BEFORE THE HEARING PANEL APPOINTED BY KAIPARA DISTRICT COUNCIL

Under the	Resource Management Act 1991
In the matter	Private Plan Change 85 (Mangawahi East) to the Kaipara District Plan

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EVIDENCE OF CALLUM BERNARD SANDS ON BEHALF OF KAIPARA DISTRICT COUNCIL

Geotechnical

1 December 2025

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1. INTRODUCTION

1.1 My name is Callum Bernard Sands, and I am a Chartered Geotechnical Engineer with Hawthorn Geddes Engineers & Architects Ltd (HGEA), where I serve as a Director and lead geotechnical engineer.

1.2 I hold a Bachelor of Engineering (Honours) in Civil Engineering from the University of Auckland and am a Chartered Professional Engineer (CPEng) and a Chartered Member of Engineering New Zealand (CMEngNZ, Registration No. 1161318).

1.3 I have seven years of experience in geotechnical engineering, specialising in geotechnical site investigations, earthworks monitoring, foundation assessments, ground improvement and slope stability analysis across a wide range of Northland terrain and soil conditions.

1.4 I have been engaged by Kaipara District Council (**Council**) to provide evidence to this Hearing Panel regarding the suitability of the geotechnical assessments associated with proposed Private Plan Change 85 (Mangawhai East) to the Operative Kaipara District Plant (**PPC 85**).

1.5 While I acknowledge that this is not an Environment Court hearing, I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023 and have complied with it in preparing this evidence. I confirm that the issues addressed in this evidence are within my area of expertise and I have not omitted material facts known to me that might alter or detract from my evidence.

1.6 I am authorised to make this statement on behalf of the Council. I understand that this statement will be attached to the report under section 42A of the Resource Management Act 1991 (**RMA**) that is being prepared by Jonathan Clease.

2. SCOPE OF EVIDENCE

2.1 In this evidence, I will:

(a) Assess the suitability of the geotechnical assessments and reporting submitted as part of the plan change, and

(b) Provide recommendations for points that require clarification, as well as areas where further testing and analysis are required.

2.2 In preparing this evidence I have reviewed the following documents (as they relate to geotechnical hazards only:

(a) "Plan Change (Private) - Mangawhai East Development Area" dated July 2025 (**PPC 85**);

(b) The two geotechnical reports attached to the PC 85 s32 report as Appendix 9, namely:

(i) Initia Limited (Initia) – Black Swamp Road, Mangawhai, Geotechnical Assessment Report for a proposed plan Change (**Initia Report**); and

(ii) Wiley Geotechnical Ltd (Wiley) – Geotechnical Investigation for Proposed Plan Change at 18a Black Swamp Road, Mangawhai (**Wiley Report**).

3. SUMMARY

3.1 My evidence evaluates the geotechnical suitability of land proposed for rezoning under PPC85 in Mangawhai East. Two reports were reviewed: the Initia Report that relates to the northern portion of the site, and the Wiley Report that relates to the southern portion. The Initia Report is comprehensive, including cone penetration tests (**CPTs**), test pits, liquefaction modelling, and stratigraphic profiling. It identifies key hazards such as liquefaction, lateral spreading, soft soils, and acid sulphate soils, and recommends TC2 foundation systems and engineered fill.

However, in my opinion, further testing is needed in the uninvestigated western area of the site near the estuary covered by the Initia Report, where ground conditions may differ and pose greater risks before the western area can be confirmed as suitable for rezoning as proposed under PPC85.

3.2 In contrast, in my view, the Wiley Report lacks depth and rigour, relying solely on shallow hand augers and visual inspection, with no CPTs, slope stability modelling, or liquefaction assessment. This falls short of MBIE Module 2 standards for greenfield development and leaves significant gaps in understanding the site's geotechnical risks. Without further investigation, particularly in areas with hummocky terrain, saturated soils, and low elevations, the southern portion of the site, assessed by the Wiley Report, cannot be reliably assessed for rezoning.

