Report

Halswell Aquatic Centre, Waterslide Detailed Engineering Evaluation BU 1691-003 EQ2 Quantitative Report

Prepared for Christchurch City Council (Client)

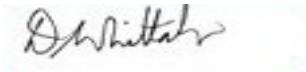
By Beca Carter Hollings & Ferner Ltd (Beca)

4 October 2013

Revision History

Revision Nº	Prepared By	Description	Date
A	Andreas Trapezaris	Draft for CCC review	22 February 2013
B	Andreas Trapezaris	Final	4 October 2013

Document Acceptance

Action	Name	Signed	Date
Prepared by	Andreas Trapezaris		4 October 2013
Reviewed by	Nicholas Charman		4 October 2013
Approved by	David Whittaker		4 October 2013
on behalf of	Beca Carter Hollings & Ferner Ltd		

Halswell Aquatic Centre - Waterslide
BU 1691-003 EQ2

Detailed Engineering Evaluation
Quantitative Report – SUMMARY
Version 1

Address
339 Halswell Road
Halswell
Christchurch

Background

This is a summary of the Quantitative Assessment report for the building structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) Revision 7 issued by the Engineering Advisory Group (EAG) in 2012.

A Qualitative Report was issued to CCC on 9 October 2012.

The Waterslide structure at Halswell Aquatic Centre is located at 339 Halswell Road, Halswell, Christchurch. No construction drawings are available. It was built in 1989-1990, as advised by CCC, and has an approximate overall length of 25m. The Waterslide is an outdoor, standalone and elevated waterslide structure which consists of diagonally braced steel frames at the entrance to the slide, and cantilever steel posts supporting the waterslide over its remaining length. Calculations have been undertaken as part of the Quantitative Assessment. Limited intrusive investigations and site measurements of critical structural elements have been undertaken.

The format and content of this report follows a template provided by CCC, which is based on the EAG document.

Key Damage Observed

No significant earthquake damage was observed during our 8 May 2012 visual inspections.

Critical Structural Weaknesses (CSW)

No Critical Structural Weaknesses have been identified as a result of our Quantitative Assessment.

Indicative Building Strength (from Detailed Assessment)

The structure has been assessed to have a seismic capacity in the order of 45%NBS using the New Zealand Society for Earthquake Engineering (NZSEE) Detailed Assessment guideline 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006, and is therefore classified as Earthquake Risk and Seismic Grade C.

Recommendations

The structure is considered to be earthquake risk, having an assessed capacity between 33% and 67%NBS.

No restrictions on use or occupancy are recommended.

It is recommended that:

- Further operational safety checks would be needed as part of re-commissioning of the slide.

Table of Contents

Appendices

1 Background

Beca Carter Hollings & Ferner Ltd (Beca) has been engaged by Christchurch City Council (CCC) to undertake a Quantitative Detailed Engineering Evaluation (DEE) of the Waterslide at Halswell Aquatic Centre located at 339 Halswell Road, Halswell, Christchurch.

This report is a Quantitative Assessment of the structure, and is based on the document 'Guidance on Detailed Engineering Evaluation of Earthquake Affected Non-residential Buildings in Canterbury – Part 2 Evaluation Procedure' (draft) Revision 7 issued by the Engineering Advisory Group (EAG) in 2012.

A quantitative assessment involves analytical calculations of the structure's strength and may involve material testing, geotechnical testing and intrusive investigation. The qualitative assessment previously carried out involved inspections of the building, a desktop review of existing structural and geotechnical information, including existing drawings and calculations, if available and an assessment of the level of seismic capacity against current code using the Initial Evaluation Procedure (IEP).

The purpose of these assessments is to determine the likely building performance and damage patterns, to identify any potential Critical Structural Weaknesses (CSW) or collapse hazards, and to make an assessment of the likely building strength in terms of percentage of New Building Standard (%NBS).

The description below is based on our visual inspections and limited site measurements only, as drawings were not available.

The format and content of this report follows a template provided by CCC, which is based on the EAG document.

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 carry out a full structural survey before the building is re-occupied.

We understand that CERA will 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). It is understood that CERA is adopting the Detailed Engineering Evaluation Procedure document (draft) Revision 7 issued by the Engineering Advisory Group in 2012, which sets out a methodology for both qualitative and quantitative assessments. We understand this report will be used in response to CERA Section 51.

The qualitative assessment includes a thorough visual inspection of the building coupled with a desktop review of available documentation such as drawings, specifications and IEP's. The quantitative assessment involves analytical calculation of the building's strength and may require non-destructive or destructive material testing, geotechnical testing and intrusive investigation.

It is anticipated that factors determining the extent of evaluation and strengthening level required will include:

- The importance level and occupancy of the building
- The placard status that was assigned during the state of emergency following the 22 February 2011 earthquake
- The age and structural type of the building
- Consideration of any Critical Structural Weaknesses
- The extent of any earthquake damage

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 any alteration. This effectively means that a building cannot be weakened as a result of an alteration (including partial demolition).

Section 115 – Change of Use

This section requires that the territorial authority (in this case Christchurch City Council (CCC)) be satisfied that the building with a new use complies with the relevant sections of the Building Code 'as near as is reasonably practicable'. Regarding seismic capacity 'as near as reasonably practicable' has previously been interpreted by CCC as achieving a minimum of 67%NBS however where practical achieving 100%NBS is desirable. The New Zealand Society for Earthquake Engineering (NZSEE) recommend a minimum of 67%NBS.

Section 121 – Dangerous Buildings

The definition of dangerous building in the Act was extended by the Canterbury Earthquake (Building Act) Order 2010, and it now defines a building as dangerous if:

- 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
- 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
- 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
- There is a risk that that other property could collapse or otherwise cause injury or death; or

- 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 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 ground shaking 33% of the shaking 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 of the 4th September 2010.

The 2010 amendment includes the following:

- A process for identifying, categorising and prioritising Earthquake Prone Buildings, commencing on 1 July 2012;
- A strengthening target level of 67% of a new building for buildings that are Earthquake Prone;
- A timeframe of 15-30 years for Earthquake Prone Buildings to be strengthened; and,
- 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.

It is understood that any building with a capacity of less than 33%NBS (including consideration of Critical Structural Weaknesses) will need to be strengthened to a target of 67%NBS of new building standard as recommended by the Policy.

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.

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:

a. Hazard Factor increased from 0.22 to 0.3 (36% increase in the basic seismic design load)
b. Serviceability Return Period Factor increased from 0.25 to 0.33 (80% increase in the serviceability design loads when combined with the Hazard Factor increase)

The increase in the above factors has resulted in a reduction in the level of compliance of an existing building relative to a new building despite the capacity of the existing building not changing.

3 Earthquake Resistance Standards

For this assessment, the building's Ultimate Limit State 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 new building standard load requirements have been determined in accordance with the current earthquake loading standard (NZS 1170.5:2004 Structural design actions - Earthquake actions - New Zealand).

No consideration has been given at this stage to checking the level of compliance against the increased Serviceability Limit State requirements.

The likely ultimate capacity of this building has been derived in accordance with the New Zealand Society for Earthquake Engineering (NZSEE) guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' (AISPBE), 2006. These guidelines provide an Initial Evaluation Procedure that assesses a building's capacity based on a comparison of loading codes from when the building was designed and currently. It is a quick high-level procedure that can be used when undertaking a Qualitative analysis of a building. The guidelines also provide guidance on calculating a modified Ultimate Limit State capacity of the building which is much more accurate and can be used when undertaking a Quantitative analysis.

