

Appendix G

Groundwater Impact Assessment

	4 Fred Thomas Drive, Takapuna, Auckland 0622 PO Box 100253, North Shore, Auckland 0745 Tel: 09 489 7872 Email: riley@riley.co.nz	Project No: 240065	Page 1 of 4	
	22 Moorhouse Avenue, Addington, Christchurch 8011 PO Box 4355, Christchurch 8140 Tel: 03 379 4402 Email: rileychch@riley.co.nz	Project: Vineway Ltd	Calc: LKB	Date: 8 December 2025
		Check: JLB	Date: 8 December 2025	
		Description: Calculation of settlement due to groundwater drawdown and extent of the drawdown (Stage 1)		

Inputs:	<ol style="list-style-type: none"> From review of investigation data and groundwater level monitoring adopt a GWL at 3m depth within the surficial soil mantle, which is consistent with gwl data excluding MH01. MH01 is excluded because of its location within a slump mass it is likely that the gwl in the upper piezo is not representative of the overall gwl within the surficial soils. Drawdown within the non-compressible rock materials is not considered. Refer to the groundwater monitoring sheet. For the northern boundary adopt a 9m thick surficial soil mantle based on MH02, for the eastern and southern boundaries adopt 8m depth based on MH06. Typical undrained shear strength along the northern boundary is 50-100kPa, along the eastern and southern boundaries the typical value is >100kPa. Therefore, adopt $m_v = 0.067\text{MN/m}^2$ for the northern boundary (for $C_u=50\text{kPa}$) and for the eastern and southern boundaries adopt $m_v = 0.033\text{MN/m}^2$. These values are considered to be conservative. M_v (MN/m^2) is calculated as $1/(300 \times C_u) \times 1000$. Max cuts for calculation 9m (northern boundary), 12.5m (northern portion of eastern boundary), 3.5m (southern portion of eastern boundary) and 4.5m (southern boundary). A permeability of $1 \times 10^{-7}\text{m/s}$ is considered appropriate for the silty clay/clayey silt type materials present. At the southern boundary the max cut so distance is at the boundary, and therefore the max drawdown is at the boundary. <p>For plane flow, the distance of influence, L_0, has been estimated using Powrie and Preene, 1994 as below:</p> $L_0 = \sqrt{\frac{12 * k * D * T}{S}}$ <p>Where:</p> <p>k is the soil permeability in metres/second, D is the aquifer thickness in metres, t is the time since pumping started in seconds, and, S is the aquifer storage coefficient.</p> <p>The depth of the groundwater drawdown at the boundary has been estimated assuming a linear relationship between the groundwater level at the maximum drawdown and zero drawdown at the distance of influence. This method is considered a conservative evaluation as the groundwater drawdown is not a linear relationship in reality.</p>
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The attached spreadsheet indicates the maximum settlement due to drawdown is expected to be 12.8mm at the north eastern boundary. The distances from the base of each cut were measured off the drawing set Delmore Stage 1 by McKenzie & CO.

Table 1: Calculated GW drawdown induced settlements

Location	Maximum Boundary Cut	Maximum Groundwater drawdown	Calculated Settlement at the Boundary
Northern boundary	8m	5m	4.6mm
Northern part of eastern boundary and eastern part of northern boundary	12.5m	6m*	15.6mm
Southern part of eastern boundary	3.5m	0.5m	<1mm
Southern boundary	4.5m	1.5m	2.3mm

*Maximum groundwater drawdown is taken as the shallower of the depth to rock or the base of the boundary cut.

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		Description: Calculation of settlement due to groundwater drawdown and extent of the drawdown (Stage 1)		

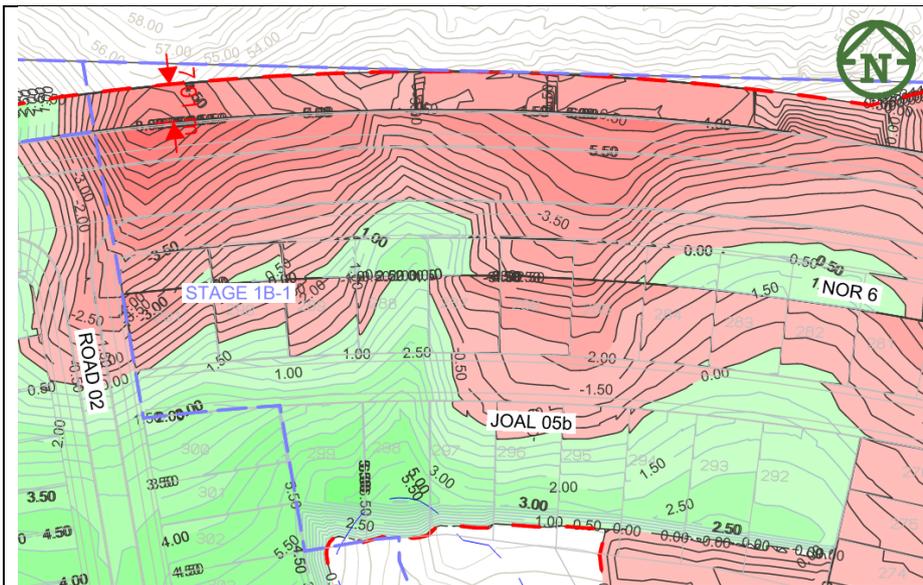


Figure 1: Northern boundary measurement

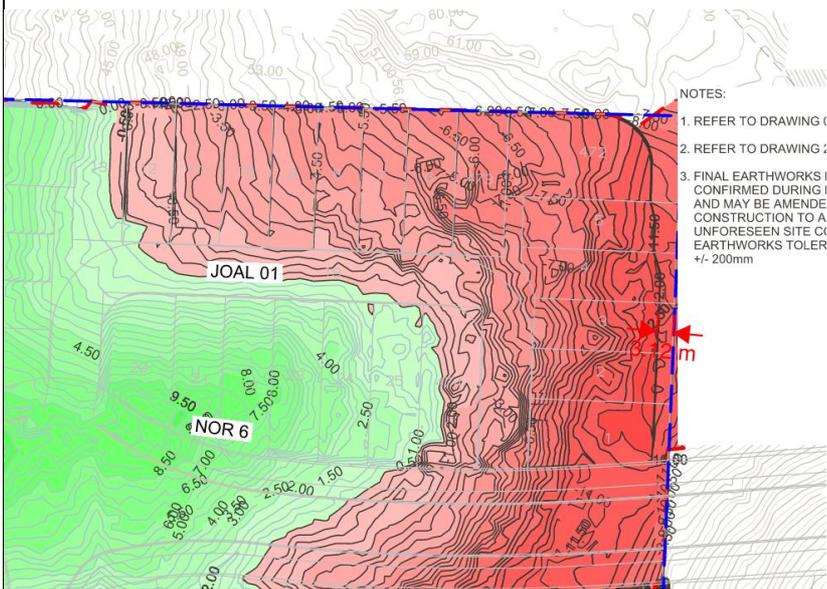


Figure 2: North eastern boundary measurement

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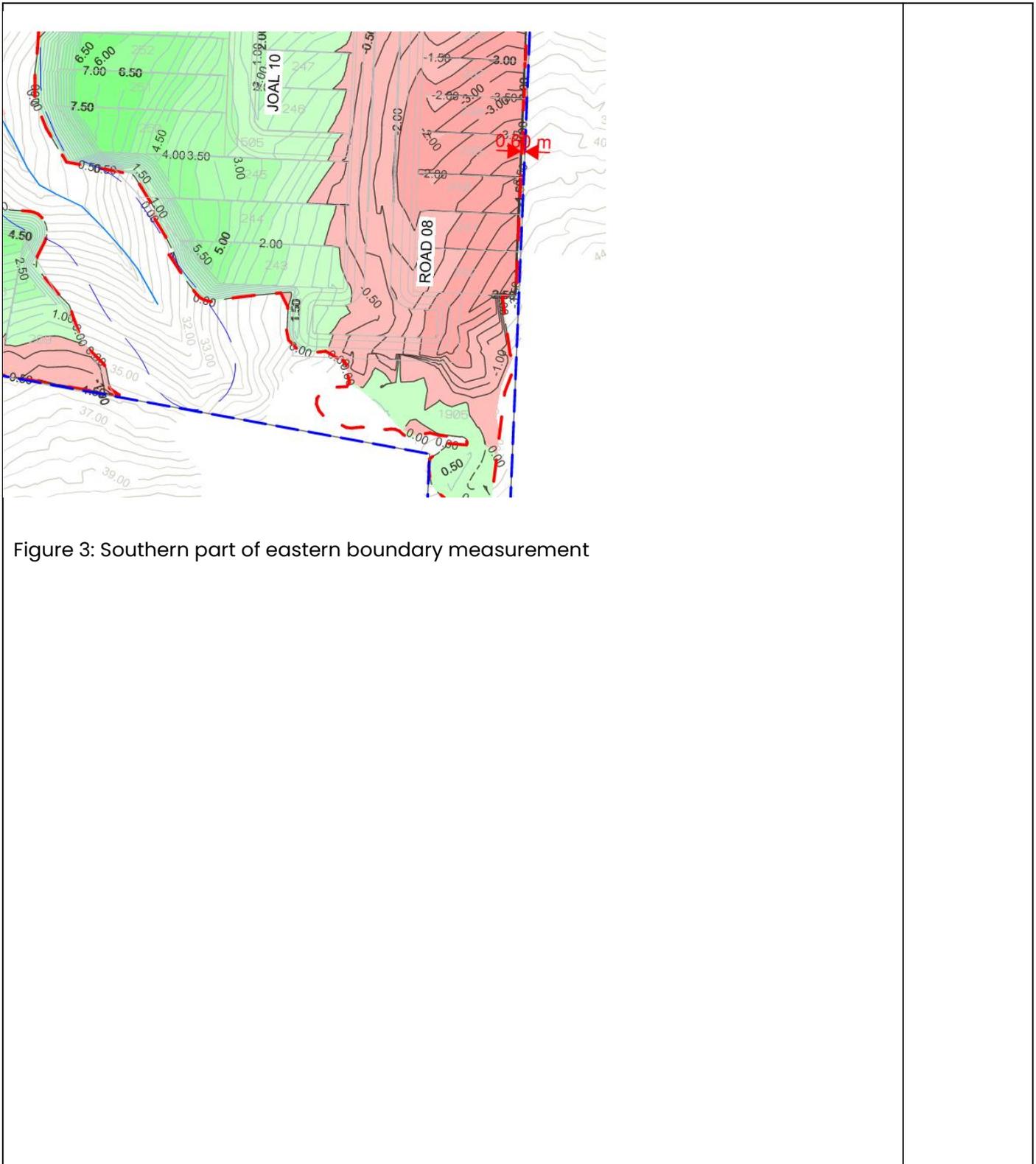