3.3 Accordingly, based on the level of information currently provided, I am unable to confirm whether the western and southern portions of the site are suitable for re-zoning as proposed under PPC85 without additional testing, analysis, and reporting to address these critical uncertainties.

4. PPC85 Geotechnical Review

4.1 A preliminary assessment of the adequacy of the geotechnical assessments provided in Appendix 9 of the PPC85 application is presented below. These assessments evaluate the suitability of the land encompassed within the PPC85 area to accommodate the proposed development intensity, which includes provision for approximately 788 residential lots and 201 non-residential Household Unit Equivalents (HUEs), as defined in the Water Acumen memorandum (Appendix B of Appendix 10 – Infrastructure Report).

4.2 My review focuses on the technical content of the geotechnical reporting and its appropriateness in informing the suitability of the site(s) for urban development. Specifically, it considers whether the investigations and recommendations and conclusions are sufficient to support rezoning from rural to a mix of residential (large lot, low density, medium density), commercial, and rural lifestyle zones, as proposed in the PPC85 Structure Plan.

4.3 This review has been split into two parts, firstly reviewing the reporting undertaken in the Initia Report, for the northern portion of the PPC85 site (**northern area**). This is followed by a review of the Wiley Report for the southern portion of the PPC85 site. These two areas are divided by Black Swamp Road, with the Initia Report covering that area of the PPC85 site on the northern side, and the Wiley Report covering the area south of Black Swamp Road (**southern area**). A map of the PPC85 site identifying these areas is **attached** to my evidence as **Attachment 1**.

4.4 A comparison of the Initia Report and Wiley Report is presented herein, to emphasise the difference in geotechnical hazard reporting and risk assessment provided as part of the plan change.

5. INITIA REPORT REVIEW

Report Review Outline

5.1 The Initia Report presents a detailed geotechnical investigation of the northern area, commissioned by SAM Property Ltd. Initia conducted two rounds of fieldwork in June 2022 and February 2024, comprising a total of 34 test pits and 30 CPTs. These investigations were used to develop and present a well-defined geological model and cross-sections illustrating the site's stratigraphy. Testing was undertaken at an intensity of approximately 3.1 CPTs per hectare of site tested, which is in compliance with the recommendations set out in Table 2.1 of MBIE Earthquake technical engineering practice Module 2: Geotechnical investigations for earthquake engineering (**MBIE Module 2**). It is noted that no testing was undertaken in the western portion of the proposed low-density residential zone, north of Black Swamp Road (**western area**).

5.2 The Initia Report identifies and provides a preliminary assessment of several potential geotechnical hazards relevant to future development and the proposed plan change. These include: liquefaction, lateral spreading, soft soils (settlement), and acid sulphate soils.

5.3 Liquefaction risk is assessed in alignment with the recommendations set out in the operative MBIE Earthquake geotechnical engineering practice Guidelines. Liquefaction was considered negligible under serviceability and intermediate seismic events, but moderate to high under ultimate limit state conditions. Lateral spreading is reported as low risk due to the flat terrain in areas tested/assessed, although proximity to the estuary may warrant further assessment or mitigation. The upper 0.2 to 1.2m, comprising soft organic sandy silt and fibrous peat layer (**soft soils**) is flagged as susceptible to cyclic softening, and its removal and replacement with engineered fill is recommended.

5.4 Acid sulphate soils are briefly noted as a potential risk due to the site's low elevation and organic content, though no formal screening or laboratory testing was undertaken. Reporting does not provide likely classification of works in accordance with the KDC Acid Sulphate Soil Planning Policy Basic Guide.

5.5 The site is classified as Subsoil Class D – Deep Soil, in accordance with NZS1170.5:2004 Structural Design Actions Part 5: Earthquake actions – New Zealand (**NZS1170.5**). Design parameters for seismic loading were developed in accordance with MBIE Earthquake geotechnical engineering practice Module 1: Overview of the guidance (**MBIE Module 1**) and the NZTA Bridge Manual 3rd Edition, 3rd Amendment.

