring at the time of priming must not exceed 16%. All face surfaces and edges must be primed prior to membrane installation.
- 13.5 Substrates must be primed with ARDEX Multiprime and allowed to dry fully before the membrane is installed.

### Membrane Installation

- 14.1 Installation must not be undertaken where the substrate surface temperature is below 10°C or above 35°C.
- 14.2 ARDEX WPM 002 liquid and dry components must be mixed and left to stand for 5 minutes before re-mixing, then applying. ARDEX WPM 001 and ARDEX WPM 155 Rapid must be thoroughly stirred before application.
- 14.3 The membranes must be applied in a minimum of two coats at the rates set out in the Technical Literature to give a total finished thickness of 0.5-1.2 mm. Subsequent coats must be applied at an opposite direction to the previous coat.
- 14.4 Application can be made by roller [medium/long nap], brush [long bristle], or a flat steel trowel.
- 14.5 Reinforcement fabric is bedded into the wet layer between coats to provide movement protection at wall/wall and wall/floor junctions, and at any other areas such as joints in the flooring substrate, floor cracks or around penetrations in the membrane. ARDEX STB Tape must be used with ARDEX WPM 155 Rapid to take advantage of the rapid/fast drying features.
- 14.6 Clean up may be undertaken with water.

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## Tiling

- 15.1 The membrane must be fully cured before tiling. The cured membrane must be protected at all times to prevent mechanical damage, so may require temporary covers until the finishing is completed.
- 15.2 Tiling must be undertaken in accordance with AS 3958.1 and the BRANZ Good Practice Guide: Tiling. The compatibility of the tile adhesive must be confirmed with the adhesive manufacturer or ARDEX New Zealand Limited.

## Inspections

- 16.1 Critical areas of inspection are:
- Construction of substrates, including crack control and installation of bond breakers and movement control joints.
  - Moisture content of the substrate prior to the application of the membrane.
  - Acceptance of the substrate by the membrane installer prior to application of the membrane.
  - Installation of the membrane to the supplier's instructions, particularly installation to the correct thickness and use of reinforcement.
  - Membrane curing and integrity prior to the installation of tiles including protection from mechanical damage during curing and prior to tile installation.

## Health and Safety

- 17.1 Safe use and handling procedures for the membrane are provided in the Technical Literature. The materials must be used in conjunction with the relevant Material Safety Data Sheet.

## Basis of Appraisal

The following is a summary of the technical investigations carried out:

### Tests

- 18.1 The following testing of ARDEX WPM 001 and ARDEX WPM 002 has been undertaken by ARDEX Australia Pty Limited research and development laboratory: water vapour transmission, water absorption, tensile strength and elongation before and after UV exposure, immersion in bleach, immersion in industrial detergent and immersion in water. Test methods and results were reviewed by BRANZ and found to be satisfactory.
- 18.2 The following testing of ARDEX WPM 001 was undertaken by the Commonwealth Scientific Industrial Research Organisation [CSIRO] Australia:
- In accordance with ANSI A118.10 for ICBO Evaluation Service - dimensional stability, waterproofness, shear strength to ceramic tile and cement mortar, and fungal and micro-organism resistance.
  - In accordance with AS 1145 - behaviour under cyclic strain.
- 18.3 Testing of ARDEX WPM 001 and ARDEX WPM 002 has been undertaken by BRANZ for low temperature flexibility and peel adhesion after heat/humidity aging.
- 18.4 The following testing of ARDEX WPM 155 Rapid was undertaken by various organisations:
- Durability testing to AS/NZS 4858 Appendix A including effect of heat aging, bleach, detergent and water on tensile strength and elongation.
  - Cyclic movement resistance requirements of AS/NZS 4858:2004 Appendix B.
  - Water vapour transmission using both wet and dry cup methods from ASTM E96.
  - Water transmission behaviour following the procedures of AS/NZS 4858 Appendix C.
- 18.5 The above test methods and results have been reviewed by BRANZ and found to be satisfactory.

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### Other Investigations

- 19.1 An assessment was made of the durability of the ARDEX Undertile Liquid Membranes by BRANZ technical experts.
- 19.2 Site inspections have been carried out by BRANZ to examine the practicability of installation.
- 19.3 The Technical Literature has been examined by BRANZ and found to be satisfactory.

### Quality

- 20.1 The manufacture of the membrane has been examined by BRANZ, and details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.
- 20.2 The quality management system of membrane's manufacturer has been assessed and found to be satisfactory.
- 20.3 The quality of supply of the membrane system materials to the market is the responsibility of ARDEX New Zealand Limited.
- 20.4 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of the framing systems and substrate.
- 20.5 Quality on-site is the responsibility of the trained installers, approved by ARDEX New Zealand Limited.
- 20.6 Building owners are responsible for the maintenance of the ceramic or stone tiles in accordance with the instructions of ARDEX New Zealand Limited.

### Sources of Information

- AS 3740:2021 Waterproofing of domestic wet areas.
- AS 3958.1:2007 Ceramic tiles - Guide to the installation of ceramic tiles.
- AS/NZS 1170:2002 Structural design actions
- AS/NZS 2908.2:2000 Cellulose-cement products - Flat sheets.
- AS/NZS 4858:2004 Wet area membranes.
- AS/NZS 2269:2012 Plywood - Structural.
- BRANZ Good Practice Guide: Tiling (Third Edition), April 2015.
- NZS 3101:2006 Concrete Structures Standard.
- NZS 3602:2003 Timber and wood-based products for use in buildings.
- NZS 3604:2011 Timber-framed buildings.
- NZS 4229:2013 Concrete masonry buildings not requiring specific engineering design.
- NZS 4230:2004 Code of practice for the design of masonry structures.
- Ministry of Business, Innovation and Employment Record of amendments - Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.

**BC230628**  
**Received by**  
**Kapiti Coast District Council**  
**13/09/2023**



**BRANZ Appraisal**  
Appraisal No. 472 [2022]  
02 August 2022

ARDEX UNDERTILE INTERNAL  
LIQUID WATERPROOFING  
MEMBRANES



In the opinion of BRANZ, **ARDEX Undertile Internal Liquid Waterproofing Membranes** are fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided they are used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **ARDEX New Zealand Limited**, and is valid until further notice, subject to the Conditions of Appraisal.

### Conditions of Appraisal

1. This Appraisal:
  - a) relates only to the product as described herein;
  - b) must be read, considered and used in full together with the Technical Literature;
  - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
  - d) is copyright of BRANZ.
2. **ARDEX New Zealand Limited:**
  - a) continues to have the product reviewed by BRANZ;
  - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
  - c) abides by the BRANZ Appraisals Services Terms and Conditions;
  - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
  - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
  - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
  - c) any guarantee or warranty offered by **ARDEX New Zealand Limited**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **ARDEX New Zealand Limited** or any third party.

For BRANZ

**Chelydra Percy**

Chief Executive

Date of Issue:  
02 August 2022

BC230628  
Received by  
Kapiti Coast District Council  
13/09/2023



association of consulting and engineering



99

# PRODUCER STATEMENT – PS1 DESIGN

**BUILDING CODE CLAUSE(S):** B1/VM/VM4  
**ISSUED BY:** BASE CONSULTING ENGINEERS LTD.  
(Engineering Design Firm)

**JOB NUMBER:** 23055

**TO:** T. ATKINSON  
(Owner/Developer)

BC230628  
Received by  
Kapiti Coast District Council  
13/09/2023

**TO BE SUPPLIED TO:** KAPITI COAST DISTRICT COUNCIL  
(Building Consent Authority)

**IN RESPECT OF:** ATKINSON DWELLING  
(Description of Building Work)

**AT:** LOT 43 ANDERSON PARK, WAIKANAE  
(Address, Town/City)

**LEGAL DESCRIPTION:**

N/A

We have been engaged by the owner/developer referred to above to provide (Extent of Engagement):

The Structural Design for: Roof Truss, Beams; Bracing Schedule

in respect of the requirements of the Clause(s) of the Building Code specified above for Part only, as specified in the Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- Compliance documents issued by the Ministry of Business, Innovation & Employment (Verification method/acceptable solution) AS/NZS: 1170; NZS: 3603; NZS: 3404 and/or;
- Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

On behalf of the Engineering Design Firm, and subject to:

- Site verification of the following design assumptions: N/A
- All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that:

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM2 level of construction monitoring.

I, (Name of Engineering Design Professional) PETER BOLTON, am:

- CPEng number 56179

and hold the following qualifications BE Civil

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than \$200,000

The Engineering Design Firm is not a member of ACE New Zealand.

**SIGNED BY (Name of Engineering Design Professional):** PETER BOLTON

(Signature below):

**ON BEHALF OF (Engineering Design Firm):** BASE CONSULTING ENGINEERS LTD.

Date: 16/06/2023

Note: This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, is limited to the sum of \$200,000.

This form is to accompany Form 2 of the Building (Forms) Regulations 2004 for the application of a Building Consent.

### SCHEDULE to PS1

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below: |

23055: Design & Drawing

BC230628  
Received by  
Kapiti Coast District Council  
13/09/2023

## GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website  
<https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/>

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

**PS1 DESIGN** Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

**PS2 DESIGN REVIEW** Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

**PS3 CONSTRUCTION** Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011<sup>2</sup>

**PS4 CONSTRUCTION REVIEW** Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

### Competence of Engineering Professional

This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

### Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

### Professional Services during Construction Phase

There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers<sup>3</sup>). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

### Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

### Refer Also:

- 1 Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
- 2 NZIA Standard Conditions of Contract SCC 2011
- 3 Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
- 4 PN01 Guidelines on Producer Statements

[www.acenz.org.nz](http://www.acenz.org.nz)

[www.engineeringnz.org](http://www.engineeringnz.org)

BASE CONSULTING ENGINEERS  
279 Oxford Street  
Levin 5510

BC230628  
Further Information Received  
12/10/23



11 October 2023

Job No:23055

**Re: Schedule of Inspections  
Atkinson Dwelling, Lot 43 Anderson Park, Waikanae**

In order to provide a PS4 for the above new building the following inspections are required to be undertaken.

Item	Stage	Frequency
Truss connections to SS1/SS2	After installation	Once
Steel beam connections to SS3	After installation	Once

Ensure steelwork is inspected prior to steelworker/access equipment leaving site.

Where an inspection has been failed a re-inspection is required, multiple inspection failures will result in additional inspection fees.

All inspections above must be complete and all outstanding issues must be resolved for BCE to provide PS4 at the completion of the project.

Yours faithfully  
**Base Consulting Engineers Ltd.**

**Peter Bolton CPEng CMEngNZ IntPE(NZ)  
Director**

BC230628  
 Received by  
 Kapiti Coast District Council  
 13/09/2023

Form 2A

**Memorandum from licensed building practitioner: Certificate of design work**  
**Section 45 and Section 30C, Building Act 2004**

Please fill in the form as fully and correctly as possible.

If there is insufficient room on the form for requested details, please continue on another sheet and attach the additional sheet(s) to this form.

**THE BUILDING**

Street address: LOT 43 ANDERSON PARK

Town/City: WAIKANAE	Postcode:
---------------------	-----------

**THE OWNER**

Name: T. ATKINSON

Mailing address:

Suburb:	PO Box/Private Bag:
Town/City:	Postcode:
Phone number:	Email address:

**BASIS FOR PROVIDING THIS MEMORANDUM**

I am providing this memorandum in my role as the: Please tick the option that applies (✓)	
( )	sole designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design myself – no other person will be providing any additional memoranda for the project
( )	lead designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and no other person will be providing any additional memoranda for the project
( )	lead designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the other designers will provide their own memoranda relating to their specific RBW design
(✓)	specialist designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

**IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)**

I, Peter Bolton, carried out the following design work that is restricted building work

**PRIMARY STRUCTURE: B1**

Design work that is restricted building work	Description	Carried out/ supervised	Reference to plans and specifications
Tick(✓) if included Cross (X) if	[If appropriate, provide details of the restricted building work]	[Specify whether you carried out this design work or supervised	[If appropriate, specify references]

<i>excluded</i>		<i>someone else carrying out this design work]</i>	
<b>Primary structure</b>			
All RBW Design work relating to B1	( )		( ) Carried out ( ) Supervised
Foundations and subfloor framing	( )		( ) Carried out ( ) Supervised
Walls	( )		( ) Carried out ( ) Supervised
Roof	(√)	Roof Truss	(√) Carried out ( ) Supervised 23055
Columns and beams	(√)	Beams	(√) Carried out ( ) Supervised 23055
Bracing	(√)	Bracing Schedule	(√) Carried out ( ) Supervised 23055
Other	( )		( ) Carried out ( ) Supervised
<b>EXTERNAL MOISTURE MANAGEMENT SYSTEMS: E2</b>			
All RBW design work relating to E2	( )		( ) Carried out ( ) Supervised
Damp proofing	( )		(√) Carried out ( ) Supervised
Roof cladding or roof cladding system	( )		( ) Carried out ( ) Supervised
Ventilation system (for example, subfloor or cavity)	( )		( ) Carried out ( ) Supervised
Wall cladding or wall cladding system	( )		( ) Carried out ( ) Supervised
Waterproofing	( )		( ) Carried out ( ) Supervised
Other	( )		( ) Carried out ( ) Supervised
<b>FIRE SAFETY SYSTEMS: C1 – C6</b>			
Emergency warning systems, evacuation and fire	( )		( ) Carried out( ) Supervised

service operation systems, suppression or control systems, or other			
---	--	--	--

**Note:** The design of fire safety systems is only restricted building work when it involves small-to-medium apartment buildings as defined by the Building (Definition of Restricted Building Work) Order 2011.

**Note:** continue on another page if necessary.

#### WAIVERS AND MODIFICATIONS

Waivers or modifications of the building code are required ( ) Yes (√) No

If Yes, provide details of the waivers or modifications below:

Clause	Waiver/modification required
<i>[List relevant clause numbers of building code]</i>	<i>[Specify nature of waiver or modification of building code]</i>

**Note:** continue on another page if necessary.

#### ISSUED BY

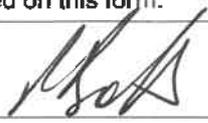
Name: Peter Bolton	LBP or Registration number: 56179
The practitioner is a: ( ) Design LBP ( ) Registered architect (√) Chartered Professional Engineer	
Design Entity or Company (optional): Base Consulting Engineers Ltd	
Mailing address (if different from below):	
Street address / Registered office: 279 Oxford Street	
Suburb:	Town/City: Levin
PO Box/Private Bag:	Postcode:
Phone number:	Mobile: 0274 444 080
After Hours:	Fax:
Email address: peter@basecon.co.nz	Website:

#### DECLARATION

I Peter Bolton [name of practitioner], CPEng,

state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:

- Complies with the building code; or
- Complies with the building code subject to any waiver or modification of the building code recorded on this form.

Signature: 

Date: 16 June 2023

To the Kapiti Coast District Council: 16 June 2023

To whom it may concern,

B2 compliance in respect of: Atkinson Dwelling

At: Lot 43 Anderson Park, Waikanae

You have requested a Producer Statement/other means of compliance for Construction Review for Clause B2 of the Building Code – Durability.

The purpose of this letter is to confirm that direct construction monitoring by Base Consulting Engineers Ltd in relation to Clause B2 (Durability) of the Building Code for the above project, has been limited in that material protection or treatment is typically carried out by specialist suppliers and requires specific quality assurance by the suppliers. However, we can confirm the specifically designed structural elements that were included in the design documentation prepared by Base Consulting Engineers Ltd. comply with the applicable verification methods:

Material	Means of Compliance	Details
Reinforced concrete	B1/VM1	Compliance with cover and concrete quality requirements for B1/VM1 are in accordance with NZS3101:2006
Structural timber	B1/VM1	The timber has been specified in accordance with NZS3640:2004. The quality of timber treatment is dependent on the QA systems of manufacturers, suppliers and the onsite contractors and sub-contractors. Refer to the contractor's PS3 and QA records where available.
Mild steel structure	B1/VM1	Protective coatings have been specified in accordance with AS/NZS 2312:2014 and SNZ TS 3404:2018. . The quality of mild steel protective coatings is dependent on: <ul style="list-style-type: none"> <li>▪ Steel preparation</li> <li>▪ Quality and production consistency of the coating products</li> <li>▪ QA of the application and curing</li> <li>▪ QA of the handling, protection and repair</li> </ul> Refer to: <ul style="list-style-type: none"> <li>▪ Contractor's and sub-contractor's PS3s and QA records where available</li> <li>▪ Third-party inspection and test results</li> </ul>

Yours sincerely,

**Peter Bolton** *CMEng* NZ CPEng # 56179



For and on behalf of

**Base Consulting Engineers Ltd**

BC230628  
 Received by  
 Kapiti Coast District Council  
 13/09/2023



**BASE CONSULTING  
ENGINEERS LIMITED**

Job Number: 23055

Page number: 1

Client: T Atkinson

By: P Bolton

Date: 31:05:2023

Project/Job: Atkinson Dwelling

Subject: Design Features Report

## DESIGN FEATURES REPORT

### Scope

The client is planning to erect a new dwelling on their site at Lot 43, Anderson Park, Waikanae. The building is a part two storey structure of lightweight construction supported on a waffle type concrete slab.

Base Consulting engineers has been contracted to provide structural design services for the client; T Wilkinson. These services are to design:

- Roof truss
- Lintels
- Bracing Schedule

No foundation design or Investigation is included in our brief

We have been provided with architectural drawings by Onboard and Online, these calculations should be read in conjunction with the architectural drawings.

### Standards

The structural design of the canopy is to comply with Clause B1 of the New Zealand Building Code. New Zealand Standards are used to ensure designs are an Acceptable Solution to B1.

New Zealand Standards used in this design are:

- NZS 1170 Structural design action
- NZS 3404 Steel structures standard
- NZS 3603 Timber Structures Standard

### Design Parameters

We have assumed the following parameters for the building:

- 50 Year design life
- Importance level 1

### Permanent actions

	Roof	Floor	Wall
Description	metal	Concrete slab	Timber
Weight(kPa)	0.4	2.4	0.4

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### Live loads

	Roof	Floor	Deck	Garage
Distributed (kPa)	0.25	1.5	2.0	2.5
Point Load	1.4	1.8	1.8	9.0



**BASE CONSULTING  
ENGINEERS LIMITED**

Job Number: 23055

Page number: 2

Client: T Atkinson

Project/Job: Atkinson Dwelling

By: P Bolton

Subject: Design Features Report

Date: 31:05:2023

### Wind Parameters

- Wind Area: W
- Wind Zone: High
- Basic ULS wind speed 51 ms<sup>-1</sup>
- Basic SLS wind speed 43 ms<sup>-1</sup>

### Deflection

Vertical deflection limits for the structure as per Table C1 in NZS1170.0

Element	Description	Criteria
Roof members (non brittle roofing)	Dead load plus long term live load	L/300
Roof members (brittle roofing)	Dead load plus long term live load	L/400
Floor members	Dead load plus long term live load	L/300
Lintels	Dead load plus long term live load	L/400 or 12mm Max

### Corrosion

External

	Timber	Structural steel	Concrete	Masonry
Zone	C	C3	B1	B1
Provision	Fixings refer To 3604	HDG-600 – 40 yrs to first maintenance	40mm cover 25MPa	60mm cover 25MPa

Sheltered

	Timber	Structural steel	Concrete	Masonry
Zone	B&C	C4,C5-M	B1	B1
Provision	Refer to 3604	HDG600 – 25yrs to first maintenance	40mm cover 25Mpa	60mm cover 25Mpa

### Geotechnical Parameters

A Geotechnical Investigation has not been provided at this time.  
The plans provided show a waffle slab foundation.

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**BASE CONSULTING  
ENGINEERS LIMITED**

Job Number: 23055

Page number: 3

Client: T Atkinson

By: P Bolton

Date: 31:05:2023

Project/Job: Atkinson Dwelling

Subject: Design Features Report

### Corrosion

#### External

	Timber	Structural steel	Concrete	Masonry
Zone	C	C3	B1	B1
Provision	Fixings refer To 3604	HDG-600 – 40 yrs to first maintenance	40mm cover 25MPa	60mm cover 25MPa

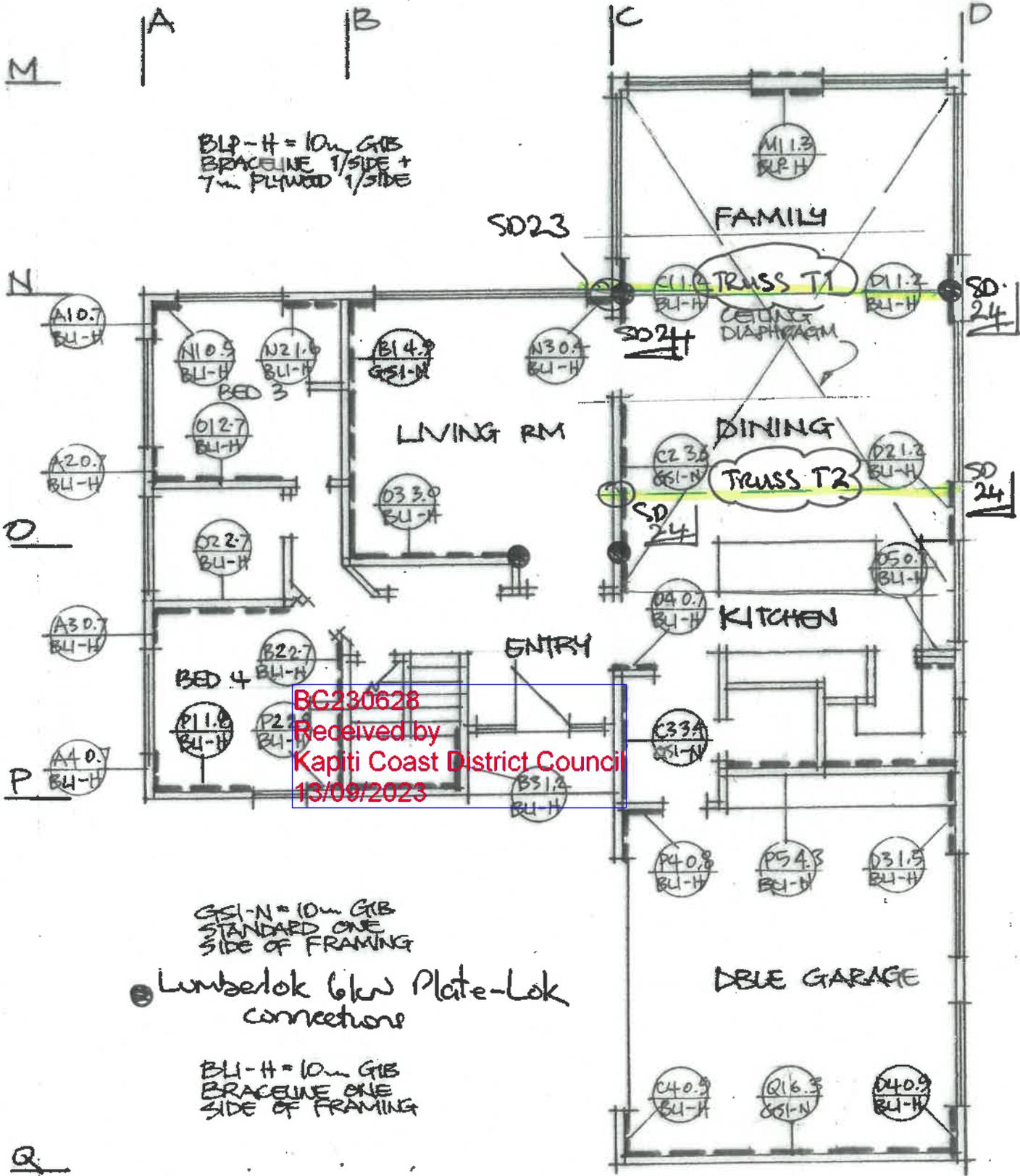
#### Sheltered

	Timber	Structural steel	Concrete	Masonry
Zone	B&C	C4,C5-M	B1	B1
Provision	Refer to 3604	HDG600 – 25yrs to first maintenance	40mm cover 25Mpa	60mm cover 25Mpa

### Geotechnical Parameters

No geotechnical report has been undertaken as the alterations are all internal.

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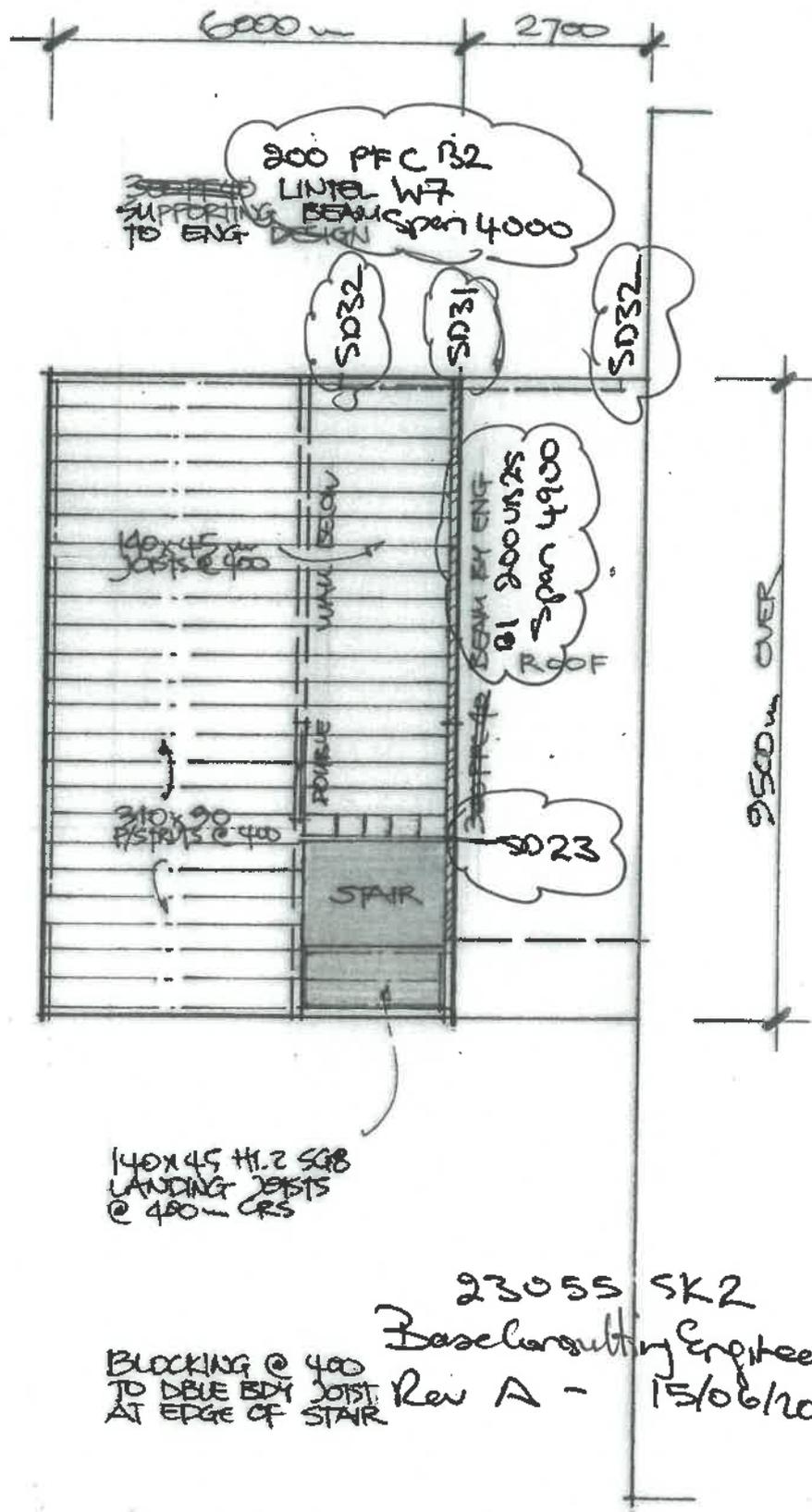


# LOWER LEVEL BRACING

23055-SK1

Base Consulting Engineers  
Rev A - 15/06/2023





20mm PLYWOOD FLOORING (H3.2 IN ALL WET AREAS)

310x90 FRYDASPAN FLOOR JOISTS @ 400 BY PREVAUER

STEEL BEAMS & CONNECTIONS TO ENGINEER DESIGN

100mm CONC SLAB SEG2 W/ST ON DPM, SAND & COMPACT H/FIL

300 Wx 305 D CONC PERIMETER WITH 3/H12 BARS

FIRTH RIBRAFT FLOOR SYSTEM TO FIRTH DETAILS

ENSURE FFL IS 225mm ABOVE GL OR 150mm ABOVE PAVING

140x45 H1.2 SGB LANDING JOISTS @ 400 CRS

BLOCKING @ 400 TO DEBE EBY JOIST AT EDGE OF STAIR

23055 SK2  
 Base Consulting Engineers  
 Rev A - 15/06/2023

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 13/09/2023

**UPPER FLOOR JOISTS**  
 SCALE 1:100

**LOT 43 ANDERSON PARK, WAIKANAЕ 6**



Job Anderson Dwellings.

By P Barton

Lot 43 Andersons Park, Waikanae

Date 31/05/23

PREMISE  
 As per DFR to provide the structural design  
 for roof truss, lintels, bracing.

Loadings:

Roof	c/s	dead	0.4 kPa
		live	0.25 kPa
Walls		dead	0.40 kPa

Wind  $V_s = V_z M_z M_h$ 

$$V_s = 51 \times 0.83 \times 1.0$$

$$= 42.3 \text{ m/s ULS}$$

$$= 35.7 \text{ m/s SLS}$$

$$V_z = 81 \text{ m/s ULS}$$

$$= 43 \text{ m/s SLS}$$

Design Wind Pressure

$$p = 0.5 \rho v_s^2 C_{pe}$$

$$= 1.08 C_{pe} \text{ kPa ULS}$$

$$= 0.76 C_{pe} \text{ kPa SLS}$$

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Seismic

$$V = C_d W_T$$

$$C_d = C_d Z R_N$$

$$= 3.0 \times 1.0 \times 0.4$$

$$= 1.2 \text{ ULS}$$

$$= 0.3 \text{ SLS}$$

$$L_T = 4 + 4 \frac{D}{V_0}$$

$$= 0.4 \text{ kPa}$$

$$R = 1.0 \text{ ULS}$$

$$= 0.25 \text{ SLS}$$

$$C_d = \frac{C_T S_p}{R}$$

$$= \frac{1.2 \times 0.9}{2.14}$$

$$= 0.50 \text{ ULS}$$

$$= \frac{0.3 \times 1.0}{2.14}$$

$$= 0.14 \text{ SLS}$$

$$R = \frac{(1.25 - 1) T_1 + 1}{0.7}$$

$$= \frac{(1.25 - 1) \times 0.4 + 1}{0.7}$$

$$= 1.14 \text{ Steel}$$

$$\text{timber} = \frac{3.0 - 1.0 (0.4) + 1}{0.7}$$

$$= 2.14$$



Job \_\_\_\_\_

By \_\_\_\_\_

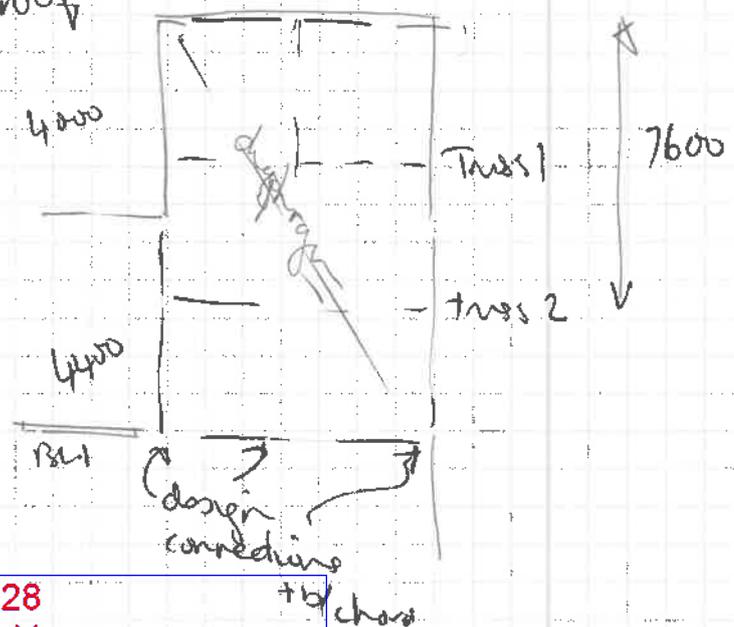
Date \_\_\_\_\_

Layout

$b = 7.6 \times \frac{1}{2} = 3.8m$

$\alpha = 30^\circ$  roof

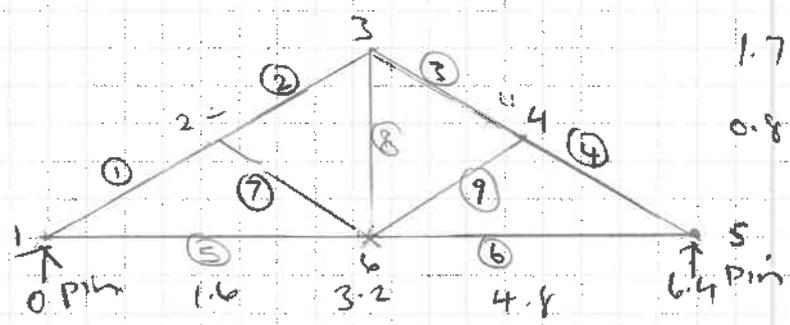
6500 o/a



Truss  
top chord  
bottom chord  
struts

190  
190  
140

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Loading.

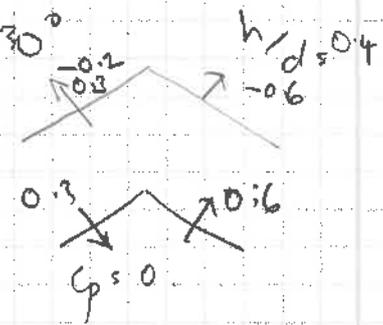
Dead  
 $w_d = w_u = 0.4 \times 3.8 \times 1.15 + 0.3 = 2.05 \text{ kN/m}$

Live  
 $w_l = w_u = 0.25 \times 3.8 \times 1.15 = 1.09 \text{ kN/m}$

wind (ULS)

$w_1 = w_2 = 1.08 \times 0.3 \times 3.8 = 1.2 \text{ kN/m}$

$w_3 = w_4 = 1.08 \times 0.6 \times 3.8 = 2.5 \text{ kN/m}$





Job \_\_\_\_\_

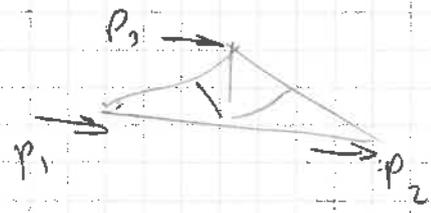
By \_\_\_\_\_

Date \_\_\_\_\_

Seismic

$$\Sigma P = 0.5 \times 3.8 \times 6.5 \times 1.15$$

$$= 1.85 \text{ kN}$$



$$P_1 = P_2 = 1.85 / 4 = 0.6 \text{ kN}$$

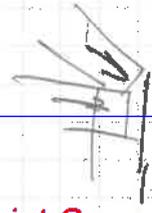
$$P_3 @ \text{ apex} = 1.0 \text{ kN} \text{ ignore}$$

From printout - AS - Axial loads  
 $1.24 + 1.50$

$$P_1 \text{ node} = 24.9 \text{ kN} \text{ ok}$$

For axial shear

$$P_v = 3.1 \text{ kN} \text{ for 2 M12}$$



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$1.24 + W_u$

$$P_n = 12.9 \text{ kN}$$

$$\Phi Q_n = n k_1 k_2 \Phi s_k$$

$$= 2.0 \times 0.85 \times 1.0 \times 10.4$$

$$= 17.7 \text{ kN} > P_n \text{ ok}$$

Use M12 bolts

6m str.

190x90 chords

For kingpost

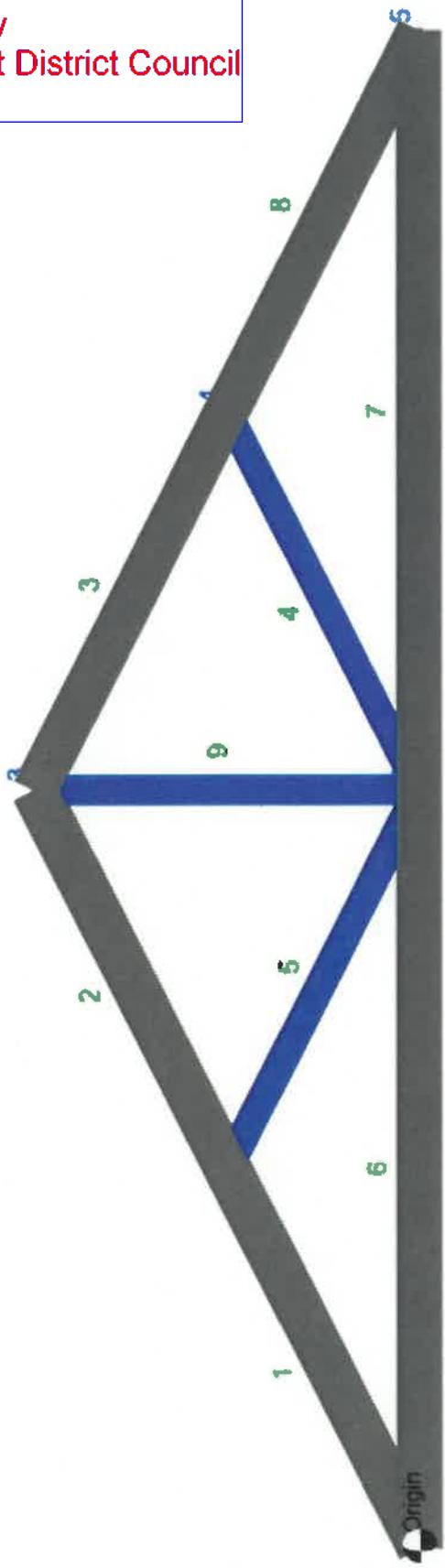
$$R^* = 4.4 \text{ kN} / 6.8 \text{ kN } 1.24 + 1.50$$

ignore, ok for 2-M12

23056-A4

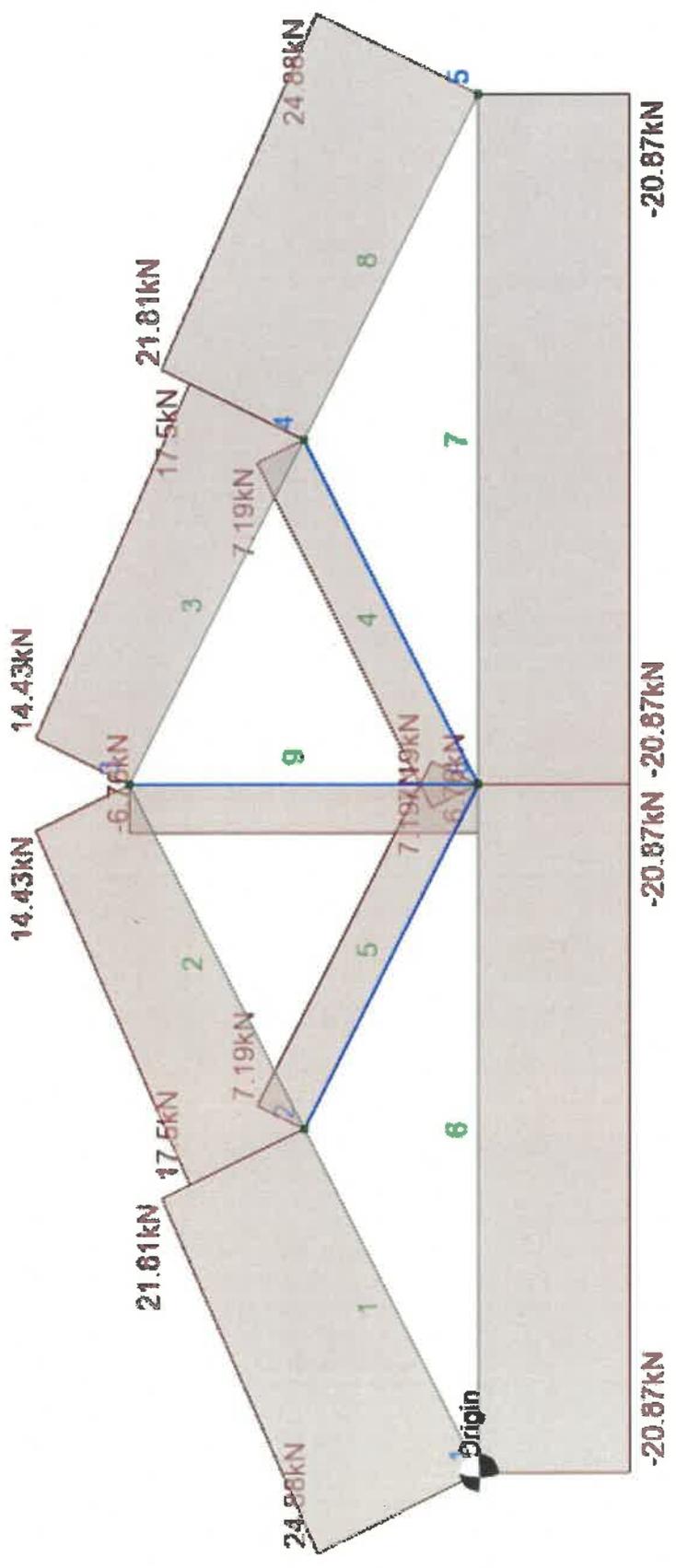
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Layout  
2-190X45 top and bottom chords 2-140X45 struts



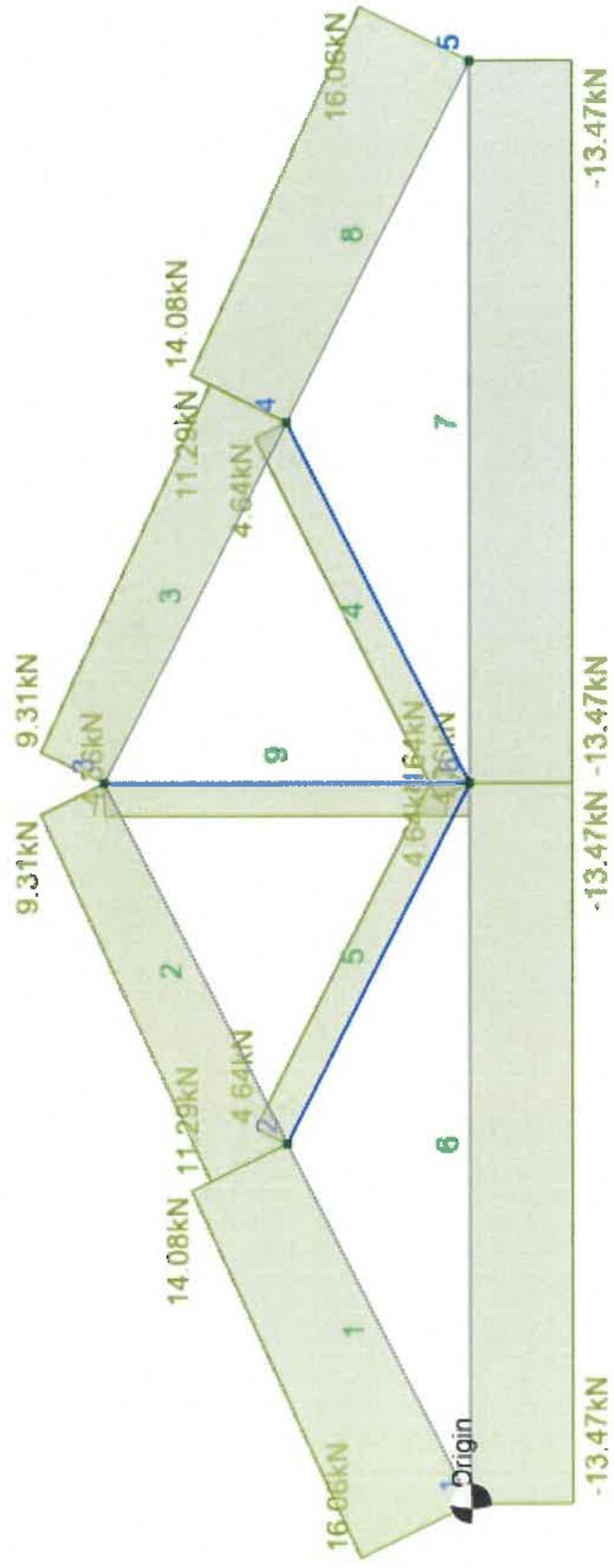
A5

1.2G + 1.5Q axial loads



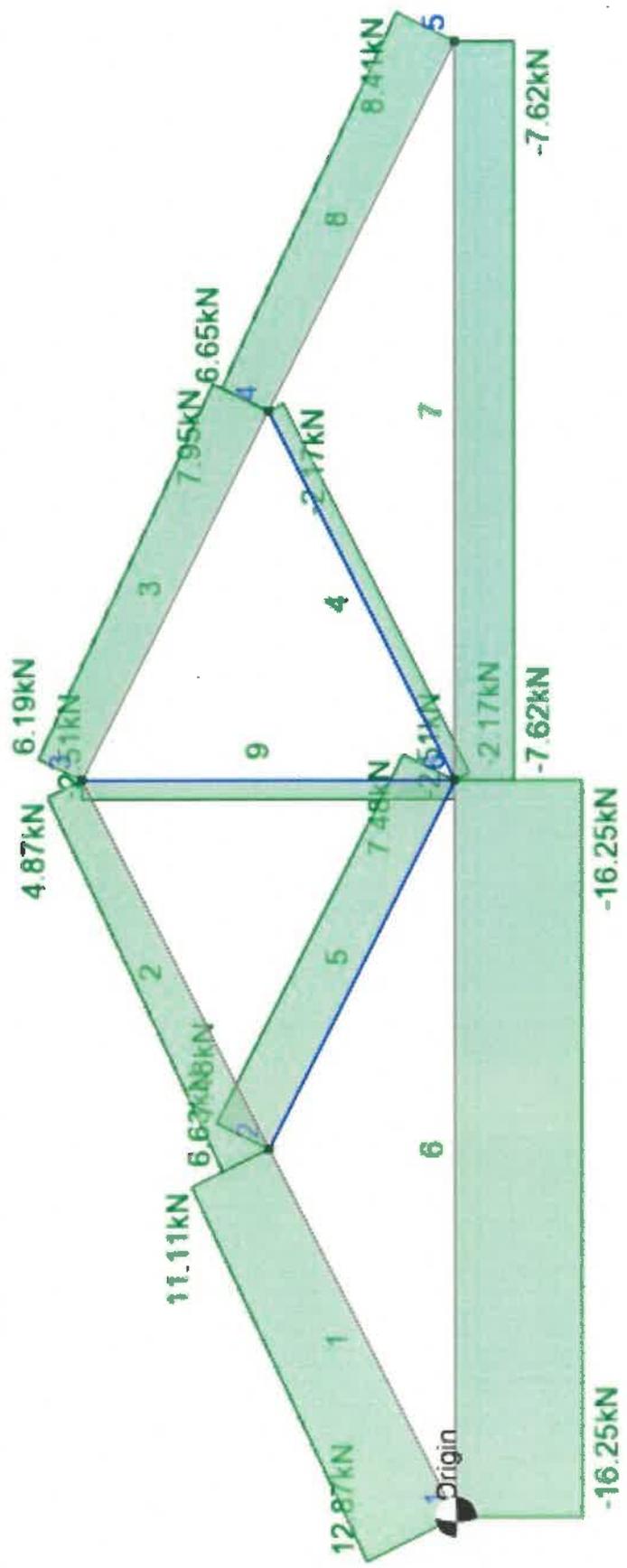
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1.35G max axial



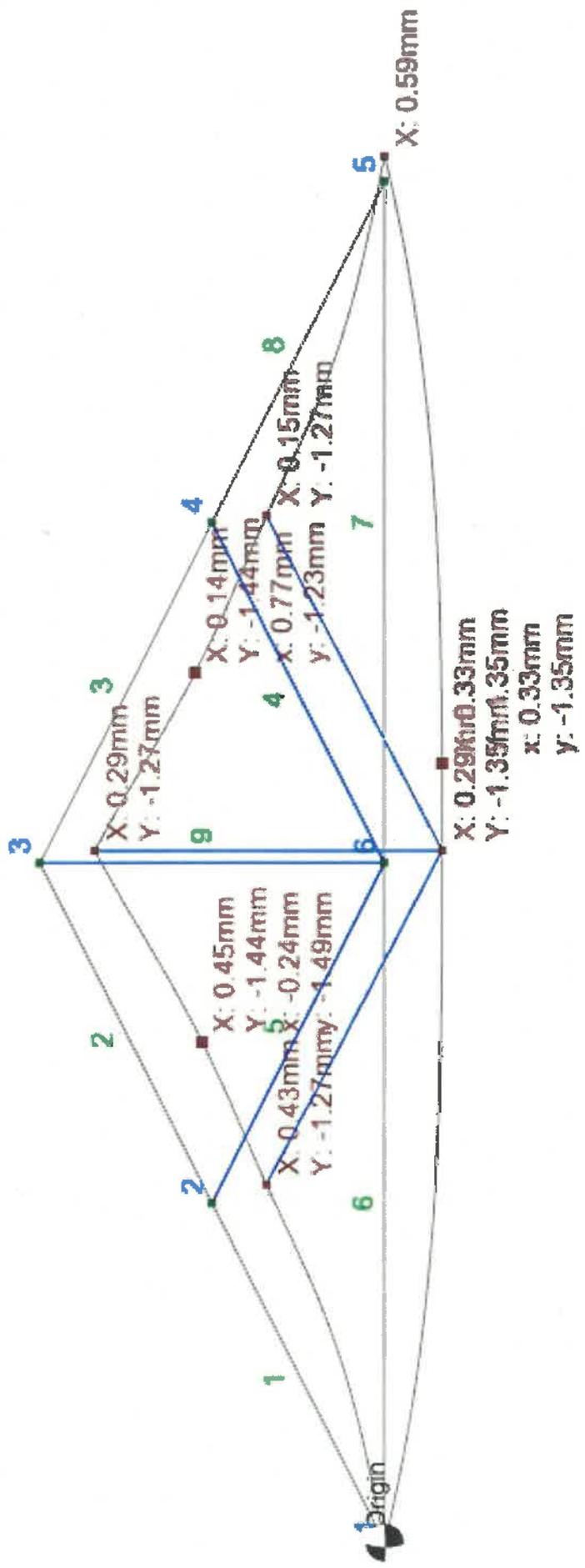
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1.2G+Wu max axial



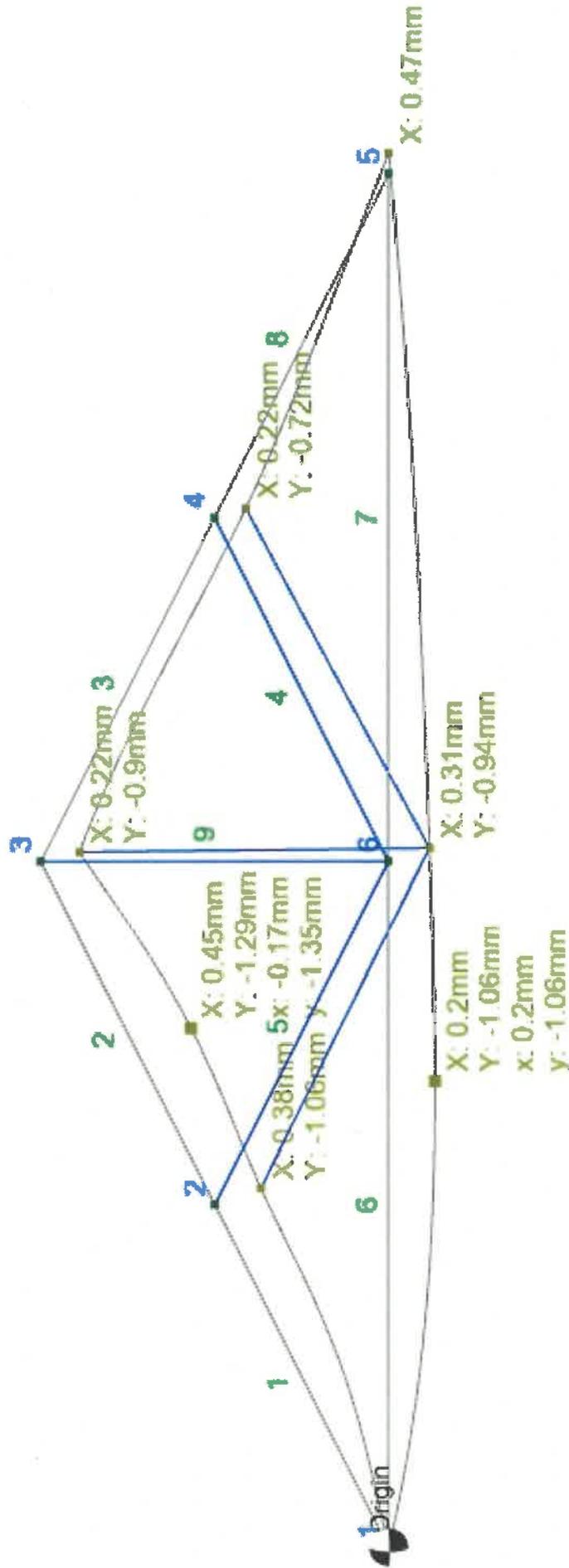
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G+0.4Q max deflection



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G+W's deflection



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NODE COORDINATES (m)

Node	X	Y	Z
1	0.000	0.000	0.000
2	1.600	0.800	0.000
3	3.200	1.600	0.000
4	4.800	0.800	0.000
5	6.400	0.000	0.000
6	8.000	0.000	0.000

MEMBER DATA (deg, kNm/rad, m)

----- (F=Fixed, R=Released) (\*=Cable length)

Membr	Dir Angle	Dir Node	Dir Axis	Membr Type	Node A	Node B	Sect	Mat	Node A Fixity	Node B Fixity	Length
1	0.00			Norm	1	2	1	1	FFFFFF	FFFFFF	1.789
2	0.00			Norm	2	3	1	1	FFFFFF	FFFFFF	1.789
3	0.00			Norm	3	4	1	1	FFFFFF	FFFFFF	1.789
4	0.00			Norm	4	6	2	1	FFFFFR	FFFFFR	1.789
5	0.00			Norm	6	2	2	1	FFFFFR	FFFFFR	1.789
6	0.00			Norm	1	6	1	1	FFFFFF	FFFFFF	3.200
7	0.00			Norm	6	5	1	1	FFFFFF	FFFFFF	3.200
8	0.00			Norm	5	4	1	1	FFFFFF	FFFFFF	1.789
9	0.00			Norm	3	6	2	1	FFFFFR	FFFFFR	1.600

NODE RESTRAINTS (kN/m, kNm/rad)

----- (F=Fixed, R=Released, S=Spring, \*=General)