Figure 3: Southern part of eastern boundary measurement

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		Check: JLB	Date: 8 December 2025	
		Description: Calculation of settlement due to groundwater drawdown and extent of the drawdown (Stage 1)		

Calculation of settlement due to groundwater drawdown
Riley Reference: 240065 - Vineway Ltd Stage 1
08 December 2025
Designed: LKB
Check: JLB



Northern Boundary

Powrie and Preene, 1994:

$$k := 0.0000001 \frac{m}{s}$$

Soil permeability

$$D := 5 \text{ m}$$

Aquifer thickness - drawdown

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 9.66 \text{ m}$$

Distance from max drawdown

$$i := \frac{D - 0 \text{ m}}{L_0}$$

Change in hydraulic grade between L0 and max drawdown

$$h_0 := 5 \text{ m}$$

$$h := i \cdot 7 \text{ m} = 3.623 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = 1.377 \text{ m}$$

Drawdown at x (Boundary)

Northern Part of Eastern Boundary

Powrie and Preene, 1994:

$$k := 0.0000001 \frac{m}{s}$$

Soil permeability

$$D := 6 \text{ m}$$

Aquifer thickness - drawdown

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 10.582 \text{ m}$$

Distance from max drawdown

$$i := \frac{D - 0 \text{ m}}{L_0}$$

Change in hydraulic grade between L0 and max drawdown

$$h_0 := 9.5 \text{ m}$$

$$h := i \cdot 3.12 \text{ m} = 1.769 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = 7.731 \text{ m}$$

Drawdown at x (Boundary)

Southern Part of Eastern Boundary

Powrie and Preene, 1994:

$$k := 0.0000001 \frac{\text{m}}{\text{s}}$$

Soil permeability

$$D := 0.5 \text{ m}$$

Aquifer thickness - drawdown

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 3.055 \text{ m}$$

Distance from max drawdown

$$i := \frac{D - 0 \text{ m}}{L_0} = 0.164$$

Change in hydraulic grade between L0 and max drawdown

$$h_0 := 0.5 \text{ m}$$

$$h := i \cdot 0.6 \text{ m} = 0.098 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = 0.402 \text{ m}$$

Drawdown at x (Boundary)

Calculate Settlement Due To Groundwater Drawdown.
 Russell Road, Wainui : Northern Boundary (8m cut)
 Typical Cross-section

Job No. 240065

Designed LKB 18/12/2025
 Checked JLB 18/12/2025

m BLG	Geology	γ	σ	Initial		Drained		Designed	LKB	18/12/2025
				W	σ'			kN/m ²	(m ² /MN)	(m)
								$\Delta\sigma'$	m_v	S
0	Ground level at boundary			0	0	0	0			
0.25	Soils (Cu>50kPa)	18	4.5	0	4.5	0	4.5	0	0.07	0.00E+00
0.5	Soils (Cu>50kPa)	18	9	0	9	0	9	0	0.07	0.00E+00
0.75	Soils (Cu>50kPa)	18	13.5	0	13.5	0	13.5	0	0.07	0.00E+00
1	Soils (Cu>50kPa)	18	18	0	18	0	18	0	0.07	0.00E+00
1.25	Soils (Cu>50kPa)	18	22.5	0	22.5	0	22.5	0	0.07	0.00E+00
1.5	Soils (Cu>50kPa)	18	27	0	27	0	27	0	0.07	0.00E+00
1.75	Soils (Cu>50kPa)	18	31.5	0	31.5	0	31.5	0	0.07	0.00E+00
2	Soils (Cu>50kPa)	18	36	0	36	0	36	0	0.07	0.00E+00
2.25	Soils (Cu>50kPa)	18	40.5	0	40.5	0	40.5	0	0.07	0.00E+00
2.5	Soils (Cu>50kPa)	18	45	0	45	0	45	0	0.07	0.00E+00
2.75	Soils (Cu>50kPa)	18	49.5	0	49.5	0	49.5	0	0.07	0.00E+00
3	Soils (Cu>50kPa)	18	54	10	51.5	0	54	2.5	0.07	4.19E-05
3.25	Soils (Cu>50kPa)	18	58.5	10	53.5	0	58.5	5	0.07	8.38E-05
3.5	Soils (Cu>50kPa)	18	63	10	55.5	0	63	7.5	0.07	1.26E-04
3.75	Soils (Cu>50kPa)	18	67.5	10	57.5	0	67.5	10	0.07	1.68E-04
4	Soils (Cu>50kPa)	18	72	10	59.5	0	72	12.5	0.07	2.09E-04
4.25	Soils (Cu>50kPa)	18	76.5	10	61.5	0	76.5	15	0.07	2.51E-04
4.5	Soils (Cu>50kPa)	18	81	10	63.5	10	78.5	15	0.07	2.51E-04
4.75	Soils (Cu>50kPa)	18	85.5	10	65.5	10	80.5	15	0.07	2.51E-04
5	Soils (Cu>50kPa)	18	90	10	67.5	10	82.5	15	0.07	2.51E-04
5.25	Soils (Cu>50kPa)	18	94.5	10	69.5	10	84.5	15	0.07	2.51E-04
5.5	Soils (Cu>50kPa)	18	99	10	71.5	10	86.5	15	0.07	2.51E-04
5.75	Soils (Cu>50kPa)	18	103.5	10	73.5	10	88.5	15	0.07	2.51E-04
6	Soils (Cu>50kPa)	18	108	10	75.5	10	90.5	15	0.07	2.51E-04
6.25	Soils (Cu>50kPa)	18	112.5	10	77.5	10	92.5	15	0.07	2.51E-04
6.5	Soils (Cu>50kPa)	18	117	10	79.5	10	94.5	15	0.07	2.51E-04
6.75	Soils (Cu>50kPa)	18	121.5	10	81.5	10	96.5	15	0.07	2.51E-04
7	Soils (Cu>50kPa)	18	126	10	83.5	10	98.5	15	0.07	2.51E-04
7.25	Soils (Cu>50kPa)	18	130.5	10	85.5	10	100.5	15	0.07	2.51E-04
7.5	Soils (Cu>50kPa)	18	135	10	87.5	10	102.5	15	0.07	2.51E-04
7.75	Soils (Cu>50kPa)	18	139.5	10	89.5	10	104.5	15	0.07	2.51E-04
8	Soils (Cu>50kPa)	18	144	10	91.5	10	106.5	15	0.07	2.51E-04

4.6
(mm)

Calculate Settlement Due To Groundwater Drawdown

Russell Road, Wainui : Stage 1 Eastern Boundary (Max 12.5m cut), Northern Portion

