

## Appendix 4.2

### Site 3: Park Road, Katikati: field logs, stratigraphic description, and site description

#### Criteria suitability

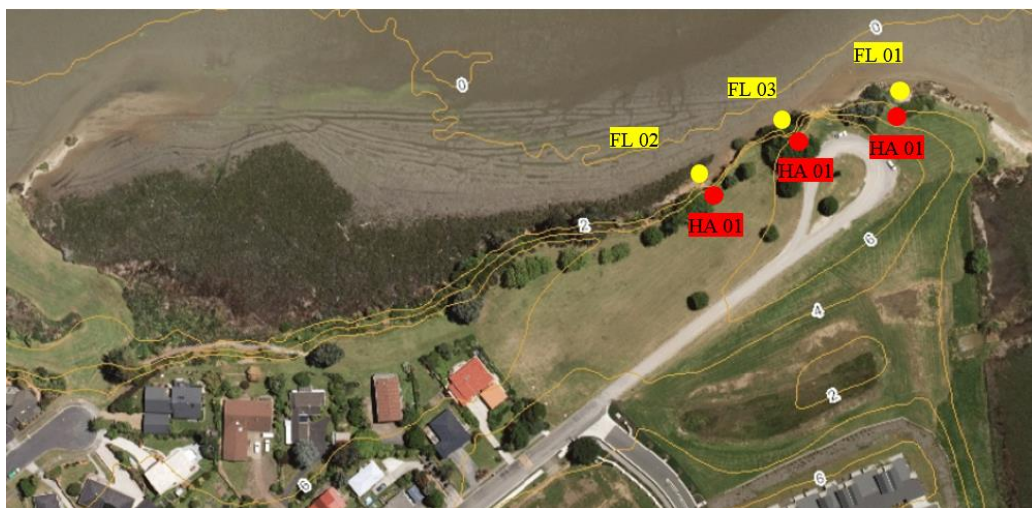
The third site selected was at Park Road Reserve, Katikati (**Figure 1**). This site lacked a landslide however did have a good coastal stratigraphic exposure of Matua Subgroup sediments with sensitive Pahoia Tephra. Useful site information was obtained from geotechnical reports completed by Coffey Geotechnics in 2008 on the adjacent site (Summerset Retirement Village, **Figure 1**). Due to time constraints, this site was not sampled and geomechanical testing was not carried out, however the stratigraphic exposure was still logged.

#### Geomorphologic site description

The coastal escarpment logged is located on public land at Park Road Reserve, Katikati (**Figure 1**). The reserve is located on the northern tip of a gently undulating, low lying (max 8 m high) ENE aligned marine terrace bordering onto the estuarine northern reaches of Tauranga Harbour. The domain itself is gently undulating to flat grassed area, with steep 5 m high coastal cliffs on the northern side, and a more gradual transition to the harbour on the southern side.

#### Stratigraphic observations

Three face logs were completed to capture the stratigraphy (**Figures 2, 3 and 4**). Hand augers immediately adjacent the face logs were drilled to capture the full profile of shear strength (**Figures 2, 3 and 4**) (Appendix 4.2a). The stratigraphy had an apparent gentle dip of approximately 8.5° WSW. Edbrooke (2001) mapped the underlying geology as Matua sediments overlain with recent ashes. 0.3 - 0.5 m of mottled dark brown-orange fill, probably derived from recent farming activities overlies natural sediments. Below this is a series of stiff to very stiff ashes. Determining exactly which ash formations these are would require dating of volcanic glass shards, and is out of the scope for this thesis. Origin of the ash layers was discussed with Professor David Lowe and Associate Professor Roger Briggs, two geologists with very thorough experience in identifying volcanic ash layers in Tauranga. They both agreed that the lower prominent SAND/Silty SAND/Sandy



**Figure 1.** Sensitive material was located at Park Road Reserve, Katikati, adjacent a Coffey Geotechnics project (Summerset Retirement Village). Face logs were logged at positions 1, 2 and 3, and hand auger boreholes were drilled in the adjacent reserve. Photos: WBOPDC: Mapi 2015.

