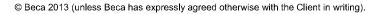
Vehicle Garage Building – Christchurch Wastewater Treatment Plant Detailed Engineering Evaluation BU 0879-019 EQ2 Quantitative Report

Prepared for Christchurch City Council (Client)

By Beca Carter Hollings & Ferner Ltd (Beca)

4 October 2013



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Revision History

Revision Nº	Prepared By	Description	Date
A	Andreas Trapezaris	Draft for CCC review	5 April 2013
В	Andreas Trapezaris	Final	4 October 2013

Document Acceptance

Action	Name	Signed	Date				
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on behalf of	Beca Carter Hollings & Ferner Ltd						



Vehicle Garage Building – Christchurch Wastewater Treatment Plant BU 0879-019 EQ2

Detailed Engineering Evaluation Quantitative Report – SUMMARY Version 1

Address Shuttle Drive Bromley 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.

The Vehicle Garage Building is located at the Christchurch Wastewater Treatment Plant (CWTP), Shuttle Drive, Bromley and is being assessed and reported in two parts. Part 1 comprises two building areas and Part 2 only one building area.

Separate Qualitative Reports for Part 1 and Part 2 of the Vehicle Garage Building were issued to CCC on 06 June 2012.

The two building areas of Part 1 are referred to as Area 1 (including Extension) and Area 2. Area 1 consists of structural steel frames and timber framed walls with internal linings, and brick veneer. Each structure was treated as structurally independent as they were built at different stages. Area 2 comprises timber framed walls with brick veneer. The floor of both areas is slab on grade and the buildings have sliding steel doors. The approximate total internal floor areas for Area 1 and 2 are 380m² and 105m² respectively.

The Part 2 area was also treated independently and consists of a timber framed building, with internal linings, brick veneer and slab on grade. This building is located between the Area 1 and Area 2 buildings of Part 1, having an approximate total internal floor area of 80m².

Partial sets of architectural and structural drawings were available for the Vehicle Garage Building which indicates the building Parts were constructed in different stages prior to 1968. Calculations for Part 1 and Part 2 have been undertaken as part of the Quantitative Assessment.

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

Key Damage Observed

Visual inspections on 1, 14 and 24 February 2012 indicate the Vehicle Garage Building has suffered minor damage. The key damage observed includes:



- Cracking to brick veneer including partial collapse of the rear wall of Part 1, Area 2 which has been removed and replaced with plywood.
- Differential settlement at the northwest corner of Part 1, Area 2.
- Cracking to adjacent retaining wall located to the north-east of the building.
- Splitting and cracking of timber framed walls at the north-east area of the Part 1, Area 1 Extension.
- Construction joint separation of approximately 25mm in Part 2.
- Minor cracking of Part 2 Gib-board lining.
- Separation between the Part 2 office area and Part 1, Area 1.

Critical Structural Weaknesses (CSW)

The following Critical Structural Weakness has been identified:

 Site Characteristics due to widespread liquefaction and tension cracks in the surrounding ground.

Indicative Building Strength (from Detailed Assessment)

The Vehicle Garage Building has been assessed to have a seismic capacity of 43%NBS, governed by Part 1, Area 1, 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.

The structural damage observed is predominantly minor and the seismic capacity is not considered to have materially diminished from its pre-earthquake level. However there are localised areas of damage such as a split stud framing in Part 1, Area 1 that should have temporary repairs to secure moderately damaged elements.

Our assessment has identified the structural components that have governed/limited the building's seismic performance, and their potential failure mechanisms, are as follows:

- Part 1, Area 1 transverse timber framed walls have a seismic capacity of 43%NBS, governed by the plasterboard bracing under in-plane loading.
- Part 1, Area 1 Extension longitudinal timber framed walls have a seismic capacity of 64%NBS, governed by the nailed connections of the timber bracing under in-plane loading.

Recommendations

In order that the owner can make an informed decision about the on-going use and occupancy of their building the following information is presented in line with the Department of Building and Housing document 'Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch', June 2012.

Part 1, Area 1 and Part 1, Area 1 Extension of the Vehicle Garage Building are considered to be Earthquake Risk, having assessed capacities between 33%NBS and 67%NBS and are classified as Seismic Grade C. The risk of collapse of an earthquake risk building is considered to be 5 to 10 times greater than that of an equivalent new building.



Part 1, Area 2 and Part 2 of the Vehicle Garage Building are considered not to be Earthquake Risk, having assessed capacities greater than 67%NBS, and are classified as Seismic Grade B. The risk of collapse of a Grade B building is 2 to 5 times greater than that of an equivalent new building.

No significant damage was identified to the seismic or gravity load resisting system of the Vehicle Garage that would reduce its ability to resist further loads and therefore no general restrictions on use or occupancy are recommended. However the damaged brick veneer is considered a collapse hazard and requires attention as recommended below.

It is recommended that:

- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- The structural integrity of the adjacent retaining wall is investigated further (not considered part of this building or DEE).
- Partially collapsed brick veneer has been removed and temporarily lined/replaced with plywood. We recommend other damaged areas of brick veneer are removed or have barriers around, as advised in our Qualitative Report and by email on 26 October 2012.
- Split timber wall studs in Part 1, Area 1 should have local repairs (temporary or permanent) to stabilise them.
- 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.



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1 Background

Beca Carter Hollings & Ferner Ltd (Beca) has been engaged by the Christchurch City Council (CCC) to undertake a Quantitative Detailed Engineering Evaluation (DEE) of the Vehicle Garage building located at the Christchurch Wastewater Treatment Plant (CWTP) at Shuttle Drive, Bromley Christchurch.

This report is a Quantitative Assessment of 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) on 2012..

A quantitative assessment involves analytical calculations of the building'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 or collapse hazards, and to make an initial assessment of the likely building strength in terms of percentage of New Building Standard (%NBS).

Partial architectural and structural drawings were made available, and these have been considered in our assessment of the building. The building description below is based on a review of the drawings and our visual inspections.

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.

Description	Grade	Risk	%NBS	Existing Building Structural Performance	Structural		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	100%NBS desirable. Improvement should achieve at least 67%NBS		
Moderate Risk Building	BorC	Moderate	34 to 66	Acceptable legally. Improvement recommended		(unless change in use) This is for each TA to decide. Improvement is not limited to 34%NBS.	Not recommended. Acceptable only in exceptional circumstances		
High Risk Building	D or E	High	33 of lower	Unacceptable (Improvement		Unacceptable	Unacceptable		

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.

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.

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

 Table 3.1: %NBS Compared to Relative Risk of Failure

4 Building Description

4.1 General

The Vehicle Garage Building is located at the Christchurch Wastewater Treatment Plant (CWTP), Shuttle Drive, Bromley and was previously considered as two parts. Part 1 comprises two building areas and Part 2 comprises only one building area (refer Figure A1 in Appendix A). Each area has a different structural system. Summary information about the buildings is given in Table 4.1.

Item	Details	Comment
Building name	Vehicle Garage Building at CWTP	
Street Address	Shuttle Drive Bromley Christchurch	
Age	Part 1: Area 1 and Area 2 were originally designed prior to 1968. Area 1 was extended in 1968. Part 2: Originally designed prior to 1968 with internal alterations undertaken in 1987.	The drawings available are for Area 1 Extension and Part 2 only. Part 1 (Area 1 Extension) drawings indicate Part 2 was constructed prior to 1968. Part 2 alteration drawing is dated 1987.
Description	Single storey.	Applies to both Parts.
Building Footprint / Floor Area	Part 1: Area 1 and Area 2 have total internal floor areas of 380m ² and 105m ² respectively. Part 2: Approximate internal floor area of 80m ² .	Excluding roof canopies. Part 2 is located at the corner between the two areas of Part 1 (and is structurally independent).
No. of storeys / basements	1 storey no basement	Applies to both Parts.
Occupancy / use	Part 1 is used for workshops and storage. Part 2 is used as offices.	Importance Level 2.

Table 4.1: Building Summary Information



ltem	Details	Comment
Construction	Part 1, Area 1: Mix of steel portal frames and timber framed wall construction with brick veneer.	Based on visual inspection and limited drawings available.
	Part 1, Area 2: Timber framed wall construction with brick veneer.	
	Part 2: Timber construction with brick veneer.	
Gravity load resisting system	Part 1, Area 1 (including Extension): Timber purlins supported by steel rafters, spanning between steel columns and timber framed walls.	Based on visual observations and the limited structural drawings of extension to Part 1, Area 1 available.
	Part 1, Area 2: Timber framed roof supported by timber framed walls.	
	Part 2: Timber framed walls supporting timber rafters, purlins and lightweight roof.	
Seismic load resisting system	Part 1, Area 1 (including Extension): Timber framed walls with diagonal bracing longitudinally and plasterboard lined timber framed walls transversely. Timber sarking and timber roof bracing was observed.	Part 1, Area 2 lateral system is based on visual inspection.
	Part 1, Area 2: Timber framed walls with diagonal bracing in both directions.	
	Part 2: Plasterboard lined timber framed walls in both directions. The roof is assumed to be braced by the plasterboard lined ceiling.	
Foundation system	Reinforced concrete slab on grade with strip footings.	Based on the limited drawings available.
Stair system	N.A.	
Other notable features	Part 1: Perimeter of building is clad by brick veneer where roller doors are not present. Part 2: The north-east and north- west walls are clad by brick veneer. The south-west and south-east walls are shared with Part 1 of the Vehicle Garage Building.	Brick ties were noted during the visual inspection.
External works	Asphalt pavement, car parking and reinforced concrete retaining wall to the north-east of the building (wall located approximately 2m from the north- east elevation of Part 1, Area 1).	Investigation may be necessary to confirm the stability of the retaining wall.



