



## Determination 2013/006

### Regarding the issue of a code compliance certificate for a house and timber retaining wall at 16 Highland Drive, Richmond



#### 1. The matter to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004<sup>1</sup> (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, Ministry of Business, Innovation and Employment (“the Ministry”)<sup>2</sup>, for and on behalf of the Chief Executive of the Ministry.
- 1.2 In terms of section 176 of the Act the parties to the determination are the owner of the property, the P & E A Williams Family Trust (“the applicant”), and Tasman District Council (“the authority”) carrying out its duties as a territorial authority or building consent authority.
- 1.3 I consider that the following are persons with an interest in this determination:
  - The contractor who completed the works (“the contractor”).
  - The consulting engineers (“the engineer”) who carried out the geotechnical investigations for the retaining wall and who designed the retaining wall.

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<sup>1</sup> The Building Act, Building Code, Compliance documents, past determinations and guidance documents issued by the Ministry are all available at [www.dbh.govt.nz](http://www.dbh.govt.nz) or by contacting the Ministry on 0800 242 243.

<sup>2</sup> After the application was made, and before the determination was completed, the Department of Building and Housing was transitioned into the Ministry of Business, Innovation and Employment. The term “the Ministry” is used for both.

1.4 This determination arises from the applicant's view that a code compliance certificate for a house and timber retaining wall had been issued incorrectly, despite the authority having received a producer statement (PS4) for the review of the construction of the retaining wall from the engineer, as the retaining wall had been built at a level higher than that detailed in the consent documents. The applicant was also of the view that the retaining wall and the associated shear key did not comply with Clause B1 Structure.

1.5 The matters to be determined<sup>3</sup> are therefore

- whether the timber retaining wall ("the wall") as constructed complies with Building Code Clause B1 Structure<sup>4</sup>
- whether the code compliance certificate was correctly issued in accordance with section 94(1)(a), in that the completed work had been built in accordance the approved building consent.

## 1.6 Matters outside this determination

1.6.1 Following a hearing on 3 May 2011, the applicant's legal adviser provided a submission outlining the matters on which the applicant requested a determination (refer paragraph 4.5.5).

1.6.2 I note that actions of the authority, other than those defined under section 177 of the Act, are outside my jurisdiction in respect of the matters I can determine. The matter to be determined therefore is limited to that as described in paragraph 1.5.

1.7 In making my decision, I have considered the submissions of the parties, the report from the expert commissioned by the Ministry to advise on the matter ("the expert"), a report from a firm of consulting engineers ("the peer reviewer(s)") who produced peer review advice on the design of the retaining wall, and the other evidence in this matter.

## 2. The building work

2.1 The single storey house is built on a gently sloping hill site with a northerly aspect. The house has been constructed with a concrete block and poured concrete foundation and floor slab, and a light timber framed structure with brick veneer cladding.

2.2 The development of the subdivision and site was subject to specific investigation and design by the engineer. The engineer prepared a technical report for the subdivision that required (amongst other things) specific investigation and design be undertaken for any further development of the land, and new retaining walls to be designed to resist significant lateral earth pressures associated with the overall stability for the land.

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<sup>3</sup> Under sections 177(1)(a), 177(1)(b) and 177(2)(d) of the Act

<sup>4</sup> In this determination, unless otherwise stated, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code (the First Schedule to the Building Regulations 1992).

2.3 In order to accommodate the house design and the chosen siting, a retaining wall to the rear (southern side) of the section extending around to the eastern boundaries was required. A timber pole retaining wall was designed by the engineer using site-specific geotechnical data, including that obtained from a test pit excavation. The geotechnical assessment from the engineer states that:

‘... the entire length of the timber pole wall behind the property will have to be designed to resist the soil loading from a potential failure block above the property. This is greater than normal active or at rest pressures. This wall should be designed for a load of 50kN/m width to be applied at 1/3 retained height. If the height of the cut is reduced then the loads on the retaining wall would also reduce.’

2.4 Figures 1 and 2 show the retaining wall in relation to the house as described in the approved consent documents.

2.5 The retaining wall consists of 250mm SED<sup>5</sup> treated timber posts at 1.2m centres, with 150x75 horizontal timber walings behind. A shear key is installed immediately behind the retaining wall designed to intersect one or more potential sliding failure planes that are located in the ground behind the wall. A section through the retaining wall as constructed was provided to the authority, and was appended to the PS4.

