Christchurch City Council

Governors Bay Pool Shed by Playground BU 3569-001 EQ2

Detailed Engineering Evaluation

Quantitative Assessment Report

Christchurch City Council

Governors Bay Pool Shed by Playground

Quantitative Assessment Report

Prepared By

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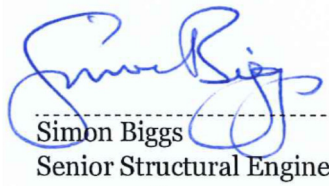

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Status: Final

Summary

Governors Bay Pool Playground Shed
BU 3569-001 EQ2

Detailed Engineering Evaluation
Quantitative Report - Summary
Final

Background
This is a summary of the quantitative report for the Governors Bay Shed by Playground structure, and is based on the Detailed Engineering Evaluation Procedure document (draft) issued by the Structural Advisory Group on 19 July 2011 and visual inspections on 15 October 2012.

Key Damage Observed
No major damaged was observed.

Critical Structural Weaknesses
No critical structural weaknesses have been identified.

Indicative Building Strength
The structure has been found to have a seismic capacity of 48%NBS due to a lack of tie down in the connection between floor bearers and footings and therefore is not classed as an earthquake prone building.

Although 48%NBS may appear low, this building is not considered as a significant hazard. This is due to the expectation that, if the footing tie down were to fail during a seismic event, the consequences would be minimal given that the structure sits on ground on one side and only 200mm off the ground on the other side. Therefore, due to the short periods of time the shed will be accessed, a restriction on occupancy is not deemed to be necessary.

Recommendations
The following recommendations have been made:

(a) Strengthening options be developed to increase the seismic capacity of the shed to at least 67%NBS.

(b) The maintenance issue of the rotting timber members around the base of the structure is considered by CCC in the future.

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1 Introduction

Opus International Consultants Limited has been engaged by Christchurch City Council to undertake a detailed seismic assessment of the Governors Bay Pool Shed by Playground, located at 1 Cresswell Avenue, Governors Bay following the Canterbury Earthquake Sequence since September 2010.

The purpose of the assessment is to determine if the building is classed as being earthquake prone in accordance with the Building Act 2004.

The seismic assessment and reporting have been undertaken based on the qualitative and quantitative procedures detailed in the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) [3] [4].

2 Compliance

This section contains a brief summary of the requirements of the various statutes and authorities that control activities in relation to buildings in Christchurch at present.

2.1 Canterbury Earthquake Recovery Authority (CERA)

CERA was established on 28 March 2011 to take control of the recovery of Christchurch using powers established by the Canterbury Earthquake Recovery Act enacted on 18 April 2011. This act gives the Chief Executive Officer of CERA wide powers in relation to building safety, demolition and repair. Two relevant sections are:

Section 38 – Works

This section outlines a process in which the chief executive can give notice that a building is to be demolished and if the owner does not carry out the demolition, the chief executive can commission the demolition and recover the costs from the owner or by placing a charge on the owners' land.

Section 51 – Requiring Structural Survey

This section enables the chief executive to require a building owner, insurer or mortgagee to carry out a full structural survey before the building is re-occupied.

We understand that CERA require a detailed engineering evaluation to be carried out for all buildings (other than those exempt from the Earthquake Prone Building definition in the Building Act). CERA have adopted the Detailed Engineering Evaluation Procedure (DEEP) document (draft) issued by the Structural Engineering Society (SESOC) on 19 July 2011. This document sets out a methodology for both initial qualitative and detailed quantitative assessments.

It is anticipated that a number of factors, including the following, will determine the extent of evaluation and strengthening level required:

1. The importance level and occupancy of the building.
2. The placard status and amount of damage.
3. The age and structural type of the building.
4. Consideration of any critical structural weaknesses.

Christchurch City Council requires any building with a capacity of less than 34% of New Building Standard (including consideration of critical structural weaknesses) to be strengthened to a target of 67% as required under the CCC Earthquake Prone Building Policy.

2.2 Building Act

Several sections of the Building Act are relevant when considering structural requirements:

Section 112 - Alterations

This section requires that an existing building complies with the relevant sections of the Building Code to at least the extent that it did prior to the alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

The Earthquake Prone Building policy for the territorial authority shall apply as outlined in Section 2.3 of this report.

Section 115 – Change of Use

This section requires that the territorial authority is satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'.

This is typically interpreted by territorial authorities as being 67% of the strength of an equivalent new building or as near as practicable. This is also the minimum level recommended by the New Zealand Society for Earthquake Engineering (NZSEE).

Section 121 – Dangerous Buildings

This section was extended by the Canterbury Earthquake (Building Act) Order 2010, and defines a building as dangerous if:

1. In the ordinary course of events (excluding the occurrence of an earthquake), the building is likely to cause injury or death or damage to other property; or
2. In the event of fire, injury or death to any persons in the building or on other property is likely because of fire hazard or the occupancy of the building; or
3. There is a risk that the building could collapse or otherwise cause injury or death as a result of earthquake shaking that is less than a 'moderate earthquake' (refer to Section 122 below); or

4. There is a risk that other property could collapse or otherwise cause injury or death; or
5. A territorial authority has not been able to undertake an inspection to determine whether the building is dangerous.