SILT layer around 1 - 2 m was most likely the Rotoehu Ash (c. 50,000 BP) (Froggatt & Lowe, 1990). The Silty CLAY overlying this layer is likely to be derived from the Younger Ashes or Post Rotoehu Ash (<64,000 BP  $\pm$  4,000yrs) (Briggs *et al.* 1996). The ashes correlate well with Coffey geotechnics hand auger boreholes at the adjacent property (**Figure 5**).

Below this are highly variable sediments of the Matua Subgroup. The dark colour and limonite weathering of the low – high plasticity Silty CLAY/CLAY/Clayey

SILT from approximately 2 – 3.5 m indicates that it is probably a paleosol deposited in an environment prone to wetting and drying. Pockets of peat intermixed with sandy layers (Appendix 4.5) in the adjacent retirement village property suggest a low energy, fluvial to estuarine environment. The Silty CLAY/CLAY below this was quite unique in that it had a consistent purple-brown colour. It was also highly weathered as evidenced by heavy limonite staining. A thin (0.05-0.1 m) bright orange band of limonite stained Silty CLAY/CLAY was below the purple-brown layer in HA's 2 and 3. The CLAY below this has probably impeded drainage of limonite rich groundwater flowing through the overlying purple-brown layer, therefore allowing it to pool and precipitate into a concentrated layer. Below the purple-brown layer is a soft, sensitive to extra-sensitive (ranging 6 - 10) CLAY. The soil was very easily broken down by hand-shearing, and released significant water upon remoulding. The contact between the limonite rich-layer and the sensitive material is sharp and changes with height very quickly over short distances, indicating reworking of the overlying soil with the sensitive soil.



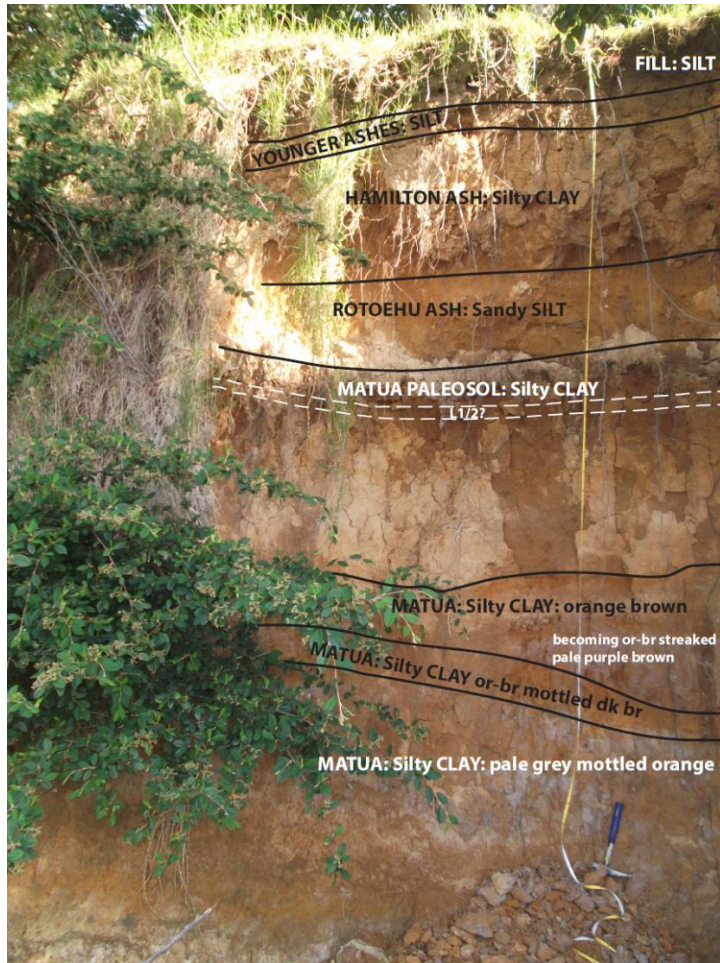


Figure 3. Face log 2 (left) correlated to hand auger 2 (right).