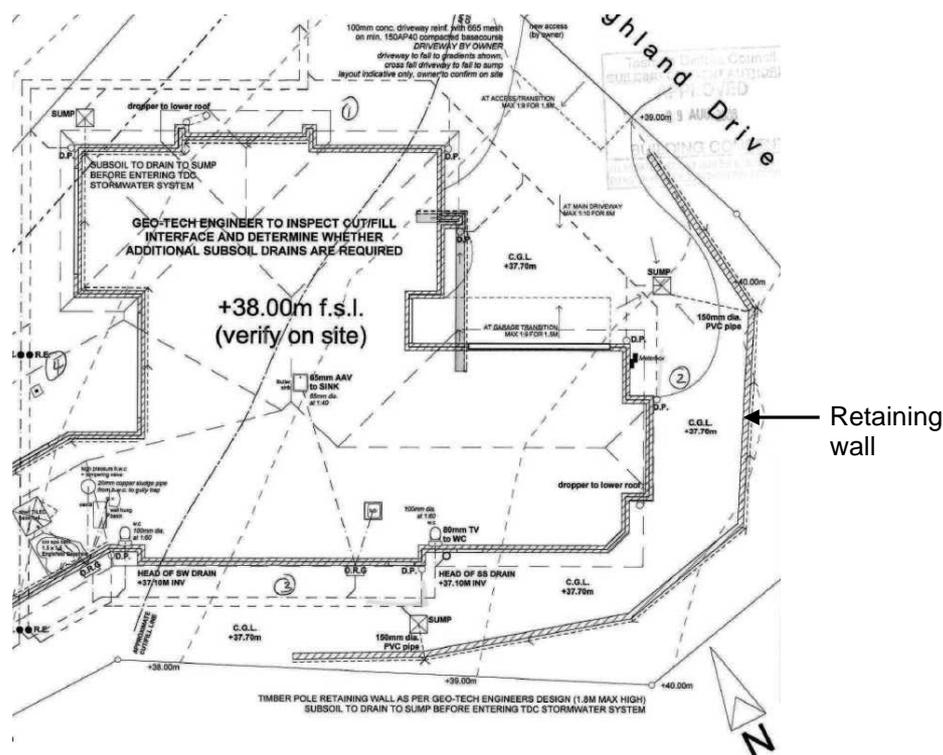
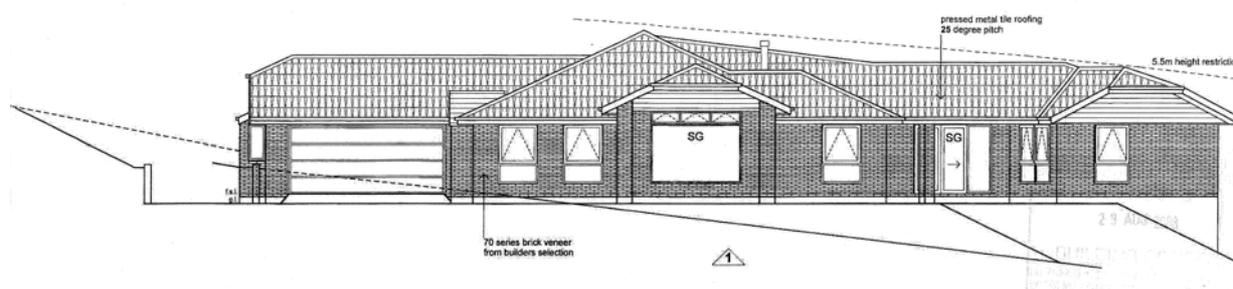