Section 122 – Earthquake Prone Buildings

This section defines a building as earthquake prone (EPB) if its ultimate capacity would be exceeded in a 'moderate earthquake' and it would be likely to collapse causing injury or death, or damage to other property.

A moderate earthquake is defined by the building regulations as one that would generate loads 33% of those used to design an equivalent new building.

Section 124 – Powers of Territorial Authorities

This section gives the territorial authority the power to require strengthening work within specified timeframes or to close and prevent occupancy to any building defined as dangerous or earthquake prone.

Section 131 – Earthquake Prone Building Policy

This section requires the territorial authority to adopt a specific policy for earthquake prone, dangerous and insanitary buildings.

2.3 Christchurch City Council Policy

Christchurch City Council adopted their Earthquake Prone, Dangerous and Insanitary Building Policy in 2006. This policy was amended immediately following the Darfield Earthquake on 4 September 2010.

The 2010 amendment includes the following:

1. A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
2. A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
3. A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
4. Repair works for buildings damaged by earthquakes will be required to comply with the above.

The council has stated their willingness to consider retrofit proposals on a case by case basis, considering the economic impact of such a retrofit.

If strengthening works are undertaken, a building consent will be required. A requirement of the consent will require upgrade of the building to comply 'as near as is reasonably practicable' with:

- The accessibility requirements of the Building Code.
- The fire requirements of the Building Code. This is likely to require a fire report to be submitted with the building consent application.

Where an application for a change of use of a building is made to Council, the building will be required to be strengthened to 67% of New Building Standard or as near as is reasonably practicable.

2.4 Building Code

The Building Code outlines performance standards for buildings and the Building Act requires that all new buildings comply with this code. Compliance Documents published by The Department of Building and Housing can be used to demonstrate compliance with the Building Code.

On 19 May 2011, Compliance Document B1: Structure was amended to include increased seismic design requirements for Canterbury as follows:

- increase in the basic seismic design load for the Canterbury earthquake region (Z factor increased to 0.3 equating to an increase of 36 – 47% depending on location within the region);
- Increased serviceability requirements.

2.5 Institution of Professional Engineers New Zealand (IPENZ) Code of Ethics

One of the core ethical values of professional engineers in New Zealand is the protection of life and safeguarding of people. The IPENZ Code of Ethics requires that:

Members shall recognise the need to protect life and to safeguard people, and in their engineering activities shall act to address this need.

1.1 Giving Priority to the safety and well-being of the community and having regard to this principle in assessing obligations to clients, employers and colleagues.

1.2 Ensuring that responsible steps are taken to minimise the risk of loss of life, injury or suffering which may result from your engineering activities, either directly or indirectly.

All recommendations on building occupancy and access must be made with these fundamental obligations in mind.

3 Earthquake Resistance Standards

For this assessment, the building's earthquake resistance is compared with the current New Zealand Building Code requirements for a new building constructed on the site. This is expressed

as a percentage of new building standard (%NBS). The loadings are in accordance with the current earthquake loading standard NZS1170.5 [1].

A generally accepted classification of earthquake risk for existing buildings in terms of %NBS that has been proposed by the NZSEE 2006 [2] is presented in Figure 1 below.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Improvement of Structural Performance	
					Legal Requirement	NZSEE Recommendation
Low Risk Building	A or B	Low	Above 67	Acceptable (improvement may be desirable)	The Building Act sets no required level of structural improvement (unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	100%NBS desirable. Improvement should achieve at least 67%NBS
Moderate Risk Building	B or C	Moderate	34 to 66	Acceptable legally. Improvement recommended		Not recommended. Acceptable only in exceptional circumstances
High Risk Building	D or E	High	33 or lower	Unacceptable (Improvement required under Act)	Unacceptable	Unacceptable

Figure 1: NZSEE Risk Classifications Extracted from table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 1 below compares the percentage NBS to the relative risk of the building failing in a seismic event with a 10% risk of exceedance in 50 years (i.e. 0.2% in the next year).

Table 1: %NBS compared to relative risk of failure

Percentage of New Building Standard (%NBS)	Relative Risk (Approximate)
>100	<1 time
80-100	1-2 times
67-80	2-5 times
33-67	5-10 times
20-33	10-25 times
<20	>25 times

3.1 Minimum and Recommended Standards

Based on governing policy and recent observations, Opus makes the following general recommendations:

3.1.1 Occupancy

The Canterbury Earthquake Order[1] in Council 16 September 2010, modified the meaning of "dangerous building" to include buildings that were identified as being EPB's. As a result of this, we would expect such a building would be issued with a Section 124 notice, by the Territorial Authority, or CERA acting on their behalf, once they are made aware of our assessment. Based on information received from CERA to date and from the DBH guidance document dated 12 June 2012 [6], this notice is likely to prohibit occupancy of the building (or parts thereof), until its seismic capacity is improved to the point that it is no longer considered an EPB.