5.6 Liquefaction assessments were carried out using the CLiq software and the Boulanger & Idriss (2014) method, with results indicating vertical settlements of up to 200 mm. This is considered to be industry best practice, and appropriate given the site's soil conditions. This approach is also in alignment with the recommendations set out in the MBIE Earthquake geotechnical engineering practice Module 3: Identification, assessment, and mitigation of liquefaction hazards (**MBIE Module 3).**

5.7 Earthworks recommendations include full excavation of the underlying soft soils across all development platforms and infrastructure zones, with replacement by compacted engineered fill. Specifications reference NZS 4431:1989 and NZS 4404:2010, and include appropriate compaction criteria for both cohesive and

granular materials. TC2 foundation systems are recommended for residential structures, with a design to accommodate vertical movement. Based on the subsoil testing, and logs prepared by Initia, this is considered to be an appropriate conclusion. The provisions set out in the General Standards Dev X G-S2 (1)(b), is considered adequate, and specific conditions to address the Initia Report conclusions not necessary.

5.8 TC2 foundations, as outlined in the MBIE's Canterbury Residential Technical Guidance, are designed for land with a moderate risk of liquefaction, where earthquake shaking can cause the ground to temporarily lose strength and behave like a liquid. To reduce the risk of structural damage, MBIE recommends foundation systems that either improve the ground (like gravel rafts or soil densification) or use stronger foundation types such as reinforced concrete slabs or timber floors on deeper piles. These solutions aim to spread building loads more effectively and maintain stability even if the soil shifts

5.9 Pavement design assumes a subgrade CBR of 4%, with proof rolling and subgrade.

Additional Consideration & Recommendations

5.10 While the Initia report provides a sound geotechnical basis for the proposed rezoning of land in the northern area, there are two areas where further investigation and clarification are warranted:

5.11 The Initia report recommends a TC2 foundation system for residential structures across the northern portion of the PPC85 site, this recommendation may not be universally appropriate, given the site's proximity to the Mangawhai estuary. The western extent of the PPC85 area lies closer to the estuarine margin and is outside the area of testing undertaken by Initia. This area is likely underlain by similar geological units but may exhibit lower-strength sediments, elevated groundwater levels, and increased susceptibility to liquefaction and lateral spreading. These conditions suggest that a more robust ground improvement approach, may be warranted in these zones. To confirm this, further CPT testing should be undertaken in the western area to validate the subsoil profile and enable a

preliminary lateral spread and liquefaction assessment. This would ensure that the foundation design is appropriately matched to the site's geotechnical risk profile and that future development is resilient to seismic hazards.

5.12 Secondly, the report briefly acknowledges the potential presence of acid sulphate soils (ASS), particularly within the soft soils. Given the site's low elevation (less than 5.0 m One Tree Point Datum OTPD) and the likelihood that earthworks will extend below the groundwater table (removal of the soft soils), the disturbance of potentially acidic soils is a credible risk. In accordance with best practice, such as the Queensland Acid Sulphate Soil Management Guidelines, a preliminary screening of ASS should be undertaken to determine the presence and extent of ASS. If confirmed, an Acid Sulphate Soil Management Plan would be required to mitigate environmental risks and infrastructure corrosion, particularly for buried concrete infrastructure (council vested).

Final Remarks

5.13 Overall, the Initia report provides a technically sound and site-specific assessment that is appropriate to inform the PPC85 rezoning decision. It identifies key geotechnical risks and proposes reasonable mitigation strategies. Additional CPTs are recommended in areas near to the estuary in the western area, outside where Initia have already tested.

5.14 Further comment on the soil acid sulphate risk, and the impact this may have on future private and council-owned infrastructure should be provided. Soil screening in alignment with the Queensland Acid Sulphate Soil Management Guidelines may be warranted. Definition of the risk in accordance with the Acid Sulphate Soil Planning Policy Basic Guide should be provided to better understand the likely implications to buried infrastructure, and the impacts to the environment.