Job No. 240065

Typical Cross-section m BLG	Geology	γ	σ	Initial		Drained		Designed	LKB	8/12/2025
				W	σ'	Δσ'	m _v	S		
									Checked	JLB
0	Ground level at boundary			0	0	0	0			
0.25	Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.03	0.00E+00
0.5	Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.03	0.00E+00
0.75	Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.03	0.00E+00
1	Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.03	0.00E+00
1.25	Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.03	0.00E+00
1.5	Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.03	0.00E+00
1.75	Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.03	0.00E+00
2	Soils (Cu>100kPa)	18	36	0	36	0	36	0	0.03	0.00E+00
2.25	Soils (Cu>100kPa)	18	40.5	0	40.5	0	40.5	0	0.03	0.00E+00
2.5	Soils (Cu>100kPa)	18	45	0	45	0	45	0	0.03	0.00E+00
2.75	Soils (Cu>100kPa)	18	49.5	0	49.5	0	49.5	0	0.03	0.00E+00
3	Soils (Cu>100kPa)	18	54	10	51.5	0	54	2.5	0.03	2.09E-05
3.25	Soils (Cu>100kPa)	18	58.5	10	53.5	0	58.5	5	0.03	4.19E-05
3.5	Soils (Cu>100kPa)	18	63	10	55.5	0	63	7.5	0.03	6.28E-05
3.75	Soils (Cu>100kPa)	18	67.5	10	57.5	0	67.5	10	0.03	8.38E-05
4	Soils (Cu>100kPa)	18	72	10	59.5	0	72	12.5	0.03	1.05E-04
4.25	Soils (Cu>100kPa)	18	76.5	10	61.5	0	76.5	15	0.03	1.26E-04
4.5	Soils (Cu>100kPa)	18	81	10	63.5	0	81	17.5	0.03	1.47E-04
4.75	Soils (Cu>100kPa)	18	85.5	10	65.5	0	85.5	20	0.03	1.68E-04
5	Soils (Cu>100kPa)	18	90	10	67.5	0	90	22.5	0.03	1.88E-04
5.25	Soils (Cu>100kPa)	18	94.5	10	69.5	0	94.5	25	0.03	2.09E-04
5.5	Soils (Cu>100kPa)	18	99	10	71.5	0	99	27.5	0.03	2.30E-04
5.75	Soils (Cu>100kPa)	18	103.5	10	73.5	0	103.5	30	0.03	2.51E-04
6	Soils (Cu>100kPa)	18	108	10	75.5	0	108	32.5	0.03	2.72E-04
6.25	Soils (Cu>100kPa)	18	112.5	10	77.5	0	112.5	35	0.03	2.93E-04
6.5	Soils (Cu>100kPa)	18	117	10	79.5	0	117	37.5	0.03	3.14E-04
6.75	Soils (Cu>100kPa)	18	121.5	10	81.5	0	121.5	40	0.03	3.35E-04
7	Soils (Cu>100kPa)	18	126	10	83.5	0	126	42.5	0.03	3.56E-04
7.25	Soils (Cu>100kPa)	18	130.5	10	85.5	0	130.5	45	0.03	3.77E-04
7.5	Soils (Cu>100kPa)	18	135	10	87.5	0	135	47.5	0.03	3.98E-04
7.75	Soils (Cu>100kPa)	18	139.5	10	89.5	0	139.5	50	0.03	4.19E-04
8	Soils (Cu>100kPa)	18	144	10	91.5	0	144	52.5	0.03	4.40E-04
8.25	Soils (Cu>100kPa)	18	148.5	10	93.5	0	148.5	55	0.03	4.61E-04
8.5	Soils (Cu>100kPa)	18	153	10	95.5	0	153	57.5	0.03	4.82E-04
8.75	Soils (Cu>100kPa)	18	157.5	10	97.5	0	157.5	60	0.03	5.03E-04
9	Soils (Cu>100kPa)	18	162	10	99.5	0	162	62.5	0.03	5.23E-04
9.25	Soils (Cu>100kPa)	18	166.5	10	101.5	0	166.5	65	0.03	5.44E-04
9.5	Soils (Cu>100kPa)	18	171	10	103.5	0	171	67.5	0.03	5.65E-04
9.75	Soils (Cu>100kPa)	18	175.5	10	105.5	0	175.5	70	0.03	5.86E-04
10	Soils (Cu>100kPa)	18	180	10	107.5	0	180	72.5	0.03	6.07E-04
10.25	Soils (Cu>100kPa)	18	184.5	10	109.5	0	184.5	75	0.03	6.28E-04
10.5	Soils (Cu>100kPa)	18	189	10	111.5	0	189	77.5	0.03	6.49E-04
10.75	Soils (Cu>100kPa)	18	193.5	10	113.5	10	191	77.5	0.03	6.49E-04
11	Soils (Cu>100kPa)	18	198	10	115.5	10	193	77.5	0.03	6.49E-04
11.25	Soils (Cu>100kPa)	18	202.5	10	117.5	10	195	77.5	0.03	6.49E-04
11.5	Soils (Cu>100kPa)	18	207	10	119.5	10	197	77.5	0.03	6.49E-04
11.75	Soils (Cu>100kPa)	18	211.5	10	121.5	10	199	77.5	0.03	6.49E-04
12	Soils (Cu>100kPa)	18	216	10	123.5	10	201	77.5	0.03	6.49E-04
12.25	Soils (Cu>100kPa)	18	220.5	10	125.5	10	203	77.5	0.03	6.49E-04
12.5	Soils (Cu>100kPa)	18	225	10	127.5	10	205	77.5	0.03	6.49E-04

15.6
(mm)

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 1 Southern part of eastern boundary (Max 3.5m cut)

Typical Cross-section				Job No. 240065		Designed		LKB		8/12/2025
				Initial		Drained		Checked	JLB	8/12/2025
m BLG	Geology	γ	σ	W	σ'			kN/m ² $\Delta\sigma'$	(m ² /MN) m_v	(m) S
0	Ground level at boundary			0	0	0	0	0		
0.25	Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.03	0.00E+00
0.5	Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.03	0.00E+00
0.75	Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.03	0.00E+00
1	Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.03	0.00E+00
1.25	Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.03	0.00E+00
1.5	Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.03	0.00E+00
1.75	Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.03	0.00E+00
2	Soils (Cu>100kPa)	18	36	0	36	0	36	0	0.03	0.00E+00
2.25	Soils (Cu>100kPa)	18	40.5	0	40.5	0	40.5	0	0.03	0.00E+00
2.5	Soils (Cu>100kPa)	18	45	0	45	0	45	0	0.03	0.00E+00
2.75	Soils (Cu>100kPa)	18	49.5	0	49.5	0	49.5	0	0.03	0.00E+00
3	Soils (Cu>100kPa)	18	54	10	51.5	0	54	2.5	0.03	2.09E-05
3.25	Soils (Cu>100kPa)	18	58.5	10	53.5	0	58.5	5	0.03	4.19E-05
3.5	Soils (Cu>100kPa)	18	63	10	55.5	10	60.5	5	0.03	4.19E-05
3.75	Soils (Cu>100kPa)	18	67.5	10	57.5	10	62.5	5	0.03	4.19E-05
4	Soils (Cu>100kPa)	18	72	10	59.5	10	64.5	5	0.03	4.19E-05
4.25	Soils (Cu>100kPa)	18	76.5	10	61.5	10	66.5	5	0.03	4.19E-05
4.5	Soils (Cu>100kPa)	18	81	10	63.5	10	68.5	5	0.03	4.19E-05
4.75	Soils (Cu>100kPa)	18	85.5	10	65.5	10	70.5	5	0.03	4.19E-05
5	Soils (Cu>100kPa)	18	90	10	67.5	10	72.5	5	0.03	4.19E-05
5.25	Soils (Cu>100kPa)	18	94.5	10	69.5	10	74.5	5	0.03	4.19E-05
5.5	Soils (Cu>100kPa)	18	99	10	71.5	10	76.5	5	0.03	4.19E-05
5.75	Soils (Cu>100kPa)	18	103.5	10	73.5	10	78.5	5	0.03	4.19E-05
6	Soils (Cu>100kPa)	18	108	10	75.5	10	80.5	5	0.03	4.19E-05
6.25	Soils (Cu>100kPa)	18	112.5	10	77.5	10	82.5	5	0.03	4.19E-05
6.5	Soils (Cu>100kPa)	18	117	10	79.5	10	84.5	5	0.03	4.19E-05
6.75	Soils (Cu>100kPa)	18	121.5	10	81.5	10	86.5	5	0.03	4.19E-05
7	Soils (Cu>100kPa)	18	126	10	83.5	10	88.5	5	0.03	4.19E-05
7.25	Soils (Cu>100kPa)	18	130.5	10	85.5	10	90.5	5	0.03	4.19E-05
7.5	Soils (Cu>100kPa)	18	135	10	87.5	10	92.5	5	0.03	4.19E-05
7.75	Soils (Cu>100kPa)	18	139.5	10	89.5	10	94.5	5	0.03	4.19E-05
8	Soils (Cu>100kPa)	18	144	10	91.5	10	96.5	5	0.03	4.19E-05

0.9
(mm)

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 1 Southern Boundary (Max 4.5m cut)