3.1.2 Cordoning

Where there is an overhead falling hazard, or potential collapse hazard of the building, the areas of concern should be cordoned off in accordance with current CERA/territorial authority guidelines.

3.1.3 Strengthening

Industry guidelines (NZSEE 2006 [2]) strongly recommend that every effort be made to achieve improvement to at least 67%NBS. A strengthening solution to anything less than 67%NBS would not provide an adequate reduction to the level of risk.

It should be noted that full compliance with the current building code requires building strength of 100%NBS.

3.1.4 Our Ethical Obligation

In accordance with the IPENZ code of ethics, we have a duty of care to the public. This obligation requires us to identify and inform CERA of potentially dangerous buildings; this would include earthquake prone buildings.

[1] This Order only applies to buildings within the Christchurch City, Selwyn District and Waimakariri District Councils authority

4 Background Information

4.1 Building Description

The single storey timber framed shed is approximately 7.7m long and 4.1m wide. The roof is assumed to be supported by timber rafters pitched at an angle of 45°. Timber stud walls are supported off a timber framed floor. The timber floor is elevated approximately 100mm off the ground on one side, where it is supported by concrete piles, and is supported by a concrete slab on the other side.

Figure 2: Governors Bay Pool Shed by Playground Location (Courtesy Google Earth)

4.2 Survey

4.2.1 Post 22 February 2011 Rapid Assessment

No rapid assessment notice was posted on the building at the time of the survey.

4.2.2 Further Inspections

An inspection was undertaken by Opus on 15 October 2012, to measure and ascertain the structural systems and extent of damage. Internal access to the building was not possible at the time of the site visit.

4.3 Original Documentation

No copies of the drawings or design calculations have been obtained for this building. Our measure up sketches (refer Appendix 3) and observations recorded when the site visit was undertaken have been exclusively used to confirm the structural systems, to investigate

potential critical structural weaknesses (CSW) wherever possible, and identify details which required particular attention.

5 Structural Damage

No significant structural damage has been observed following visual inspections undertaken following the 22 February earthquake. However, a portion of glazing has been damaged, indicating that large displacements may have occurred during seismic activity.

The timber members around the base of the structure are showing signs of rot, although this is not as a result of seismic activity, it is a maintenance issue.

5.1 Surrounding Buildings

Other surrounding buildings within the Governors Bay Pool premises have been assessed in a quantitative report issued in August 2012.

5.2 Residual Displacements

No residual displacements were noticeable.

5.3 Foundations

Liquefaction was not evident at the site and no foundation displacement was evident.

5.4 Primary Gravity Structure

The gravity system consists of pitched timber rafters supporting the roof, timber stud walls and concrete piles and slab supporting a timber floor.

6 General Observations

Visual inspection shows that there is no significant connection between bearers and the supporting concrete piles. This is not in accordance with current design codes.

7 Detailed Seismic Assessment

The detailed seismic assessment has been based on the NZSEE 2006 [2] guidelines for the "Assessment and Improvement of the Structural Performance of Buildings in Earthquakes" together with the "Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure" [3] draft document prepared by the Engineering Advisory Group on 19 July 2011, and the SESOC guidelines "Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes" [5] issued on 21 December 2011.

7.1 Critical Structural Weaknesses

The term Critical Structural Weakness (CSW) refers to a component of a building that could contribute to increased levels of damage or cause premature collapse of a building. No CSWs were identified in the quantitative assessment.

7.2 Quantitative Assessment Methodology

The method of assessment is an evaluation using a seismic loads derived from an equivalent static analysis. Seismic loads are transferred through walls and into the footings.

7.3 Limitations and Assumptions in Results

The observed level of damage suffered by the building was deemed low enough to not affect the capacity. Therefore the analysis and assessment of the building was based on it being in an undamaged state. There may have been damage to the building that was unable to be observed during assessments that could cause the capacity of the building to be reduced; therefore the current capacity of the building may be lower than that stated.

The results have been reported as a %NBS and the stated value is that obtained from our analysis and assessment. Despite the use of best national and international practice in this analysis and assessment, this value contains uncertainty due to the many assumptions and simplifications which are made during the assessment. These include:

a. Simplifications made in the analysis,
b. Assessments of material strengths based on an external inspection only,
c. The normal variation in material properties which change from batch to batch,
d. Approximations made in the assessment of the capacity of each element.

7.4 Assessment

A summary of the structural performance of the building is shown in the following table. Note that the values given generally represent the worst performing elements in the building, where these effectively define the building's capacity. Other elements within the building may have significantly greater capacity when compared with the governing.

Due to limited access to the structure during inspection, the presence of internal wall lining could not be determined. If present, internal wall lining would significantly increase the lateral bracing capacity of the structure. Results presented in Table 2 are based on the assumption that the shed walls are not internally lined.