The New Zealand Society for Earthquake Engineering has proposed a way for classifying earthquake risk for existing buildings in terms of %NBS and this is shown in Figure 3.1 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	Unacceptable	Unacceptable

Figure 3.1: NZSEE Risk Classifications Extracted from Table 2.2 of the NZSEE 2006 AISPBE Guidelines

Table 3.1 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. on average 0.2% in any year). It is noted that the current seismic risk in Christchurch results in a 6% risk of exceedance in the next year.

Table 3.1: %NBS Compared to Relative Risk of Failure

Building Grade	Percentage of New Building Standard (*%NBS*)	Approx. Risk Relative to a New Building
A+	>100	<1
A	80-100	1-2 times
B	67-80	2-5 times
C	33-67	5-10 times
D	20-33	10-25 times
E	<20	>25 times

4 Building Description

4.1 General

Summary information about the building is given in the following table. As no drawings were available, the information below is from site observations only. Refer to Appendix B for site measurements taken.

Table 4.1: Building Summary Information

Item	Details	Comment
Building name	Waterslide at Halswell Aquatic Centre	
Street Address	339 Halswell Road, Halswell Christchurch	
Age	Built 1989-1990	As advised by CCC. No drawings available.
Description	Outdoor, elevated waterslide with steel support structure.	
Building Footprint / Floor Area	Length = 25m	Estimated from aerial photograph
No. of storeys / basements	N/A	Support structure for hydroslide.
Occupancy / use	Recreational waterslide	Importance Level 2.
Construction	Structural steel and fibreglass	
Gravity load resisting system	Steel frame at slide entrance with intermediate vertical steel supports.	
Seismic load resisting system	Lateral loads from the platform are resisted by diagonal steel bracing in the transverse direction and cantilever steel columns longitudinally. Lateral loads from the slide, transverse and longitudinally, are resisted by cantilever steel columns.	Based on visual inspection. No drawings available.

Item	Details	Comment
Foundation system	700mm diameter concrete foundations. A depth of 700mm was adopted in the calculations.	The intrusive investigation on a single foundation was carried out to a depth of 700mm, but did not go further to prevent undermining the foundation.
Stair system	Steel	
Other notable features		
External works	Landing pool	Not reviewed
Construction information	No drawings available	Refer Appendix B for site measurements taken.
Likely design standard	NZS4203:1976	Inferred from estimated age of building. Not a 'building' structure but expected to have been designed in accordance with loading requirements or principles of NZS4203 (or similar alternative design standard).
Heritage status	Not heritage listed	
Other	Constructed on sloping land	

4.2 Structural 'Hot-spots'

Areas in which damage may be expected to occur from earthquake shaking are outlined below:

- Steel connections
- Connection of fibreglass slide sections to steelwork

5 Site Investigations

5.1 Previous Assessments

The building had a Level 2 rapid assessment undertaken on 22 June 2011 (refer to Appendix E).

Visual inspections as part of the Level 4 damage assessment were undertaken on 8 May 2012. A Qualitative Report was issued to CCC on 9 October 2012.

5.2 Level 5 Intrusive Investigations

Intrusive investigations were carried out on the foundations on 4 February 2013 as part of the Level 5 quantitative assessment. This revealed that the foundations are 700mm in diameter and have a depth of 700mm minimum. Site measurements were undertaken on 9 November 2012 (refer Appendix B).

6 Damage Assessment

6.1 Damage Summary

The table below provides a summary of damage observed during our inspection. Refer to Appendix A for photographs.

Table 6.1: Damage Summary

Damage type	Unknown	Minor	Moderate	Major	Comment
Settlement of foundations	✓				A level survey was undertaken. Refer to Section 9 and Appendix C.
Tilt of building	✓				None observed during visual inspection. Verticality survey may be required to confirm.
Liquefaction	✓				None observed during visual inspection. The aerial reconnaissance on 24 Feb 2011 shows that liquefaction occurred on neighbouring sites, where the extent was considered minor.
Settlement of external ground	✓				None observed during visual inspection.
Lateral spread / ground cracks	✓				None observed during visual inspection.
Frame					No damage observed during visual inspection.
Bracing					No damage observed during visual inspection.
Stairs					No damage observed during visual inspection.
Building services	✓				No inspections of services were carried out.
Other					

6.2 Surrounding Buildings

The Halswell Aquatic Centre has a number of other buildings on the site (See Site Layout in Appendix A), however there are no adjacent structures that are close enough that may affect the Waterslide during an earthquake.

6.3 Residual Displacements and General Observations

No evidence of permanent settlement or displacements were observed during our visual inspection, however a level survey was carried out (refer Section 9). A global verticality survey may reveal movement that could be described as damage under insurance entitlement.

6.4 Implication of Damage

Based on our visual inspection, the structure appears to be undamaged therefore we believe the structural capacity has not been affected.

7 Generic Issues

Generic issues referred to in Appendix A of the EAG guideline document are not applicable to the Waterslide structure.

8 Geotechnical Consideration

No Geotechnical information was available for this site. During the inspection, any damage to the surrounding ground was noted and any affect to the structure was considered.

9 Survey

A level survey was carried out for the Halswell Aquatic Centre (Refer to Appendix C). The survey covered the two main buildings on the site, as well as the three pools. The ground surrounding the Waterslide was not surveyed. CCC may wish to undertake a verticality level survey as part of insurance entitlement considerations.

10 Detailed Seismic Capacity Assessment

10.1 Assessment Methodology

The building has had its seismic capacity assessed using the Detailed Assessment Procedures in the NZSEE 2006 AISPBE guidelines, based on the site measurements undertaken.

No earthquake damage was observed during our visual inspections. The post-damage capacity is considered to be the same as the original capacity.

10.2 Assumptions

The following assumptions were used in our quantitative assessment:

- Structural steel yield strength, fy = 350MPa
- Concrete compressive strength, f'c = 25MPa
- Cantilever column foundation depth of 700mm

10.3 Critical Structural Weaknesses

No Critical Structural Weaknesses have been identified as a result of our Quantitative Assessment.

10.4 Seismic Parameters

The seismic design parameters based on current design requirements from NZS 1170.5:2004 and the NZBC clause B1 for this building are:

- Site soil class: D – NZS 1170.5:2004, Clause 3.1.3, Soft Soil
- Site hazard factor, Z = 0.3 – NZBC, Clause B1 Structure, Amendment 11 effective from 19 May 2011
- Return period factor Ru = 1 – NZS 1170.5:2004, Table 3.5, Importance Level 2 structure with a 50 year design life.

- Near fault factor N(T,D) = 1 – NZS 1170.5:2004, Clause 3.1.6, Distance more than 20 km from fault line.

10.5 Results of Seismic Assessment

The results of our quantitative assessment indicate the structure has a seismic capacity in the order of 45%NBS. This is less than the IEP assessment of 59%NBS in the previous Qualitative Report. Table 10.1 presents the evaluated seismic capacity in terms of %NBS of the individual structural systems in each loading direction.

Table 10.1: Summary of Seismic Assessment of Structural Systems

Item	Direction	Ductility, μ	Seismic Performance	Notes
Overall %NBS adopted from DEE	**Both**	**1.25**	**45%NBS**	**Governed by foundations**
Cantilever column steel post	Both	1.25	>100%NBS	
Steel frame	Both	1.25	>100%NBS	
Foundations	Both	1.0	45%NBS	Governed by overturning resistance of the assumed foundation size of 700mm diameter x 700mm deep (refer Appendix B).

10.6 Discussion of results

The key findings of the assessment are as follows:

- The foundations have a seismic capacity of 45%NBS, assuming a 700mm deep foundation.

