13 August 2021 Document Ref: AKL2021-0056AD Rev 1

Matvin Group
Unit G4
27 William Pickering Drive, Albany
Auckland 0632

Attention: Matthew Ellingham

Dear Matthew

RE: GEOTECHNICAL EXPERT INPUT

1092 COATESVILLE-RIVERHEAD HIGHWAY, RIVERHEAD

1 INTRODUCTION

CMW Geosciences (CMW) has been engaged by Matvin Group to provide expert input for the proposed Retirement Village at 1092 Coatesville-Riverhead Highway, Riverhead.

CMW's experienced team currently comprises 65 staff across our NZ offices based in Auckland, Tauranga and Hamilton with a further 100 staff in Australia. Each of our New Zealand offices operates an in house IANZ accredited soils testing laboratory for earthworks quality control testing and our Quality, Health & Safety and Environmental systems are all accredited to the latest ISO standards.

CMW Auckland and CMW Auckland staff have been involved in a number of developments throughout the Riverhead area and have thorough experience working in similar geological settings and on similar scaled projects.

We understand that this letter will be used as part of a Fast-Track application for Resource Consent with Auckland Council.

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENTS

The site consists of two parcels of land, legally described as Lots 1 and 2 DP 164590 with a total land area of approximately 10 hectares.

The site is roughly rectangular in shape and is bound by Coatesville-Riverhead Highway and residential properties to the east, rural lifestyle properties to the north, horticultural lands to the west and Riverhead Road to the south. More horticultural lands are located across Riverhead Road.

There is an existing dwelling on the site, accessed from Coatesville Riverhead-Highway. The remainder of the site is used for horticulture. The site is generally flat with a gentle slope towards the north.

The provided Gel Architects plan, titled 'Overall Site Plan', referenced 20043 10-02 Rev. A depicts the construction of a large retirement village complex comprising the following:

- 158 Villas
- 9 Apartment Blocks
- 2 Care Home Units
- Childcare Centre
- Café
- 1 Retail Block incorporated into one of the apartment blocks
- Medical Centre incorporated into one of the apartment blocks
- Miscellaneous infrastructure including roads, carparks, greenhouses, golf pu ting green, playground, and lawn bowls rink
- An extension to the existing Cambridge Road

No earthworks plans are currently available, however from the gentle gradients a ross the site, any earthworks required to form the development are expected to be minimal.

3 DESKTOP STUDY

3.1 Site History and Geomorphology

Historic aerial photography viewed on the Auckland GIS viewer[1] and from the Retrolens[2] website indicates the site was in pasture in 1940 with a shallow broad gully running generally south to north through the northern half of the site. This gully appears to originate abruptly within the site, and it is not certain if the gully head was filled in prior to available aerial photos records. The gully exits the site in the approximate location of the modern-day intersection of Queen Street and Cambridge Road. A small farmhouse and associated infrastructure was located near the south western corner of the site, accessed via Riverhead Road.

Figure 1: 1957 Aerial photo with subject site outlined in red.

Source: Retrolens

Sometime between 1957 and 1973 the original farm house was removed and the land use started to change from pasture to horticulture.

[1] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

[2] https://retrolens.co.nz/Map/

By 1988 the site had developed into how it is currently. The gully appears to have been filled in and a number of shelter belts have grown across the site. The current residential dwelling on the site was constructed between 1981 and 1988.