Table 2: Summary of Seismic Performance

Structural Element/System	Failure Mode, or description of limiting criteria based on displacement capacity of critical element.	% NBS based on calculated capacity
End walls	In-plane shear	85
Front wall*	In-plane shear	>100
Rear wall**	In-plane shear	>100
Studs bracing end wall window	Out-of-plane bending	68
Bearer to pile connection	Overturning, structure lifting off footing	>100
Bearer to pile connection	Shear, structure shifting off footing	48

* Front wall refers to the wall on the playground side with double door entry
** Rear wall refers to the wall with a single door entry

The shed has a calculated seismic capacity of 48%NBS, as limited by bearer to footings tie down and to a lesser extent by the wall bracing. The structure is therefore not classified as an earthquake prone building but as medium risk in accordance with NZSEE guidelines.

Although 48%NBS may appear low, this building is not considered as a significant hazard. This is due to the expectation that, if the footing tie down were to fail during a seismic event, the consequences would be minimal given that the structure sits on ground on one side and only 200mm off the ground on the other side.

8 Summary of Geotechnical Appraisal

The following is a summary of the geotechnical appraisal completed by Opus International Consultants on 12 July 2012. A full copy of the report can be found in Appendix 2.

8.1 General

There are no subsurface investigations in the vicinity of the site. Given the site benching that has occurred during pool excavation, it is likely that fill has been placed under the eastern part of the site, under the floor slabs and paved areas. No areas of sinkholes, an indicator of tunnel gullying, were observed.

A walkover inspection of the interior of the other Governors Bay Pool buildings and surrounding land was carried out by Opus Geotechnical Engineer on 2 May 2012. The following observations were made (refer to the Walkover Inspection Plan and Site Photographs attached to this report):

8.2 Liquefaction Potential

The Christchurch Earthquake Recovery Authority (CERA) last updated 10 February 2012 has classified 1 Cresswell Ave and the surrounding residential properties as Green Zone, indicating repair and rebuilding process can begin. The area around the pool grounds is not shown as being liquefaction prone.

8.3 Summary

No evidence of liquefaction or lateral spreading due to the recent earthquakes was observed on the property or adjoining properties. An internal inspection of the pool buildings did not identify any evidence of differential settlement of the foundations, however no level survey has been completed. There was some differential settlement noted on paths around the pool.

Based on the observed site performance during the walkover survey dated 2 May 2012 in and around the Governors Bay pool in recent earthquakes, the land is not likely to be susceptible to slope failure, liquefaction or settlement. No further geotechnical investigations or geotechnical assessments are therefore considered necessary.

9 Conclusions

This building has been assessed to have a seismic capacity of 48% NBS and therefore is not classed as an earthquake prone building.

The building is classed as a moderate risk building in accordance with NZSEE guidelines however the lack of pile-bearer hold downs is not considered to be a significant hazard and due to the short periods of time the shed will be accessed, a restriction on occupancy is not deemed to be necessary.

10 Recommendations

The following recommendations have been made:

(a) Strengthening options be developed to increase the seismic capacity of the shed to at least 67%NBS.

(b) The maintenance issue of the rotting timber members around the base of the structure is considered by CCC in the future.

11 Limitations

(a) This report is based on an inspection of the structures with a focus on the damage sustained from the 22 February 2011 Canterbury Earthquake and aftershocks only. Some non-structural damage is mentioned but this is not intended to be a comprehensive list of non-structural items.

(b) Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at the time.

(c) This report is prepared for the CCC to assist with assessing remedial works required for council buildings and facilities. It is not intended for any other party or purpose.

12 References

[1] NZS 1170.5: 2004, Structural design actions, Part 5 Earthquake actions, Standards New Zealand.

[2] NZSEE (2006), Assessment and improvement of the structural performance of buildings in earthquakes, New Zealand Society for Earthquake Engineering.

[3] Engineering Advisory Group, Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury, Part 2 Evaluation Procedure, Draft Prepared by the Engineering Advisory Group, Revision 5, 19 July 2011.

[4] Engineering Advisory Group, *Guidance on Detailed Engineering Evaluation of Non-residential buildings, Part 3 Technical Guidance*, Draft Prepared by the Engineering Advisory Group, 13 December 2011.

[5] SESOC (2011), Practice Note – Design of Conventional Structural Systems Following Canterbury Earthquakes, Structural Engineering Society of New Zealand, 21 December 2011.

[6] DBH (2012), Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch, Department of Building and Housing, June 2012.

Appendix 1 - Photographs

Site Name		
No.	Item description	Photo
General		
1.	Rear and end walls	
2.	Front and end walls	

3.	Glazing damage	
4.	No connection between bearer and pile evident	
5.	Evidence of rot on timber members around base	

Appendix 2 - Geotechnical Appraisal

12 July 2012

Michael Sheffield
Christchurch City Council
PO Box 237
CHRISTCHURCH 8140

6-QUCCC.61/055SC

Dear Michael

Geotechnical Desktop Study – Governors Bay Pool – Shed, Plant Room and Storage Room (BU-3569-001 EQ2 BU 3569-003 EQ2)

1. Introduction

This report summarises the findings of a geotechnical desktop study and site walkover completed by Opus International Consultants (Opus) for the Christchurch City Council (CCC) at the above property on 2 May 2012. The Geotechnical desk study follows the Canterbury Earthquake Sequence initiated by the 4 September 2010 earthquake.