Figure 1: Part-plan of the house and retaining wall as consented

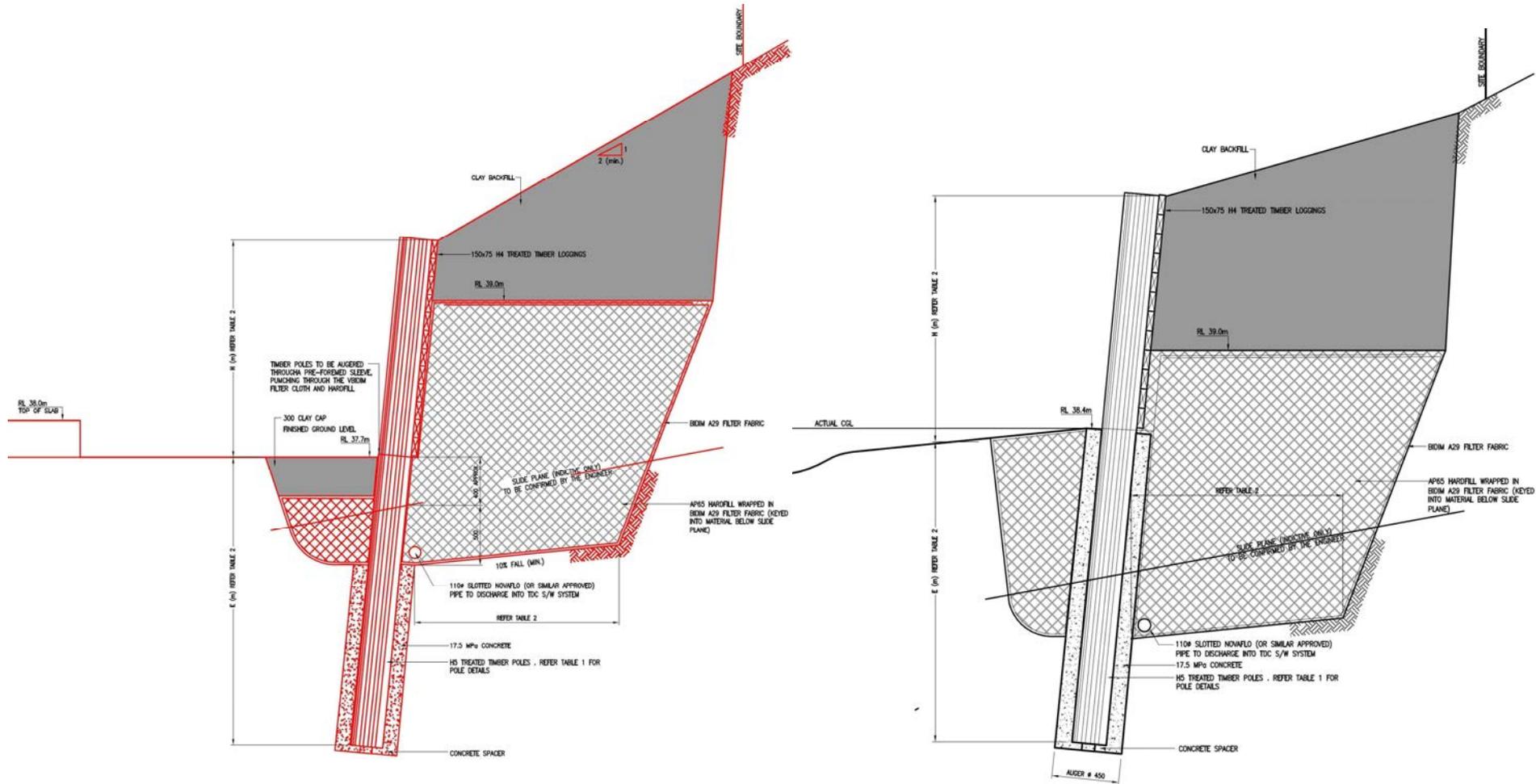
<sup>5</sup> Small end diameter



**Figure 2: Northeast elevation as consented (retaining wall at far left)**

### 3. The background

- 3.1 The applicant purchased the property as a vacant section with the intention of constructing a residential dwelling.
- 3.2 On the 11 July 2008 the engineer issued a Producer Statement PS1 Design for the retaining wall.
- 3.3 On 29 August 2008 the authority issued a building consent (BC 080870) under the Act, which included construction of the retaining wall and associated site work. The dwelling was subsequently built by the contractor and was substantially completed by August 2009.
- 3.4 The site works and retaining wall were carried out during September and October 2008. The construction process of both the foundations and the retaining wall was supervised and inspected by the engineer, with each inspection stage documented. As a result of a surveying error, the retaining wall was constructed approximately 700mm to 1000mm higher than designed relative to the survey datum (refer paragraph 6.4).
- 3.5 After the retaining wall was constructed, the ground in front of the wall had to be lowered to form the cleared ground platform for the construction of the house. Issues then arose during the construction of the house over the relative height of the house floor to the correct datum point.
- 3.6 Following consultation between the subdivision developer and contractor, a revised foundation height was agreed and the engineer was asked to comment on the lowering the ground in front of the wall by 200mm. At that stage the relative levels (“RLs”) for the wall were already at variance with those in the consented plans.
- 3.7 The as-built floor slab is, as a consequence, some 140 to 220mm higher than was originally consented (the various surveys undertaken give a range in the RL for the finished floor level).



Retaining wall section (as designed)

Retaining wall section (as-built)<sup>6</sup>

Figure 3: Sections through the wall, as designed and as-built, taken from the engineer's drawing as received by the authority

<sup>6</sup> This is considered correct with respect to the exposed profile; the elements of the wall not exposed to view have not been independently verified

- 3.8 A Producer Statement - PS4 - Construction Review (“PS4”) was issued by the engineer in respect of the ‘timber pole retaining wall’ on 18 August 2009. The PS4 verifies construction monitoring to level ‘CM3’<sup>7</sup> was undertaken.
- 3.9 Following completion of the building work, the applicant commissioned a building inspection company to report on the construction of the dwelling and associated works. The report, dated 28 August 2009, raised questions over the construction of the retaining wall and its finished height. The applicant also commissioned a survey, dated 27 August 2009, to determine the RL of the finished floor of the house (38.10m), and to provide an RL to a peg that was placed at the base of the retaining wall (38.40m).
- 3.10 On 31 August 2009 the authority issued a code compliance certificate for the building work completed under the building consent BC 080870.
- 3.11 At some time around October 2009, the engineer provided a design for additional retaining walls to support the ground immediately in front of the retaining wall. The design of the additional walls was not to provide additional structural stability to the retaining wall but to support the ground under and adjacent the horizontal timber walings to enable the ground in front of the wall to be lowered to provide for paving and drainage to the house. The engineer then reassessed the retaining wall, taking into account that the wall had been built at a higher level than designed, and confirmed that the structural stability of the wall as-built complied with Clause B1.
- 3.12 The Ministry received an application for determination on 23 November 2010.

#### **4. The submissions and the preliminary hearing**

- 4.1 The applicant sought a determination as to whether the retaining wall was code-compliant; and in particular whether it had been constructed in accordance with the approved design as included in the plans and specifications, and whether the shear plane identified in the test pit geotechnical data had been taken into consideration in the construction of the retaining wall.
- 4.2 Along with a covering letter describing the background to the matter, the applicant provided copies of the following relevant documents:
- The engineer’s Producer Statement - PS4 - Construction Review, dated 18 August 2009, which had attached to it:
    - completion of geotechnical services dated 25 August 2009
    - geotechnical inspection schedule dated 31 August 2009
    - an ‘as-built issue’ plan showing two sections through the retaining wall, dated 25 August 2009
    - consented ‘Site layout plan, timber retaining wall’ stamped ‘Approved’, 29 August 2008

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<sup>7</sup> Refer ‘Guideline on the Briefing & Engagement for Consulting Engineering Services, January 2004, Appendix 4’. Level CM3 monitoring includes ‘Review ... *random samples* of important work procedures, for compliance with the requirements of the plans and specifications and review important completed work prior to enclosure or on completion as appropriate. Be available to advise the constructor on the technical interpretation of the plans and specifications.’