Item	Details	Comment
Construction information	Partial architectural and structural drawings (Griffiths Moffat and Partners, 1968) available for Part 1, Area 1 Extension and Part 2.	
	No architectural or structural drawings are available for the Part 1, Area 1 and Area 2 buildings.	
Likely design standard	Part 1, Area 1 Extension – NZSS 1900, Chapter 8:1965	Inferred from age of building (drawings dated 1968)
	Part 1, Area 1 and Area 2, and Part 2 – NZSS No. 95: 1955	Inferred from likely age of buildings.
Heritage status	No heritage status	
Other	A digester is to the west of the building (Part 1 Area 2)	

4.2 Structural 'Hot-spots'

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

- Differential settlement / movement between adjacent buildings (Vehicle Garage Part 1 and Vehicle Garage Part 2 buildings)
- Wall bracing
- Brick veneer
- Interface between Part 1, Area 1 and Part 1, Area 1 Extension.

5 Site Investigations

5.1 **Previous Assessments**

This building had a Level 2 rapid assessment undertaken after the February 2011 earthquakes (refer to Appendix D). Another rapid assessment was undertaken following the June 2011 earthquake events, however, we have been unable to obtain a copy of this report.

A series of damage assessments have previously been undertaken including the following by Beca:

- CWTP Earthquake Damage Minor Structural Repairs report dated 20 October 2010 issued after the September 2010 earthquake.
- CWTP: Post-Earthquake Structural Damage Assessment report dated 1 April 2011 issued after the February 2011 earthquake.
- CWTP: Claim Report Civil and Structural Repairs issued 30 November 2011.

Visual inspections as part of the Level 4 damage assessment were undertaken on 1, 14 and 24 February 2012. A Qualitative Report was issued to CCC on 1 June 2012.

5.2 Level 5 Intrusive Investigations and Site Measures

As only a partial set of drawings was available for the Vehicle Garage Building, information used in the Level 5 Quantitative Assessment was obtained through site measurements of the building. No intrusive investigations were carried out as part of the Level 5 Quantitative Assessment.



6 Damage Assessment

6.1 Damage Summary

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

Damage type			i abie		Comment	
	Unknown	Minor	Moderate	Major		
settlement of foundations		•			Cracks were observed in the reinforced concrete retaining wall located 2m from the north-east face of Part 1, Area 1. Crack widths of up to 2mm were measured. Possible damage to the Part 1, Area 2 foundation due to observed instability in digester sloped ground. Separation / differential settlement noted between Vehicle Garage Part 1 and Part 2.	
tilt of building	✓				None observed during visual inspection. Verticality survey may be required to confirm.	
liquefaction	•				Widespread liquefaction in surrounding site and neighbourhood. None observed during our visual inspection.	
settlement of external ground		~			Cracks in north-east face of adjacent concrete retaining wall as noted above.	
lateral spread / ground cracks	•				A previous damage assessment report noted tension cracks in the sloped ground at Digester No. 4 west of Part 1, Area 2. None observed during our visual inspection.	
frame			✓		Part 1: Cracking and splitting of timber studs where the brick veneer ties and timber brace members are connected.	
concrete walls		✓			Cracking in adjacent retaining wall as noted above.	
cracking to concrete floors			✓		Part 2: Construction joint seperation of approximately 25mm in Part 2 - between the concrete slab floor built in 1987 and the original structure. (refer to Appendix A for typical damage)	
bracing		✓			Cracking and splitting to timber bracing.	
precast flooring seating					Not Applicable	
stairs					Not Applicable	

Table	6.1:	Damage	Summary
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Damage type	Unknown	Minor	Moderate	Major	Comment
cladding /envelope			~		Separation between Vehicle Garage Part 1 and Part 2 buildings (refer to Appendix A for typical damage). Widespread cracking in the brick veneer. This is considered to be a potential hazard for people walking around the outside.
internal fit out		~			Part 1: Vertical crack of the original Part 1, Area 1 external wall now acting as a brick veneer partition to Part 1, Area 1 Extension. Part 2: Minor cracking in GIB lined partitions (refer to Appendix A for typical damage).
building services	✓				No inspection of services.
other					

6.2 Surrounding Buildings

The sloping ground around the digester, located approximately 10m to the west of the building, has experienced tension cracking as reported in the CWTP: Post-Earthquake Structural Damage Assessment report dated 1 April 2011. This report recommends an investigation into the stability of the sloped ground.

The retaining wall located approximately 2m from the north-east wall of the building has widespread vertical cracking. Failure of this retaining wall may affect the building's foundations. A full damage and stability check of the retaining wall is recommended.

6.3 Residual Displacements and General Observations

Differential movement and settlement between areas of the building was observed during our visual inspection. A global settlement survey may be required to determine the extent of settlement and displacement of the building.

6.4 Implication of Damage

Based on our visual inspection, the structure appears to have suffered minor structural damage only and therefore we believe the structural capacity has not materially diminished.

The damaged brick veneer is a hazard and should be removed or barricaded off. Some temporary works, where brick veneer has been removed and replaced with plywood, were completed prior to the issue of this report.

7 Generic Issues

The following generic issues referred to in Appendix A of the EAG guideline document have been identified as applicable to the Vehicle Garage Building:

Structural irregularity



Inadequate foundations

The building is clad with brick veneer. As part of further inspecting and repairing the damage, the adequacy of veneer ties to the whole building should be assessed.

8 Geotechnical Consideration

We have obtained previous geotechnical reports for the Christchurch Wastewater Treatment Plant: the Christchurch Wastewater Treatment Plant Upgrade 1998 Geotechnical Report, and the Proposed Biosolids Drying Facility: Geotechnical Interpretive Report dated March 2008. Neither of these reports have boreholes in the vicinity of the Vehicle Garage Building, however, the ground conditions across the site appear to be fairly consistent, with sand and silty sand logged to a depth of 20m. These reports state that liquefaction was considered likely in a significant earthquake, with potential damage occurring as a result of liquefaction and the resulting settlements. This is consistent with the damage observed following the recent earthquakes.

Widespread vertical cracking in the retaining wall adjacent to the building is most likely due to settlement or liquefaction of the ground caused by recent Canterbury earthquake events. In addition, there are tension ground cracks in the sloping ground by the digester behind Part 1, Area 2 of the Vehicle Garage Building. Differential settlement and movement between adjacent buildings were observed during our visual inspections.

9 Survey

No level or verticality surveys were carried out. CCC may wish to undertake a 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 limited drawings available and site measurements undertaken.

The structure has suffered minor structural damage. 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:

- Concrete compressive strength, f_c = 20 MPa
- Timber compressive parallel strength, f_c = 20.9 MPa
- Timber tension parallel strength, $f_t = 10.5$ MPa
- Timber bending parallel strength, f_{b=} = 17.7 MPa
- Timber brace connection comprises of 3 nails of 3.55mm diameter (from a typical connection review during site measurements)
- Plasterboard linings and fixings achieve 50% of current GIB values.



10.3 Critical Structural Weaknesses

The following Critical Structural Weakness was identified in the Qualitative Report:

 Site Characteristics due to widespread liquefaction and tension cracks in the surrounding ground.

The site characteristics have been identified as a potential CSW in our earlier Qualitative Report. We note that liquefaction is still considered a potential CSW however it has not been considered in this quantitative assessment as we believe it will not significantly impact the structure's ability to resist further loads or cause global failure of the structure.

10.4 Seismic Parameters

The seismic design parameters based on current design requirements from NZS1170.5:2004 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 that the Vehicle Garage Building Part 1, Area 1 has a seismic capacity in the order of 43%NBS. This is higher than the IEP assessment of 22%NBS given in the previous Qualitative Report. Table 10.1 presents the evaluated seismic capacity for Part 1, Area 1 in terms of %NBS of the individual structural system in each direction.

Note: Ductility factors are in accordance with values recommended in the NZSEE 2006 AISPBE guidelines.

ltem	Direction	Ductility, μ	Seismic Performance	Notes
Overall %NBS adopted from DEE	Transverse	3.0	43%NBS	Governed by plasterboard lined timber framed walls.
Plasterboard lined timber framed walls	Transverse	3.0	43%NBS	Assessed using GIB EzyBrace Systems and adopting a 50% reduction factor.
Timber frame wa ll bracing	Longitudinal	1.25	49%NBS	Governed by capacity of nailed connections in bracing members.

Part 1, Area 1 Extension has been assessed to have a seismic capacity in the order of 64%NBS. This is higher than the IEP assessment of 22%NBS given in the previous Qualitative Report. Table 10.2 presents the evaluated seismic capacity for Part 1, Area 1 Extension in terms of %NBS of the individual structural system in each direction.



ltem	Direction	Ductility, μ	Seismic Performance	Notes		
Overall %NBS adopted from DEE	Longitudinal	1.25	64%NBS	Governed by nailed connections.		
Plasterboard lined timber framed walls	Transverse	3.0	78%NBS	Assessed using GIB EzyBrace Systems and adopting a 50% reduction factor.		
Timber frame wall bracing	Longitudinal	1.25	64%NBS	Governed by capacity of nailed connections in bracing members.		

Table 10.2: Summary of Seismic Assessment of Structural Systems for Part 1, Area 1Extension

Part 1, Area 2 has been assessed to have a seismic capacity in the order of 78%NBS. This is higher than the IEP assessment of 30%NBS given in the previous Qualitative Report. Table 10.3 presents the evaluated seismic capacity for Part 1, Area 2 in terms of %NBS of the individual structural system in each direction.