The purpose of the geotechnical study is to assess the current ground conditions and the potential geotechnical hazards that may be present at the site, and determine whether further subsurface geotechnical investigations are necessary.

It is our understanding this is the first inspection by a Geotechnical Engineer of this property following the Canterbury Earthquake Sequence. The Geotechnical Desk Study has been undertaken without the benefit of any site specific investigations and is therefore preliminary in its nature.

2. Desktop Study

2.1 Site Description

The Governors Bay Pool is located at 1 Cresswell Ave, Governors Bay within the Lyttelton Harbour. The pool complex faces south on to Cresswell St, and is bounded to the east by a residential section, to the north by a gently sloping bank planted in trees, and to the west by a gently sloping grass area.

The building is a single storey structure with reinforced masonry walls, timber frame roof structure, and concrete floors. Though no detailed drawings for the foundations have been found, it is assumed that the foundations are likely to be shallow perimeter strip footings.

The building and wall extend a total length of 30 m on the eastern boundary of the site.

2.2 Structural Drawings

A search of CCC property files has not located any extracts from construction drawings.

No geotechnical reports or records of a ground condition assessment associated with the construction of the original building or additions have been identified.

The structure was constructed in approx. 1972 (pers comm. Pool Caretaker) and comprises two separate buildings containing two changing sheds, a plant room and a store room, all sharing a hollow block fence/wall at the rear. The northern building houses one changing room (approx. 2.4m x 4.7m), the second building houses a changing room (approx. 2.4m x 4.6m); a plant room (approx. 2.4m x 2.9m) and a store room (approx. 4.3m x 2.4m).

2.3 Regional Geology

The Banks Peninsula Geological Map[1] indicates the site to be underlain by a loess mantle over rocks of the Lyttelton Volcanic Group. Loess is a windblown deposit and typically consists of sandy silt in the Banks Peninsula region. ECAN well information indicates groundwater approximately 2 m below the surface (M36/10180, approx. 300 m from the site).

2.4 Expected Ground Conditions

There are no subsurface investigations in the vicinity of the site. Given the site benching that has occurred during pool excavation, it is likely that fill has been placed under the eastern part of the site, under the floor slabs and paved areas. No areas of sinkholes, an indicator of tunnel gullying, were observed.

2.5 Liquefaction Hazard

The Christchurch Earthquake Recovery Authority (CERA) last updated 10 February 2012 has classified 1 Cresswell Ave and the surrounding residential properties as Green Zone, indicating repair and rebuilding process can begin. The area around the pool grounds is not shown as being liquefaction prone.

3. Site Walkover Inspection

A walkover inspection of the interior of the buildings and surrounding land was carried out by an Opus Geotechnical Engineer on 2 May 2012. The following observations were made (refer to the Walkover Inspection Plan and Site Photographs attached to this report):

- Confirmed evidence of building damage, likely due to seismic shaking. Damage comprises extensive wall cracking and movement; separation of the wall from the column “buttress” units.
- Propping of the structure.

4. Discussion

Cracking of the walls of the hollow concrete block buildings has occurred to the Governors Bay Pool buildings at 1 Cresswell Ave due to the Canterbury Earthquake Sequence following the 4 September 2010 earthquake. This has resulted in building closure, and propping of the structure has been required.

No evidence of liquefaction or lateral spreading due to the recent earthquakes was observed on the property or adjoining properties. An internal inspection of the pool buildings did not identify any evidence of differential settlement of the foundations,

[1] Sewell, R.J.; Weaver, S.D.; Reay, M.B. 1992: Geology of Banks Peninsula. Scale 1:100,000. Institute of Geological & Nuclear Sciences geological map 3.

however no level survey has been completed. There was some differential settlement noted on paths around the pool. Discussions with the pool caretaker indicate cracking in the storeroom floor slab and paths was existing prior to the September 2010 earthquake.

Detailed drawings of the foundations have not been located. Based on the walkover it is assumed that the foundations are strip foundations along the perimeter of the building and some of the interior walls. The existing foundations have performed satisfactorily and do not appear to have sustained damage from cracking from differential settlement.

GNS Science indicates an elevated risk of seismic activity is expected in the Canterbury region as a result of the earthquake sequence following the 4 September 2010 earthquake. Recent advice[2] indicates there is a 14% probability of another Magnitude 6 or greater earthquake occurring in the next 12 months in the Canterbury region. This event may cause further building damage at the site, dependent on the location of the earthquake's epicentre. It is expected that the probability of occurrence is likely to decrease with time following periods of reduced seismic activity.

5. Recommendations

- Based on the observed site performance during the walkover survey dated 2 May 2012 in and around the Governors Bay Pool, the land is not likely to be susceptible to slope failure, liquefaction or settlement. No further geotechnical investigations or geotechnical assessments are therefore considered necessary.

- Should the building be rebuilt on new foundations, we recommend carrying out a site specific investigations, comprising hand augers and scala penetrometers to provide information for foundation design.