The intrusive investigation of the foundation was carried out to a depth of 700mm. Excavation was halted at this depth but the foundation may continue deeper.

Based on the results of our Quantitative Assessment, the Waterslide structure is considered Earthquake Risk as the seismic capacity was assessed to be between 33% and 67%NBS, and classified as Seismic Grade C.

11 Recommendations

11.1 Occupancy

The structure is considered to be earthquake risk, having an assessed capacity in the order of 45%NBS.

No restrictions on use or occupancy are recommended.

11.2 Further Investigations, Survey or Geotechnical Work

It is recommended that:

- Further operational safety checks would be needed as part of re-commissioning of the slide.

11.3 Damage Reinstatement

According to the recent CCC Instructions to Engineers document (16 October 2012), Council's insurance provides for repairing damaged elements to a condition substantially as new. We suggest you consult further with your insurance advisor.

12 Design Features Report

No repairs are required. No new load paths are expected.

13 Limitations

The following limitations apply to this engagement:

- Beca and its employees and agents are not able to give any warranty or guarantee that all defects, damage, conditions or qualities have been identified.
- Inspections are primarily limited to visible structural components. Appropriate locations for invasive inspection, if required, will be based on damage patterns observed in visible elements, and review of the construction drawings and structural system. As such, there will be concealed structural elements that will not be directly inspected.
- The inspections are limited to building structural components only.
- Inspection of building services, pipework, pavement, and fire safety systems is excluded from the scope of this report.
- Inspection of the glazing system, linings, carpets, claddings, finishes, suspended ceilings, partitions, tenant fit-out, or the general water tightness envelope is excluded from the scope of this report.
- The assessment of the lateral load capacity of the building is limited by the completeness and accuracy of the drawings provided. Assumptions have been made in respect of the geotechnical conditions at the site and any aspects or material properties not clear on the drawings. Where these assumptions are considered material to the outcome further investigations may be recommended. It is noted the assessment has not been exhaustive, our analysis and calculations have focused on representative areas only to determine the level of provision made. At this stage we have not undertaken any checks of the gravity system, wind load capacity, or foundations.
- The information in this report provides a snapshot of building damage at the time the detailed inspection was carried out. Additional inspections required as a result of significant aftershocks are outside the scope of this work.

This report is of defined scope and is for reliance by CCC only, and only for this commission. Beca should be consulted where any question regarding the interpretation or completeness of our inspection or reporting arises.

Appendix A

Photographs

Figure A1: Site Layout (Waterslide indicated)

Photo 1: External view

Photo 2: Underside of entrance platform

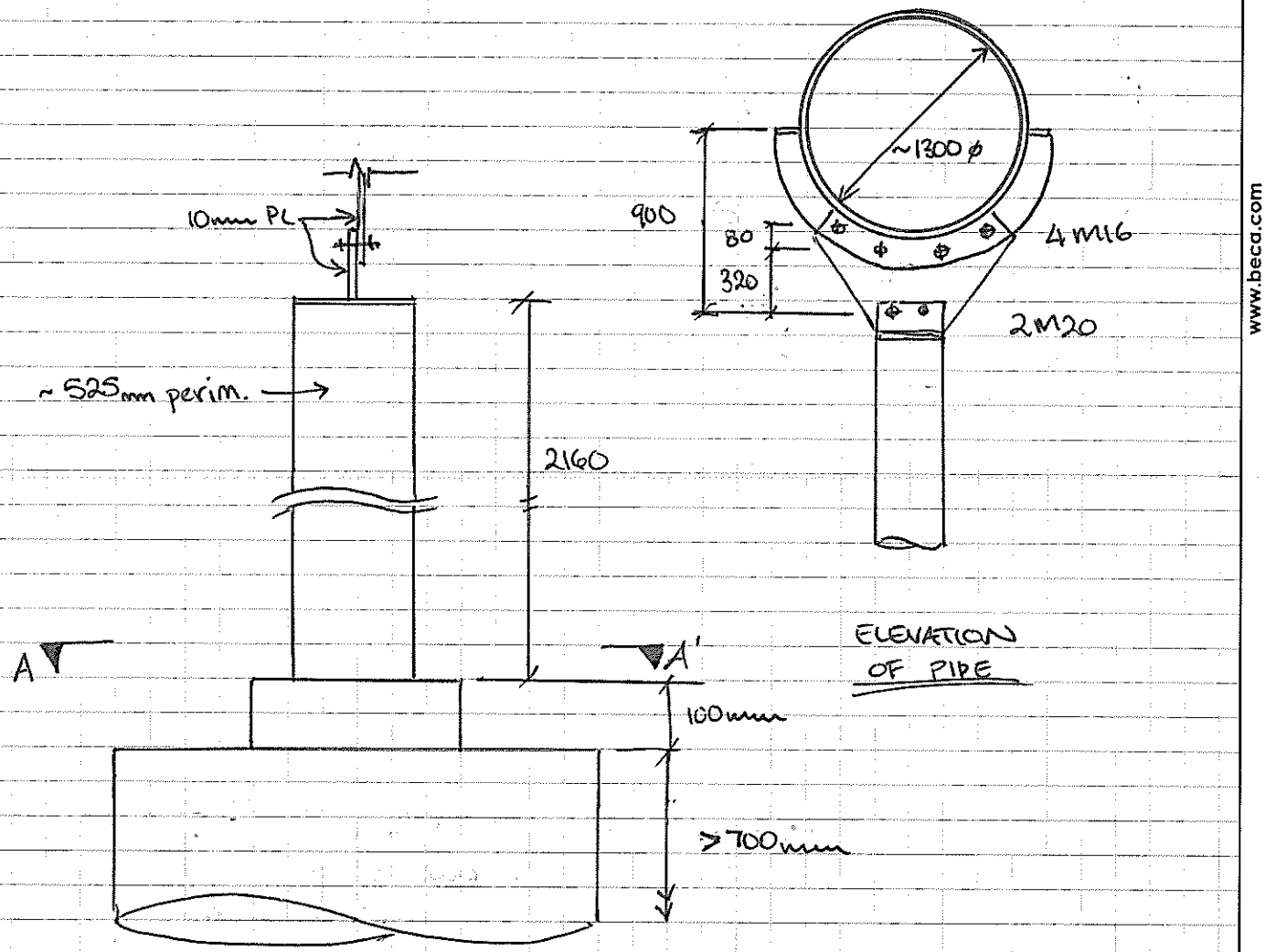
Photo 3: Exposed part of foundation

Photo 4: Connection between slide and cantilever support column

Appendix B

Site Measurements

Drawing Plotted:



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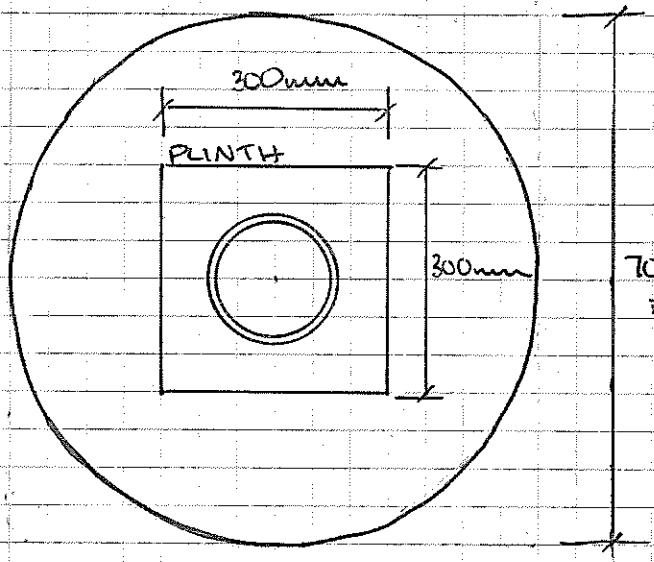