Node	Rest Code	X Axial Stiffness	Y Axial Stiffness	Z Axial Stiffness	X Rotation Stiffness	Y Rotation Stiffness	Z Rotation Stiffness
1	FFFFFR						
5	RFFFFR						

SECTION PROPERTIES (mm, mm<sup>2</sup>, mm<sup>4</sup>, deg)

----- (\*=Factored properties)

Sect	Name	Mark	Shape	Source
1	2/190x45	S1	Solid rect	AustTimb
2	2/120x45	S2	Solid rect	AustTimb

Sect	Area of Section	Torsion Constant	Y-Axis Mom of In	Z-Axis Mom of In	Y-Axis Shr Area	Z-Axis Shr Area	Princ Angle
1	1.7100E+04	3.2400E+07	1.1500E+07	5.1400E+07	Infinite	Infinite	0.00
2	1.0800E+04	1.5700E+07	7.2500E+06	1.3000E+07	Infinite	Infinite	0.00

Sect	Shape	Trans	Mir	Rotate	D	Bt/Bb	Stw/Ebw	Tt/Tb	Tv/Rr
1	Solid rect	No	No	0.00	190.00	90.00	0.00	0.00	0.00
						0.00	0.00	0.00	0.00
2	Solid rect	No	No	0.00	120.00	90.00	0.00	0.00	0.00
						0.00	0.00	0.00	0.00

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MATERIAL PROPERTIES (MPa, T/m<sup>3</sup>, strain/degC)

Matl	Material Name	Young's Modulus	Poisson's Ratio	Mass Density	Coeff of Expansion	Concrete Strength
1	F7 Mix Pinus U	7.9000E+03	0.37	8.6000E-01	0.000E+00	

MEMBER DISTRIBUTED FORCES (m, kN/m)

Load Case	Membr	Sub Load	Axis Sys	Start Position	Finish Position	X Start/Finish	Y Start/Finish	Z Start/Finish	Load Cat
1	1	1	GP	0.000%	100.000%	0.000 0.000	-2.050 -2.050	0.000 0.000	0
	2	1	GP	0.000%	100.000%	0.000 0.000	-2.050 -2.050	0.000 0.000	0
	3	1	GP	0.000%	100.000%	0.000 0.000	-2.050 -2.050	0.000 0.000	0
	8	1	GP	0.000%	100.000%	0.000 0.000	-2.050 -2.050	0.000 0.000	0
2	1	1	GI	0.000%	100.000%	0.000 0.000	-1.050 -1.050	0.000 0.000	0
	2	1	GI	0.000%	100.000%	0.000 0.000	-1.050 -1.050	0.000 0.000	0
	3	1	GI	0.000%	100.000%	0.000 0.000	-1.050 -1.050	0.000 0.000	0
	8	1	GI	0.000%	100.000%	0.000 0.000	-1.050 -1.050	0.000 0.000	0
3	1	1	L	0.000%	100.000%	0.000 0.000	-1.200 -1.200	0.000 0.000	0
	2	1	L	0.000%	100.000%	0.000 0.000	-1.200 -1.200	0.000 0.000	0
	3	1	L	0.000%	100.000%	0.000 0.000	2.500 2.500	0.000 0.000	0
	8	1	L	0.000%	100.000%	0.000 0.000	2.500 2.500	0.000 0.000	0

COMBINATION LOAD CASES

Load case 21: G+ws

Load case 10: 1.2g+1.5q

1.000 \* Load case 1: G  
0.700 \* Load case 3: Wu

1.200 \* Load case 1: G  
1.500 \* Load case 2: Q

LOAD CASE TITLES

Load case 11: 1.35g

1.350 \* Load case 1: G

Load Case Title

Load case 12: 1.2g+Wu

1.200 \* Load case 1: G  
1.000 \* Load case 3: Wu

1 G  
2 Q  
3 Wu  
10 1.2g+1.5q  
11 1.35g

Load case 13: 0.9G+Wu

0.900 \* Load case 1: G  
1.000 \* Load case 3: Wu

12 1.2g+Wu  
13 0.9G+Wu  
20 G+0.4Q  
21 G+ws

Load case 20: G+0.4Q

1.000 \* Load case 1: G  
0.400 \* Load case 2: Q

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NODE DISPLACEMENTS (mm,rad)

Load case 1 (Linear): G  
 Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.348	-1.027	0.000	0.000	0.000	0.000
3	0.236	-1.029	0.000	0.000	0.000	0.000
4	0.124	-1.027	0.000	0.000	0.000	0.000
5	0.473	0.000	0.000	0.000	0.000	0.001
6	0.236	-1.090	0.000	0.000	0.000	0.000

Load case 2 (Linear): Q  
 Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.207	-0.611	0.000	0.000	0.000	0.000
3	0.141	-0.612	0.000	0.000	0.000	0.000
4	0.074	-0.611	0.000	0.000	0.000	0.000
5	0.281	0.000	0.000	0.000	0.000	0.001
6	0.141	-0.648	0.000	0.000	0.000	0.000

Load case 3 (Linear): Wu  
 Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.046	-0.051	0.000	0.000	0.000	0.000
3	-0.024	0.191	0.000	0.000	0.000	0.001
4	0.134	0.446	0.000	0.000	0.000	0.000
5	-0.002	0.000	0.000	0.000	0.000	-0.001
6	0.101	0.217	0.000	0.000	0.000	0.000

Load case 10 (Linear): 1.2g+1.5g  
 Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.002
2	0.725	-2.148	0.000	0.000	0.000	0.000
3	0.494	-2.153	0.000	0.000	0.000	0.000
4	0.260	-2.148	0.000	0.000	0.000	0.000
5	0.985	0.000	0.000	0.000	0.000	0.002
6	0.494	-2.280	0.000	0.000	0.000	0.000

Load case 11 (Linear): 1.35g  
 Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.470	-1.387	0.000	0.000	0.000	0.000
3	0.315	-1.389	0.000	0.000	0.000	0.000
4	0.168	-1.387	0.000	0.000	0.000	0.000

5	0.638	0.000	0.000	0.000	0.000	0.001
6	0.319	-1.471	0.000	0.000	0.000	0.000

Load case 12 (Linear): 1.2g+Wu  
Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.464	-1.283	0.000	0.000	0.000	0.000
3	0.259	-1.044	0.000	0.000	0.000	0.001
4	0.283	-0.787	0.000	0.000	0.000	0.000
5	0.565	0.000	0.000	0.000	0.000	0.000
6	0.385	-1.091	0.000	0.000	0.000	0.000

Load case 13 (Linear): 0.5G+Wu  
Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.360	-0.975	0.000	0.000	0.000	0.000
3	0.188	-0.735	0.000	0.000	0.000	0.001
4	0.246	-0.479	0.000	0.000	0.000	0.000
5	0.423	0.000	0.000	0.000	0.000	0.000
6	0.314	-0.764	0.000	0.000	0.000	0.000

Load case 20 (Linear): G+0.4Q  
Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.431	-1.271	0.000	0.000	0.000	0.000
3	0.293	-1.274	0.000	0.000	0.000	0.000
4	0.154	-1.271	0.000	0.000	0.000	0.000
5	0.585	0.000	0.000	0.000	0.000	0.001
6	0.293	-1.349	0.000	0.000	0.000	0.000

Load case 21 (Linear): G+ws  
Paradise solver

Node	X-Axis Transl'n	Y-Axis Transl'n	Z-Axis Transl'n	X-Axis Rotation	Y-Axis Rotation	Z-Axis Rotation
1	0.000	0.000	0.000	0.000	0.000	-0.001
2	0.381	-1.063	0.000	0.000	0.000	0.000
3	0.219	-0.896	0.000	0.000	0.000	0.001
4	0.218	-0.715	0.000	0.000	0.000	0.000
5	0.471	0.000	0.000	0.000	0.000	0.000
6	0.307	-0.938	0.000	0.000	0.000	0.000

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## MEMBER FORCES AND MOMENTS (kN, kNm)

Load case 1 (Linear): G  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	11.895	1.475	0.000	0.000	0.000	-0.255
	2	10.428	-1.458	0.000	0.000	0.000	-0.240
2	2	8.366	1.291	0.000	0.000	0.000	-0.240
	3	6.899	-1.643	0.000	0.000	0.000	-0.554
3	3	6.899	1.643	0.000	0.000	0.000	-0.554
	4	8.366	-1.291	0.000	0.000	0.000	-0.240
4	4	3.437	0.000	0.000	0.000	0.000	0.000
	6	3.437	0.000	0.000	0.000	0.000	0.000
5	6	3.437	0.000	0.000	0.000	0.000	0.000
	2	3.437	0.000	0.000	0.000	0.000	0.000
6	1	-9.979	-0.079	0.000	0.000	0.000	0.255
	6	-9.979	-0.079	0.000	0.000	0.000	0.002
7	6	-9.979	0.079	0.000	0.000	0.000	0.002
	5	-9.979	0.079	0.000	0.000	0.000	0.255
8	5	11.895	1.475	0.000	0.000	0.000	-0.255
	4	10.428	-1.458	0.000	0.000	0.000	-0.240
9	3	-3.232	0.000	0.000	0.000	0.000	0.000
	6	-3.232	0.000	0.000	0.000	0.000	0.000

Load case 2 (Linear): Q  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	7.071	0.877	0.000	0.000	0.000	-0.152
	2	6.199	-0.867	0.000	0.000	0.000	-0.143
2	2	4.973	0.768	0.000	0.000	0.000	-0.143
	3	4.101	-0.976	0.000	0.000	0.000	-0.330
3	3	4.101	0.976	0.000	0.000	0.000	-0.330
	4	4.973	-0.768	0.000	0.000	0.000	-0.143
4	4	2.043	0.000	0.000	0.000	0.000	0.000
	6	2.043	0.000	0.000	0.000	0.000	0.000
5	6	2.043	0.000	0.000	0.000	0.000	0.000
	2	2.043	0.000	0.000	0.000	0.000	0.000
6	1	-5.932	-0.047	0.000	0.000	0.000	0.152
	6	-5.932	-0.047	0.000	0.000	0.000	0.001
7	6	-5.932	0.047	0.000	0.000	0.000	0.001
	5	-5.932	0.047	0.000	0.000	0.000	0.152
8	5	7.071	0.877	0.000	0.000	0.000	-0.152
	4	6.199	-0.867	0.000	0.000	0.000	-0.143

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9	3	-1.921	0.000	0.000	0.000	0.000	0.000
	6	-1.921	0.000	0.000	0.000	0.000	0.000

Load case 3 (Linear): Wu  
Paradise solver

Memb	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	-1.395	0.891	0.000	0.000	0.000	-0.114
	2	-1.395	-1.256	0.000	0.000	0.000	-0.441
2	2	-3.413	1.429	0.000	0.000	0.000	-0.441
	3	-3.413	-0.719	0.000	0.000	0.000	0.196
3	3	-2.088	-1.933	0.000	0.000	0.000	0.196
	4	-2.088	2.535	0.000	0.000	0.000	0.737
4	4	-6.250	0.000	0.000	0.000	0.000	0.000
	6	-6.250	0.000	0.000	0.000	0.000	0.000
5	6	3.356	0.000	0.000	0.000	0.000	0.000
	2	3.356	0.000	0.000	0.000	0.000	0.000
6	1	-4.270	-0.031	0.000	0.000	0.000	0.114
	6	-4.270	-0.031	0.000	0.000	0.000	0.015
7	6	4.358	-0.091	0.000	0.000	0.000	0.015
	5	4.358	-0.091	0.000	0.000	0.000	-0.277
8	5	-5.862	-1.979	0.000	0.000	0.000	0.277
	4	-5.862	2.493	0.000	0.000	0.000	0.737
9	3	1.373	0.000	0.000	0.000	0.000	0.000
	6	1.373	0.000	0.000	0.000	0.000	0.000

Load case 10 (Linear): 1.2g+1.5q  
Paradise solver

Memb	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	24.880	3.086	0.000	0.000	0.000	-0.533
	2	21.812	-3.051	0.000	0.000	0.000	-0.502
2	2	17.499	2.701	0.000	0.000	0.000	-0.502
	3	14.430	-3.436	0.000	0.000	0.000	-1.160
3	3	14.430	3.436	0.000	0.000	0.000	-1.160
	4	17.499	-2.701	0.000	0.000	0.000	-0.502
4	4	7.189	0.000	0.000	0.000	0.000	0.000
	6	7.189	0.000	0.000	0.000	0.000	0.000
5	6	7.189	0.000	0.000	0.000	0.000	0.000
	2	7.189	0.000	0.000	0.000	0.000	0.000
6	1	-20.874	-0.165	0.000	0.000	0.000	0.533
	6	-20.874	-0.165	0.000	0.000	0.000	0.004
7	6	-20.874	0.165	0.000	0.000	0.000	0.004
	5	-20.874	0.165	0.000	0.000	0.000	0.533
8	5	24.880	3.086	0.000	0.000	0.000	-0.533
	4	21.812	-3.051	0.000	0.000	0.000	-0.502

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9	3	-6.761	0.000	0.000	0.000	0.000	0.000
	6	-6.761	0.000	0.000	0.000	0.000	0.000

Load case 11 (Linear): 1.35g  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	16.058	1.992	0.000	0.000	0.000	-0.344
	2	14.078	-1.969	0.000	0.000	0.000	-0.324
2	2	11.294	1.743	0.000	0.000	0.000	-0.324
	3	9.313	-2.218	0.000	0.000	0.000	-0.748
3	3	9.313	2.218	0.000	0.000	0.000	-0.748
	4	11.294	-1.743	0.000	0.000	0.000	-0.324
4	4	4.640	0.000	0.000	0.000	0.000	0.000
	6	4.640	0.000	0.000	0.000	0.000	0.000
5	6	4.640	0.000	0.000	0.000	0.000	0.000
	2	4.640	0.000	0.000	0.000	0.000	0.000
6	1	-13.472	-0.107	0.000	0.000	0.000	0.344
	6	-13.472	-0.107	0.000	0.000	0.000	0.003
7	6	-13.472	0.107	0.000	0.000	0.000	0.003
	5	-13.472	0.107	0.000	0.000	0.000	0.344
8	5	16.058	1.992	0.000	0.000	0.000	-0.344
	4	14.078	-1.969	0.000	0.000	0.000	-0.324
9	3	-4.363	0.000	0.000	0.000	0.000	0.000
	6	-4.363	0.000	0.000	0.000	0.000	0.000

Load case 12 (Linear): 1.2g+Wu  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	12.875	2.661	0.000	0.000	0.000	-0.420
	2	11.114	-3.006	0.000	0.000	0.000	-0.729
2	2	6.626	2.978	0.000	0.000	0.000	-0.729
	3	4.866	-2.689	0.000	0.000	0.000	-0.470
3	3	6.191	0.038	0.000	0.000	0.000	-0.470
	4	7.951	0.990	0.000	0.000	0.000	0.449
4	4	-2.166	0.000	0.000	0.000	0.000	0.000
	6	-2.166	0.000	0.000	0.000	0.000	0.000
5	6	7.481	0.000	0.000	0.000	0.000	0.000
	2	7.481	0.000	0.000	0.000	0.000	0.000
6	1	-16.245	-0.126	0.000	0.000	0.000	0.420
	6	-16.245	-0.126	0.000	0.000	0.000	0.018
7	6	-7.617	0.003	0.000	0.000	0.000	0.018
	5	-7.617	0.003	0.000	0.000	0.000	0.029
8	5	8.412	-0.209	0.000	0.000	0.000	-0.029
	4	6.652	0.743	0.000	0.000	0.000	0.449

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9	3	-2.506	0.000	0.000	0.000	0.000	0.000
	6	-2.506	0.000	0.000	0.000	0.000	0.000

Load case 18 (Linear): 0.9G+Wu  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	9.306	2.218	0.000	0.000	0.000	-0.343
	2	7.986	-2.669	0.000	0.000	0.000	-0.657
2	2	4.116	2.551	0.000	0.000	0.000	-0.657
	3	2.796	-2.196	0.000	0.000	0.000	-0.303
3	3	4.121	-0.455	0.000	0.000	0.000	-0.303
	4	5.442	1.377	0.000	0.000	0.000	0.521
4	4	-3.197	0.000	0.000	0.000	0.000	0.000
	6	-3.197	0.000	0.000	0.000	0.000	0.000
5	6	6.450	0.000	0.000	0.000	0.000	0.000
	2	6.450	0.000	0.000	0.000	0.000	0.000
6	1	-13.252	-0.102	0.000	0.000	0.000	0.343
	6	-13.252	-0.102	0.000	0.000	0.000	0.017
7	6	-4.623	-0.020	0.000	0.000	0.000	0.017
	5	-4.623	-0.020	0.000	0.000	0.000	-0.048
8	5	4.844	-0.651	0.000	0.000	0.000	0.048
	4	3.523	1.181	0.000	0.000	0.000	0.521
9	3	-1.536	0.000	0.000	0.000	0.000	0.000
	6	-1.536	0.000	0.000	0.000	0.000	0.000

Load case 20 (Linear): G+0.4Q  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	14.723	1.826	0.000	0.000	0.000	-0.316
	2	12.908	-1.805	0.000	0.000	0.000	-0.297
2	2	10.355	1.598	0.000	0.000	0.000	-0.297
	3	8.539	-2.033	0.000	0.000	0.000	-0.686
3	3	8.539	2.033	0.000	0.000	0.000	-0.686
	4	10.355	-1.598	0.000	0.000	0.000	-0.297
4	4	4.254	0.000	0.000	0.000	0.000	0.000
	6	4.254	0.000	0.000	0.000	0.000	0.000
5	6	4.254	0.000	0.000	0.000	0.000	0.000
	2	4.254	0.000	0.000	0.000	0.000	0.000
6	1	-12.352	-0.098	0.000	0.000	0.000	0.316
	6	-12.352	-0.098	0.000	0.000	0.000	0.003
7	6	-12.352	0.098	0.000	0.000	0.000	0.003
	5	-12.352	0.098	0.000	0.000	0.000	0.316
8	5	14.723	1.826	0.000	0.000	0.000	-0.316
	4	12.908	-1.805	0.000	0.000	0.000	-0.297

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A18

9	3	-4.001	0.000	0.000	0.000	0.000	0.000
	6	-4.001	0.000	0.000	0.000	0.000	0.000

Load case 21 (Linear): G+ws  
Paradise solver

Membr	Node	Axial Force	Y-Axis Shear	Z-Axis Shear	X-Axis Torsion	Y-Axis Moment	Z-Axis Moment
1	1	10.915	2.099	0.000	0.000	0.000	-0.335
	2	9.449	-2.338	0.000	0.000	0.000	-0.548
2	2	5.977	2.291	0.000	0.000	0.000	-0.548
	3	4.510	-2.145	0.000	0.000	0.000	-0.417
3	3	5.438	0.289	0.000	0.000	0.000	-0.417
	4	6.904	0.486	0.000	0.000	0.000	0.276
4	4	-0.966	0.000	0.000	0.000	0.000	0.000
	6	-0.966	0.000	0.000	0.000	0.000	0.000
5	6	5.786	0.000	0.000	0.000	0.000	0.000
	2	5.786	0.000	0.000	0.000	0.000	0.000
6	1	-12.968	-0.101	0.000	0.000	0.000	0.335
	6	-12.968	-0.101	0.000	0.000	0.000	0.013
7	6	-6.529	0.015	0.000	0.000	0.000	0.013
	5	-6.529	0.015	0.000	0.000	0.000	0.061
8	5	7.792	0.090	0.000	0.000	0.000	-0.061
	4	6.325	0.287	0.000	0.000	0.000	0.276
9	3	-2.271	0.000	0.000	0.000	0.000	0.000
	6	-2.271	0.000	0.000	0.000	0.000	0.000

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Job \_\_\_\_\_

By \_\_\_\_\_

Date \_\_\_\_\_

CONSIDER AIRCRAFT

Wind loading will govern.

Onboard lift & r brace for single story  
 Wind = 1066  $\Rightarrow$  52 km/h  
 $\times 1.9$  734  $\Rightarrow$  36 km/h  
 9500

$0.94 + w$

$w^* = p/h_w$

$p = 1.08 \text{ kPa}$

$C_p = 0.7 + 0.5 = 1.2$

$p = 1.30 \text{ kPa}$

$w = 1.3 \times 2.15$

$\approx 2.8 \text{ km/h}$   
 @ top plate

For seismic (ULS)

$C_d = 0.50$   $w_{ef} = 0.4 \text{ kPa}$

Edge Force  $w_e^*$

$w_e^* = C_d w_{ef}$

$= 0.50 \times 0.4 \times 6.5 \times 1.15$  (0.75 km/h each side)  
 $= 1.5 \text{ km/h}$

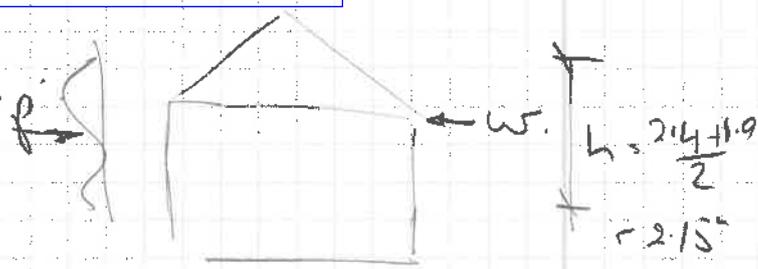
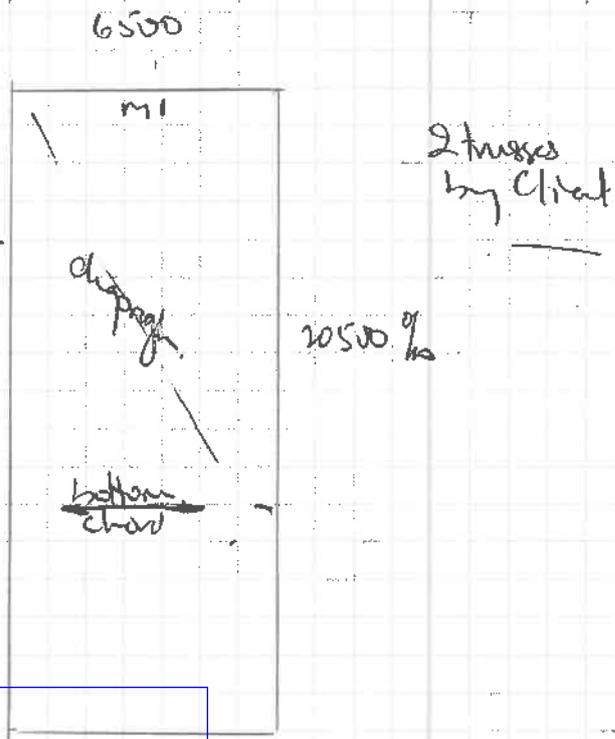
For 12.5 x 6.5 diaphragm for seismic only (ignore adjoining 2 story)

$P_e = w_e l/2$   
 $= 1.5 \times 12.5/2$

$= 9.4 \text{ kN}$

$= 9.4 \times 20 \times 2.55 \times 1.4$   
 $= 200 \text{ kN each end}$

7000  
 (ULS)  
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By \_\_\_\_\_

Date \_\_\_\_\_

Ceiling Diaphragm for seismic

$P_e \leq 200$  kN each end.

$$M1 = BLP \times 1.3 \times 150 = 195 \text{ kNm}$$

195 kNm  
accept.

$$P5 = BL1 \times 4.3 \times 105 = 452 \text{ kNm}$$

452 kNm  
accept.

12.5 x 6.5 diaphragm ok, ignores minor braces  $\rightarrow$  conservative.

13mm grib  
to crib  
Erybrane  
Ceiling  
Diaphragm  
Nails @  
100%

Consider bottom chord of truss to transfer loads

$$P_n = 1.5 \times 9.5 \frac{1}{2} = 7.1 \text{ kNm seismic}$$

$$P_w = 2.8 \times 9.5 \frac{1}{2} = 13.3 \text{ kNm wind}$$

wind governs

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For 190 x 90 S480  $P_n \leq 6500$

$$\phi N_c = k_1 k_2 k_3 P_n$$
$$= 1.0 \times 0.85 \times 0.08 \times 19.0 \times 11.1$$
$$= 20.9 \text{ kNm} > P_w \text{ ok}$$

$$S < k_1 o / d$$
$$= 1.0 \times 6500 / 90$$
$$= 72$$

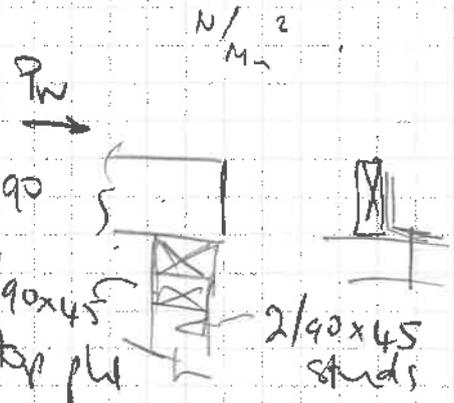
btm chord  
190 x 90 ok  
No restraint

For Truss/Top Plate Connection

$$k_2 = 0.08$$
$$P_c = 18.0 \text{ MPa}$$
$$A = 190 \times 90 = 17100 \text{ mm}^2$$

$$P_w = 13.3 \text{ kNm total}$$

$$P_T = 13.3 \frac{1}{2} = 6.6 \text{ kNm each side wall}$$



For 2/M16 bolts in beam & bp plate.  
Try B58.

$$\phi P_n = n k_1 k_2 k_3 P_n$$
$$= 2.0 \times 0.85 \times 0.7 \times 1.0 \times 9.29$$

$$= 11.0 \text{ kNm (for top plate)} > 6.6 \text{ ok}$$

$$B58, 181 \times 75$$
$$2/M12 = 2.0 \times 0.85 \times 0.7 \times 6.92$$
$$= 8.2 \text{ kNm ok}$$



Job \_\_\_\_\_

By \_\_\_\_\_

Date \_\_\_\_\_

For B58 in beam  
 $\phi \phi_n = 2 \times 0.85 \times 0.7 \times 10.4$   
 $\leq 12.4 \text{ kN OK}$

2/m12 b top plate  
 $M_{12} = 6.97 \text{ kN}$   
 $M_{12} = 10.4 \text{ T}$

Truss/Top Plate  
 B58 thru  
 2/90x45+p

CONSIDER LIVING ROOM BEAMS

1.24+1.5

Refer Sect EE

W = upper floor

span 4.0m

$$= 1.2(0.4) + 1.5(1.5) \left( 2 \frac{1}{2} + 1.2(0.4) \left( 2.8 + \frac{6.0}{2} + 2.7 \right) \right) \frac{1}{1.5}$$

39

$$= 6.7 \text{ kN}$$

For B1 Beam

B2-Lintel  
 span 4.0m

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Design Moment  $M^*$

$$M^* = wL^2/8$$

$$\leq 6.7 \times 4.9^2/8$$

$$= 20.3 \text{ kNm}$$

B1 beam  
 span 4.9m

For 200x25

Moment Capacity  $\phi M_b$

$$\phi M_b = \alpha_s \alpha_n M_s$$

$$= 0.86 \times 1.13 \times 75$$

$$\leq 30.5 \text{ kNm - accept!}$$

$$l_e = 1.07l$$

$$= 5.3$$

$$\alpha_s = 0.86$$

$$\alpha_n = 1.13$$

Check Deflect

$$2w_s = 4.4 \text{ kNm}$$

$$\delta = \frac{5wL^4}{384EI}$$

$$= \frac{5 \times 4.4 \times 4.9^4}{384 \times 200 \times 23.60}$$

$$\leq 7 \text{ mm - accept!}$$

$$\delta_L = 1.5 \times 1.05 = 1.6 \text{ kNm}$$

$$\leq 2 \text{ mm - any}$$

Beam B1  
 Living Room  
 200x25  
 4900



Job \_\_\_\_\_

By \_\_\_\_\_

Date \_\_\_\_\_

Beam Reaction

$$R_{b1} = wL \quad 1.2y + 1.5Q$$

$$= 6.7 \times 4.9 \frac{1}{2}$$

$$= 16.4 \text{ kN}$$

$$w_{b2} = 1.2(0.4)2.8 + 1.2(0.3)$$

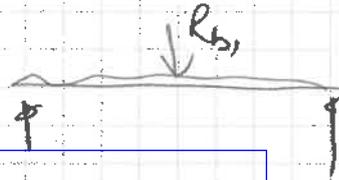
$$= 1.7 \text{ kN/m}$$

Design Moment  $M_2^d$  Beam B2 - span 4.0 m

$$M_2^d = R_{b1} \frac{L}{4} + w_{b2} \frac{L^2}{8}$$

$$= 16.4 \times 4.0 \frac{1}{4} + 1.7 \times 4.0^2 \frac{1}{8}$$

$$= 19.8 \text{ kNm}$$



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For 200 PFC

Moment Capacity  $\phi M_{PFC}$ 

$$\phi M_{PFC} = \alpha_s \alpha_m M'_s$$

$$= 0.435 \times 1.14 \times 60$$

$$= 30 \text{ kNm} - \text{accept}$$

$$L_s = 4.4 -$$

$$L_s = 0.435$$

Connection 2-M12 - OK

Point load on Ribraft - B1

$$R_{b1} = 16.4 \text{ kN (ULS)}$$

Beam B2  
Lintel WF  
span 4.0 m  
200 PFC



association of  
consulting  
engineers



## PRODUCER STATEMENT – PS1 DESIGN

**BUILDING CODE CLAUSE(S):** B1/VM1/VM4  
**ISSUED BY:** BASE CONSULTING ENGINEERS LTD.  
(Engineering Design Firm)  
**TO:** T. ATKINSON  
(Owner/Developer)

**JOB NUMBER:** 23055

**TO BE SUPPLIED TO:** KAPITI COAST DISTRICT COUNCIL  
(Building Consent Authority)  
**IN RESPECT OF:** ATKINSON DWELLING  
(Description of Building Work)  
**AT:** LOT 43 ANDERSON PARK, WAIKANAE  
(Address, Town/City)  
**LEGAL DESCRIPTION:**

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N/A

We have been engaged by the owner/developer referred to above to provide (Extent of Engagement):

The Structural Design for: Balustrade  
in respect of the requirements of the Clause(s) of the Building Code specified above for Part only , as specified in the  
Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- Compliance documents issued by the Ministry of Business, Innovation & Employment (Verification method/acceptable solution) AS/NZS: 1170; NZS: 3603: and/or;
- Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

On behalf of the Engineering Design Firm, and subject to:

- Site verification of the following design assumptions: N/A
- All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that:

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM 2  level of construction monitoring.

I, (Name of Engineering Design Professional) PETER BOLTON, am:

- CPEng number 56179  
and hold the following qualifications BE CIVIL

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than \$200,000

The Engineering Design Firm is not  a member of ACE New Zealand.

**SIGNED BY (Name of Engineering Design Professional):** PETER BOLTON  
(Signature below):

**ON BEHALF OF (Engineering Design Firm):** BASE CONSULTING ENGINEERS LTD.

Date: 11/10/2023

**Note:** This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, is limited to the sum of \$200,000.

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

## GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website

<https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/>

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

**PS1 DESIGN** Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

**PS2 DESIGN REVIEW** Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

**PS3 CONSTRUCTION** Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011<sup>2</sup>

**PS4 CONSTRUCTION REVIEW** Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

### Competence of Engineering Professional

This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

### Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

### Professional Services during Construction Phase

There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers<sup>3</sup>). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

### Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

### Refer Also:

- <sup>1</sup> Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
- <sup>2</sup> NZIA Standard Conditions of Contract SCC 2011
- <sup>3</sup> Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
- <sup>4</sup> PN01 Guidelines on Producer Statements

[www.acenz.org.nz](http://www.acenz.org.nz)

[www.engineeringnz.org](http://www.engineeringnz.org)

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### SCHEDULE to PS1

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below:

23055-Design & Drawing

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Form 2A

**Memorandum from licensed building practitioner: Certificate of design work****Section 45 and Section 30C, Building Act 2004**

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Please fill in the form as fully and correctly as possible.

If there is insufficient room on the form for requested details, please continue on another sheet and attach the additional sheet(s) to this form.

**THE BUILDING**

Street address: LOT 43 ANDERSON PARK

Town/City: WAIKANAЕ

Postcode:

**THE OWNER**

Name: T. ATKINSON

Mailing address:

Suburb:

PO Box/Private Bag:

Town/City:

Postcode:

Phone number:

Email address:

**BASIS FOR PROVIDING THIS MEMORANDUM**

I am providing this memorandum in my role as the: Please tick the option that applies (✓)

<input type="checkbox"/>	<b>sole</b> designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design myself – no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	<b>lead</b> designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	<b>lead</b> designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the other designers will provide their own memoranda relating to their specific RBW design
<input checked="" type="checkbox"/>	<b>specialist</b> designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

**IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)**

I, Peter Bolton, carried out the following design work that is restricted building work

**PRIMARY STRUCTURE: B1**

Design work that is restricted building work	Description	Carried out/ supervised	Reference to plans and specifications
Tick (✓) if included Cross (X) if	[If appropriate, provide details of the restricted building work]	[Specify whether you carried out this design work or supervised]	[If appropriate, specify references]

<i>excluded</i>		<i>someone else carrying out this design work</i>	
<b>Primary structure</b>			
All RBW Design work relating to B1	( )		( ) Carried out ( ) Supervised
Foundations and subfloor framing	( )		( ) Carried out ( ) Supervised
Walls	( )		( ) Carried out ( ) Supervised
Roof	( )		( ) Carried out ( ) Supervised
Columns and beams	( )		( ) Carried out ( ) Supervised
Bracing	( )		( ) Carried out ( ) Supervised
Other	(√)	Balustrade	(√) Carried out ( ) Supervised
			23055

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#### EXTERNAL MOISTURE MANAGEMENT SYSTEMS: E2

All RBW design work relating to E2	( )		( ) Carried out ( ) Supervised
Damp proofing	( )		(√) Carried out ( ) Supervised
Roof cladding or roof cladding system	( )		( ) Carried out ( ) Supervised
Ventilation system (for example, subfloor or cavity)	( )		( ) Carried out ( ) Supervised
Wall cladding or wall cladding system	( )		( ) Carried out ( ) Supervised
Waterproofing	( )		( ) Carried out ( ) Supervised
Other	( )		( ) Carried out ( ) Supervised

#### FIRE SAFETY SYSTEMS: C1 – C6

Emergency warning systems, evacuation and fire	( )		( ) Carried out ( ) Supervised
--	-----	--	-----------------------------------

service operation systems, suppression or control systems, or other			
---	--	--	--

**Note:** The design of fire safety systems is only restricted building work when it involves small-to-medium apartment buildings as defined by the Building (Definition of Restricted Building Work) Order 2011.

**Note:** continue on another page if necessary.

### WAIVERS AND MODIFICATIONS

Waivers or modifications of the building code are required ( ) Yes (√) No

If Yes, provide details of the waivers or modifications below:

Clause	Waiver/modification required
<i>[List relevant clause numbers of building code]</i>	<i>[Specify nature of waiver or modification of building code]</i>

**Note:** continue on another page if necessary.

### ISSUED BY

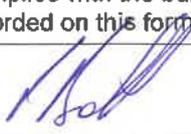
Name: Peter Bolton	LBP or Registration number: 56179
The practitioner is a: ( ) Design LBP ( ) Registered architect (√) Chartered Professional Engineer	
Design Entity or Company (optional): Base Consulting Engineers Ltd	
Mailing address (if different from below):	
Street address / Registered office: 279 Oxford Street	
Suburb:	Town/City: Levin
PO Box/Private Bag:	Postcode:
Phone number:	Mobile:0274 444 080
After Hours:	Fax:
Email address: peter@basecon.co.nz	Website:

### DECLARATION

I Peter Bolton *[name of practitioner]*, CPEng,

state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:

- Complies with the building code; or
- Complies with the building code subject to any waiver or modification of the building code recorded on this form.

Signature: 

Date: 11 October 2023

BC230628  
Further Information Received  
12/10/23

To the Kapiti Coast District Council: 11 October 2023

To whom it may concern,

B2 compliance in respect of: Atkinson Dwelling

At: Lot 43 Anderson Park, Waikanae

BC230628  
Further Information Received  
12/10/23

You have requested a Producer Statement/other means of compliance for Construction Review for Clause B2 of the Building Code – Durability.

The purpose of this letter is to confirm that direct construction monitoring by Base Consulting Engineers Ltd in relation to Clause B2 (Durability) of the Building Code for the above project, has been limited in that material protection or treatment is typically carried out by specialist suppliers and requires specific quality assurance by the suppliers. However, we can confirm the specifically designed structural elements that were included in the design documentation prepared by Base Consulting Engineers Ltd. comply with the applicable verification methods:

Material	Means of Compliance	Details
Reinforced concrete	B1/VM1	Compliance with cover and concrete quality requirements for B1/VM1 are in accordance with NZS3101:2006
Structural timber	B1/VM1	The timber has been specified in accordance with NZS3640:2004. The quality of timber treatment is dependent on the QA systems of manufacturers, suppliers and the onsite contractors and sub-contractors. Refer to the contractor's PS3 and QA records where available.
Mild steel structure	B1/VM1	Protective coatings have been specified in accordance with AS/NZS 2312:2014 and SNZ TS 3404:2018. The quality of mild steel protective coatings is dependent on: <ul style="list-style-type: none"> <li>▪ Steel preparation</li> <li>▪ Quality and production consistency of the coating products</li> <li>▪ QA of the application and curing</li> <li>▪ QA of the handling, protection and repair</li> </ul> Refer to: <ul style="list-style-type: none"> <li>▪ Contractor's and sub-contractor's PS3s and QA records where available</li> <li>▪ Third-party inspection and test results</li> </ul>

Yours sincerely,

**Peter Bolton CMEngNZ CPEng # 56179**

For and on behalf of

**Base Consulting Engineers Ltd**



Job ATKINSONS BRUSTRAD  
Lot 43 Anderson Park Waukara

By P BOSTON

Date 11/10/23

To provide the structural design for balustrade for stairs as per sheet 15, on floor

BC230628  
Further Information Received  
12/10/23

AS/NZS 1170  
Table 3.3

Design Loads

$P_h = 0.6 \text{ kN} \uparrow \downarrow \rightarrow$   
 $W_h = 0.35 \text{ kN/m}$

From drawing

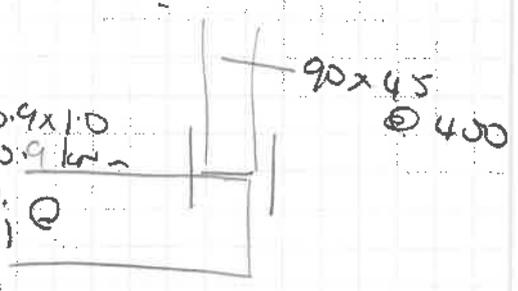
90x45 framing @ 400%

For  $P_h = 0.6 \text{ kN}$

1.2y + 1.5Q

$P^* = 1.5 \times 0.6$   
 $= 0.9 \text{ kN}$

$M^* = 0.9 \times 1.0$   
 $= 0.9 \text{ kNm}$   
140 f<sub>j</sub> @ 400%



Consider Strap Stud/Joist fixing

$T = \frac{M^*}{d}$   
 $= \frac{0.9}{0.09}$   
 $= 10 \text{ kN}$

$d = 0.09$



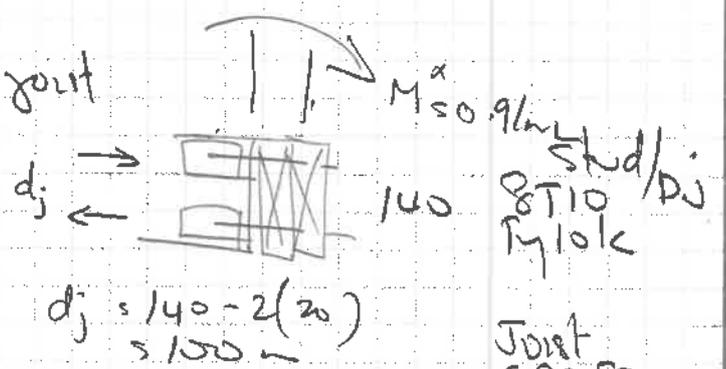
Use 8 T15

Capacity 8T15 240x68 219 kN

$\phi N_t = 0.85 \times 219 \times 68 / 1000$   
 $= 12.7 \text{ kN OK}$

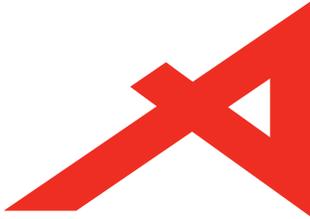
For Double Joist/Floor joint

$T_j = \frac{M^*}{d_j}$   
 $= \frac{0.9}{0.1}$   
 $= 9.0 \text{ kN}$



For CPC 40 + 15 both sides

$\phi T = 2.0 \times 9.0 / 2 \times 0.85 = 6.3 \text{ kN}$  no gap CPC 80 14k both sides



**BRANZ Appraised**  
Appraisal No. 1229 [2023]

## THERMAKRAFT COVERTEK 215 ROOF UNDERLAY



**Appraisal No. 1229 [2023]**

### BRANZ Appraisals

Technical Assessments of products for building and construction.



### Kingspan Insulation NZ Limited

11 Turin Place  
Ōtara

Auckland 2013  
New Zealand

Tel: 09 273 3727

Email: [info@kingspaninsulation.co.nz](mailto:info@kingspaninsulation.co.nz)

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**BRANZ**

### BRANZ

1222 Moonshine Rd,

RD1, Porirua 5381

Private Bag 50 908

Porirua 5240,

New Zealand

Tel: 04 237 1170

[branz.co.nz](http://branz.co.nz)



## Product

- 1.1 Thermakraft Covertek 215 Roof Underlay is a non-fire-retardant, synthetic, self-supporting building underlay for use under roof claddings.

## Scope

- 2.1 Thermakraft Covertek 215 Roof Underlay has been appraised for use as a roof underlay on buildings within the following scope:
  - the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1 for timber-framed buildings; or,
  - the scope limitations of NASH Building Envelope Solutions, Paragraph 1.1 for steel-framed buildings; and,
  - with masonry tile roof cladding; and,
  - with metal tile roof cladding; and,
  - with profiled metal roof cladding; and,
  - situated in NZS 3604 and NASH Standard Part 2 Wind Zones up to, and including, Extra High.

## Building Regulations

### New Zealand Building Code (NZBC)

- 3.1 In the opinion of BRANZ, Thermakraft Covertek 215 Roof Underlay, if used, designed, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet, or contribute to meeting the following provisions of the NZBC:

**Clause B2 DURABILITY:** Performance B2.3.1 [a] not less than 50 years, B2.3.1 [b] 15 years and B2.3.2. Thermakraft Covertek 215 Roof Underlay meets these requirements. See Paragraphs 9.1 and 9.2.

**Clause E2 EXTERNAL MOISTURE:** Performance E2.3.2. When used as part of the roof cladding system, Thermakraft Covertek 215 Roof Underlay contributes to meeting this requirement. See Paragraphs 12.1 and 12.2.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. Thermakraft Covertek 215 Roof Underlay meets this requirement.

**BC230628**  
**Received by**  
**Kapiti Coast District Council**  
**13/09/2023**

## Technical Specification

- 4.1 Thermakraft Covertek 215 Roof Underlay is a synthetic building underlay for use under roof claddings. The product consists of a micro-porous, water-resistant film, laminated between two layers of non-woven spun-bonded polyolefin. Thermakraft Covertek 215 Roof Underlay is coloured white.
- 4.2 The product is supplied in rolls 1.35 m wide x 18.6 and 37 m long. The product is printed with the Thermakraft Covertek 215 logo repeated along the length of the roll. The rolls are wrapped in clear polythene film.

### Accessories

- 4.3 Accessories used with Thermakraft Covertek 215 Roof Underlay which are supplied by the installer are:
- **Fixings** - stainless steel staples, clouts, screws or proprietary underlay fixings, or other temporary fixings to attach the roof underlay to the framing.

## Handling and Storage

- 5.1 Handling and storage of the product, whether on-site or off-site, is under the control of the installer. The rolls must be protected from damage and weather. They must be stored on end, under cover, in clean, dry conditions and must not be crushed.

## Technical Literature

- 6.1 This Appraisal must be read in conjunction with:
- Installation Guide, Thermakraft™ Covertek 215, Issue 1.0, dated January 2023.
  - Product Data Sheet, Thermakraft™ Covertek 215, Issue 1.0, dated January 2023.
- 6.2 All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

## Design Information

### General

- 7.1 Thermakraft Covertek 215 Roof Underlay is intended for use as an alternative to conventional kraft paper roof underlays, which are fixed over timber or steel-framed roofs in order to limit the entry of wind into the roof cavity, and to assist in the moisture management of the roof cladding system.
- 7.2 The material also provides a degree of temporary weather protection during early construction. However, the product will not make the roof weathertight and some wetting of the underlying structure is always possible before the roof cladding is installed. Hence, the entire building must be closed-in and made weatherproof before moisture sensitive materials such as ceiling linings and insulation materials are installed.
- 7.3 Thermakraft Covertek 215 Roof Underlay must not be exposed to the weather or ultraviolet (UV) light for a total of more than 7 days before being covered by the roof cladding.
- 7.4 Thermakraft Covertek 215 Roof Underlay is suitable for use under roof claddings on buildings as a roof underlay in accordance with NZBC Acceptable Solution E2/AS1, Table 23 for timber-framed buildings or NASH Building Envelope Solutions, Table 23 for steel-framed buildings. Refer to Table 1.
- 7.5 Thermakraft Covertek 215 Roof Underlay is suitable for use at roof pitches 3° and above. When used at pitches less than 10°, Thermakraft Covertek 215 Roof Underlay can be installed horizontally when spanning no greater than 1,200 mm in one direction, or it can be installed vertically when fully supported by a corrosion resistant material.
- 7.6 At pitches 10° and greater, Thermakraft Covertek 215 Roof Underlay can be installed vertically or horizontally and must span no greater than 1,200 mm in one direction.
- 7.7 At roof pitches less than 10° (minimum 3°), Thermakraft Covertek 215 Roof Underlay may be run horizontally, or vertically if installed over a roof underlay support.

**Table 1: Material Properties**

NZBC Acceptable Solution E2/AS1 Table 23 Roof Underlay Properties	Property Performance Requirement	Results
Absorbency	≥ 150 g/m <sup>2</sup>	Pass*
Vapour Resistance	≤ 7 MN s/g	Pass
Water Resistance	≥ 100 mm	Pass
pH of Extract	≥ 5.5 and ≤ 8	Pass
Shrinkage	≤ 0.5%	Pass
Mechanical	Edge tear and tensile strength	Edge tear [Average]: Machine direction = 249 N Cross direction = 155 N  Tensile strength [Average]: Machine direction = 5.4 kN/m Cross direction = 3.5 kN/m

\* Evaluated for roofs by testing to section 8 of BRANZ Study Report SR 228 [2010]

7.8 Refer to Table 2 for a summary of the roof underlay support requirements.

**Table 2: Roof Underlay Support Requirements**

Roof Pitch	Span	Roof Underlay Support Required?	
		Horizontally Installed	Vertically Installed
10° or more	Greater than 1,200 mm	Yes	Yes
	1,200 mm or less	No	No
Less than 10° [minimum 3°]	Greater than 1,200 mm	Yes	Yes
	1,200 mm or less	No	Yes

#### Timber and Steel Framing

7.9 Timber and steel roof framing must be provided in accordance with the requirements of the NZBC and the roof cladding manufacturer.

#### Structure

8.1 Thermakraft Covertek 215 Roof Underlay is suitable for use in all Wind Zones of NZS 3604 up to, and including, Extra High or NASH Standard Part 2 Wind Zones up to, and including, Extra High.

#### Durability

9.1 Thermakraft Covertek 215 Roof Underlay meets code compliance with NZBC Clause B2.3.1 (a) not less than 50 years for roof underlays used where the roof cladding durability requirement or expected serviceable life is not less than 50 years, e.g. behind masonry roof tile cladding, and code compliance with NZBC Clause B2.3.1 (b) 15 years for roof underlays used where the roof cladding durability requirement is 15 years.

#### Serviceable Life

9.2 Provided it is not exposed to the weather or UV light for a total of more than 7 days, and provided the roof cladding is maintained in accordance with the cladding manufacturer's instructions and the roof cladding remains weather resistant, Thermakraft Covertek 215 Roof Underlay is expected to have a serviceable life equal to that of the roof cladding.

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## Control of Internal Fire and Smoke Spread

- 10.1 Thermakraft Covertek 215 Roof Underlay has an AS 1530 Part 2 flammability index of greater than 5. For Risk Groups other than SH, Thermakraft Covertek 215 Roof Underlay must be enclosed by a suitable internal lining in occupied spaces [not exposed to view].

## Prevention of Fire Occurring

- 11.1 Separation or protection must be provided to Thermakraft Covertek 215 Roof Underlay from heat sources such as fireplaces, heating appliances, flues and chimneys. Part 7 of NZBC Verification Method C/VM1 and Acceptable Solution C/AS1, and NZBC Acceptable Solution C/AS2 provide methods for separation and protection of combustible materials from heat sources.

## External Moisture

- 12.1 Thermakraft Covertek 215 Roof Underlay must only be used under roof claddings that meet the requirements of the NZBC, such as those covered by NZBC Acceptable Solution E2/AS1 or NASH Building Envelope Solutions, or roof claddings covered by a valid BRANZ Appraisal.
- 12.2 Thermakraft Covertek 215 Roof Underlay, when installed in accordance with the Technical Literature and this Appraisal, will assist in the total cladding system's compliance with NZBC Clause E2.

## Installation Information

### Installation Skill Level Requirement

- 13.1 All design and building work must be carried out in accordance with the Thermakraft Covertek 215 Roof Underlay Technical Literature and this Appraisal by competent and experienced tradespersons conversant with Thermakraft Covertek 215 Roof Underlay. Where the work involves Restricted Building Work [RBW] this must be completed by, or under the supervision of, a Licensed Building Practitioner [LBP] with the relevant License class.

### Underlay Installation

- 14.1 Thermakraft Covertek 215 Roof Underlay must be fixed at maximum 300 mm centres to all framing members with large-head clouts 20 mm long, 6-8 mm stainless steel staples, self-drilling screws or proprietary underlay fixings. The membrane must be pulled taut over the framing before fixing.
- 14.2 Thermakraft Covertek 215 Roof Underlay may be installed horizontally or vertically at roof pitches 3° and above [refer to Table 2 for further guidance]. It must extend from the ridge and overhang the fascia board by 20-25 mm. Vertical laps must be no less than 150 mm wide. Horizontal laps must also be no less than 150 mm, with the direction of the lap ensuring that water is shed to the outer face of the underlay. End laps must be made over framing and be no less than 150 mm wide. To assist with achieving the correct lap dimension, Thermakraft Covertek 215 Roof Underlay has a 150 mm lap line printed continuously along the top face.
- 14.3 When fixing the product in windy conditions, care must be taken due to the large sail area created.
- 14.4 Any damaged areas of Thermakraft Covertek 215 Roof Underlay, such as tears, holes or gaps around service penetrations, must be repaired. Damaged areas can be repaired by covering with new material lapping the damaged area by at least 150 mm and taping, or by taping small tears.

### Inspections

- 14.5 The Technical Literature must be referred to during the inspection of Thermakraft Covertek 215 Roof Underlay installations.

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**13/09/2023**

## Basis of Appraisal

The following is a summary of the technical investigations carried out:

### Tests

- 15.1 The following tests have been carried out on Thermakraft Covertek 215 Roof Underlay in accordance with NZBC Acceptable Solution E2/AS1 and NASH Building Envelope Solutions Table 23: tensile strength, edge-tear resistance and resistance to water vapour transmission in accordance with AS/NZS 4200.1, shrinkage in accordance with AS/NZS 4201.3, resistance to water penetration in accordance with AS/NZS 4201.4, surface water absorbency in accordance with AS/NZS 4201.6 and pH of extract in accordance with AS/NZS 1301.421s. A range of these tests were completed before and after the underlay were exposed to UV light.
- 15.2 Testing was also completed to the Surface Water No-Drip Test method contained in BRANZ Study Report SR 228.

### Other Investigations

- 16.1 A durability opinion has been given by BRANZ technical experts.
- 16.2 An evaluation of the expected performance of Thermakraft Covertek 215 Roof Underlay in direct contact with metal roof cladding has been completed by BRANZ.
- 16.3 The practicability of installation of Thermakraft Covertek 215 Roof Underlay has been assessed by BRANZ and found to be satisfactory.
- 16.4 The Technical Literature, including installation instructions, has been examined by BRANZ and found to be satisfactory.

### Quality

- 17.1 The manufacture of Thermakraft Covertek 215 Roof Underlay has been examined by BRANZ, including methods adopted for quality control. Details regarding the quality and composition of the materials used were obtained by BRANZ and found to be satisfactory.
- 17.2 The quality of supply to the market is the responsibility of Kingspan Insulation NZ Limited.
- 17.3 Building designers are responsible for the design of the building, and for the incorporation of the roof underlay into their design in accordance with the instructions of Kingspan Insulation NZ Limited.
- 17.4 Quality of installation is the responsibility of the installer in accordance with the instructions of Kingspan Insulation NZ Limited.

## Sources of Information

- AS/NZS 1301.421s:1998 Determination of the pH value of aqueous extracts of paper, board and pulp - cold extraction method.
- AS/NZS 4200.1:1994 Pliable building membranes and underlays - materials.
- AS/NZS 4201.3:1994 Pliable building membranes and underlays - Methods of test - Shrinkage.
- AS/NZS 4201.4:1994 Pliable building membranes and underlays - Methods of test - Resistance to water penetration.
- AS/NZS 4201.6:1994 Pliable building membranes and underlays - Methods of test - Surface water absorbency.
- BRANZ Study Report SR 228 [2010] Study of the Moisture Management Properties of Roof Underlays.
- NASH Building Envelope Solutions:2019 Light steel-framed buildings.
- NASH Standard Part Two:2019 Light steel-framed buildings.
- NZS 3604:2011 Timber-framed buildings.
- Ministry of Business, Innovation and Employment Record of amendments - Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.



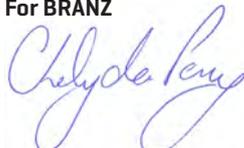
In the opinion of BRANZ, **Thermakraft Covertex 215 Roof Underlay** is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Kingspan Insulation NZ Limited**, and is valid until further notice, subject to the Conditions of Appraisal.

### Conditions of Appraisal

1. This Appraisal:
  - a) relates only to the product as described herein;
  - b) must be read, considered and used in full together with the Technical Literature;
  - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
  - d) is copyright of BRANZ.
2. **Kingspan Insulation NZ Limited:**
  - a) continues to have the product reviewed by BRANZ;
  - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
  - c) abides by the BRANZ Appraisals Services Terms and Conditions;
  - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
  - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
  - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
  - c) any guarantee or warranty offered by **Kingspan Insulation NZ Limited**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Kingspan Insulation NZ Limited** or any third party.