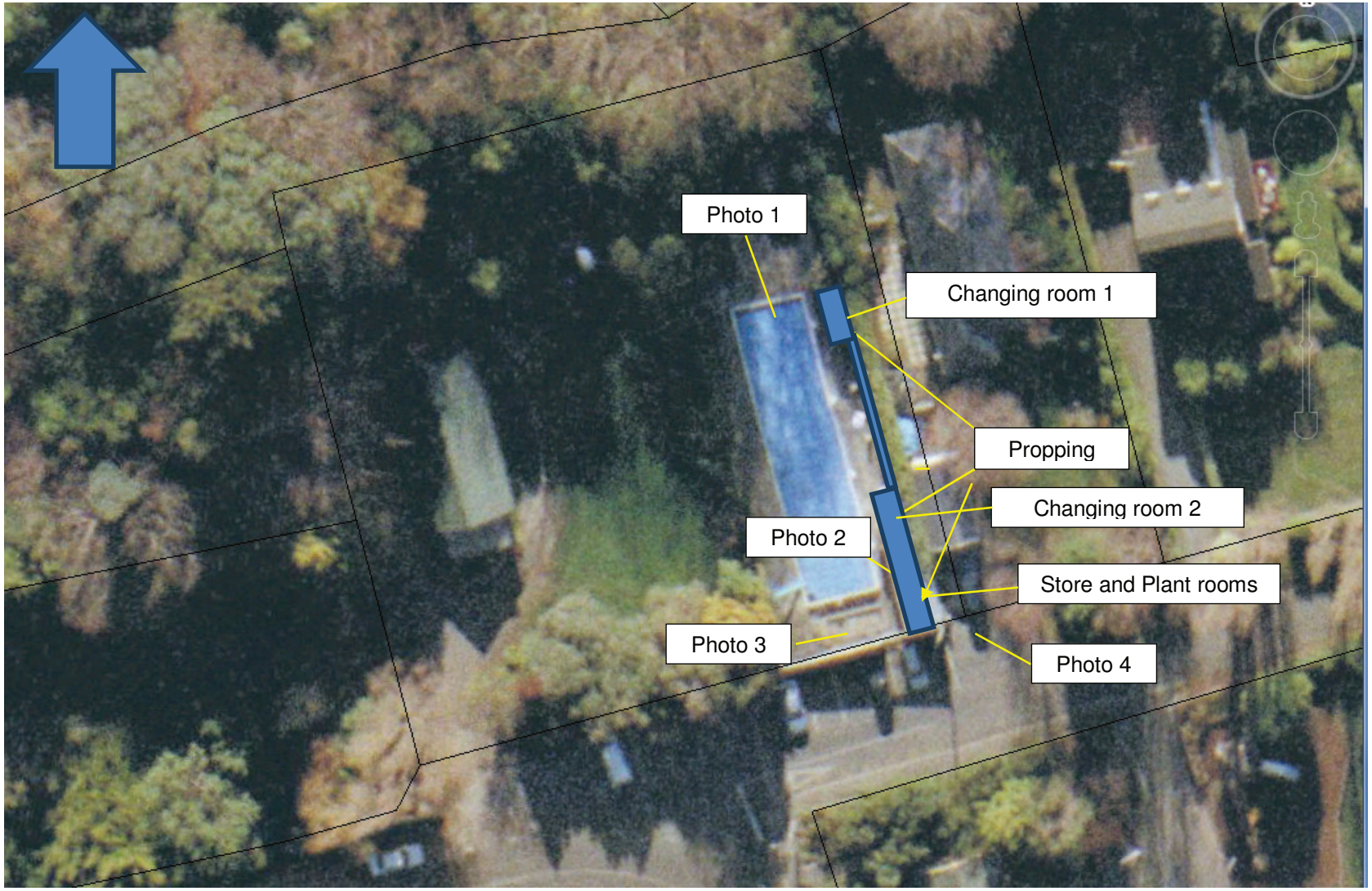
6. Limitation

This report has been prepared solely for the benefit of Christchurch City Council as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Figures:
Site Location Plan
Walkover Inspection Plan
Site Photographs

[2] GNS Science reporting on Geonet Website: http://www.geonet.org.nz/canterbury-quakes/aftershocks/ updated on 9th July 2012.

Opus International Consultants Ltd. Christchurch Office 20 Moorhouse Ave PO Box 1482 Christchurch, New Zealand Tel: +64 3 363 5400 Fax: +64 3 365 7857	**Project:**	1 Cresswell Ave, Governors Bay Geotechnical Desktop Study	**Site Location Plan**
	Project No.:	6-QUCCC.61/055SC	
	Client:	Christchurch City Council	



Opus International Consultants Ltd. Christchurch Office 20 Moorhouse Ave PO Box 1482 Christchurch, New Zealand Tel: +64 3 363 5400 Fax: +64 3 365 7857	**Project:** 1 Cresswell Ave Governors Bay Geotechnical Desktop Study **Project No.:** 6-QUCCC.61/055SC **Client:** Christchurch City Council	**Walkover Inspection Plan** **Date Drawn:** 21/05/2012