| Graphic log | Depth (m)   | Unit description   | Consistency  | Moisture condition |       | Vane shear (kPa) |
|-------------|---|--|--------------|--------------------|-------|------------------|
|             |   |  |              | Moist              | Stiff |                  |
|             | 0.0 - 0.3   | FILL: SILT: low liquid limit, dark brown, trace fine grained sand, trace rootlets, sensitive.  | dry to moist | very stiff         | stiff | 10               |
|             | 0.3 - 0.4   | 0.3 m: with minor fine grained sand, pale orange mottles   |              | stiff              | 10    |                  |
|             | 0.4 - 0.6   | 0.4 m: becoming pale orange-brown  | dry to moist | very stiff         | stiff | 10               |
|             | 0.6 - 1.0   | YOUNGER ASHES: Sandy SILT: low liquid limit, pale orange-brown, sand is fine grained, trace rootlets, friable, sensitive.  |              | stiff              | 10    |                  |
|             | 1.0 - 1.5   | HAMILTON ASH: Silty CLAY: non-plastic to low plasticity, pale orange-brown, minor rootlets, sensitive.   | dry to moist | very stiff         | stiff | 10               |
|             | 1.5 - 2.0   | ROTOEHU ASH: Sandy SILT: non-plastic, pale orange-brown, sand is fine grained, trace rootlets.   |              | stiff              | 10    |                  |
|             | 2.0 - 2.1   | MATUA PALEOSOL: Clayey SILT: low liquid limit, dark brown, trace fine grained sand, trace fine rootlets.   | moist        | very stiff         | stiff | 10               |
|             | 2.1 - 2.2   | MATUA PALEOSOL: Silty CLAY: low plasticity, dark brown, minor fine rootlets, trace limonite inclusions, sensitive - extra sensitive.                                     |              | stiff              | 10    |                  |
|             | 2.2 - 2.4   | 2.1 m: becoming brown mottled orange-brown, with some limonite staining (L1/L2?)<br>2.2 m: becoming brown, no limonite staining<br>2.4 m: becoming slightly more plastic | moist        | very stiff         | stiff | 10               |
|             | 2.4 - 3.0   | 3.0 m: becoming pale brown   |              | stiff              | 10    |                  |
| 3.0 - 3.5   | MATUA: Silty CLAY: orange brown, streaked pale grey, minor fine rootlets, sensitive - extra sensitive.  | moist  | very stiff   | stiff              | 10    |                  |
| 3.5 - 4.0   | MATUA: Silty CLAY: low plasticity, orange-brown streaked pale purple-brown.   |  | stiff        | 10                 |       |                  |
| 4.0 - 4.5   | MATUA: Silty CLAY: medium plasticity, orange-brown, mottled dark brown, limonite stained, non-sensitive.<br>MATUA: CLAY: high plasticity, pale grey mottled orange, with some limonite inclusions, non-sensitive. | moist  | very stiff   | stiff              | 10    |                  |
| 4.5 - 5.0   |   |  | stiff        | 10                 |       |                  |