A-A'

No.	Revision	By	Chk	Appd	Date

Client: CCC

Project: HALSWELL POOL – WATERSLIDE

Title: SITE MEASUREMENTS

Approved for Construction * FOR INFO. Date:
* Refer to Revision 1 for Original Signatures

Design		
Drawn	LZC	
Dsg Verifier		
Dwg Check		

Scale as drawn (A4) NTS

Discipline

Drawing No. 6323355/127 SK01

Rev. A

Document No.

www.beca.com

DO NOT SCALE

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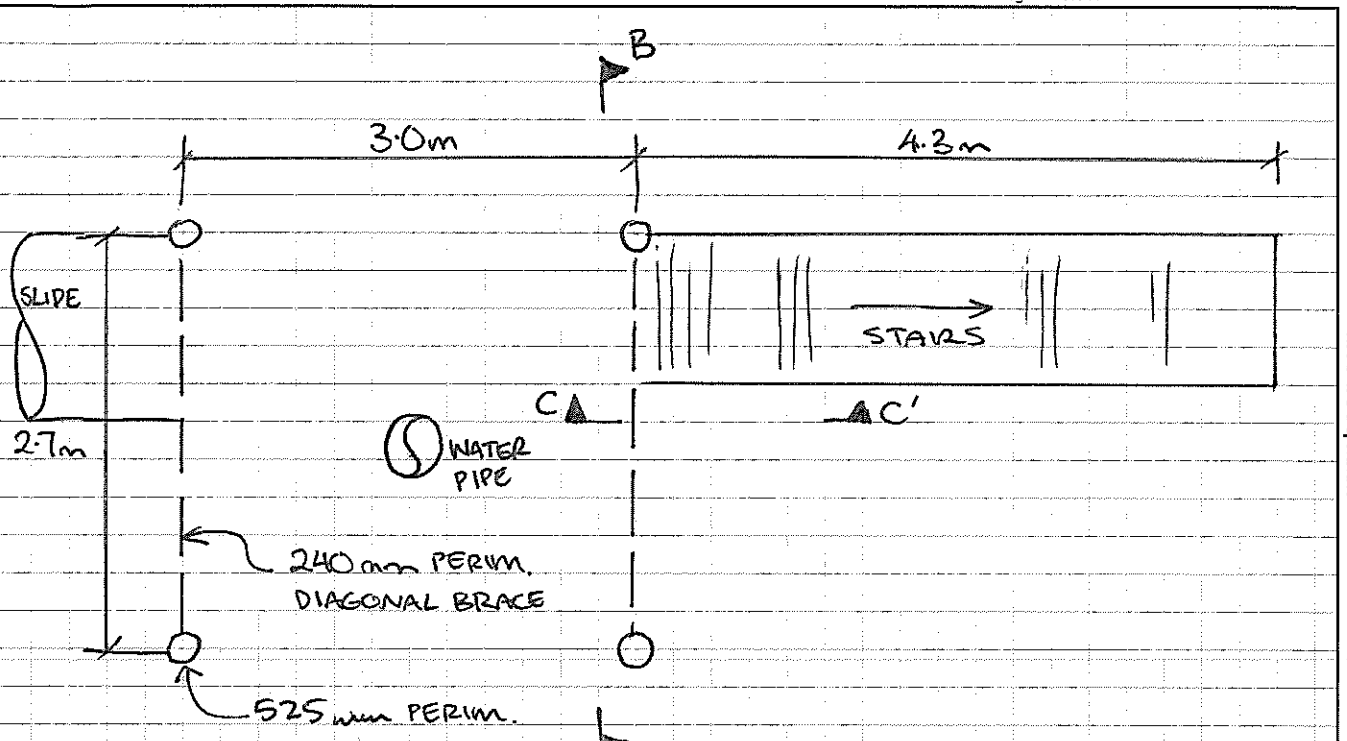
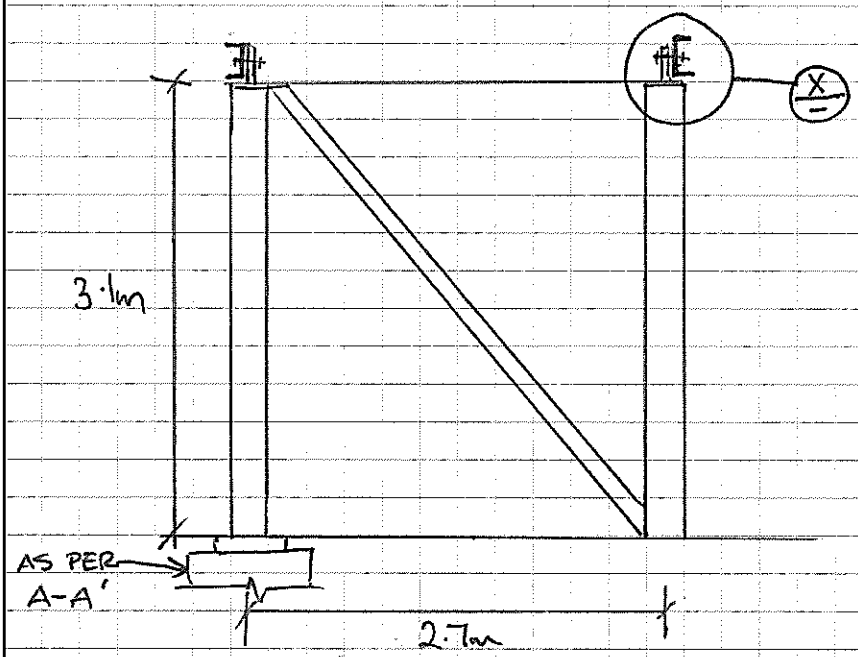
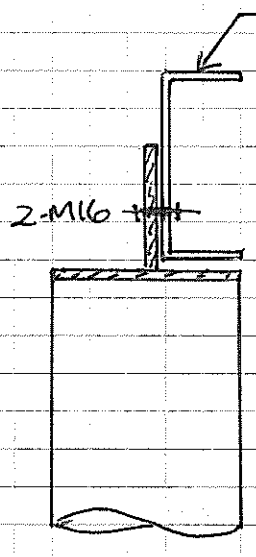


PLAN





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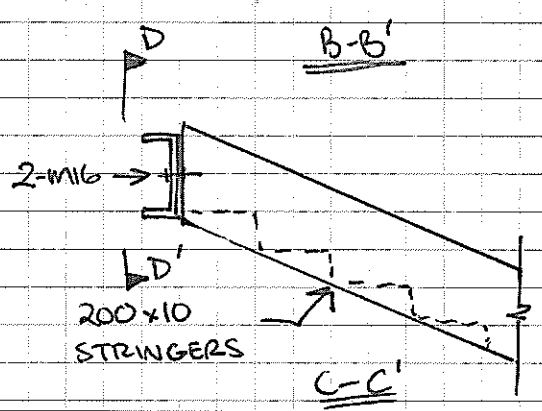
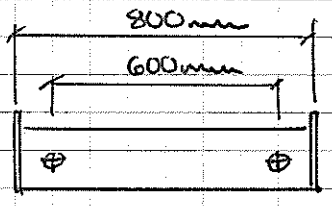


B-B'

C-C'



D-D'

No.	Revision	By	Chk	Appd	Date

Client: CCC

Project: HALSWELL POOL - WATERSLIDE

Design
Drawn: LBC
Dsg Verifier
Dwg Check

Beca

Title: SITE MEASUREMENTS

Approved for Construction * FOR INFO.
Date:
* Refer to Revision 1 for Original Signatures