Table 10.3: Summary of Seismic Assessment of Structural	Systems for Part 1, Area 2
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Item	Direction	Ductility, µ	Seismic Performance	Notes
Overall %NBS adopted from DEE	Transverse	1.25	78%NBS	Governed by bracing tension capacity.
Timber frame wa ll bracing	Both	1.25	78%NBS	Governed by transverse bracing tension capacity.
Timber frame wall bracing connections	Both	1.25	82%NBS	Governed by transverse timber brace nailed connections.

Part 2 has been assessed to have a seismic capacity in the order of 72%NBS. This is higher than the IEP assessment of 30%NBS given in the previous Qualitative Report. Table 10.4 presents the evaluated seismic capacity for Part 2 in terms of %NBS of the individual structural system in each direction.

Table 10.4: Summary of Seismic Assessment of Structural Systems for Part 2
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ltem	Direction	Ductility, µ	Seismic Performance	Notes
Overall %NBS adopted from DEE	Transverse	3.0	72%NBS	Assessed to NZS 3604:2011
Timber framed walls (plasterboard lined)	Both	3.0	72%NBS	Governed by transverse direction. Assessed to NZS 3604:2011

10.6 Discussion of results

The key findings of the assessment are as follows:



- Part 1, Area 1 transverse timber framed walls have a seismic capacity of 43%NBS, governed by the plasterboard bracing under in-plane loading.
- Part 1, Area 1 Extension longitudinal timber frame walls have a seismic capacity of 64%NBS, governed by the nailed connections of the timber bracing under in-plane loading.

Based on the results of our Quantitative Assessment, Part 1, Area 1 and Part 1, Area 1 Extension of the Vehicle Garage Building are considered Earthquake Risk as the seismic capacity of each structure was assessed to be between 33%NBS and 67%NBS, and are both classified as Seismic Grade C.

Part 1, Area 2 and Part 2 of the Vehicle Garage Building are considered not Earthquake Risk as the seismic capacity of each structure was assessed to be greater than 67%NBS, and are both classified as Seismic Grade B.

11 Recommendations

11.1 Occupancy

In order that the owner can make an informed decision about the on-going use and occupancy of their building the following information is presented in line with the Department of Building and Housing document 'Guidance for engineers assessing the seismic performance of non-residential and multi-unit residential buildings in greater Christchurch', June 2012.

Part 1, Area 1 and Part 1, Area 1 Extension of the Vehicle Garage Building are considered to be Earthquake Risk, having assessed capacities between 33%NBS and 67%NBS and are classified as Seismic Grade C. The risk of collapse of an earthquake risk building is considered to be 5 to 10 times greater than that of an equivalent new building.

Part 1, Area 2 and Part 2 of the Vehicle Garage Building are considered not to be Earthquake Risk, having assessed capacities greater than 67%NBS, and are classified as Seismic Grade B. The risk of collapse of a Grade B building is 2 to 5 times greater than that of an equivalent new building.

No significant damage was identified to the seismic or gravity load resisting system of the Vehicle Garage that would reduce its ability to resist further loads and therefore no general restrictions on use or occupancy are recommended. However there are localised areas of damage such as a split stud framing in Part 1, Area 1 that should have temporary repairs to secure moderately damaged elements. The damaged brick veneer is considered a collapse hazard and requires attention as recommended below.

11.2 Further Investigations, Survey or Geotechnical Work

It is recommended that:

- A verticality and level survey could be carried out to determine the extent of settlement of the building for insurance purposes.
- The structural integrity of the adjacent retaining wall is investigated further (not considered part of this building or DEE).
- Partially collapsed brick veneer has been removed and temporarily/replaced with plywood. We
 recommend other damaged areas of brick veneer are removed or have barriers around, as
 advised in our Qualitative Report and by email on 26 October 2012.
- Split timber wall studs in Part 1, Area 1 should have local repairs (temporary or permanent) to stabilise them.



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

Repairs will be required to reinstate the existing structural system. A repair methodology has not been prepared at this stage. No new load paths are expected as a result of the repairs required.

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



Photo 1: Exterior view of Part 1, Area 1



Photo 2: Interior view of Part 1, Area 1



Photo 3: Interior view of Part 1, Area 1



Photo 4: Exterior view of Part 1, Area 2



Photo 5: Interior view of Part 1, Area 2

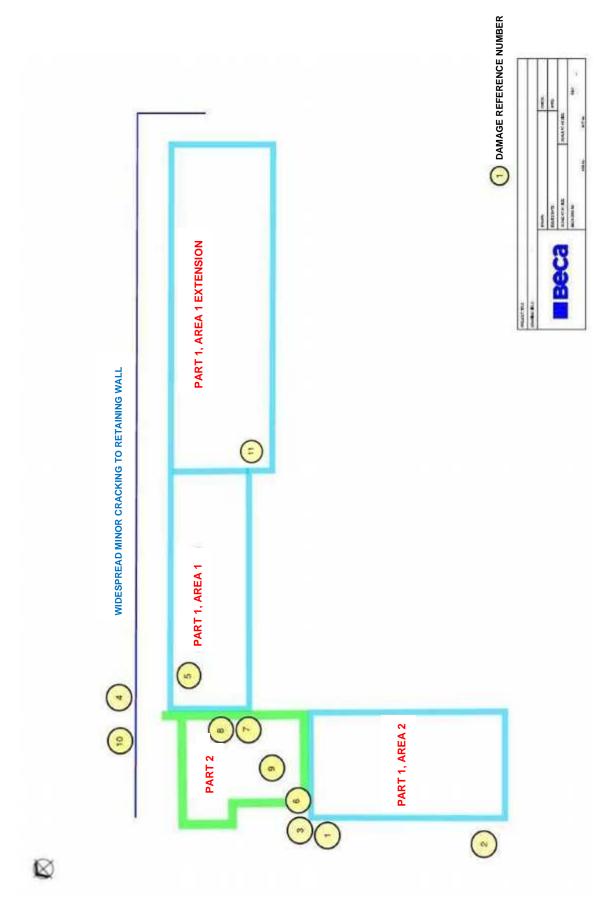


Figure A2: Plan of Damage Photos



Photo 6: Damage at location 1

General damage description: Damage to brick veneer.



Photo 7: Damage location 2

General damage description: Cracked brick veneer (30mm crack width) - has been removed and replaced with plywood.



Photo 8: Damage at location 3

General damage description: Differential settlement between adjacent walls.



Photo 9: Damage at location 4

General damage description: Cracking in retaining wall.



Photo 10: Damage at location 5

General damage description: Timber framed walls splitting of vertical stud members at brick veneer tie and bracing locations.



Photo 11: Damage at location 5 General damage description: Cracking and splitting of timber brace



Photo 12: Damage at location 7

General damage description: Separation at plaster board joint.

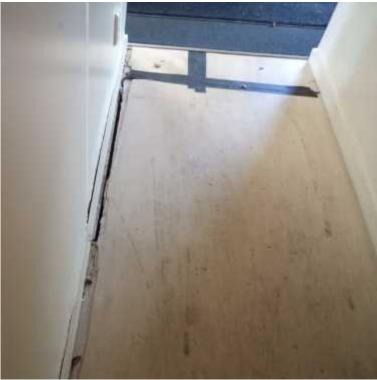


Photo 13: Damage at location 8

General damage description: Separation at slab joint.

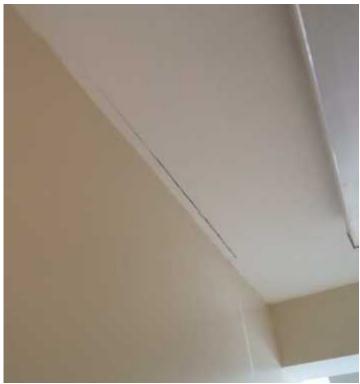


Photo 14: Damage at location 8

General damage description: Separation at plaster board ceiling.



Photo 15: Damage at location 9

General damage description: Crack in concrete slab.



Photo 16: Damage at location 10

General damage description: Cracking in retaining wall.