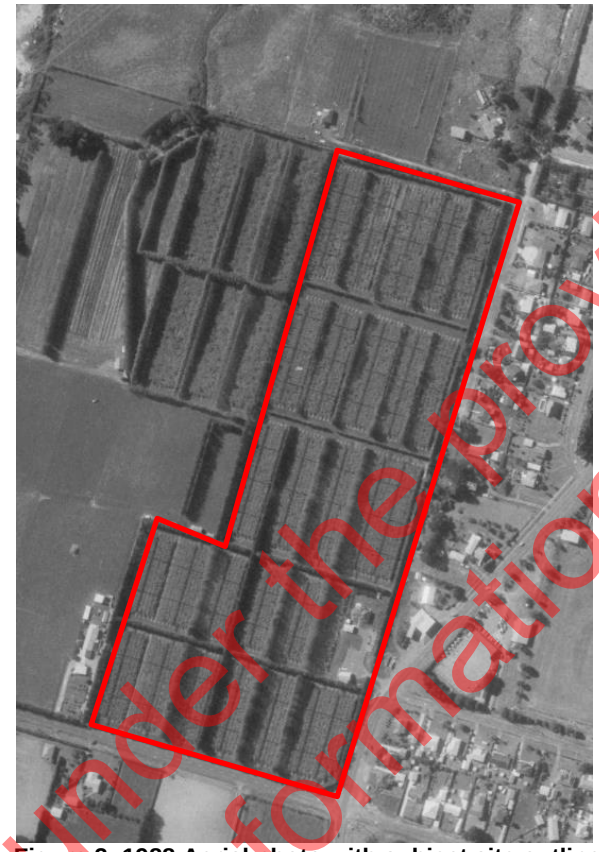

Figure 2: 1988 Aerial photo with subject site outlined in red.

Source: Retrolens

A review of the Auckland Council GIS shows a series of overland flow paths and flood plains are located across the site.

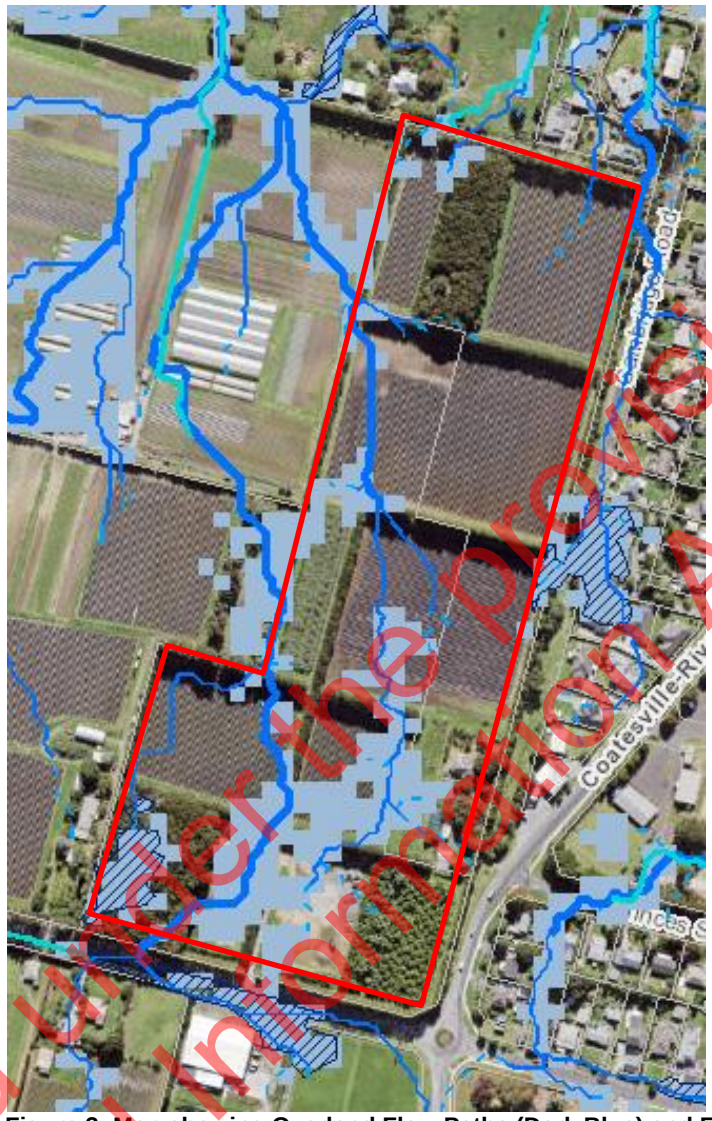

Figure 3: Map showing Overland Flow Paths (Dark Blue) and Flood Plains (Light Blue) with subject site outlined in red. Source: Retrolens