Scale as drawn (A4) NTS

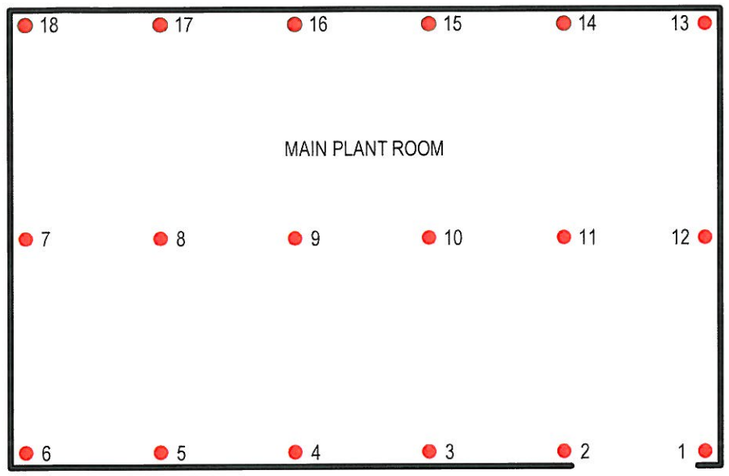
Discipline

Drawing No. 5323555/127 SK02

Rev. A

Appendix C

Site Survey Results



MEASUREMENT LOCATIONS

NOTES:
a) Plan shows measurement locations of all shots observed on the ground floor of Halswell Pool buildings.
b) All levels were observed using a Technidea Zip Level with an accuracy specified by the manufacturer of +/-3mm for any given measurement.
c) Levels in terms of CDD Datum from CCC control mark EHAL R.L. 23.79 January 2012.

FOR INFORMATION
NOT FOR CONSTRUCTION

No	Revision	By	Chk	Appd	Date
A	Rev A for Initial Release	AKH			12/11/12

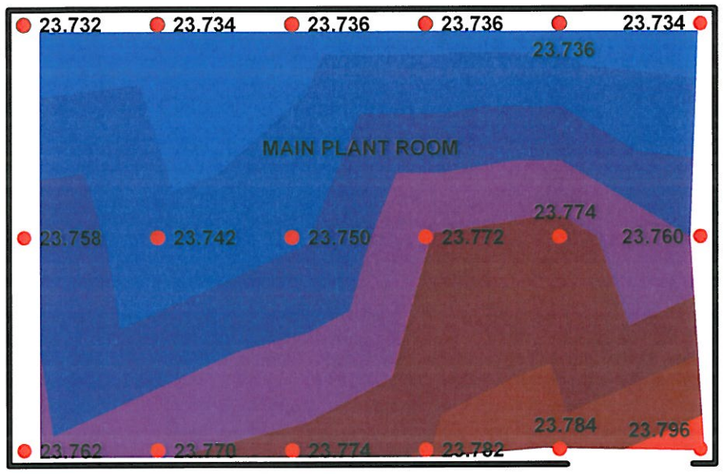
Drawing Originator: Beca

Original Scale (A1):	Surveyed: AH	07/11/12	Approved For:
	Drawn: MA	NOV 12	
Reduced Scale (A3):	Verified: DRF		
	Dwg Check:		Date

* Refer to Revision 1 for Original Signature

Client: CHRISTCHURCH CITY COUNCIL
Project: HALSWELL AQUATIC CENTRE
Title: HALSWELL POOL FLOOR LEVEL SURVEY MEASUREMENT LOCATIONS
Discipline: GEOSPATIAL
Drawing No: 5323355-GS-001
Rev: A

Drawing Plotted 12 Nov 2012 12:31 p m



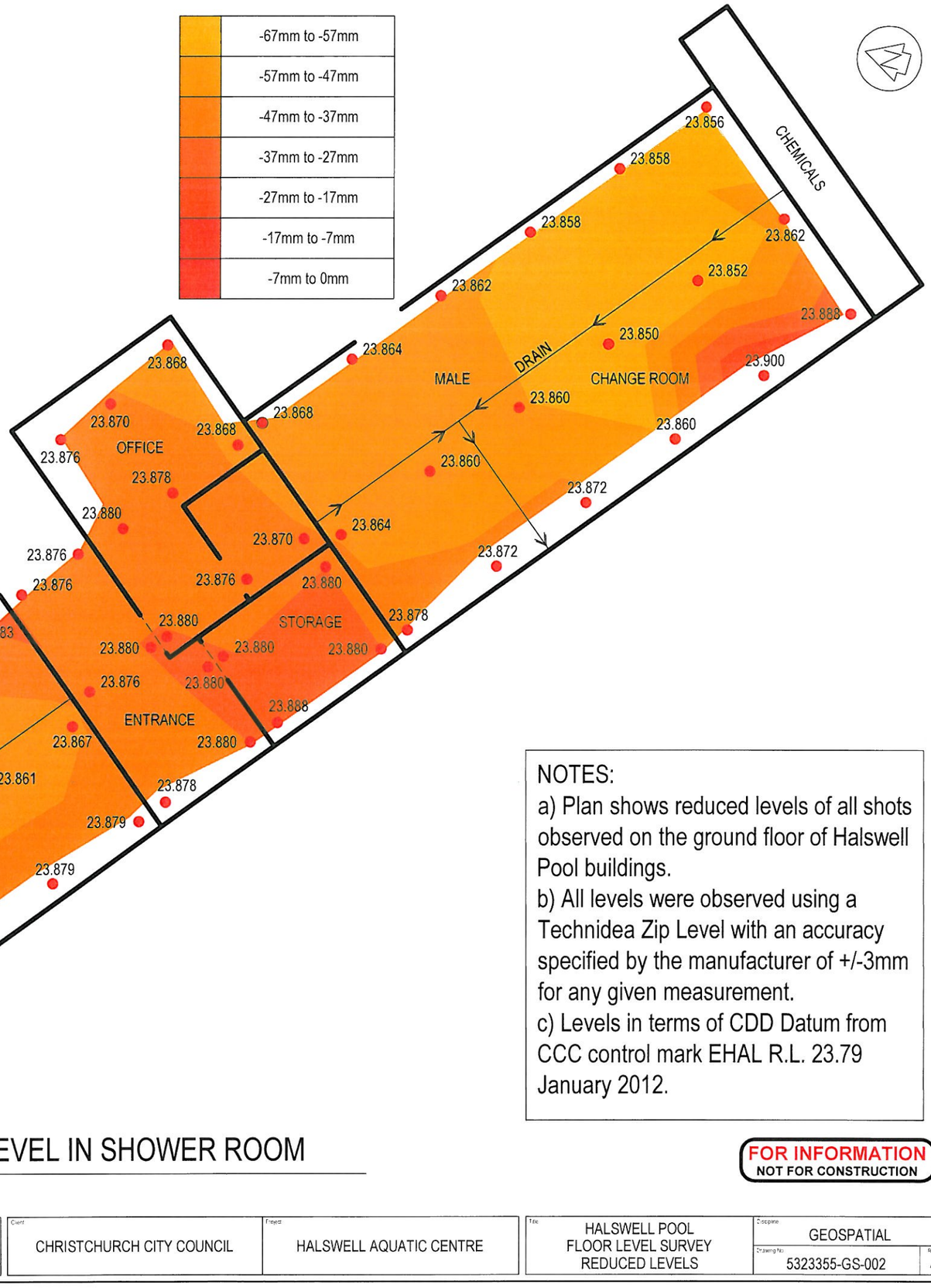
-64mm to -56mm
-56mm to -46mm
-46mm to -36mm
-36mm to -26mm
-26mm to -16mm
-16mm to -6mm
-6mm to 0mm

-67mm to -57mm
-57mm to -47mm
-47mm to -37mm
-37mm to -27mm
-27mm to -17mm
-17mm to -7mm
-7mm to 0mm

MEASUREMENT LOCATIONS

DENOTES A CHANGE IN FLOOR COVERING

-34mm to -33mm
-33mm to -23mm
-23mm to -13mm
-13mm to - 3mm
-3mm to 0mm



DROPPED FLOOR LEVEL IN SHOWER ROOM

PLAN NOT TO SCALE

NOTES:
a) Plan shows reduced levels of all shots observed on the ground floor of Halswell Pool buildings.
b) All levels were observed using a Technidea Zip Level with an accuracy specified by the manufacturer of +/-3mm for any given measurement.
c) Levels in terms of CDD Datum from CCC control mark EHAL R.L. 23.79 January 2012.