- Also from the engineer:
  - excavation log dated 20 May 2008
  - ‘Geotechnical Assessment’ dated 9 June 2008
  - ‘Toe wall detail’ drawing dated 6 October 2009
- the building inspection company’s report dated 28 August 2009
- the surveyor’s findings for the as-built level of the house pad
- photographs of the retaining wall
- code compliance certificate, dated 31 August 2009.

4.3 The engineer did not make a direct submission to the application for determination, but in correspondence dated 17 December 2010, the engineer stated:

We have reviewed the stability of the as-built retaining wall. This has been completed using finite element stability modelling of slope, shear key and retaining wall as an integrated solution.

We conclude that the wall and slope (in current profile) is unlikely to be subject to deformation or instability within the design life of the wall or residential dwelling. There is no significant risk to the adjoining buildings.

The critical (or most likely) failure mechanism is a shear failure combined with rotation of the poles as shown in the attached figure.

While the current wall configuration does meet the requirements of the Building Code we still recommend the remedial works are undertaken.

4.4 In a letter to the Ministry dated 28 January 2011 the authority acknowledged the application and stated it had

... acted in accordance with our Building Consent Authority process and the requirements of procedure T-07-1: Producer Statements - Inspection were met. Staff were satisfied that reasonable grounds existed to accept the producer statement from the engineer and accordingly the Code Compliance Certificate (CCC) was issued.

The authority also provided relevant documentation on the construction of the retaining wall from its files.

## **4.5 The preliminary hearing**

4.5.1 The applicant requested a hearing in order to present particular documents. Whilst a hearing is normally held after a draft determination is issued for comment, I considered in this instance a hearing would be of more value in advance.

4.5.2 The hearing was held on 3 May 2011 before me. In attendance were the applicant and the applicant’s legal adviser, the contractor, the engineer, and two officers of the Ministry. The authority declined the invitation to attend.

4.5.3 As part of the hearing a site visit was undertaken. At the conclusion of the hearing the applicant sought the opportunity to provide clarification of the matter they were seeking determination on by way of a letter from their legal adviser (refer paragraph 4.5.5).

- 4.5.4 In a letter to the Ministry dated 10 May 2011 the applicant provided six photographs ‘to confirm what was seen during the visit’ that was carried out as part of the preliminary hearing.
- 4.5.5 In a letter to the Ministry dated 13 May 2011 the applicant’s legal adviser outlined the matters for determination in the applicant’s opinion as (in summary):
- whether the as-built retaining wall complies in all respects ‘with the minimum standards imposed’ by the Building Code
  - whether the authority had ‘reasonable grounds’ to satisfy itself that the building work complied with the building consent, particularly
    - considering that the authority failed or neglected to make its own enquiries beyond the PS4 issued by the engineer
    - where the ‘as-built’ retaining wall substantially differed from the design and height specifications it had permitted, and, was inconsistent with the PS4 issued by the engineer
  - whether there is a land stability issue should an earthquake or other disaster occur if, as it appears, the retaining wall, shear key and drains have been constructed at considerably higher levels than that documented on the PS4
  - why the authority issued a code compliance certificate when the house and retaining wall were built outside their design specifications (primarily in relation to height and depth).
- 4.5.6 I have considered the legal adviser’s submission to the extent of the matters I can determine in paragraph 1.6.
- 4.5.7 On 24 May 2011 the authority provided a further submission to the Ministry by email, noting:
- ... it is [the authority’s] opinion that the project is well documented with adequate site notes, approvals etc on file for all non specific design elements as per standard practice. [The authority] also believe[s] that issues of dispute that arose during construction are in relation to engineers specific design elements e.g. floor slab and retaining wall. [The authority is] of the opinion that those issues were satisfactorily resolved between the engineer and builder and professional certificates (PS4) attesting to compliance were issued and accepted by [the authority] as is standard practice. As-built plans and certificates are also on file ...
- 4.5.8 On 8 June 2011 the contractor provided a submission by email to the Ministry. The contractor noted that changes are often made onsite subsequent to works commencing due to the ground conditions encountered, and even a test pit prior is ‘only a snap shot of the total eventual ground conditions.’ The contractor acknowledged the difference in height as shown on the plan to that which the retaining wall and house was-built.

## **5. The first draft determination**

- 5.1.1 The first draft determination was issued to the parties on 20 June 2011 and comments were duly received. However, the applicant brought into question the validity of the process used by an expert (“the first expert”) engaged by the Ministry. The Ministry

does not accept the matters raised of process by the applicant are necessarily correct, but (as noted in paragraph 5.1.2 below) in the interests of natural justice I responded to the concerns raised by the applicant.

- 5.1.2 The acceptance by the parties of the basis on which evidence has been gathered by an expert is essential, as that evidence is used to assist me in making a decision. Given the significance of the matters raised by the applicant to the first expert's findings, it was decided to set the first draft determination aside and engage another expert (refer paragraph 6) to assist me.
- 5.1.3 In response to the first draft determination the applicant also further clarified the matters he wished to be determined.