3.2 Geology

Published Geological Maps[3] suggest the site is underlain by alluvial deposits of Puketoka Formation (Tauranga Group) overlying alternating sandstone and siltstone (with variable volcanic content and interbedded pebbl and boulder sized clasts) of the East Coast Bays Formation and Albany Conglomerate (Waitemata Group)

[3] Edbrooke, S.W. (complier) 2001, Geology of the Auckland Area, 1:250,000 Geological Map 3, GNS Science

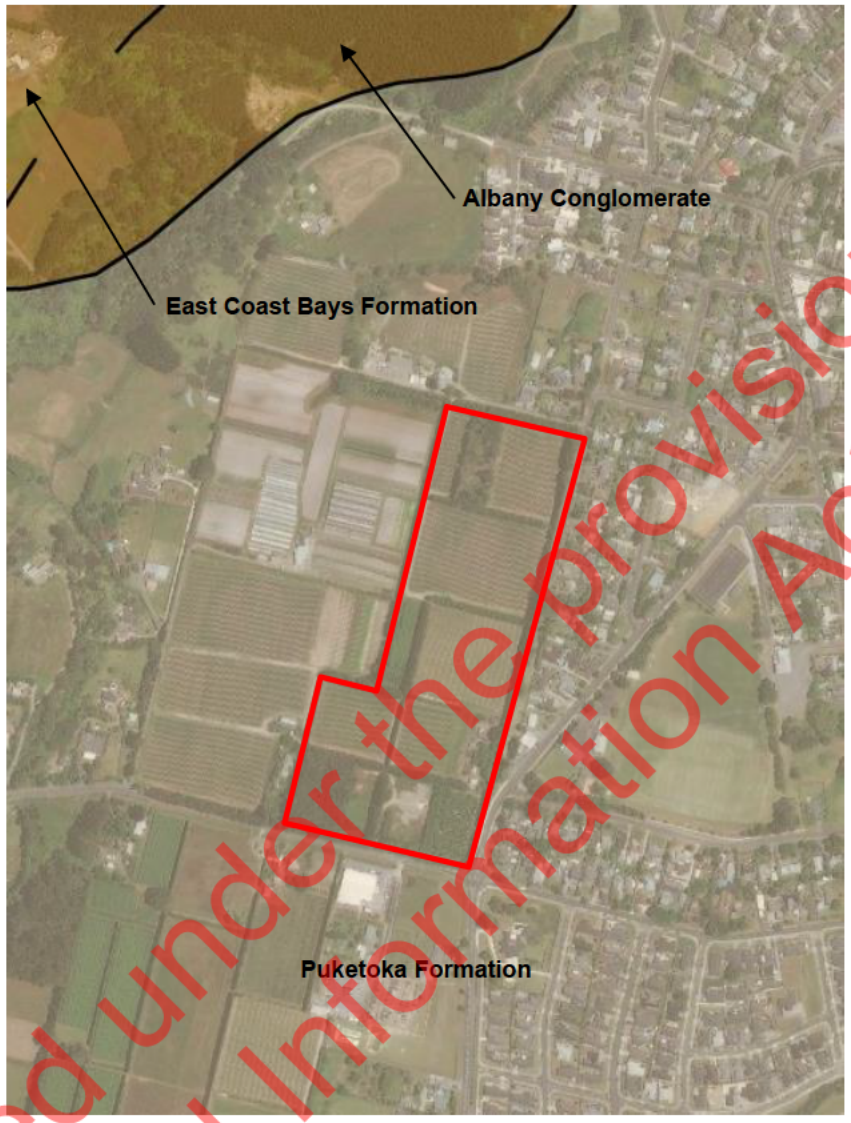

Figure 4: Geology map, site is highlighted in red. Source: GNS Web viewer

Tauranga Group alluvial deposits comprise Pliocene aged, or later, deposits including silts, clays and sands with possible peat or organic rich clay soils, and carbonaceous deposits. Some volcanic deposits are also often encountered. Accordingly, these deposits can be quite varied in their properties and may include soft and /or organic layers or deposits of soils that are sensitive to disturbance.