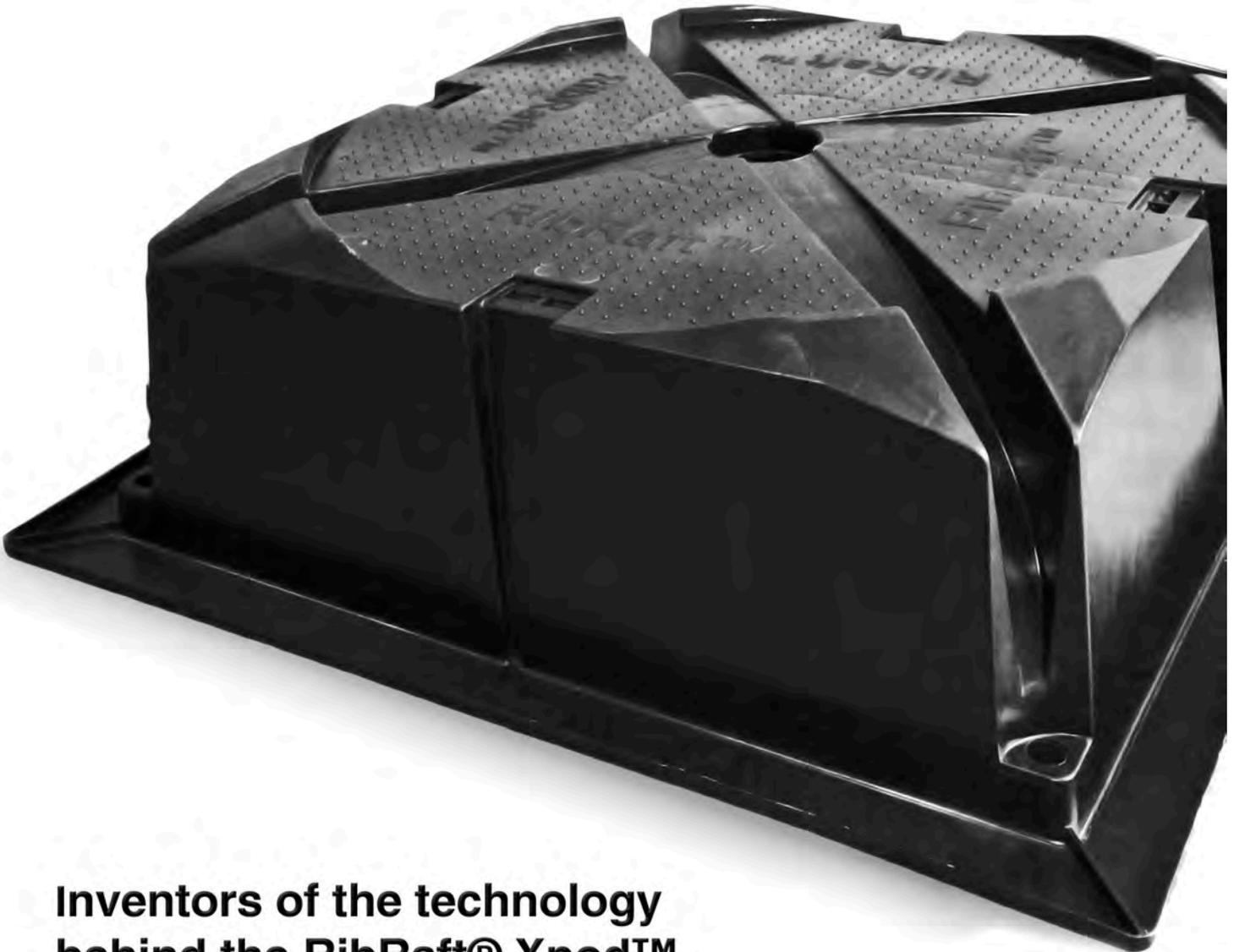
For BRANZ



**Chelydra Percy**  
Chief Executive

Date of Issue:  
18 January 2023

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**Received by**  
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**13/09/2023**



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LOT 43 AT 110 NGARARA ROAD - WAIKANAE

PROJECT

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08.08.23

FPA

JOB

DOCUMENT

REV.

DATE

ISSUED BY

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Kapiti Coast District Council  
13/09/2023

## Foundation Design - Calculation Note

## Introduction

This calculation note has been prepared using the Wafflesuite® software.

In particular, a non-linear finite element analysis for a soil-structure interaction has been carried out using the Liquefaction-Induced Parabolic Method (L.I.P.S.), in compliance with MBIE/NZGS Module 4 “Earthquake resistant foundation design” and MBIE Guidance “Repairing and rebuilding houses affected by the Canterbury earthquakes” for the specific soil conditions (ref. to “Soil Performance” Paragraph) and foundation type (Ribraft® XPod™).

For this specific design, the Verification Method that has been adopted to demonstrate compliance with NZBC consists of AS/NZS 1170 used in conjunction with the relevant cited material standards as modified by Verification Method B1/VM1, B1/VM4, B1/AS1.

NZS3101 - 2006 was used to determine the capacities of the structural sections.

The following combinations of actions have been considered in the analysis:

ULS and SLS (waffle raft):

$E_d = [G + 0.3Q + L]$  permanent, imposed actions and soil loss of support actions

ULS (Short-term actions on soil):

$E_d = [1.2G + 1.5Q]$  permanent and imposed actions

SLS (Long-term actions on soil):

$E_d = [G + 0.4Q]$  permanent and imposed actions

This document and the annexed plans shall be read in conjunction with the Ribraft® XPod™ Designers guide issued by Firth Industries and it is accompanied by a Producer Statement Design.

## Software Disclaimer

Anyone who distributes this document is a suitably qualified professional who has read the Wafflesuite® User Terms, understands them and agrees to be bound by them.

Wafflesuite® is a software developed by Cresco Group [www.cresco-group.com](http://www.cresco-group.com)

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13/09/2023

## Project Information

Client:	Tim Atkinson
Job Number:	7544
Project address- Street:	Lot 43 at 110 Ngarara Road
Project address - Town/City:	Waikanae
Project address - Local Authority:	Kapiti Coast District Council

## Soil Performance

Stable/Soft Soil:	No
Expansive Soil:	No
Liquefaction Prone Soil:	Yes
Ultimate Bearing Capacity:	200 kPa
Building Platform Stiffness:	10000 kPa/m
Natural Soil Unit Weight:	18 kN/m
Liquefaction Potential	TC2-LIKE
Total Liquefaction Settlements at ULS:	100 mm
Total Liquefaction Settlements at SLS:	50 mm

## Foundation Type

Waffle raft system:	XPOD-750
Edge Beam Protrusion Beyond Waffle Raft Overall Standard Depth:	NIL
Foundation type:	Shallow
Engineered Fill Thickness Below Ground Level (BGL):	200 mm
Engineered Fill Thickness Above Ground Level (AGL):	0 mm
Fill Unit Weight :	22 kN/m

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## Load Analysis

### Rectangle 1

1 storey  
Lightweight roof  
Standard Edge Beams

#### EL1

20.5 m  
1. Cladframe  
G = 2.8 kN/m  
Q = 0.8 kN/m

#### EL2

20.5 m  
1. Cladframe  
G = 2.8 kN/m  
Q = 0.8 kN/m

#### EB1

6.5 m  
1. Cladframe  
G = 2.8 kN/m  
Q = 0.8 kN/m

#### EB2

6.5 m  
1. Cladframe  
G = 2.8 kN/m  
Q = 0.3 kN/m

### Rectangle 2

1 storey  
Lightweight roof  
Standard Edge Beams

#### EL1

15.2 m  
1. Cladframe  
G = 1.7 kN/m  
Q = 0.1 kN/m

#### EL2

15.2 m  
1. Cladframe  
G = 1.7 kN/m  
Q = 0.1 kN/m

#### EB1

9.5 m  
1. Cladframe  
G = 5.7 kN/m  
Q = 3.5 kN/m

#### EB2

9.5 m  
1. Cladframe  
G = 2.8 kN/m  
Q = 0.8 kN/m

#### User defined additional loads:

Load #1: G = 1.7 kN/m Q = 1.1 kN/m  
Load #2: G = 1.7 kN/m Q = 1.1 kN/m  
Load #3: G = 5.5 kN/m Q = 5.3 kN/m  
Load #4: G = 2.9 kN/m Q = 1.8 kN/m  
Load #5: G = 2.9 kN/m Q = 1.8 kN/m  
Load #6: G = 7.7 kN Q = 4.8 kN  
Load #7: G = 5.2 kN Q = 3.3 kN  
Load #8: G = 5.2 kN Q = 3.3 kN

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## Rib Reinforcing Summary

Rectangle 1		
	TOP Reinforcing	BTM Reinforcing
RL*	SE62 + 1 HD12 @rib	1 HD12 @rib
RB*	SE62 + 1 HD12 @rib	1 HD12 @rib
Rectangle 2		
	TOP Reinforcing	BTM Reinforcing
RL*	SE62 + 1 HD12 @rib	1 HD12 @rib
RB*	SE62 + 1 HD12 @rib	1 HD12 @rib

## Design Summary

LIQUEFACTION POTENTIAL	TC2-LIKE
TOTAL LIQUEFACTION SETTLEMENTS AT ULS	100 mm
TOTAL LIQUEFACTION SETTLEMENTS AT SLS	50 mm
ULTIMATE BEARING CAPACITY	200 kPa
WAFFLE RAFT TYPE	RIBRAFT X-POD 750
TOP SLAB THICKNESS (T)	85 mm
WAFFLE RAFT OVERALL DEPTH (H)	300 mm
RIB SPACING	750 mm
INTERNAL RIB AVERAGE WIDTH	135 mm
EDGE BEAM MINIMUM WIDTH (B)	300 mm
INTERNAL RIB BTM REINFORCING (M1)	1 HD12
INTERNAL RIB TOP REINFORCING (M2)	1 HD12
EDGE BEAM BTM REINFORCING (M3)	2 HD12
EDGE BEAM TOP REINFORCING (M4)	3 HD12
SLAB FABRIC	SE62 TOP
CONCRETE STRENGTH (fc')	20 MPa (Firth mixcode IP2019X)
DESIGNED WITH WAFFLESUITE	REF CRSA-7795-0823

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## Checks Summary

### Rib

Deflection ratio = 1 in 222 < 1 in 200 over 2 m cantilever  
M\*,hog = 17.5 kNm <  $\Phi$ Mu,hog = 19.4 kNm  
M\*,sag = 10.1 kNm <  $\Phi$ Mu,sag = 16.9 kNm  
V\*,max = 12.6 kN <  $\Phi$ Vu = 17 kN  
P\*,short term = 18.4 kPa < DBC = 100 kPa  
P\*,long term = 11.9 kPa < ABC = 66.7 kPa

### Edge Beam

Deflection ratio = 1 in 242 < 1 in 200 over 2 m cantilever  
M\*,hog = 29.7 kNm <  $\Phi$ Mu,hog = 37.5 kNm  
M\*,sag = 18 kNm <  $\Phi$ Mu,sag = 32.9 kNm  
V\*,max = 19.9 kN <  $\Phi$ Vu = 39.9 kN  
P\*,short term = 33.3 kPa < DBC = 100 kPa  
P\*,long term = 21.5 kPa < ABC = 66.7 kPa

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### Rectangle 1 - Loss of Support 1



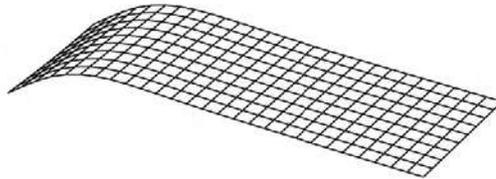
**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

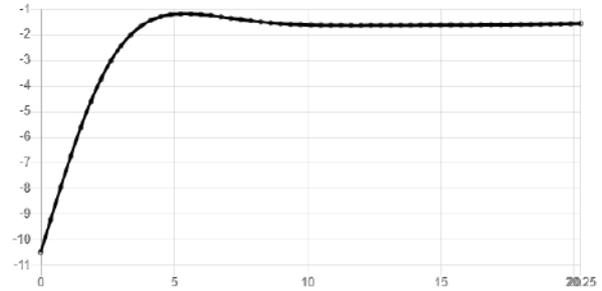
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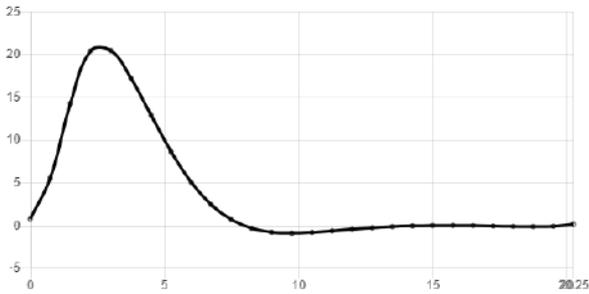
**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 320 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 20.9 \text{ kNm} < \Phi M_{u, \text{hog}} = 29.2 \text{ kNm}$   
 $M^*, \text{sag} = 0.9 \text{ kNm} < \Phi M_{u, \text{sag}} = 30.3 \text{ kNm}$   
 $V^*, \text{max} = 13.5 \text{ kN} < \Phi V_u = 39.9 \text{ kN}$

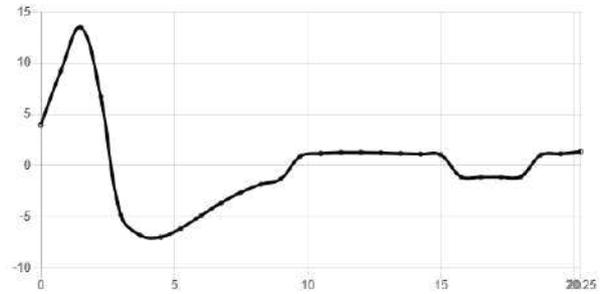
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



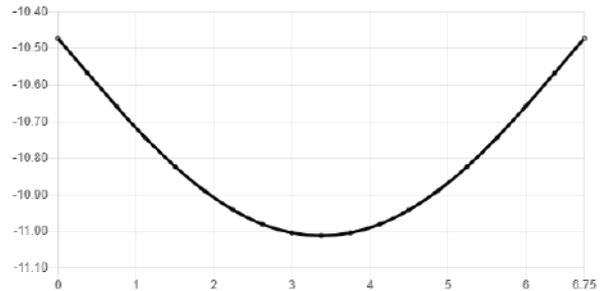
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



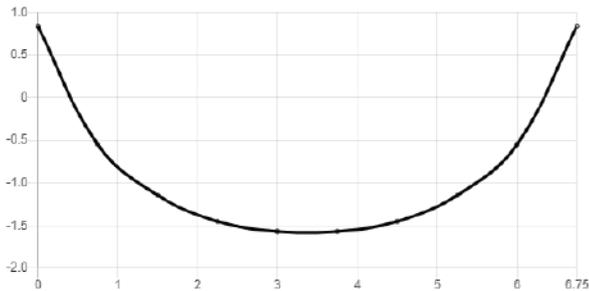
**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 0.8 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 1.9 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

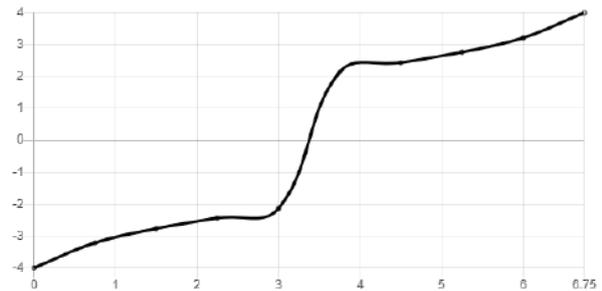
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]

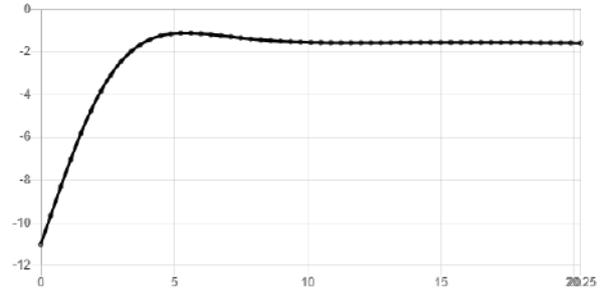


**Rib (RL\*) - Summary**

Deflection ratio = 1 in 301 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 12.2 \text{ kNm} < \Phi M_{u, hog} = 19.4 \text{ kNm}$   
 $M^*, sag = 0.5 \text{ kNm} < \Phi M_{u, sag} = 16.9 \text{ kNm}$   
 $V^*, max = 7.8 \text{ kN} < \Phi V_u = 17 \text{ kN}$

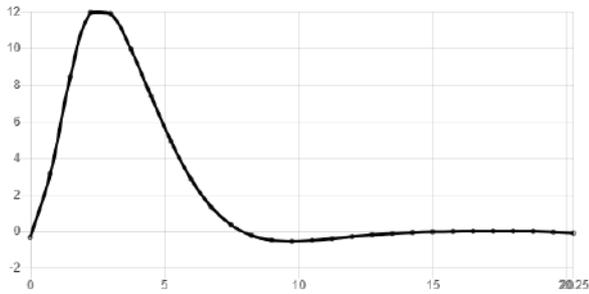
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



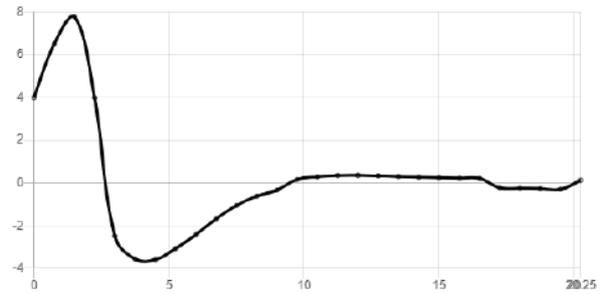
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.2 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 0.8 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 1.3 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

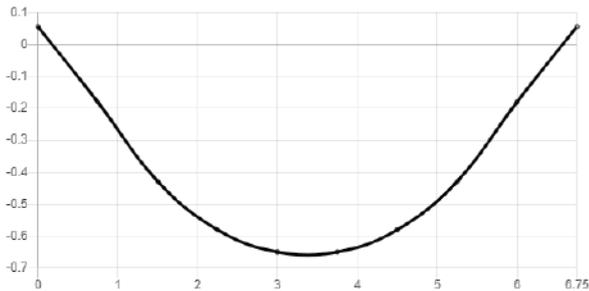
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



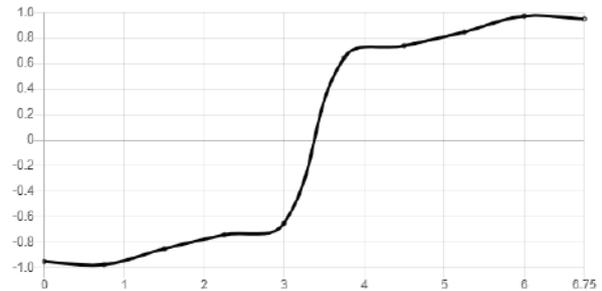
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

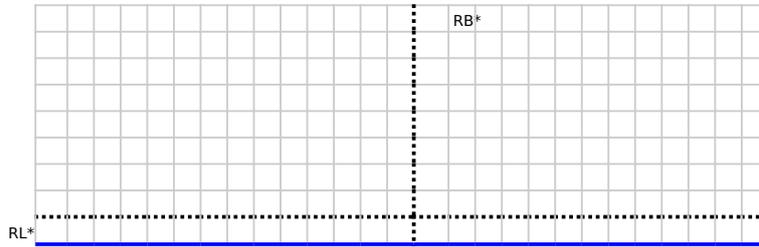


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 1 - Loss of Support 2



**Loads**

S2

Loads in accordance with paragraph "Load Analysis"

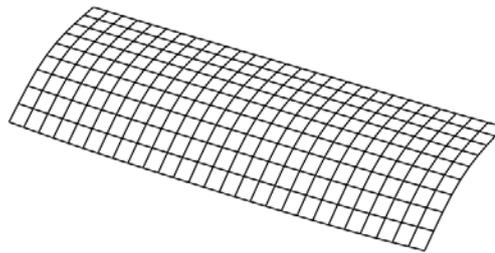
**Notes**

S: Line where maximum loss of support occurs

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

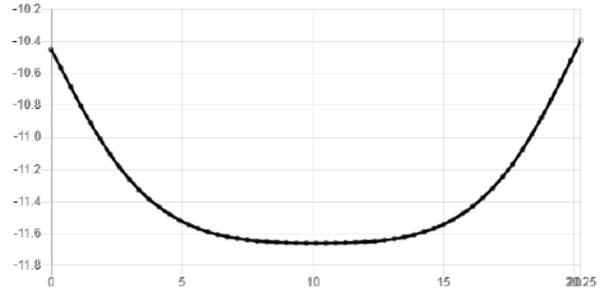


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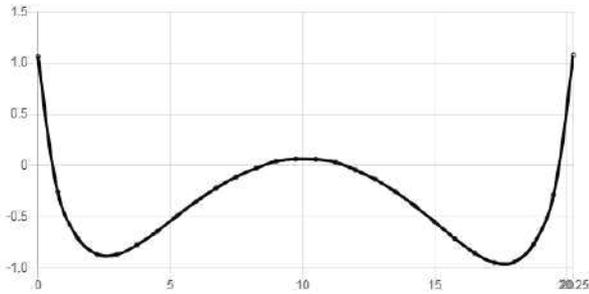
**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 1.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 1.2 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

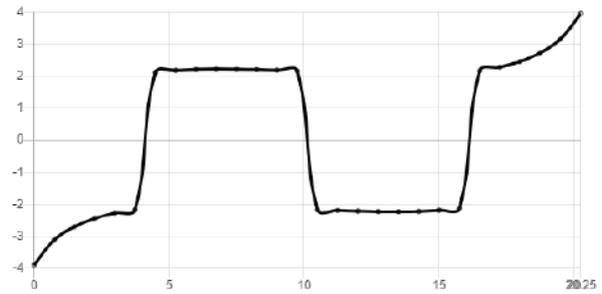
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



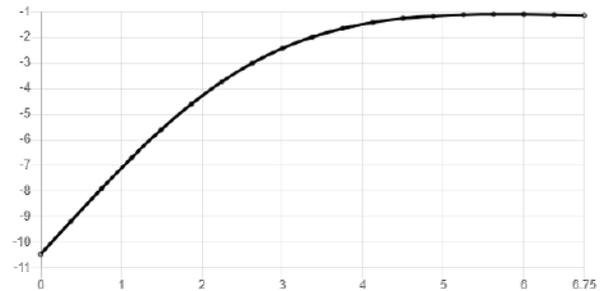
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



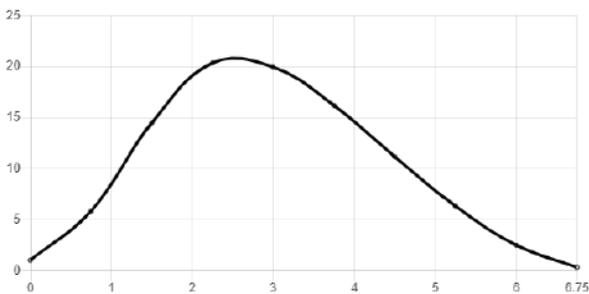
**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 320 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 20.6 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 13.3 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

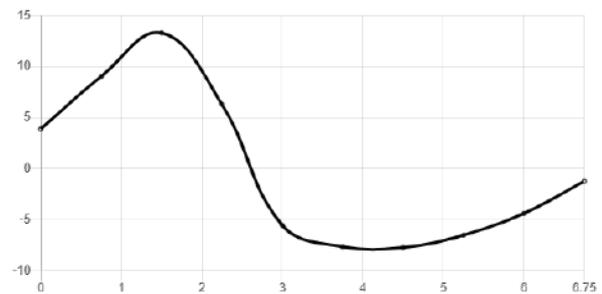
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



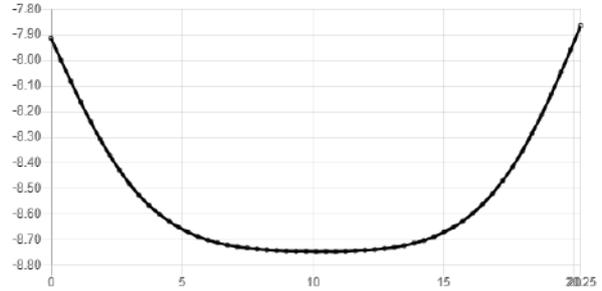
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**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
M\*,hog = 0.2 kNm <  $\Phi$ Mu,hog = 11 kNm  
M\*,sag = 0.5 kNm <  $\Phi$ Mu,sag = 14.2 kNm  
V\*,max = 1.4 kN <  $\Phi$ Vu = 16.8 kN

**Rib (RL\*) - Deflection**

[X:m, Y:mm]



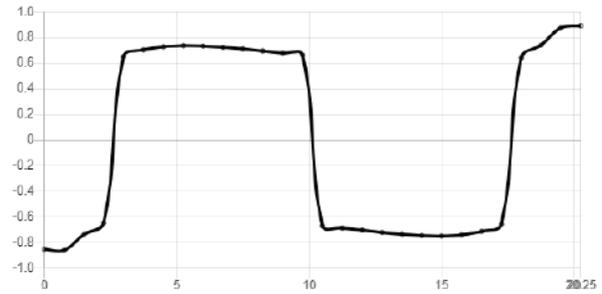
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

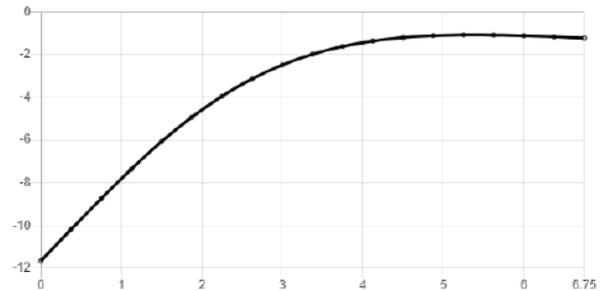


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 279 < 1 in 200 over 2 m cantilever  
M\*,hog = 13 kNm <  $\Phi$ Mu,hog = 19.4 kNm  
M\*,sag = 0.2 kNm <  $\Phi$ Mu,sag = 16.9 kNm  
V\*,max = 8.2 kN <  $\Phi$ Vu = 17 kN

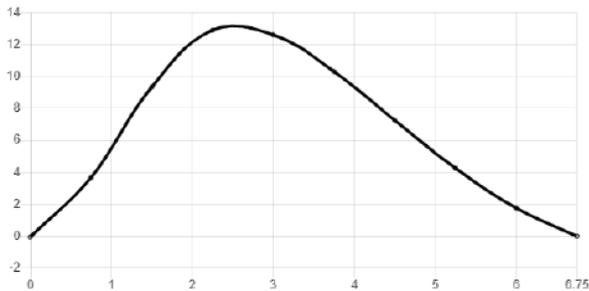
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



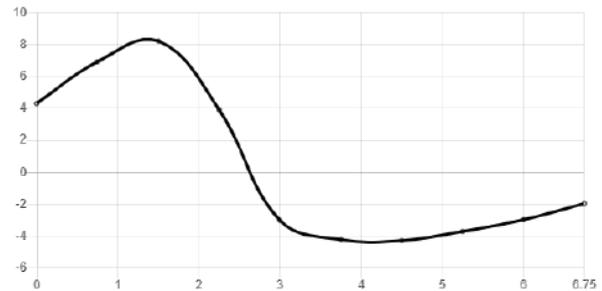
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 1 - Loss of Support 3



**Loads**

Loads in accordance with paragraph "Load Analysis"

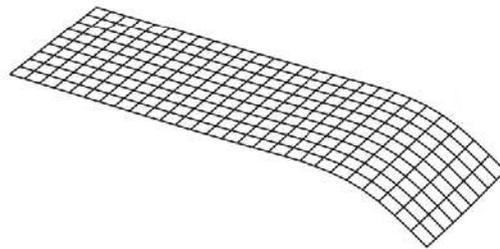
**Notes**

S: Line where maximum loss of support occurs

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



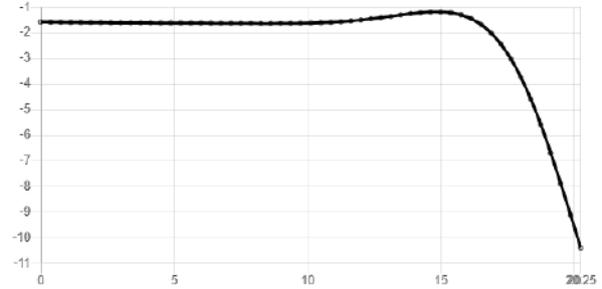
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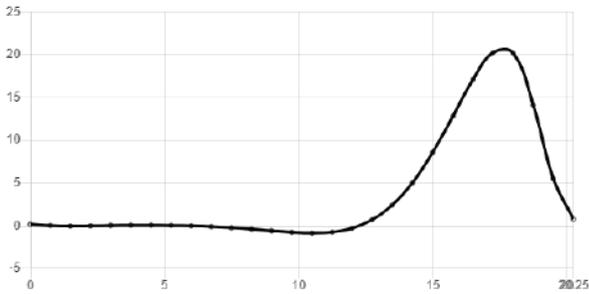
**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 324 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 20.7 \text{ kNm} < \phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0.8 \text{ kNm} < \phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 13.4 \text{ kN} < \phi V_u = 39.4 \text{ kN}$

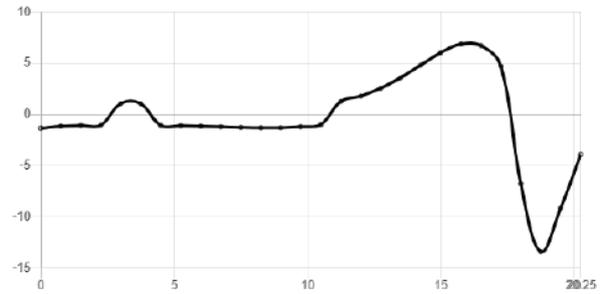
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



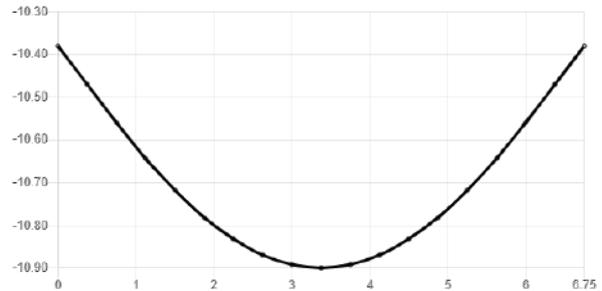
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



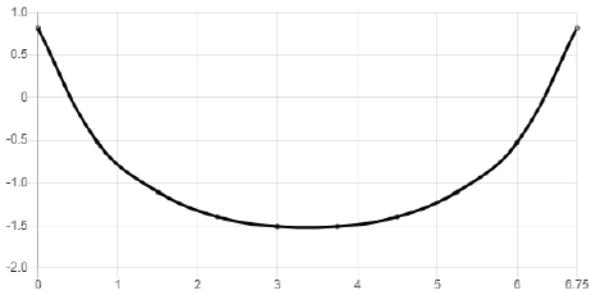
**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 0.8 \text{ kNm} < \phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 1.9 \text{ kNm} < \phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 3.9 \text{ kN} < \phi V_u = 39.4 \text{ kN}$

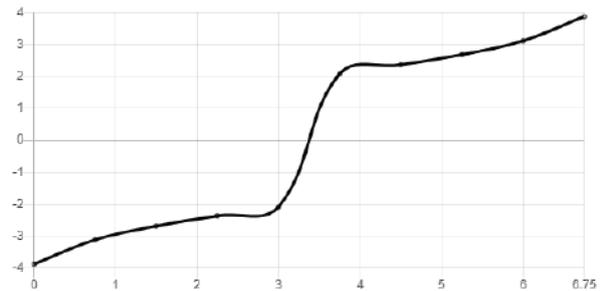
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]

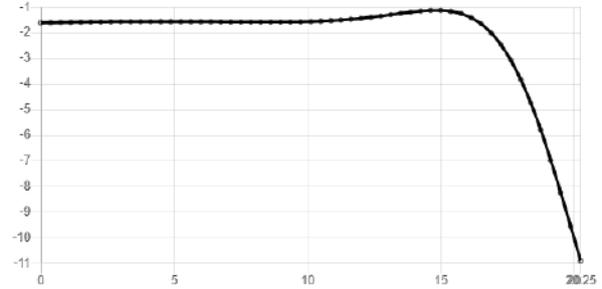


**Rib (RL\*) - Summary**

Deflection ratio = 1 in 305 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 12 \text{ kNm} < \Phi M_{u, hog} = 19.4 \text{ kNm}$   
 $M^*, sag = 0.5 \text{ kNm} < \Phi M_{u, sag} = 16.9 \text{ kNm}$   
 $V^*, max = 7.7 \text{ kN} < \Phi V_u = 17 \text{ kN}$

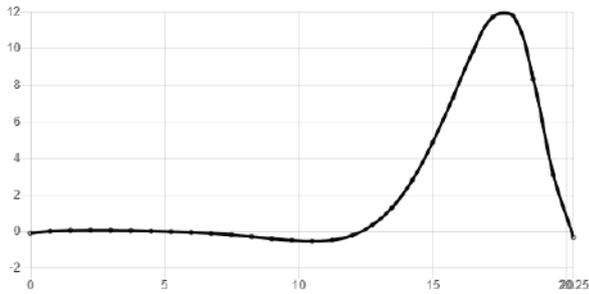
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



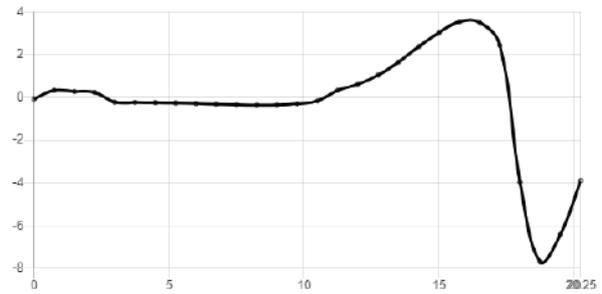
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

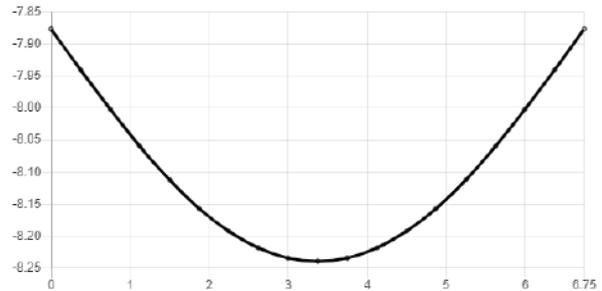


**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.2 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 0.7 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 1.3 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

**Rib (RB\*) - Deflection**

[X:m, Y:mm]



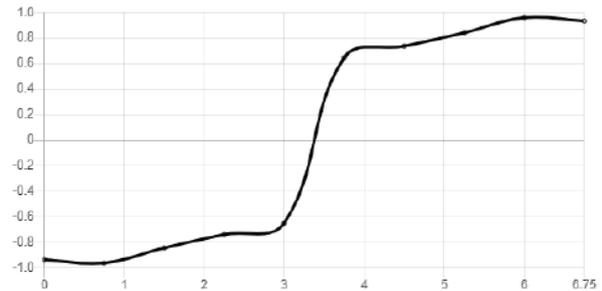
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

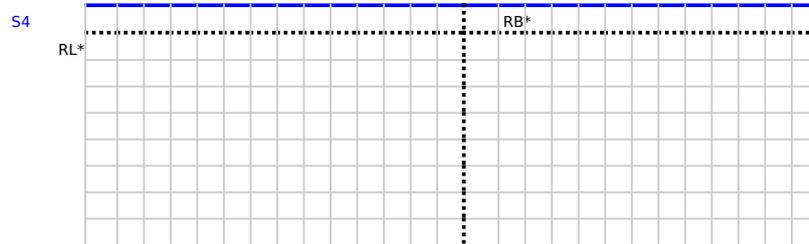


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 1 - Loss of Support 4



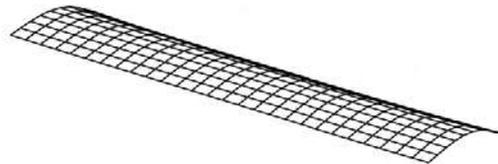
**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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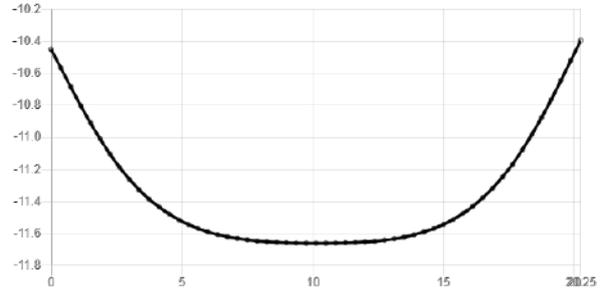


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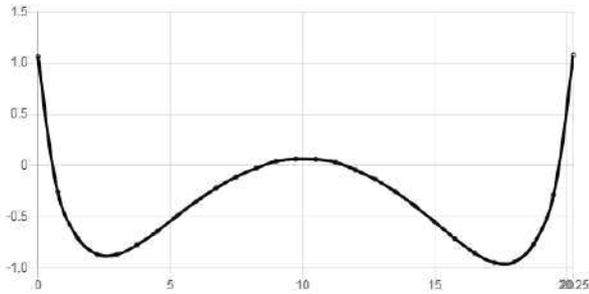
**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 1.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 1.2 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

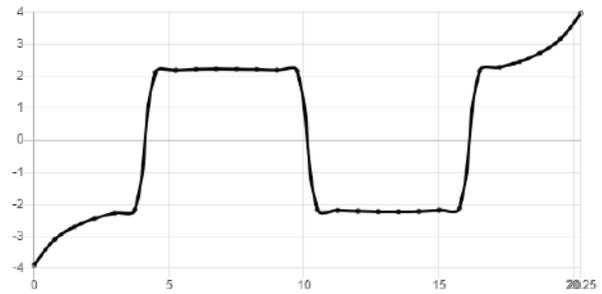
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



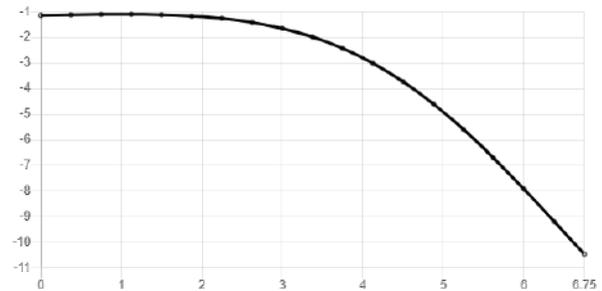
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



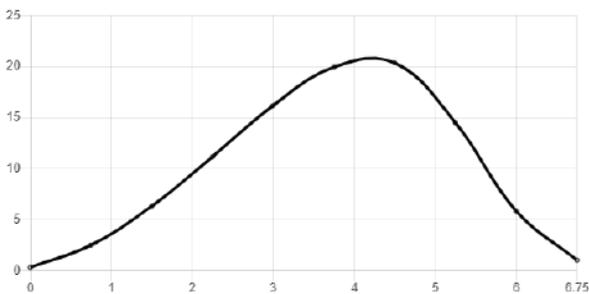
**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 320 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 20.6 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 13.3 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

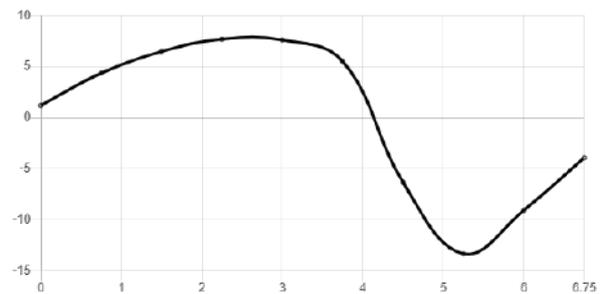
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]

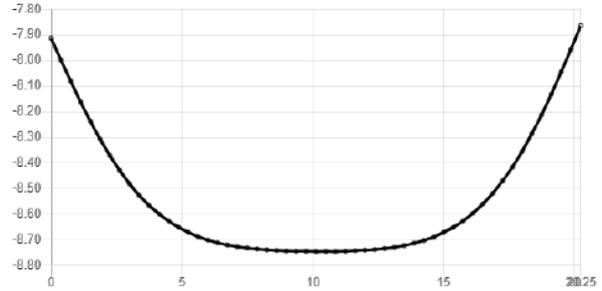


**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.2 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 0.5 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 1.4 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

**Rib (RL\*) - Deflection**

[X:m, Y:mm]



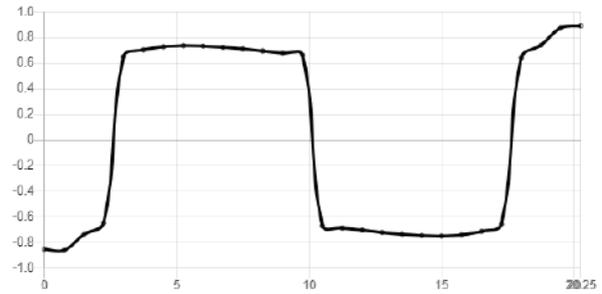
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

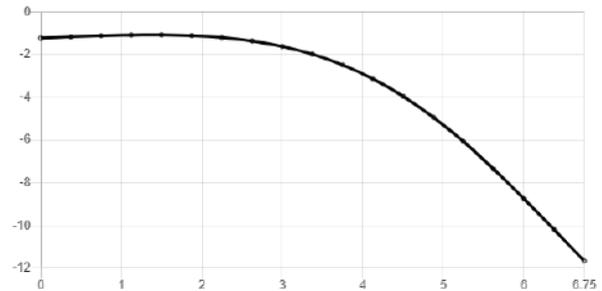


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 279 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 13 \text{ kNm} < \Phi M_{u, hog} = 19.4 \text{ kNm}$   
 $M^*, sag = 0.2 \text{ kNm} < \Phi M_{u, sag} = 16.9 \text{ kNm}$   
 $V^*, max = 8.2 \text{ kN} < \Phi V_u = 17 \text{ kN}$

**Rib (RB\*) - Deflection**

[X:m, Y:mm]



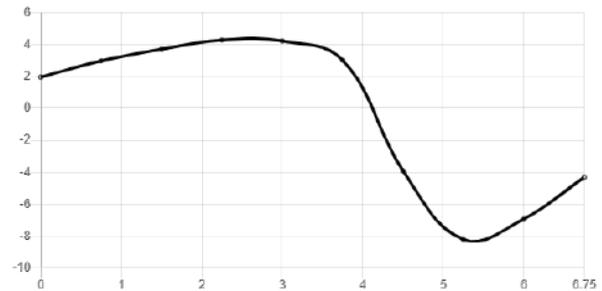
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

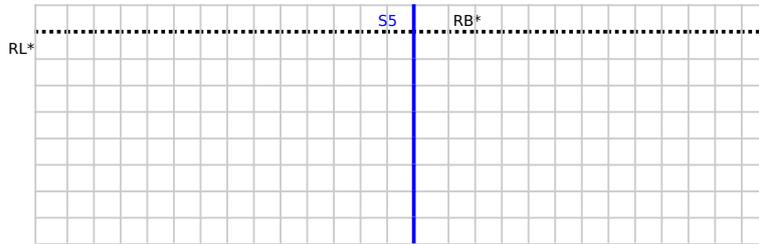


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 1 - Loss of Support 5

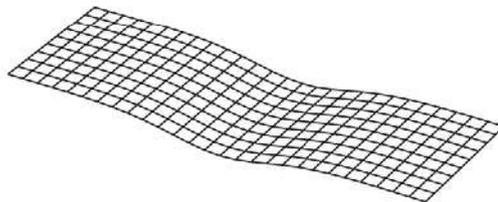


**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



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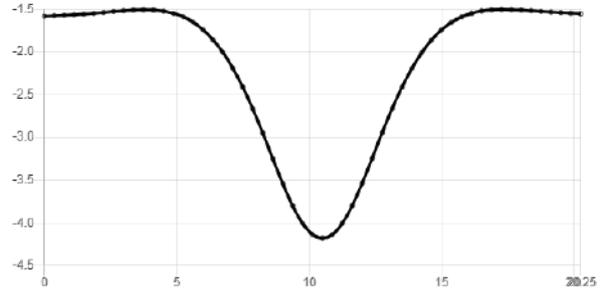
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**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 2002 < 1 in 400 over 4 m length  
 $M^*, hog = 5.2 \text{ kNm} < \Phi M_{u, hog} = 20.9 \text{ kNm}$   
 $M^*, sag = 13.3 \text{ kNm} < \Phi M_{u, sag} = 27.5 \text{ kNm}$   
 $V^*, max = 11.1 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



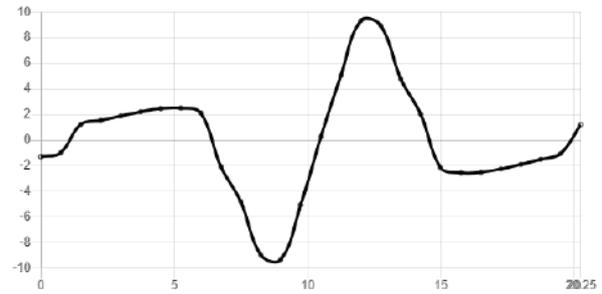
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]

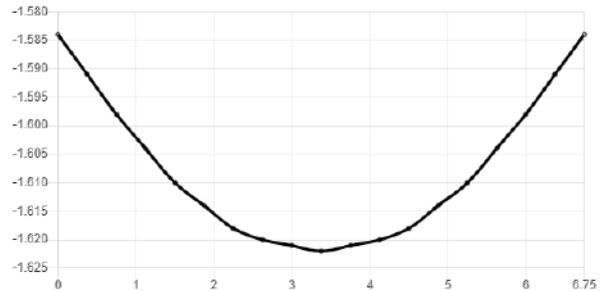


**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.2 \text{ kNm} < \Phi M_{u, hog} = 20.9 \text{ kNm}$   
 $M^*, sag = 0.1 \text{ kNm} < \Phi M_{u, sag} = 27.5 \text{ kNm}$   
 $V^*, max = 1.4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

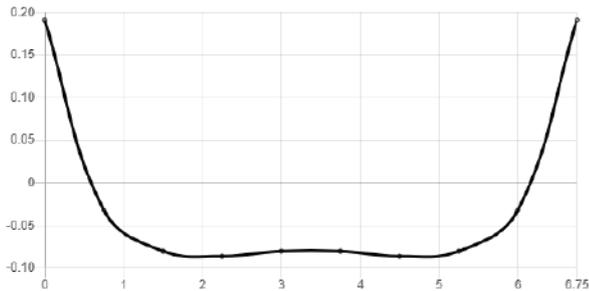
**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



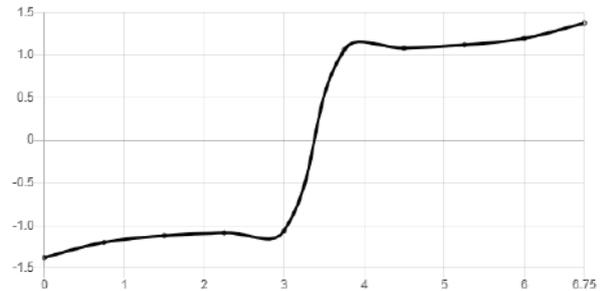
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]

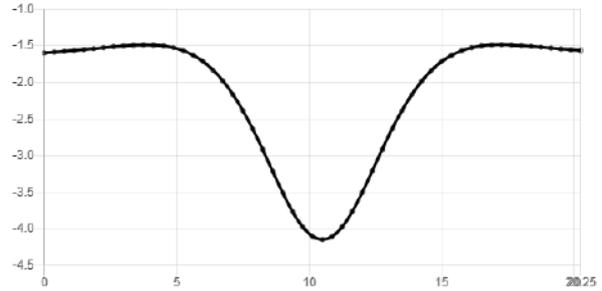


**Rib (RL\*) - Summary**

Deflection ratio = 1 in 2008 < 1 in 400 over 4 m length  
 $M^*, hog = 2.9 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 7.5 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 6 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

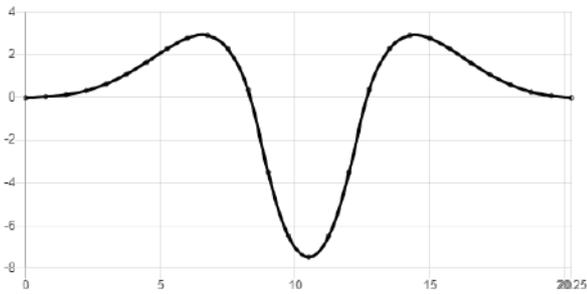
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



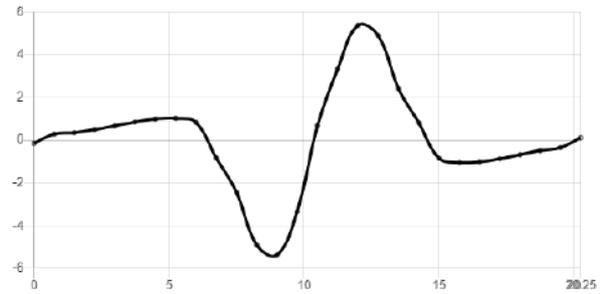
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

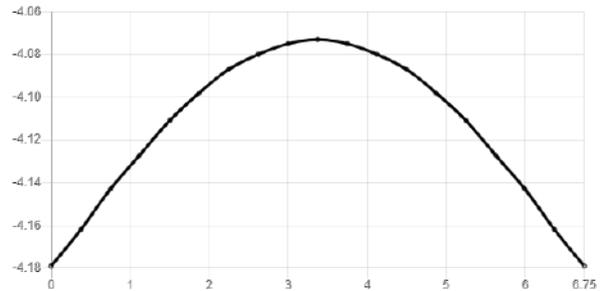


**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.2 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 0.1 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 0.9 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

**Rib (RB\*) - Deflection**

[X:m, Y:mm]



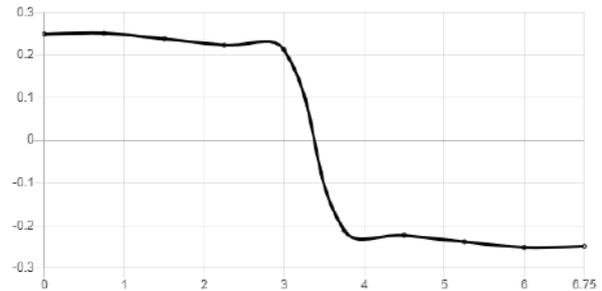
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

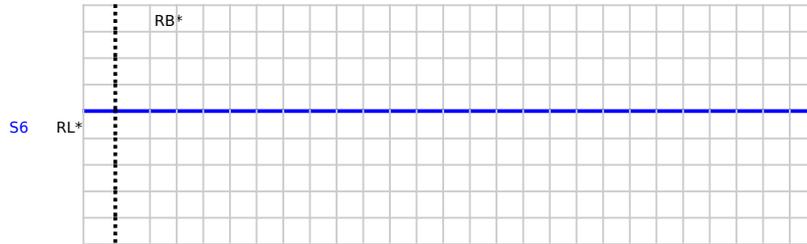


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 1 - Loss of Support 6

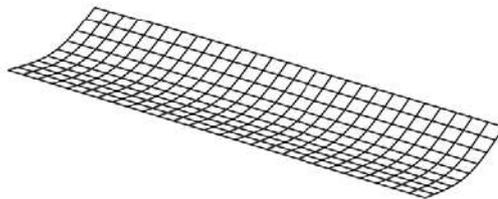


**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

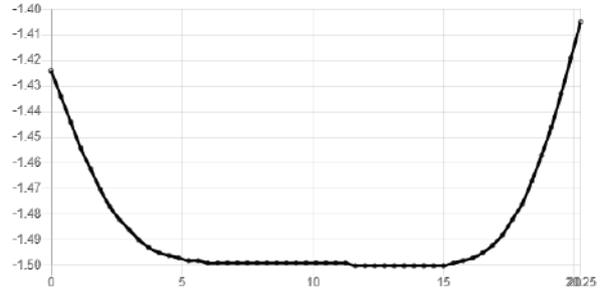


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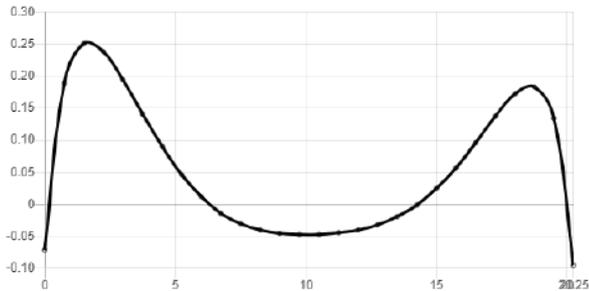
**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 0.4 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0.1 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 2 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

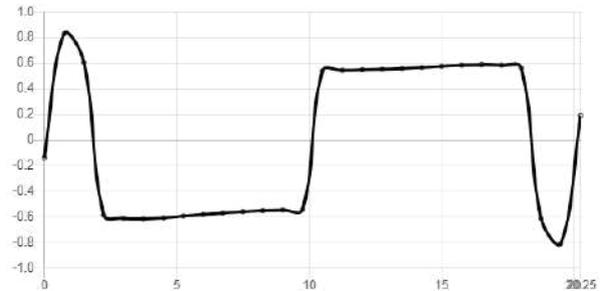
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



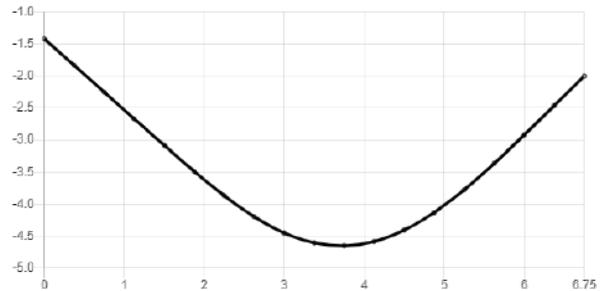
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



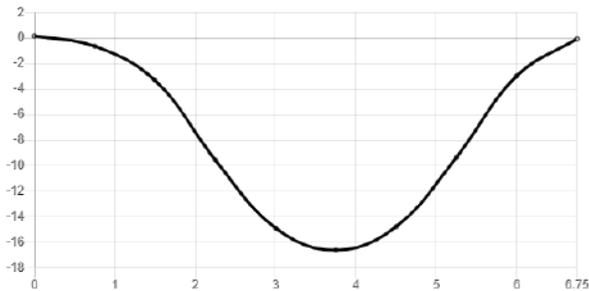
**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 1459 < 1 in 400 over 4 m length  
 $M^*, \text{hog} = 0.2 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 16.6 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 10.8 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]

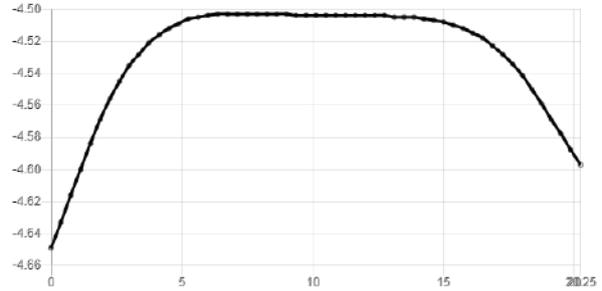


**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.3 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 0.1 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 1 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

**Rib (RL\*) - Deflection**

[X:m, Y:mm]



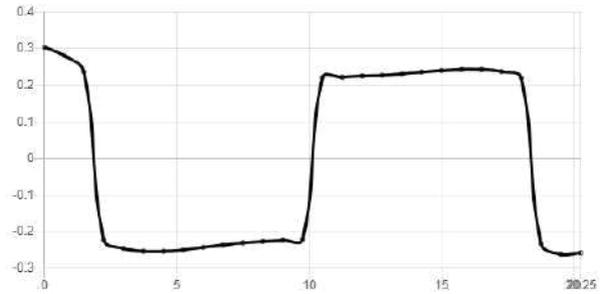
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

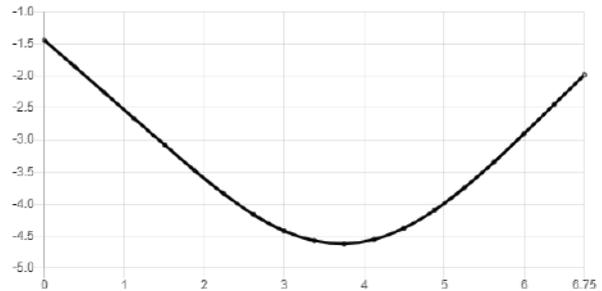


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 1465 < 1 in 400 over 4 m length  
 $M^*, hog = 0 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 9.3 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 5.8 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

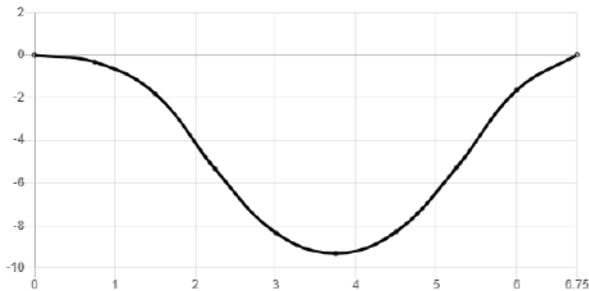
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



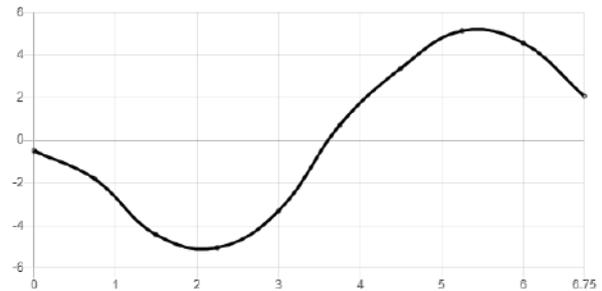
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



## Rectangle 1 - Pressure Analysis (Short Term)

### Rib

**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , short term = 24.7 kPa

#### Pressure on natural soil

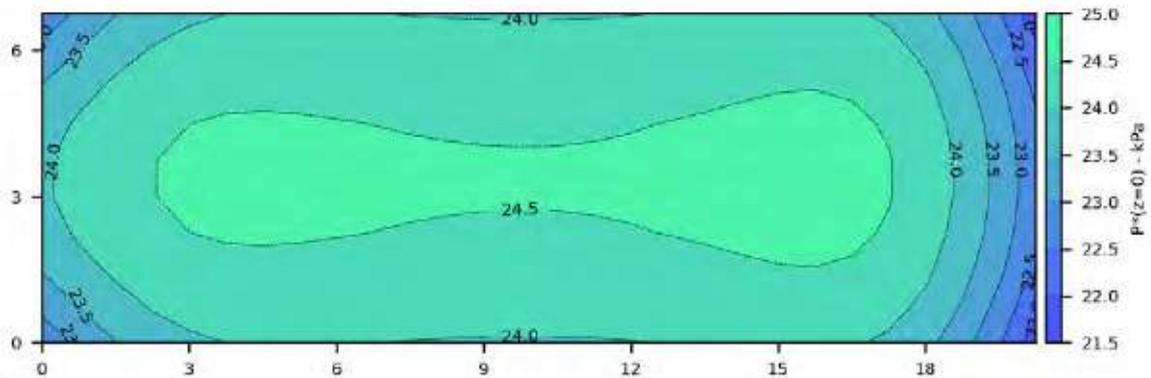
Engineered Fill Thickness = 200 mm  
 $P^*$ , short term = 11.5 kPa < DBC = 100 kPa

### Edge Beam

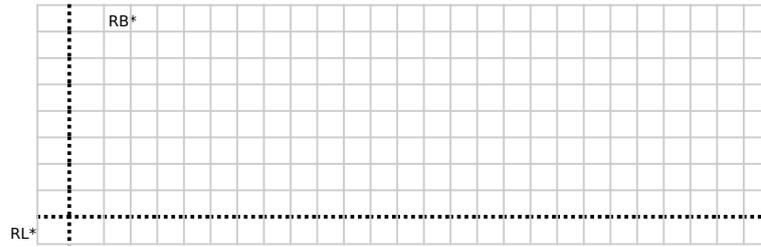
**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , short term = 24.1 kPa

#### Pressure on natural soil

Engineered Fill Thickness = 200 mm  
 $P^*$ , short term = 19.7 kPa < DBC = 100 kPa



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**Loads**

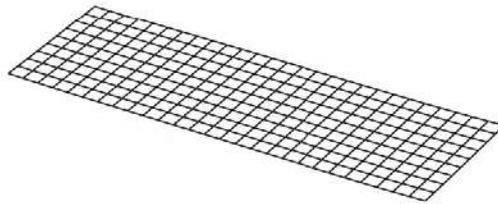
Loads in accordance with paragraph "Load Analysis"

**Notes**

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



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### Edge Beam (EL) - Summary

Deflection check not applicable for a ULS Short Term combination.