6. WILEY REPORT REVIEW

Report Review Outline

6.1 Wiley Geotechnical Limited (WGL) was engaged to undertake a preliminary geotechnical investigation to support the PPC85 rezoning application for land at 18A Black Swamp Road, Mangawhai. The investigation comprised 23 hand augers to a maximum depths of up to 3.0 m, with accompanying hard held shear vane and scala penetrometer testing. No CPTs, boreholes, excavator test pits, or soil laboratory testing were undertaken. The investigation was limited to shallow subsurface exploration and visual site inspection only.

6.2 The site was observed to contain moderately sloping terrain, overland flow paths, and several farm ponds. A geological boundary was identified across the site, with lower elevations underlain by Tauranga Group alluvium and higher elevations by Pakiri Formation sedimentary rocks. The subsurface profile was divided into two zones based on elevation; below a reduced level (RL) of 4.0 m, soils consisted of sandy topsoil overlying silty sand and clean sand, and above RL 4.0 m, where the profile transitioned to friable tephra and clayey silt. Groundwater was encountered between 0.8 m and 2.8 m depth. It is noted that the low-lying land, underlain by the Tauranga Group alluvium below RL4.0 m, is proposed to be zoned medium-density residential.

6.3 The report provides some commentary on several geotechnical hazards, including expansive soils (Class A to Class M per AS2870), non-engineered fill around farm infrastructure and pond margins, liquefaction, settlement and slope instability.

6.4 Expansive soils are types of clay-rich soils that shrink when dry and swell when wet, causing significant ground movement. This expansion and contraction can lead to cracking, uneven settlement, and structural damage to buildings if not properly accounted for. In Australia, the AS 2870 standard (Residential Slabs and Footings) provides a framework for identifying and managing these soils through site classification, which helps engineers design appropriate foundations.

6.5 Hummocky terrain and terracing were observed in elevated areas. WGL concluded that no deep-seated movement was evident, though this was based solely on visual inspection. No numerical slope stability modelling was undertaken, nor was any deep investigation carried out to confirm geological continuity or identify potential weak planes within the underlying soils and rock horizons. Slope instability is defined within the WGL report as "not considered a major risk"; however, given the scope of the reporting supplied with the plan change application, it appears this statement was made in the absence of any quantitative analysis.

6.6 No liquefaction or lateral spread assessment was undertaken, despite the presence of saturated sandy soils in low-lying areas. No commentary, or assessment of acid sulphate soils was provided, despite the site's low elevation and organic-rich sediments.

6.7 Recommendations for pavement design or stormwater disposal limitations were also not included within the WGL reporting.

6.8 The recommendations relating to earthworks are not considered to be complete, with no measurable/quantifiable limitations given. It is recommended by WGL that no soil be placed over the site, unless done so in a controlled manner as not to cause slope stability issues; however, it is not clear what parts of the site this applies to. The recommendations appear to apply to fill less than 600mm thick, which, given the slope angles and the likelihood of development in the area, is highly likely.

Additional Considerations & Recommendations

6.9 WGL's conclusions are based on shallow hand augers and qualitative observations only; key limitations identified within their reporting include:

(a) No liquefaction or lateral spread assessment, despite the presence of saturated sandy soils in low-lying areas.

(b) Use of handheld shear vanes in silty sands which is not considered reliable for strength determination.

(c) No slope stability modelling, despite evidence of hummocky ground and overland flow paths.

(d) No assessment of acid sulphate soils, despite low elevations.

(e) No recommendations for pavement design, including CBR values or undercutting criteria.

(f) No recommendations or restrictions on earthworks, such as setbacks from farm drains, steeper slopes, or loading limitations.

(g) No commentary on stormwater disposal limitations, despite the presence of ponds and flow paths.

6.10 The WGL investigation does not meet the MBIE Module 2 minimum expectations for greenfield urban development. MBIE Module 2 recommends a minimum of 1 deep subsoil test (such as CPTs) per 4 hectares, where the site area is in excess of 10 hectares; WGL's undertook none.