Photo 17: Damage at location 11

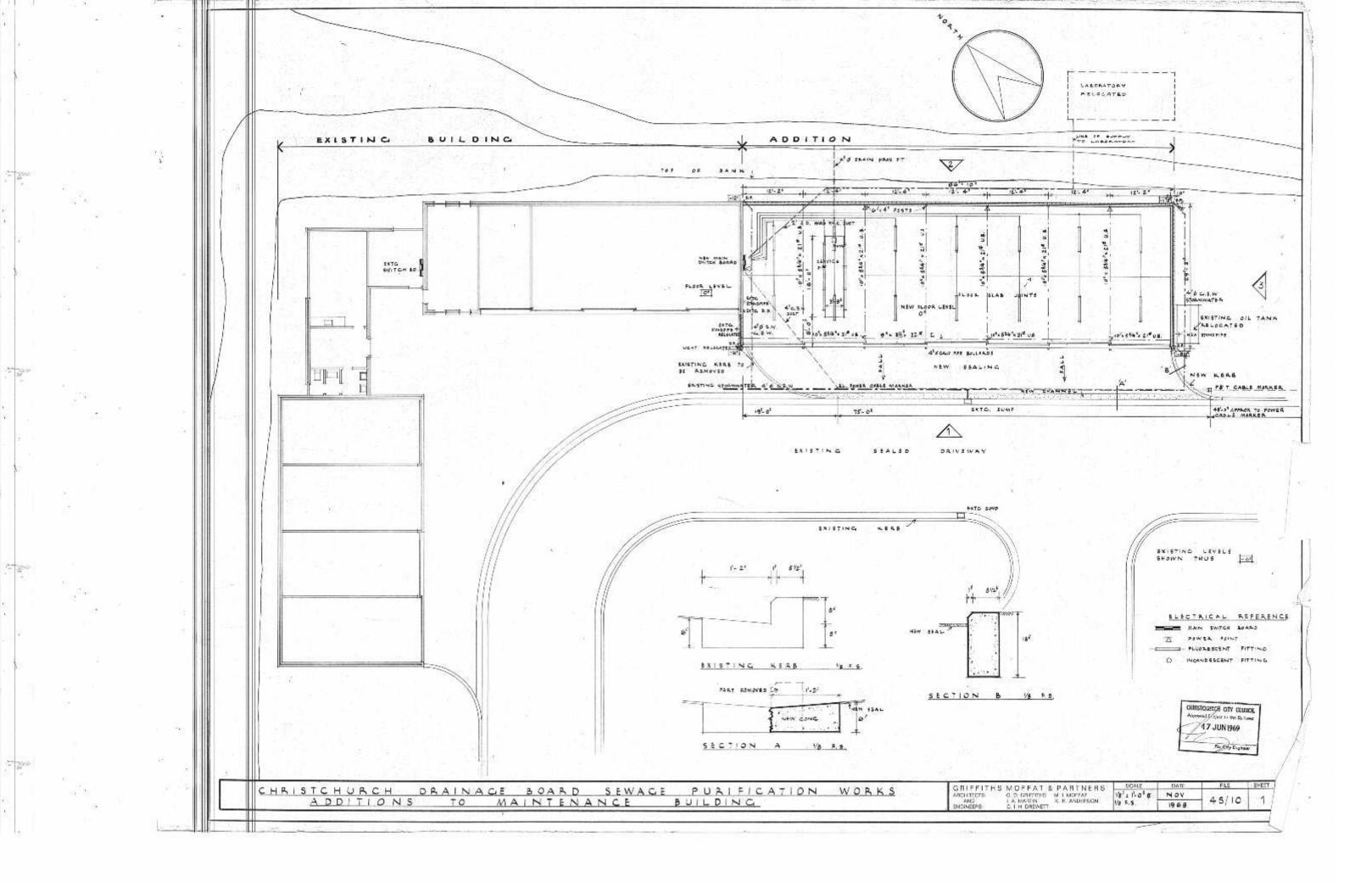
General damage description: Vertical crack in brick veneer between Part 1, Area 1 and Area 1 Extension.