FOR INFORMATION
NOT FOR CONSTRUCTION

No	Revision	By	Chk	Appd	Date
A	Rev A for Initial Release	AKH			12/11/12

Drawing Originator: Beca

Original Scale (A1)	Surveyed	AH	07/11/12
	Drawn	MA	NOV 12
Reduced Scale (A3)	Verifier	DRF	
	Dwg Check		

Approved For Date

* Refer to Revision 1 for Original Signature

Client: CHRISTCHURCH CITY COUNCIL

Project: HALSWELL AQUATIC CENTRE

Title: HALSWELL POOL FLOOR LEVEL SURVEY REDUCED LEVELS

Discipline: GEOSPATIAL

Drawing No: 5323355-GS-002

Rev: A

Document No HALSWALL AQUATIC CENTRE DWG

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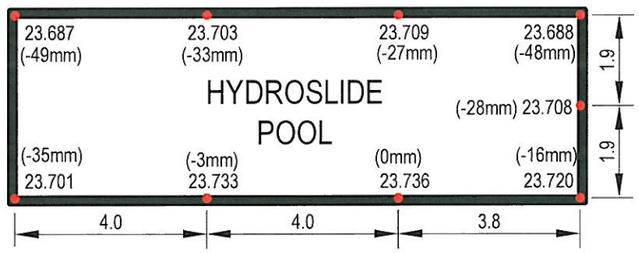
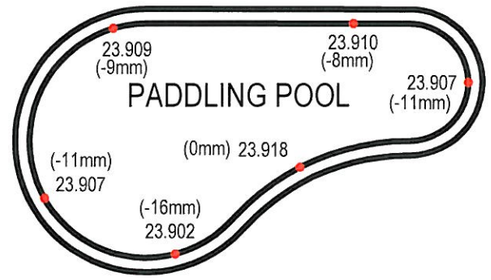
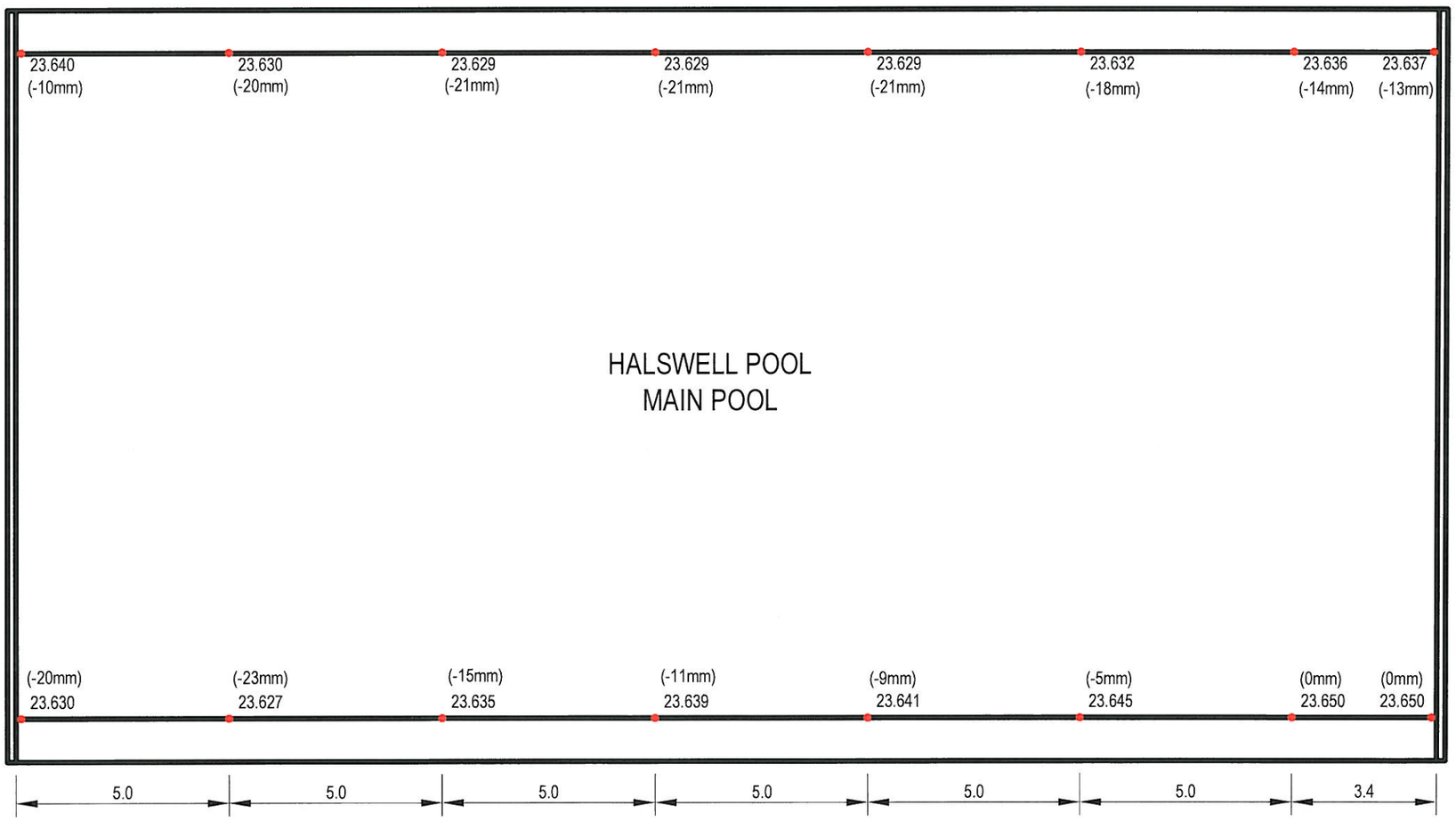






NOTES:

a) Plan shows reduced levels of all shots observed on the perimeter of the pools at the Halswell Aquatic Centre.

b) All levels were observed using a Topcon AT-30 Automatic Level which has an accuracy of +/- 2mm for any given measurement.

c) Levels in terms of CDD Datum from CCC control mark EHAL R.L. 23.79 January 2012.