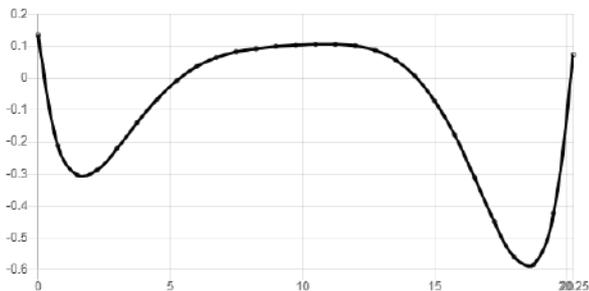
Refer to Long Term combination check.

$M^*,\text{hog} = 0.1 \text{ kNm} < \Phi M_{u,\text{hog}} = 20.9 \text{ kNm}$

$M^*,\text{sag} = 0.6 \text{ kNm} < \Phi M_{u,\text{sag}} = 27.5 \text{ kNm}$

$V^*,\text{max} = 2.2 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

### Edge Beam (EL) - Bending Moment (M\*) [X:m, Y:kNm/rib]

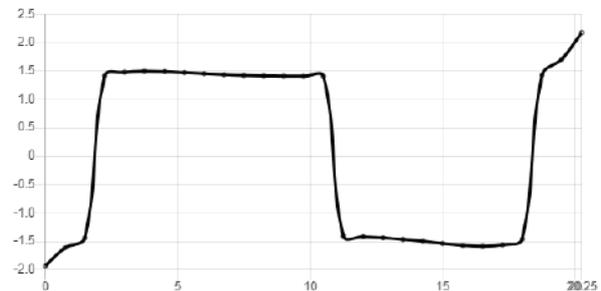


### Edge Beam (EL) - Deflection [X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Edge Beam (EL) - Shear Force (V\*) [X:m, Y:kN/rib]



### Edge Beam (EB) - Summary

Deflection check not applicable for a ULS Short Term combination.

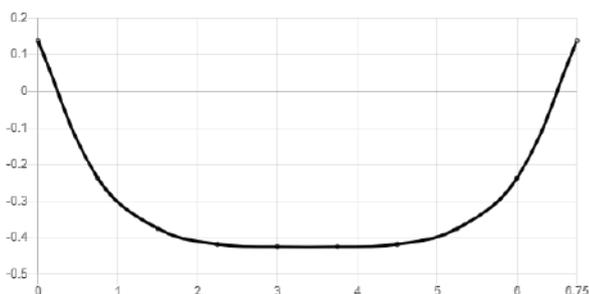
Refer to Long Term combination check.

$M^*,\text{hog} = 0.1 \text{ kNm} < \Phi M_{u,\text{hog}} = 20.9 \text{ kNm}$

$M^*,\text{sag} = 0.4 \text{ kNm} < \Phi M_{u,\text{sag}} = 27.5 \text{ kNm}$

$V^*,\text{max} = 2.1 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

### Edge Beam (EB) - Bending Moment (M\*) [X:m, Y:kNm/rib]

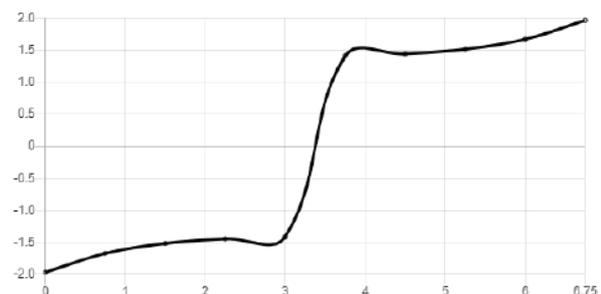


### Edge Beam (EB) - Deflection [X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Edge Beam (EB) - Shear Force (V\*) [X:m, Y:kN/rib]



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### Rib (RL\*) - Summary

Deflection check not applicable for a ULS Short Term combination.

Refer to Long Term combination check.

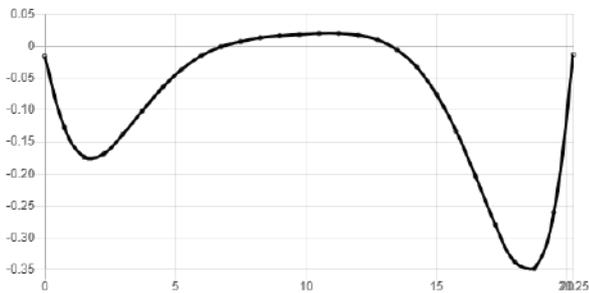
$M^*, \text{hog} = 0.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$

$M^*, \text{sag} = 0.3 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$

$V^*, \text{max} = 1 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

### Rib (RL\*) - Bending Moment (M\*)

[X:m, Y:kNm/rib]



### Rib (RL\*) - Deflection

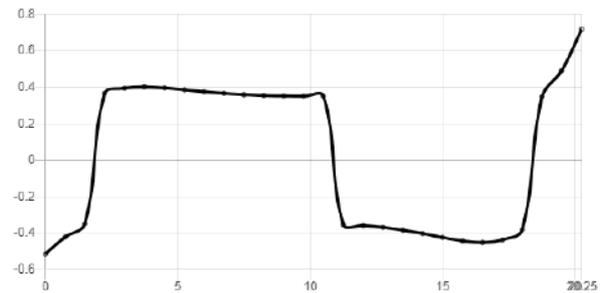
[X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Rib (RL\*) - Shear Force (V\*)

[X:m, Y:kN/rib]



### Rib (RB\*) - Summary

Deflection check not applicable for a ULS Short Term combination.

Refer to Long Term combination check.

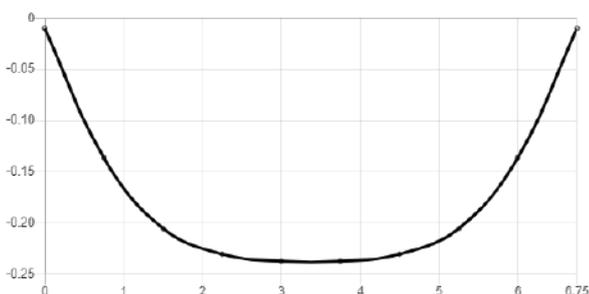
$M^*, \text{hog} = 0 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$

$M^*, \text{sag} = 0.2 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$

$V^*, \text{max} = 0.8 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

### Rib (RB\*) - Bending Moment (M\*)

[X:m, Y:kNm/rib]



### Rib (RB\*) - Deflection

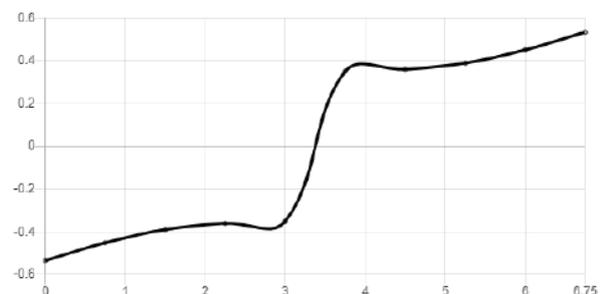
[X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Rib (RB\*) - Shear Force (V\*)

[X:m, Y:kN/rib]



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### Rectangle 1 - Pressure Analysis (Long Term)

#### Rib

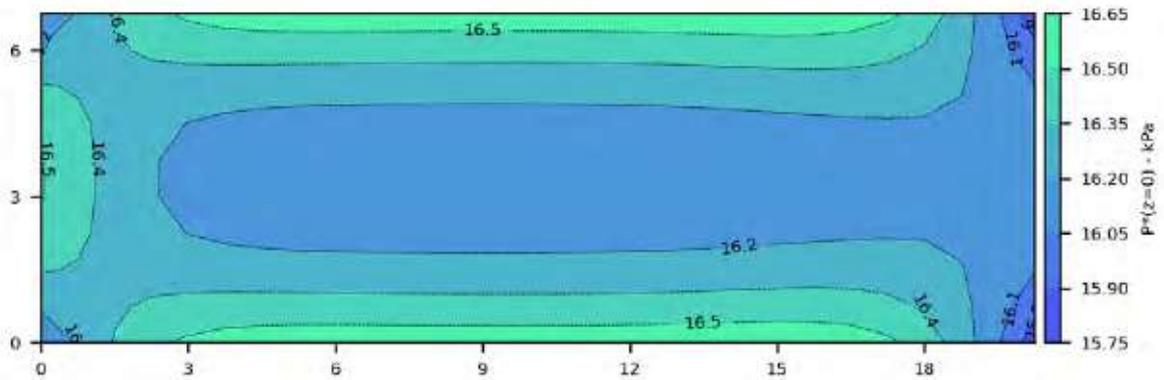
**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , long term = 16.5 kPa

**Pressure on natural soil**  
Engineered Fill Thickness = 200 mm  
 $P^*$ , long term = 7.9 kPa < ABC = 66.7 kPa

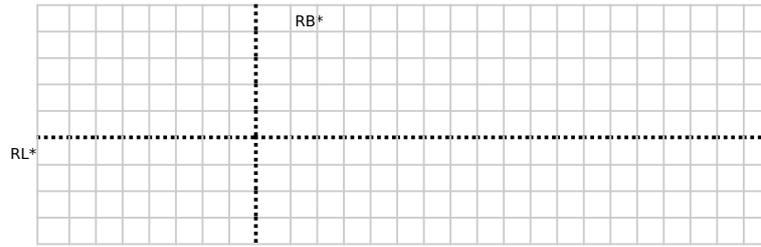
#### Edge Beam

**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , long term = 16.6 kPa

**Pressure on natural soil**  
Engineered Fill Thickness = 200 mm  
 $P^*$ , long term = 13.8 kPa < ABC = 66.7 kPa



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**Loads**

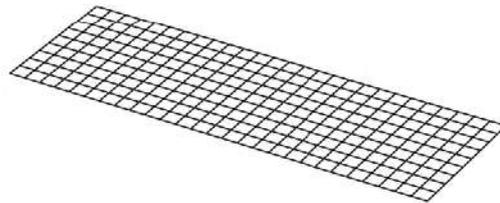
Loads in accordance with paragraph "Load Analysis"

**Notes**

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



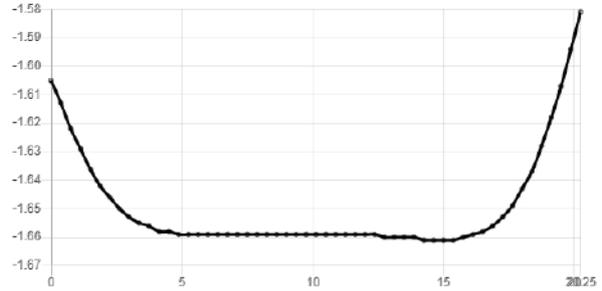
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**Edge Beam (EL) - Summary**

$\Delta = 0.1 \text{ mm} < \Delta_{\text{max}} = 40 \text{ mm}$   
 $M^*, \text{hog} = 0.2 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0.1 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 1.4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

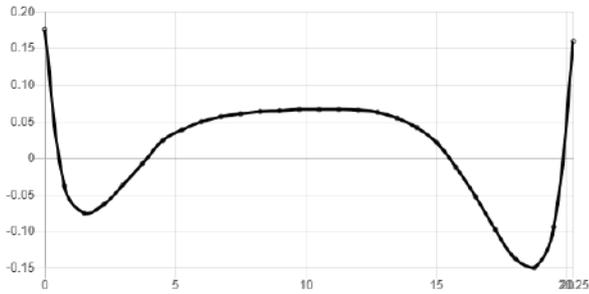
**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



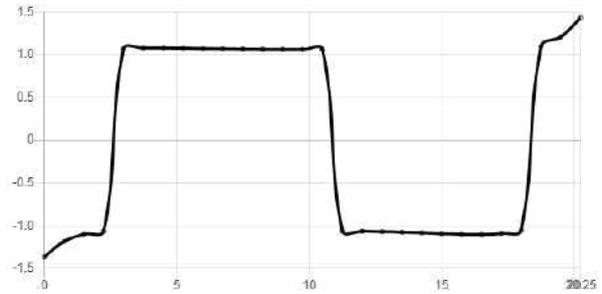
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]



**Edge Beam (EB) - Summary**

$\Delta = 0 \text{ mm} < \Delta_{\text{max}} = 21.7 \text{ mm}$   
 $M^*, \text{hog} = 0.2 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0.1 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 1.4 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

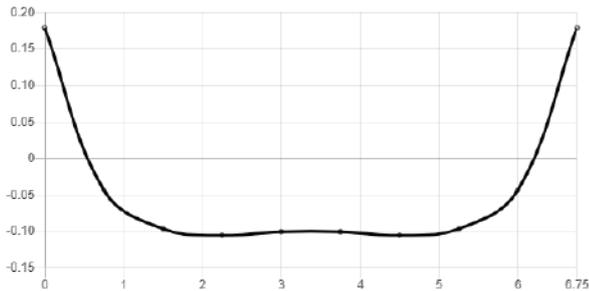
**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



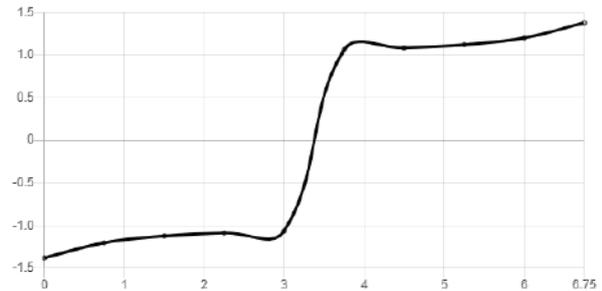
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]



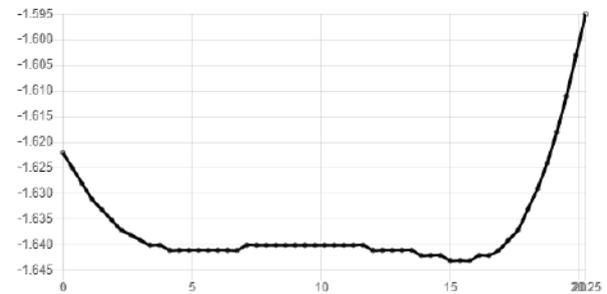
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**Rib (RL\*) - Summary**

$\Delta = 0 \text{ mm} < \Delta_{\text{max}} = 40 \text{ mm}$   
 $M^*, \text{hog} = 0.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$   
 $M^*, \text{sag} = 0.1 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$   
 $V^*, \text{max} = 0.6 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

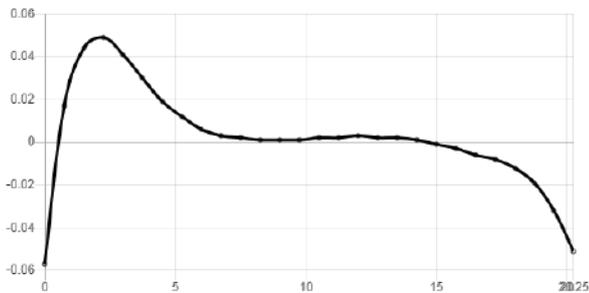
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



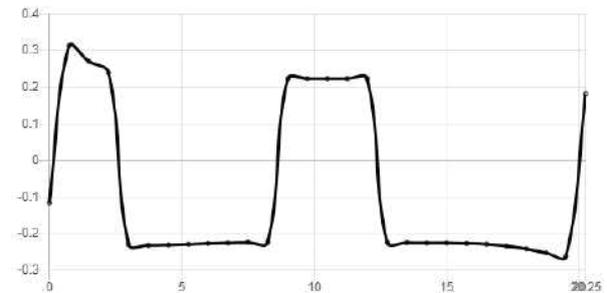
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

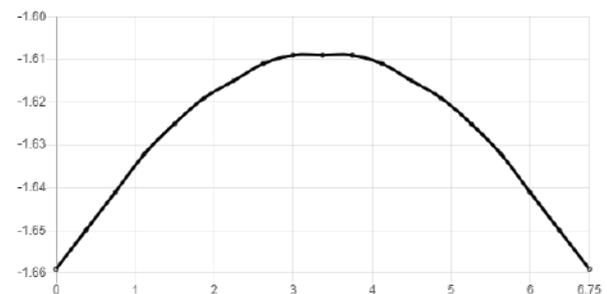


**Rib (RB\*) - Summary**

$\Delta = 0.1 \text{ mm} < \Delta_{\text{max}} = 21.7 \text{ mm}$   
 $M^*, \text{hog} = 0.2 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$   
 $M^*, \text{sag} = 0 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$   
 $V^*, \text{max} = 0.6 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

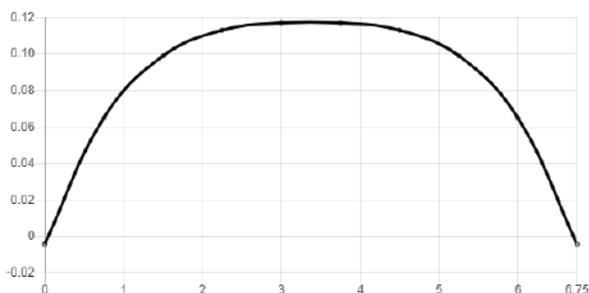
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



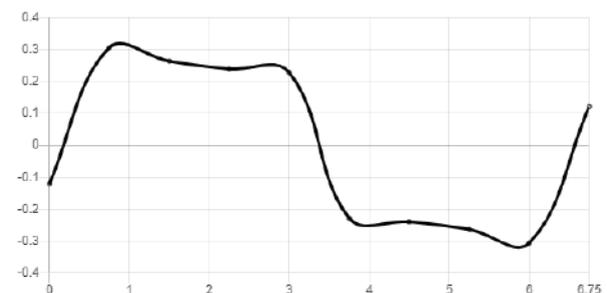
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

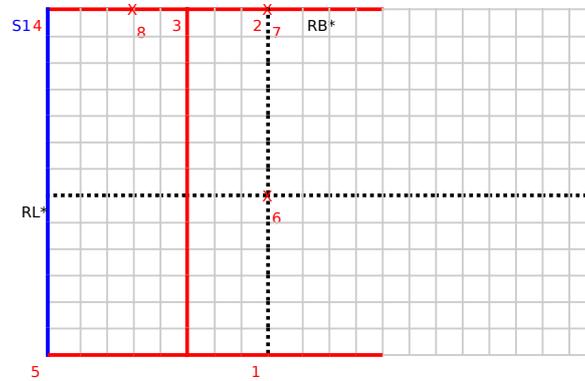


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



## Rectangle 2 - Loss of Support 1



### Loads

Loads in accordance with paragraph "Load Analysis"

### Notes

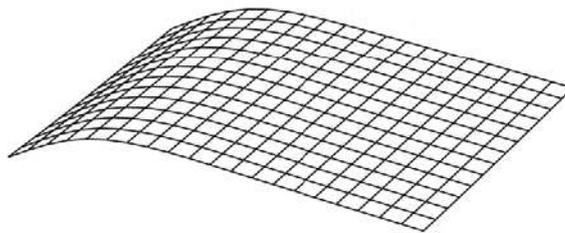
S: Line where maximum loss of support occurs

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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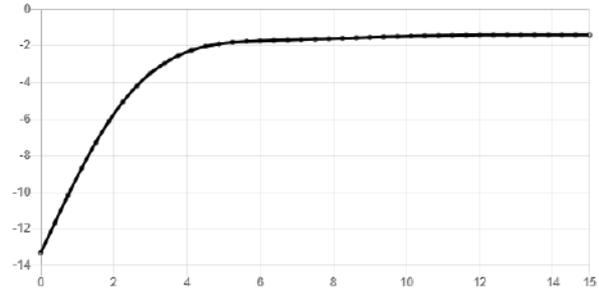


**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 260 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 27.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 29.2 \text{ kNm}$   
 $M^*, \text{sag} = 0.4 \text{ kNm} < \Phi M_{u, \text{sag}} = 30.3 \text{ kNm}$   
 $V^*, \text{max} = 17.6 \text{ kN} < \Phi V_u = 39.9 \text{ kN}$

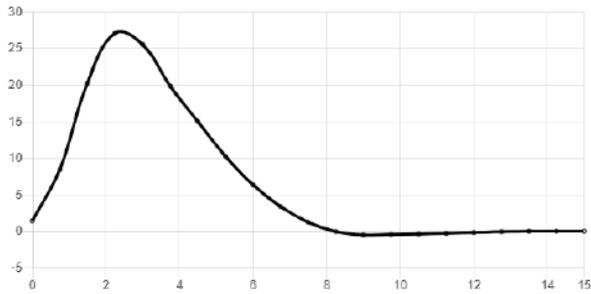
**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



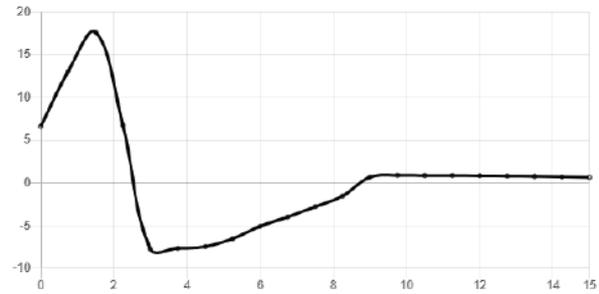
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]

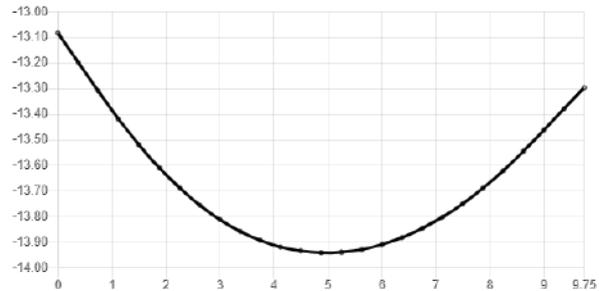


**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 1.6 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 1.5 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 5.9 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

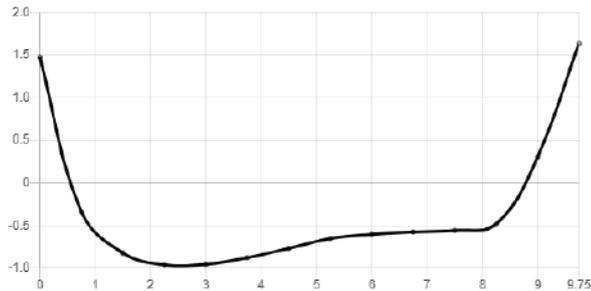
**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



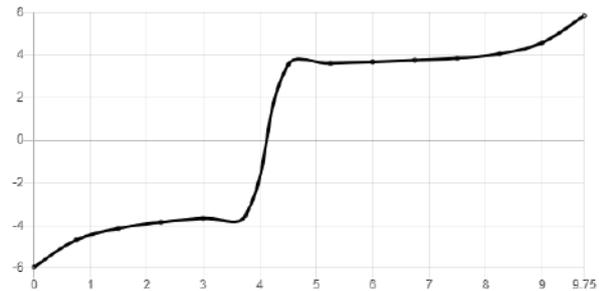
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]

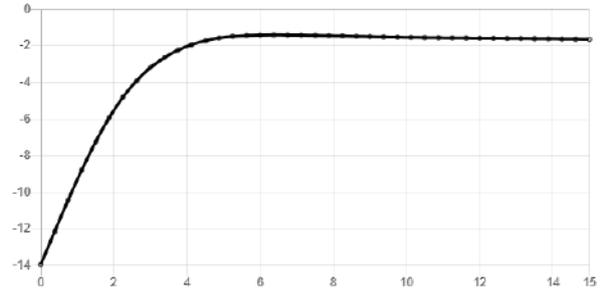


**Rib (RL\*) - Summary**

Deflection ratio = 1 in 234 < 1 in 200 over 2 m cantilever  
 $M^*,\text{hog} = 16.9 \text{ kNm} < \Phi M_{u,\text{hog}} = 19.4 \text{ kNm}$   
 $M^*,\text{sag} = 0.4 \text{ kNm} < \Phi M_{u,\text{sag}} = 16.9 \text{ kNm}$   
 $V^*,\text{max} = 10.8 \text{ kN} < \Phi V_u = 17 \text{ kN}$

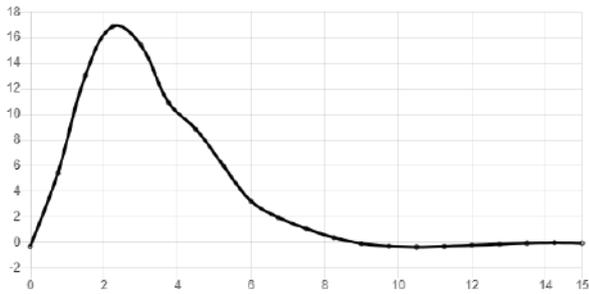
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



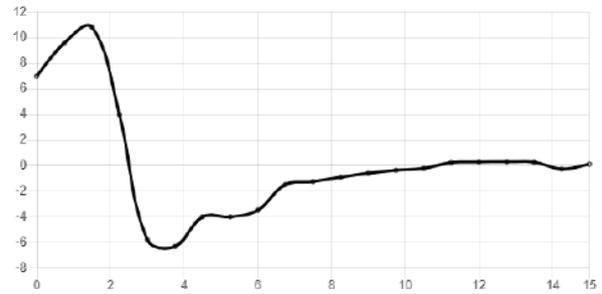
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*,\text{hog} = 1 \text{ kNm} < \Phi M_{u,\text{hog}} = 11 \text{ kNm}$   
 $M^*,\text{sag} = 1.5 \text{ kNm} < \Phi M_{u,\text{sag}} = 14.2 \text{ kNm}$   
 $V^*,\text{max} = 3.3 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

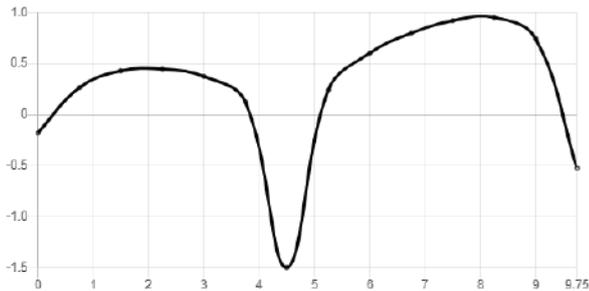
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



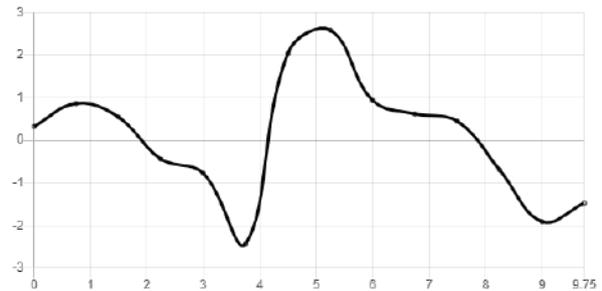
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

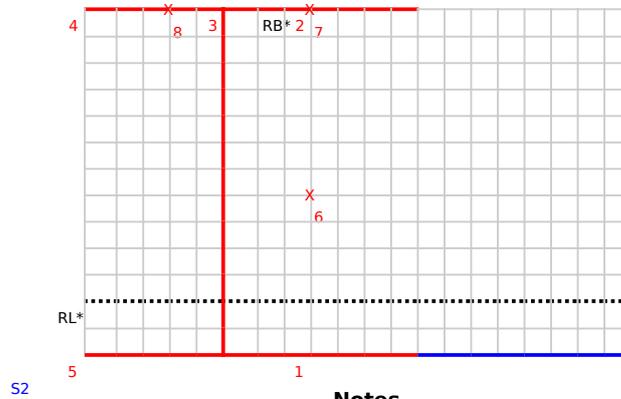


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 2 - Loss of Support 2



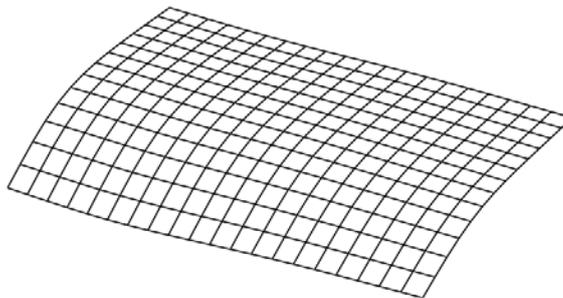
**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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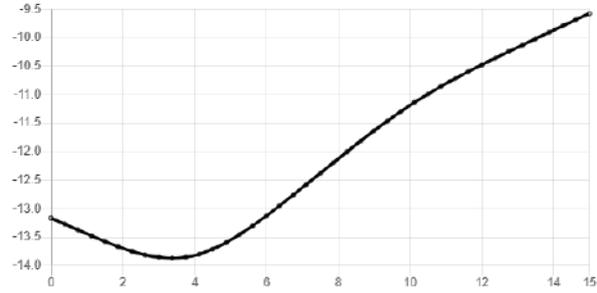
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**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 2 \text{ kNm} < \Phi M_{u, hog} = 20.9 \text{ kNm}$   
 $M^*, sag = 5.2 \text{ kNm} < \Phi M_{u, sag} = 27.5 \text{ kNm}$   
 $V^*, max = 4.5 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

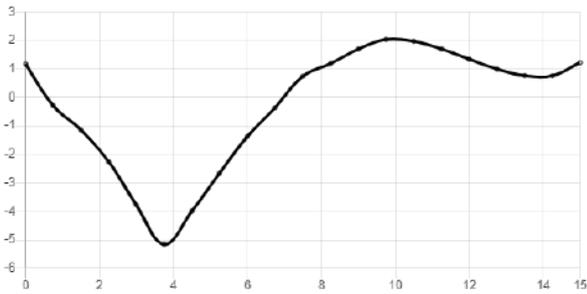
**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



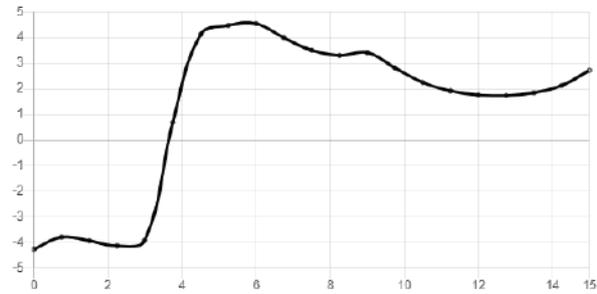
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]

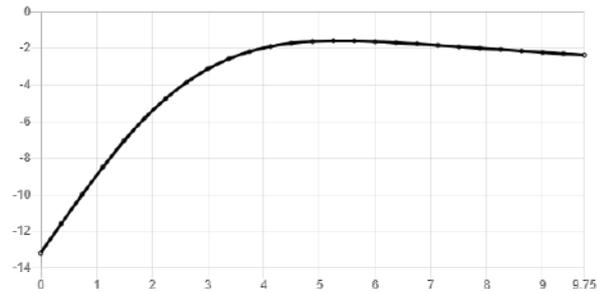


**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 254 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 27.7 \text{ kNm} < \Phi M_{u, hog} = 29.2 \text{ kNm}$   
 $M^*, sag = 0 \text{ kNm} < \Phi M_{u, sag} = 30.3 \text{ kNm}$   
 $V^*, max = 19.3 \text{ kN} < \Phi V_u = 39.9 \text{ kN}$

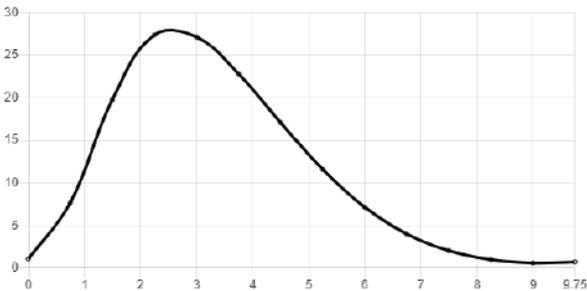
**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



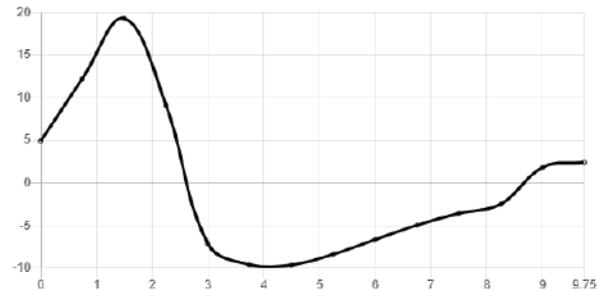
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]



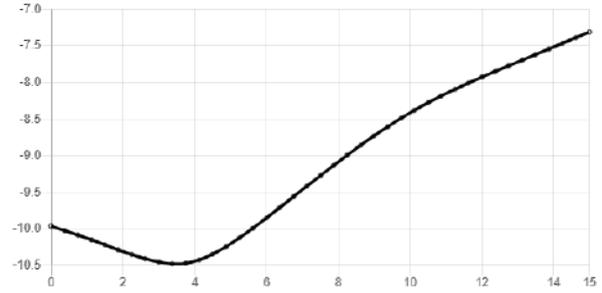
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**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 1.1 \text{ kNm} < \Phi Mu, hog = 11 \text{ kNm}$   
 $M^*, sag = 3.4 \text{ kNm} < \Phi Mu, sag = 14.2 \text{ kNm}$   
 $V^*, max = 4.1 \text{ kN} < \Phi Vu = 16.8 \text{ kN}$

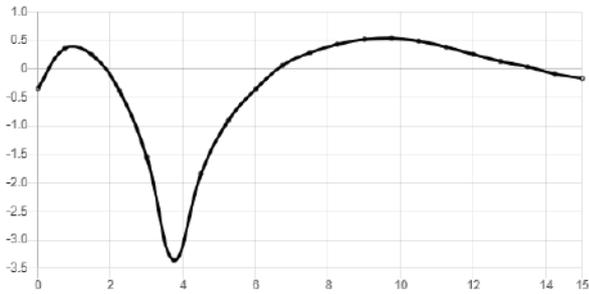
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



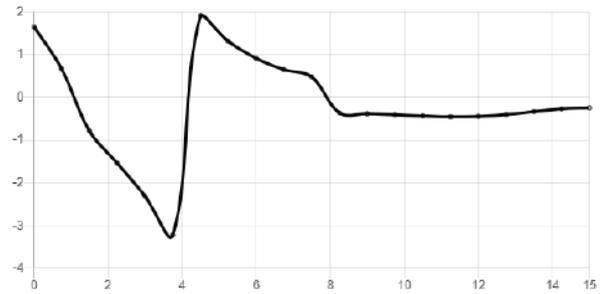
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

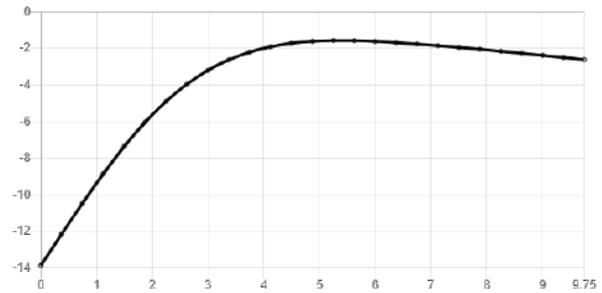


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 240 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 15.9 \text{ kNm} < \Phi Mu, hog = 19.4 \text{ kNm}$   
 $M^*, sag = 0.6 \text{ kNm} < \Phi Mu, sag = 16.9 \text{ kNm}$   
 $V^*, max = 11.7 \text{ kN} < \Phi Vu = 17 \text{ kN}$

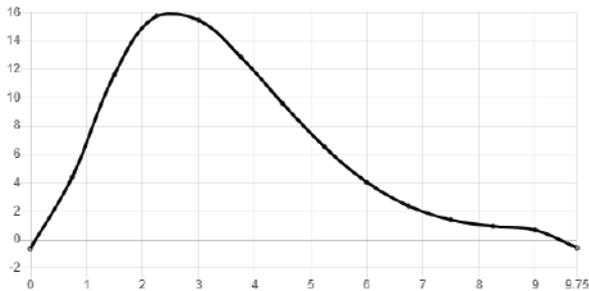
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



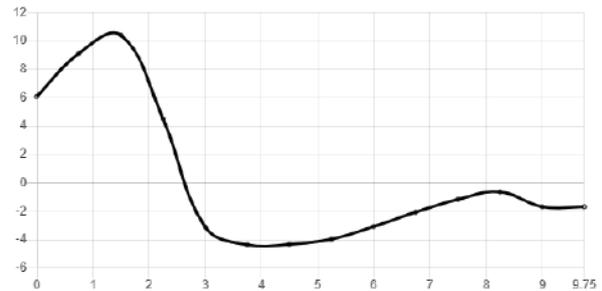
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

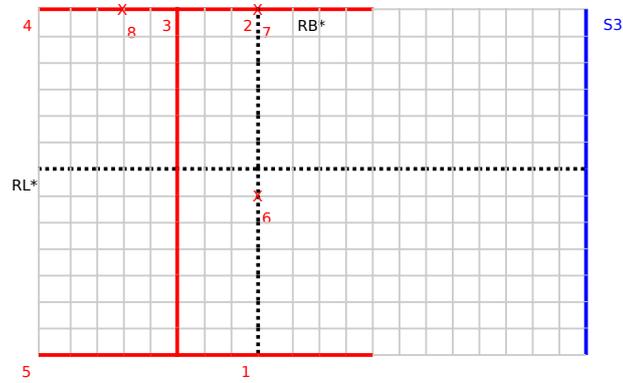


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



**Rectangle 2 - Loss of Support 3**



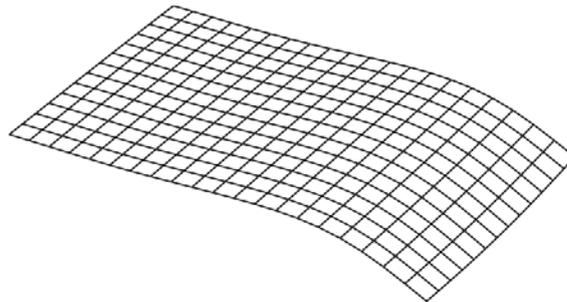
**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
 RL: Rib for analysis along L  
 RB: Rib for analysis along B  
 The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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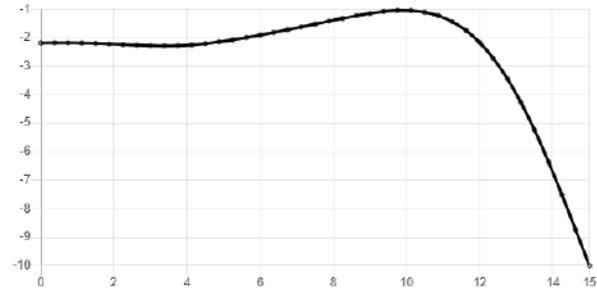


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 Received by  
 Kapiti Coast District Council  
 13/09/2023

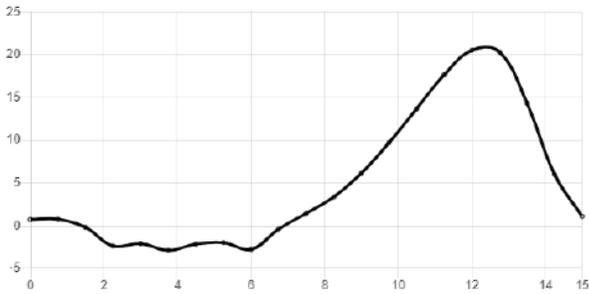
**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 327 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 20.9 \text{ kNm} < \phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 2.9 \text{ kNm} < \phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 12.4 \text{ kN} < \phi V_u = 39.4 \text{ kN}$

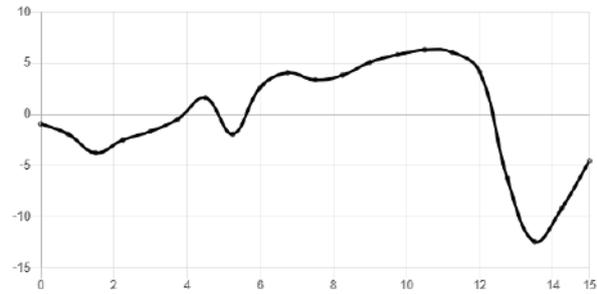
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



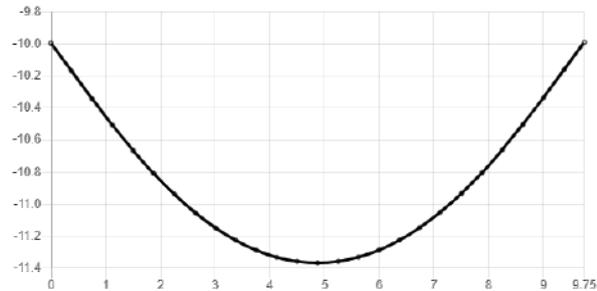
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



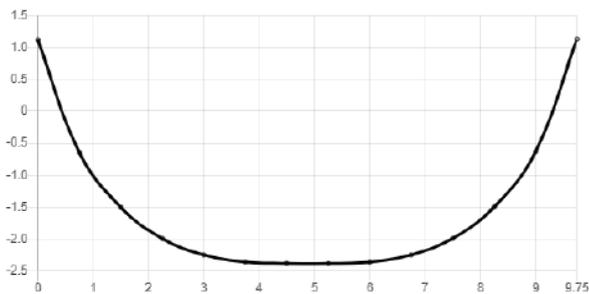
**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 1.1 \text{ kNm} < \phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 2.7 \text{ kNm} < \phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 4.5 \text{ kN} < \phi V_u = 39.4 \text{ kN}$

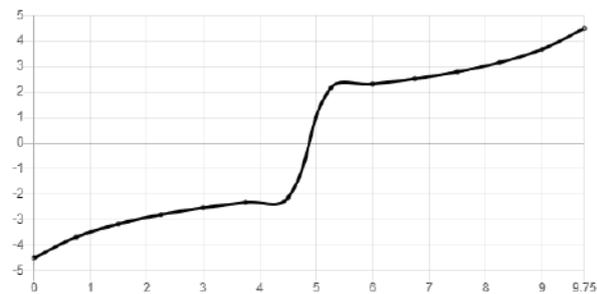
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



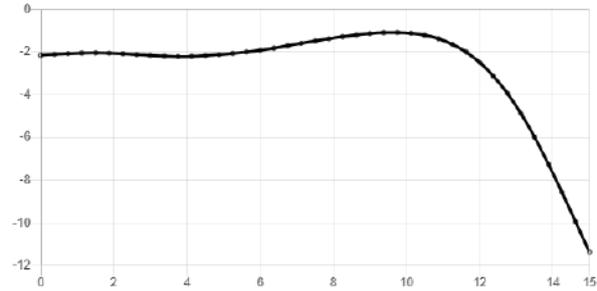
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**Rib (RL\*) - Summary**

Deflection ratio = 1 in 290 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 12.5 \text{ kNm} < \Phi M_{u, \text{hog}} = 19.4 \text{ kNm}$   
 $M^*, \text{sag} = 2.9 \text{ kNm} < \Phi M_{u, \text{sag}} = 16.9 \text{ kNm}$   
 $V^*, \text{max} = 8 \text{ kN} < \Phi V_u = 17 \text{ kN}$

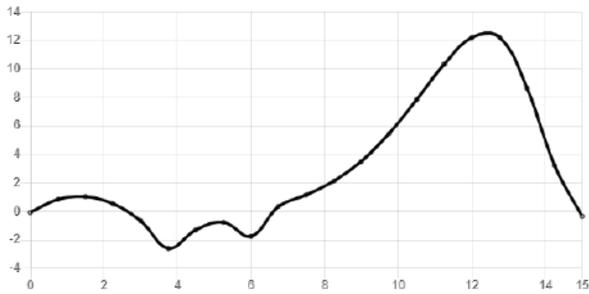
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



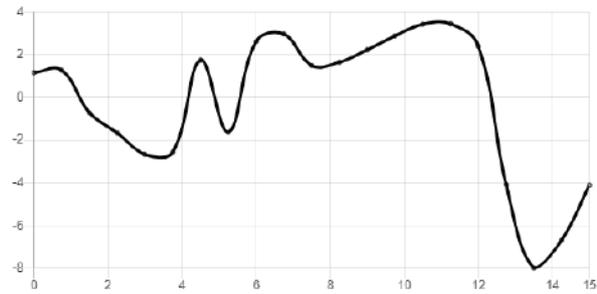
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

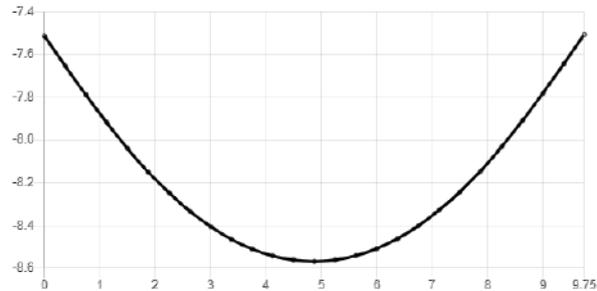


**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 1 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$   
 $M^*, \text{sag} = 1.5 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$   
 $V^*, \text{max} = 2.8 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

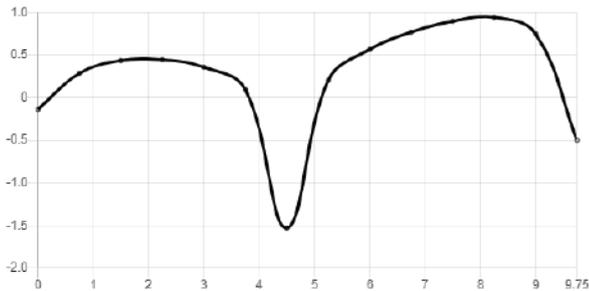
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



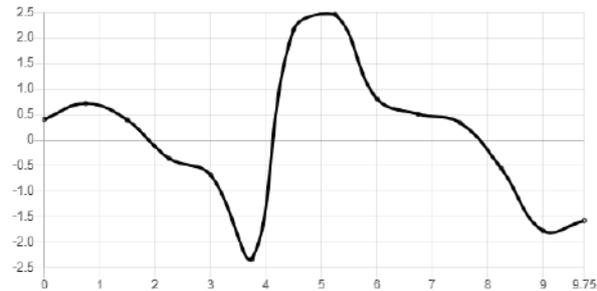
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

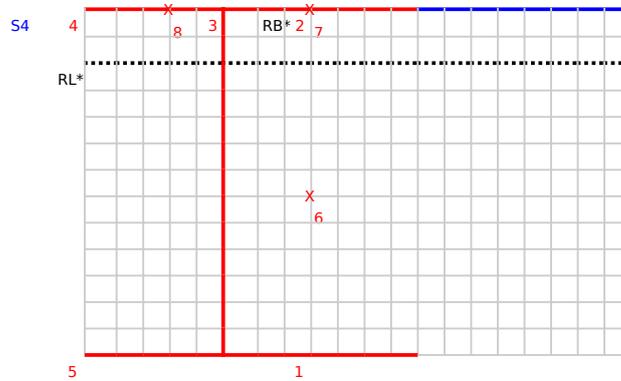


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



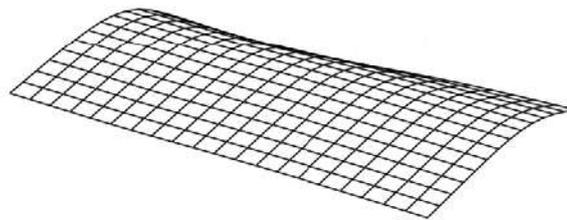
### Rectangle 2 - Loss of Support 4



**Loads**  
Loads in accordance with paragraph "Load Analysis"

**Notes**  
S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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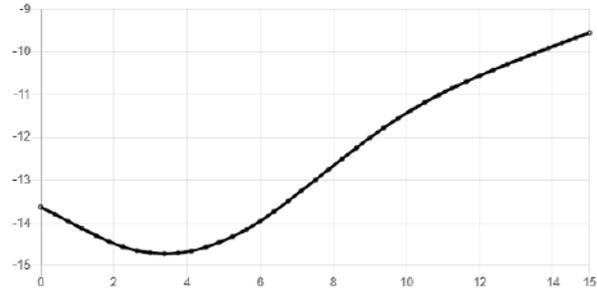


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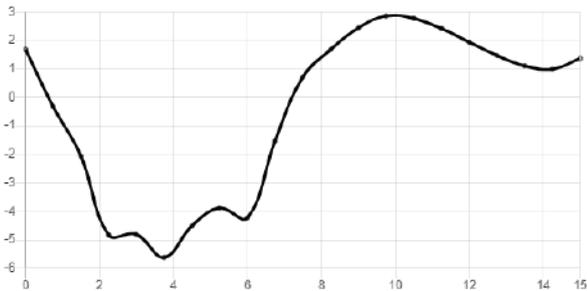
**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 2.9 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 5.7 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 6.5 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

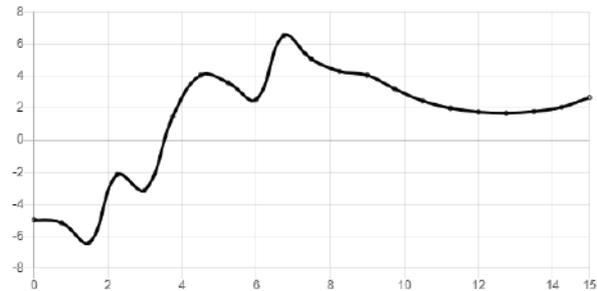
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