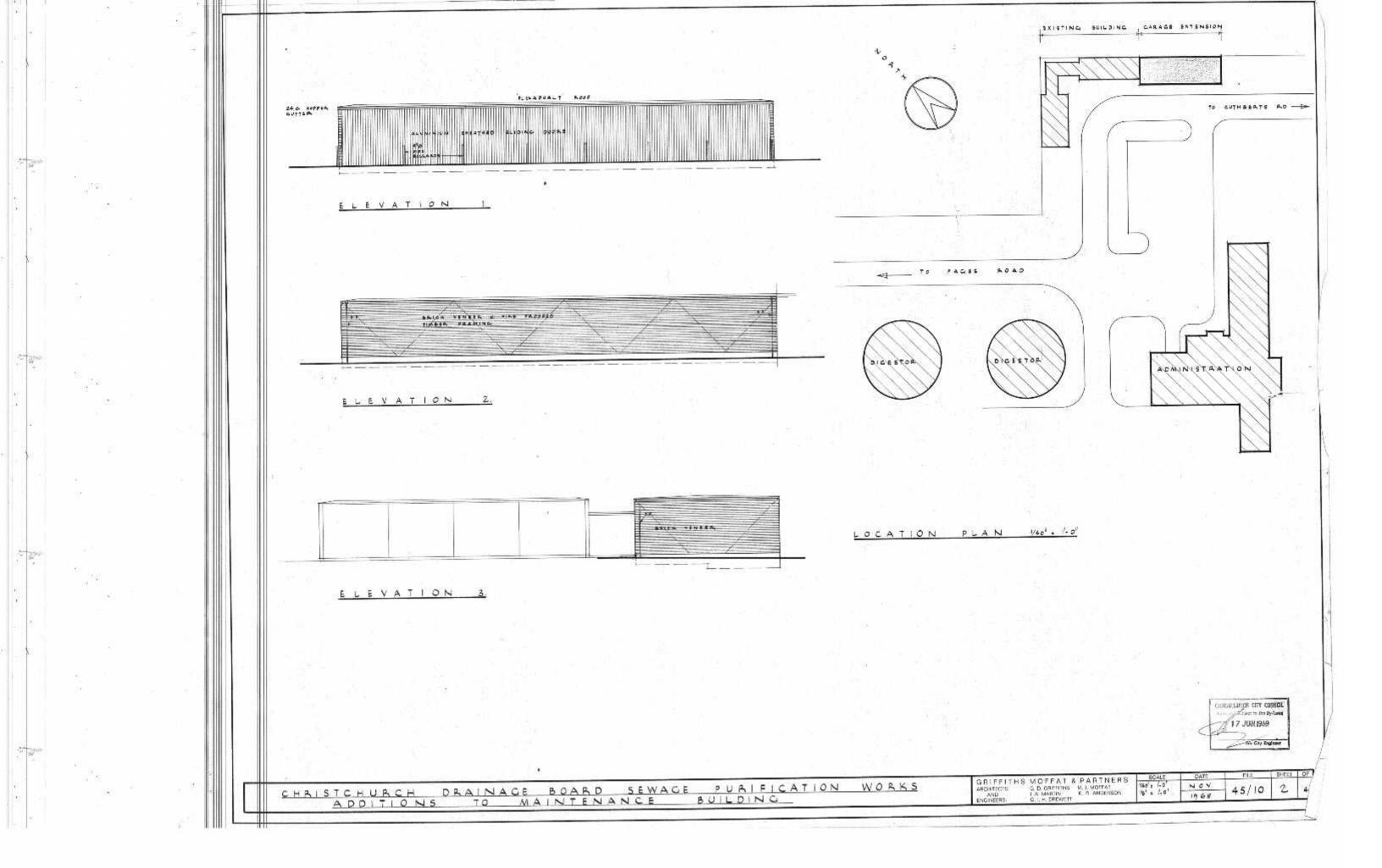
Appendix B

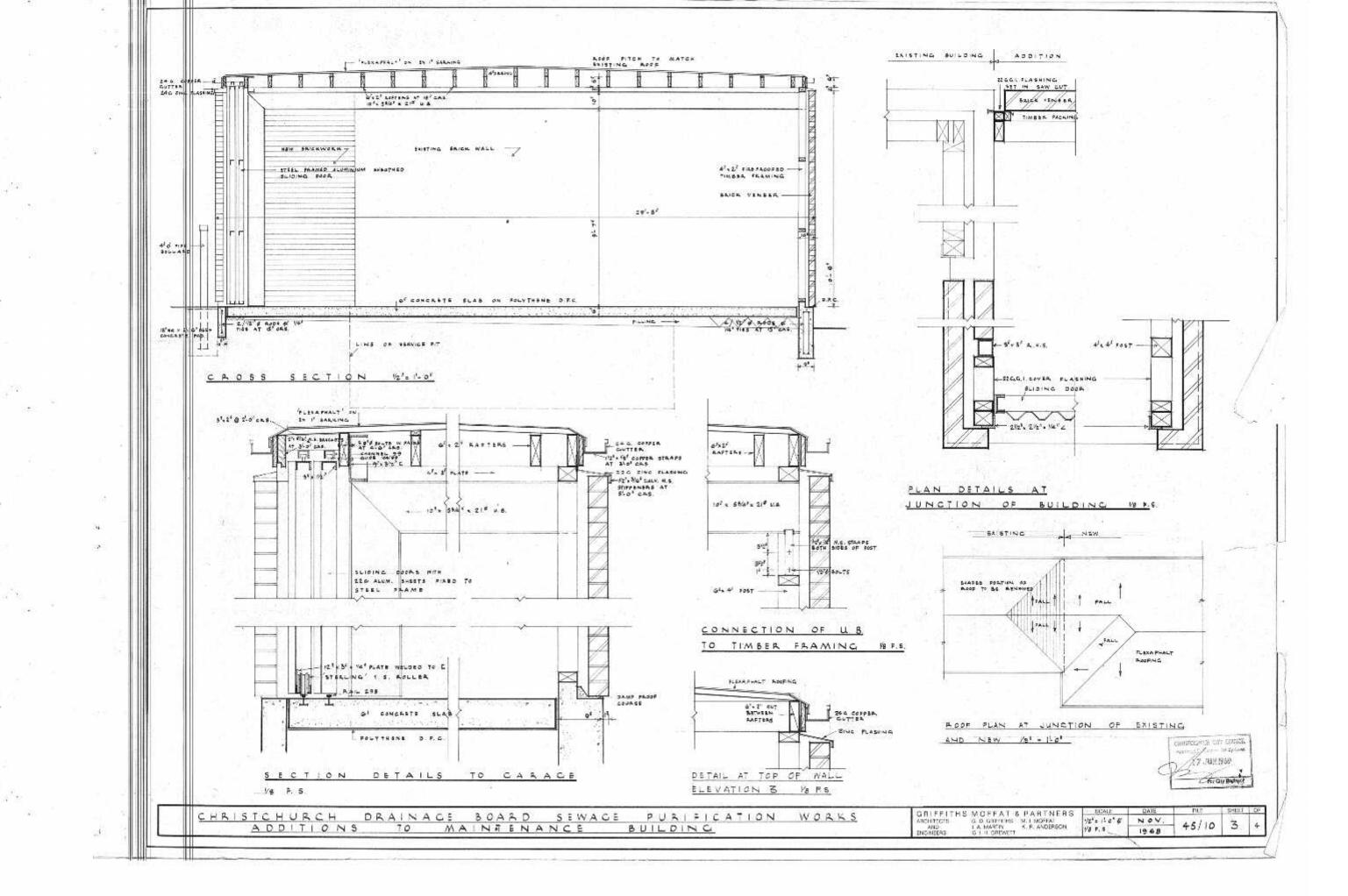


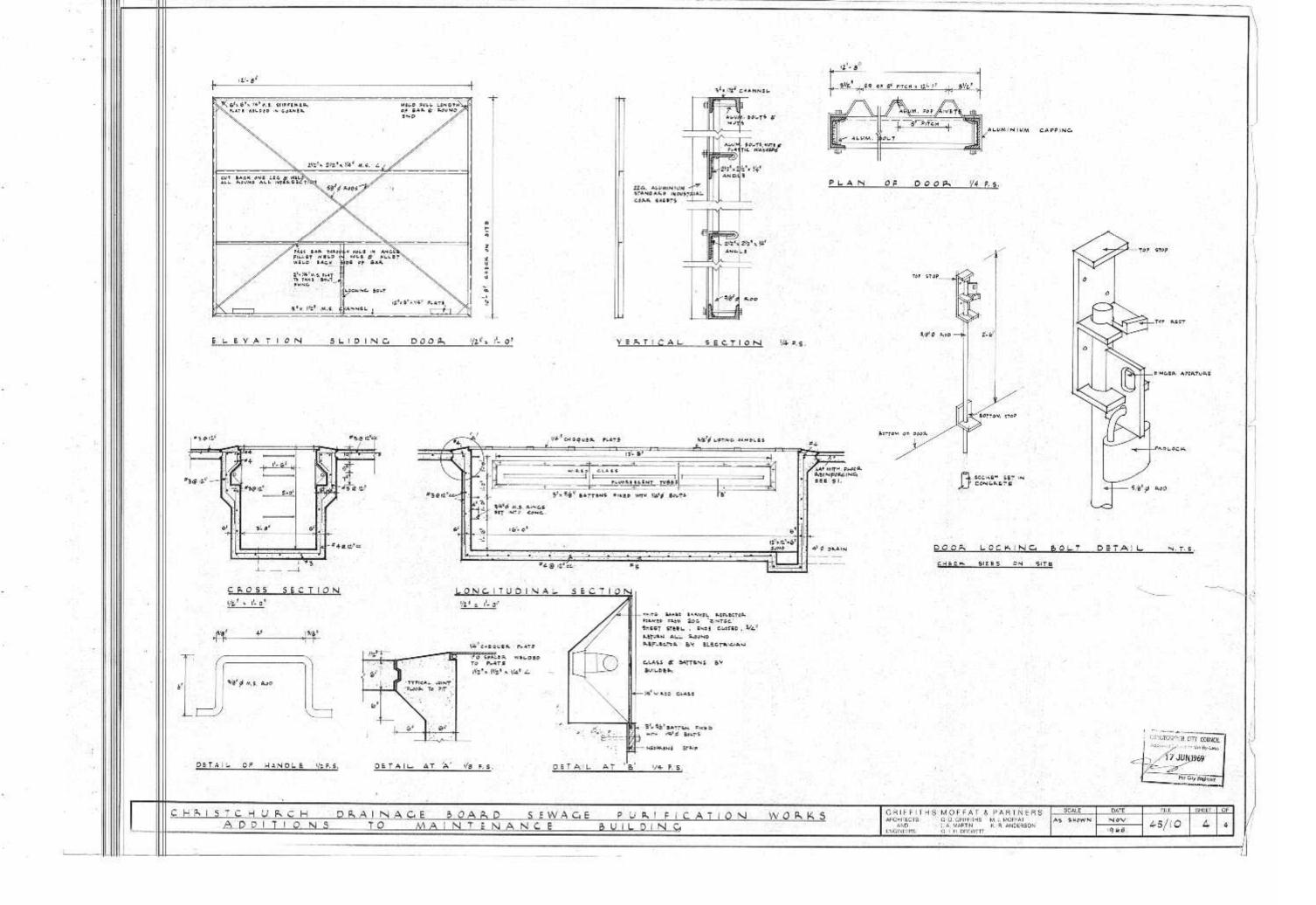
n Part 1, Area 1 Extension Drawings

n Part 2 Alteration Drawings