PLAN NOT TO SCALE

FOR INFORMATION
NOT FOR CONSTRUCTION

No	Revision	By	Chk	Appd	Date
A	Rev A for Initial Release	AKH			12/11/12

Drawing Originator: Beca

Original Scale (A1):
Reduced Scale (A3):

Surveyed	AH	07/11/12
Drawn	MA	NOV 12
Verified	DRF	
Dwg Check		

Approved for Issue (Name): Date:

* Refer to Revision 1 for Original Signature

Client: CHRISTCHURCH CITY COUNCIL

Project: HALSWELL AQUATIC CENTRE

Title: HALSWELL POOL
POOL LEVEL SURVEY
REDUCED LEVELS

Discipline: GEOSPATIAL

Drawing No: 5323355-GS-003

Rev: A

Document No: HALSWALL AQUATIC CENTRE.DWG

Appendix D

CERA DEE Summary Data

Detailed Engineering Evaluation Summary Data V1.11

Location

Building Name:	Waterslide			Reviewer:	David Whittaker
	Unit	No:	Street	CPEng No:	123089
Building Address:	Halswell Aquatic Centre	339	Halswell Road	Company:	Beca
Legal Description:				Company project number:	5323355
				Company phone number:	03 3663521
	Degrees	Min	Sec		
GPS south:				Date of submission:	
GPS east:				Inspection Date:	8/05/2012
				Revision:	
Building Unique Identifier (CCC):	BU 1691-003 EQ2			Is there a full report with this summary?	yes

Site

Site slope:	slope < 1in 10	Max retaining height (m):	
Soil type:		Soil Profile (if available):	Unknown
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):	0.00

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):	0.00
Storeys below ground	0			
Foundation type:	isolated pads, no tie beams		if Foundation type is other, describe:	
Building height (m):	3.50		height from ground to level of uppermost seismic mass (for IEP only) (m):	
Floor footprint area (approx):				
Age of Building (years):	36		Date of design:	1976-1992
Strengthening present?	no		If so, when (year)?	
			And what load level (%g)?	
Use (ground floor):	other (specify)		Brief strengthening description:	
Use (upper floors):	other (specify)			
Use notes (if required):	Waterslide			
Importance level (to NZS1170.5):	IL2			

Gravity Structure

Gravity System:	frame system		
Roof:			none
Floors:	timber	joist depth and spacing (mm)	with steel framing
Beams:	steel non-composite	beam and connector type	
Columns:	structural steel	typical dimensions (mm x mm)	
Walls:			0

Lateral load resisting structure

Lateral system along:	other (note)	**Note: Define along and across in detailed report!**	describe system	Cantilevering steel posts
Ductility assumed, μ:	1.25			
Period along:	0.40	0.00	estimate or calculation?	estimated
Total deflection (ULS) (mm):			estimate or calculation?	
maximum interstorey deflection (ULS) (mm):			estimate or calculation?	
Lateral system across:	other (note)		describe system	Steel diagonal bracing at platform, cantilever posts supporting slide
Ductility assumed, μ:	1.25			
Period across:	0.40	0.00	estimate or calculation?	estimated
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:	steel	describe supports	
Wall cladding:			none
Roof Cladding:			none
Glazing:			none
Ceilings:			none
Services(list):	plumbing		

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:	Good	Describe damage:	No site damage was observed
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:	green		
Along	Damage ratio:	0%	Describe how damage ratio arrived at:	No damage was observed
	Describe (summary):			
Across	Damage ratio:	0%		
	Describe (summary):			
Diaphragms	Damage?:	no	Describe:	
CSWs:	Damage?:	no	Describe:	
Pounding:	Damage?:	no	Describe:	
Non-structural:	Damage?:	no	Describe:	

$$Damage\_Ratio = \frac{(\%NBS\,(before) - \%NBS\,(after))}{\%NBS\,(before)}$$

Recommendations

	Level of repair/strengthening required:	none	Describe:	
	Building Consent required:	no	Describe:	
	Interim occupancy recommendations:	full occupancy	Describe:	
Along	Assessed %NBS before:	45%	##### %NBS from IEP below	
	Assessed %NBS after:	45%	If IEP not used, please detail assessment methodology:	Force based quantitative assessment.
Across	Assessed %NBS before:	45%	##### %NBS from IEP below	
	Assessed %NBS after:	45%		

IEP **Use of this method is not mandatory - more detailed analysis may give a different answer, which would take precedence. Do not fill in fields if not using IEP.**

Period of design of building (from above): 1976-1992 — h_n from above: m

Seismic Zone, if designed between 1965 and 1992: — not required for this age of building / not required for this age of building

	along	across
Period (from above):	0.4	0.4
(%NBS)nom from Fig 3.3:		

Note:1 for specifically design public buildings, to the code of the day: pre-1965 = 1.25; 1965-1976, Zone A =1.33; 1965-1976, Zone B = 1.2; all else 1.0
Note 2: for RC buildings designed between 1976-1984, use 1.2
Note 3: for buildngs designed prior to 1935 use 0.8, except in Wellington (1.0)

	along	across
Final $(\%NBS)_{nom}$:	**0%**	**0%**

2.2 Near Fault Scaling Factor — Near Fault scaling factor, from NZS1170.5, cl 3.1.6:

	along	across
Near Fault scaling factor (1/N(T,D), **Factor A**:	#DIV/0!	#DIV/0!

2.3 Hazard Scaling Factor — Hazard factor Z for site from AS1170.5, Table 3.3:
Z_{1992}, from NZS4203:1992
Hazard scaling factor, **Factor B:** #DIV/0!

2.4 Return Period Scaling Factor — Building Importance level (from above):
Return Period Scaling factor from Table 3.1, **Factor C**:

	along	across
2.5 Ductility Scaling Factor — Assessed ductility (less than max in Table 3.2)		
Ductility scaling factor: =1 from 1976 onwards; or =kμ, if pre-1976, fromTable 3.3:		
Ductiity Scaling Factor, **Factor D**:	1.00	1.00
2.6 Structural Performance Scaling Factor: Sp:		
Structural Performance Scaling Factor **Factor E**:	#DIV/0!	#DIV/0!
2.7 Baseline %NBS, $(NBS\%)_b$ = $(\%NBS)_{nom}$ x A x B x C x D x E — **$\%NBS_b$:**	**#DIV/0!**	**#DIV/0!**

Global Critical Structural Weaknesses: (refer to NZSEE IEP Table 3.4)

3.1. Plan Irregularity, factor A: 1
3.2. Vertical irregularity, Factor B: 1
3.3. Short columns, Factor C: 1
3.4. Pounding potential — Pounding effect D1, from Table to right; Height Difference effect D2, from Table to right
Therefore, Factor D: 0
3.5. Site Characteristics 1

Table for selection of D1	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Alignment of floors within 20% of H	**0.7**	**0.8**	**1**
Alignment of floors not within 20% of H	**0.4**	**0.7**	**0.8**

Table for Selection of D2	Severe	Significant	Insignificant/none
Separation	0<sep<.005H	.005<sep<.01H	Sep>.01H
Height difference > 4 storeys	0.4	0.7	1
Height difference 2 to 4 storeys	0.7	0.9	1
Height difference < 2 storeys	1	1	1

	Along	Across
3.6. Other factors, Factor F — For ≤ 3 storeys, max value =2.5, otherwise max valule =1.5, no minimum		
Rationale for choice of F factor, if not 1		

Detail Critical Structural Weaknesses: (refer to DEE Procedure section 6)
List any: Refer also section 6.3.1 of DEE for discussion of F factor modification for other critical structural weaknesses

3.7. Overall Performance Achievement ratio (PAR)	**0.00**	**0.00**
4.3 PAR x (%NBS)b: — PAR x Baselline %NBS:	**#DIV/0!**	**#DIV/0!**
4.4 Percentage New Building Standard (%NBS), (before)		**#DIV/0!**

Official Use only:
Accepted By:
Date:

Appendix E

Previous Reports and Assessments

Christchurch Eq RAPID Assessment Form - LEVEL 2

Inspector Initials: MK
Territorial Authority: Christchurch City
Date: 21/06/2011
Time: 9:54
Final Posting (e.g. UNSAFE): G1