6.11 There is a portion of elevated terrain, identified in WGL's Figure 4, that was assessed as part of a previous subsoil investigation and reporting (Refence 22112_Rev1, dated November 2023). This assessment report and associated subsoil data are not summarised or attached to the submitted PPC85 WGL report, Appendix 9. This area is of particular interest due to its steep slopes and evidence of hummocky ground, which may indicate deeper-seated movement and sensitivity to increased loading (ie earthworks). No numerical analysis or deep investigation is evident to define the continuity and strength of the underlying strata, nor to justify the provided limitation on earthworks. From the PPC85 Structural Plan, this area is proposed to be zoned low-density residential to large lot residential.

6.12 Given the proposed low-density residential zoning over these slopes, earthworks to form individual residential sites will likely require cut-to-fill and retaining. Some analysis to determine the limitations on cut/fill and retaining would be expected to

ensure slope stability is maintained under both normal and elevated groundwater conditions, and seismic loading in alignment with current best practice.

Final Remarks

6.13 Overall, in my opinion, the Wiley's report is considered to be incomplete. There is missing data for a large portion of the PP85 site, which is considered imperative to informing KDC on the appropriateness of that land for the proposed rezoning.

6.14 Furthermore, the geotechnical engineering advice in the Wiley reporting is limited with no quantitative (numerical) analysis having been undertaken for the identified Geotechnical hazards.

6.15 It may be that the November 2023 report, as referenced in the May 2024 report, Paragraph 1, will provide clarity/justification on the recommendations and considerations provided; however, in the absence of this information and reporting, there is insufficient evidence to support the engineering conclusions, as identified in paragraph 6.3, namely those relating to slope stability, earthworks, and land suitability for provided for slope stability, and site suitability for the proposed plan change.

(a) It is noted that the Wiley Report states that:

(i) *The site is generally suitable for the proposed subdivision development, subject to further geotechnical investigations to develop more detailed geological models and provide engineering design recommendations to support subdivision of the site. – Page 6 / 7.*

(b) The above statement does not align with the intent of the report, however, is likely written in error. Revision of the report to correct this mistake is suggested.

7. COMPARISON OF INITIA REPORT & WILEY REPORT

7.1 The Initia and Wiley reports present markedly different levels of geotechnical investigation and analysis, which is important to acknowledge when considering the overall suitability of the PPC85 site for rezoning and future development.

7.2 Initia's report for the northern portion of the site is comprehensive and technically robust. It includes two rounds of fieldwork with 30 cone penetration tests (CPTs) and 34 test pits, supported by a geological model, cross-sections, and liquefaction and lateral spread assessments. Initia also provides seismic classification, settlement estimates, and foundation recommendations aligned with MBIE Module 1 through Module 3. Their work meets MBIE's minimum expectations for plan change-level assessment, although additional CPTs are recommended in low-density and estuarine-adjacent areas where no testing has been undertaken to date.

7.3 The MBIE Modules 1 through 3 are part of New Zealand's official geotechnical guidelines that help ensure buildings are safe during earthquakes, especially when planning new developments or changes to land use. Module 1 gives an overview of earthquake-related ground risks and explains how these fit into the building rules, it is essentially a big-picture guide for understanding seismic hazards. Module 2 focuses on how to properly investigate the ground before building, making sure engineers gather the right soil and site data to design safe foundations. Module 3 deals specifically with liquefaction, when the ground turns soft and unstable during shaking, and provides advice on how to identify, assess, and reduce this risk. Together, these modules are highly relevant to any proposed plan change because they help councils and developers make informed decisions about land suitability, foundation design, and long-term resilience of buildings.

7.4 In contrast, Wiley's report for the southern portion of the site is limited in scope. It relies solely on 23 shallow hand augers, with no CPTs, boreholes, excavator test pits, or laboratory testing. No geological model or stratigraphic cross-sections are presented. The report does not include liquefaction or lateral spread analysis, despite the presence of saturated sandy soils in low-lying areas. There is also no

numerical slope stability modelling, even though hummocky terrain and terracing are observed in elevated zones proposed for low-density residential development. Acid sulphate soils are not assessed, despite the site's low elevation and organic content. Stormwater disposal limitations are also not addressed, which is a concern given the presence of ponds and overland flow paths.