## **6. The expert's report**

- 6.1 I engaged an independent expert, who is a Registered Building Surveyor ("the expert"), and who also has qualifications in engineering, to undertake a review of the relevant documentation and make an assessment at the site. The expert completed a site visit on 2 September 2011 which included meeting with the applicant, the local authority, the engineer and the builder. The expert subsequently spoke with the designer of the retaining wall and provided a report dated 30 September 2011.
- 6.2 The parties and persons with an interest were provided with a copy of the expert's report on 3 October 2011. At the request of the applicant the report was revised on 7 November 2011 to confirm that a copy of the as-built drawing prepared by the engineer was appended to the PS4 viewed by the expert. The revised report was re-issued to the parties on the 8 November 2011.
- 6.3 The report is extensive and covers in detail a number of specific questions raised by the applicant. Though I have taken into account all of the submissions and content of the expert's report I have not traversed those questions and responses in full here.
- 6.4 The expert found that the retaining wall, including the shear key and the drains, had been built at a higher level than designed relative to the survey datum, but in all other respects the building work was in accordance with the approved plans. The expert put the increase in height at between 700mm and 1 metre. This also resulted in the retaining wall being higher than planned relative to the house.
- 6.5 The expert noted that the wall and surrounding ground works in their current state have been assessed by the engineer as being structurally stable and in compliance with Clause B1.
- 6.6 The expert also commented that:
- the removal of any of the ground immediately in front of parts of the retaining wall would mean that the backfill behind and below the horizontal timber walings would no longer be fully supported, and
  - the cleared ground between the retaining wall and house is such that water ponding occurs in places adjacent to the edge of the concrete house floor.

## **6.7 The engineer's response**

- 6.7.1 In an email to the engineer on 7 September 2011, the expert asked whether the ground immediately in front of the retaining wall could be lowered to the originally planned 300mm below the house floor slab.
- 6.7.2 The engineer responded by email on 23 September 2011, reiterating that 'the wall in its current profile has sufficient stability to meet the requirements of the [B]uilding Act section 71 and Building [C]ode B1. It is not likely to be subject to slippage etc.' The engineer noted that:
- the presence or absence of the clay cap and the gravel below the clay cap has no structural implications to the wall performance
  - the pole embedment (as measured by the engineer) is at least 2.6m below finished ground level, as measured immediately below the wall
  - it would not be possible to simply lower the ground level further in front of the wall and still achieve the 'design objectives'.
- 6.7.3 The engineer investigated what mitigation would be required should the ground level in front of the wall be lowered by 0.5m and provided a sketch of a potential solution. The sketch showed a reinforced concrete slab located between the house and the wall, with a 500mm upstand located immediately in front of the wall.

## **7. The second draft determination and peer review**

### **7.1 The second draft determination**

- 7.1.1 A second draft determination was issued for comment to the parties, and persons with an interest on 8 December 2011.
- 7.1.2 In a response dated 11 January 2012, the applicant agreed with the decision of the draft determination that the as-built work has not been built in accordance with the consent and the authority should not have issued a code compliance certificate. However, the applicant disputed the views formed around Building Code compliance and disputed a number of points in the draft determination that the applicant felt did not have any basis in fact, in particular that the wall does not comply with Building Code Clause B1.3.3 items (d) earth pressure, (f) earthquake and (r) removal of support and that:

... the construction is a major variation from the design consented by the BCA and built without any formal amendment of the consent by the BCA as required by the NZ Building Act. Therefore the construction cannot comply with NZ Building Code clause B1.

The facts remain the shear key was constructed 1000mm above the levels required to secure the known [shear plane] which runs across the site.

This will place additional ... loading on the [wall] and for this reason it cannot comply with NZ Building Code Clause B1/VM4

## 7.2 The peer review

7.2.1 Following the parties responses to the second draft determination, the expert, on behalf of the Ministry engaged an independent firm of structural engineers to undertake a peer review of the design of the retaining wall: the firm in turn engaged specialist geotechnical engineers to review the geotechnical assumptions impacting on the design for the wall. Collectively the firm of structural engineers and the specialist geotechnical engineers are referred to as the “the peer reviewers”.

7.2.2 The peer reviewers came to the following conclusions:

- The retaining wall design concept was for imposed soil loads according to the ultimate limit state. This concept to determine code-compliance is consistent with the requirements of Clause B1 of the Building Code.
- Using the information supplied it was not possible to independently verify the wall geometry, the shear plane location and some other parameters impacting on the design of the wall with sufficient confidence. Therefore compliance of the wall with Clause B1 has not been confirmed due to there being too many uncertainties in the analysis.
- However, if the revised Plaxis model and data are assumed to accurately reflect the situation as-built, the wall appears to meet the requirements of Clause B1 in terms of the external soils actions on the wall. This is an alternative solution, and not one contained in B1/VM4.
- The bending moment capacity of a typical pole extending above ground was reviewed against the requirements of the timber design standard NZS 3603<sup>8</sup> as a simple timber pole model subject to lateral pressure derived from the Plaxis analysis and was found to comply with Clause B1.
- The construction of the wall has not followed the building consent documents and the building consent was not amended to record the actual construction at the time the code compliance certificate was sought.
- At least some of the input data to the Plaxis model was found to be incorrect, for example the pole embedment depth, and that compromises the conclusions reached in the analysis. Compliance with Clause B1 is therefore in doubt.
- The PS4 wording does not reflect the alternative solution compliance strategy that was adopted.