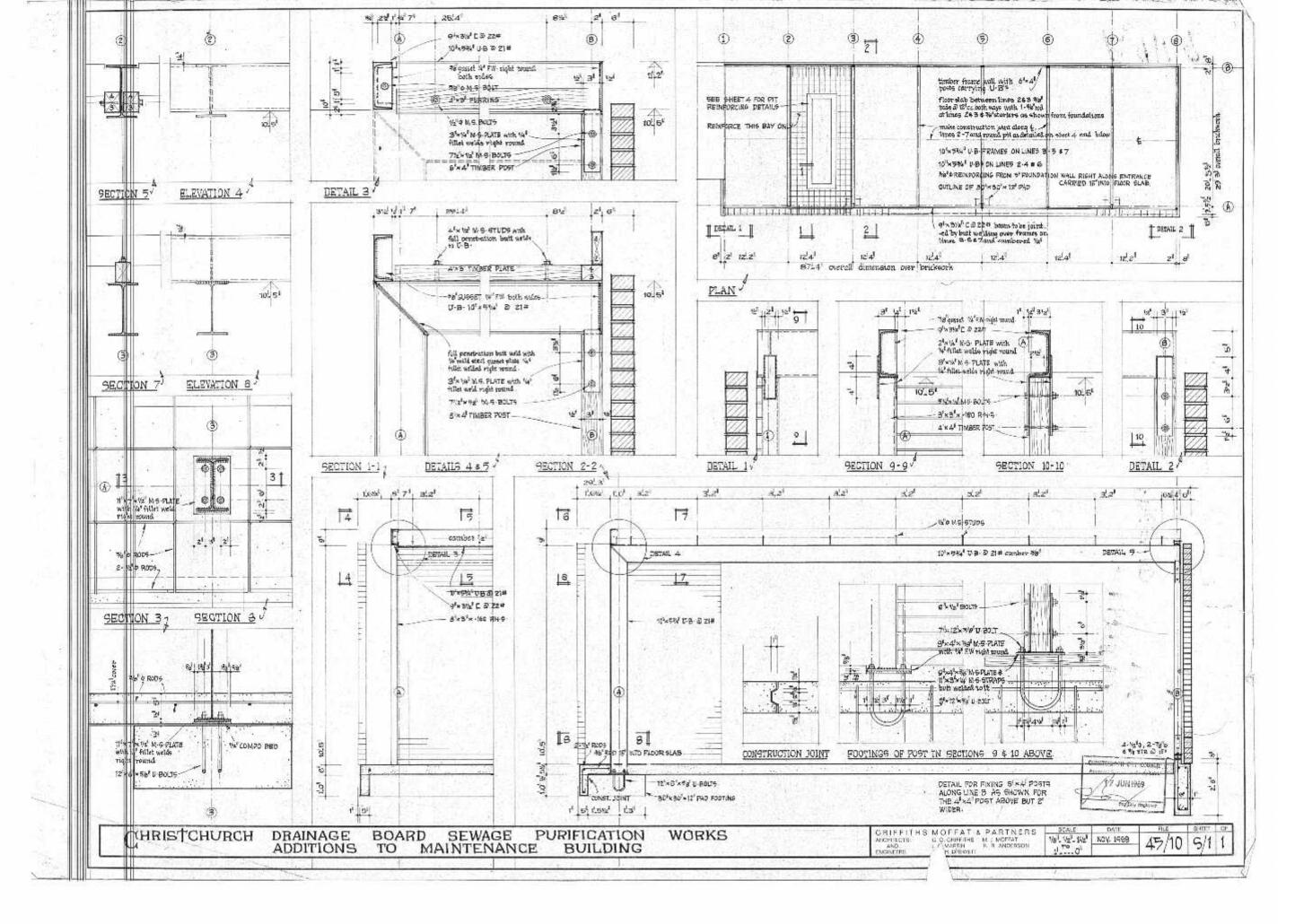






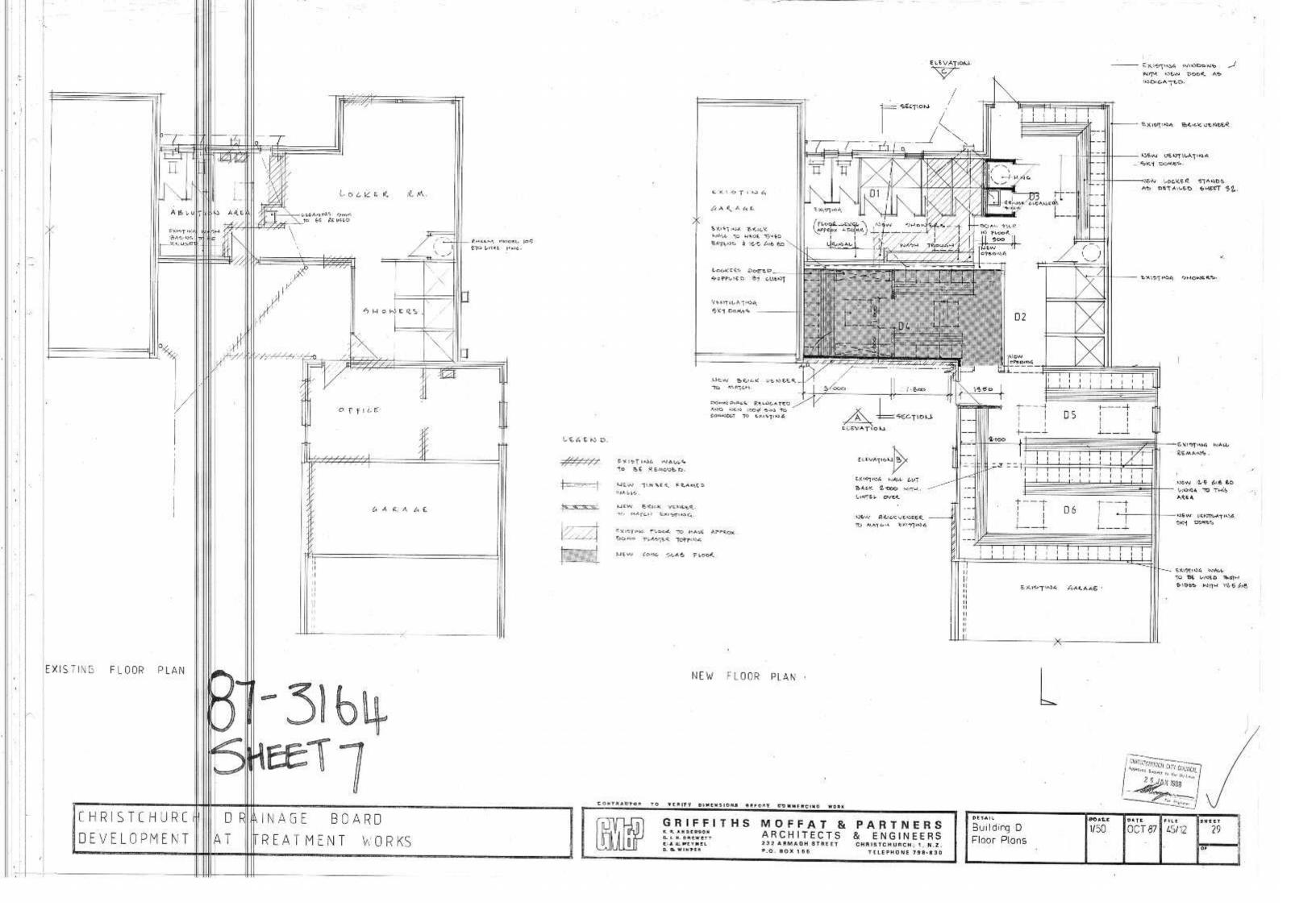


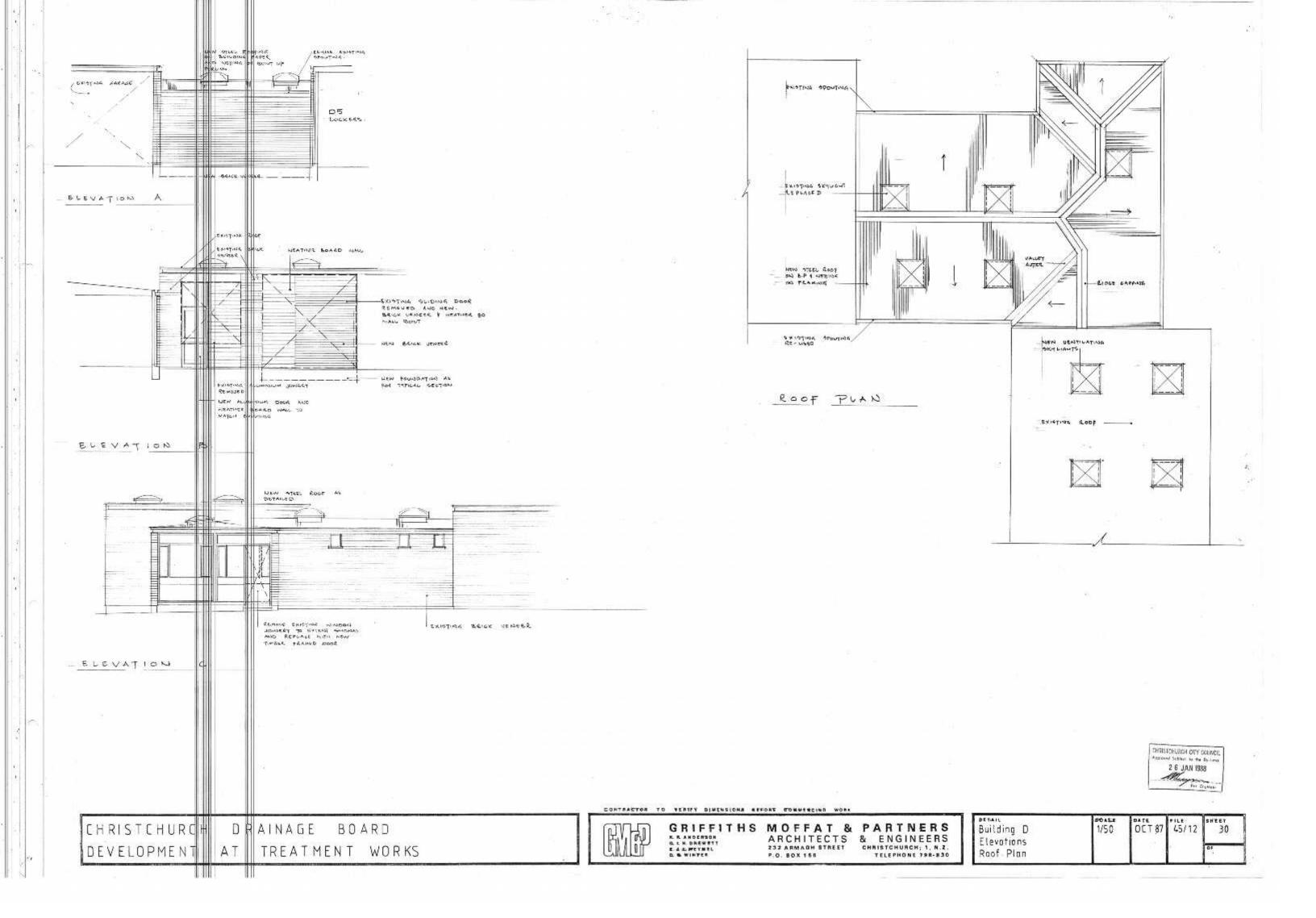
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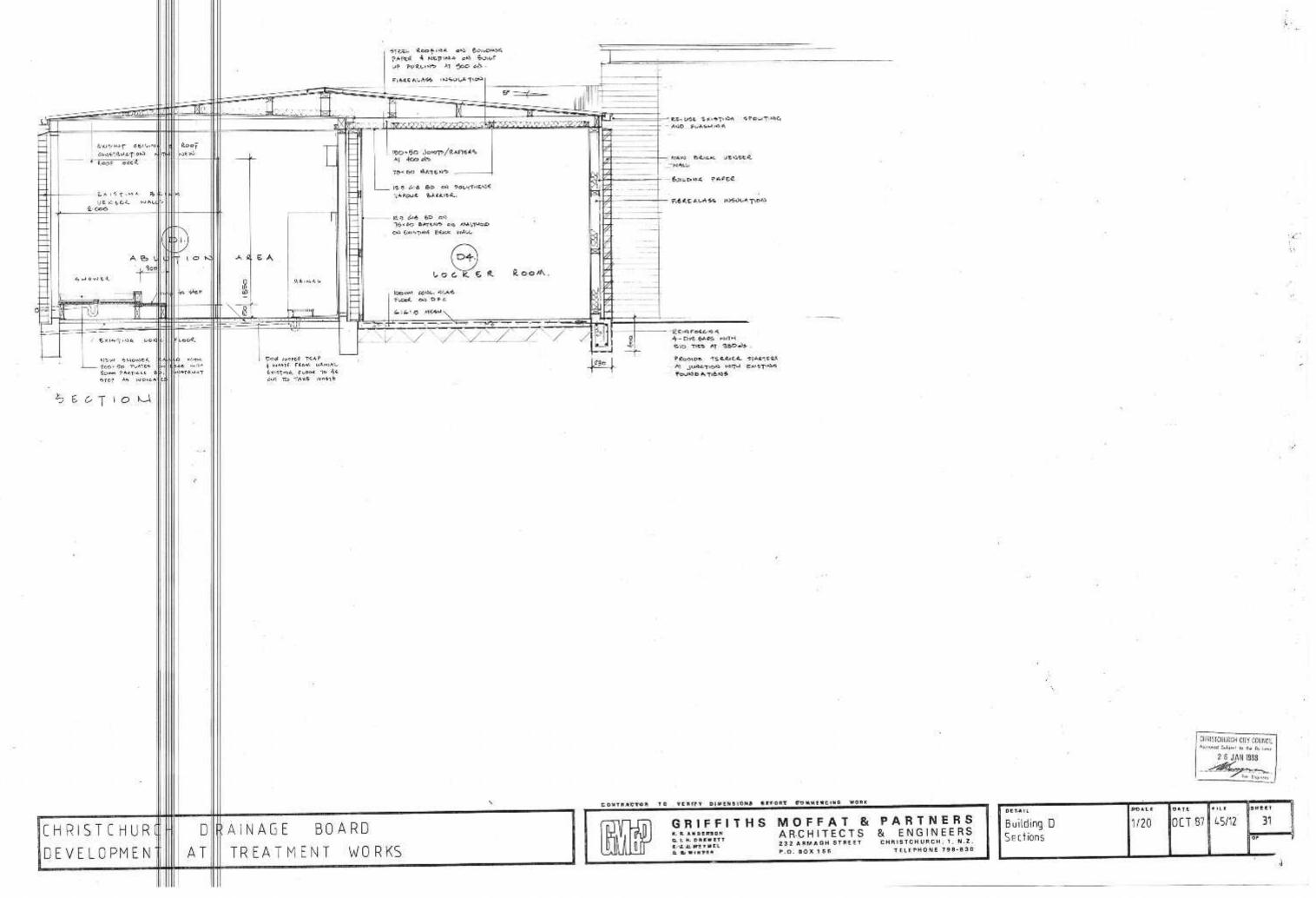