Building Name: HALSWELL POOL
Short Name: WATERSLIDE
Address: BU 1691-003-EQ2
301 HALSWELL ROAD
GPS Co-ordinates: S° E°
Contact Name:
Contact Phone:
Storeys at and above ground level:
Below ground level:
Total gross floor area (m²):
Year built:
No of residential Units:
Photo Taken: Yes No

Type of Construction
- ☐ Timber frame
- ☐ Steel frame
- ☐ Tilt-up concrete
- ☐ Concrete frame
- ☐ RC frame with masonry infill
- ☐ Concrete shear wall
- ☐ Unreinforced masonry
- ☐ Reinforced masonry
- ☐ Confined masonry
- ☐ Other: Water slide composite with steel supports

Primary Occupancy
- ☐ Dwelling
- ☐ Other residential
- ☐ Public assembly
- ☐ School
- ☐ Religious
- ☐ Commercial/ Offices
- ☐ Industrial
- ☐ Government
- ☐ Heritage Listed
- ☐ Other

Investigate the building for the conditions listed on page 1 and 2, and check the appropriate column. A sketch may be added on page 3

Overall Hazards / Damage	Minor/None	Moderate	Severe	Comments
Collapse, partial collapse, off foundation	☑	☐	☐	
Building or storey leaning	☐ N/A	☐	☐	
Wall or other structural damage	☐ N/A	☐	☐	
Overhead falling hazard	☑	☐	☐	
Ground movement, settlement, slips	☑	☐	☐	
Neighbouring building hazard	☑	☐	☐	
Electrical, gas, sewerage, water, hazmats	☐ N/A	☐	☐	

Record any existing placard on this building:

Existing Placard Type (e.g. UNSAFE): GREEN (COMPLEX)

Choose a new posting based on the new evaluation and team judgement. Severe conditions affecting the whole building are grounds for an UNSAFE posting. Localised Severe and overall Moderate conditions may require a RESTRICTED USE. Place INSPECTED placard at main entrance. Post all other placards at every significant entrance. Transfer the chosen posting to the top of this page.

INSPECTED GREEN: (G1) G2
RESTRICTED USE YELLOW: Y1 Y2
UNSAFE RED: R1 R2 R3

Record any restriction on use or entry:

Further Action Recommended:

Tick the boxes below only if further actions are recommended

- ☐ Barricades are needed (state location):
- ☑ Detailed engineering evaluation recommended
  - ☑ Structural
  - ☑ Geotechnical
  - ☐ Other:
- ☐ Other recommendations:

Needs thorough check before use

Estimated Overall Building Damage (Exclude Contents)

None	☐		
0-1 %	☑	31-60 %	☐
2-10 %	☐	61-99 %	☐
11-30 %	☐	100 %	☐

Sign here on completion: Kowalska
Date & Time: 22/6/11
ID:

Inspection ID: _____ (Office Use Only)

PROP1:

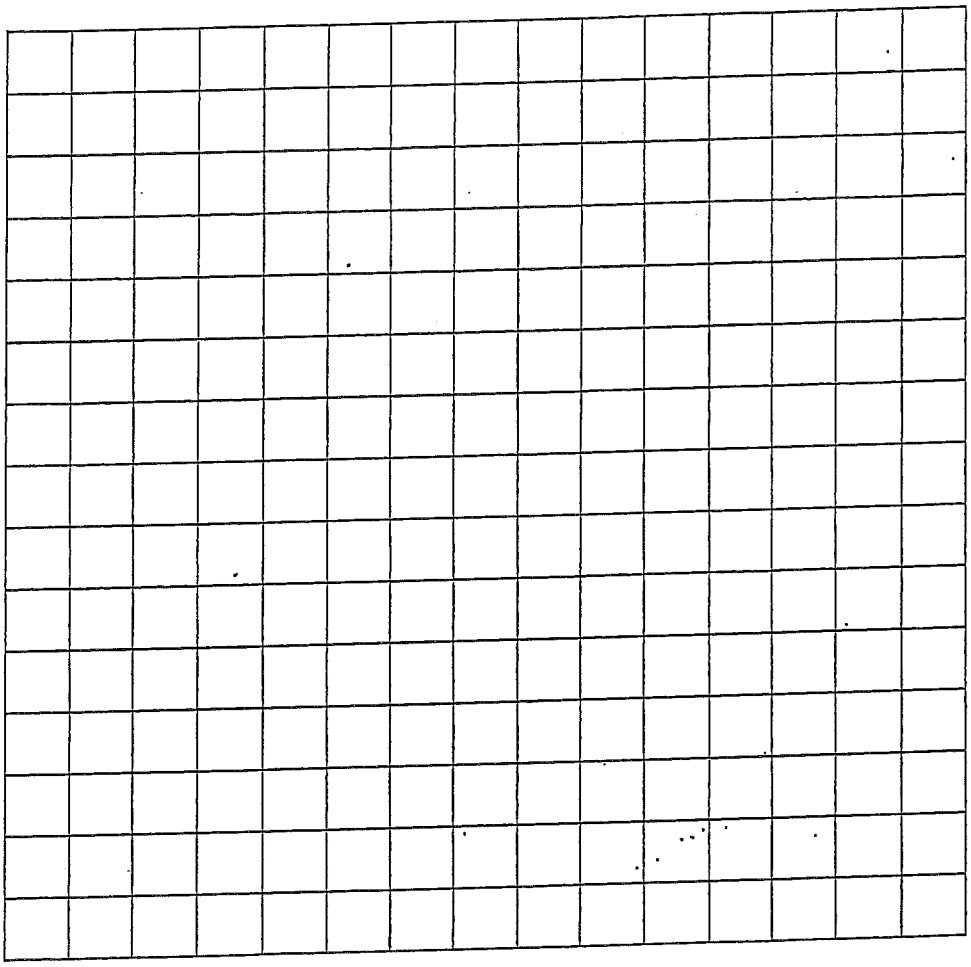
Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
Foundations	☑	☐	☐	
Roofs, floors (vertical load) steel deck	☑ N	☐	☐	
Columns, pilasters, corbels	☑	☐	☐	
Diaphragms, horizontal bracing	☑	☐	☐	
Pre-cast connections	☐ N/A	☐	☐	
Beam	☑	☐	☐	
Non-structural Hazards / Damage				
Parapets, ornamentation	☑	☐	☐	
Cladding, glazing	☐ N/A	☐	☐	
Ceilings, light fixtures	☑	☐	☐	
Interior walls, partitions	☐ N/A	☐	☐	
Elevators	☐ N/A	☐	☐	
Stairs/ Exits	☑	☐	☐	
Utilities (eg. gas, electricity, water)	☐ Not checked	☐	☐	
Other	☐	☐	☐	
Geotechnical Hazards / Damage				
Slope failure, debris	☑	☐	☐	
Ground movement, fissures	☑	☐	☐	
Soil bulging, liquefaction	☑	☐	☐	

General Comment _____

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage *Low risk*	Inspected (Green)	G1. Occupiable, no immediate further investigation required	
		G2. Occupiable, repairs required	
Medium damage *Medium risk*	Restricted Use (Yellow)	Y1. Short term entry	
		Y2. No entry to parts until repaired or demolished	
Heavy damage *High risk*	Unsafe (Red)	R1. Significant damage: repairs, strengthening possible	
		R2. Severe damage: demolition likely	
		R3. At risk from adjacent premises or from ground failure	

Sketch (optional)
Provide a sketch of the entire building or damage points. Indicate damage points.



Recommendations for Repair and Reconstruction or Demolition (Optional)