East Coasts Bays Formation (ECBF) deposits of the Waitemata Group are evident along much of the eastern coastline of the Auckland area, formed during the Early Miocene in the submarine fan and basin floor depositional environments and typically consist of thickly bedded sandstone and interbedded laminated mudstones/siltstones. Residual soils formed by weathering and alteration of the parent sedimentary formation typically form silts and clays or mixtures of the two depending on groundwater conditions, faulting and land gradients

Albany Conglomerate of the Waitemata Group is similar to the ECBF but consists of thick bedded sandstone and interbedded laminated mudstones/siltstone with dioritic and andesitic pebble to boulder sized clasts.

3.3 Existing Geological Information

3.3.1 New Zealand Geotechnical Database

A search of the New Zealand Geotechnical Database[4] (NZGD) was undertaken to gather nearby existing ground information. No existing information was located within the subject site.

Three groundwater bore drillers logs are located approximately 100m to the south, east and west of the subject site. The western borehole, located within the neighbouring horticultural property, logged clays to 2m depth, above fine sands to 3m depth. Alternating sandstone and mudstone was logged from 3m to the base of the borehole at 217m. The eastern borehole, located near the Riverhead Bowling Club logged a mixture of brown and grey silts and clays to 19m depth. Alternating sandstone and mudstone was logged from 19m to the base of the borehole at 252m. No indications of soil or rock strength w re included in the ogs. The southern borehole, located south of the Zaberri World warehouse, logged clays with 'timber' inclusions to 7m depth. Mudstone and sandstone was logged from 7m to 21m. Hard sandst ne with some gravels was logged to the base of the borehole at 303m. It is not certain if the 'timber' encounte ed was natu al wood associated with alluvial deposits or manmade timber associated with uncertified filling.

A number of other groundwater bore drillers logs are located around the subject si e, and these follow the general trend of the depth to rock increasing towards the east.

Two hand auger boreholes are located along Cambridge Road, along the eastern boundary of the subject site. These hand augers generally encountered stiff t very stiff clays and silts below a thick (0.25m and 0.7m) topsoil layer to the target depth of 2.6m. The northern hand auge located near the intersection of Queen Street and Cambridge Road (where the histor c gully appeared to xit the subject site) encountered soft soils to approximately 1.2m deep. No rock was encountered although vane shear strengths did improve at the base of one hand auger and siltstone clasts were encounte ed near the base of the other. Groundwater was measured between 0.4m and 0.7m below ground level.

One hand auger is located along Riverhead Road outside the south-western corner of the subject site. This hand auger encountered very stiff clays and s lts elow a thick (0.8m) topsoil/fill layer to a depth of 2.7m. No rock was encountered however the borehole was terminated due to materials being too hard to penetrate further. No Dynamic Cone Penetrometer (DCP) test was undertaken at the base to confirm the presence of rock.

3.3.2 CMW Database

CMW have recently been involve in a site investigation to the south west of the subject site. Investigations near Riverhead Road generally encountered stiff to hard clays and silts with occasional organically stained and organic clay lay rs beneath a thick (1.1m) topsoil layer. Rock was not encountered. Groundwater was enc untered 0.9m below existing ground levels. Laboratory results on samples taken during this investigation indicated AS270 Expansive Site Class of H2 (high).

CMW have also been involved in a number of construction projects across the wider Riverhead area. In a small selection of these projects an approximately 300m thick hard pan layer consisting of hard white ashy silts was encountered within the soil profile. This hardpan layer could not be penetrated using handheld equipment and could generally not be penetrated by a DCP.