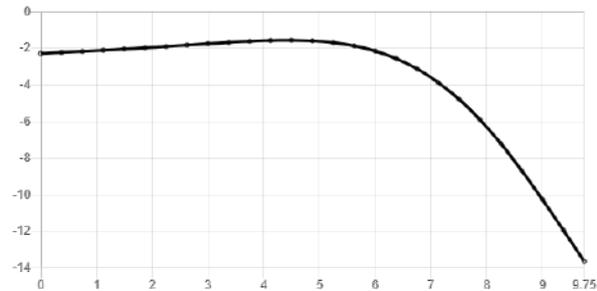
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



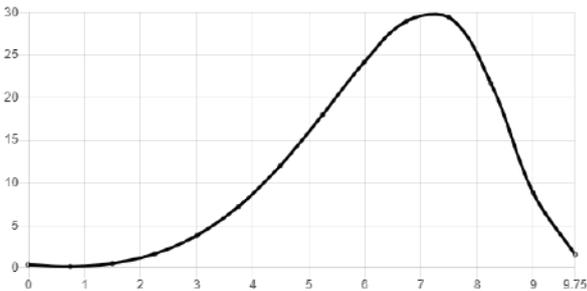
**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 242 < 1 in 200 over 2 m cantilever  
 $M^*, \text{hog} = 29.7 \text{ kNm} < \Phi M_{u, \text{hog}} = 37.5 \text{ kNm}$   
 $M^*, \text{sag} = 0 \text{ kNm} < \Phi M_{u, \text{sag}} = 32.9 \text{ kNm}$   
 $V^*, \text{max} = 19.9 \text{ kN} < \Phi V_u = 39.9 \text{ kN}$

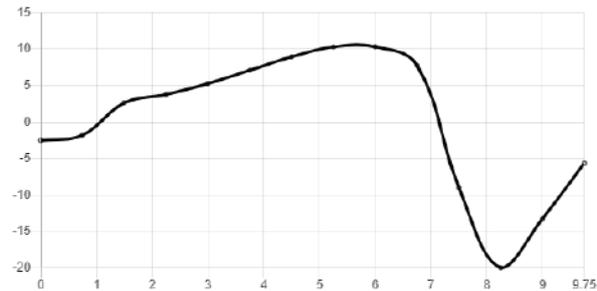
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



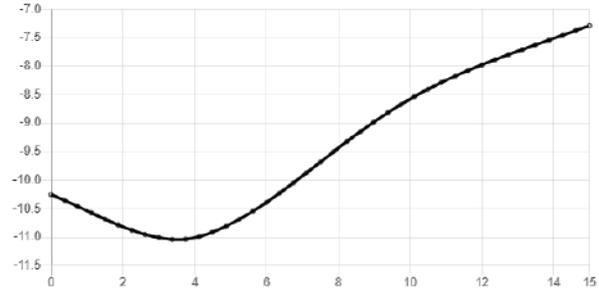
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**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 1.2 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 3.7 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 4.2 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

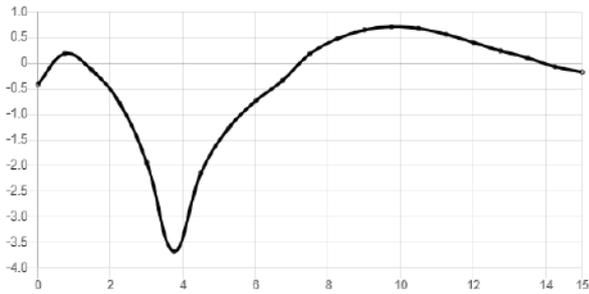
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



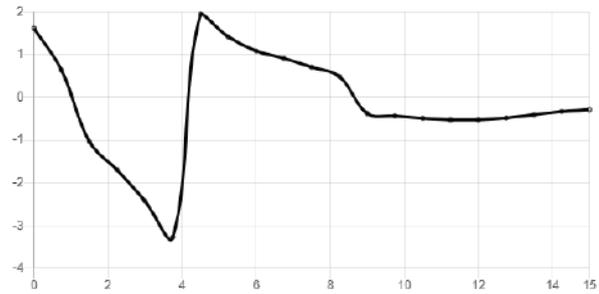
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

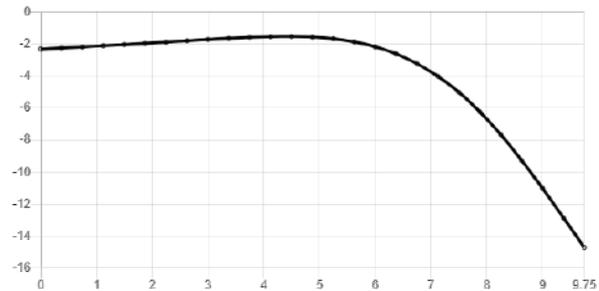


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 222 < 1 in 200 over 2 m cantilever  
 $M^*, hog = 17.5 \text{ kNm} < \Phi M_{u, hog} = 19.4 \text{ kNm}$   
 $M^*, sag = 1 \text{ kNm} < \Phi M_{u, sag} = 16.9 \text{ kNm}$   
 $V^*, max = 12.6 \text{ kN} < \Phi V_u = 17 \text{ kN}$

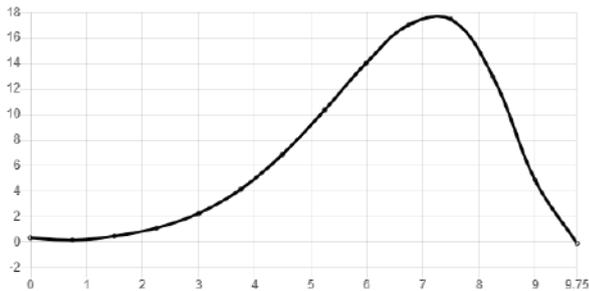
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



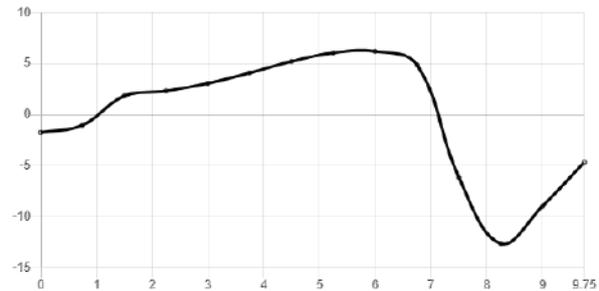
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

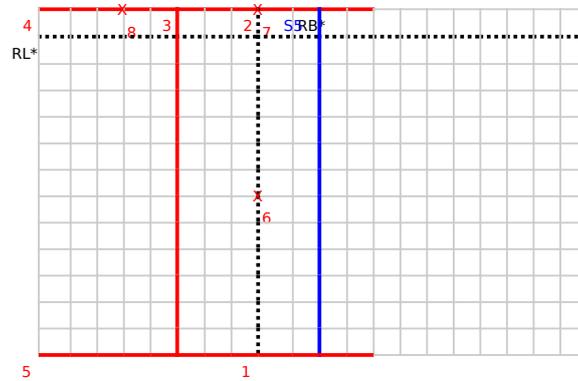


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



### Rectangle 2 - Loss of Support 5



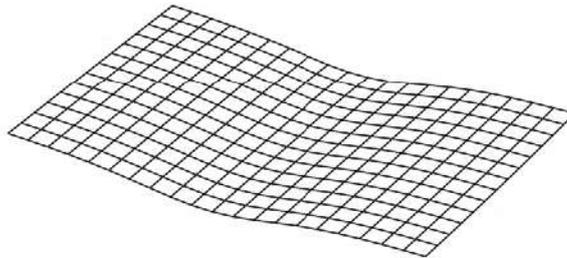
**Loads**

Loads in accordance with paragraph "Load Analysis"

**Notes**

S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

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**Edge Beam (EL) - Summary**

Deflection ratio = 1 in 1740 < 1 in 400 over 4 m length  
 $M^*, hog = 6.4 \text{ kNm} < \Phi M_{u, hog} = 20.9 \text{ kNm}$   
 $M^*, sag = 14.1 \text{ kNm} < \Phi M_{u, sag} = 27.5 \text{ kNm}$   
 $V^*, max = 13.2 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

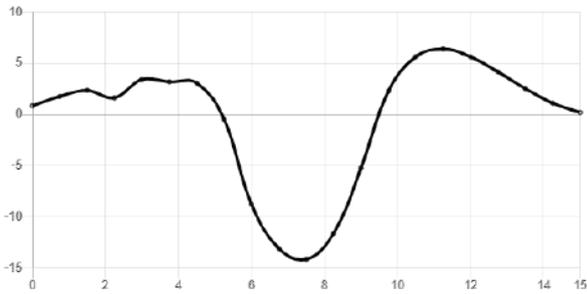
**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



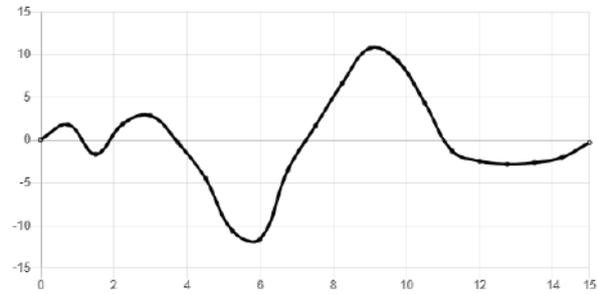
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]

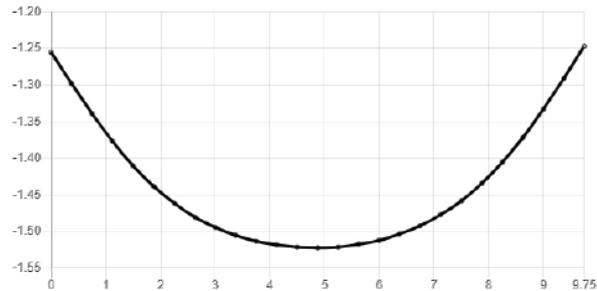


**Edge Beam (EB) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 0.9 \text{ kNm} < \Phi M_{u, hog} = 20.9 \text{ kNm}$   
 $M^*, sag = 0.1 \text{ kNm} < \Phi M_{u, sag} = 27.5 \text{ kNm}$   
 $V^*, max = 2.9 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



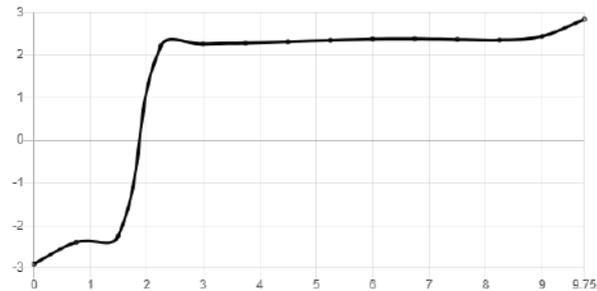
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]



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**Rib (RL\*) - Summary**

Deflection ratio = 1 in 1407 < 1 in 400 over 4 m length  
 $M^*, hog = 3.5 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 7.8 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 8 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

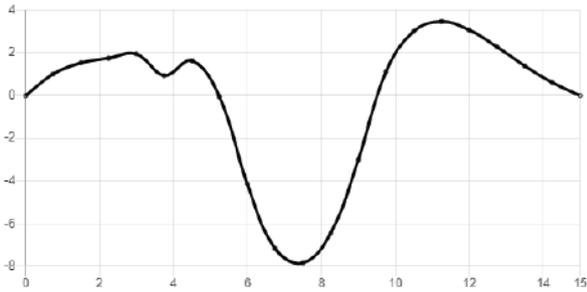
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



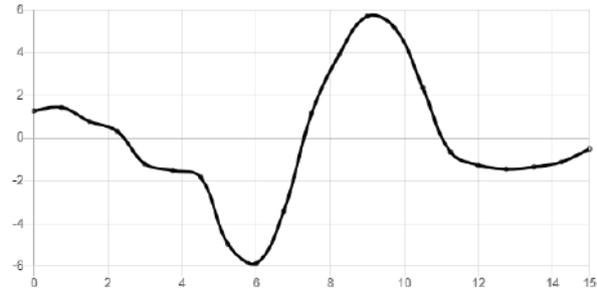
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

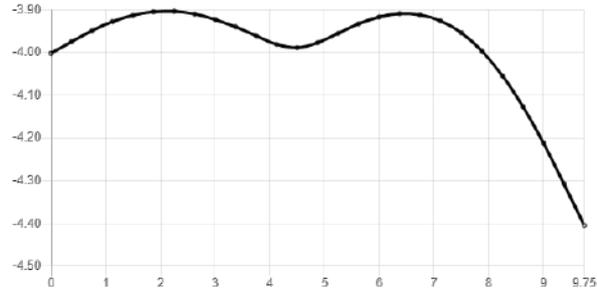


**Rib (RB\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 1 \text{ kNm} < \Phi M_{u, hog} = 11 \text{ kNm}$   
 $M^*, sag = 1.5 \text{ kNm} < \Phi M_{u, sag} = 14.2 \text{ kNm}$   
 $V^*, max = 2.7 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

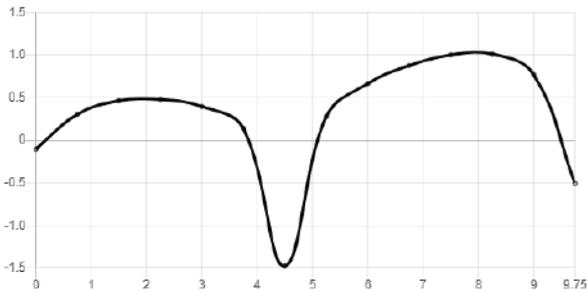
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



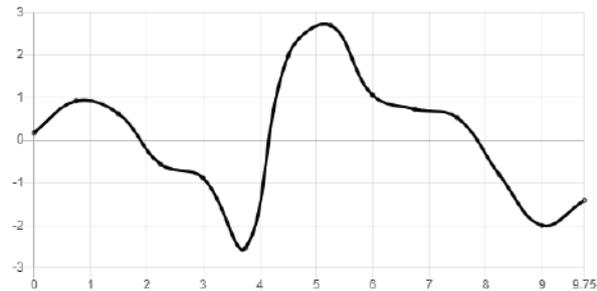
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]

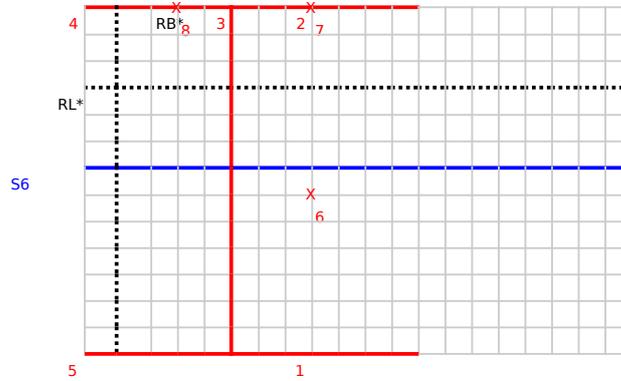


**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



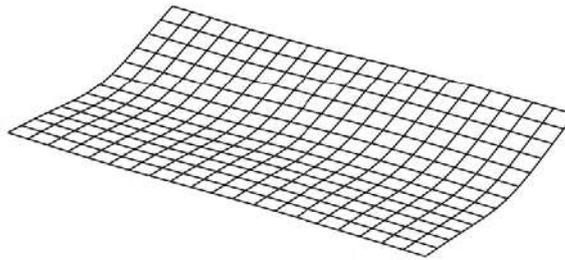
### Rectangle 2 - Loss of Support 6



**Loads**  
Loads in accordance with paragraph "Load Analysis"

**Notes**  
S: Line where maximum loss of support occurs  
RL: Rib for analysis along L  
RB: Rib for analysis along B  
The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.

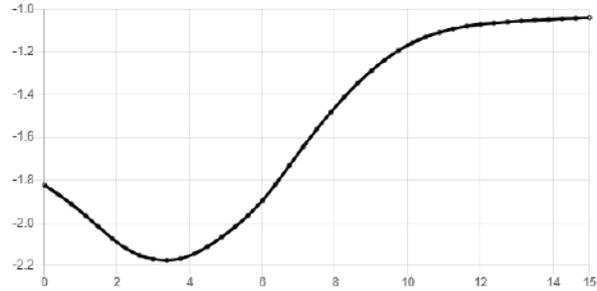
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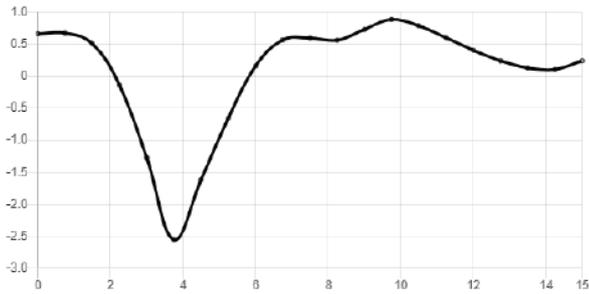
**Edge Beam (EL) - Summary**

Deflection ratio check not required along this direction  
 $M^*, \text{hog} = 0.9 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 2.6 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 2.8 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

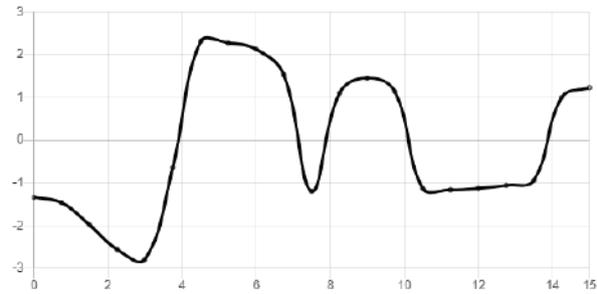
**Edge Beam (EL) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EL) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



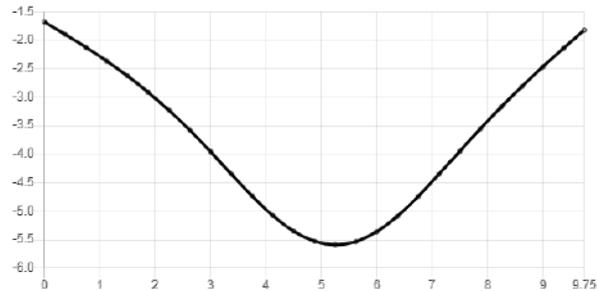
**Edge Beam (EL) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]



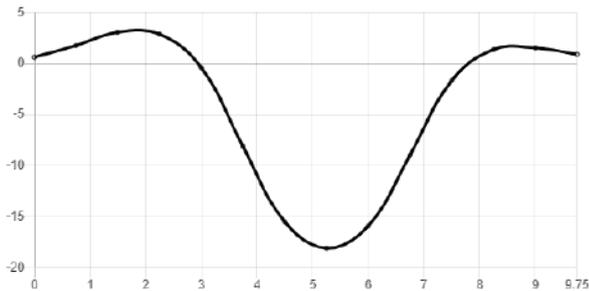
**Edge Beam (EB) - Summary**

Deflection ratio = 1 in 1506 < 1 in 400 over 4 m length  
 $M^*, \text{hog} = 3.1 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 18 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 13.3 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

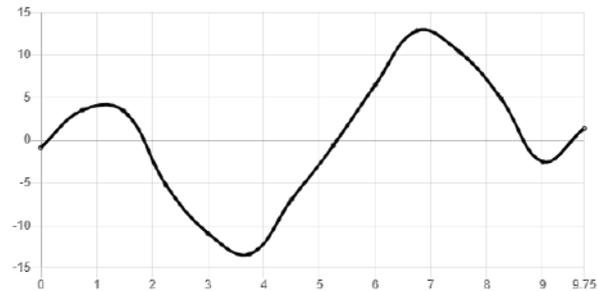
**Edge Beam (EB) - Deflection**  
 [X:m, Y:mm]



**Edge Beam (EB) - Bending Moment (M\*)**  
 [X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**  
 [X:m, Y:kN/rib]

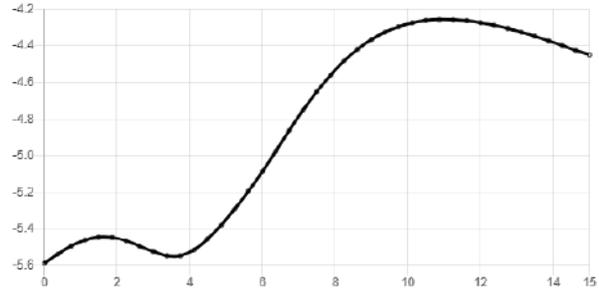


**Rib (RL\*) - Summary**

Deflection ratio check not required along this direction  
 $M^*, hog = 1.1 \text{ kNm} < \Phi Mu, hog = 11 \text{ kNm}$   
 $M^*, sag = 2.8 \text{ kNm} < \Phi Mu, sag = 14.2 \text{ kNm}$   
 $V^*, max = 3.7 \text{ kN} < \Phi Vu = 16.8 \text{ kN}$

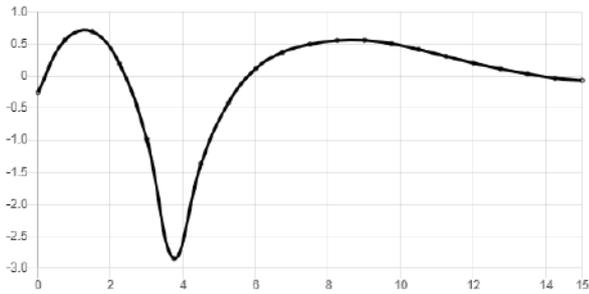
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



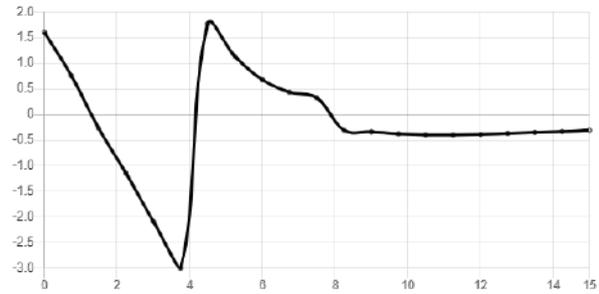
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

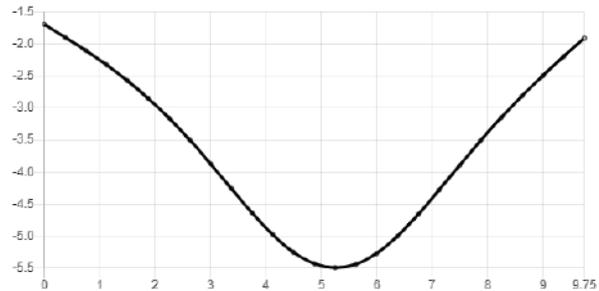


**Rib (RB\*) - Summary**

Deflection ratio = 1 in 1512 < 1 in 400 over 4 m length  
 $M^*, hog = 2.1 \text{ kNm} < \Phi Mu, hog = 11 \text{ kNm}$   
 $M^*, sag = 10.1 \text{ kNm} < \Phi Mu, sag = 14.2 \text{ kNm}$   
 $V^*, max = 7.8 \text{ kN} < \Phi Vu = 16.8 \text{ kN}$

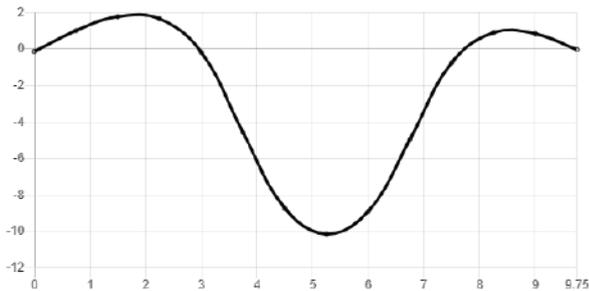
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



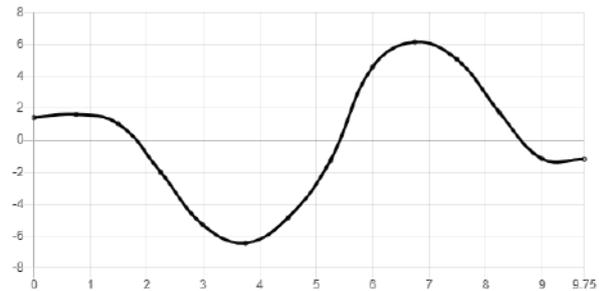
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



**Rectangle 2 - Pressure Analysis (Short Term)**

**Rib**

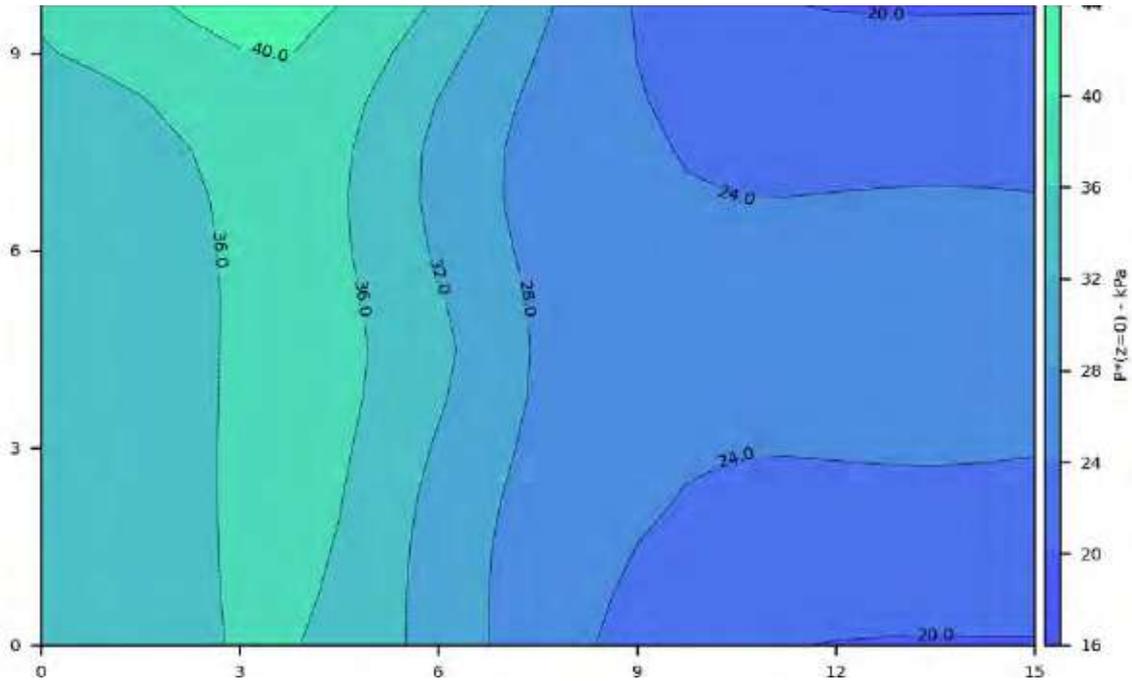
**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , short term = 40.7 kPa

**Pressure on natural soil**  
 Engineered Fill Thickness = 200 mm  
 $P^*$ , short term = 18.4 kPa < DBC = 100 kPa

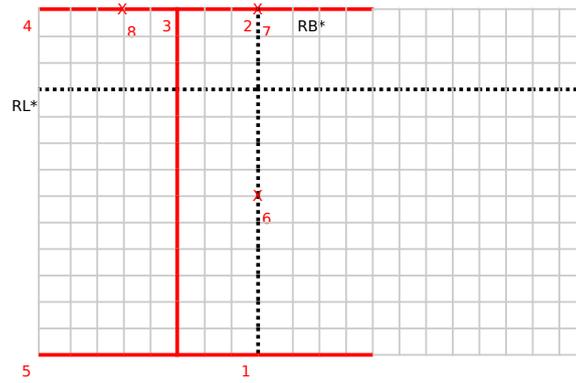
**Edge Beam**

**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , short term = 41.5 kPa

**Pressure on natural soil**  
 Engineered Fill Thickness = 200 mm  
 $P^*$ , short term = 33.3 kPa < DBC = 100 kPa



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**Loads**

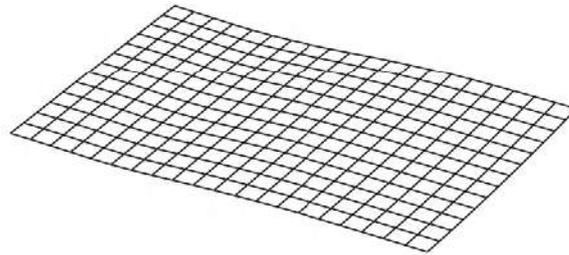
Loads in accordance with paragraph "Load Analysis"

**Notes**

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



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### Edge Beam (EL) - Summary

Deflection check not applicable for a ULS Short Term combination.

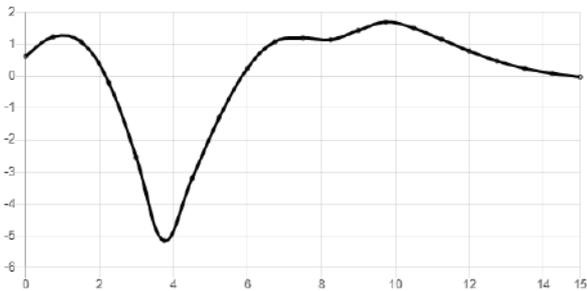
Refer to Long Term combination check.

$M^*,\text{hog} = 1.7 \text{ kNm} < \Phi M_{u,\text{hog}} = 20.9 \text{ kNm}$

$M^*,\text{sag} = 5.1 \text{ kNm} < \Phi M_{u,\text{sag}} = 27.5 \text{ kNm}$

$V^*,\text{max} = 4.7 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

### Edge Beam (EL) - Bending Moment (M\*) [X:m, Y:kNm/rib]

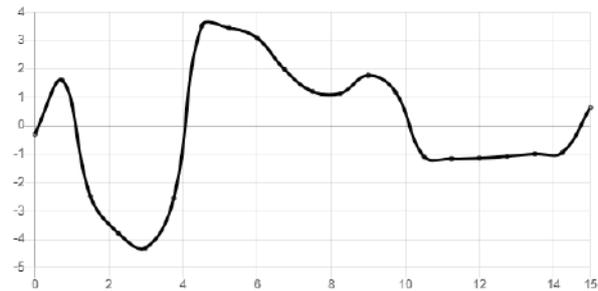


### Edge Beam (EL) - Deflection [X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Edge Beam (EL) - Shear Force (V\*) [X:m, Y:kN/rib]



### Edge Beam (EB) - Summary

Deflection check not applicable for a ULS Short Term combination.

Refer to Long Term combination check.

$M^*,\text{hog} = 0 \text{ kNm} < \Phi M_{u,\text{hog}} = 20.9 \text{ kNm}$

$M^*,\text{sag} = 1.2 \text{ kNm} < \Phi M_{u,\text{sag}} = 27.5 \text{ kNm}$

$V^*,\text{max} = 2.8 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

### Edge Beam (EB) - Bending Moment (M\*) [X:m, Y:kNm/rib]

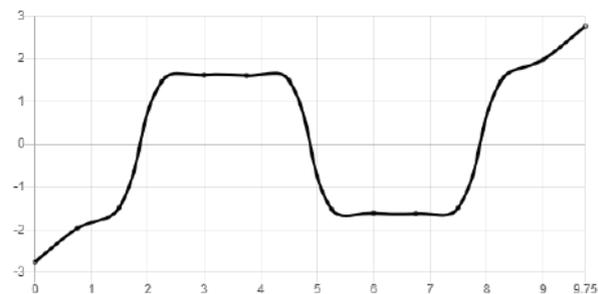


### Edge Beam (EB) - Deflection [X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Edge Beam (EB) - Shear Force (V\*) [X:m, Y:kN/rib]



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### Rib (RL\*) - Summary

Deflection check not applicable for a ULS Short Term combination.

Refer to Long Term combination check.

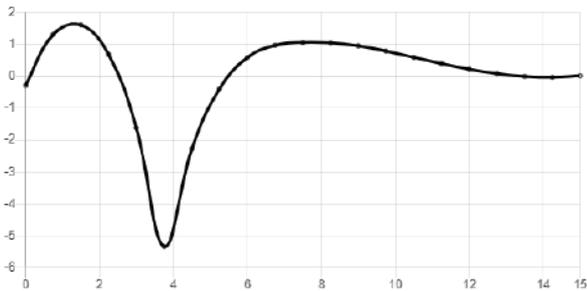
$M^*,\text{hog} = 2 \text{ kNm} < \Phi M_{u,\text{hog}} = 11 \text{ kNm}$

$M^*,\text{sag} = 5.3 \text{ kNm} < \Phi M_{u,\text{sag}} = 14.2 \text{ kNm}$

$V^*,\text{max} = 6.1 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

### Rib (RL\*) - Bending Moment (M\*)

[X:m, Y:kNm/rib]



### Rib (RL\*) - Deflection

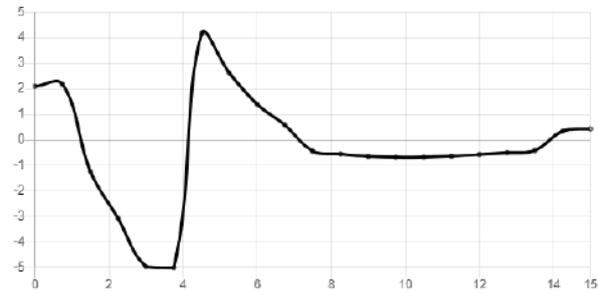
[X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Rib (RL\*) - Shear Force (V\*)

[X:m, Y:kN/rib]



### Rib (RB\*) - Summary

Deflection check not applicable for a ULS Short Term combination.

Refer to Long Term combination check.

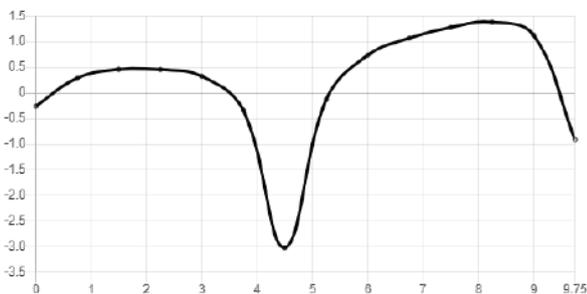
$M^*,\text{hog} = 1.4 \text{ kNm} < \Phi M_{u,\text{hog}} = 11 \text{ kNm}$

$M^*,\text{sag} = 3 \text{ kNm} < \Phi M_{u,\text{sag}} = 14.2 \text{ kNm}$

$V^*,\text{max} = 5 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

### Rib (RB\*) - Bending Moment (M\*)

[X:m, Y:kNm/rib]



### Rib (RB\*) - Deflection

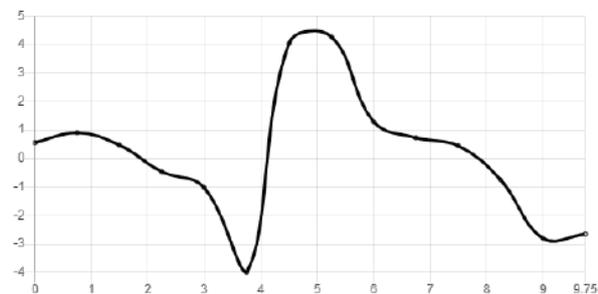
[X:m, Y:mm]

Deflection diagram not applicable for a ULS Short Term combination.

Refer to Long Term combination diagram.

### Rib (RB\*) - Shear Force (V\*)

[X:m, Y:kN/rib]



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**Rectangle 2 - Pressure Analysis (Long Term)**

**Rib**

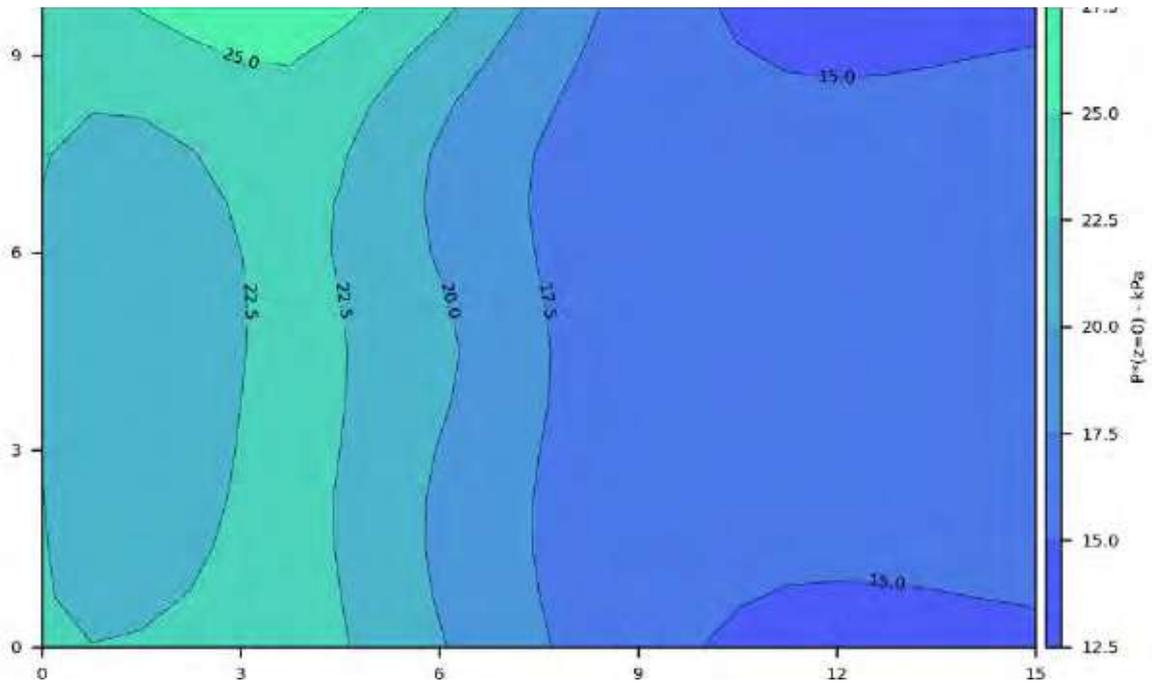
**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , long term = 25.8 kPa

**Pressure on natural soil**  
 Engineered Fill Thickness = 200 mm  
 $P^*$ , long term = 11.9 kPa < ABC = 66.7 kPa

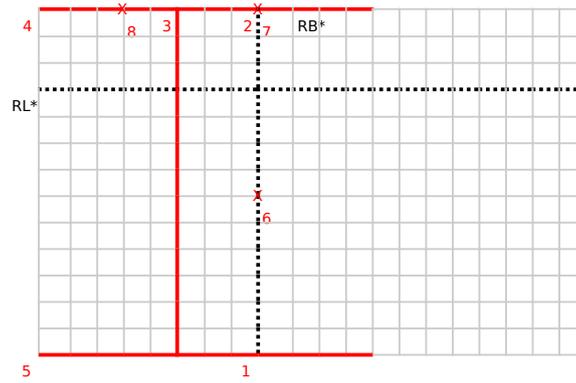
**Edge Beam**

**Pressure at the foundation/building platform interface:**  
 $P^*(z=0)$ , long term = 26.4 kPa

**Pressure on natural soil**  
 Engineered Fill Thickness = 200 mm  
 $P^*$ , long term = 21.5 kPa < ABC = 66.7 kPa



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**Loads**

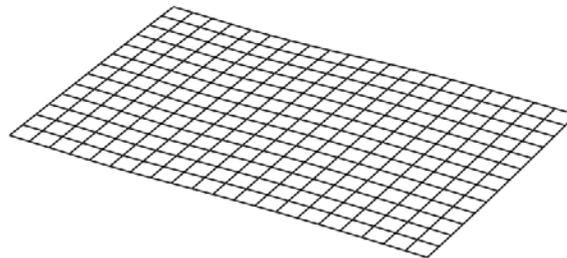
Loads in accordance with paragraph "Load Analysis"

**Notes**

RL: Rib for analysis along L

RB: Rib for analysis along B

The loads shown on this diagram are additional to the edge loads induced by the external walls and to the uniform surface load induced by the waffle raft.



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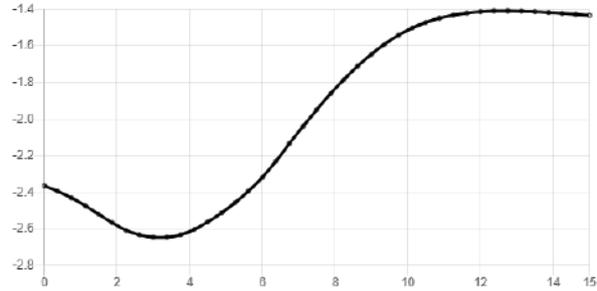
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**Edge Beam (EL) - Summary**

$\Delta = 1.2 \text{ mm} < \Delta_{\text{max}} = 40 \text{ mm}$   
 $M^*, \text{hog} = 1 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 2.7 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 2.7 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

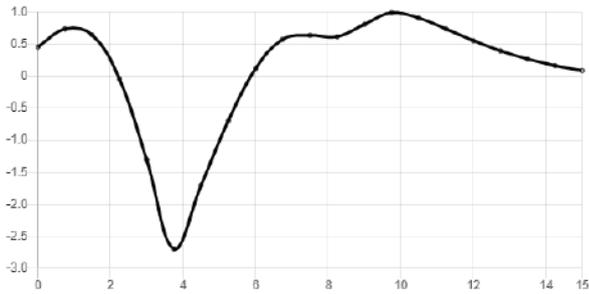
**Edge Beam (EL) - Deflection**

[X:m, Y:mm]



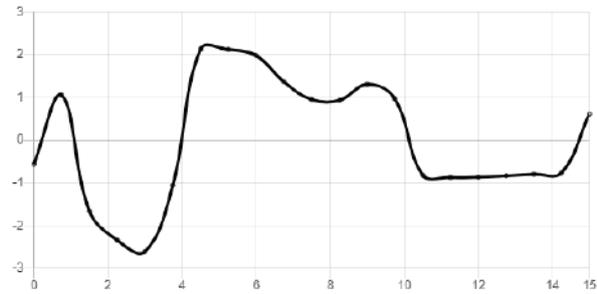
**Edge Beam (EL) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EL) - Shear Force (V\*)**

[X:m, Y:kN/rib]

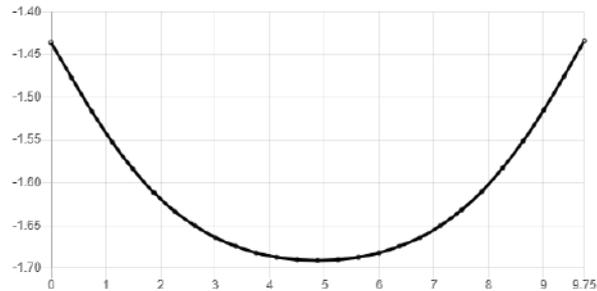


**Edge Beam (EB) - Summary**

$\Delta = 0.3 \text{ mm} < \Delta_{\text{max}} = 31.7 \text{ mm}$   
 $M^*, \text{hog} = 0.8 \text{ kNm} < \Phi M_{u, \text{hog}} = 20.9 \text{ kNm}$   
 $M^*, \text{sag} = 0 \text{ kNm} < \Phi M_{u, \text{sag}} = 27.5 \text{ kNm}$   
 $V^*, \text{max} = 2.6 \text{ kN} < \Phi V_u = 39.4 \text{ kN}$

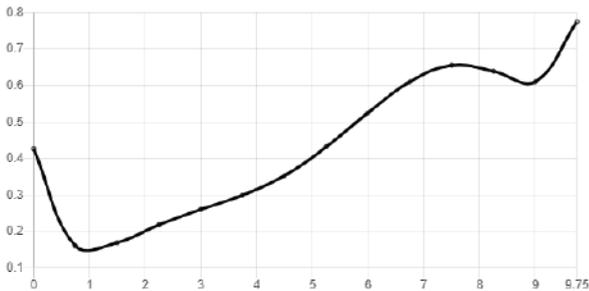
**Edge Beam (EB) - Deflection**

[X:m, Y:mm]



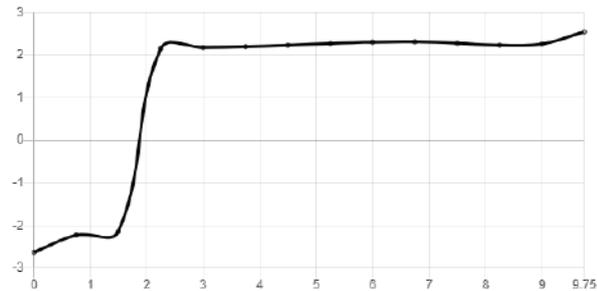
**Edge Beam (EB) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Edge Beam (EB) - Shear Force (V\*)**

[X:m, Y:kN/rib]

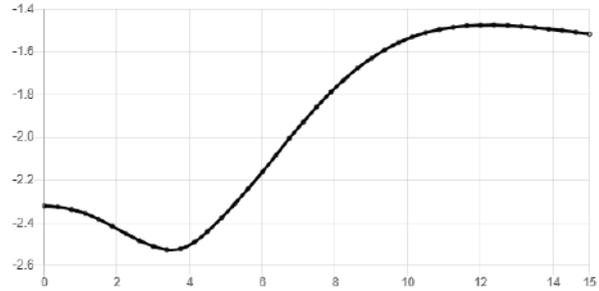


**Rib (RL\*) - Summary**

$\Delta = 1 \text{ mm} < \Delta_{\text{max}} = 40 \text{ mm}$   
 $M^*, \text{hog} = 1.2 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$   
 $M^*, \text{sag} = 2.7 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$   
 $V^*, \text{max} = 3.3 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

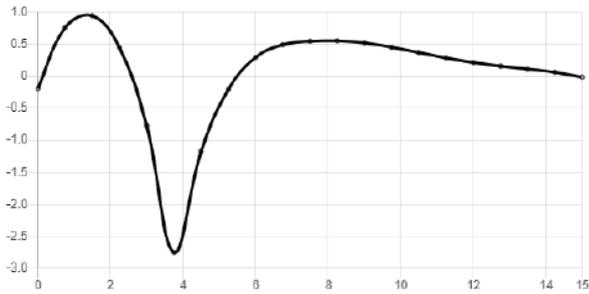
**Rib (RL\*) - Deflection**

[X:m, Y:mm]



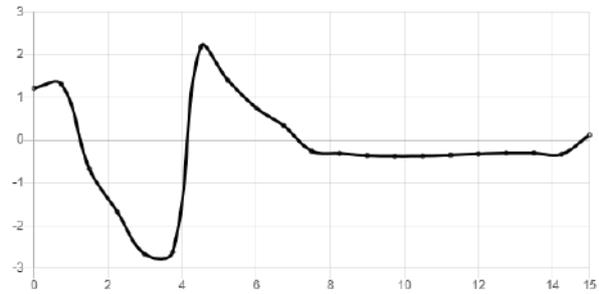
**Rib (RL\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RL\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]

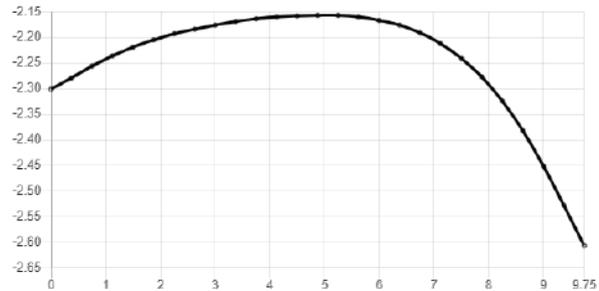


**Rib (RB\*) - Summary**

$\Delta = 0.4 \text{ mm} < \Delta_{\text{max}} = 31.7 \text{ mm}$   
 $M^*, \text{hog} = 1 \text{ kNm} < \Phi M_{u, \text{hog}} = 11 \text{ kNm}$   
 $M^*, \text{sag} = 1.7 \text{ kNm} < \Phi M_{u, \text{sag}} = 14.2 \text{ kNm}$   
 $V^*, \text{max} = 3 \text{ kN} < \Phi V_u = 16.8 \text{ kN}$

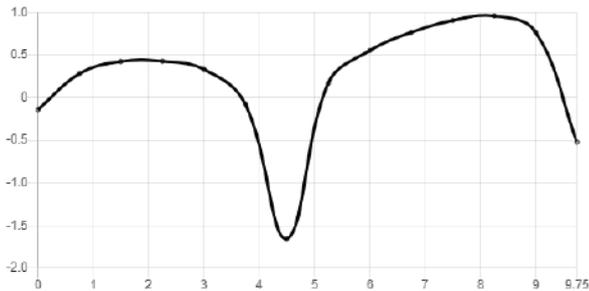
**Rib (RB\*) - Deflection**

[X:m, Y:mm]



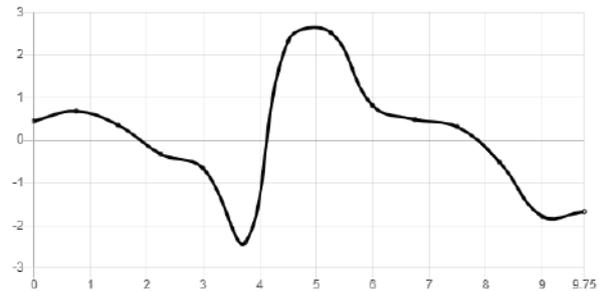
**Rib (RB\*) - Bending Moment (M\*)**

[X:m, Y:kNm/rib]



**Rib (RB\*) - Shear Force (V\*)**

[X:m, Y:kN/rib]



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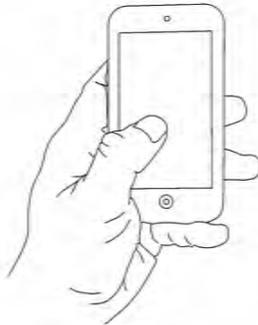
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3. Plans to be read in conjunction with the architectural documentation. The architect must be notified for any inconsistency, error or omission in the documents, or between documents.
4. All dimensions and levels are to be checked on site before fabrication.
5. Material performance to comply with all aspects of the NZ Building Code, approved documents and nzs 3804:2011.
6. Apply proprietary materials and components to the manufacturer's express written instructions.
7. Plans A3 format, do not scale drawings
8. All dimensions are in millimetres unless otherwise noted.
9. The drawings are to be read in conjunction with the installation procedure in sheet 4.
10. The installer shall assess the acceptability of the ground across the entire building platform before proceeding with the construction.
11. Refer to the geotechnical investigation report and/or geotechnical engineer recommendations for ground improvement works if any.

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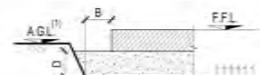
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**1 BUILDING PLATFORM**  
 N.T.S. - TYPICAL DETAIL



- ULTIMATE BEARING CAPACITY (UBC, kPa) ≥ 200
- ENGINEERED FILL DEPTH (D, mm) 200
- ENGINEERED FILL EXTENSION (B, mm) 200
- A29 BIDIM GEOTEXTILE AT BASE: NO
- TX190 GEOGRID (Number of layers) (2): 0

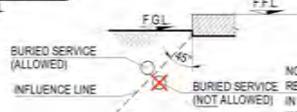
**NOTES:**

- (1) A.G.L. = -225 mm F.F.L. UNLESS OTHERWISE NOTED IN THE ARCHITECTURAL PLANS
- (2) ENGINEERED FILL: AP40 or AP65 95% DRY DENSITY 200 mm COMPACTION LAYERS (MAX). WHEN ENGINEERED FILL DEPTH 'D' IS ZERO, NO ENGINEERING FILL IS REQUIRED.
- (3) GEOGRID (WHEN REQUIRED) TO BE PLACED WITH THE FIRST GEOGRID SHEET AT BASE AND SUBSEQUENT GEOGRID LAYERS @ 200 mm INTERVALS

**SITE VERIFICATION CHECKS:**

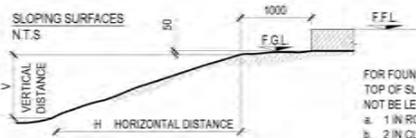
- ULTIMATE BEARING CAPACITY (UBC)
  - NO INTERFERING BURIED SERVICES
  - NO EVIDENCE OF EROSION OR LAND INSTABILITY
  - NO UNCONTROLLED LAND FILLING
  - NO ORGANICS
- The installer shall get the acceptability of the ground across the entire building platform assessed before proceeding with the construction.
- Cresco will require a soilcut report confirming what above as a condition for issuing a PSA.*
- Refer to the geotechnical investigation report and/or geotechnical engineer recommendations for ground improvement works if any.

**3 BURIED SERVICES**  
 N.T.S. - TYPICAL DETAIL



NO BURIED SERVICES OTHER THAN THE PIPES REQUIRED BY THE ARCHITECT AND CONSTRUCTED IN ACCORDANCE WITH THE DETAILS PROVIDED WITHIN THIS SET OF PLANS ALLOWED WITHIN THE INFLUENCE LINE

**4 SLOPING SURFACES**  
 N.T.S. - TYPICAL DETAIL



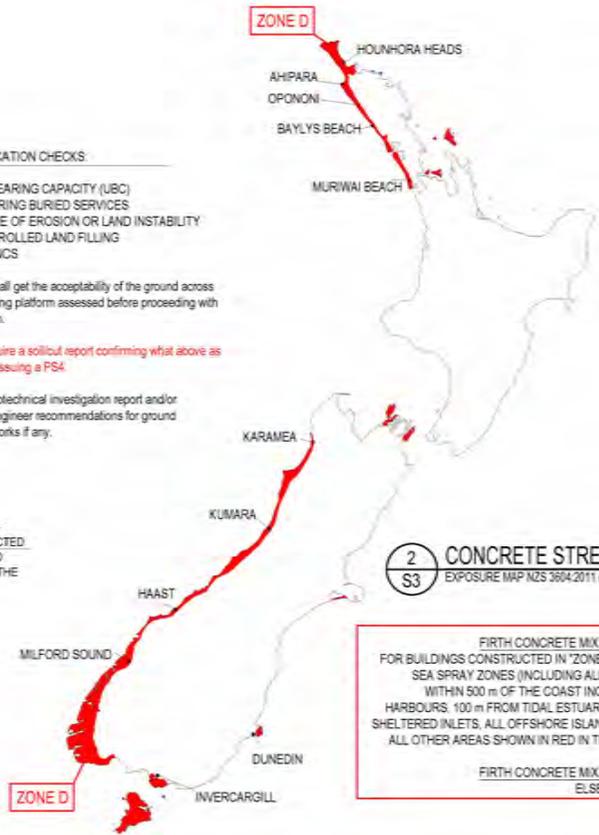
FOR FOUNDATIONS ERECTED AT THE TOP OF SLOPE THE H/V RATIO SHALL NOT BE LESS THAN:

- a. 1 IN ROCK
- b. 2 IN CLAY
- c. 3 IN OTHER MATERIALS

**2 CONCRETE STRENGTH**  
 EXPOSURE MAP NZS 3804:2011 cl. 4.2.3

FIRTH CONCRETE MIX IP2519X FOR BUILDINGS CONSTRUCTED IN 'ZONE D' AND SEA SPRAY ZONES (INCLUDING ALL AREAS WITHIN 500 m OF THE COAST INCLUDING HARBOURS, 100 m FROM TIDAL ESTUARIES AND SHELTERED INLETS, ALL OFFSHORE ISLANDS AND ALL OTHER AREAS SHOWN IN RED IN THE MAP)

FIRTH CONCRETE MIX IP2019X ELSEWHERE



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BUILDING PLATFORM & SEA SPRAY ZONES N.T.S. A3 S3  
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**1. SITE PREPARATION**

All vegetation, topsoil and other organic or deleterious material shall be removed from the area to be covered by the building (formation area) prior to commencing construction of the system.