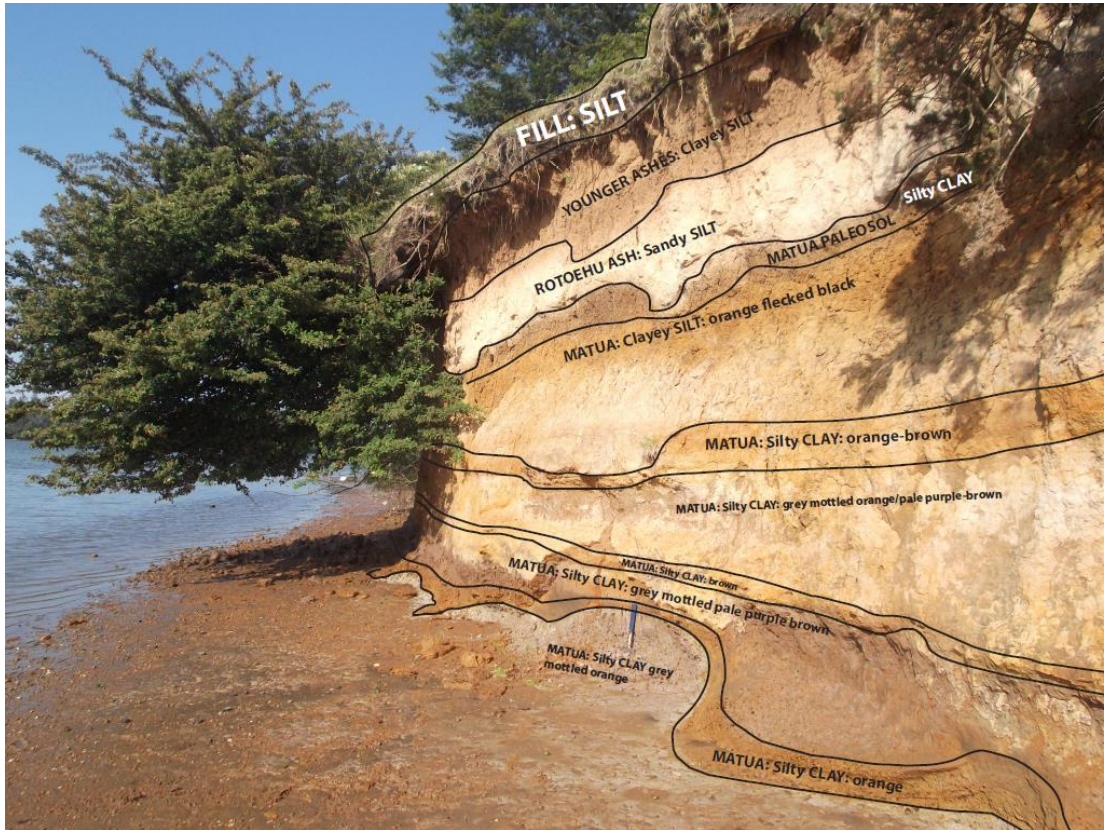


Figure 4. Face log 3 (left) correlated to hand auger 3 (right).

| Graphic log | Depth (m) | Unit description   | Consistency  | Moisture condition | Vane shear (kPa) |    |    |
|-------------|-----------|--|--------------|--------------------|------------------|----|----|
|             |           |  |              |                    | 1                | 2  | 3  |
|             | 0.0 - 0.3 | FILL: SILT: low liquid limit, dark brown, trace fine grained sand, minor rootlets.<br>0.3 m: becoming pale orange-brown  | dry to moist | very stiff         | 10               | 10 | 10 |
|             | 0.3 - 1.0 | YOUNGER ASHES: Clayey SILT: low liquid limit, pale orange-brown, trace fine grained sand, trace fine rootlets, sensitive - extra sensitive.<br>ROTOEHU ASH: Sandy SILT: non-plastic, pale orange brown, sand is fine to medium grained, trace rootlets, sensitive<br>ROTOEHU ASH: Silty SAND: fine grained, pale orange-brown, sensitive.<br>1.2 m: becoming brown | moist        | stiff              | 10               | 10 | 10 |
|             | 1.0 - 1.4 | MATUA PALEOSOL: Silty CLAY: low plasticity, brown, minor fine to medium grained sand, trace rootlets, sensitive.<br>1.4 m: becoming medium plasticity, with trace fine gravel sized organic fragments  |              |                    | 10               | 10 | 10 |
|             | 1.4 - 2.0 | MATUA: CLAY: medium plasticity, brown, trace fine grained sand, sensitive.<br>1.6 m: with trace limonite inclusions and limonite staining  |              |                    | 10               | 10 | 10 |
|             | 2.0 - 2.6 | MATUA: Clayey SILT: low liquid limit, orange flecked black, minor fine grained sand, moderately sensitive.<br>2.6 m: becoming brown mottled pale brown/orange  |              |                    | 10               | 10 | 10 |
|             | 2.6 - 3.0 | MATUA: Silty CLAY: low plasticity, orange-brown, moderately sensitive.   |              |                    | 10               | 10 | 10 |
|             | 3.0 - 3.5 | MATUA: Silty CLAY: low plasticity, grey mottled orange/pale purple-brown, moderately sensitive.<br>3.5 m: becoming medium plasticity   |              |                    | 10               | 10 | 10 |
|             | 3.5 - 4.0 | MATUA: CLAY: high plasticity, brown, non-sensitive.  |              |                    | 10               | 10 | 10 |
|             | 4.0 - 4.5 | MATUA: Silty CLAY: high plasticity, grey mottled orange/pale purple-brown, non-sensitive.  |              |                    | 10               | 10 | 10 |
|             | 4.5 - 5.0 | MATUA: CLAY: high plasticity, orange, limonite stained, non-sensitive.<br>MATUA: CLAY: high plasticity, grey mottled orange, non-sensitive.  |              |                    | 10               | 10 | 10 |