7.2.3 In a response to the peer review dated 8 August 2012, the applicant noted:

- the as-built drawings ‘are nothing like the actual construction’, and the geotechnical peer review correctly concludes that there are too many uncertainties to conclude the wall complies with Clause B1
- the peer review concludes ‘the retained height is no greater than intended’, however, given the top of the wall is at RL40.2 metres and not RL39.5 metres as per the consented plan, how can this be the case?
- the use of an alternative solution to design the wall was questioned. What alternative solution was used and why, and how was this documented?

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<sup>8</sup> New Zealand Standard NZS 3603 Timber structures standard

- the peer review concludes the wall appears to meet the requirements of Clause B1. This is disputed given that the engineer considers a second wall is necessary in front of the wall.

7.2.4 In response to the applicant's submission I note:

- the 'retained height' refers to the height of the material located behind the wall: it has no relevance to the RL of the wall itself
- compliance with the Building Code can be achieved by the use of Acceptable Solutions, the use of the methods described in the Verification Methods, or by the use of an alternative solution: all three options can provide a legitimate means of establishing compliance with the Building Code
- in this instance Plaxis Analysis was used as an alternative solution to determine the compliance of the wall, although this was not declared in the documentation provided. This methodology should have been clearly documented on the PS1 and the PS4
- Plaxis Analysis is a recognised category of design tool that can be used for walls such as this. In this case the peer reviewers are of the opinion that incorrect input data was applied to the Plaxis model. This of itself does not lessen the validity of using a Plaxis Analysis as a means of determining compliance as an alternative solution to the verification methods included in B1/VM4
- however, as with any such analysis, in order to provide a high degree of confidence, it needs to be formulated in a manner that correctly identifies the critical features contributing to the applied load, such as shear planes and likely ground water levels, and include appropriate strength reduction factors on the resistance side where required to ensure that required stability factors are maintained.

7.2.5 I note the peer reviewer's recommendation that the finding of the geotechnical investigation is largely reliant on the accuracy of the input parameters. Additional information on elevation of the shear plane plus the actual pole embedment lengths should be incorporated into the engineer's final geotechnical assessment report. Acknowledging the "high degree of confidence" requirement referred to in paragraph 7.2.4, the Plaxis Analysis should be re-run to ascertain whether the as-constructed wall meets the requirements of Clause B1 of the Building Code.

7.2.6 However, I understand that the outline solution proposed by the engineer (refer paragraph 6.7.3) is capable of properly resolving any uncertainties associated with the design of the as-built wall: if that solution is adopted it will need to be properly verified taking the above findings into account.

## **8. The third draft determination**

8.1 A third draft determination was produced to take account of the comments received and in response to the peer review, and was issued to the parties and the persons with an interest for comment on 18 September 2012.

- 8.2 The Ministry received a response from the applicant on 4 October 2012. The applicant accepted the draft in general terms, but in a letter provided with the response dated 31 September 2012, the applicant submitted that:
- the surveying error referred to in paragraph 3.4 was made by the contractor
  - levels in front of the wall had already been lowered some 600mm prior to the engineer being asked to comment on lowering the levels 200mm (refer paragraph 3.6), and the engineer was aware of the change in the level of the retaining wall and embedment before providing the PS4
  - the peer reviewers reported the wall would only meet the requirements of Clause B1 ‘if the model and data correctly reflect the wall as-built’, and that this ‘was impossible to confirm’ because the peer reviewers were ‘unable to rely on the information provided by the [engineer]’.
- 8.3 The engineer’s submission, dated 2 November 2012, combined comment on the peer reviewers’ reports and provided further information in response to the third draft determination. The engineer reiterated acceptance of the determination finding that the retaining wall did not comply with the consent in respect of the level difference, but was of the view that the information provided established that the retaining wall complies with Clause B1. The engineer noted that the area was subject to a significant rainfall event (with 80-100 year return period) in December 2011 which exceeded the Building Codes requirements, and the wall had shown ‘no evidence of distress’.
- 8.4 The engineer was of the understanding that the overall conclusion of the peer review was that the wall meets the requirements of the Building Code on the proviso that site conditions as verified by the engineer are accurate. The engineer provided further detail in the submission. I have taken account of that information but have only summarised the comments on the peer reviewers findings as follows:
- Wall geometry and soil conditions relative to the wall were verified during construction, and the engineer is confident that the Plaxis model reflects the conditions as confirmed during construction.
  - It was agreed that the PS4 does not reflect the compliance method used, ‘the correct wording should be “aspects of VM4 and Alternative Solutions”’. The use of alternative design methods was required because of the presence of ‘pre-existing slide surfaces which could not be modelled using [the verification methods stated] in VM4’.
  - In respect of the pole embedment and pole off cuts: the engineer confirmed pole hole depths met or exceeded design requirements, the contractor confirmed that the poles were installed and concreted to the required depth. Invoices for the poles were provided for the poles as supplied. The engineer did not observe ‘the pole installation and concreting’.
  - In respect of any uncertainty in the as-built dimensions of the shear key: the shear key was excavated in three sections and the design criteria verified; the wall was constructed to the minimum dimensions specified in the design.
  - In respect of any uncertainty in the elevation of shear key zone and geometry of shear key: the presence of the shear plane was verified during construction

and ‘the depth of this feature is consistent with the projection of the lower shear zone in the pre-construction test pit’.