Typical Cross-section				Job No. 240065		Designed Checked			LKB JLB		8/12/2025
m BLG	Geology	γ	σ	Initial W	σ'	Drained		kN/m ² $\Delta\sigma'$	(m ² /MN) m_v	(m) S	8/12/2025
0	Ground level at boundary			0	0	0	0				
0.25	Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.03	0.00E+00	
0.5	Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.03	0.00E+00	
0.75	Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.03	0.00E+00	
1	Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.03	0.00E+00	
1.25	Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.03	0.00E+00	
1.5	Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.03	0.00E+00	
1.75	Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.03	0.00E+00	
2	Soils (Cu>100kPa)	18	36	0	36	0	36	0	0.03	0.00E+00	
2.25	Soils (Cu>100kPa)	18	40.5	0	40.5	0	40.5	0	0.03	0.00E+00	
2.5	Soils (Cu>100kPa)	18	45	0	45	0	45	0	0.03	0.00E+00	
2.75	Soils (Cu>100kPa)	18	49.5	0	49.5	0	49.5	0	0.03	0.00E+00	
3	Soils (Cu>100kPa)	18	54	10	51.5	0	54	2.5	0.03	2.09E-05	
3.25	Soils (Cu>100kPa)	18	58.5	10	53.5	0	58.5	5	0.03	4.19E-05	
3.5	Soils (Cu>100kPa)	18	63	10	55.5	0	63	7.5	0.03	6.28E-05	
3.75	Soils (Cu>100kPa)	18	67.5	10	57.5	0	67.5	10	0.03	8.38E-05	
4	Soils (Cu>100kPa)	18	72	10	59.5	0	72	12.5	0.03	1.05E-04	
4.25	Soils (Cu>100kPa)	18	76.5	10	61.5	0	76.5	15	0.03	1.26E-04	
4.5	Soils (Cu>100kPa)	18	81	10	63.5	10	78.5	15	0.03	1.26E-04	
4.75	Soils (Cu>100kPa)	18	85.5	10	65.5	10	80.5	15	0.03	1.26E-04	
5	Soils (Cu>100kPa)	18	90	10	67.5	10	82.5	15	0.03	1.26E-04	
5.25	Soils (Cu>100kPa)	18	94.5	10	69.5	10	84.5	15	0.03	1.26E-04	
5.5	Soils (Cu>100kPa)	18	99	10	71.5	10	86.5	15	0.03	1.26E-04	
5.75	Soils (Cu>100kPa)	18	103.5	10	73.5	10	88.5	15	0.03	1.26E-04	
6	Soils (Cu>100kPa)	18	108	10	75.5	10	90.5	15	0.03	1.26E-04	
6.25	Soils (Cu>100kPa)	18	112.5	10	77.5	10	92.5	15	0.03	1.26E-04	
6.5	Soils (Cu>100kPa)	18	117	10	79.5	10	94.5	15	0.03	1.26E-04	
6.75	Soils (Cu>100kPa)	18	121.5	10	81.5	10	96.5	15	0.03	1.26E-04	
7	Soils (Cu>100kPa)	18	126	10	83.5	10	98.5	15	0.03	1.26E-04	
7.25	Soils (Cu>100kPa)	18	130.5	10	85.5	10	100.5	15	0.03	1.26E-04	
7.5	Soils (Cu>100kPa)	18	135	10	87.5	10	102.5	15	0.03	1.26E-04	
7.75	Soils (Cu>100kPa)	18	139.5	10	89.5	10	104.5	15	0.03	1.26E-04	
8	Soils (Cu>100kPa)	18	144	10	91.5	10	106.5	15	0.03	1.26E-04	

2.3
(mm)

	4 Fred Thomas Drive, Takapuna, Auckland 0622 PO Box 100253, North Shore, Auckland 0745 Tel: 09 489 7872 Email: riley@riley.co.nz	Project No:	240065	Page	1	of	2	
	22 Moorhouse Avenue, Addington, Christchurch 8011 PO Box 4355, Christchurch 8140 Tel: 03 379 4402 Email: rileychch@riley.co.nz	Project:	Vineway Ltd					
		Calc:	LKB	Date:	18 Dec 2025			
		Check:	JLB	Date:	18 Dec 2025			
Description:	Calculation of settlement due to groundwater drawdown and extent of the drawdown (Stage 2)							

Inputs:	<ol style="list-style-type: none"> From review of investigation data and groundwater level monitoring adopt a conservative GWL at 2m depth within the surficial soil mantle, which is consistent with the shallowest gwl data. Drawdown within the non-compressible rock materials is not considered for the purpose of calculating in settlements. GWL monitoring sheet at link below. For the western boundary adopt a 4m thick surficial soil mantle based on TP53. For the northeast corner adopt a rock depth of 3.5m (TP25), for the eastern boundary adopt a depth of 5.2m (TP35 and TP36), south eastern boundary adopt a depth of 4m (TP28) and for the southern boundary adopt 8m depth (base of cut as rock was not encountered along the southern boundary). Typical undrained shear strength along the western boundary is 40-85kPa, along the northern and eastern boundaries the typical value is 70-100kPa and for the southern boundary 50-100kPa. Therefore, adopt $m_v = 0.083\text{MN/m}^2$ for the western boundary (for $C_u=40\text{kPa}$), for the northern and eastern boundaries adopt $m_v = 0.048\text{MN/m}^2$ (for $C_u=70\text{kPa}$), and for the southern boundary adopt $m_v = 0.067\text{MN/m}^2$ (for $C_u=50\text{kPa}$). These values are considered to be conservative. M_v (MN/m^2) is calculated as $1/(300 \times C_u) \times 1000$. Max cuts for calculation 6.5m (western boundary), 12m (northern portion of eastern boundary), 8.5m (southern portion of eastern boundary), 7.5m (eastern boundary) and 9m (southern boundary). A permeability of $1 \times 10^{-6}\text{m/s}$ is considered appropriate as an average for the sandy silt/clayey silt type materials present. The maximum cut depth has been selected where appropriate. In some circumstance a smaller cut that is closer to the boundary may have a greater impact on the drawdown settlement at the boundary. <p>For plane flow, the distance of influence, L_0, has been estimated using Powrie and Preene, 1994 as below:</p> $L_0 = \sqrt{\frac{12 * k * D * T}{S}}$ <p>Where: k is the soil permeability in metres/second, D is the aquifer thickness in metres, t is the time since pumping started in seconds, and S is the aquifer storage coefficient.</p> <p>The depth of the groundwater drawdown at the boundary has been estimated assuming a linear relationship between the groundwater level at the maximum drawdown and zero</p>
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drawdown at the distance of influence. This method is considered a conservative evaluation as the groundwater drawdown is not a linear relationship in reality.

Refer to the attached calculation sheet for the groundwater drawdown at the closest point to the western, northern part of the eastern, southern part of the eastern and southern boundary.

We note the distance of influence (L_0) is located within the property boundary at the northern part of the eastern boundary and therefore there is no drawdown beyond the boundary.

The attached spreadsheet indicates the maximum drawdown is expected to be 6.4mm at the northern boundary. The distances from the base of each cut were measured off the drawing set Delmore Stage 1 by McKenzie & CO.

Table 1: Calculated GW drawdown induced settlements

Location	Boundary Cut	Maximum Groundwater drawdown	Calculated Settlement at the Boundary
Western boundary	6.5m	2m*	2mm
Northern part of eastern boundary	12.5m	1.5m*	0mm
Southern part of eastern boundary	8.5m	3.2m*	1.3mm
Southern boundary	7m	6m*	11.7mm
Eastern boundary	7.5m	2m*	5.7mm

*Maximum groundwater drawdown is taken as the shallower of the depth to rock or the base of the boundary cut.

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Figure 1: Western boundary measurement

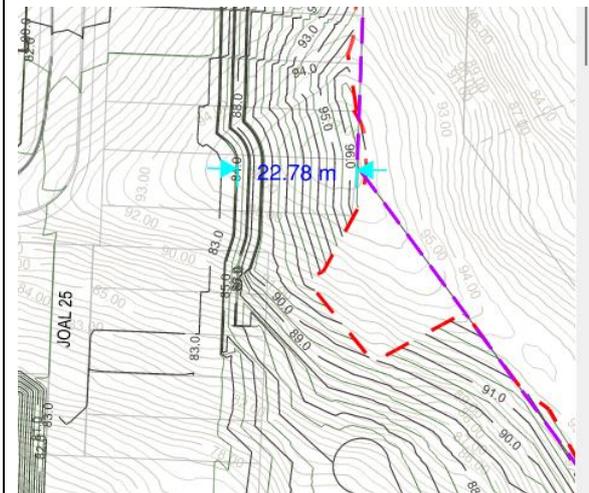
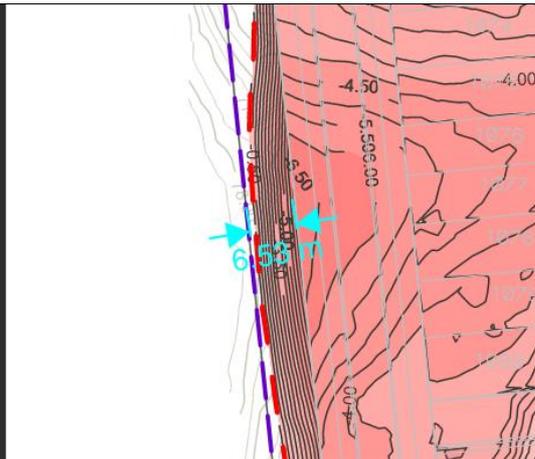