**Engineering Log - Hand Auger**

Client: **SUMMERSET VILLAGE KATIKATI LTD**  
 Principal:  
 Project: **PARK ROAD, KATIKATI**  
 Hand Auger location:

Hand Auger No. **BH 44**  
 Sheet 1 of 1  
 Project No: **GEOTTAUC13752**  
 Date started: **18.12.2007**  
 Date completed: **18.12.2007**  
 Logged by: **GKW**  
 Checked by: **GKW**

| drilling information |       | material substance               |      |                 |   |                          |  |                       |                               |   |  |  |
|----------------------|-------|----------------------------------|------|-----------------|---|--------------------------|--|-----------------------|-------------------------------|---|--|--|
| stratigraphy         | water | notes<br>sample #,<br>tests, etc | R.L. | depth<br>metres | graphic log   | classification<br>symbol | material<br>Soil type, colour, structure, Grading, bedding,<br>plasticity, sensitivity, Secondary and minor<br>components, additional information. | moisture<br>condition | consistency/<br>density index | vane shear<br>(remoulded<br>value)<br>(peak)<br>kPa | Soils Penetrometer<br>blows per 100 mm |  |
|                      |       |                                  |      | 1               | TOPSOIL   |                          | TOPSOIL  | VSt                   |                               |   |  |  |
|                      |       |                                  |      | 1               | FILL, silt, cream black speckled brown streaked light brown, damp with trace fine sand, no plasticity |                          |  | Damp                  |                               |   |  |  |
|                      |       |                                  |      | 1               | TOPSOIL   |                          | TOPSOIL  | St                    |                               |   |  |  |
|                      |       |                                  |      | 1               | SILT, cream black speckled light brown-orange, no plasticity, damp, with trace fine sand              |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 1               | PEAT, dark brown-black, no plasticity, moist  |                          |  | M                     |                               |   |  |  |
|                      |       |                                  |      | 2               | SAND, fine to medium, black speckled light grey, wet  |                          |  | W                     |                               |   |  |  |
|                      |       |                                  |      | 2               | SILT, black speckled orange streaked light brown, wet, no plasticity, with trace fine sand            |                          |  | VSt                   |                               |   |  |  |
|                      |       |                                  |      | 3               | SILT, black streaked blue-grey, saturated, no plasticity  |                          |  | S                     |                               |   |  |  |
|                      |       |                                  |      | 3               | Borehole BH 44 terminated at 3 metres.  |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 4               |   |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 5               |   |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 6               |   |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 7               |   |                          |  |                       |                               |   |  |  |
|                      |       |                                  |      | 8               |   |                          |  |                       |                               |   |  |  |

|  |  |  |  |   |
|--|--|--|--|---|
| classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005 | vane shear (kPa)<br>● remoulded<br>x peak<br>>x peak greater than 200kPa | water<br>▽ 10/150 water level on date shown<br>▽ water inflow<br>▽ water outflow | moisture<br>D dry<br>M moist<br>W wet<br>S saturated | consistency/ density index<br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
|--|--|--|--|---|

**Figure 5:** One hand auger drilled at the adjacent site at Summerset Retirement Village (Coffey Geotechnics).