**2. EARTHWORKS**

The formation area shall be prepared in accordance of detail 1S3 and under the supervision of a qualified professional.

Where fill is required to achieve this level or a suitable bearing capacity, the fill is subject to site verification and must be certified by personnel appointed by Cresco or, for fills that are less than 400 mm deep, shall be installed in accordance with Clause 7.5.3 of NZS 3604:2011 "Timber Framed Buildings". The installer / engineer shall get the acceptability of the ground over the entire building platform assessed before proceeding with the construction. Council inspectors might want to inspect site before slab construction commences.

**3. PLUMBING AND SERVICES (beneath the system)**

Plumbing and services required beneath the system should preferably be conveyed underground to their plan location (then brought up through the system). The trenching, placing, and bedding of the pipeducts and the backfilling of the trenches shall conform to the requirements of the consent documentation.

**4. SAND BLINDING**

A layer of sand shall be placed, screeded and compacted over the building platform, extending to at least 300 mm beyond the system perimeter. The maximum thickness of this blinding layer shall be 40 mm. If the ground has been softened (i.e. has a muddy surface layer due to construction activities), remove the softened material before placing the sand. Granular fill required if excavation lowers the ground surface to more than 40 mm below the underside of the foundation.

**5. DAMP PROOF MEMBRANE**

The RibRaft® Thermo DPM or NZS 3604 compliant DPM shall be laid over the entire building platform (to the outer edge of the perimeter at least) directly on top of the sand blinding layer. The joints shall be lapped 50 mm and sealed with RibRaft® Thermo Tape or pressure sensitive tape.

All penetrations of the DPM by plumbing and services or punctures during construction shall also be sealed with RibRaft® Thermo Tape or pressure sensitive tape.

**6. EDGE FORMWORK**

The edge formwork shall be constructed ensuring that the requirements of NZS 3109:1997 "Concrete Construction" are adhered to. The formwork shall be adequately supported and braced to prevent any buckling or warping. If the wall is to be constructed in masonry veneer, formwork for a masonry veneer rebate should be adequately fixed to the perimeter formwork. Foundation positioning and levels might need to be certified by a land surveyor before pouring, it is recommended to organize the inspection at this stage.

**7. LAYING THE PODS AND KEYSTONES**

The RibRaft® Xpod™ 215/750 or 215/1500 pods (as specified at sheet n.5) shall be laid out over the DPM in a regular waffle pattern ensuring direct contact with the ground across the entire pod. All pods shall be locked at each corner with a RibRaft® Xpod™ Keystone 816 connector. Make sure the Keystone connector pins engage and click into the holes placed at each corner of the pods. "Set out start" corner is indicated in this set of plans. Lay RibRaft® Xpod™ MINPOD 215/300 and ADJ215/350,700 pods any time (at the edges, steps, penetration lines...) a full pod does not fit within the available space.

**8. PLUMBING AND SERVICES (within the system)**

Services shall be placed in accordance with the details provided by Cresco and along orthogonal directions matching the pods layout. RibRaft® MINPODs 215/300 can be used to reduce concrete consumption along services lines. Allowed diameters of the services/ducts, positioning constraints and localized strengthenings are detailed within this set of plans.

**9. REINFORCING STEEL BARS**

The reinforcing bars in the ribs and edge beams shall conform to AS/NZS 4671:2001. Specifically designed spacers (RibRaft® Xpod™ Keystones 816) are used to hold in place and retain the reinforcing bars within the ribs in a secure manner until the concrete is placed with no need for the reinforcing bars to be tied.

50/65 bar chairs to be used to support the reinforcing bars within the edge beams as necessary. Reinforcing bars within the edge beams when not retained by keystones to be tied and fixed in their position. Unless otherwise noted, reinforcing bars shall lap as follow:  
10 mm diameter bars: 600 mm  
12 mm diameter bars: 720 mm  
16 mm diameter bars: 960 mm  
Unless otherwise specified, 50 mm cover to the edge of the beam and 50 mm cover to the DPM surface shall be allowed for.

**10. MESH REINFORCING**

Top reinforcing steel in the top slab, unless otherwise specified, shall consist of Welded Reinforcing Mesh complying with AS/NZS 4671:2001 with a minimum weight of 2.27 kg/m<sup>2</sup> (a lower characteristic stress of 500 MPa, square configuration of orthogonal bars between 150 to 300 mm centres and ductility class L or E). The Reinforcing Mesh shall be placed on top of RibRaft® pods without mesh chairs unless otherwise specified. The Reinforcing Mesh shall lap a minimum of 225 mm or 1 grid space + 50 mm (whichever ever is the greater). The Reinforcing Mesh shall be tied (1@600mm) at all laps. U.N.O. two bars (Grade 500E and diameter specified in sheet 5), 1200mm long shall be placed across the corner, tied to the top of the mesh at re-entrant corners at 200 mm centres, with 50 mm cover from the internal corner.

**11. CONCRETE PLACING AND FINISHING**

Concrete placing, finishing and curing shall be in accordance with NZS 3109:1997, Clause 7. Concrete to be poured monolithically. U.N.O. one of the following Firth concrete products shall be used in the system:

**1 FIRTH CONCRETE MIX IP2018X**

**2 FIRTH CONCRETE MIX IP2515X** for buildings constructed in the 'sea spray zone' (including all areas within 500 m of the coast including harbours, 100 m from local estuaries and sheltered inlets, all offshore islands and all other areas shown in red in the map in sheet 3)

The concrete shall be compacted with the use of an immersion vibrator around all steel and into all corners of the formwork.

Screeding with the aid of a level shall commence immediately after compaction. Unless specifically installed as a screeding datum, the top of the formwork shall not be assumed as level and thus shall not be used for screeding purposes. Final finishing with a trowel shall take place after all the bleed water has evaporated. The edge of the slab and rebates shall be tooled to prevent chipping of the top of the slab.

Early age care of the slab shall be in accordance with good trade practice appropriate for the weather conditions. The surface shall be a blemish free surface to class U3 finish (refer NZS 3114:1987). Proper curing of the concrete must take place immediately after finishing the concrete. One of the following methods of curing is recommended: (i) ponding or continuous sprinkling of water (ii) placing a wet covering or plastic membrane over the slab or (iii) using liquid membrane curing compounds. Immediate and continuous wet curing to reduce the maximum temperature and/or raise the minimum temperature to reduce the risk of this type of cracking.

No saw cuts are required unless specified, however, the contractor may opt to use saw cuts as they are not detrimental for the performance of the system. Shrinkage control joints shall be saw cut after

hardening. The saw cut shall be cut to a depth of 25mm and shall be cut no later than 24 hours in summer, or 48 hours in winter. The shrinkage control joints shall be positioned to coincide with major changes in floor plan.

Where the concrete is to be exposed or brittle covering placed over, the maximum intermediate bay sizes shall be limited to 6 m. Bay dimensions formed by shrinkage control joints shall be limited to a maximum ratio of length/width of 2:1.

The formwork shall not be removed prior to 12 hrs after the slab has been finished. No loads to be placed on the system before adequate curing has taken place.

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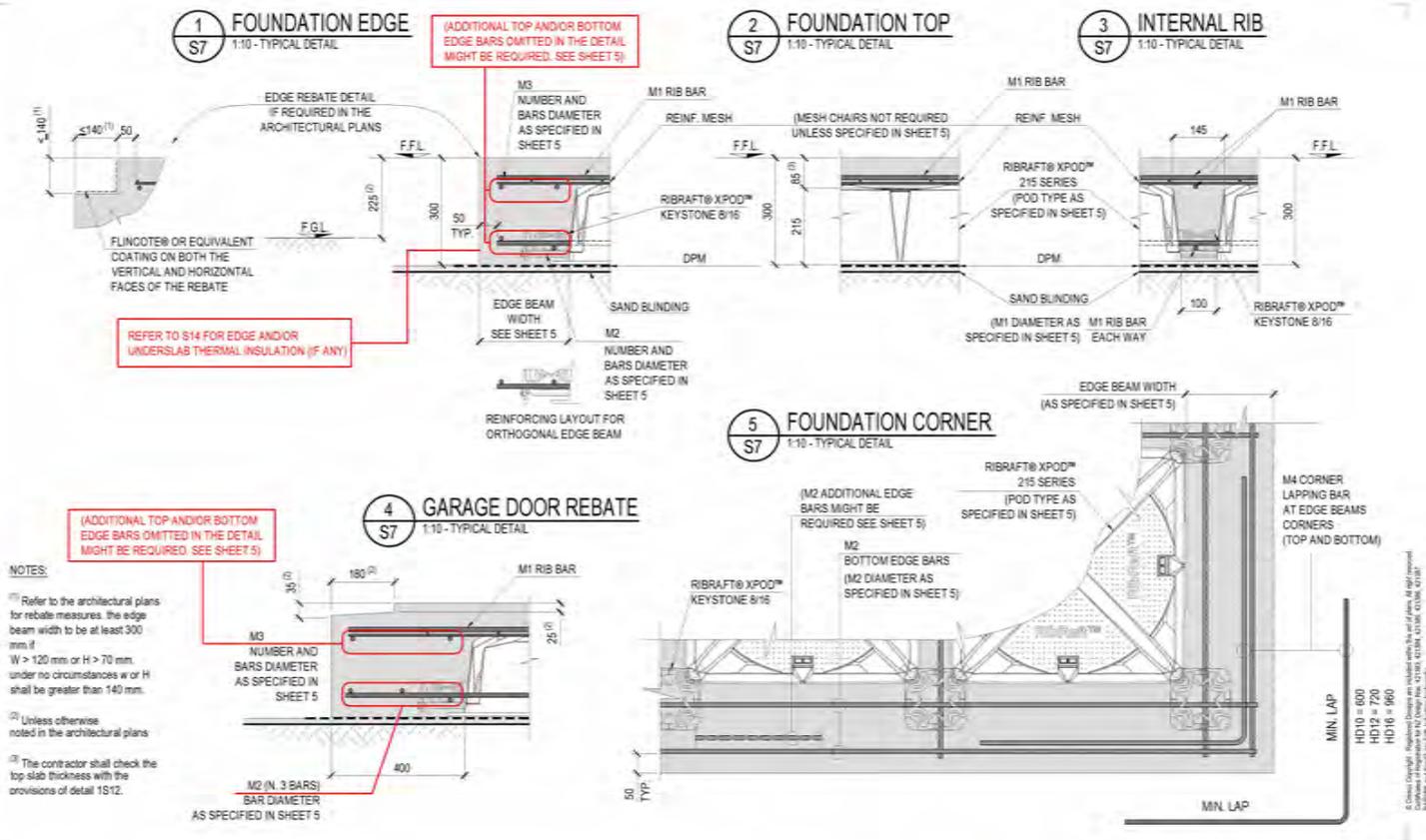
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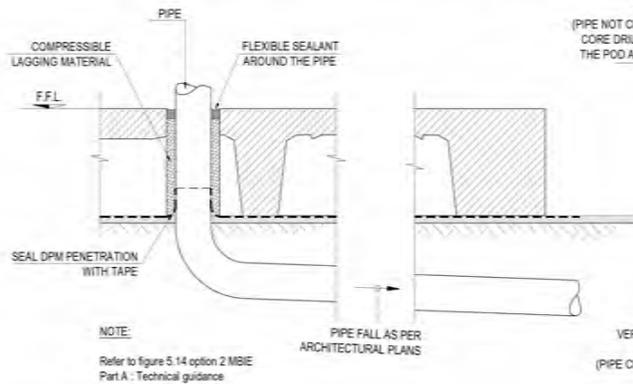
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EDGE BEAMS AND RIBS DETAILS 1:10 A3 **S7**  
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1 UNDERGROUND SERVICES  
S9 1:10 - TYPICAL DETAIL

SECTION ALONG THE PIPE LINE  
1:10



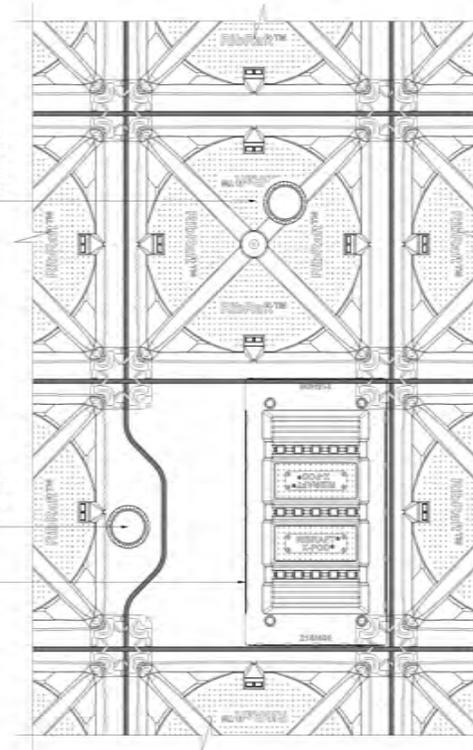
VERTICAL PENETRATION THROUGH THE SLAB (PIPE NOT CLASHING WITH A RIB): CORE DRILL A POD OR REMOVE THE POD AND PLACE A MINIPOD

VERTICAL PENETRATION THROUGH THE SLAB (PIPE CLASHING WITH A RIB): PLACE A MINIPOD

MINIPOD

PLAN VIEW  
1:10

NOTE: Reinforcing mesh omitted for clarity



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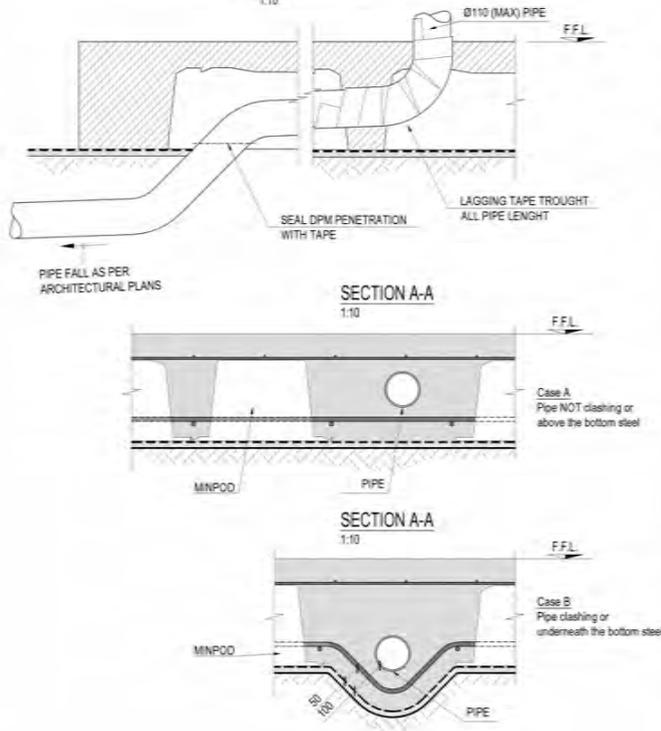
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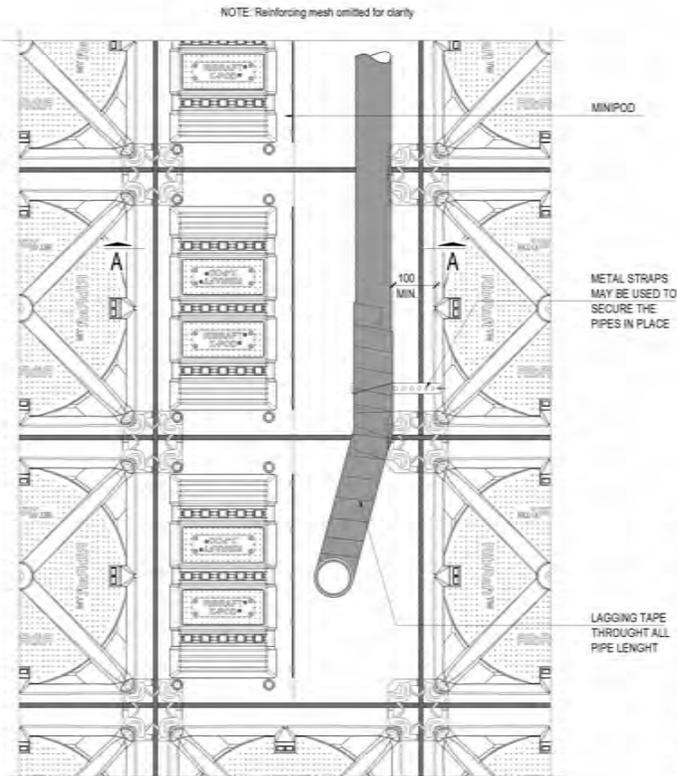
SERVICES DETAILS - OPTION 1 1:10 A3 S9  
DOCUMENT TITLE SCALE FORMAT SHEET

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 by  
 Kapiti  
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 Council  
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**1**  
**S10**  
**EMBEDDED SERVICES**  
 1:10 - TYPICAL DETAIL  
**SECTION ALONG THE PIPE LINE**  
 1:10



**PLAN VIEW**  
 1:10



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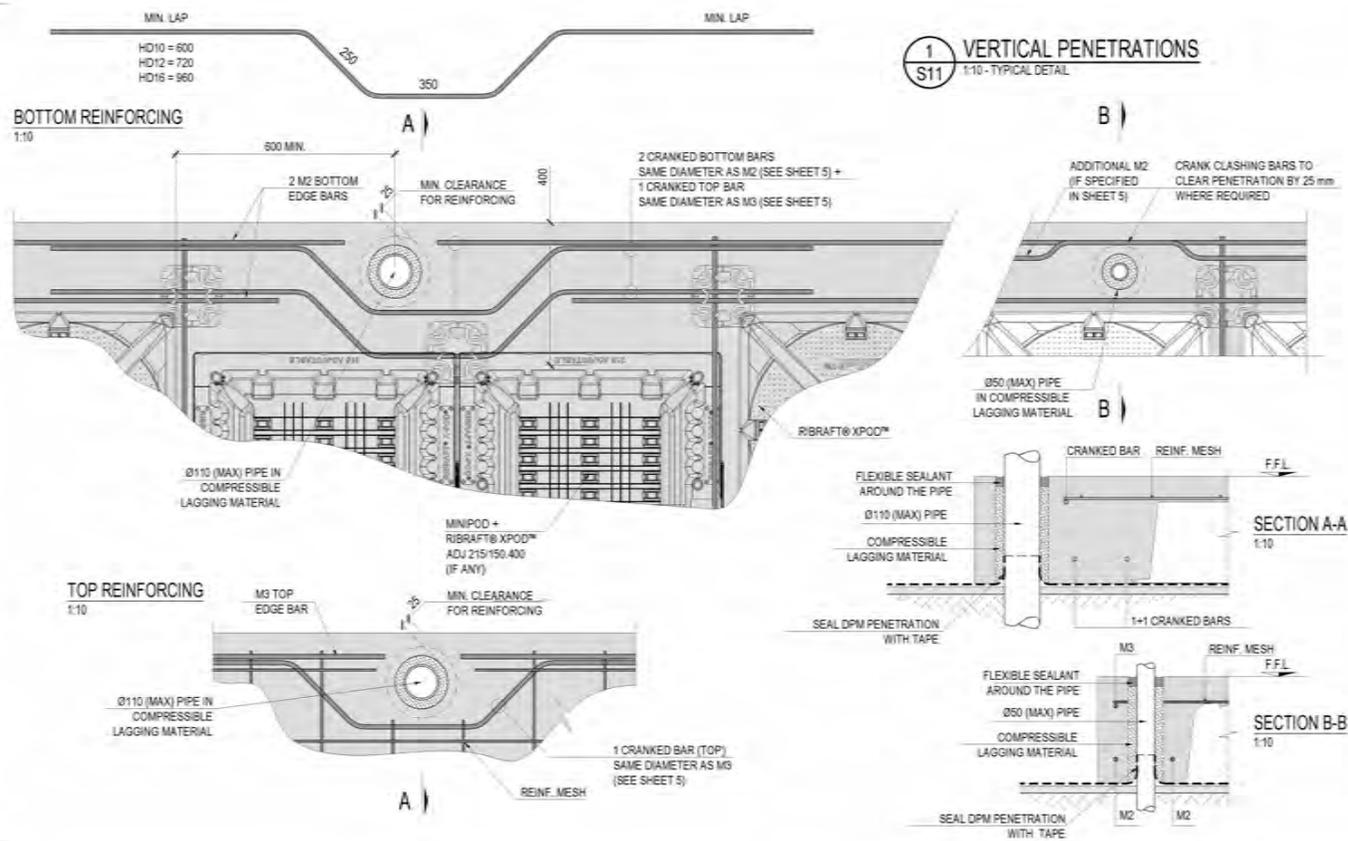


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 SERVICES DETAILS - OPTION 2      1:10      A3      SHEET

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1 VERTICAL PENETRATIONS  
S11 1:10 - TYPICAL DETAIL



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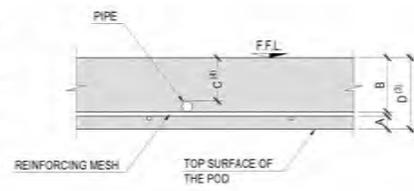
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VERTICAL PENETRATIONS DETAILS 1:10 A3 **S11**  
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**1 TOP SLAB DEPTH**  
TYPICAL DETAIL

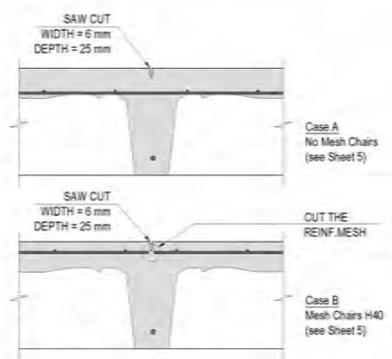
		A (mm)	B (mm)	C (mm)	D (mm)
STANDARD	NO MESH CHAIRS	12	61	N/A	85
	MESH CHAIRS H40	40	33	N/A	85
POLISHED CONCRETE <sup>(1)</sup>	GRINDING MAX = 3 mm	40	33	N/A	85
	GRINDING MAX = 10 mm	40	43	N/A	95
HYDRONIC UNDERFLOOR HEATING <sup>(2)</sup>	MESH CHAIRS H40	40	63	47	115
POLISHED CONCRETE AND HYDRONIC UNDERFLOOR HEATING	MESH CHAIRS H40	40	63	47	115



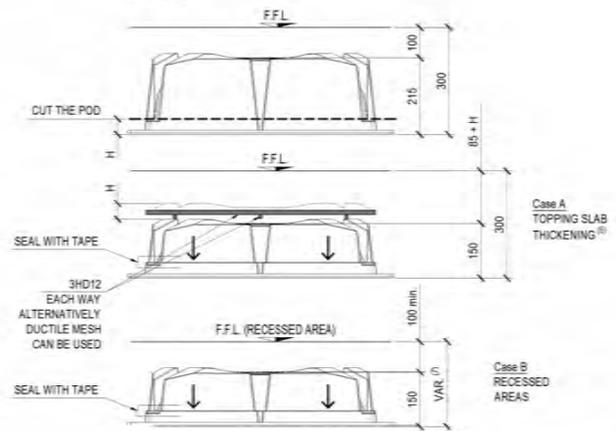
**NOTES**

- <sup>(1)</sup> Check requirements with the architect
- <sup>(2)</sup> Underfloor Heating Pipes Diameter = 16 mm  
The contractor shall always check with the installer of the underfloor heating system the compliance of this detail before commencing the works.
- <sup>(3)</sup> The top slab thickness might need to be increased if reinforcing steel bars are used in combination with the reinforcing mesh. Seek advice with Cresco.
- <sup>(4)</sup> "C" to be at least 40 mm in correspondence of saw cuts.
- <sup>(5)</sup> No saw cuts are required unless where specified in sheet 5.
- <sup>(6)</sup> Not required unless specified in sheet 5.
- <sup>(7)</sup> Depending on the recess requirements.

**2 FLOOR SAW CUT<sup>(5)</sup>**  
1:10 - TYPICAL DETAIL



**3 POD DEPTH ADJUSTMENT**  
1:10 - TYPICAL PROCEDURE



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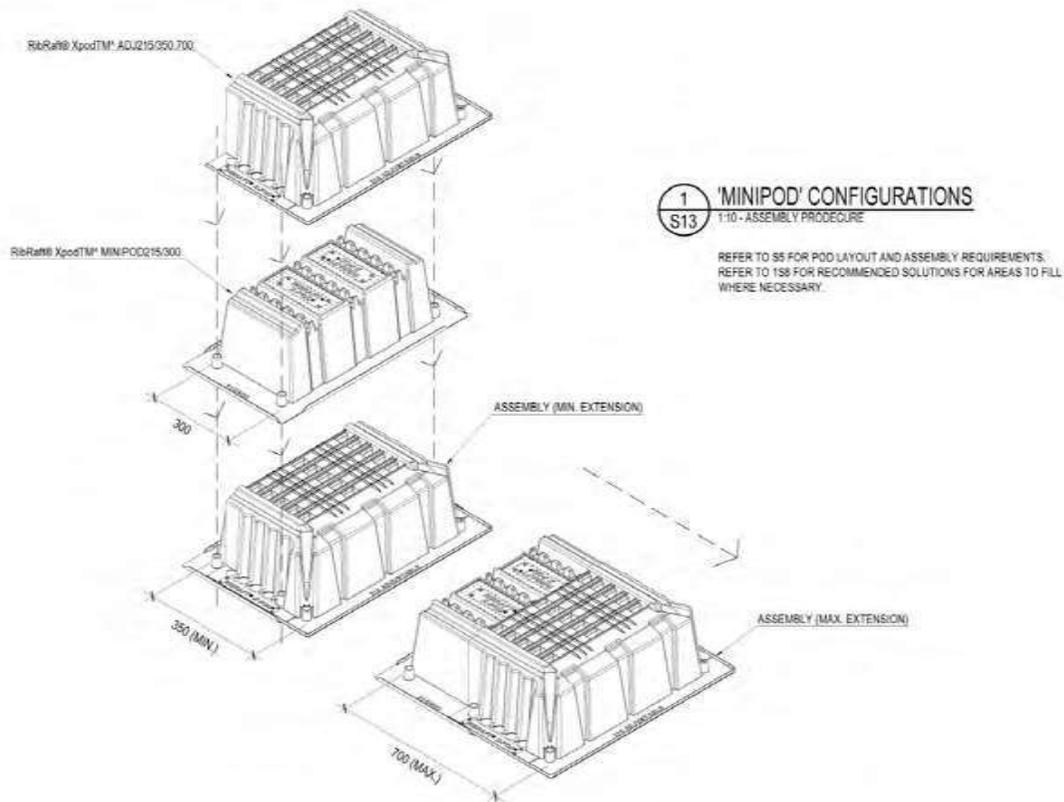
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DATE      LOCATION      NO.      DATE      LOCATION

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FOUNDATION DETAILS      1:10      A3      **S13**

FOUNDATION TITLE      SCALE      DRAWING NO.      SHEET

## PRODUCER STATEMENT – PS1 – DESIGN

ISSUED BY (Design Firm): **CRESCO ENGINEERS NEW ZEALAND LIMITED**

TO (Owner/Developer): **Tim Atkinson**

TO BE SUPPLIED TO (Building Consent Authority): **Kapiti Coast District Council**

IN RESPECT OF (Description of Building Work): **Residential Foundation**

AT (Street Address): **Lot 43 at 110 Ngarara Road**  
 (Town/city): **Waikanae**

LOT: **43** DP: ----- SO:

We have been engaged by the owner/developer referred to above to provide **Residential Foundation design services** in respect of the requirements of Clause(s) **B1** of the Building Code for All  or Part only  (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

Compliance Documents issued by the Ministry of Business, Innovation & Employment **B1/VM1, B1/VM4, MBIE/NZGS Module 4 “Earthquake resistant foundation design”**

Alternative solution as per the attached schedule:

The proposed building work covered by this producer statement is described on the documents titled **7544 - F001\_A** and **7544 - C001\_A**; together with the specification, and other documents set out in the schedule attached to this statement (if any).

**On behalf of the Design Firm**, and subject to:

- (i) All proprietary products meeting their performance specification requirements;
- (ii) Site verification of the following design assumptions: **Geotechnical Report Ref. 21852-RPT-G-002-A dated 24/08/22, by CGW Consulting Engineers.**

I **believe on reasonable grounds** that a) the structure, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation:

CM1  CM2  CM3  CM4  CM5 (Engineering Categories) or  as per agreement with owner/developer (Architectural)

I, **Fabio Parodi** hold  CPEng registration No. **1025559**

I am a Member of :  ENGINEERING NEW ZEALAND and hold the following qualifications: **CPEng, Dott. Ing (ITA), M.Eng (Hons)**

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than \$500,000\*.

SIGNED BY **FABIO PARODI** ON BEHALF OF **CRESCO ENGINEERS NEW ZEALAND LIMITED**

(signature)

Date: 08/08/23

*Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of \$500,000\*.*

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**13/09/2023**

## Important Advisory Note

Cresco Engineers New Zealand Limited (Cresco) is supplying Producer Statements to be submitted to territorial or building consent authorities in order for Code of Compliance Certificates to be issued.

Producer statements are not a product warranty or guarantee of compliance.

Producer statements deal with compliance at the date on which they were written. They will not necessarily provide assurance of on-going compliance.

The design provided by Cresco and covered under this Producer Statement (Design) cannot be used by any third party and cannot be used if there are changes in the laws or regulations.

Only the Owner/Developer, and the Building Consent Authority are entitled to rely upon this Design. Cresco accepts no liability to anyone other than the Owner/Developer in any way in relation to the Design and the content of it and any direct or indirect effect this Design may have. Cresco does not contemplate anyone else relying on this Design or that it will be used for any other purpose.

The Design is based upon information provided by the Owner/Developer or his representatives and no warranty is included; either expressed or implied that the actual site conditions and forces generated by structures designed by others will conform to the information that Cresco has received.

When the Design includes foundation design, the check for the pressure generated by the foundation onto the ground is provided. When the pressure is above and beyond the values indicated in the geotechnical report / site tests provided by the Owner/Developer, the Design includes the calculation of the depth of the compacted granular fill required to comply.

The Granular Fill Required Depth (D) is intended to be read as: *"the required depth of the compacted granular fill beneath the foundation for a specified value of the ground Ultimate Bearing Capacity (immediately underneath the granular fill and subject to site verification) in absence of any unfavorable condition such as: (a) potentially compressible ground such as top soil, soft soils such as very soft clays which can be moulded easily in the fingers, and un-compacted loose gravel which contains obvious voids (b) expansive soils being those that have a liquid limit of more than 50 % when tested in accordance with NZS 4402 Test 2.2, and a linear shrinkage of more than 15 % when tested from the liquid limit in accordance with NZS 4402 Test 2.6; and (c) any ground which could foreseeably experience movement of 25 mm or greater for any reason including one or a combination of land instability, ground creep, subsidence, seasonal swelling and shrinking, frost heave, changing groundwater level, erosion, dissolution of soil in water, and effects of tree roots"*.

The investigation of the above mentioned unfavorable conditions as well as the remediation works to be undertaken (for example, but not limited: cut of the top soil, any groundworks that may extend beyond the depth of the granular fill indicated by us, deep ground improvements of any kind...) are outside of the scope of the Design. The Design is not intended to alter or substitute the instructions contained in a geotechnical report when available and it is under the

responsibility of the Client to undertake the necessary actions to assess the suitability of the ground in the respect of the unfavorable conditions listed above.

The PS1 (Producer Statement - Design) is intended for use by a suitably qualified, competent design professional (i.e. Chartered Professional Engineer) as a statement of opinion. The opinion is based on reasonable grounds that certain aspects of proposed building work will comply with the Building Code, if the work is constructed according to the referenced documentation (e.g. engineering design drawings and specifications).

The PS1 records the means of compliance e.g. the Acceptable Solution or Verification Method used and it only covers specifically designed building elements or specifically designed portions / strengthening of building elements. The Chartered Professional Engineer signatory of the Producer Statements does not provide professional opinion for means of compliance of construction elements designed/completed in accordance with design/construction procedures contained within technical manuals of proprietary systems.

The PS4 (Producer Statement - Construction Review) is intended for use by a suitably qualified, competent design professional as a statement of opinion. This is based on reasonable and stated grounds which may include the records of construction monitoring and information supplied by (i) the contractor (ii) by a person acting under the control of the Chartered Professional Engineer or (iii) collected by the Chartered Professional Engineer himself, that certain aspects of building work have been completed according to the building consent and amendments.

It is under the responsibility of the Owner / Developer's agent or contractor to notify Cresco when site observations are to be required. Cresco strongly recommends to provide sufficient notice (at least 5 working days) prior to time of site observation.

The records of construction monitoring and instructions (including authorization to proceed with concrete pouring when applicable) are provided, upon Chartered Professional Engineer's review and approval, generally within 24 hours from the date of the site observation.

A Chartered Professional Engineer nominated by Cresco will issue a PS4 if the building works have been completed (i) in accordance with the relevant requirements of the Building Consent and Building Consent Amendments, (ii) in compliance with the structural documentation and if (iii) at least all construction monitoring visits recommended within the inspection schedule as stated on the consent documents have been carried out by inspectors appointed by Cresco.

Cresco is unable to providing site observation for unauthorized and non-consent works.

Should anyone wish to discuss the content of this Design with Cresco Engineers New Zealand Limited, they are welcome to contact us on **0800 11 33 11** or [support@cresco.co.nz](mailto:support@cresco.co.nz).

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Form 2A

**Memorandum from licensed building practitioner: Certificate of design work  
 Section 45 and Section 30C, Building Act 2004**
**THE BUILDING**

Street address: Error! Reference source not found.

Town/City: **Error! Reference source not found.****THE OWNER / DEVELOPER**Name(s): **Error! Reference source not found.****BASIS FOR PROVIDING THIS MEMORANDUM**

I am providing this memorandum in my role as the: Tick <input checked="" type="checkbox"/> if included <input type="checkbox"/> if excluded	
<input type="checkbox"/>	<b>sole</b> designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design myself – no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	<b>lead</b> designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	<b>lead</b> designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the other designers will provide their own memoranda relating to their specific RBW design
<input checked="" type="checkbox"/>	<b>specialist</b> designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

**IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)**I, **Fabio Parodi**, ~~carried out~~ / supervised the following design work that is restricted building work**PRIMARY STRUCTURE: B1**

Design work that is restricted building work	Description	Carried out/ supervised	Reference to plans and specifications
<b>Primary structure</b>			
All RBW Design work relating to B1 <input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Foundations and subfloor framing <input checked="" type="checkbox"/>	<i>Residential Foundation Design Services</i>	<input type="checkbox"/> Carried out <input checked="" type="checkbox"/> Supervised	<i>See PS1</i>
Walls <input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Roof <input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	

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Columns and beams	<input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Bracing	<input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	
Other	<input type="checkbox"/>		<input type="checkbox"/> Carried out <input type="checkbox"/> Supervised	

**ISSUED BY**

Name: <b>Fabio Parodi</b>		LBP or Registration number: <b>1025559</b>	
The practitioner is a:	<input type="checkbox"/> Design LBP	<input type="checkbox"/> Registered architect	<input checked="" type="checkbox"/> Chartered professional engineer
Design Entity or Company: <b>CRESCO ENGINEERS NEW ZEALAND LIMITED</b>			
Mailing address (if different from below): <b>PO Box 9200 8149 Addington Christchurch</b>			
Street address / Registered office: <b>c.o. M J Mowat, 290 Clyde Road</b>			
Suburb: <b>Bryndwr</b>		Town/City: <b>Christchurch</b>	
PO Box/Private Bag: <b>N/A</b>		Postcode: <b>8053</b>	
Phone number: <b>N/A</b>		Mobile: <b>027 838 8338</b>	
After Hours: <b>N/A</b>		Fax: <b>N/A</b>	
Email address: <b>f.parodi@cresco-group.com</b>		Website: <b>www.cresco.co.nz</b>	

**DECLARATION**

I **Fabio Parodi** [name of practitioner], LBP,

state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:

- Complies with the building code; or
- ~~Complies with the building code subject to any waiver or modification of the building code recorded on this form.~~

Signature:

Date: 08/08/23

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 Kapiti Coast District Council  
 13/09/2023

To  
**Error! Reference source not found.**  
Building Consent Authority

08/08/23

Dear Sir / Madam,

## **B2 Compliance**

*Residential Foundation at **Error! Reference source not found.**, **Error! Reference source not found.***

We are not able to supply a Producer Statement for Design in respect of the requirements of Clause(s) **B2** of the Building Code since there is no effective verification method for this Clause within the Building Code.

However, we can confirm that for the structural elements shown in our documentation:

### **Timber**

Timber treatment has been selected in accordance with Table 1A of B2/AS1.

### **Concrete**

Concrete covers have been selected in accordance with NZS3101, Part 1, Section 3.

### **Mild Steel**

Generally, steel member/connections requirements as per NZS3604:2011 or proprietary coatings to comply with AS/NZS2312. Otherwise, steel protection has been specified in accordance with the 'Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings' AS/NZS 2312. We note that this is on a time to first maintenance basis.

We trust this provides the information that you are seeking.

Yours faithfully,



**Fabio Parodi**  
Cresco Engineers New Zealand Limited

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**Received by**  
**Kapiti Coast District Council**  
**13/09/2023**



## Demand Calculation Sheet

### Job Details

Name: NEW HOUSE - Bedrooms  
 Street and Number: Lot 43 Anderson Park  
 Lot and D.P. Number: Lot 43  
 City/Town/District: Waikanae  
 Designer: Grant Baxter  
 Company: Onboard & Online Ltd  
 Date: 24/4/2023

### Building Specification

Number of Storeys	2		
Floor Loading	2 kPa		
Foundation Type	Slab		
	<b>Upper</b>		<b>Lower</b>
Cladding Weight	Light		Light
Roof Weight	Light		Light
Room in Roof Space	No		No
Roof Pitch	30		8
Roof Height above Eaves (m)	2.0		1.0
Building Height to Apex (m)	7.5		
Ground to Lower Floor (m)	0.2		
Lower to Upper Floor (m)			2.7
Stud Height (m)	2.4		2.4
Building Length (m)	9.5		10
Building Width (m)	8.7		10
Build Plan Area (m2)	57		79.5

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### Building Location

Wind Zone = High

Earthquake Zone 3

Soil Type D & E (Deep to Very Soft)

Annual Probability of Exceedance 1 in 500 (NZS3604:2011 Default)

### Bracing Units required for Wind

	Along	Across
Upper Level	508	502
Lower Level	1147	1154

### Bracing Units required for Earthquake

	Along and Across
Upper Level	503
Lower Level	1036



## Upper Level Along Resistance Sheet

Timber Floor Limit of 120 BUs/m Applied

									Wind	EQ
									Demand	
									508	503
									Resistance	
Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	784 154%	702 140%
a	1	3.0		2.4	BL1-H	GIB®	360	312		
	2	0.7		2.4	BL1-H	GIB®	73	71		
									433 OK	383 OK
b	1	0.7		2.4	BL1-H	GIB®	73	71		
	2	1.6		2.4	BL1-H	GIB®	192	166		
	3	0.8		2.4	BL1-H	GIB®	87	82		
									351 OK	319 OK

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## Upper Level Across Resistance Sheet

Timber Floor Limit of 120 BUs/m Applied

									Wind	EQ
									Demand	
									502	503
									Resistance	
Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	943 188%	874 174%
n	1	1.8		2.4	EP1-1.2	GIB®	216	216		
	2	0.4		2.4	BL1-H	GIB®	36	40		
	3	0.4		2.4	BL1-H	GIB®	36	40		
									287 OK	296 OK
o	1	3.6		2.4	GS1-N	GIB®	248	216		
	2	1.1		2.4	BL1-H	GIB®	132	114		
									380 OK	330 OK
p	1	1.8		2.4	BL1-H	GIB®	216	187		
	2	0.6		2.4	BL1-H	GIB®	59	61		
									275 OK	248 OK

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## Lower Level Along Resistance Sheet

									Wind	EQ
									Demand	
									1147	1036
									Resistance	
Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	1735 151%	1504 145%
A	1	0.7		2.4	BL1-H	GIB®	73	71		
	2	0.7		2.4	BL1-H	GIB®	73	71		
	3	0.7		2.4	BL1-H	GIB®	73	71		
	4	0.7		2.4	BL1-H	GIB®	73	71		
									290 OK	284 OK
B	1	4.9		2.55	GS1-N	GIB®	318	277		
	2	2.7		2.4	BL1-H	GIB®	346	281		
	3	1.2		2.55	BL1-H	GIB®	145	117		
									808 OK	675 OK
C	1	1.2		2.4	BL1-H	GIB®	154	125		
	2	3.6		2.4	GS1-N	GIB®	248	216		
	3	3.4		2.4	GS1-N	GIB®	235	204		
									637 OK	545 OK

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## Lower Level Across Resistance Sheet

Line	Element	Length (m)	Angle (degrees)	Stud Ht. (m)	Type	Supplier	Wind (BUs)	EQ (BUs)	Wind	EQ
									Demand	
									1154	1036
									Resistance	
									1962 170%	1617 156%
N	1	0.5		2.4	BL1-H	GIB®	47	50		
	2	1.6		2.4	BL1-H	GIB®	205	166		
	3	0.4		2.55	BL1-H	GIB®	34	38		
									285 OK	254 OK
O	1	2.7		2.4	BL1-H	GIB®	346	281		
	2	2.7		2.4	BL1-H	GIB®	346	281		
	3	3.0		2.4	BL1-H	GIB®	384	312		
									1075 OK	874 OK
P	1	1.8		2.4	BL1-H	GIB®	230	187		
	2	2.9		2.4	BL1-H	GIB®	371	302		
									602 OK	489 OK

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## Custom Wall Elements

Supplier	System	Min. Length (m)	Wind (BUs/m)	EQ (BUs/m)
ECOPLY	EP1-1.2	1.2	120	120

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# OPERATION AND MAINTENANCE GUIDES



<b>O&amp;M For:</b>	US1010000
<b>Date:</b>	July 2022
<b>Code:</b>	US1010000
<b>Description:</b>	ENDURO Super Duty Underground Tank 10,000 Ltr 1.0m
<b>Product Warranty:</b>	10 years

## SPECIFICATIONS

	Width (mm)	Height (mm)	Length (mm)	Weight (kg)	Manhole Dia (mm)
	1250	1000	10200	810	600
<b>Standard</b>	Complies with: <ul style="list-style-type: none"><li>•AS/NZS 4020: Products in contact with drinking water</li><li>•AS/NZS 2070 (INT): Plastics material for food contact use</li><li>•Certified to AS/ANZ 4766:2020</li></ul>				
<b>Uses</b>	<ul style="list-style-type: none"><li>• Potable Water Storage</li><li>• Retention/Detention Stormwater Management</li><li>• Waste Storage</li></ul>				
<b>Statement</b>	In line with today's focus on Ecologically Sustained Development, Green Building Initiatives and 5 Star Ratings, Promax is committed to supplying quality Liquid Storage and Handling Solutions. Promax Plastics confirms that if these tanks are installed according to Good Management practices set out in the Promax Installation Guides, they will perform as stated throughout their intended life.				

## MAINTENANCE

Description	Action	Frequency
Tank Lid	Remains securely fitted	Bi-Monthly
Inlet/Outlet Fitting	Remains securely fitted with no leakage	Bi-Monthly
Pump	Check Pump, if fitted, for inlet screen blockages	Bi-Monthly
Sediment Build Up	Remains lower than base outlet - if outlet flow becomes restricted remove sediment with vacuum truck. Re-attach tank lid securely.	Half yearly or as necessary

**Please note: Entry into this tank is at owners risk.**

**Authorised By:**  
Promax Engineered Plastics Limited  
PO Box 749, Kerikeri 0245, New Zealand  
T: 0800 77 66 29  
E: sales@promaxplastics.co.nz

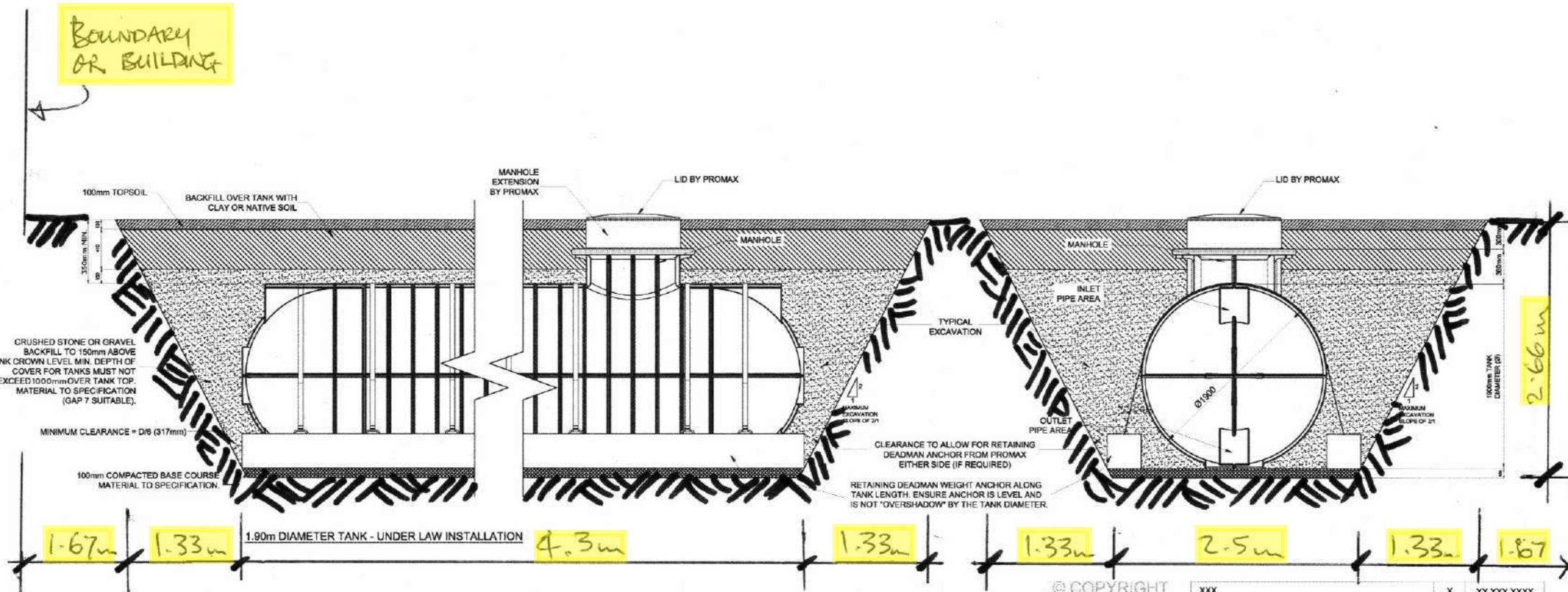




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# UNDER LAWN INSTALLATION GUIDE

NTS



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ORIG. SCALE	NTS	A2	X	XX XXX XXXX
DESIGNER			ISS	DATE
DETAIL:	UNDER LAWN INSTALLATION (ALL NEW ZEALAND LOCATIONS)		REMARKS	
PROJECT:	1900mm DIAMETER TANK INSTALLATION GUIDE		<b>PROMAX ENGINEERED PLASTICS</b> 399 Waipara Rd Kerikeri 0226 Bay of Islands Phone (09) 407 3575 Free Phone 0800 773623	

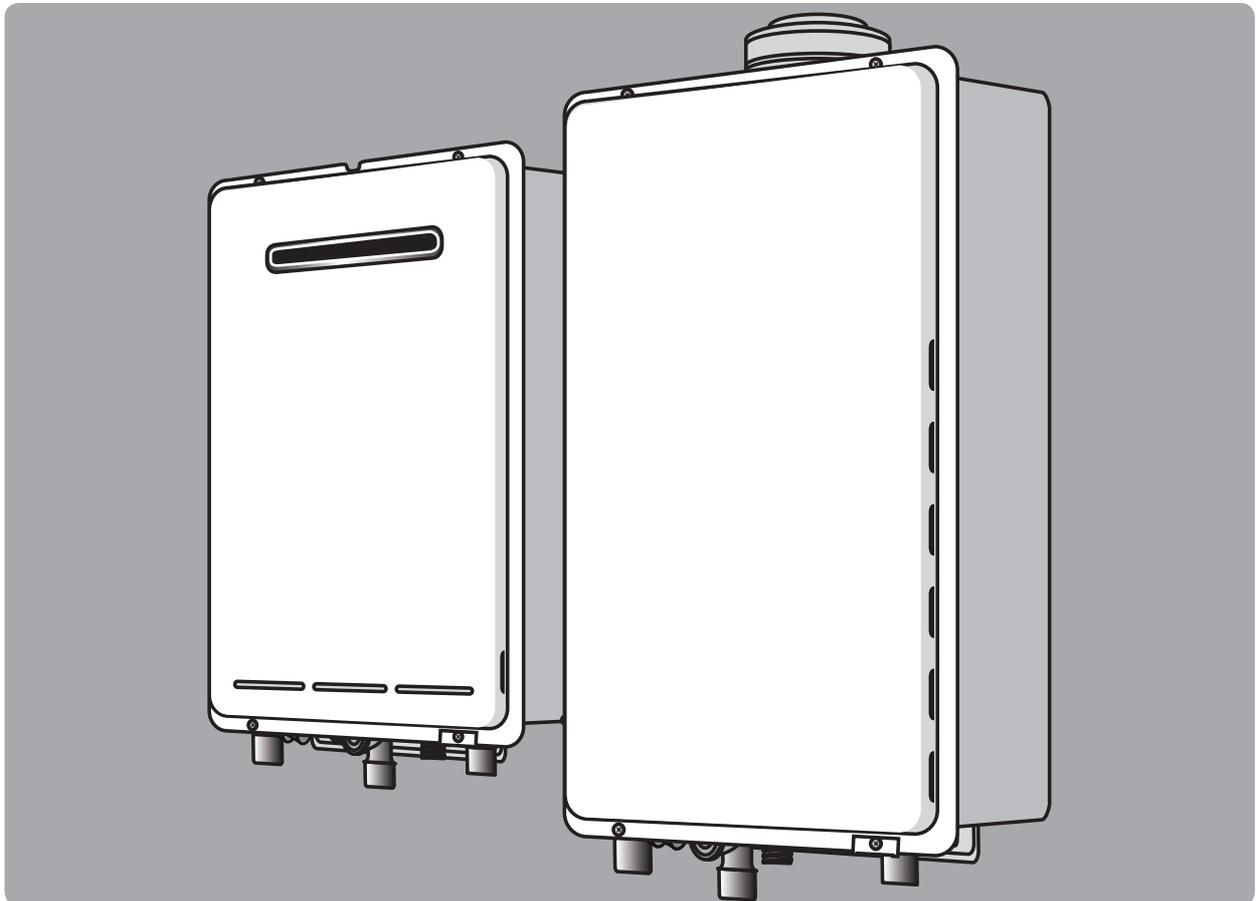
**Rinnai**

## Installation guide

---

# Continuous flow water heaters

Models: VT16-26, HD200, HDi200, HD250, EF24, EF250, EFi250



## Important:

This appliance must be installed in accordance with:

- Manufacturer's installation instructions
- Current AS/NZS3000, AS/NZS3500, AS/NZS 5601.1 and G12/AS1
- Local regulations and municipal building codes

For use with Natural Gas or Universal LPG as indicated on the appliance.

Not suitable as a spa or swimming pool heater.

Rinnai continuous flow internal water heaters ('i' models) must be installed with an approved Rinnai flue system.

Appliance must be installed, commissioned and serviced by an authorised person, being in New Zealand a licensed gasfitter, in accordance with these instructions and all applicable local rules and regulations.

### **Warning**

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life.

---

For more information about buying, using, and servicing of Rinnai appliances call: 0800 RINNAI (0800 746 624)

Rinnai New Zealand Limited  
105 Pavilion Drive, Mangere, Auckland  
PO Box 53177, Auckland Airport, Auckland 2150

Phone: (09) 257 3800, Fax: (09) 257 3899  
Email: [info@rinnai.co.nz](mailto:info@rinnai.co.nz)  
Web: [www.rinnai.co.nz](http://www.rinnai.co.nz), [www.youtube.com/rinnainz](http://www.youtube.com/rinnainz)

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# Before installation

## Check for damage

Unpack the appliance and flue components (if applicable) and check for damage. DO NOT install any damaged items.

## Check components and gas type

Check all components have been supplied and that you have the correct gas type.

## Read these instructions before starting

Read these instructions to get an overview of the steps required before starting the installation. Failure to follow these instructions could cause a malfunction of the appliance. This could result in serious injury and property damage.

## Solar installations

For Rinnai continuous flow water heaters used in solar installations, refer 'Recommended Solar System Layout'.

## EF models are heavy

The Rinnai Infinity EF models are 32 kg. Please use care when lifting and seek assistance if required.

## Applicable models

These installation instructions apply to the following Rinnai continuous flow water heaters.

Rinnai Infinity VT16	External	REU-VR1620WG	<b>Model number</b> Note: The model number is written on the data plate on the left hand side of the appliance.
Rinnai Infinity VT20	External	REU-VR2024WG	
Rinnai Infinity VT24	External	REU-VR2426WG	
Rinnai Infinity VT26	External	REU-VR2626WG	
Rinnai Infinity HD200	External	REU-VRM2632WC	
Rinnai Infinity HDi200	Internal	REU-VR2632FFUG	
Rinnai Infinity HD250	External	REU-VR3237WG	
Rinnai Infinity EF24	External	REU-K2430WG	
Rinnai Infinity EF250	External	REU-KM3237WD	
Rinnai Infinity EFi250	Internal	REU-KM3237FFUD	

i = internal—these must be installed with an approved Rinnai flue system

For nominated gas consumption, gas pressures, and gas types please refer to the data plate on the left hand side of the appliance.

# Appliance location

## Installation in environments free from corrosive compounds

Air surrounding the water heater, venting and vent termination(s) is used for combustion and must be free from compounds that cause corrosion of internal components. These include corrosive compounds that are found in aerosol sprays, detergents, bleaches, cleaning solvents, oil based paints/varnishes, and refrigerants. Therefore Rinnai recommends outdoor models be used for these locations where possible. The water heater, venting and vent termination(s) should not be installed in any areas where the air may contain these corrosive compounds. Chemicals that are corrosive in nature should not be stored or used near the water heater or vent termination.

Damage and repair due to corrosive compounds in the air is not covered by warranty.

If it is necessary for a water heater to be located in areas which may contain corrosive compounds, Rinnai strongly recommends the following:

### Indoor (internal) water heaters

- DO NOT install in areas where contaminated air is present.
- Consider, before installation, where air has the ability to travel within the building.
- Where possible, install the heater in a sealed closet so that it is free of contaminated indoor air.