Figure 2: Northern part of eastern boundary measurement

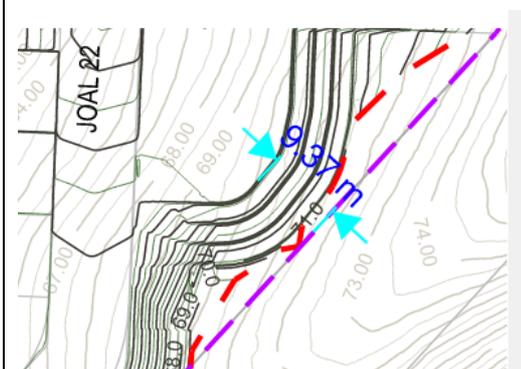
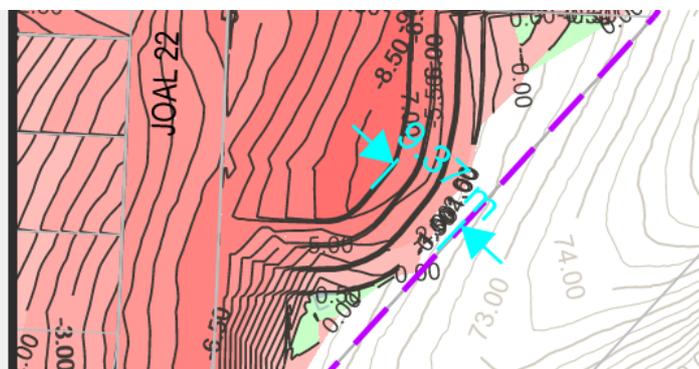


Figure 3: Southern part of eastern boundary measurement



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			Check: JLB	Date: 18 Dec 2025
	Description:	Calculation of settlement due to groundwater drawdown and extent of the drawdown (Stage 2)		

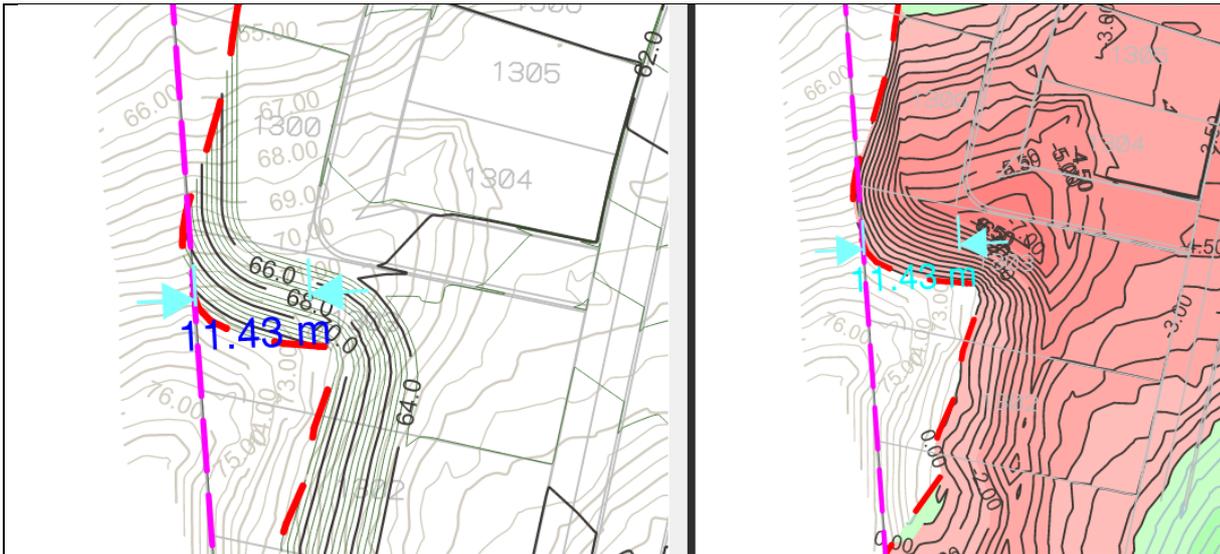


Figure 4: Southern boundary measurement

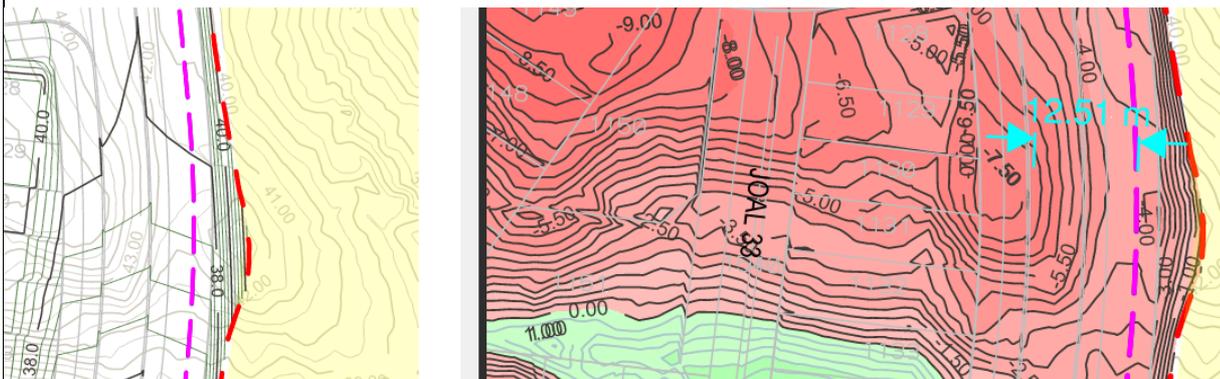


Figure 5: Eastern boundary measurement

Calculation of settlement due to groundwater drawdown
Riley Reference: 240065 - Vineway Ltd Stage 2
18 Dec 2025
Designed: LKB
Check: JLB



Western Boundary

Powrie and Preene, 1994:

$$k := 0.000001 \frac{m}{s}$$

Soil permeability

$$D := 2 \text{ m}$$

Aquifer thickness

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 19.32 \text{ m}$$

Distance from max drawdown

$$i := \frac{2 \text{ m} - 0 \text{ m}}{L_0}$$

Change in hydraulic grade between L_0 and max drawdown

$$h_0 := 2 \text{ m}$$

$$h := i \cdot 6.66 \text{ m} = 0.689 \text{ m}$$

GWL at distance x , where x is distance to boundary

$$h_0 - h = 1.311 \text{ m}$$

Drawdown at x (Boundary)

Northern Part of Eastern Boundary

Powrie and Preene, 1994:

$$k := 0.000001 \frac{m}{s}$$

Soil permeability

$$D := 1.5 \text{ m}$$

Aquifer thickness

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 16.731 \text{ m}$$

Distance from max drawdown

$$i := \frac{1.5 \text{ m} - 0 \text{ m}}{L_0}$$

Change in hydraulic grade between L0 and max drawdown

$$h_0 := 1.5 \text{ m}$$

$$h := i \cdot 22.78 \text{ m} = 2.042 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = -0.542 \text{ m}$$

Drawdown at x (Boundary)

Southern part of Eastern Boundary

Powrie and Preene, 1994:

$$k := 0.000001 \frac{\text{m}}{\text{s}}$$

Soil permeability

$$D := 3.2 \text{ m}$$

Aquifer thickness

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 24.438 \text{ m}$$

Distance from max drawdown

$$i := \frac{3.2 \text{ m} - 0 \text{ m}}{L_0} = 0.131 \quad \text{Change in hydraulic grade between L0 and max drawdown}$$

$$h_0 := 3.2 \text{ m}$$

$$h := i \cdot 9.37 \text{ m} = 1.227 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = 1.973 \text{ m}$$

Drawdown at x (Boundary)

Southern Boundary

Powrie and Preene, 1994:

$$k := 0.000001 \frac{m}{s}$$

Soil permeability

$$D := 6.0 \text{ m}$$

Aquifer thickness

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 33.463 \text{ m}$$

Distance from max drawdown

$$i := \frac{6.0 \text{ m} - 0 \text{ m}}{L_0} = 0.179 \quad \text{Change in hydraulic grade between } L_0 \text{ and max drawdown}$$

$$h_0 := 6.0 \text{ m}$$

$$h := i \cdot 11.43 \text{ m} = 2.049 \text{ m}$$

GWL at distance x, where x is distance to boundary

$$h_0 - h = 3.951 \text{ m}$$

Drawdown at x (Boundary)