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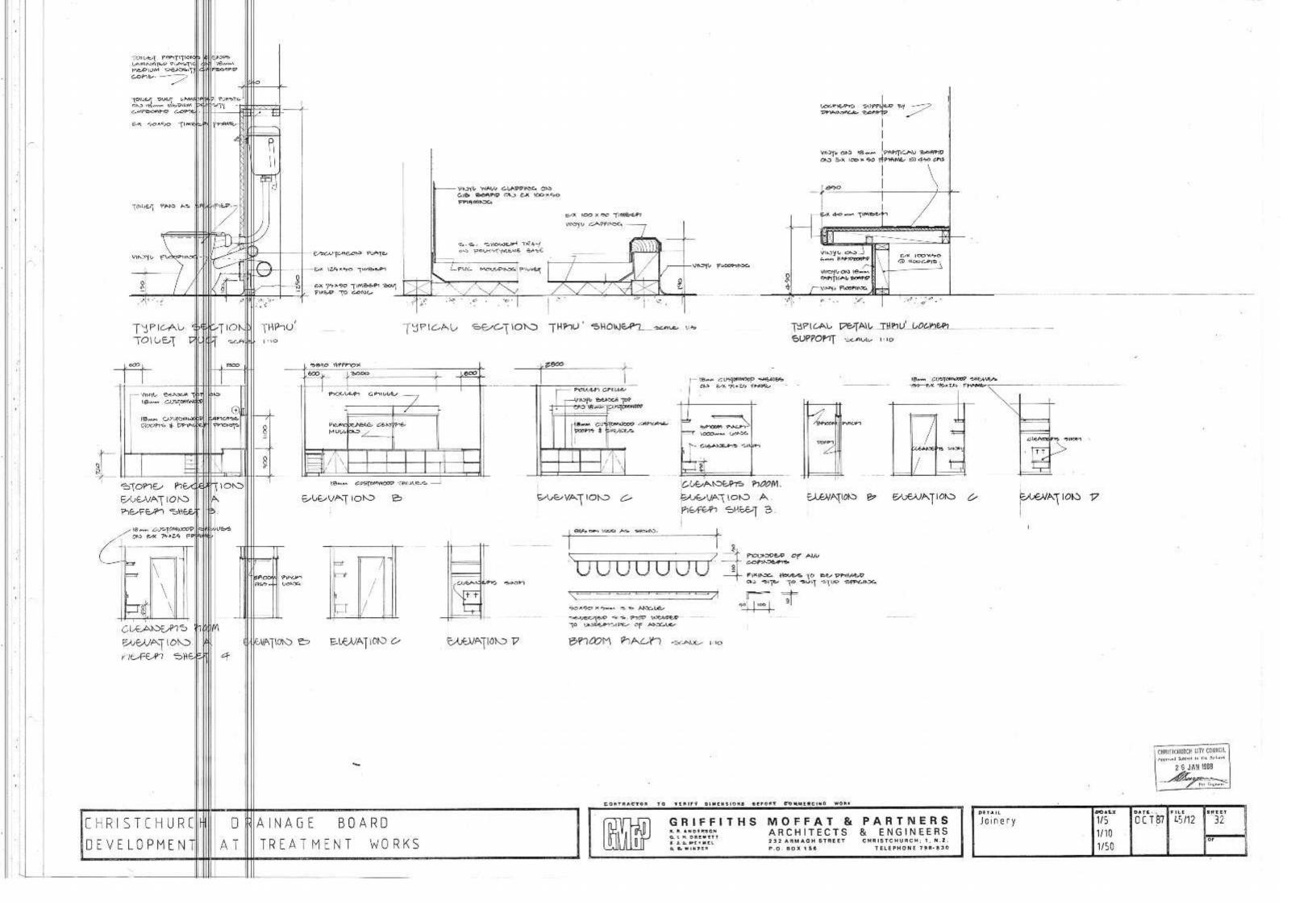
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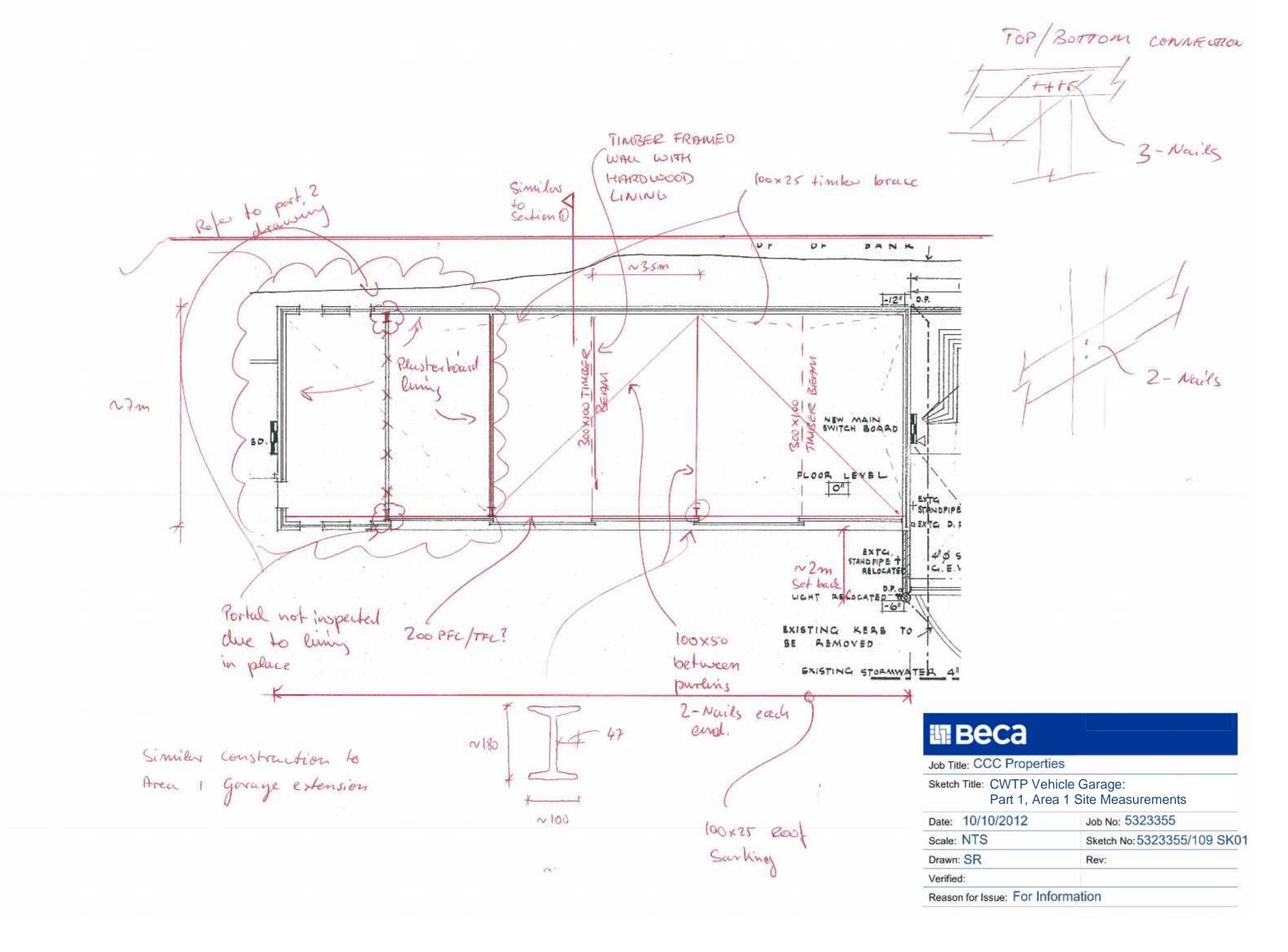