Photo 1. Pool service building on left, with concrete block wall on boundary. Note site slopes gently to far back left (SE)

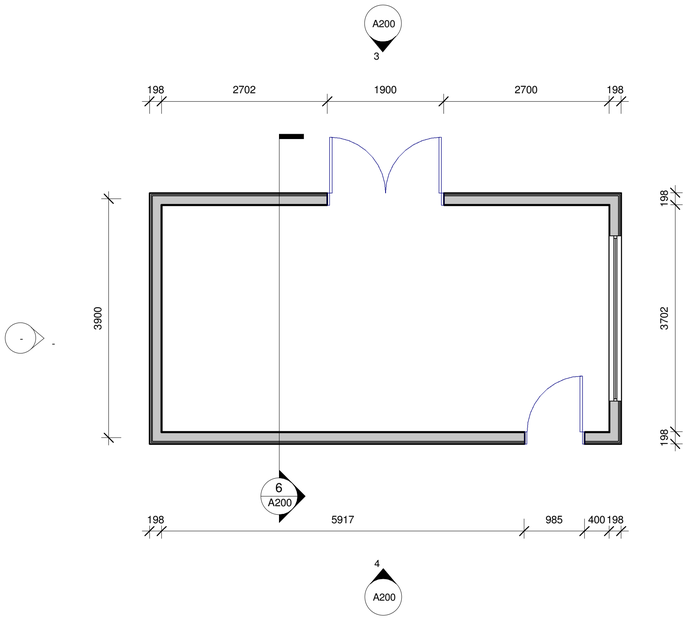
Photo 2. Store room floor slab cracking

Photo 3 Extensive propping of building. Paving slabs around pool tilted.

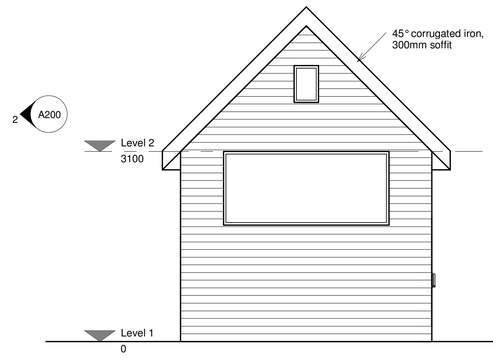
Photo 4. Blockwork on SE corner of building at back of storeroom propped.

Appendix 3 – Sketch Plans

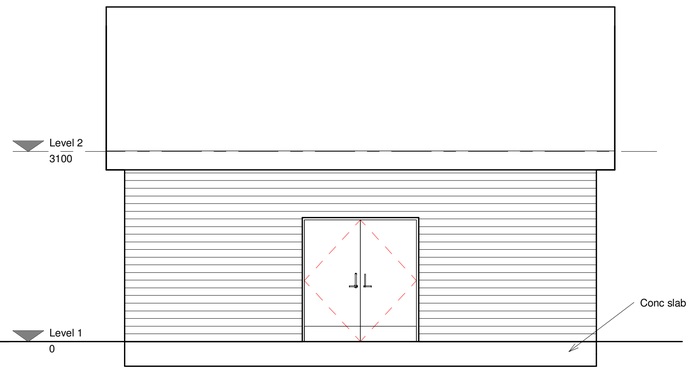
NOTE:
See photos - a lot of bore through weatherboards