Southern Boundary

Powrie and Preene, 1994:

$$k := 0.000001 \frac{m}{s}$$

Soil permeability

$$D := 2.0 \text{ m}$$

Aquifer thickness

$$t := 6 \cdot 30 \cdot 24 \cdot 60 \cdot 60 \text{ s}$$

Time

$$S := 1.0$$

Aquifer storage coefficient

$$L_0 := \sqrt{\frac{12 \cdot k \cdot D \cdot t}{S}} = 19.32 \text{ m}$$

Distance from max drawdown

$$i := \frac{6.0 \text{ m} - 0 \text{ m}}{L_0} = 0.311 \quad \text{Change in hydraulic grade between } L_0 \text{ and max drawdown}$$

$$h_0 := 6.0 \text{ m}$$

$$h := i \cdot 12.51 \text{ m} = 3.885 \text{ m}$$

$$h_0 - h = 2.115 \text{ m}$$

GWL at distance x, where x is distance to boundary

Drawdown at x (Boundary)

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 2 Northern Portion of Eastern Boundary (Max 12.5m cut)

Job No. 240065

Designed Checked	LKB		18/12/2025	
	JLB		18/12/2025	
kN/m2 $\Delta\sigma'$	(m2/MN) m_v	(m) S		
0	0.05	0.00E+00		
0.05	0.05	0.00E+00		
0.10	0.05	0.00E+00		
0.15	0.05	0.00E+00		
0.20	0.05	0.00E+00		
0.25	0.05	0.00E+00		
0.30	0.05	0.00E+00		
0.35	0.05	0.00E+00		
0.40	0.05	0.00E+00		
0.45	0.05	0.00E+00		
0.50	0.05	0.00E+00		
0.55	0.05	0.00E+00		
0.60	0.05	0.00E+00		
0.65	0.05	0.00E+00		
0.70	0.05	0.00E+00		
0.75	0.05	0.00E+00		
0.80	0.05	0.00E+00		
0.85	0.05	0.00E+00		
0.90	0.05	0.00E+00		
0.95	0.05	0.00E+00		
1.00	0.05	0.00E+00		
1.05	0.05	0.00E+00		
1.10	0.05	0.00E+00		
1.15	0.05	0.00E+00		
1.20	0.05	0.00E+00		
1.25	0.05	0.00E+00		
1.30	0.05	0.00E+00		
1.35	0.05	0.00E+00		
1.40	0.05	0.00E+00		
1.45	0.05	0.00E+00		
1.50	0.05	0.00E+00		
1.55	0.05	0.00E+00		
1.60	0.05	0.00E+00		
1.65	0.05	0.00E+00		
1.70	0.05	0.00E+00		
1.75	0.05	0.00E+00		
1.80	0.05	0.00E+00		
1.85	0.05	0.00E+00		
1.90	0.05	0.00E+00		
1.95	0.05	0.00E+00		
2.00	0.05	0.00E+00		
2.05	0.05	0.00E+00		
2.10	0.05	0.00E+00		
2.15	0.05	0.00E+00		
2.20	0.05	0.00E+00		
2.25	0.05	0.00E+00		
2.30	0.05	0.00E+00		
2.35	0.05	0.00E+00		
2.40	0.05	0.00E+00		
2.45	0.05	0.00E+00		
2.50	0.05	0.00E+00		
2.55	0.05	0.00E+00		
2.60	0.05	0.00E+00		
2.65	0.05	0.00E+00		
2.70	0.05	0.00E+00		
2.75	0.05	0.00E+00		
2.80	0.05	0.00E+00		
2.85	0.05	0.00E+00		
2.90	0.05	0.00E+00		
2.95	0.05	0.00E+00		
3.00	0.05	0.00E+00		
3.05	0.05	0.00E+00		
3.10	0.05	0.00E+00		
3.15	0.05	0.00E+00		
3.20	0.05	0.00E+00		
3.25	0.05	0.00E+00		
3.30	0.05	0.00E+00		
3.35	0.05	0.00E+00		
3.40	0.05	0.00E+00		
3.45	0.05	0.00E+00		
3.50	0.05	0.00E+00		
3.55	0.05	0.00E+00		
3.60	0.05	0.00E+00		
3.65	0.05	0.00E+00		
3.70	0.05	0.00E+00		
3.75	0.05	0.00E+00		
3.80	0.05	0.00E+00		
3.85	0.05	0.00E+00		
3.90	0.05	0.00E+00		
3.95	0.05	0.00E+00		
4.00	0.05	0.00E+00		
4.05	0.05	0.00E+00		
4.10	0.05	0.00E+00		
4.15	0.05	0.00E+00		
4.20	0.05	0.00E+00		
4.25	0.05	0.00E+00		
4.30	0.05	0.00E+00		
4.35	0.05	0.00E+00		
4.40	0.05	0.00E+00		
4.45	0.05	0.00E+00		
4.50	0.05	0.00E+00		
4.55	0.05	0.00E+00		
4.60	0.05	0.00E+00		
4.65	0.05	0.00E+00		
4.70	0.05	0.00E+00		
4.75	0.05	0.00E+00		
4.80	0.05	0.00E+00		
4.85	0.05	0.00E+00		
4.90	0.05	0.00E+00		
4.95	0.05	0.00E+00		
5.00	0.05	0.00E+00		
5.05	0.05	0.00E+00		
5.10	0.05	0.00E+00		
5.15	0.05	0.00E+00		
5.20	0.05	0.00E+00		
5.25	0.05	0.00E+00		
5.30	0.05	0.00E+00		
5.35	0.05	0.00E+00		
5.40	0.05	0.00E+00		
5.45	0.05	0.00E+00		
5.50	0.05	0.00E+00		
5.55	0.05	0.00E+00		
5.60	0.05	0.00E+00		
5.65	0.05	0.00E+00		
5.70	0.05	0.00E+00		
5.75	0.05	0.00E+00		
5.80	0.05	0.00E+00		
5.85	0.05	0.00E+00		
5.90	0.05	0.00E+00		
5.95	0.05	0.00E+00		
6.00	0.05	0.00E+00		
6.05	0.05	0.00E+00		
6.10	0.05	0.00E+00		
6.15	0.05	0.00E+00		
6.20	0.05	0.00E+00		
6.25	0.05	0.00E+00		
6.30	0.05	0.00E+00		
6.35	0.05	0.00E+00		
6.40	0.05	0.00E+00		
6.45	0.05	0.00E+00		
6.50	0.05	0.00E+00		
6.55	0.05	0.00E+00		
6.60	0.05	0.00E+00		
6.65	0.05	0.00E+00		
6.70	0.05	0.00E+00		
6.75	0.05	0.00E+00		
6.80	0.05	0.00E+00		
6.85	0.05	0.00E+00		
6.90	0.05	0.00E+00		
6.95	0.05	0.00E+00		
7.00	0.05	0.00E+00		
7.05	0.05	0.00E+00		
7.10	0.05	0.00E+00		
7.15	0.05	0.00E+00		
7.20	0.05	0.00E+00		
7.25	0.05	0.00E+00		
7.30	0.05	0.00E+00		
7.35	0.05	0.00E+00		
7.40	0.05	0.00E+00		
7.45	0.05	0.00E+00		
7.50	0.05	0.00E+00		
7.55	0.05	0.00E+00		
7.60	0.05	0.00E+00		
7.65	0.05	0.00E+00		
7.70	0.05	0.00E+00		
7.75	0.05	0.00E+00		
7.80	0.05	0.00E+00		
7.85	0.05	0.00E+00		
7.90	0.05	0.00E+00		
7.95	0.05	0.00E+00		
8.00	0.05	0.00E+00		
8.05	0.05	0.00E+00		
8.10	0.05	0.00E+00		
8.15	0.05	0.00E+00		
8.20	0.05	0.00E+00		
8.25	0.05	0.00E+00		
8.30	0.05	0.00E+00		
8.35	0.05	0.00E+00		
8.40	0.05	0.00E+00		
8.45	0.05	0.00E+00		
8.50	0.05	0.00E+00		
8.55	0.05	0.00E+00		
8.60	0.05	0.00E+00		
8.65	0.05	0.00E+00		
8.70	0.05	0.00E+00		
8.75	0.05	0.00E+00		
8.80	0.05	0.00E+00		
8.85	0.05	0.00E+00		
8.90	0.05	0.00E+00		
8.95	0.05	0.00E+00		
9.00	0.05	0.00E+00		
9.05	0.05	0.00E+00		
9.10	0.05	0.00E+00		
9.15	0.05	0.00E+00		
9.20	0.05	0.00E+00		
9.25	0.05	0.00E+00		
9.30	0.05	0.00E+00		
9.35	0.05	0.00E+00		
9.40	0.05	0.00E+00		
9.45	0.05	0.00E+00		
9.50	0.05	0.00E+00		
9.55	0.05	0.00E+00		
9.60	0.05	0.00E+00		
9.65	0.05	0.00E+00		
9.70	0.05	0.00E+00		
9.75	0.05	0.00E+00		
9.80	0.05	0.00E+00		
9.85	0.05	0.00E+00		
9.90	0.05	0.00E+00		
9.95	0.05	0.00E+00		
10.00	0.05	0.00E+00		
10.05	0.05	0.00E+00		
10.10	0.05	0.00E+00		
10.15	0.05	0.00E+00		
10.20	0.05	0.00E+00		
10.25	0.05	0.00E+00		
10.30	0.05	0.00E+00		
10.35	0.05	0.00E+00		
10.40	0.05	0.00E+00		
10.45	0.05	0.00E+00		
10.50	0.05	0.00E+00		
10.55	0.05	0.00E+00		
10.60	0.05	0.00E+00		
10.65	0.05	0.00E+00		
10.70	0.05	0.00E+00		
10.75	0.05	0.00E+00		
10.80	0.05	0.00E+00		
10.85	0.05	0.00E+00		
10.90	0.05	0.00E+00		
10.95	0.05	0.00E+00		
11.00	0.05	0.00E+00		
11.05	0.05	0.00E+00		
11.10	0.05	0.00E+00		
11.15	0.05	0.00E+00		
11.20	0.05	0.00E+00		
11.25	0.05	0.00E+00		
11.30	0.05	0.00E+00		
11.35	0.05	0.00E+00		
11.40	0.05	0.00E+00		
11.45	0.05	0.00E+00		
11.50	0.05	0.00E+00		
11.55	0.05	0.00E+00		
11.60	0.05	0.00E+00		
11.65	0.05	0.00E+00		
11.70	0.05	0.00E+00		
11.75	0.05	0.00E+00		
11.80	0.05	0.00E+00		
11.85	0.05	0.00E+00		
11.90	0.05	0.00E+00		
11.95	0.05	0.00E+00		
12.00	0.05	0.00E+00		
12.05	0.05	0.00E+00		
12.10	0.05	0.00E+00		
12.15	0.05	0.00E+00		
12.20	0.05	0.00E+00		
12.25	0.05	0.00E+00		
12.30	0.05	0.00E+00		
12.35	0.05	0.00E+00		
12.40	0.05	0.00E+00		
12.45	0.05	0.00E+00		
12.50	0.05	0.00E+00		
12.55	0.05	0.00E+00		
12.60	0.05	0.00E+00		
12.65	0.05	0.00E+00		
12.70	0.05	0.00E+00		
12.75	0.05	0.00E+00		
12.80	0.05	0.00E+00		
12.85	0.05	0.00E+00		
12.90	0.05	0.00E+00		
12.95	0.05	0.00E+00		
13.00	0.05	0.00E+00		
13.05	0.05	0.00E+00		
13.10	0.05	0.00E+00		
13.15	0.05	0.00E+00		
13.20	0.05	0.00E+00		
13.25	0.05	0.00E+00		
13.30	0.05	0.00E+00		
13.35	0.05	0.00E+00		
13.40	0.05	0.00E+00		
13.45	0.05	0.00E+00		
13.50	0.05	0.00E+00		
13.				