7.5 It is expected that some high-level analysis be undertaken for a plan change, as this provides a preliminary understanding of the site sensitivity to changes to land form, such as limitations of excavation, fill and water conveyance, which directly impact the suitable density of development over that land. In the context of PC85, and the southern portion of the site, a preliminary assessment of slope stability would be expected.

7.6 Some of the conclusions drawn by Initia, particularly regarding liquefaction susceptibility, cyclic softening, and TC2 ground improvement, may be relevant to the southern area, especially in zones underlain by silty sands (as shown in Wiley's Figure 5). However, without CPT data or deeper testing, this cannot be confirmed. Further investigation is required to validate whether TC2 foundations are appropriate or if TC3-level ground improvement is warranted.

7.7 Overall, the Initia report provides a reliable basis for rezoning decisions and future design (apart from in relation to the western area), while the Wiley report is more indicative of a desktop-level review. The disparity in engineering analysis between the two reports is significant. To confirm the geotechnical suitability of the land for the rezoning proposed under PPC85 further investigation, or supplement of the Wiley report Reference 22112_Rev1, dated November 2023 is required across the southern area to confirm ground conditions, assess geotechnical hazards, and support future development.

8. CONCLUSIONS

8.1 Based on the level of information currently provided, I am unable to confirm whether the western and southern portions of the site are suitable for re-zoning as

proposed under PPC85 without additional testing, analysis, and reporting to address these critical uncertainties.

8.2 In particular, further geotechnical work is required to confirm the geotechnical suitability of the land for the rezoning proposed under the proposed plan change and ensure the land is suitable for the intended future development. While the Initia Report for the northern area is comprehensive, additional testing is needed in uninvestigated zones of the western area.

8.3 The Wiley Report for the southern area is considered to be incomplete, with insufficient evidence to support the engineering conclusions made, nor to support the proposed plan change.

8.4 The following are matters that shall be addressed prior to any rezoning/plan change:

(a) The referenced and missing, Wiley's report "Reference 22112_Rev1, dated November 2023" should be provided to confirm whether any quantitative slope stability analysis or deep subsoil testing was undertaken. Without this, the current Wiley report cannot be relied upon for rezoning decisions in the southern portion of the site.

(b) If 8.3(a) above is not satisfied then:

(i) Undertake deep subsoil testing, at a frequency compliant with MBIE Module 2 recommendations over the southern area; and

(ii) A detailed slope stability assessment should be undertaken for the southern area, particularly in zones of hummocky terrain and proposed low-density residential development. This should include numerical modelling under static and seismic conditions and provide clear limitations on cut/fill operations and retaining wall design.

(c) Undertake additional deep subsoil testing, at a frequency aligned with the MBIE Module 2 recommendations over the western area, and the

medium density residential zone in the southern area, to confirm subsoil conditions to depth, i.e. 1 CPT per 4 HA. Confirmation that the conclusions and recommendations made in the Initia Report relating to liquefaction, settlement and lateral spreading apply to this area of the site should be provided.

(d) Commentary on the acid sulphate soil risk for those low-lying areas of the site. Reporting engineer(s) shall provide some high-level comments, outlining any earthworks restrictions or producing a map indicating potential risk areas across the PPC85 site.

8.5 It is expected that, as part of subdivision works, that:

(a) Screening and laboratory testing for acid sulphate soils should be carried out, in general accordance with Queensland Acid Sulphate Soil Management Guidelines, defining any development earthworks risks in terms of the KDC Acid Sulphate Soil Planning Policy Basic Guide.

(b) If acid sulphate soils are confirmed, an Acid Sulphate Soil Management Plan shall be required to mitigate environmental risks and protect buried infrastructure.

Callum Bernard Sands

1 December 2025

Attachment 1: Map of the PPC85 site