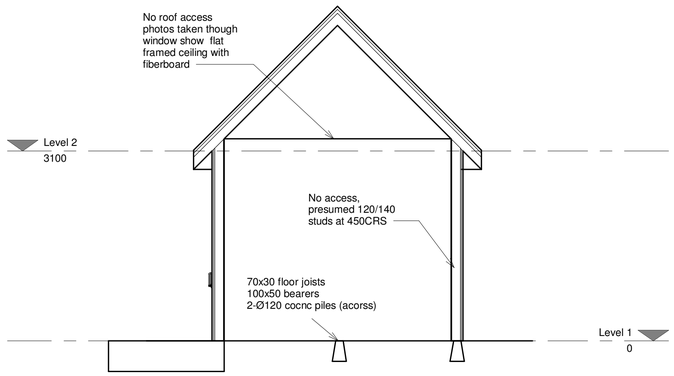
1 / A200 Level 1 Plan
1 : 50



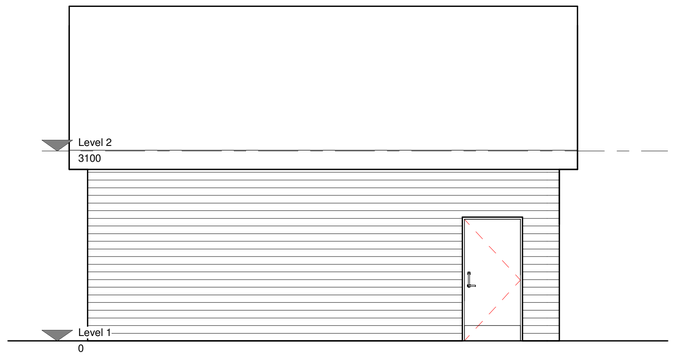
2 / A200 East Elevation
1 : 50



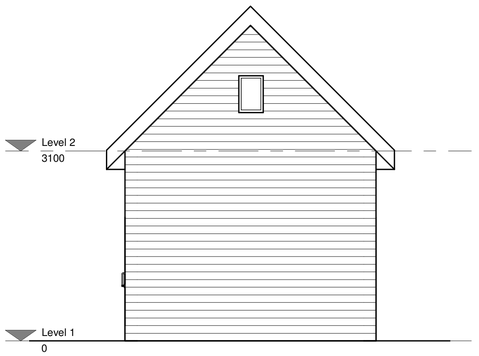
3 / A200 North Elevation
1 : 50



6 / A200 Section
1 : 50



4 / A200 South Elevation
1 : 50



5 West Elevation
1 : 50

Draft

Revision	Amendment	Approved	Revision Date

OPUS
Christchurch Office
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PO Box 1482
Christchurch 8140
New Zealand

Drawn	Designed	Approved	Revision Date
Author	Designer	Approver	

Project
CCC
Governor's Bay Park, Christchurch
Shed by Playground

Title
Existing Floor Plan, Elevations, Section

Project No.	Scale	Drawing No.	Sheet No.	Revision
6-QUCC1.81	1 : 50	6/1366/312/8602	A200	RA

Appendix 4 – CERA DEE Spreadsheet

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Governors Bay Pool Playground Shed				Reviewer:	Will Parker
	Unit	No:	Street		CPEng No:	144116
Building Address:		1	Cresswell Ave		Company:	Opus International Consultants
Legal Description:					Company project number:	6-QUCCC.61
					Company phone number:	03 363 5400
	Degrees	Min	Sec			
GPS south:	43	37	24.00		Date of submission:	20-Feb-13
GPS east:	172	38	58.50		Inspection Date:	15-Oct-12
					Revision:	Final
Building Unique Identifier (CCC):	BU 3569-001 EQ2				Is there a full report with this summary?	yes

Site

Site slope:	flat	Max retaining height (m):	
Soil type:	sandy silt	Soil Profile (if available):	
Site Class (to NZS1170.5):	D		
Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	
Proximity to clifftop (m, if < 100m):			
Proximity to cliff base (m,if <100m):		Approx site elevation (m):	

Building

No. of storeys above ground:	1	single storey = 1	Ground floor elevation (Absolute) (m):	
Ground floor split?	no		Ground floor elevation above ground (m):	
Storeys below ground	0			
Foundation type:	bored cast-insitu concrete piles		if Foundation type is other, describe:	
Building height (m):	3.10		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):	31			
Age of Building (years):	30		Date of design:	
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):			Brief strengthening description:	
Use (upper floors):				
Use notes (if required):				
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	load bearing walls		
Roof:	timber truss	truss depth, purlin type and cladding	
Floors:	timber	joist depth and spacing (mm)	70mm D at 450 crs
Beams:			
Columns:			
Walls:			

Lateral load resisting structure

Lateral system along:	lightweight timber framed walls	**Note: Define along and across in detailed report!**	note typical wall length (m)	7.8
Ductility assumed, μ:	2.00			
Period along:	0.15	0.00	estimate or calculation?	calculated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	lightweight timber framed walls		note typical wall length (m)	4
Ductility assumed, μ:	2.00			
Period across:	0.15	0.00	estimate or calculation?	calculated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	

Separations:

north (mm):		leave blank if not relevant
east (mm):		
south (mm):		
west (mm):		

Non-structural elements

Stairs:			
Wall cladding:	other light	describe	Timber weatherboard
Roof Cladding:	Metal	describe	Corrugated iron
Glazing:	timber frames		
Ceilings:	light tiles		
Services(list):			

Available documentation

Architectural	none	original designer name/date
Structural	none	original designer name/date
Mechanical	none	original designer name/date
Electrical	none	original designer name/date
Geotech report	none	original designer name/date

Damage

Site: (refer DEE Table 4-2)

Site performance:		Describe damage:	
Settlement:	none observed	notes (if applicable):	
Differential settlement:	none observed	notes (if applicable):	
Liquefaction:	none apparent	notes (if applicable):	
Lateral Spread:	none apparent	notes (if applicable):	
Differential lateral spread:	none apparent	notes (if applicable):	
Ground cracks:	none apparent	notes (if applicable):	
Damage to area:	none apparent	notes (if applicable):	

Building:

	Current Placard Status:			
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	
	Describe (summary):			
Across	Damage ratio:	0%	$Damage\_Ratio = \frac{(\%NBS(before) - \%NBS(after))}{\%NBS(before)}$	
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	yes	Describe:	damaged glazing

Recommendations

	Level of repair/strengthening required:	minor structural	Describe:	floorboards to be removed for new bearer
	Building Consent required:	no	Describe:	to pier connections
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	48% ##### %NBS from IEP below	If IEP not used, please detail assessment methodology:	Quantitative
	Assessed %NBS after:	48%		
Across	Assessed %NBS before:	48% ##### %NBS from IEP below		
	Assessed %NBS after:	48%		

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