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 2 Eastern Boundary (Max 7.5m cut)

Typical Cross-section				Job No. 240065		Designed Checked		LKB		18/10/2025
m	BLG	Geology	γ	σ	Initial	Drained	kN/m2	(m2/MN)	(m)	18/10/2025
					W	σ'	$\Delta\sigma'$	m_v	S	
0		Ground level at boundary			0	0				
0.25		Soils (Cu>100kPa)	18	4.5	0	4.5	0	0.05	0.00E+00	
0.5		Soils (Cu>100kPa)	18	9	0	9	0	0.05	0.00E+00	
0.75		Soils (Cu>100kPa)	18	13.5	0	13.5	0	0.05	0.00E+00	
1		Soils (Cu>100kPa)	18	18	0	18	0	0.05	0.00E+00	
1.25		Soils (Cu>100kPa)	18	22.5	0	22.5	0	0.05	0.00E+00	
1.5		Soils (Cu>100kPa)	18	27	0	27	0	0.05	0.00E+00	
1.75		Soils (Cu>100kPa)	18	31.5	0	31.5	0	0.05	0.00E+00	
2		Soils (Cu>100kPa)	18	36	10	33.5	0	0.05	3.00E-05	
2.25		Soils (Cu>100kPa)	18	40.5	10	35.5	0	0.05	6.00E-05	
2.5		Soils (Cu>100kPa)	18	45	10	37.5	0	0.05	9.00E-05	
2.75		Soils (Cu>100kPa)	18	49.5	10	39.5	0	0.05	1.20E-04	
3		Soils (Cu>100kPa)	18	54	10	41.5	0	0.05	1.50E-04	
3.25		Soils (Cu>100kPa)	18	58.5	10	43.5	0	0.05	1.80E-04	
3.5		Soils (Cu>100kPa)	18	63	10	45.5	0	0.05	2.10E-04	
3.75		Soils (Cu>100kPa)	18	67.5	10	47.5	0	0.05	2.40E-04	
4		Soils (Cu>100kPa)	18	72	10	49.5	0	0.05	2.70E-04	
4.25		Soils (Cu>100kPa)	18	76.5	10	51.5	10	0.05	2.70E-04	
4.5		Soils (Cu>100kPa)	18	81	10	53.5	10	0.05	2.70E-04	
4.75		Soils (Cu>100kPa)	18	85.5	10	55.5	10	0.05	2.70E-04	
5		Soils (Cu>100kPa)	18	90	10	57.5	10	0.05	2.70E-04	
5.25		Soils (Cu>100kPa)	18	94.5	10	59.5	10	0.05	2.70E-04	
5.5		Soils (Cu>100kPa)	18	99	10	61.5	10	0.05	2.70E-04	
5.75		Soils (Cu>100kPa)	18	103.5	10	63.5	10	0.05	2.70E-04	
6		Soils (Cu>100kPa)	18	108	10	65.5	10	0.05	2.70E-04	
6.25		Soils (Cu>100kPa)	18	112.5	10	67.5	10	0.05	2.70E-04	
6.5		Soils (Cu>100kPa)	18	117	10	69.5	10	0.05	2.70E-04	
6.75		Soils (Cu>100kPa)	18	121.5	10	71.5	10	0.05	2.70E-04	
7		Soils (Cu>100kPa)	18	126	10	73.5	10	0.05	2.70E-04	
7.25		Soils (Cu>100kPa)	18	130.5	10	75.5	10	0.05	2.70E-04	
7.5		Soils (Cu>100kPa)	18	135	10	77.5	10	0.05	2.70E-04	
7.75		Soils (Cu>100kPa)	18	139.5	10	79.5	10	0.05	2.70E-04	
8		Soils (Cu>100kPa)	18	144	10	81.5	10	0.05	2.70E-04	
									5.7	
									(mm)	

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 2 Southern Portion of Eastern Boundary (8.5m cut)

Job No. 240065

Designed LKB 18/12/2025
Checked JLB 18/12/2025

Typical Cross-section

m BLG	Geology	γ	σ	Initial		Drained		Designed	LKB	18/12/2025
				W	σ'			kN/m2 $\Delta\sigma'$	(m2/MN) m_v	(m) S
0	Ground level at boundary			0	0	0	0			
0.25	Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.05	0.00E+00
0.5	Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.05	0.00E+00
0.75	Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.05	0.00E+00
1	Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.05	0.00E+00
1.25	Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.05	0.00E+00
1.5	Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.05	0.00E+00
1.75	Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.05	0.00E+00
2	Soils (Cu>100kPa)	18	36	0	36	0	36	0	0.05	0.00E+00
2.25	Soils (Cu>100kPa)	18	40.5	0	40.5	0	40.5	0	0.05	0.00E+00
2.5	Soils (Cu>100kPa)	18	45	0	45	0	45	0	0.05	0.00E+00
2.75	Soils (Cu>100kPa)	18	49.5	0	49.5	0	49.5	0	0.05	0.00E+00
3	Soils (Cu>100kPa)	18	54	0	54	0	54	0	0.05	0.00E+00
3.25	Soils (Cu>100kPa)	18	58.5	10	56	0	58.5	2.5	0.05	3.00E-05
3.5	Soils (Cu>100kPa)	18	63	10	58	0	63	5	0.05	6.00E-05
3.75	Soils (Cu>100kPa)	18	67.5	10	60	0	67.5	7.5	0.05	9.00E-05
4	Soils (Cu>100kPa)	18	72	10	62	0	72	10	0.05	1.20E-04
4.25	Soils (Cu>100kPa)	18	76.5	10	64	0	76.5	12.5	0.05	1.50E-04
4.5	Soils (Cu>100kPa)	18	81	10	66	0	81	15	0.05	1.80E-04
4.75	Soils (Cu>100kPa)	18	85.5	10	68	0	85.5	17.5	0.05	2.10E-04
5	Soils (Cu>100kPa)	18	90	10	70	0	90	20	0.05	2.40E-04
5.25	Soils (Cu>100kPa)	18	94.5	10	72	10	92	20	0.05	2.40E-04
5.5	Soils (Cu>100kPa)	18	99	10	74	10	94	20	0.00	0.00E+00
5.75	Soils (Cu>100kPa)	18	103.5	10	76	10	96	20	0.00	0.00E+00
6	Soils (Cu>100kPa)	18	108	10	78	10	98	20	0.00	0.00E+00
6.25	Soils (Cu>100kPa)	18	112.5	10	80	10	100	20	0.00	0.00E+00
6.5	Soils (Cu>100kPa)	18	117	10	82	10	102	20	0.00	0.00E+00
6.75	Soils (Cu>100kPa)	18	121.5	10	84	10	104	20	0.00	0.00E+00
7	Soils (Cu>100kPa)	18	126	10	86	10	106	20	0.00	0.00E+00
7.25	Soils (Cu>100kPa)	18	130.5	10	88	10	108	20	0.00	0.00E+00
7.5	Soils (Cu>100kPa)	18	135	10	90	10	110	20	0.00	0.00E+00
7.75	Soils (Cu>100kPa)	18	139.5	10	92	10	112	20	0.00	0.00E+00
8	Soils (Cu>100kPa)	18	144	10	94	10	114	20	0.00	0.00E+00
1.3										
(mm)										