### Outdoor (external) water heaters and vent terminations of indoor (internal) water heaters

- Install as far away as possible from exhaust vent hoods
- Install as far away as possible

from air inlet vents—corrosive fumes may be released through these vents when air is not being run through them

## Internal models



Internal models are designed for indoor installations only. They may be installed in an enclosure if the requirements of AS/NZS 5601.1 are satisfied. An enclosure is defined as a compartment, enclosed area or partitioned off space primarily used for the installation of the appliance.

They must be mounted on a vertical structure with the water and gas connections on the underside pointing downwards. For appliances installed in roof spaces or elevated structures, specific requirements apply. Refer to AS/NZS 5601.1 for details.

## Catch pan



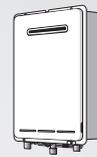
It is important that a suitably drained catch pan is fitted where damage could be caused by discharge from the water heater. Provision must be made for safe disposal of any leaking water to an external location.

This appliance MUST be used with the appropriate Rinnai flue system.

The location of the flue terminal must comply with AS/NZS 5601.1 Fig. 6.2.

Manufacturer's instructions for model REU-KM3237FFUD (EFi250); for reference j, gas appliances over 200 MJ/h input, use  $\geq 300$  mm.

## External models



External models are designed for outdoor installations only. They must be located in an above ground open-air situation with natural ventilation, without stagnant areas, and where gas leakage and products of combustion are rapidly dispersed by wind and natural convection.

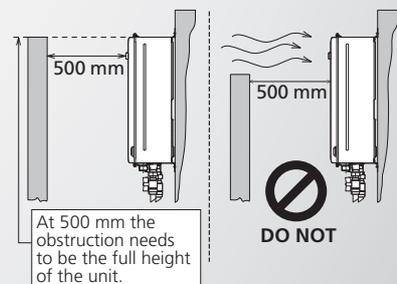
They must be mounted on a vertical structure with the water and gas connections on the underside pointing downwards.

The location of the flue terminal must comply with AS/NZS 5601.1 Fig. 6.2.

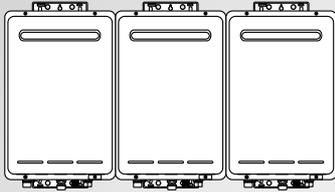
Manufacturer's instructions for model REU-KM3237WD (EF250); for reference j, gas appliances over 200 MJ/h input, use  $\geq 300$  mm.

## Horizontal obstructions

AS/NZS 5601 stipulates a minimum horizontal clearance of 500 mm between a building structure and obstruction facing the terminal. At 500 mm the obstruction needs to be the full height of the unit (as shown), and not a partial obstruction. A partial obstruction of less than 1 m could result in wind pushing flue gases back into the flue terminal.



When multiple units of the same model are installed on the same vertical face, with the flue terminals at the same height, they can be installed next to each other (as shown).



### All models

This appliance must be placed as close as possible to the most frequently used hot water outlet or outlets to minimise the delay for hot water delivery.

For installations where the distance between the water heater and the outlets is considerable, a flow and return system can be used to minimise the waiting time for hot water delivery. Alternatively, multiple appliances can be strategically placed to serve different outlets. Contact Rinnai for further information.

An AC 230 V, 10 Amp, earthed power point must be provided adjacent to the appliance. For outdoor installations, this power point must be weatherproof. It must be clear of the gas and water connections to the appliance and also the flue exhaust and water pressure relief valve. The power cord of the appliance is 1.5 m long.

All appliances must be installed to ensure access can be gained without hazard or undue difficulty for inspection, repair, renewal or operational purposes. Sufficient clearances shall allow access to and removal of all serviceable components.

Appliances should not be mounted higher than 3.5 m above the ground or floor level unless the customer can arrange permanent and safe access or can provide another means of access such as scissor or boom lifts.

### Clearances from combustible materials

The appliance can be mounted directly against the wall or structure. There is no need to use non-combustible sheeting or leave an air gap between the appliance back panel and the wall or structure for the purposes of meeting the temperature hazard requirements of AS/NZS 5601.

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# General installation information

## Catch pan

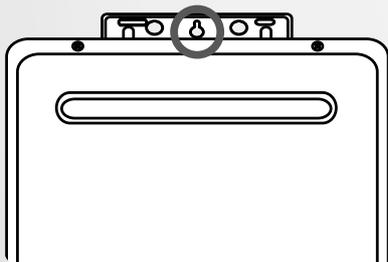
It is important a suitably drained catch pan is fitted (especially for internal units) where damage could be caused by discharge from the water heater. Provision must be made for safe disposal of any leaking water to an external location.

## Mounting the appliance

Refer 'Connections and Fittings' for individual appliance weights. The wall or structure on which these units are to be mounted must be capable of supporting these weights and the associated pipe work.

Ensure suitable fixing screws or bolts are used to secure the units to the walls, in accordance with AS/NZS 5601.1. Wooden plugs shall not be used.

The top bracket has a keyhole slot (circled below) so the appliance can be positioned by hanging it on one screw while the other screws are secured.



## Circuit diagrams

Refer to commissioning sheet supplied with the appliance (inside front cover of appliance).

## Pipe sizing



Refer 'Connections and Fittings' for appliance gas consumption. If the gas pipe sizing is insufficient the customer will not get the full performance benefit. Gas pipe sizing must consider the gas input to this appliance as well as all the other gas appliances in the premises. The gas meter and regulator must be specified for this gas rate.

An approved sizing chart such as the one in AS/NZS 5601.1, or proprietary system manufacturer guide should be used.

Water pipe sizing and layout should be performed in accordance with AS/NZS 3500. All hot water pipe work should be insulated to optimise performance and energy efficiency.

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## Water supply



Refer 'Connections and Fittings' for applicable water pressures. Approved pressure limiting valves may be required if the stated maximum rated water supply pressures are exceeded. To achieve the rated flow, the stated minimum water supply pressures must be supplied. The water heaters will operate at lower pressures but will not achieve the rated flow.

Water chemistry and impurity limits are stated in our detailed warranty statement. Most metropolitan water supplies fall within these requirements. If you are unsure about the quality of the water, please contact Rinnai and we will provide you with the details of an authorised agency who are able to test your water for compliance to Rinnai standards. If sludge or foreign matter is present in the water supply, a suitable filter or strainer should be incorporated in the water supply to the water heater.

# Flued (internal) water heaters

This water heater must be fitted with the appropriate Rinnai flue system.

The chart below highlights the maximum flue length and number of bends. It also shows the difference between a short and long flue—this is important if changing settings (DIP switches).

		Number of 90 Degree Bends				
		0	1	2	3	4
Flue Length (m)	1	Short flue setting				
	2					
	3	Long flue setting				
	4					
	5	Long flue setting				
	6					
	7	Long flue setting				
	9					
	11	Long flue setting				
	13					
	15	Long flue setting				

Maximum flue length

Refer to separate Rinnai flue guide for further details.

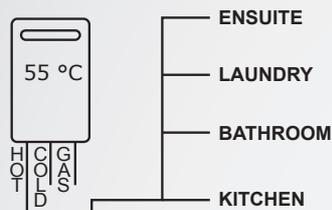
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# Water delivery temperature

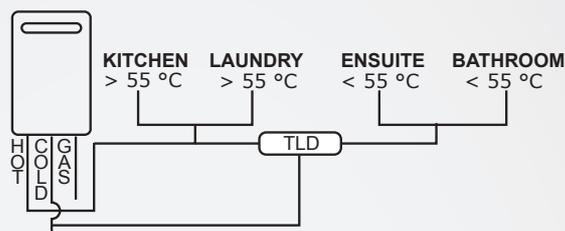
Local regulations and/or requirements of AS/NZS3500.4 must be considered regarding the temperature limitations of hot water supplied to areas used primarily for personal hygiene. The temperature of these areas may be limited to 55 °C or less.

If the appliance is to deliver water primarily for the purposes of personal hygiene in an early childhood centre, school, nursing home or similar facility as defined in AS/NZS3500.4 a Temperature Limiting Device (TLD), such as a Tempering Valve may be required (even if the appliance is set to 55 °C or less). For these types of applications contact Rinnai.

Requirements for Rinnai continuous flow units installed without controllers



**Diagram 1 - 55 °C Appliance**



**Diagram 2 - Not a 55 °C Appliance**  
(TLD = Temperature Limiting Device)

When the continuous flow unit is set to deliver water at a temperature higher than 55 °C, it will be necessary to fit a Temperature Limiting Device for delivery to areas used for the purposes of personal hygiene.

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# Connections and fittings

Models	Gas consumption MJ/h	Water Supply kPa		Weight kg	Fittings			Condensate
		Min.	Max.		Hot	Cold	Gas	
VT16 external REU-VR1620WG	125	120	1000	15	R $\frac{1}{2}$ (15 mm)	R $\frac{1}{2}$ (15 mm)	R $\frac{3}{4}$ (20 mm)	N/A
VT20 external REU-VR2024WG	160	160	1000	16	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
VT24 external REU-VR2426WG	188	180	1000	17	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
VT26 external REU-VR2626WG	199	180	1000	17	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
HD200 external REU-VRM2632WC	199	140	1000	21	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
HDI200 internal REU-VR2632FFUG	195	140	1000	21	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
HD250 external REU-VR3237WG	249	200	1000	29	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	N/A
EF24 external REU-K2430WG	162	240	1000	27	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{1}{2}$ (15 mm)
EF250 external REU-KM3237WD	211	240	1000	32	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{1}{2}$ (15 mm)
EFi250 internal REU-KM3237FFUD	211	240	1000	32	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{3}{4}$ (20 mm)	R $\frac{1}{2}$ (15 mm)

## Service connection points

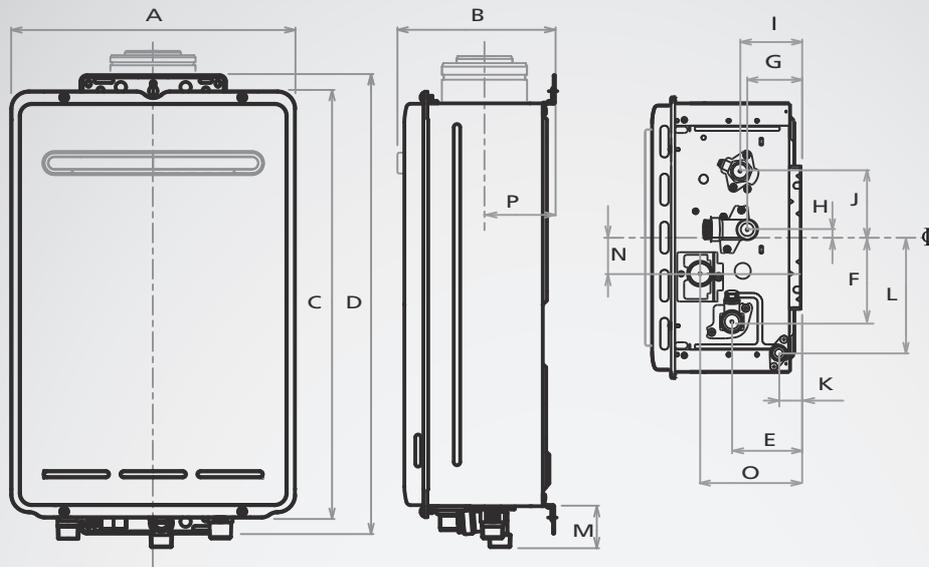
These dimensions are NOT an indication of the pipe sizes required.

An approved full flow isolation valve and disconnection union **MUST** be fitted to the cold water inlet. A non-return valve is not required unless required by local regulations.

Isolation valves must be fitted so the appliance can be removed.

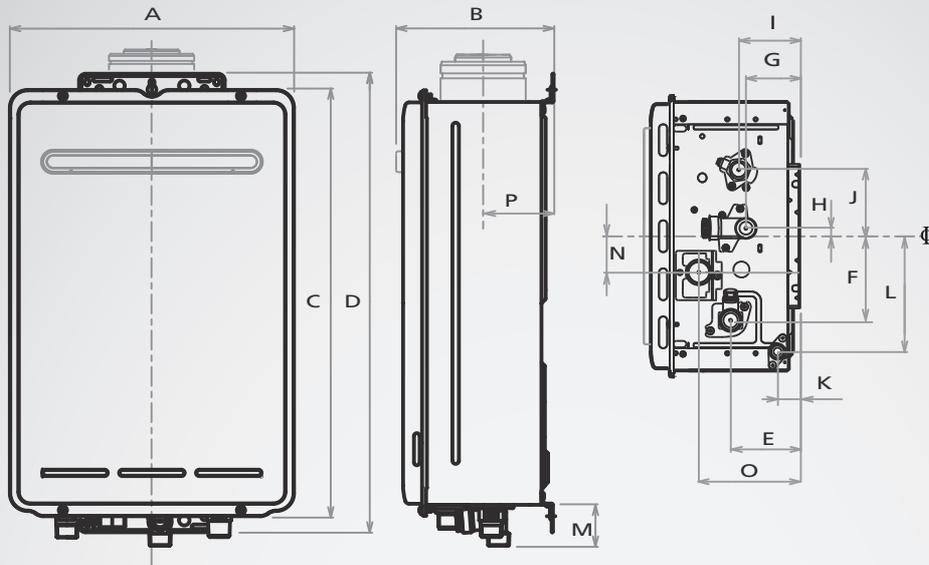
Purge gas and cold water supply lines to remove air and swarf before final connection of the appliance. Swarf in the gas or water supplies may cause damage.

# Dimensions: VT and HD models



Dimensions table (mm)		VT16 external (REU-VR1620WG)	VT20 external (REU-VR2024WG)	VT24 external (REU-VR2426WG)	VT26 external (REU-VR2626WG)	HD200 external (REU-VRM2632WC)	HDi200 internal (REU-VR2632FFUG)	HD250 external (REU-VR3237WG)
<b>A</b>	Width	350	350	350	350	350	350	470
<b>B</b>	Depth	194	194	194	194	250	235~275	244
<b>C</b>	Height - unit	530	530	530	530	600	600	600
<b>D</b>	Height - including brackets	571	571	571	571	636	641	644
<b>E</b>	Hot water outlet (from wall)	87	87	87	87	95	91~131	115
<b>F</b>	Hot water outlet (from centre)	105	105	105	105	110	110	61
<b>G</b>	Cold water inlet (from wall)	68	68	68	68	74	70~110	99
<b>H</b>	Cold water inlet (from centre)	10	10	10	10	27*	27*	52
<b>I</b>	Gas connection (from wall)	77	77	77	77	103	99~139	61
<b>J</b>	Gas connection (from centre)	83	83	83	83	89	89	110
<b>K</b>	Condensate outlet (from wall)	-	-	-	-	-	-	-
<b>L</b>	Condensate outlet (from centre)	-	-	-	-	-	-	-
<b>M</b>	Gas: Length gas connection (from base)	40	40	40	40	41	41	41
	Cold: Length of cold water inlet (from base)	50	50	50	50	51	51	51
	Hot: Length of hot water outlet (from base)	39	39	39	39	42	42	42
<b>N</b>	Electrical connection (from centre)	45	45	45	45	21**	21**	2**
<b>O</b>	Electrical connection (from wall)	128	128	128	128	160	160~200	100
<b>P</b>	Flue spigot centre line (from wall)	-	-	-	-	-	95~135	-
* This measurement is to the left of the centre line								
** This measurement is to the right of the centre line								
HDi200, height of flue spigot from base of unit approx. 85 mm								

# Dimensions: EF models



Dimensions table (mm)		EF24 external (REU-K2430WG)	EF250 external (REU-KM3237WD)	EFi250 internal (REU-KM3237FFUD)
<b>A</b>	Width	350	470	470
<b>B</b>	Depth	277	283.1	257~307
<b>C</b>	Height - unit	600	654	654
<b>D</b>	Height - including brackets	644	721.6	721.6
<b>E</b>	Hot water outlet (from wall)	164.5	115	110~150
<b>F</b>	Hot water outlet (from centre)	100	100	100
<b>G</b>	Cold water inlet (from wall)	83	79.6	74.6~114.6
<b>H</b>	Cold water inlet (from centre)	53*	27.2	27.7
<b>I</b>	Gas connection (from wall)	70.5	104	99~139
<b>J</b>	Gas connection (from centre)	25	103.2	103.2
<b>K</b>	Condensate outlet (from wall)	33	137.6	132.6~172.6
<b>L</b>	Condensate outlet (from centre)	132	195	195
<b>M</b>	Gas: Length gas connection (from base)	51	40.2	40.2
	Cold: Length of cold water inlet (from base)	62	50.2	50.2
	Hot: Length of hot water outlet (from base)	41	41.2	41.2
	Condensate connection length (from base)	24	22.4	22.4
<b>N</b>	Electrical connection (from centre)	10**	49	49
<b>O</b>	Electrical connection (from wall)	175	200	195~235
<b>P</b>	Flue spigot centre line (from wall)	-	-	139~179
* This measurement is to the left of the centre line				
** This measurement is to the right of the centre line				

# EF250 models: Earthing the unit

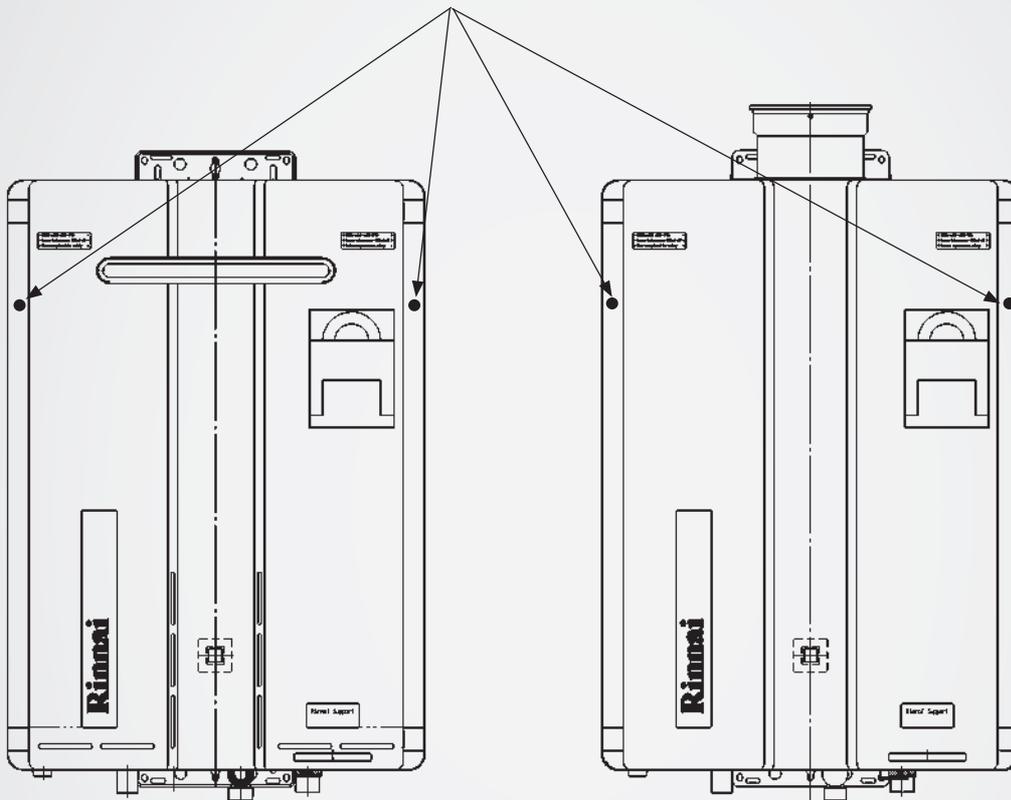
## Removing the cover and earthing the unit

For the Rinnai condensing continuous flow water heaters (EF250 & EFi250), the earthing screws are located under the side trim, refer image below. First remove the trim and then the earthing screws before lifting off the cover.



For safe operation of the appliance the earthing screws **MUST** be replaced.

## Earthing screws located under side trim



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# EF models: Condensate drain

The Rinnai Infinity EF water heaters generate condensate continuously at a rate of up to five litres per hour as a by-product of a highly efficient gas burner. Condensate must be drained via a pipe to a suitable discharge point.

As condensate is a by-product of gas combustion it is mildly acidic. For this reason copper tube and fittings **MUST NOT** be used as it will corrode. Instead Rinnai recommend plastic pipes and fittings.

## Important considerations for the condensate drain pipe

Content of AS3500.4.2003 section 5.12 'Temperature/Pressure Relief and Expansion Control Valve Drain Lines' has been used as a guide in preparing these considerations.

- Water heater drain outlet connection, ½ " (15 mm) BSP male.
- PE ½ "BSP (15 mm) female to barbed ignition system connector (13-19 mm) or equivalent plastic fitting.
- Drain pipe and fittings to match (B).
- Continuous fall of at least 2° from water heater to discharge point, length and bends in accordance with 'Maximum length and changes of direction greater than 45°'.
- Suitable points of discharge are deemed to be sewers or pits. **DO NOT** discharge onto electrical connections, earth stakes, copper pipes, concrete paths, or into a pond.

## Maximum length and changes of direction greater than 45°

### Length and changes of direction

Max. length (m)	9	8	7	6
Max. changes of direction (> 45°)	3	4	5	6

## Installation of a condensate drain

Point of discharge from each drain line shall be located so the release of condensate does not cause a nuisance, is readily discernible and incurs no risk of building damage. There shall be no tap, valve or other restrictions in any line. Each line shall fall continuously from the valve to the approved point of discharge.

Drain lines shall not discharge into a storage water heater safe tray. The end of the condensate drain line shall be:

- Not lower than 200 mm, or higher than 300 mm above an unpaved surface; or
- Not lower than 75 mm, or higher than 300 mm above a gravel pit, and not less than 100 mm in diameter in a paved surface.

Where discharging over a tundish or gully trap, drain lines shall have an air gap of a size at least twice the diameter of a drain line.

## Joining of condensate drain lines

Condensate drain lines from multiple water heaters may be joined together provided they conform with the installation requirements stated on this page.

## Common stack discharge

Where individual heaters are installed in a multistory building, the condensate drain lines may discharge into a common stack subject to the following:

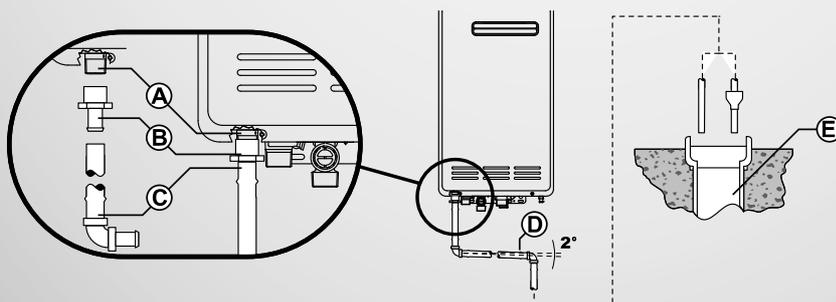
- Drained to a tundish having a discharge line that is not less than the common stack, directly connected to a fixture trap, and installed in a connection with any adjacent soil or waste stack.
- Discharge point of the common stack is readily visible and does not cause any nuisance.
- Common stack is vented by extending the pipe upwards, above the roof level.

## Tundish drain lines

The drain line from any tundish shall be not less than DN 20 or less than one size larger than that of the largest drain line discharging into the tundish. Tundish drain lines shall comply with the installation requirements above.

## Areas subject to freezing

In areas where water pipes are prone to freezing, the drain pipe from any valve shall be insulated and not exceed 300 mm in length. It shall discharge into a tundish through an air gap of not less than 75 mm and not exceed more than 150 mm measured from the outlet of the drain pipe to the rim of the tundish.



# Controllers - general information

Water controllers are available as an optional extra. Universal (Compact), Deluxe, and Wireless controllers can be used together.

## Maximum number of controllers

A maximum of four water controllers can be fitted with the following limitations:

- Max. of one Kitchen Deluxe controller (MV-100V)
- Max. of two Bathroom Deluxe controllers (BC-100V)

Only one controller can be set to deliver 55 °C, this cannot be a Bathroom Deluxe controller.

This next section refers to wired controllers. For details on wireless controllers refer to separate instructions.

## Important

Others manufacturers' controllers are not compatible with Rinnai Infinity continuous flow water heaters.

## Installation of controllers

Do not install controllers:

- near a heat source such as, a cook top, stove or oven— heat, steam, smoke, or hot oil may cause damage
- in direct sunlight
- outdoors unless protection from dust ingress and sunlight are provided
- against a metal wall unless in accordance with AS3000

## Positioning

Controllers must be installed in shaded and clean locations. They should be fitted out of reach of children (suggested height 1.5 m). The Compact and Bathroom Deluxe Controllers are water resistant, however, durability is improved when positioned outside the shower recess or at least 400 mm above the highest part of a sink, basin or bath.

## Water controller cables

Water controllers operate at extra low voltage (12 Volts DC) which is supplied from the water heater. Controllers come with 15 m of electrical cable. The appliance end of the controller cables are fitted with spade terminals.

Extension cabling is available as an accessory from Rinnai. Alternatively, a two core sheathed (double insulated) flex with a minimum cross sectional area of 0.5 mm<sup>2</sup> may be used.

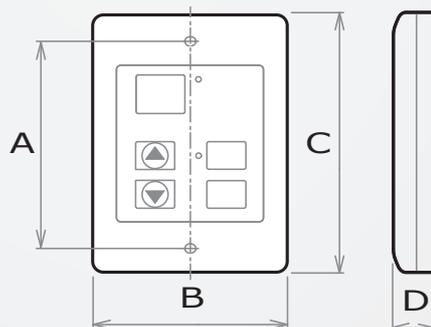
Maximum individual cable runs:

One controller	= 100 m
Two controllers	= 50 m*
Three plus controllers	= 20 m*

\* per controller

Water controller cables are not polarity sensitive.

## Dimensions



Dim.	Description	Compact (MC-91)	Kitchen Deluxe (MC-100V)	Bathroom Deluxe (BC-100V)
A	Distance between mounting holes	83	83	181
B	Width	90	128	195
C	Height	120	120	97
D	Depth	20	20	22

# Controllers - Universal (Compact)

## Fitting the Universal (Compact) controller

1. Determine the most suitable position for the controller.
2. Drill three holes as shown (Fig. 1 and Fig. 2) for securing screws and one to provide cable access.
6. Remove protective plastic from the controller face as shown (Fig. 4) and replace the face plate.

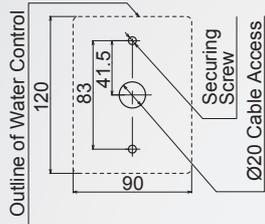


Fig.1

3. When running cable through the access hole ensure the connector and the end of the cable is located nearest to the controller (Fig. 2).

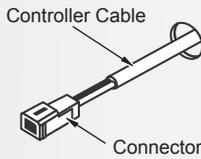


Fig.2

4. Carefully remove the face plate from the controller using the screwdriver (Fig. 3).

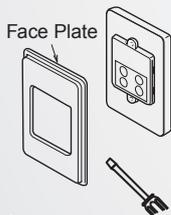


Fig.3

5. Fix the controller to the wall using appropriate fittings as shown (Fig. 4).

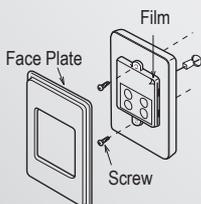


Fig.4

## Optional programming of the Universal controller

### Step one

Are four controllers connected?  
 If NO—refer to step two. If YES, activate the fourth controller as follows.

1. For the controller in the kitchen only, press and hold the 'Transfer' and 'On/Off' buttons simultaneously until a beep is heard (approximately five seconds).



2. Check display on all four controllers is displaying a temperature when switched on. If any controller displays two dashes, repeat above step.



### Step two

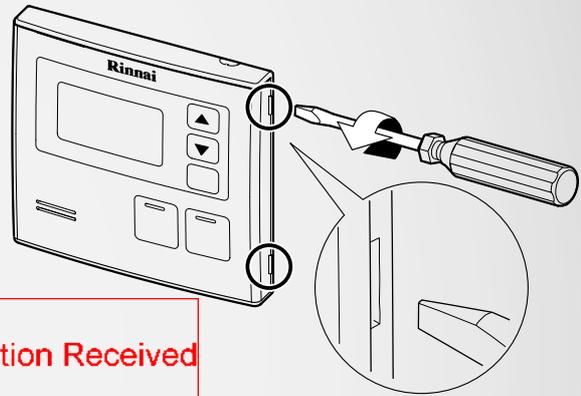
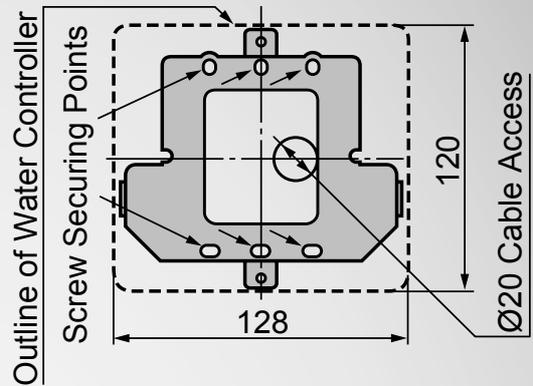
1. For the controller in the kitchen only, press and hold the 'Transfer' and 'On/Off' buttons simultaneously until a beep is heard (approximately five seconds).
2. When the controller fitted in the kitchen is switched on it will be possible to select temperatures higher than 50 °C (at this controller). If not repeat above step.

If the kitchen controller is swapped repeat the programming procedure.

# Controllers - Kitchen Deluxe

## Installation

1. Determine the most suitable position for the controller.
2. Use the wall mounting bracket as a template to mark and drill three holes, locating the cable access hole as shown.
3. Fix the mounting bracket to the wall using the appropriate fixings.
4. Run the water controller cable through the hole in the wall.
5. Carefully remove the face plate from the controller using a screwdriver as shown.
6. Connect the controller cable to the kitchen water controller. At this point cables from other controllers (if fitted) may also be connected to the kitchen water terminals, eliminating the need for multiple cable runs directly to the water heater. Feed excess cable lengths into the wall cavity to avoid pinching of cables between the wall and the water controllers.
7. Fasten water controllers to wall mounting bracket. Avoid the use of impact drills and over-tightening of fixings as this may damage the controllers.
8. Remove the protective plastic from the controller face and replace the face plate.



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# Controllers - Bathroom Deluxe

## Installation

1. Determine the most suitable position for the controller.
2. Mark and drill three holes, locating the cable access hole as shown (Fig.1).
3. When running a cable through the access hole ensure the connector end of the cable is located nearest to the controller (Fig.2).
4. Affix the double sided self-adhesive seal to the back of the controller (Fig.3).
5. Carefully remove the face plate from the controller. Do this by placing your thumbs on the front digital display while hooking your fingers behind the top plate and gently push down as shown (Fig.4). Do not use a screwdriver as this may damage the controller.
6. Connect the cable to the bathroom controller. Feed excess cable lengths into the wall cavity to avoid pinching of cables between the wall and the controller.
7. Fix bathroom controller to the wall using appropriate fixings. Avoid the use of impact drills and over-tightening of fixings as this may damage the controller.
8. Remove the protective plastic from the controller face and replace the face plate.

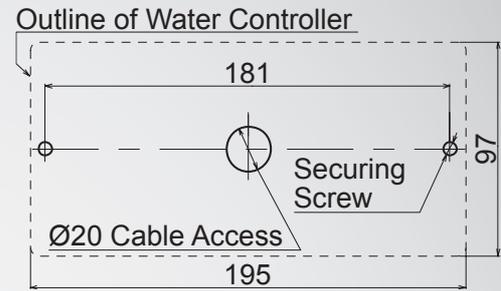


Fig.1

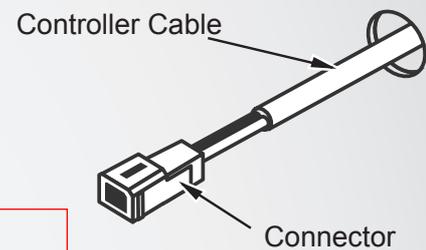


Fig.2

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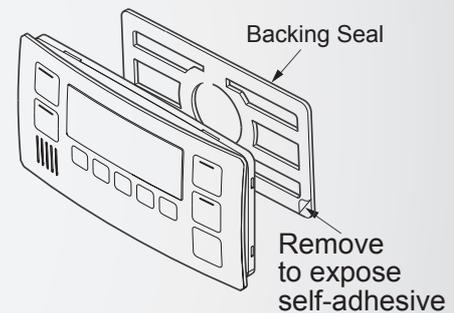


Fig.3

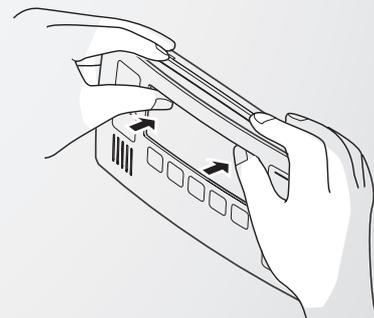


Fig.4

# Controllers - communication cables

Communication cables connect the water heater to the water controllers and operate at an extra low voltage (12 Volts DC) which is supplied from the water heater. Communication cables are supplied with the water controllers (15 m) and are fitted with spade terminals for connection to the water heater.

Up to two cables can be connected to the cable connector at the water heater. Extension cables are available from Rinnai. Alternatively two core sheathed (double insulated) flex with a minimum cross sectional area of 0.5 mm<sup>2</sup> may be used (refer maximum individual cable lengths on p. 15).



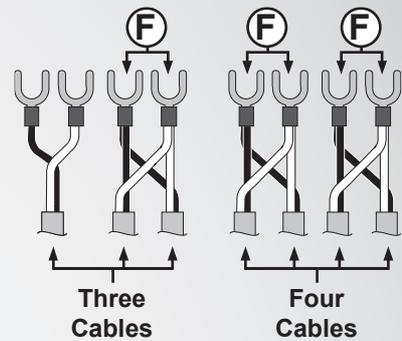
Do not attempt to connect cables to the cable connector at the water heater unless the electric power supply to the water heater is switched off otherwise damage to electrical components may occur.

## To connect up to two cables to the cable connector

1. Turn off power supply and unplug water heater from the power point.
2. Remove retaining screw of the cable connector at the base of the appliance.
3. Swing the cable connector door open. Thread the cable through the weather seal of the cable access hole (B) in the direction shown allowing sufficient cable length so the cable sheath can be secured with the cable clamp (C) supplied with the transceiver.
4. Loosen screw terminals (D) and (E) and connect cable spade connectors to these terminals and re-tighten. Polarity is not important, either wire colour can be connected to either terminal.
5. Return the cable connector to the original position taking care not to damage cable wires in the process and replace the retaining screw.

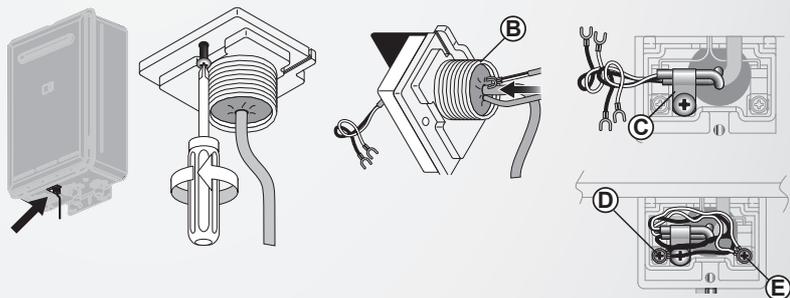
## Connecting three to four controllers

1. Repeat steps 1-3 for connecting up to two controllers.
2. To connect three to four controllers, separate all the cables to be fitted into pairs. Cut off the existing spade connectors from each pair and re-terminate each pair into a new spade connector (F) so there are only two sets of spade connectors. Four spade connectors in total to be terminated.
3. Repeat steps 4 and 5 for connecting up to two controllers.

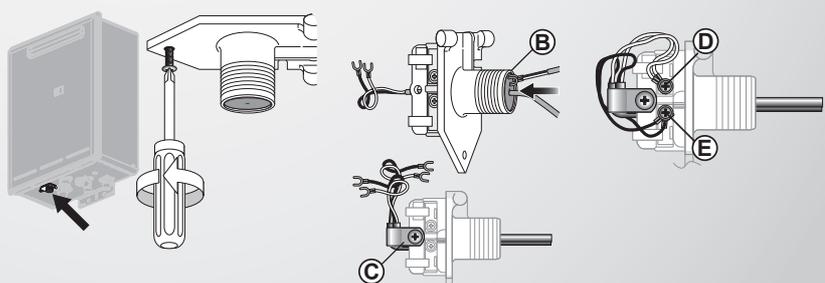


Spade connectors are available from your local electrical supplier.

## Cable connector for VT26, VT24, VT20, and VT16



## Cable connector for HD250, HD200, HDi200, and EF models



# Commissioning



The appliance operation must be tested after installation. Ensure building occupants do not have access to the hot water outlets during this procedure.

## Testing

1. Before final connection of the water heater, purge the gas and hot and cold water supply lines. Swarf in the gas or water supplies may cause damage.
2. Turn on the gas and water supplies and test for leaks (gas and water) near the unit.
3. Isolate gas supply. Remove test point screw located on the gas inlet and attach pressure gauge.
4. Turn the power on at the power point socket and turn on the gas.
5. If water controllers are fitted ensure they are on. Select the maximum delivery temperature and open all available hot water taps including the shower. If water controllers are not fitted, open all available hot water taps.
6. Operate all other gas appliances at their maximum gas rate.
7. With all gas appliances operating on maximum, the pressure should read between 1.0-3.5 kPa (NG) or 2.75-3.5 kPa (ULPG). If the pressure is lower, the gas supply is inadequate and the appliance will not operate to specification. It is the responsibility of the installer to check the gas meter, service regulator and pipe work for correct operation and sizing. The gas regulator on the appliance is electronically controlled and factory preset. Under

normal circumstances it does not need adjustment during installation.

8. Close all hot water outlets.
9. Inspect and clean the strainer located on the cold water inlet connection. This may need to be repeated to ensure the strainer remains clear, especially on new installations.
10. If water controllers are fitted, it is necessary to test their operation through the complete range of functions (refer operation guide).
11. Confirm hot water delivery temperatures using a thermometer. If controllers are fitted, ensure temperatures exceeding 55 °C cannot be selected on bathroom controllers.
12. After testing is completed, explain to the customer how to operate the water heater and water controllers (if fitted). Ensure your details are entered in the customer operation guide (Installer details).

## Gas pressure setting

The gas regulator on the appliance is electronically controlled and factory preset. Under normal circumstances it does not need adjustment during installation. Make adjustments only if the unit is not operating correctly and all other causes for incorrect operation have been eliminated. Instructions for gas pressure setting are in the instruction pocket located inside the appliance front cover.

## Commissioning checklist

Commission the unit in accordance with the Commissioning Checklist supplied with the appliance (inside front cover of appliance). Ensure you leave the completed checklist with the customer.

If the appliance can not be adjusted to perform correctly call 0800 RINNAI (0800 746 624) for assistance.

# Recommended solar system layout

Rinnai continuous flow water heaters configured for solar systems produce hot water at 75 °C and are not suitable for use with water controllers. The household water supply **MUST** be protected by a suitable tempering valve.

## Installation

Rinnai continuous flow water heaters in solar installations are only suitable as gas boosters in solar hot water systems. These models produce water at higher than normal temperatures and must be connected to the hot water supply by use of a suitable tempering valve.

Install a Rinnai continuous flow water heater using a flow diversion valve as shown. Remember 'B to Boiler' when setting up the flow diversion valve.

The water heater must be set to 75 °C (refer dip switch settings on following pages).

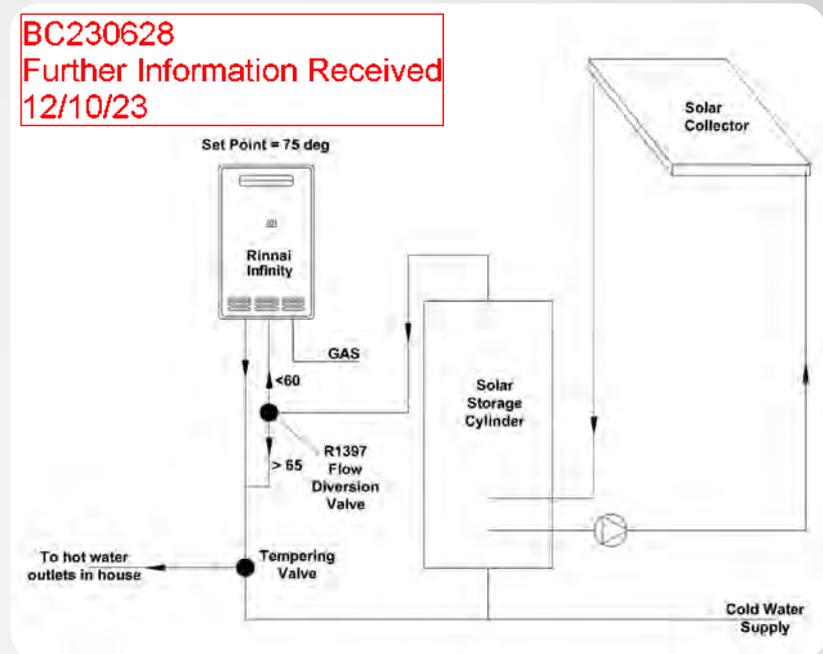
Rinnai water controllers cannot be used with Rinnai Infinity solar units as the hot water does not always pass through the Rinnai Infinity, and the Rinnai Infinity dip switch setting of 75 °C is unable to be adjusted.

## System configuration to protect for Legionella

If the system is configured according to the details above it will meet the requirements of the Acceptable Solution G12/AS2 for protection against Legionella. Section 3.5.2 states:

b) the instantaneous water heater must heat all water passing through it to not less than 70 °C.

## Recommended system layout using a Rinnai Continuous Flow water Heater and Flow Diversion Valve



# DIP switch settings

# DIP switch settings - important

DIP switch settings must only be changed by a licensed gasfitter. They have been provided as there may be a requirement to change the temperature of the water delivered from the water heater.



**WARNING** Care must be taken when changing the temperature settings as the DIP switches are small and can be easily switched or bumped into the wrong position. Please use this information carefully and fully check the operation of the water heater before leaving site including the temperature of the water delivered.

The cover of the water heater will need to be removed to carry out this operation. As this will expose live mains voltage wiring **please disconnect the power supply before removing the front cover.**

We wish to draw your attention to the requirements of the New Zealand Building Code and compliance document G12. This requires that water delivered to sanitary fixtures be no more than 55 °C. Increasing the water heater set temperature will therefore require that you protect all sanitary fixtures to which the appliance is plumbed with suitable tempering valves or similar.

Rinnai will accept no liability for issues arising out of the use of this DIP switch information.

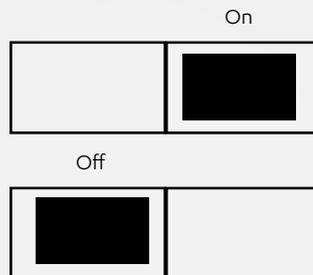
If you have any doubts about the performance of the water heater please contact Rinnai by phoning 0800 TO RINNAI (0800 86 746 624).

The setting of water temperatures in domestic model Infinity units (white cases) to greater than 55 °C (with the exception of units set to 75 °C in domestic solar installations) will reduce the warranty period. Refer to warranty

information in the Operation Guide for further information.

The following pages detail DIP switch settings for the specific Rinnai continuous flow water heaters listed. They ARE NOT applicable for older models.

## Legend for DIP switch settings (black indicates position of switch)



## Short and long flues

Reference to what is a short and long flue can be found on page 8.

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# DIP switch settings



## Applicable models and REU numbers

Rinnai Infinity VT16	External	REU-VR1620WG
Rinnai Infinity VT20	External	REU-VR2024WG
Rinnai Infinity VT24	External	REU-VR2426WG
Rinnai Infinity VT26	External	REU-VR2626WG
Rinnai Infinity EF24	External	REU-K2430WG

## DIP switch 1: Upper SW (8P)

SW No.	Note						
1		Off					
2	Fixed temperature (with controllers)	Off	Fixed temperature			On	With controllers
3	Temperature settings	See Chart A					
4							
5							
6		Off					
7	Gas pressure	Off	Normal	On	Forced min.	On	Forced max.
8		Off		Off		On	

## Chart A: Temperature settings

DIP. SW.1-SW No. (8P)			SW No. 2 = Off (fixed temperature)	SW No. 2 = On (with controllers)	
3	4	5	No controllers (fixed temp.)	No controllers (fixed temp.)	With controllers (max. set temp.)
Off	Off	Off	55	55	55
On	Off	Off	75	55	75
Off	On	Off	65	55	65
On	On	Off	60	55	60
Off	Off	On	50	50	50
On	Off	On	42	42	42
Off	On	On	not to be used	40	40
On	On	On	not to be used	55	75

## DIP switch 2: Lower SW (4P)

SW No.	Note				
1	Gas type	Off	ULPG	On	NG
2,3,4	Model settings	See Chart B			

## Chart B: Model settings

DIP. SW.2-SW No. (4P)			Model (REU-number)
2	3	4	
Off	Off	Off	VT26 (VR2626WG) and EF24 (K2430WG)
Off	On	Off	VT24 (VR2426WG)
Off	Off	On	VT20 (VR2024WG)
Off	On	On	VT16 (VR1620WG)

# DIP switch settings



## Applicable models and REU numbers

Rinnai Infinity HD200	External	REU-VRM2632WC
Rinnai Infinity HDi200	Internal	REU-VR2632FFUG
Rinnai Infinity HD250	External	REU-VR3237WG

## DIP switch 1: Upper SW (8P)

SW No.	Note							
1	HDi200	Flue setting	Off	Long flue (p. 8)		On	Short flue (p. 8)	
	HD200, HD250	Model setting	Off					
2	Fixed temperature (with controllers)		Off	Fixed temperature		On	With controllers	
3	Temperature settings		See Chart A					
4								
5								
6			Off					
7	Gas pressure		Off	Normal	On	Forced min.	On	Forced max.
8			Off		Off		On	

## Chart A: Temperature settings

DIP. SW.1-SW No. (8P)			SW No. 2 = Off (fixed temperature)	SW No. 2 = On (with controllers)	
3	4	5	No controllers (fixed temp.)	No controllers (fixed temp.)	With controllers (max. set temp.)
Off	Off	Off	55	55	55
On	Off	Off	75	55	75
Off	On	Off	65	55	65
On	On	Off	60	55	60
Off	Off	On	50	50	50
On	Off	On	42	42	42
Off	On	On	85, 95 <sup>1</sup>	40	40
On	On	On	85	55	75

<sup>1</sup> 95 °C setting only available for HD250 model

## DIP switch 2: Lower SW (4P)

SW No.	Note					
1	Gas type		Off	ULPG	On	NG
2,3,4	Model settings		See Chart B			
5,6	Not in use		Off			

## Chart B: Model settings

DIP. SW.2-SW No. (4P)			Model (REU-number)
2	3	4	
Off	Off	Off	HD250 (VR3237WG)
Off	Off	On	HD200 (VRM2632WC)
Off	On	On	HDi200 (VR2632FFUG)

# DIP switch settings



## Applicable models and REU numbers

Rinnai Infinity EF250	External	REU-KM3237WD
Rinnai Infinity EFi250	Internal	REU-KM3237FFUD

## DIP switch 1: Upper SW (8P)

SW No.	Note						
1	Flue settings	Off	EF250 Ext & EFi250 Int long flue (p. 8)	On	EFi250 Internal short flue (p. 8)		
2	Fixed temperature (with controllers)	Off	Fixed temperature	On	With controllers		
3 4 5	Temperature settings	See Chart A					
6	Not in use	Factory setting is 'Off'					
7	Gas pressure	Off	Normal	On	Forced min.	On	Forced max.
8		Off		Off		On	

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## Chart A: Temperature settings

DIP. SW.1-SW No. (8P)			SW No. 2 = Off (fixed temperature)	SW No. 2 = On (with controllers)	
3	4	5	No controllers (fixed temp.)	No controllers (fixed temp.)	With controllers (max. set temp.)
Off	Off	Off	55	55	55
On	Off	Off	75	55	75
Off	On	Off	65	55	65
On	On	Off	60	55	60
Off	Off	On	50	50	50
On	Off	On	42	42	42
Off	On	On	95	40	40
On	On	On	85	55	75

## DIP switch 2: Lower SW (4P)

SW No.	Note				
1	Gas type settings	Off	ULPG	On	NG
2		Off		Off	
3	Type settings	Off	External	Off	Internal
4		Off		On	
5	Automatic return	Off	Inactive	On	Active
6	External device	Off	S-BMS	On	AH

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Installation guide



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# GIB EzyBrace® Systems specification GS1-N

Specification code	Minimum length (m)	Lining requirement
GS1-N	0.4	Any 10mm or 13mm GIB® Standard plasterboard to one side only

## WALL FRAMING

Wall framing to comply with;

- NZBC B1 – Structure B1/AS1 Clause 3 Timber (NZS 3604:2011).
- NZBC B2 – Durability B2/AS1 Clause 3.2 Timber (NZS 3602).

Framing dimensions and height as determined by NZS 3604:2011 stud and top plate tables for load bearing and non-bearing walls. The use of kiln dried stress graded timber is recommended.

## BOTTOM PLATE FIXING

### Timber floor

Pairs of hand driven 100 x 3.75mm nails at 600mm centres; or three power driven 90 x 3.15mm nails at 600mm centres.

### Concrete floor

Internal Wall Bracing Lines: In accordance with the requirements of NZS 3604:2011 for internal wall plate fixing or 75 x 3.8mm shot fired fasteners with 16mm discs spaced at 150mm and 300mm from end studs and 600mm centres thereafter.

External Wall Bracing Lines: In accordance with the requirements of NZS 3604:2011 for external wall bottom plate fixing.

## WALL LINING

- Any 10mm or 13mm GIB® plasterboard lining.
- Sheets can be fixed vertically or horizontally.
- Sheet joints shall be touch fitted.
- Use full length sheets where possible.

## PERMITTED ALTERNATIVES

For permitted GIB® plasterboard alternatives refer to p. 5 in GIB EzyBrace® Systems literature.

## FASTENING THE LINING

### Fasteners

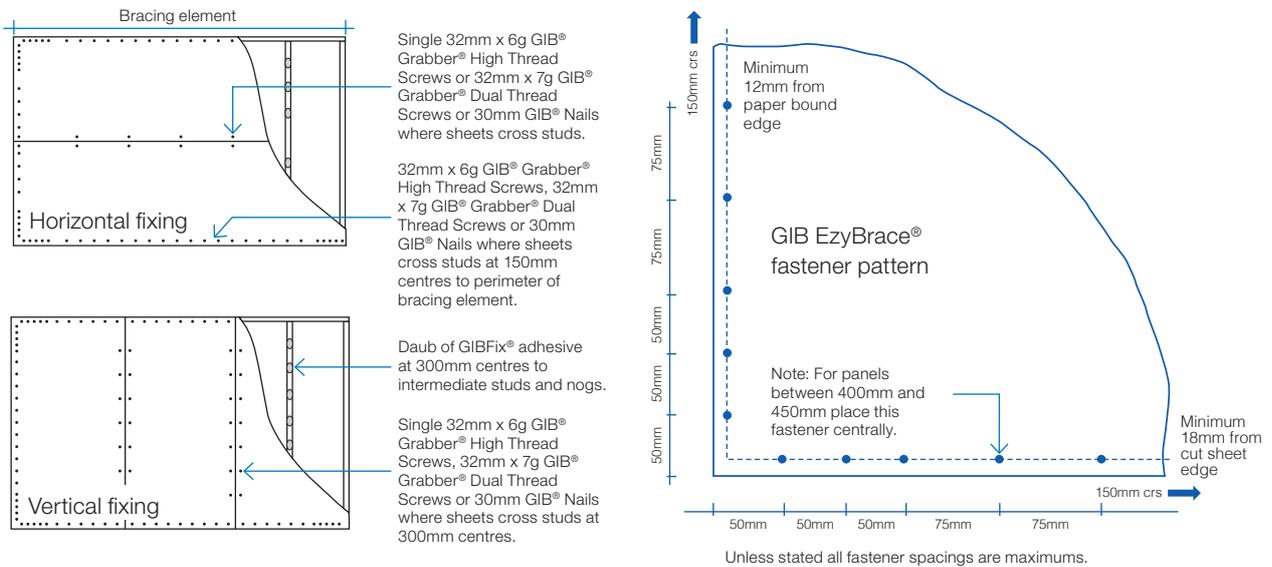
32mm x 6g GIB® Grabber® High Thread Screws, 32mm x 7g GIB® Grabber® Dual Thread Screws or 30mm GIB® Nails. If using the GIBFix® Angle use only 32mm x 7g GIB® Grabber® Dual Thread Screws.

### Fastener centres

50,100,150, 225, 300mm maximum from each corner and 150mm thereafter around the perimeter of the bracing element. For vertically fixed sheets place fasteners at 300mm maximum centres to intermediate sheet joints. For horizontally fixed sheets place single fasteners to the sheet edge where it crosses the stud. Use daubs of GIBFix® adhesive at 300mm maximum centres to intermediate studs. Place fasteners no closer than 12mm from paper bound sheet edges and 18mm from any sheet end or cut edge.

## JOINTING

Joint strength is important in delivering bracing system performance. All fastener heads stopped and all sheet joints GIB® Joint Tape reinforced and stopped in accordance with the GIB® Site Guide.



In order for GIB® systems to perform as tested, all components must be installed exactly as prescribed. Substituting components produces an entirely different system and may seriously compromise performance. Follow the specifications. This specification sheet is issued in conjunction with the publication GIB EzyBrace® Systems

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## GIB EzyBrace® Systems specification BL1-H

Specification code	Minimum length (m)	Lining requirement	Other requirements
BL1-H	0.4	10mm or 13mm GIB Braceline® to one side only	Hold downs

### WALL FRAMING

Wall framing to comply with;

- NZBC B1 – Structure B1/AS1 Clause 3 Timber (NZS 3604:2011).
- NZBC B2 – Durability B2/AS1 Clause 3.2 Timber (NZS 3602).

Framing dimensions and height as determined by NZS 3604:2011 stud and top plate tables for load bearing and non-bearing walls. The use of kiln dried stress graded timber is recommended.

### BOTTOM PLATE FIXING

#### Timber floor

Use panel hold downs at each end of the bracing element. The GIB HandiBrac® is recommended. See details in GIB EzyBrace® Systems or GIB® Site Guide.

Pairs of hand driven 100 x 3.75mm nails at 600mm centres; or  
Three power driven 90 x 3.15mm nails at 600mm centres.

#### Concrete floor

Use panel hold downs at each end of the bracing element. The GIB HandiBrac® is recommended. See details in GIB EzyBrace® Systems or GIB® Site Guide. Within the length of the bracing element bottom plates are to be fixed in accordance with the requirements of NZS 3604:2011.

### WALL LINING

- A layer of 10mm or 13mm GIB Braceline®
- Sheets can be fixed vertically or horizontally.
- Sheet joints shall be touch fitted.
- Use full length sheets where possible.