- Ground water conditions on site are more favourable than the design assumptions. The retaining wall shear key is of free draining hard fill which will act as a large drain. The likelihood of a rise in groundwater level above that designed for ‘is extremely remote’.
- The engineer confirmed a subsoil drain has been laid at the base of the shear key.

8.5 The engineer was confident that the wall met the requirements of Clause B1 and that there was sufficient evidence to show that a failure of the wall ‘must be considered extremely unlikely’. The engineer offered assistance to resolve the matter.

8.6 I sought comment from the peer reviewers on the information provided in the engineer’s submission of 2 November 2012. In a letter dated 21 November 2012 to the Ministry, the peer reviewers commented on the information and concluded that a number of ‘minor amendments’ could be made to the previous conclusions in respect of uncertainties relating to the groundwater level and constructed shear key width behind the retaining wall, but that there was not sufficient information to resolve all of the issues raised. The peer reviews considered that the following information would still be required to establish compliance:

A detailed ‘As-Built’ drawing summarising and referencing back to site notes, the measured dimensions of the shear key and retaining wall. A cross section ... across the highest portion of the wall only.

A record of the actual installed length of the timber poles, not the delivered length, and a marked up plan showing the total and embedded pole lengths at each pole location.

The Plaxis analysis undertaken by [the engineer] in July 2012 should be re-run to reflect the measured ground level and as-built configuration of the retaining wall at its highest point.

8.7 On 5 November 2012 the applicant responded to the engineer’s submission, reiterating many of the points raised in previous submissions. The applicant disputed the sequence of events during construction, and a number of the statements made in the engineer’s submission including the location of the subsoil drains, and the pole embedment. The applicant said:

[I]f the finished wall complied then there would be no issue with excavating the ground between the retaining wall and house to install paving at levels shown on the construction plan. [The engineer] claim[s] that any lowering of the ground levels may cause the wall to fail.

8.8 The engineer provided a further submission dated 5 December 2012 in response to the peer reviewers’ comment and enclosed: an as-built plan, cross section, and retaining wall dimensions; letters from the contractor and a sub-contractor regarding construction of the wall; Plaxis analysis undertaken in September 2012 based on ‘the worse case’ situation and ‘run for both deep and shallow failure surfaces’ and ‘elevated groundwater levels’. It was submitted that the analysis showed that the wall has adequate factors of safety in both ‘normal operating and extreme conditions’. The submission referred to a site survey of the wall carried out by a firm of surveyors assisted by the engineer’s staff.

8.9 On 12 and 17 December 2012 the applicant responded to the engineer's 5 December submission saying that a number of references in the new as-built drawing were incorrect, namely:

- the surveyed levels were not shown on the engineer's as-built plans
- concrete encasement was not installed to the top of the poles' embedment
- the level of encasement to the poles to the 'east end of the wall have the top of the concrete casing some 300mm below the level of concrete found on the ... centre and western poles'
- the applicant disputed the RL shown for the base of the shear key due to the location of a subsoil drain.

The applicant provided two photographs and a suggested construction sequence to support his submission. The applicant considered that the information provided by the engineer 'cannot be relied on'.

8.10 The applicant sought a copy of the survey from the engineer via the Ministry on 6 December 2012. A plan was received on 29 January 2013 but it contained very limited information as it did not include any dimensions or levels, or any identification or reference to the subject property.

8.11 The submissions from the engineer and the applicant were referred to the peer reviewer for comment. In response the peer reviewer considered there was 'insufficient independently verifiable data' to be confident that compliance had been achieved.

## 9. Discussion

9.1 In Determination 2008/030 I considered a two-stage approach to the issuing of a code compliance certificate under the Act: firstly, the authority needed to establish whether it had reasonable grounds to be satisfied the building complied with building consent; and second, whether any items that had not been detailed in the consent but that had been incorporated in the works complied with the Building Code.

### 9.2 Compliance with the building consent

9.2.1 The consented plans show a flat area between the house and the retaining wall, and the driveway extending past the garage entrance and extending out toward the retaining wall. I note the plans do not specifically note the space between the house and the retaining wall as a vehicle parking area, but there is clearly a relationship intended.

9.2.2 In this instance, in relation to the retaining wall, the authority relied on the PS4 and as such the statement by the engineer that the retaining wall "as-built" was the same as that which was consented. The as-built drawing attached to the PS4 contained a caveat in relation to as-built levels that were required to be 'confirm[ed] on site'.

9.2.3 Regardless of the above, the fact is the as-built level of the retaining wall relative to the house is substantially different from that which was consented. The height difference has resulted in the area sloping down from the retaining wall to the house.

I am of the view that the discrepancies in finished levels are significant and would have been readily observable to the authority on inspection.