[4] https://www.nzgd.org.nz/ARCGISMapViewer/mapviewer.aspx

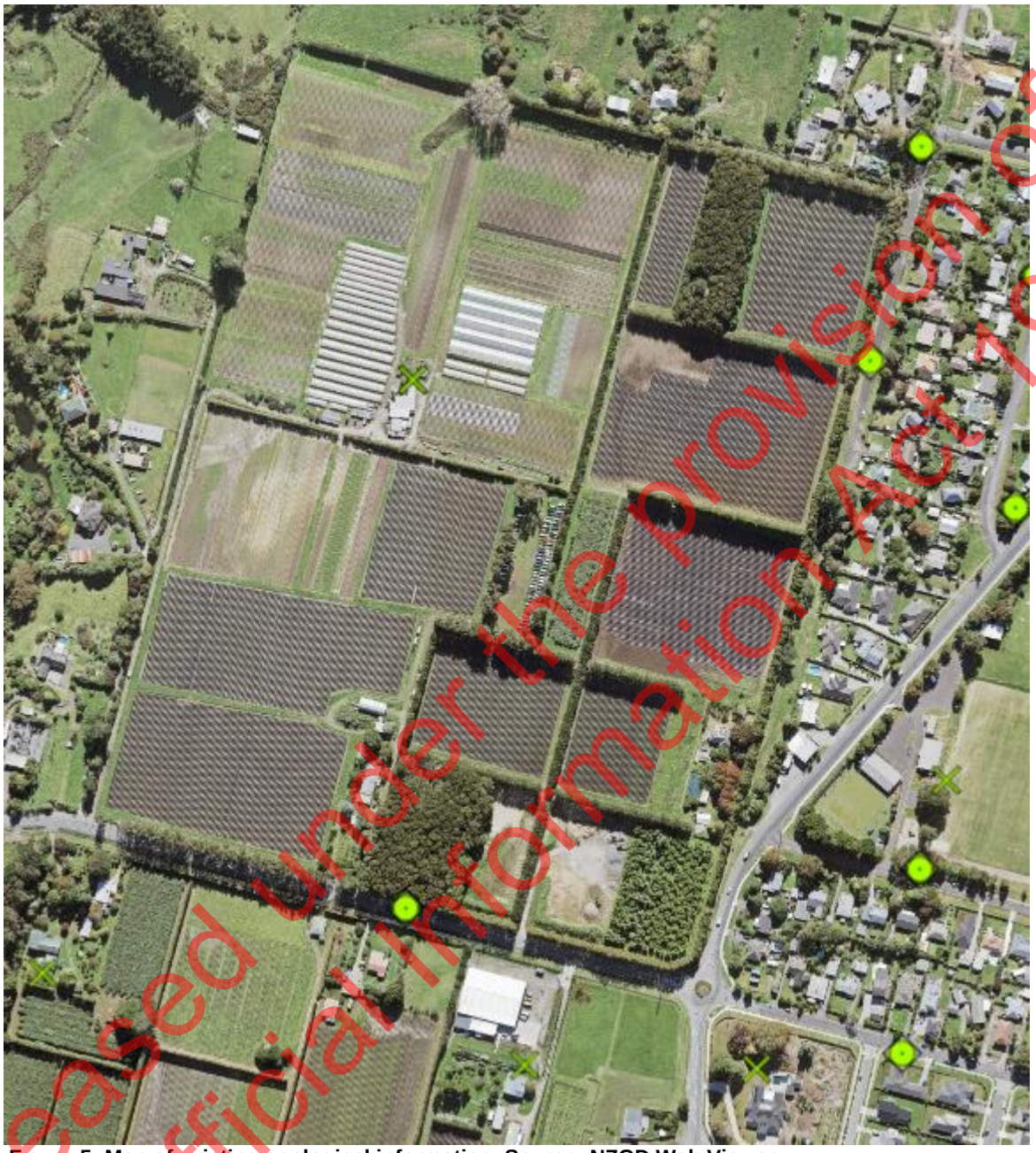

Figure 5: Map of existing geological information. Source: NZGD Web Viewer

4 PRELIMINARY GROUND MODEL

From the information gathered in the desktop study, it is likely that alluvial soils of the Puketoka Formation are present across the site consisting of stiff to very stiff clays and silts. However the presence of softer and potentially organic soils is expected, especially in the area of the historic gully. Uncertified filling is expected within the historic gully area which is shown in the aerial photographic records to have been filled as part of the change in land use from pasture to horticulture. Other areas of filling cannot be ruled out considering the historic land use of the subject site.

The depth of the bedrock is likely to vary greatly across the site, especially from west to east. Existing records vary between 3m and 19m depth. A hardpan layer, which can be falsely interpreted as rock from hand augers also could also be present.

Groundwater is anticipated to be high, with levels near the surface during wetter winter months.

5 PROJECT EVALUATION AND GEOTECHNICAL RISKS

5.1 Soft Soils and Uncertified Fills

The presence of soft soils and existing uncertified fills presents potentially the largest geotechnical risk to the development. Soft soils and uncertified fills are prone to load induced settlement which may cause damage to foundations, pavements and services. The soft soils may also have the potential for liquefaction.

Typical remediation options include preloading, undercutting and removal, raft foundations or piled foundations, amendments to road pavement designs and additional undercutting of service trenches. Due to the variable soils and depth to rock noted in the desktop study, intrusive investigation including hand augers, CPTs and machine boreholes will assist with defining the extents and depths of any soft soils and help with the design of remediation options.

Any engineered fill sourced from excess cut is likely to require conditioning to achieve appropriate moisture content. This process is typical for soils in the region.

5.2 Expansive Soils

Based on experience in the Riverhead region we anticipate the AS2870 expansive site class for these soils to range from moderate (M) to high (H1/H2). Site specific laboratory testing is typically undertaken following completion of earthworks. This can be addressed with standard foundation solutions, such as deepened edge beams, piles or stiffened rafts.

5.3 Groundwater