### PERMITTED ALTERNATIVES

For permitted GIB® plasterboard alternatives refer to p. 5 in GIB EzyBrace® Systems literature.

### FASTENING THE LINING

#### Fasteners

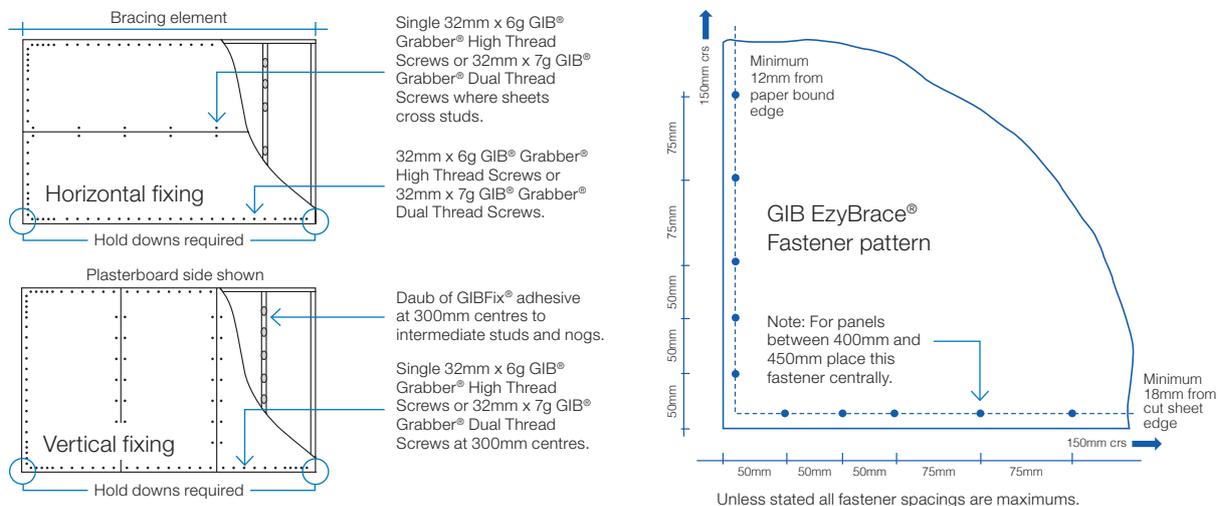
32mm x 6g GIB® Grabber® High Thread Screws or 32mm x 7g GIB® Grabber® Dual Thread Screws. If using the GIBFix® Framing System or if fastening through GIBFix® Angles use only 32mm x 7g GIB® Grabber® Dual Thread Screws.

#### Fastener centres

50,100,150, 225, 300mm from maximum each corner and 150mm thereafter around the perimeter of the bracing element. For vertically fixed sheets place fasteners at 300mm maximum centres to the sheet joint. For horizontally fixed sheets place single fasteners to the sheet edge where it crosses the stud. Use daubs of GIBFix® adhesive at 300mm maximum centres to intermediate studs. Place fasteners no closer than 12mm from paper bound sheet edges and 18mm from any sheet end or cut edge.

### JOINTING

Joint strength is important in delivering bracing system performance. All fastener heads stopped and all sheet joints GIB® Joint Tape reinforced and stopped in accordance with the GIB® Site Guide.



In order for GIB® systems to perform as tested, all components must be installed exactly as prescribed. Substituting components produces an entirely different system and may seriously compromise performance. Follow the specifications. This specification sheet is issued in conjunction with the publication GIB EzyBrace® Systems



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## GIB EzyBrace® Systems specification BLP-H

Specification code	Minimum length (m)	Lining requirement	Other requirements
BLP-H	0.4	10mm or 13mm GIB Braceline® to one side of the frame plus minimum 7mm structural plywood manufactured to AS/NZ 2269.0 :2012 to the other side	Hold downs

### WALL FRAMING

Wall framing to comply with;

- NZBC B1 – Structure; B1/AS1 Clause 3 Timber (NZS 3604:2011).
- NZBC B2 – Durability B2/AS1 Clause 3.2 Timber (NZS 3602).

Framing dimensions and height as determined by NZS 3604:2011 stud and top plate tables for load bearing and non-bearing walls. The use of kiln dried stress graded timber is recommended.

### BOTTOM PLATE FIXING

#### Timber floor

Use panel hold downs at each end of the bracing element. The GIB® HandiBrac is recommended. See details in GIB EzyBrace® Systems or GIB® Site Guide.

Pairs of hand driven 100 x 3.75mm nails at 600mm centres; or Three power driven 90 x 3.15mm nails at 600mm centres.

#### Concrete floor

Use panel hold downs at each end of the bracing element. The GIB HandiBrac® is recommended. See details in GIB EzyBrace® Systems or GIB® Site Guide. Within the length of the bracing element bottom plates are to be fixed in accordance with the requirements of AS/NZ 2269/0 :2012.

### WALL LINING

- A layer of 10mm or 13mm GIB Braceline® to one side of the wall plus minimum 7mm structural plywood manufactured to AS/NZS 2269.0 :2012 to the other side.
- Sheets can be fixed vertically or horizontally.
- Plywood is to be fixed vertically with edges supported.
- Sheet joints shall be touch fitted.
- Use full length sheets where possible.

### PERMITTED ALTERNATIVES

For permitted GIB® plasterboard alternatives refer to p. 5 in GIB EzyBrace® Systems literature.

### FASTENING THE LINING

#### Fasteners

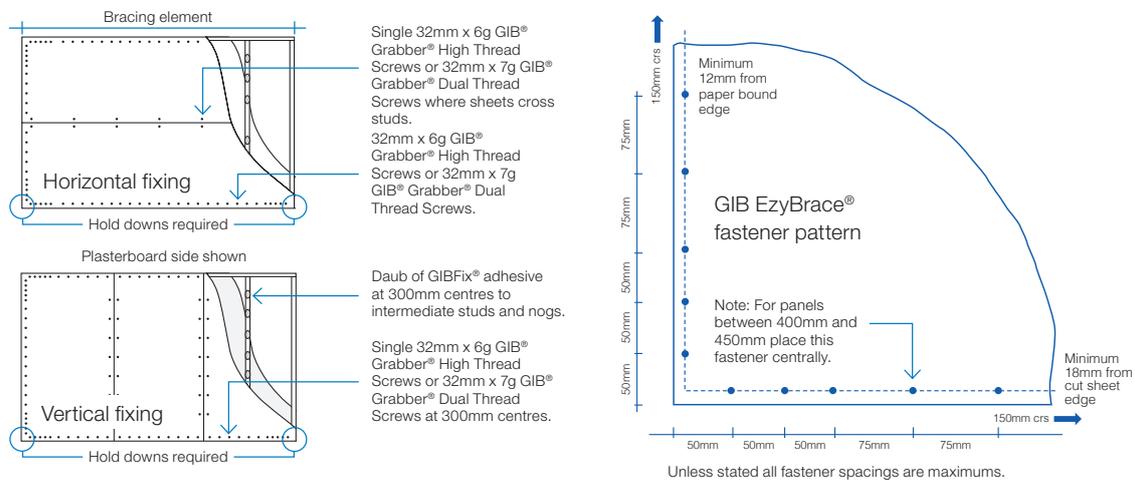
GIB Braceline® side: 32mm x 6g GIB® Grabber® High Thread Screws or 32mm x 7g GIB® Grabber® Dual Thread Screws. Plywood: 50 x 2.8mm Galv or Stainless steel annular grooved FH nails. If using the GIBFix® Framing System or if fastening through GIBFix® Angles use only 32mm x 7g GIB® Grabber® Dual Thread Screws.

#### Fastener centres

GIB® Plasterboard side: 50,100,150, 225, 300mm from each corner and then 150mm thereafter around the perimeter of the bracing element. For vertically fixed sheets place fasteners at 300mm centres to the intermediate sheet joints. For horizontally fixed sheets place single fasteners to the sheet edge where it crosses the stud. Use daubs of GIBFix® adhesive at 300mm centres to intermediate studs. Place fasteners no closer than 12mm from paper bound sheet edges and 18mm from any sheet end or cut edge. Plywood side: 150mm centres to the perimeter of each sheet. GIB® corner fastener pattern does not apply to the plywood side. 300mm centres to intermediate studs.

### JOINTING

Joint strength is important in delivering bracing system performance. All fastener heads stopped and all sheet joints GIB® Joint Tape reinforced and stopped in accordance with the GIB® Site Guide.



In order for GIB® systems to perform as tested, all components must be installed exactly as prescribed. Substituting components produces an entirely different system and may seriously compromise performance. Follow the specifications. This specification sheet is issued in conjunction with the publication GIB EzyBrace® Systems

## 3.3 ECOPLY® BRACING SPECIFICATION - EPI

Table 10: Singled Sided Structural Plywood Brace

Specification No.	Minimum Wall Length	Lining Requirements	BU's/m Wind	BU's/m Earthquake
EPI_0.4	0.4 m	Ecoply one side	80	95
EPI_0.6	0.6 m	Ecoply one side	95	105
EPI_1.2	1.2 m	Ecoply one side	120	135

**Framing**

Wall framing must comply with:

- NZBC B1 - Structure: ASI Clause 3 Timber (NZS 3604)
- NZBC B2 - Durability: ASI Clause 3.2 Timber (NZS 3602)

Framing dimensions and height are as determined by the NZS 3604 stud and top plate tables for load bearing and non load bearing walls. Kiln dried verified structural grade timber must be used. Machine stress graded timber, such as Laserframe® of SG8 stress grade minimum, is recommended.

**Bottom plate fixing**

Use GIB Handibrac® hold-down connections at each end of the bracing element. Refer to manufacturer installation instructions supplied with the connectors for correct installation instructions and bolt types to be used for either concrete or timber floors. Within the length of the bracing element, bottom plates are fixed in accordance with the requirements of NZS 3604.

**Lining**

One layer of 7 mm, 9 mm or 12 mm Ecoply plywood fixed directly to framing. If part sheets are used, ensure nailing at required centres is carried out around the perimeter of each sheet or part sheet. A 2-3 mm expansion gap should be left between sheets.

**Fastening the Ecoply® panels**

Fasten with 50 x 2.8 mm hot dipped galvanised or stainless steel flat head nails for direct fix. Place fasteners no less than 7 mm or 3 fastener diameters from sheet edges. Screws cannot be used. Power driven nails are suitable. Do not overdrive, nails must be full round head.

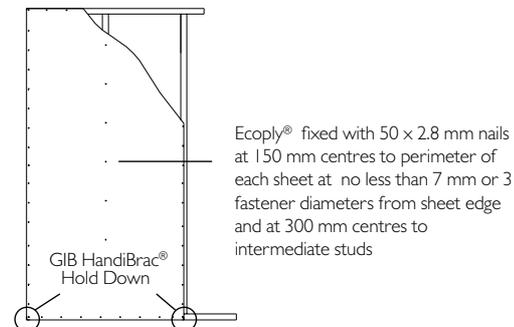
**Fasteners for H3.2 CCA treated Ecoply® panels**

Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

In certain circumstances stainless steel fasteners may be required. Refer to Table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice. Where stainless steel nails are required, annular grooved nails must be used.

**Fastening centres**

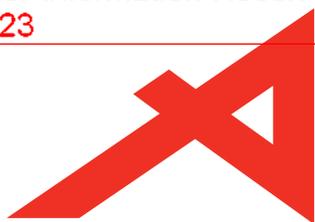
Fasteners are placed at 150 mm centres around the perimeter of each sheet and 300 mm centres to intermediate studs. Where more than one sheet forms the brace element each sheet must be nailed off independently.



Ecoply® Bracing Systems are designed to meet the requirements of the NZBC and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/ASI Structure. Testing was carried out using Ecoply manufactured by Carter

Holt Harvey and SG8 timber framing, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB Handibrac® are registered trade marks of Fletcher Building Holdings Ltd.

SEPTEMBER 2015



**BRANZ Appraised**  
Appraisal No. 928 [2021]

**GIB EZYBRACE®  
SYSTEMS**

**Appraisal No. 928 [2021]**

This Appraisal replaces BRANZ  
Appraisal No. 928 [2016]



### BRANZ Appraisals

Technical Assessments of  
products for building and  
construction.



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## Product

- 1.1 GIB EzyBrace® Systems are a range of wall and ceiling bracing systems based on the use of GIB® Standard, GIB Braceline® and other GIB® plasterboards. GIB EzyBrace® Systems are used to resist earthquake and wind loads on timber-framed buildings designed and constructed in accordance with NZS 3604 and the GIBFix® Framing System. The GIB EzyBrace® Bracing Software provides an electronic means of calculating bracing demand and resistance.

## Scope

- 2.1 GIB EzyBrace® Systems and the GIB EzyBrace® Bracing Software have been appraised for the design and use of interior wall and ceiling bracing systems in buildings within the scope limitations of NZS 3604.

## Building Regulations

### New Zealand Building Code (NZBC)

- 3.1 In the opinion of BRANZ, GIB EzyBrace® Systems, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the NZBC:

**Clause B1 STRUCTURE:** Performance B1.3.1, B1.3.2 and B1.3.4. GIB EzyBrace® Systems meet the requirements for loads arising from self-weight, earthquake, wind and impact [i.e. B1.3.3 (a), (f), (h) and (j)]. See Paragraphs 8.1-8.10.

**Clause B2 DURABILITY:** Performance B2.3.1 (a) not less than 50 years. GIB EzyBrace® Systems meet this requirement. See Paragraphs 9.1-9.4.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. GIB EzyBrace® Systems meet this requirement.

## Technical Specification

4.1 The GIB® plasterboards and accessories used with the GIB EzyBrace® Systems, and supplied or specified by Winstone Wallboards Ltd are as follows:

### GIB® plasterboards

- **GIB® Standard** - GIB® Standard plasterboard is a paper-bound, fibreglass reinforced gypsum-plaster core sheet lining material. GIB® Standard plasterboard is available in 10 mm and 13 mm thicknesses and a sheet width of 1,200 mm and 1,350 mm [GIB® Wideline]. The sheets have a taper on the two long sheet edges. The 10 mm thick sheets are also available with a square edge. Sheets are available in various lengths from 2,400 mm to 6,000 mm. The nominal sheet weight is 6.5 kg/m<sup>2</sup> for 10 mm thick sheets and 8.5 kg/m<sup>2</sup> for 13 mm thick sheets. GIB® Standard plasterboard face paper is a light buff colour.
- **GIB Braceline®** - GIB Braceline® is a high-density fibreglass reinforced, paper-bound gypsum-plaster core sheet lining material. GIB Braceline® is available in 10 mm and 13 mm thicknesses. The sheets have a taper on the two long sheet edges. GIB Braceline® has a sheet width of 1,200 mm and 1,350 mm, and is available in lengths of 2,400 mm, 2,700 mm, 3,000 mm, 3,600 mm and 4,800 mm. The nominal sheet weight is 9 kg/m<sup>2</sup> for 10 mm thick sheets and 12.5 kg/m<sup>2</sup> for 13 mm thick sheets. GIB Braceline® face paper is light blue in colour.
- **Alternative GIB® plasterboards** - in certain situations, as specified in the Technical Literature, substitution is permitted with GIB Aqualine®, GIB Fyreline®, GIB Toughline® and GIB Ultraline®.

### Components and Accessories

- **GIB® Accessories and GIB® Jointing Compounds** - as specified in the GIB® Site Guide Technical Literature.
- **Fasteners**
  - GIB Grabber® High Thread Screws for fixing directly to timber - 32 mm x 6 g.
  - GIB Nail - 30 x 2.8 mm.
  - GIB Grabber® screws for fixing to light gauge steel battens - 32 mm x 6 g.
- **Adhesive and Sealants**
  - GIBFix® One - an off-white acrylic adhesive supplied in 375 ml cartridges and 600 ml sausages.
  - GIBFix® All-Bond - a green solvent-based adhesive supplied in 375 ml cartridges and 600 ml sausages.
- **GIBFix® Framing Components**
  - GIBFix® Angle - 45 x 45 x 0.55 mm galvanised steel angle with a knurled surface. Supplied in lengths of 2.4 m and 2.7 m.
  - GIB Grabber® Dual Thread Screws for fixing to timber through GIBFix® Angle - 32 mm x 7 g needle-point screw with coarse thread lower section and fine thread upper section.
- **Fasteners, Anchors and Connections**
  - GIB® HandiBrac® - a one-piece, 2 mm thick, galvanised steel angle bracket approximately 95 mm high, 65 mm long and 54 mm wide. The bracket is supplied with five Type 17 screws, 14 g x 35 mm.
  - BOWMAC® screw bolt - M10 x 140 mm screw anchor, with a blue painted hex head.
  - Coach screws - 12 mm x 150 mm and 50 x 50 x 3 mm washer, hot-dip galvanised for fixing to timber floors.
  - Cast-in bolts - M12 x 150 mm minimum and 50 x 50 x 3 mm washers for fixing to concrete floors.
  - Shot-fired fasteners - minimum 75 mm x 3.8 mm with 16 mm discs for fixing GS1-N, GS2-N and GS2-NOM internal line bracing elements to concrete slabs.
  - Galvanised or stainless steel strap - 25 x 0.9 mm top and bottom plate connections.
  - Strap fixings - 30 x 2.5 mm hot-dip galvanised or stainless steel flat head nails. [Note: For corrosion protection requirements, refer to NZS 3604, Section 4.]

- **Ceiling Diaphragms** - ceiling diaphragms are constructed using timber ceiling battens, or GIB® Rondo® or similar metal ceiling batten systems.
- **Plywood**
  - **Plywood** – minimum of 7 mm thick complying with AS/NZS 2269 D-D Structural Grade.
  - **Plywood fixings** – 50 x 2.5 mm hot-dip galvanised or stainless steel annular-grooved, flathead nails.

## Handling and Storage

- 5.1 The best results are achieved when GIB® plasterboards are treated as a finishing material and protected from damage. Sheets must be stacked flat and kept dry at all times. For limits on stack heights see the GIB® Site Guide. Sheets must be carried on edge and not dragged.
- 5.2 All accessories must be kept dry.

## Technical Literature

- 6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for GIB EzyBrace® Systems. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

## Design Information

### General

- 7.1 NZS 3604 provides methods to distribute the bracing elements in walls to resist forces. The use of ceiling diaphragms is defined in the Technical Literature.
- 7.2 GIB EzyBrace® Systems are for use in dry, internal situations only.
- 7.3 GIB EzyBrace® Systems must not be exposed to temperatures of 52°C or greater for prolonged periods. Refer to appliance and fitting manufacturers for installation details.

### GIB EzyBrace® Bracing Software

- 7.4 The GIB EzyBrace® Bracing Software contains design procedures and an electronic calculation method for bracing demand calculated in accordance with NZS 3604, Section 5. Floor loadings can be selected in accordance with either NZS 3604, Bracing Demand Tables 5.5–5.10 for 2 kPa floor loads or less, or Tables 14.1–14.3 for 3 kPa floor loads.
- 7.5 The bracing demand calculations contained in the GIB EzyBrace® Bracing Software are based on first principles engineering and calculate wind and earthquake demand, based on the building parameters entered. Resulting bracing demand calculations are project specific and can differ from values derived using NZS 3604 wind and earthquake demand tables. The GIB EzyBrace® Bracing Software has been assessed as part of this Appraisal.
- 7.6 The bracing ratings for GIB EzyBrace® Systems are embedded in the GIB EzyBrace® Bracing Software.

### GIBFix® Framing System

- 7.7 The GIBFix® Framing System utilises GIBFix® Angles fixed at internal corners and at wall/ceiling junctions to reduce the potential for fastener ‘popping’ and joint cracking due to timber framing movement. The GIBFix® Framing System also offers an alternative arrangement of studs at corners and at intersecting walls to improve insulation and to reduce thermal bridging compared to traditional wall framing layouts. Refer to the Technical Literature for full details.
- 7.8 Where walls intersect, noggings are required at maximum 900 mm centres to enable fixing of the end stud of the intersecting wall to the main wall framing.
- 7.9 The GIBFix® Framing System permits the use of a single panel hold-down [e.g. GIB® HandiBrac®] at wall corners and T-intersections for both the across and along bracing directions.

### Framing

- 7.10 GIB EzyBrace® Systems can be installed using conventional timber framing layouts or by using the layouts provided in the GIBFix® Framing System. The bracing ratings embedded in the GIB EzyBrace® Bracing Software are equally applicable to both framing options.
- 7.11 Timber framing grade, spacing and construction must comply with NZS 3604. Timber treatment must comply with NZBC Acceptable Solution B2/AS1.
- 7.12 Winstone Wallboards Ltd recommends the use of kiln-dried stress-graded framing timber. The minimum actual framing dimensions are 90 mm x 45 mm for external walls and 75 mm x 45 mm for internal walls.
- 7.13 Joints in the top plates of bracing panels must be tied together with 3 kN and 6 kN top plate connectors using 25 mm x 0.9 mm hot-dip galvanised mild steel strap, three nails each side of joint for 3 kN and six nails each side of joint for 6 kN.

### Bracing System GS2-NOM

- 7.14 Most GIB EzyBrace® Systems require additional fasteners at the corners to achieve the published bracing ratings. The GS2-NOM system only requires fixings at 300 mm centres around the sheet perimeter.
- 7.15 Where internal doors penetrate a GS2-NOM bracing element and recessed door jambs are used, the sheets may be adhesive fixed around the door opening with GIBFix® All-Bond, instead of screw fixing. This is designed to reduce fastener 'popping' around internal doors when using grooved door frames. Screw fixing should be used where door frames are to be finished with architraves and the architrave will cover the screws. The adhesive fix option around door openings must not be used with any other GIB EzyBrace® Systems.

### Alternative GIB® plasterboards

- 7.16 GIB Ezybrace® Systems have been designed and tested using only the products specified. Occasionally additional properties may be required to be provided by a different GIB® plasterboard product. Table 1 provides acceptable alternative options.

**Table 1: Permitted Alternatives in GIB EzyBrace® Systems**

Specified	Permitted alternative GIB® plasterboard products								
	GIB® Standard	GIB Ultraline®	GIB Braceline/ Noiseline®	GIB Aqualine®	GIB Toughline®	GIB Fyreline®			
						10 mm	13 mm	16 mm	19 mm
GIB® Standard	N/A	✓	✓	✓	✓	✓ Note 1	✓ Notes 1 and 3		
GIB Braceline®	X	X	N/A	✓ Note 2	✓	X	✓ Notes 1, 2 and 3		

- **Note 1:** The fastener type and length and must be as required for the relevant Fire Resistance Rating (FRR) system but the fixing pattern must be as required for bracing elements.
- **Note 2:** The bracing element must be 900 mm or longer. Fasteners must be at maximum 100 mm centres to the perimeter of the bracing element. The bracing corner fastening pattern applies to all four corners of the element.
- **Note 3:** Specify traditional wall framing layout where a FRR is required. See Paragraph 11.4.

### BOWMAC Screw Bolts

- 7.17 When BOWMAC Screw Bolts are used as fixings for external walls with concrete masonry header block foundations, the minimum grout/concrete strength must be as specified in NZS 3604. BOWMAC Screw Bolts may be used in Corrosion Zones B and C as defined in NZS 3604. BOWMAC Screw Bolts may only be used in NZS 3604 Corrosion Zone D where the minimum concrete cover to the bolt is 60 mm. This cannot be achieved with standard 90 mm wide timber framing. An alternative option in this scenario is to use 140 mm wide framing.

## Structure

### Bracing

- 8.1 The bracing unit [BU] ratings are embedded in the GIB EzyBrace® Bracing Software and vary with the wall length.
- 8.2 The Technical Literature provides comprehensive construction and panel hold-down details. These include bottom plate fixings using anchor screws and cast-in bolts (concrete), coach screws (timber), GIB® HandiBrac® or nailed stud-to-plate straps.
- 8.3 Bracing units derived from the BRANZ P21 test method are based on a wall height of 2.4 m. The GIB EzyBrace® Bracing Software calculates bracing ratings for higher wall heights by multiplying the appropriate bracing rating by 2.4 m and dividing by the actual wall height in metres. For walls less than 2.4 m in height, the GIB EzyBrace® Bracing Software calculates bracing ratings as if they were 2.4 m high.
- 8.4 NZS 3604 limits wall bracing elements to a maximum of 120 BU/m for timber-framed floors and 150 BU/m for concrete floors.

### Ceiling Diaphragms

- 8.5 GIB® ceiling diaphragms are used to space bracing lines further apart than 6 m. The basic shape of a ceiling diaphragm must be square or rectangular and the length must not exceed twice the width.
- 8.6 For ceiling diaphragms not steeper than 15° and not exceeding 7.5 m in length, any GIB® plasterboard may be used provided the perimeter fixing are at 150 mm centres.
- 8.7 For ceiling diaphragms not steeper than 45° and not exceeding 7.5 m in length, and for diaphragms not steeper than 25° and not exceeding 12 m in length, any GIB® plasterboard may be used provided the perimeter fixings are at 100 mm centres.

### Openings in Bracing Elements

- 8.8 Small openings of 90 x 90 mm or less may be placed anywhere except within 90 mm of the edge of the bracing element.

### Shower Areas

- 8.9 GIB EzyBrace® Systems must not be located in shower cubicles or behind baths and the like. GIB EzyBrace® Systems may be used in water-splash areas provided they are protected as required by NZBC Clause E3 Internal Moisture. Refer to BRANZ Appraisal No. 427 GIB® Wet Area Systems.

### Impact Resistance

- 8.10 GIB® plasterboards provide adequate resistance to soft body impact, based upon history of use in domestic and light commercial applications.

## Durability

- 9.1 GIB EzyBrace® Systems, including linings and their fixings, have a serviceable life of at least 50 years. The ability of the systems to remain durable is dependent on them remaining dry in service, and being maintained in accordance with this Appraisal.

### Maintenance

- 9.2 The building must be maintained weatherproof and GIB® plasterboards must be protected from external and internal moisture in accordance with NZBC Clauses E2 and E3.
- 9.3 Holes resulting from damage to the lining, up to 100 x 100 mm square, will have no significant effect on the performance of the bracing panel. Such holes may be repaired by patching, stopping and finishing as appropriate. Independent expert advice must be sought to assess the effect and repair of larger areas of damage.
- 9.4 Bracing elements require no ongoing maintenance, apart from decoration and the repair of any damage.

### Prevention of Fire Occurring

- 10.1 Separation or protection must be provided to the GIB EzyBrace® Systems from heat sources such as fireplaces, heating appliances and chimneys. Part 7 of NZBC Verification Method C/VM1 and NZBC Acceptable Solution C/AS1, and NZBC Acceptable Solution C/AS2 provide methods for separation and protection of combustible materials from heat sources.

### Fire Affecting Areas Beyond the Fire Source

- 11.1 For internal surface finish properties and fire resistance ratings, refer to BRANZ Appraisal No. 289 GIB® Fire Rated Systems.

### Internal Moisture

- 12.1 GIB® plasterboard must be used in dry internal situations, and must not be used where likely to be exposed to liquid water, or where extended exposure to humidity above 90% RH is expected, e.g., such as may be expected in sauna rooms, commercial kitchens and the like.

## Installation Information

### Installation Skill Level Requirement

- 13.1 Installation of GIB EzyBrace® Systems must be completed by, or under the supervision of a Licensed Building Practitioner with the relevant Licence Class, in accordance with the Technical Literature and this Appraisal.

### General

- 14.1 GIB EzyBrace® Systems must be installed in accordance with the Technical Literature. For inspection, reference must be made to the Technical Literature.

### Framing

- 14.2 To achieve an acceptable decorative finish, the GIB® Site Guide specifies that walls must not be lined unless the moisture content of timber framing is less than 18%. Winstone Wallboards Ltd recommends a moisture content of 12% or less where buildings are to be air conditioned, centrally heated or have heat pumps installed.
- 14.3 Where the GIBFix® Framing System is used, GIBFix® Angles are tacked to the framing with flat head clouts prior to installation of the GIB® plasterboard.

### Cutting

- 14.4 GIB® plasterboard is easily cut by scoring the face paper with a sharp short-bladed trimming knife, and then snapping the plasterboard away from the cut face and cutting the back paper or by sawing. Use of a metal straightedge facilitates clean straight cuts. Cut edges can be tidied up by using a knife. Paper dags should be removed.

### Hold-downs

- 14.5 GIB EzyBrace® Systems which require hold-downs must either have a GIB® HandiBrac® fitted to each end of the bracing element or alternatively a metal stud-to-plate strap and hold-down anchor may be used. Refer to the Technical Literature for full installation details. Where a metal stud-to-plate strap is used, the hold-down anchor must be placed no more than 80 mm from the end of the bracing element.
- 14.6 Where the GIBFix® Framing System is used, a single hold-down located at a wall intersection may be used to provide the hold-down in both the across and along bracing directions.

### Plasterboard Sheet Fixing

- 14.7 Corner fixings must be 50 mm away from the sheet corner. Fixings must be no closer than 12 mm from the paper-bound sheet edge, and no closer than 18 mm from a cut edge, and driven at right angles to the sheet until the head is seated in a slight dimple just below the surface of the paper liner. Fixings must not be over-driven.

- 14.8 Wall bracing plasterboards [except for those used with the GS2-NOM system] are fixed at 150 mm centres around the perimeter framing of the bracing element [Note: There is a variation for GIB Aqualine® and GIB Fyrelite®, see Table 1]. At the corners of the wall bracing elements, a special fastening pattern is required with fasteners spaced at 50 mm, 100 mm, 150 mm, 225 mm and 300 mm from the corner and thereafter at 150 mm centres. Fixing to other framing is either mechanical or by using GIBFix® adhesives.
- 14.9 When installing GS2-NOM bracing elements, the GIB® plasterboard is fixed to framing around the bracing element perimeter and at sheet joints with fasteners at maximum 300 mm centres. Where recessed door jambs are used on internal door frames, the GIB® plasterboard may be fixed to the framing around the door opening with GIBFix® All-Bond, see Paragraph 7.15.
- 14.10 Where GIB Aqualine® or GIB Fyrelite® substitutes for GIB Braceline®, bracing elements must be longer than 900 mm and the bracing element perimeter fasteners must be spaced at 100 mm centres and the corner pattern described in Paragraph 14.8 used.
- 14.11 Full sheets must be used wherever possible.

#### **Fire Resistance Rated Bracing Elements**

- 14.12 Where a bracing element is also used as a fire-rated element, the method of fixing [including the length of the fixing specified] for the fire-rated element must be used, but the perimeter fixings of the bracing element must be at 150 mm centres and fixings at corners of the bracing element must be fixed as described in Paragraph 14.8. In two-layer systems, the inner layer must be used for bracing.

#### **Plywood Fixing**

- 14.13 Plywood is nail fixed at 150 mm centres around the perimeter of each sheet and at 300 mm centres to intermediate framing.

#### **Ceiling Diaphragms**

- 14.14 All GIB EzyBrace® System ceiling diaphragms require fixings around the perimeter at 100 mm or 150 mm centres, depending on the ceiling pitch and length. See Paragraphs 8.4-8.6 and refer to the Technical Literature.
- 14.15 The perimeter of the ceiling diaphragm is fixed to GIBFix® Angles, GIB® Rondo® perimeter channels, or alternatively, to an additional ex 150 x 40 mm timber plate fixed to the top plate.

#### **Jointing and Finishing**

- 14.16 All bracing element joints must be reinforced with GIB® tape and finished in accordance with the GIB® Site Guide.

#### **Health and Safety**

- 15.1 Dust resulting from the sanding of stopping and finishing compounds may be a respiratory irritant, and the use of a suitable facemask is recommended.

### **Basis of Appraisal**

The following is a summary of the technical investigations carried out:

#### **Tests**

- 16.1 Bracing tests were carried out by Winstone Wallboards Ltd in accordance with BRANZ Technical Paper P21 to determine the performance of GIB EzyBrace® Systems when the building is subjected to lateral wind or earthquake loading. Nail and screw slip tests were carried out by BRANZ and Winstone Wallboards Ltd. Winstone Wallboards Ltd's test facilities, procedures and results have been reviewed by BRANZ and found to be satisfactory.

### Other Investigations

- 17.1 The GIB EzyBrace® Bracing Software has been assessed by BRANZ and found to be satisfactory.
- 17.2 The GIB EzyBrace® Systems and GIB® Site Guide Technical Literature have been examined by BRANZ and found to be satisfactory.
- 17.3 Site inspections were carried out by BRANZ to assess the practicability of the installation of the systems, and to view completed installations.
- 17.4 An assessment was made of the durability of the systems by BRANZ technical experts and found to be satisfactory.
- 17.5 The properties of Winstone Wallboards Ltd GIB® plasterboards have been assessed for the following properties: MOR, MOE, paper tensile strength, paper shear strength, nail pull resistance, Hunter hardness, inspection for fungal spores, and hard and soft body impact tests.

### Quality

- 18.1 Winstone Wallboards Ltd's manufacturing process and details of the quality and composition of the materials, have been examined by BRANZ and found to be satisfactory.
- 18.2 The quality management systems of Winstone Wallboards Ltd have been assessed and registered by TELARC as meeting the requirements of ISO 9001, Registration No. 581.
- 18.3 Winstone Wallboards Ltd is responsible for the quality of the product supplied.
- 18.4 The quality of the application and finish on-site is the responsibility of the installation and stopping contractors.
- 18.5 Designers are responsible for the design of buildings.
- 18.6 Building owners are responsible for the maintenance in accordance with the instructions of Winstone Wallboards Ltd.

### Sources of Information

- AS/NZS 2269.0:2012 Plywood - Structural - Specifications.
- AS/NZS 2588:2018 Gypsum plasterboard.
- BRANZ Technical Paper P21:2010 A wall bracing test and evaluation procedure.
- NZS 3604:2011 Timber-framed buildings.
- Ministry of Business, Innovation and Employment Record of amendments - Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.



**BRANZ Appraised**  
Appraisal No. 928 [2021]

**BRANZ Appraisal**  
Appraisal No. 928 [2021]  
01 December 2021

GIB EZYBRACE® SYSTEMS



In the opinion of BRANZ, **GIB EzyBrace® Systems** are fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided they are used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Winstone Wallboards Ltd**, and is valid until further notice, subject to the Conditions of Appraisal.

### Conditions of Appraisal

1. This Appraisal:
  - a) relates only to the product as described herein;
  - b) must be read, considered and used in full together with the Technical Literature;
  - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
  - d) is copyright of BRANZ.
2. **Winstone Wallboards Ltd**:
  - a) continues to have the product reviewed by BRANZ;
  - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
  - c) abides by the BRANZ Appraisals Services Terms and Conditions;
  - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
  - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
  - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
  - c) any guarantee or warranty offered by **Winstone Wallboards Ltd**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Winstone Wallboards Ltd** or any third party.

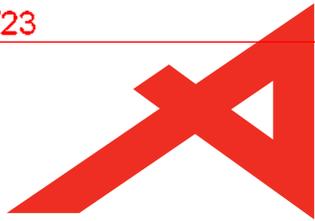
For BRANZ

**Chelydra Percy**

Chief Executive

Date of Issue:

01 December 2021



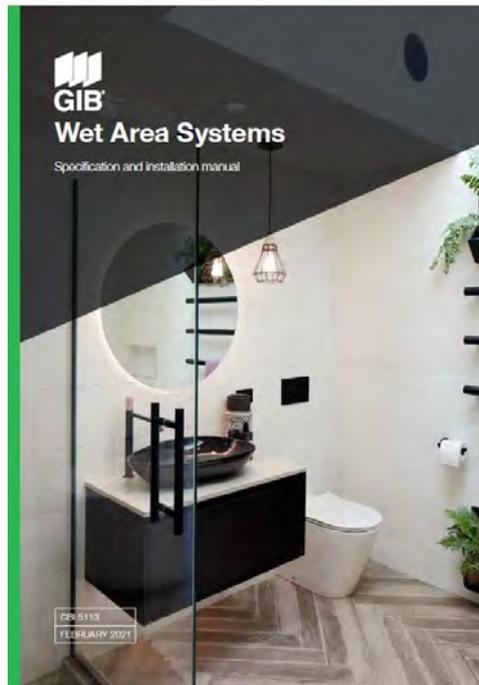
## BRANZ Appraised

Appraisal No. 427 [2021]

## GIB® WET AREA SYSTEMS

### Appraisal No. 427 [2021]

This Appraisal replaces BRANZ  
Appraisal No. 427 [2007]



### BRANZ Appraisals

Technical Assessments of  
products for building and  
construction.



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## Product

- 1.1 GIB® Wet Area Systems are for the interior lining of timber and steel-framed walls and ceilings in wet areas such as bathrooms, laundries, kitchens and toilets where a water-resistant lining material is desirable.

## Scope

- 2.1 GIB® Wet Area Systems have been appraised for use as a wet area wall and ceiling lining in buildings within the following scope:
- on timber-framed walls and ceilings within the scope limitations on NZS 3604; or,
  - on steel-framed walls and ceilings within the scope limitations of NASH Standard Part 2, or,
  - on timber and light gauge steel-framed walls and ceilings subject to specific design.

## Building Regulations

### New Zealand Building Code [NZBC]

- 3.1 In the opinion of BRANZ, GIB® Wet Area Systems, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet or contribute to meeting the following provisions of the NZBC:

**Clause B1 STRUCTURE:** Performance B1.3.1, B1.3.2 and B1.3.4. GIB® Wet Area Systems meet the requirements for loads arising from self-weight and impact [i.e. B1.3.3 (a) and (j)]. See Paragraphs 8.1-8.3.

**Clause B2 DURABILITY:** Performance B2.3.1 (b) 15 years and B2.3.1 (c) 5 years. GIB® Wet Area Systems meet these requirements. See Paragraphs 9.1-9.5.

**Clause E3 INTERNAL MOISTURE:** Performance E3.3.4 and E3.3.5. GIB® Wet Area Systems meet these requirements. See Paragraphs 12.1-12.3.

**Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. GIB® Wet Area Systems meet this requirement.

## Technical Specification

4.1 The GIB® plasterboards and accessories used in GIB® Wet Area Systems, and supplied by Winstone Wallboards Ltd are as follows:

### GIB® Plasterboards

- **GIB Aqualine®** is a paper-bound, modified water-resistant gypsum-plaster core sheet lining material. It is available in 10 and 13 mm sheet thicknesses. Sheets are available in various edge profiles and lengths from 2,400 mm to 4,800 mm. Refer to Table 1. The nominal sheet weights are 8 kg/m<sup>2</sup> and 11 kg/m<sup>2</sup> for 10 mm and 13 mm thick sheets respectively. GIB Aqualine® face paper is green in colour.
- **GIB Toughline® Aqua** is a paper-bound, modified water-resistant gypsum-plaster core sheet lining material. It is available in a sheet thickness of 13 mm. Sheets are available in various edge profiles and lengths from 2,400 mm to 3,000 mm. Refer to Table 1. The nominal sheet weight is 11.4 kg/m<sup>2</sup>. GIB Toughline® Aqua face paper is mauve in colour.
- **GIB Weatherline®** is an exterior-grade, glass-fibre fleece-wrapped modified-gypsum core sheet material. The product is available in 10 mm and 13 mm thicknesses and a board width of 1,200 mm. Standard sheet lengths are 2,450, 2,700 and 3,000 mm. Custom sheet lengths are also available. The nominal sheet weights are 9 kg/m<sup>2</sup> and 11.5 kg/m<sup>2</sup> for 10 mm and 13 mm thick sheets respectively.

**Table 1: GIB® Wet Area Plasterboard Available Sheet Sizes**

Plasterboard Type	Sheet Thickness [mm]	Sheet Edge Profile	Sheet Width [mm]	Sheet Length [mm]					
				2,400	2,450	2,700	3,000	3,600	4,800
GIB Aqualine®	10	TE/TE	1,200	✓		✓	✓	✓	
		TE/SE	1,200	✓					✓
		TE/SE	1,350	✓				✓	
	13	TE/TE	1,200	✓		✓	✓	✓	
GIB Toughline® Aqua	13	TE/TE	1,200	✓		✓	✓		
GIB Weatherline®	10	SE/SE	1,200		✓	✓	✓		
	13	SE/SE	1,200			✓	✓		

TE = Tapered Edge SE = Square Edge

### Fastenings

- GIB® Grabber® High Thread Drywall screws for fixing to timber: 6 g x 25 mm and 32 mm.
- GIB® Grabber® Self Tapping Drywall screws for fixing to light gauge steel: 6 g x 25 mm and 32 mm.

### Adhesive and Sealants

- GIBFix® One (Acrylic).
- GIBFix® All-Bond (Solvent).

### GIB® Accessories

- Corner Support Angle - GIBFix® Angle or GIB® Rondo® NZ18. Minimum 32 x 32 x 0.55 mm galvanised metal angle.

### GIB® Jointing Compounds

- As specified in the GIB® Wet Area Systems and GIB® Site Guide Technical Literature.

4.2 System components and accessories for the GIB® Wet Area Systems, which are supplied by the building contractor are:

#### **Waterproofing**

- A waterproofing system complying with AS/NZS 4858.

#### **Finishes**

- Finishes such as tiling, flexible sheet vinyl, paints and wallpapers have not been assessed and are outside the scope of this Appraisal.

## **Handling and Storage**

- 5.1 The best results are achieved when GIB® plasterboards are treated as a finishing material and protected from damage. Sheets must be stacked flat and kept dry at all times. For limits on stack heights see the GIB® Site Guide. Sheets must be carried on edge and not dragged.
- 5.2 All accessories must be kept dry.

## **Technical Literature**

- 6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for GIB® Wet Area Systems. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

## **Design Information**

### **General**

- 7.1 GIB® Wet Area Systems provide a water-resistant lining as a base for finishing systems in wet areas such as bathrooms, toilets, laundries and kitchens. The typical finishes are ceramic tiles and flexible sheet vinyl to walls, and paint and wallpaper to walls and ceilings. *[Note: GIB Weatherline® is a suitable substrate for ceramic tiles and sheet vinyl. For paint or wallpaper finishes use GIB Aqualine® or GIB Toughline® Aqua.]*
- 7.2 GIB® Wet Area Systems must not be used in the following situations:
- For bracing applications in shower areas or adjacent baths [See Paragraphs 7.4 and 8.2].
  - In areas of high humidity [above 90% RH] or continually wet areas such as group showers, steam rooms, or swimming pools.
  - Installed over a vapour barrier.
  - Applied directly to masonry, concrete or solid plaster.
  - Applied over other sheet lining materials.
  - Used externally of the building envelope.
  - Exposed to temperatures of 52°C or greater for prolonged periods. [Refer to appliance and fitting manufacturers for installation details.]
- 7.3 GIB Aqualine® may be substituted for some other GIB® plasterboard products in specific GIB® Bracing Systems, GIB® Fire Rated Systems and GIB® Noise Control Systems. Refer to the relevant systems technical literature for details.

### Wet Areas

- 7.4 Wet areas are spaces where sanitary fixtures and sanitary appliances are located such as bathrooms, toilets, laundries and kitchens. There are two general categories of wet areas as follows:
- Water Splash – These are areas subject to intermittent splashing of water such as around baths, vanities, tubs and sinks.
  - Shower Areas – These are areas subject to frequent and heavy water splash such as enclosed showers, unenclosed shower zones and showers over baths.
- 7.5 Both the above wet area categories must be finished with surfaces and joints that are impervious and easily cleaned. In addition, shower areas must be waterproofed. This can be achieved using proprietary rigid shower lining systems, flexible vinyl shower wall finishes, or tiling. Tiled shower areas must include a wet area waterproofing membrane system under the tiles.

### Intertenancy Walls – Wet Areas

- 7.6 Intertenancy construction that incorporates fire resistance and noise control must be protected from water splash. In shower areas, GIB® Wet Area plasterboards must not be substituted for other GIB® plasterboards but must be an extra lining layer. Refer to the Technical Literature.

### Tiling

- 7.7 GIB® Wet Area Systems are suitable as a substrate for tiling up to the following weights:
- 10 mm GIB Aqualine® and GIB Weatherline® - up to 26 kg/m<sup>2</sup>.
  - 13 mm GIB Aqualine®, GIB Toughline® Aqua and GIB Weatherline® - up to 40 kg/m<sup>2</sup>.
- [Note: Most ceramic and porcelain wall tiles weigh less than 20 kg/m<sup>2</sup>. For further information on tiling consult the BRANZ Good Practice Guide – Tiling.]*

### Framing

- 7.8 Supporting framing must comprise one of the following, subject to the minimum sizes, dwang centres and all other frame requirements of GIB® Wet Area Systems Technical Literature:
- Timber framing must be designed and constructed in accordance with NZS 3604, or to a specific design using NZS 3603 and AS/NZS 1170. Refer to Paragraph 15.2 regarding recommended moisture content of timber framing.
  - Steel framing must be designed and constructed in accordance with NASH Standard Part 2, or to a specific design in accordance with AS/NZS 1170.

## Structure

### Bracing

- 8.1 GIB Aqualine®, GIB Toughline® Aqua and GIB Weatherline® can be used in GIB EzyBrace® Systems. Refer to BRANZ Appraisals Nos. 928 [2016] and 1048 [2019].
- 8.2 GIB Wet Area Systems must not be used for bracing in shower areas or behind baths.

### Impact Resistance

- 8.3 GIB® plasterboards provide adequate resistance to soft body impact, based upon experience of use in domestic and light commercial applications. GIB Toughline® Aqua is recommended by Winstone Wallboards Ltd where higher impact resistance is desired.

## Durability

### Serviceable Life

- 9.1 GIB® Wet Area Systems have a serviceable life of at least 15 years as a fully protected shower or water splash lining. As a general wall and ceiling lining, GIB® Wet Area Systems will have a serviceable life in excess of 50 years. The ability of GIB® plasterboards to remain durable is dependent on being protected and remaining dry in service, and being maintained in accordance with this Appraisal.

### Maintenance

- 9.2 The building must be maintained weathertight and all lining systems protected from internal and external moisture.
- 9.3 Finishes to water splash and shower areas, including tiles, grout, waterproof membranes, sealants and flexible sheet vinyl must be checked to ensure the integrity of the system is maintained. They must be repaired or replaced if necessary. When repairing or replacing finishes, the GIB® plasterboard substrate must be checked for defects and repaired or replaced, as required.
- 9.4 For flexible sheet vinyl, particular attention must be paid to joints, especially at corners. Checks should be made to ensure the vinyl has not been punctured. Where damage has occurred, repairs must be made immediately.
- 9.5 Impact damage to GIB® plasterboard, resulting in small holes and cracks, may be patched, stopped and finished. For larger areas of damage, expert advice on repair must be sought from Winstone Wallboards Ltd.

## Prevention of Fire Occurring

- 10.1 Separation or protection must be provided to the GIB® Wet Area Systems from heat sources such as fireplaces, heating appliances, flues and chimneys. Part 7 of NZBC Acceptable Solutions C/AS1 and C/AS2, and NZBC Verification Method C/VM1 provide methods for separation and protection of combustible materials from heat sources.

## Fire Affecting Areas Beyond the Fire Source

### Control of Internal Fire and Smoke Spread

- 11.1 The gypsum plasterboard used in GIB® Wet Area Systems without an applied paint or wallpaper finish has been tested in accordance with ISO 5660 and achieved a Material Group Number of 1-S.
- 11.2 The gypsum plasterboard used in GIB® Wet Area Systems with an untested applied finish of a waterborne or solvent borne paint coating  $\leq$  0.4mm thick achieves a Material Group Number of G2-S in accordance with Table A1 of NZBC Verification Method C/VM2.
- 11.3 A lower Material Group Number may be achieved when used with a tested finishing system. The Material Group Number for the complete lining system must be obtained from the supplier of the finish product or system.

### Fire Resistance Ratings (FRRs)

- 11.4 GIB® Wet Area plasterboards, when used as part of GIB® Fire Rated Systems, can be used to provide FRRs as determined by NZBC Acceptable Solutions C/AS1 and C/AS2 and NZBC Verification Method C/VM2. Refer to BRANZ Appraisal No. 289 [2018] and relevant technical literature.

## Internal Moisture

- 12.1 When installed in accordance with this Appraisal, GIB® Wet Area Systems will provide wall surfaces adjacent to sanitary fixtures and sanitary appliances that are impervious and easily cleaned.
- 12.2 The construction methods in the Technical Literature meet with the internal moisture requirements of the NZBC Acceptable Solution E3/AS1.
- 12.3 To minimise internal condensation, adequate levels of ventilation and thermal resistance must be provided to all spaces where moisture may be generated.

### Airborne and Impact Sound

- 13.1 GIB® Wet Area plasterboards, when used as part of GIB® Noise Control systems, can be used to provide acoustic ratings as required by NZBC Acceptable Solution G6/AS1. Refer to BRANZ Appraisal No. 394 [2017] and relevant technical literature.

## Installation Information

### Installation Skill Level Requirement

- 14.1 Installation of GIB® Wet Area Systems must be completed by, or under the supervision of, a Licensed Building Practitioner with the relevant Licence Class, in accordance with the Technical Literature and this Appraisal.

### General

- 15.1 GIB® Wet Area Systems must be installed in accordance with the Technical Literature. For inspection, reference must be made to the Technical Literature.

### Framing

- 15.2 To achieve an acceptable decorative finish, the walls must not be lined unless the moisture content of timber framing is less than 18%. Winstone Wallboards Ltd recommend a moisture content of 8–12% where buildings are to be air conditioned or centrally heated.

### Cutting

- 15.3 GIB® Wet Area plasterboards are easily cut by scoring the face paper with a sharp short-bladed trimming knife, and then snapping the plasterboard away from the cut face and cutting the back paper or by sawing. Use of a metal straightedge facilitates clean straight cuts. Cut edges can be tidied up by using a knife. Paper dags should be removed.

## Fixing Sheets

### Non-Tiled Areas

- 16.1 GIB® Wet Area plasterboards may be installed vertically or horizontally. Sheets are fixed with GIB® Grabber® screws at 300 mm centres around the perimeter of the sheet, and with GIBFix® adhesive on all intermediate studs and dwangs. Adhesive must not be used under fasteners. A 5–10 mm gap must be left between the floor and the bottom of the sheet.

### Tiled Areas

- 16.2 Control joints must be provided at maximum 4 m centres.
- 16.3 Internal corners in shower areas must be reinforced with a minimum 32 x 32 x 0.55 mm galvanised metal angle [i.e. GIBFix® Angle or GIB® Rondo® NZ18] prior to lining the walls.
- 16.4 GIB® Wet Area plasterboards may be installed vertically or horizontally. Sheets are fixed with GIB® Grabber® screws at 150 mm centres to the perimeter of wall and to all intermediate studs. Adhesive must not be used in place of screws.

### Ceilings

- 16.5 Supports of timber or steel battens or ceiling joists must be 450 mm centres for 10 mm GIB Aqualine®, or 600 mm centres for 13 mm GIB Aqualine® or GIB Toughline® Aqua.
- 16.6 GIB Aqualine® and GIB Toughline® Aqua sheets must be fixed with GIB® Grabber® screws at 600 mm centres around the perimeter of the ceiling and at 200 mm centre along supports. Alternatively, sheets are screw fixed at 600 mm centres along the supports and GIBFix® adhesive placed at 200 mm centres between the screws.

### Penetrations and Sealants

- 17.1 All cut-outs for pipe penetrations must be made neatly using a hole saw. Cut-outs should be made approximately 12 mm diameter greater than the pipe.
- 17.2 A bead of sealant must be placed to the full thickness of the plasterboard sheet around all pipe penetrations, at bath rims and preformed shower bases and where an impervious junction is required at the floor/wall line.
- 17.3 In tiled areas, a bead of sealant 6 mm wide must also be placed to the full thickness of the tiles where the above situation occurs. The sealant manufacturer's technical literature must be followed for installation.

### Jointing and Finishing

- 18.1 Jointing must be carried out in accordance with GIB® Site Guide Technical Literature.
- 18.2 Tiled shower areas must incorporate a waterproofing membrane over GIB® Wet Area Systems. Waterproofing membranes are outside the scope of this Appraisal and must otherwise be specified and approved.

### Health and Safety

- 19.1 Dust resulting from the sanding of stopping and finishing compounds may be a respiratory irritant, and the use of a suitable facemask is recommended.

## Basis of Appraisal

The following is a summary of the technical investigations carried out:

### Tests

- 20.1 Winstone Wallboards Ltd GIB® plasterboards have been assessed for the following properties: MOR, MOE, paper tensile strength, paper shear strength, nail pull resistance, edge hardness, water resistance, hard and soft body impact tests and humidified deflection.
- 20.2 Cone calorimeter tests to ISO 5660 have been carried out by BRANZ.

### Other Investigations

- 21.1 An assessment was made of the durability of the systems by BRANZ technical experts and found to be satisfactory.
- 21.2 Site inspections were carried out by BRANZ to assess the practicability of the installation of the systems, and to view completed installations.
- 21.3 The GIB® Wet Area Systems and GIB® Site Guide Technical Literature have been examined by BRANZ and found to be satisfactory.

### Quality

- 22.1 Winstone Wallboards Ltd's manufacturing process and details of the quality and composition of the materials, have been examined by BRANZ and found to be satisfactory.
- 22.2 The quality management systems of Winstone Wallboards Ltd have been assessed and registered by TELARC as meeting the requirements of ISO 9001: 2015, Registration No. 581.
- 22.3 Winstone Wallboards Ltd is responsible for the quality of the product supplied.
- 22.4 The quality of the application and finish on site is the responsibility of the installation, stopping and finishing contractors.
- 22.5 Designers are responsible for the design of buildings.
- 22.6 Building owners are responsible for the maintenance in accordance with the instructions of Winstone Wallboards Ltd.

## Sources of Information

- AS/NZS 1170: 2002 Structural design actions - General principles.
- AS/NZS 2588: 2018 Gypsum plasterboard.
- BRANZ Good Practice Guide: Tiling (3rd edition), April 2015.
- ISO 5660-1:2002 Reaction-to-fire tests - Heat release, smoke production and mass loss rate - Part 1: Heat release rate (cone calorimeter method).
- NZS 3603: 1993 Timber Structures Standard.
- NZS 3604: 2011 Timber-framed buildings.
- Ministry of Business, Innovation and Employment Record of Amendments - Acceptable Solutions, Verification Methods and handbooks.
- The Building Regulations 1992.



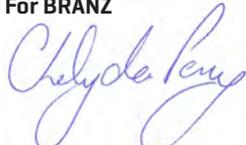
In the opinion of BRANZ, **GIB® Wet Area Systems** are fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided they are used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Winstone Wallboards Ltd**, and is valid until further notice, subject to the Conditions of Appraisal.

### Conditions of Appraisal

1. This Appraisal:
  - a) relates only to the product as described herein;
  - b) must be read, considered and used in full together with the Technical Literature;
  - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
  - d) is copyright of BRANZ.
2. **Winstone Wallboards Ltd**:
  - a) continues to have the product reviewed by BRANZ;
  - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
  - c) abides by the BRANZ Appraisals Services Terms and Conditions;
  - d) warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
  - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
  - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
  - c) any guarantee or warranty offered by **Winstone Wallboards Ltd**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Winstone Wallboards Ltd** or any third party.

For BRANZ



**Chelydra Percy**

Chief Executive

Date of Issue:

15 February 2021