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 2 Southern Boundary (Max 8m cut)

Job No. 240065

Designed JLB 28/01/2025
Checked

Typical Cross-section

m BLG	Geology	γ	σ	Initial		Drained		Designed	JLB	
				W	σ'			Checked	$\Delta\sigma'$	(m^2/MN) m_v
0	Ground level at boundary				0		0			
0.25	Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.07	0.00E+00
0.5	Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.07	0.00E+00
0.75	Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.07	0.00E+00
1	Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.07	0.00E+00
1.25	Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.07	0.00E+00
1.5	Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.07	0.00E+00
1.75	Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.07	0.00E+00
2	Soils (Cu>100kPa)	18	36	10	33.5	0	36	2.5	0.07	4.19E-05
2.25	Soils (Cu>100kPa)	18	40.5	10	35.5	0	40.5	5	0.07	8.38E-05
2.5	Soils (Cu>100kPa)	18	45	10	37.5	0	45	7.5	0.07	1.26E-04
2.75	Soils (Cu>100kPa)	18	49.5	10	39.5	0	49.5	10	0.07	1.68E-04
3	Soils (Cu>100kPa)	18	54	10	41.5	0	54	12.5	0.07	2.09E-04
3.25	Soils (Cu>100kPa)	18	58.5	10	43.5	0	58.5	15	0.07	2.51E-04
3.5	Soils (Cu>100kPa)	18	63	10	45.5	0	63	17.5	0.07	2.93E-04
3.75	Soils (Cu>100kPa)	18	67.5	10	47.5	0	67.5	20	0.07	3.35E-04
4	Soils (Cu>100kPa)	18	72	10	49.5	0	72	22.5	0.07	3.77E-04
4.25	Soils (Cu>100kPa)	18	76.5	10	51.5	0	76.5	25	0.07	4.19E-04
4.5	Soils (Cu>100kPa)	18	81	10	53.5	0	81	27.5	0.07	4.61E-04
4.75	Soils (Cu>100kPa)	18	85.5	10	55.5	0	85.5	30	0.07	5.03E-04
5	Soils (Cu>100kPa)	18	90	10	57.5	0	90	32.5	0.07	5.44E-04
5.25	Soils (Cu>100kPa)	18	94.5	10	59.5	0	94.5	35	0.07	5.86E-04
5.5	Soils (Cu>100kPa)	18	99	10	61.5	0	99	37.5	0.07	6.28E-04
5.75	Soils (Cu>100kPa)	18	103.5	10	63.5	0	103.5	40	0.07	6.70E-04
6	Soils (Cu>100kPa)	18	108	10	65.5	10	105.5	40	0.07	6.70E-04
6.25	Soils (Cu>100kPa)	18	112.5	10	67.5	10	107.5	40	0.07	6.70E-04
6.5	Soils (Cu>100kPa)	18	117	10	69.5	10	109.5	40	0.07	6.70E-04
6.75	Soils (Cu>100kPa)	18	121.5	10	71.5	10	111.5	40	0.07	6.70E-04
7	Soils (Cu>100kPa)	18	126	10	73.5	10	113.5	40	0.07	6.70E-04
7.25	Soils (Cu>100kPa)	18	130.5	10	75.5	10	115.5	40	0.07	6.70E-04
7.5	Soils (Cu>100kPa)	18	135	10	77.5	10	117.5	40	0.07	6.70E-04
7.75	Soils (Cu>100kPa)	18	139.5	10	79.5	10	119.5	40	0.07	6.70E-04
8	Soils (Cu>100kPa)	18	144	10	81.5	10	121.5	40	0.07	6.70E-04
11.7										
(mm)										

Calculate Settlement Due To Groundwater Drawdown.

Russell Road, Wainui : Stage 2 Western Boundary (6.5m cut)

Typical Cross-section				Job No. 240065		Designed Checked		LKB		18/12/2025	
m	BLG	Geology	γ	σ	Initial	Drained	kN/m ²	(m ² /MN)	JLB	18/12/2025	
					W	σ'	$\Delta\sigma'$	m_v		(m)	
										S	
0		Ground level at boundary			0	0					
0.25		Soils (Cu>100kPa)	18	4.5	0	4.5	0	4.5	0	0.00E+00	
0.5		Soils (Cu>100kPa)	18	9	0	9	0	9	0	0.00E+00	
0.75		Soils (Cu>100kPa)	18	13.5	0	13.5	0	13.5	0	0.00E+00	
1		Soils (Cu>100kPa)	18	18	0	18	0	18	0	0.00E+00	
1.25		Soils (Cu>100kPa)	18	22.5	0	22.5	0	22.5	0	0.00E+00	
1.5		Soils (Cu>100kPa)	18	27	0	27	0	27	0	0.00E+00	
1.75		Soils (Cu>100kPa)	18	31.5	0	31.5	0	31.5	0	0.00E+00	
2		Soils (Cu>100kPa)	18	36	10	33.5	0	36	2.5	0.08	5.19E-05
2.25		Soils (Cu>100kPa)	18	40.5	10	35.5	0	40.5	5	0.08	1.04E-04
2.5		Soils (Cu>100kPa)	18	45	10	37.5	0	45	7.5	0.08	1.56E-04
2.75		Soils (Cu>100kPa)	18	49.5	10	39.5	0	49.5	10	0.08	2.08E-04
3		Soils (Cu>100kPa)	18	54	10	41.5	0	54	12.5	0.08	2.59E-04
3.25		Soils (Cu>100kPa)	18	58.5	10	43.5	0	58.5	15	0.08	3.11E-04
3.5		Soils (Cu>100kPa)	18	63	10	45.5	10	60.5	15	0.08	3.11E-04
3.75		Soils (Cu>100kPa)	18	67.5	10	47.5	10	62.5	15	0.08	3.11E-04
4		Soils (Cu>100kPa)	18	72	10	49.5	10	64.5	15	0.08	3.11E-04
4.25		Soils (Cu>100kPa)	18	76.5	10	51.5	10	66.5	15	0.00	0.00E+00
4.5		Soils (Cu>100kPa)	18	81	10	53.5	10	68.5	15	0.00	0.00E+00
4.75		Soils (Cu>100kPa)	18	85.5	10	55.5	10	70.5	15	0.00	0.00E+00
5		Soils (Cu>100kPa)	18	90	10	57.5	10	72.5	15	0.00	0.00E+00
5.25		Soils (Cu>100kPa)	18	94.5	10	59.5	10	74.5	15	0.00	0.00E+00
5.5		Soils (Cu>100kPa)	18	99	10	61.5	10	76.5	15	0.00	0.00E+00
5.75		Soils (Cu>100kPa)	18	103.5	10	63.5	10	78.5	15	0.00	0.00E+00
6		Soils (Cu>100kPa)	18	108	10	65.5	10	80.5	15	0.00	0.00E+00
6.25		Soils (Cu>100kPa)	18	112.5	10	67.5	10	82.5	15	0.00	0.00E+00
6.5		Soils (Cu>100kPa)	18	117	10	69.5	10	84.5	15	0.00	0.00E+00
6.75		Soils (Cu>100kPa)	18	121.5	10	71.5	10	86.5	15	0.00	0.00E+00
7		Soils (Cu>100kPa)	18	126	10	73.5	10	88.5	15	0.00	0.00E+00
7.25		Soils (Cu>100kPa)	18	130.5	10	75.5	10	90.5	15	0.00	0.00E+00
7.5		Soils (Cu>100kPa)	18	135	10	77.5	10	92.5	15	0.00	0.00E+00
7.75		Soils (Cu>100kPa)	18	139.5	10	79.5	10	94.5	15	0.00	0.00E+00
8		Soils (Cu>100kPa)	18	144	10	81.5	10	96.5	15	0.00	0.00E+00
										2.0	
										(mm)	