- 9.2.4 I note the plan appended to the PS4 is described as ‘as-built’ when in fact it was not. In producing the PS4, the engineer advised the expert that reliance was placed on the PS3 supplied by a contractor to the builder. In doing so the engineer has provided a statement to the effect that levels are as per the design albeit with the rider in relation to levels requiring them to be ‘confirm[ed] on site’. Whilst such a statement is acceptable for documentation prior to, and in preparation of construction documents, in my view it is not appropriate when issuing as-built documents. I note the applicant has also raised doubts about revised as-built drawings provided on 5 December 2012 (refer paragraphs 8.8 and 8.9).
- 9.2.5 In addition, while an authority’s reliance upon producer statements is not wrong, I consider the acceptance of such statements does not remove the need for an authority to consider whether the work included in the PS4 is accurate and meets the requirements of the consent.
- 9.2.6 Under section 94(1)(a) of the Act, an authority can only issue a code compliance certificate if it is satisfied, on reasonable grounds, that the building work complies with the building consent. The as-built work does not accord with the consent plans to a significant degree, and the variation would have been observable to the authority on inspection; I therefore consider the authority did not have reasonable grounds to conclude that the retaining wall complied with the building consent.

### **9.3 The retaining wall’s compliance with Clause B1 Structure**

- 9.3.1 The fact that the retaining wall has been built higher than consented in relation to the datum point is not disputed by the parties. I accept the findings of the expert that the height variation is approximately 700mm to 1000mm higher relative to the survey datum.
- 9.3.2 I have noted the statements of the engineer (refer paragraph 6.7.2) where reliance appeared to be being placed on the stability requirements of Section 71 of the Act being satisfied. I acknowledge subsequent statements by the engineer confirming their view that the wall has a low probability of failure. The wall’s compliance with the mandatory provisions of Clause B1 Structure requires it to have a “low probability of rupture, becoming unstable ... throughout [its life]” (refer Clause B1.3.2). The life of the wall, as it is defined in Clause B2.3.1 is not less than 50 years.
- 9.3.3 I have taken account of the evidence presented to me, the expert’s report and the conclusions of the peer review in forming a view about compliance with the Building Code. I note that the peer reviewers found that using the information supplied by the engineer it was not possible to verify the wall’s geometry, the shear plane location, the pole embedment depth, and some other parameters with sufficient confidence to allow conclusions regarding compliance to be reached. On the other hand, the Building Code is a performance-based document and I acknowledge the validity of the engineer’s argument regarding the wall’s satisfactory performance during the 80-100 year rain event referred to in paragraph 8.3.

- 9.3.4 The wall's compliance for its expected life is also dependent on the ground immediately in front of the wall not being removed from under the bottom waling (refer paragraphs 3.11 and 6.6). This eventuality is likely, particularly with respect to future owners of the house, unless some means is provided to properly retain the ground. I note the solution as outlined in paragraphs 6.7.3 and 10.2 is capable of addressing this matter, as well as resolving any residual uncertainties about the wall's geometry and stability.
- 9.3.5 Taking the above into account, and the fact that the wall is to satisfy the requirements of Clause B1 throughout its life, I do not consider I have reasonable grounds to conclude that compliance with Clause B1 has been achieved.

#### **9.4 The issue of the code compliance certificate**

- 9.4.1 As I have found that the retaining wall does not comply with the building consent and there is not sufficient information to be satisfied on reasonable grounds that compliance with Clause B1 has been achieved, it follows that the authority was incorrect to issue a code compliance certificate for this work.

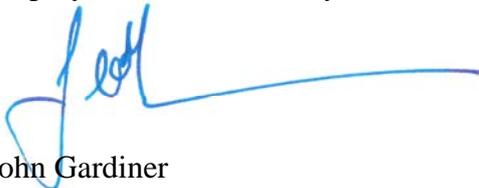
### **10. What happens next?**

- 10.1 Where a decision of an authority to issue a code compliance certificate is reversed the options open to the owner include; either presenting to the authority as-built drawings that accurately reflect the building work, or undertaking remedial work to ensure the building work reflects the approved plans and complies with the Building Code.
- 10.2 The applicant has expressed the wish to use the space between the house and the retaining wall as a vehicle parking area. The engineer has provided an outline solution (refer paragraph 6.7.3) allowing the ground between the house and the retaining wall to be lowered. I note that an appropriately designed solution is capable of ensuring the wall will comply with the provisions of the Building Code.
- 10.3 If such a solution is followed, the work will need to be formally documented and is likely to be undertaken as an amendment to the original consent. In my view the solution should be independent of the house foundation, and be based on a detailed assessment of the ground between the house and the wall. The authority will require sufficient information for it to be satisfied on reasonable grounds that the amendment will satisfy the requirements of the Building Code.

## 11. Decision

- 11.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the retaining wall does not comply with the building consent and there is insufficient information to be satisfied on reasonable grounds that it complies with the Building Code, therefore the authority incorrectly exercised its powers in issuing the code compliance certificate. Accordingly, I reverse the authority's decision to issue the code compliance certificate for building consent BC 080870.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 8 February 2013.



John Gardiner  
**Manager Determinations and Assurance**

## Appendix A: The relevant legislation

A.1 The relevant section of the Building Act is:

**94 Matters for consideration by building consent authority in deciding issue of code compliance certificate**

- (1) A building consent authority must issue a code compliance certificate if it is satisfied on reasonable grounds, —
- (a) that the building work complies with the building consent

A.2 The relevant sections of Building Code Clause B1 Structure include:

**B1.3.3** Account shall be taken of all physical conditions likely to affect the stability of buildings, building elements and sitework, including:

- (a) self-weight,
- (d) earth pressure,
- (e) water and other liquids,
- (f) earthquake,
- (l) reversing or fluctuating effects,
- (m) differential movement,
- (q) time dependent effects including creep and shrinkage, and
- (r) removal of support.