Groundwater levels are expected to be high which can cause problems during earthworks, basement excavations, and civil works.

Typical remediation options include subsoil drainage, drains within service trenches and temporary dewatering during construction. Basements may require tanking and could also require anchor piles to resist uplift pressures.

Where basements are proposed which could intercept groundwater, specific groundwater take or diversion consents may be triggered.

5.4 Slope Stability

Due to the gentle gradients across the site and the expectation that minimal earthworks will be required, slope stability is not considered a geotechnical risk to the development.

6 CONCLUSION

On the basis of our desktop study, we consider the subject site is generally suitable for future development, subject to the comments and recommendations above. There are not expected to be any geotechnical limitations to the development of the land for the planned purpose of a retirement village that are unable to be remediated through standard geotechnical means, or that would prevent a consent being granted.

Other residential developments in the area have been completed utilising standard construction processes and foundation solutions as outlined above.

A Geotechnical Investigation Report will be required to quantify the geotechnical hazards to the development and provide remediation options. This will comprise intrusive investigations and specific geotechnical design

and reporting. Investigations should be planned to better define the extent and depth of soft soil and uncertified fill deposits.

7 LIMITATIONS

This report has been prepared for use by our client Matvin Group and their consultants. Liability fo its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

It should be noted that factual data referenced in this report has been obtained from discret locations in the neighbouring properties using normal geotechnical investigation techniques. As such investigation methods by their nature only provide information about a relatively small volume of subsoils there may be spec al conditions pertaining to this site which have not been disclosed by the neighbouring investigations and which have not been taken into account in this report.

8 CLOSURE

We trust this report meets your requirements.

Should you require any further information or clarification regarding the information provided in this report, please do not hesitate to contact the undersigned.

For and on behalf of CMW Geosciences

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Distribution: electronic copy t client via email
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