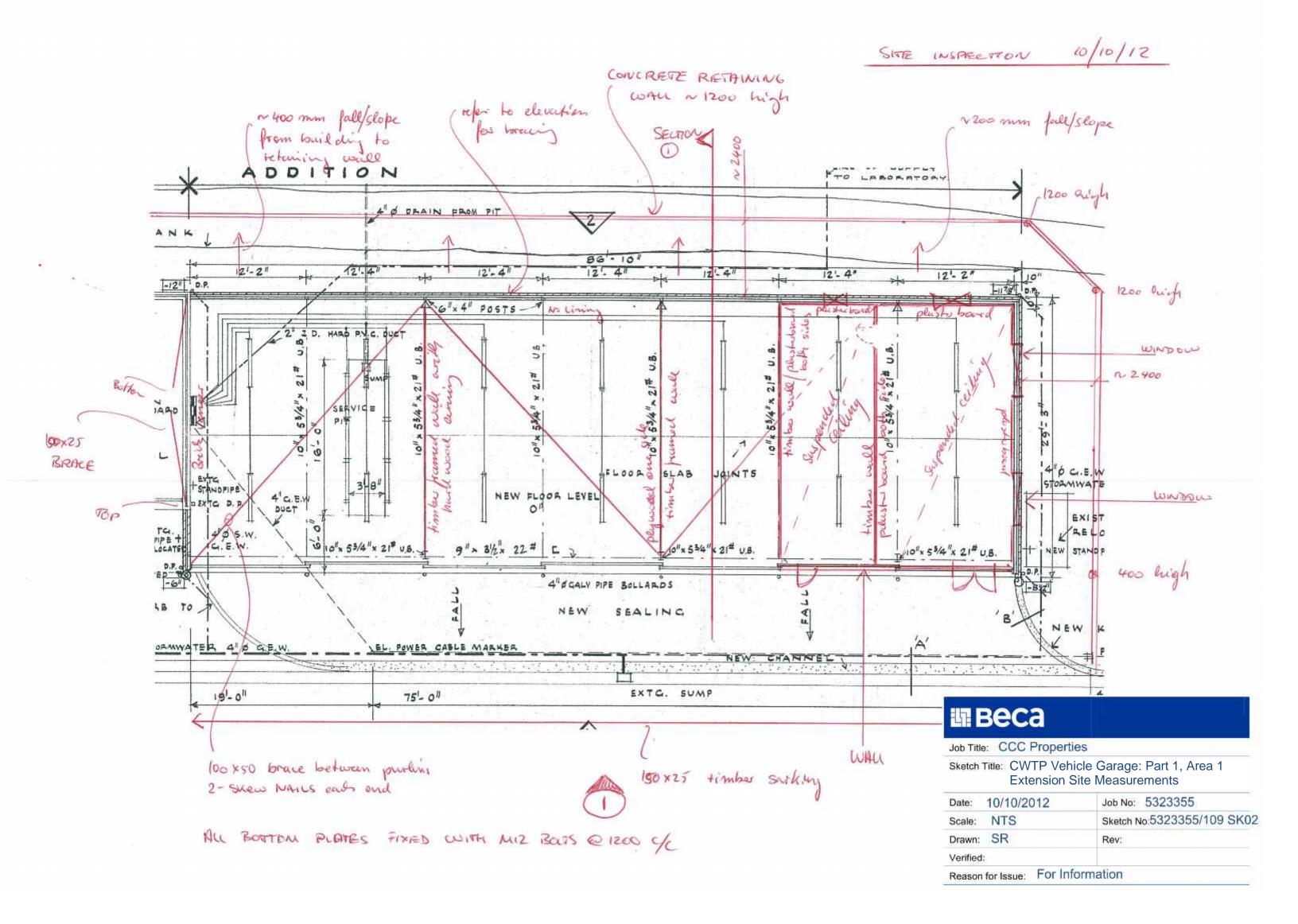
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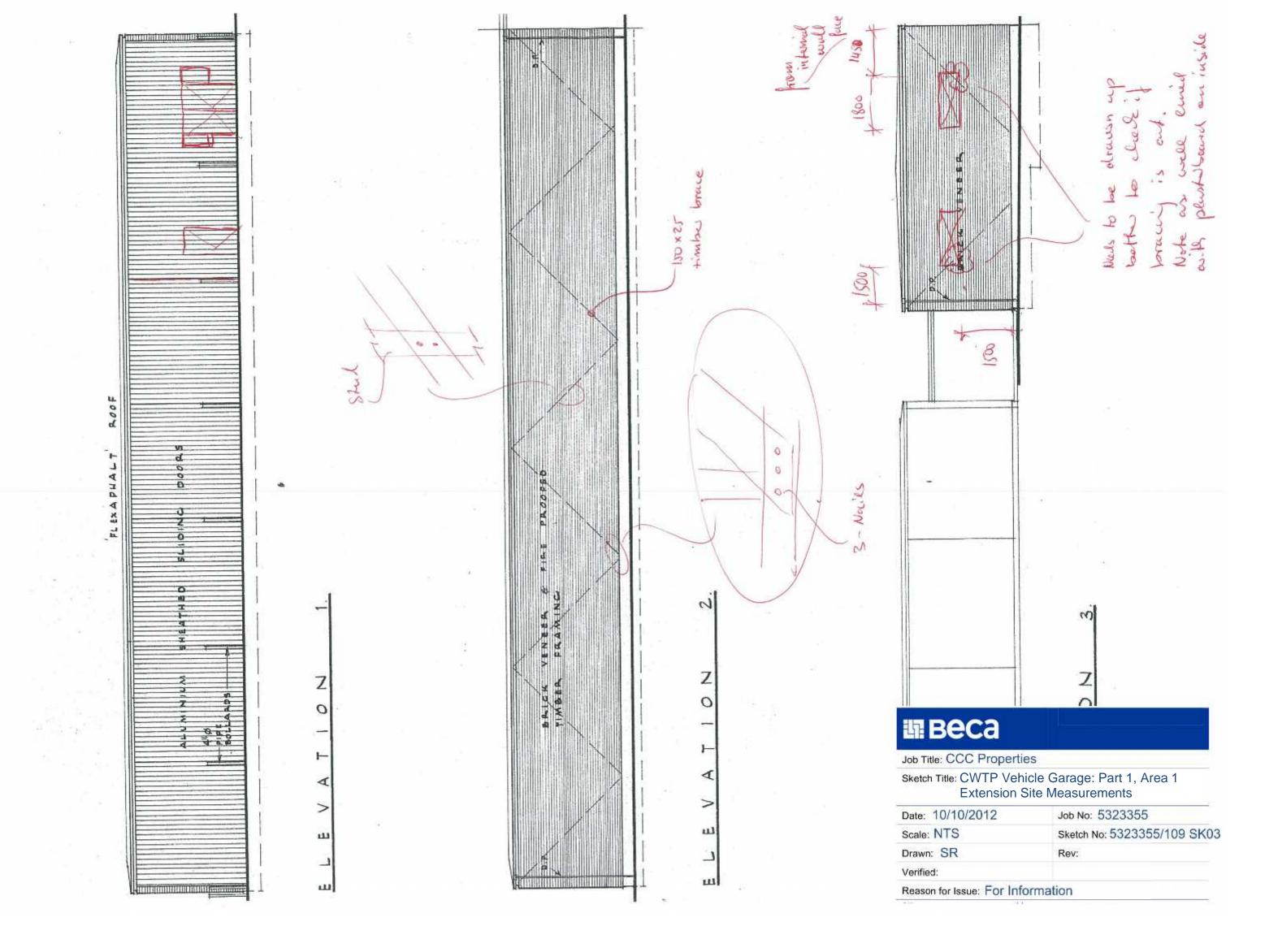


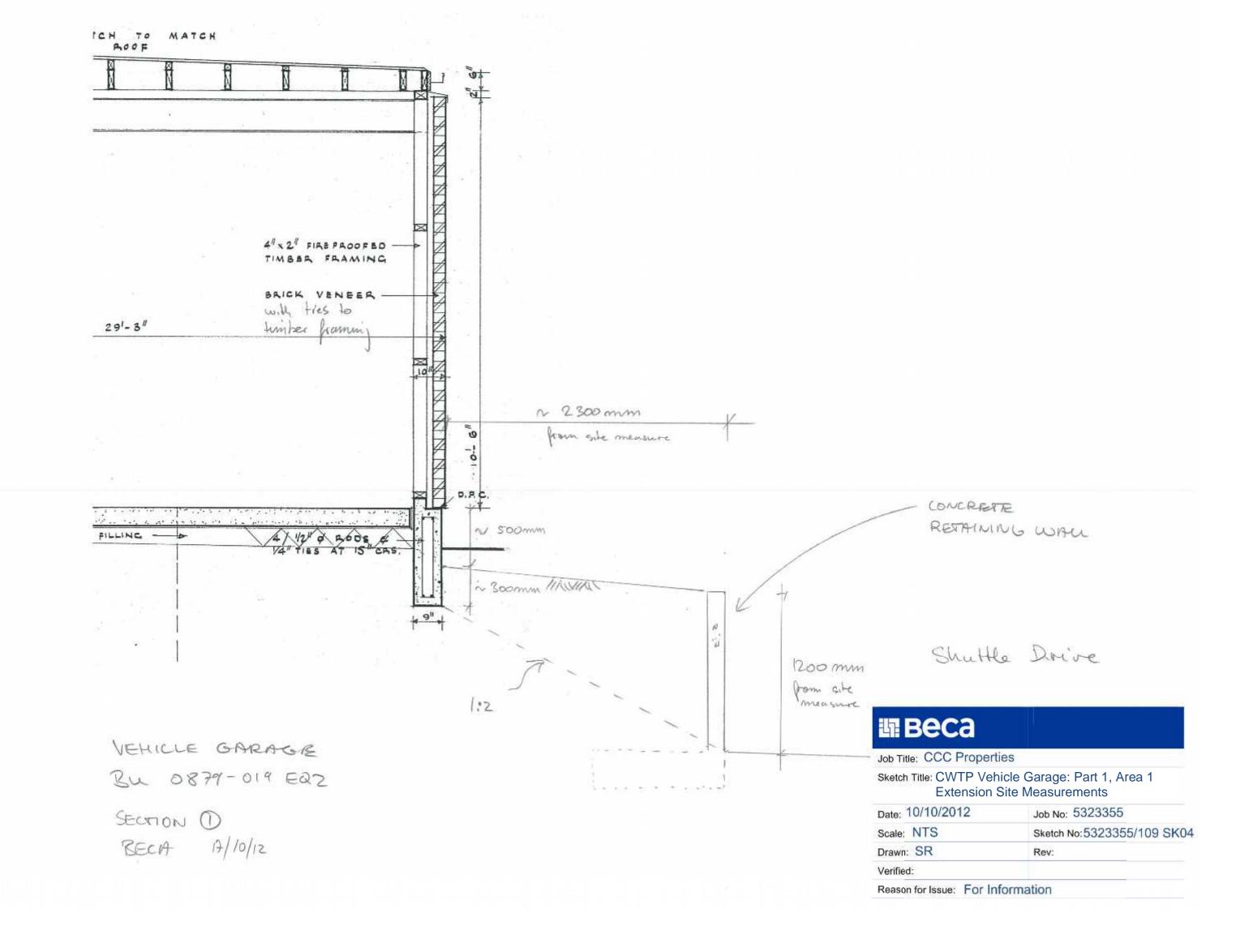
Appendix C

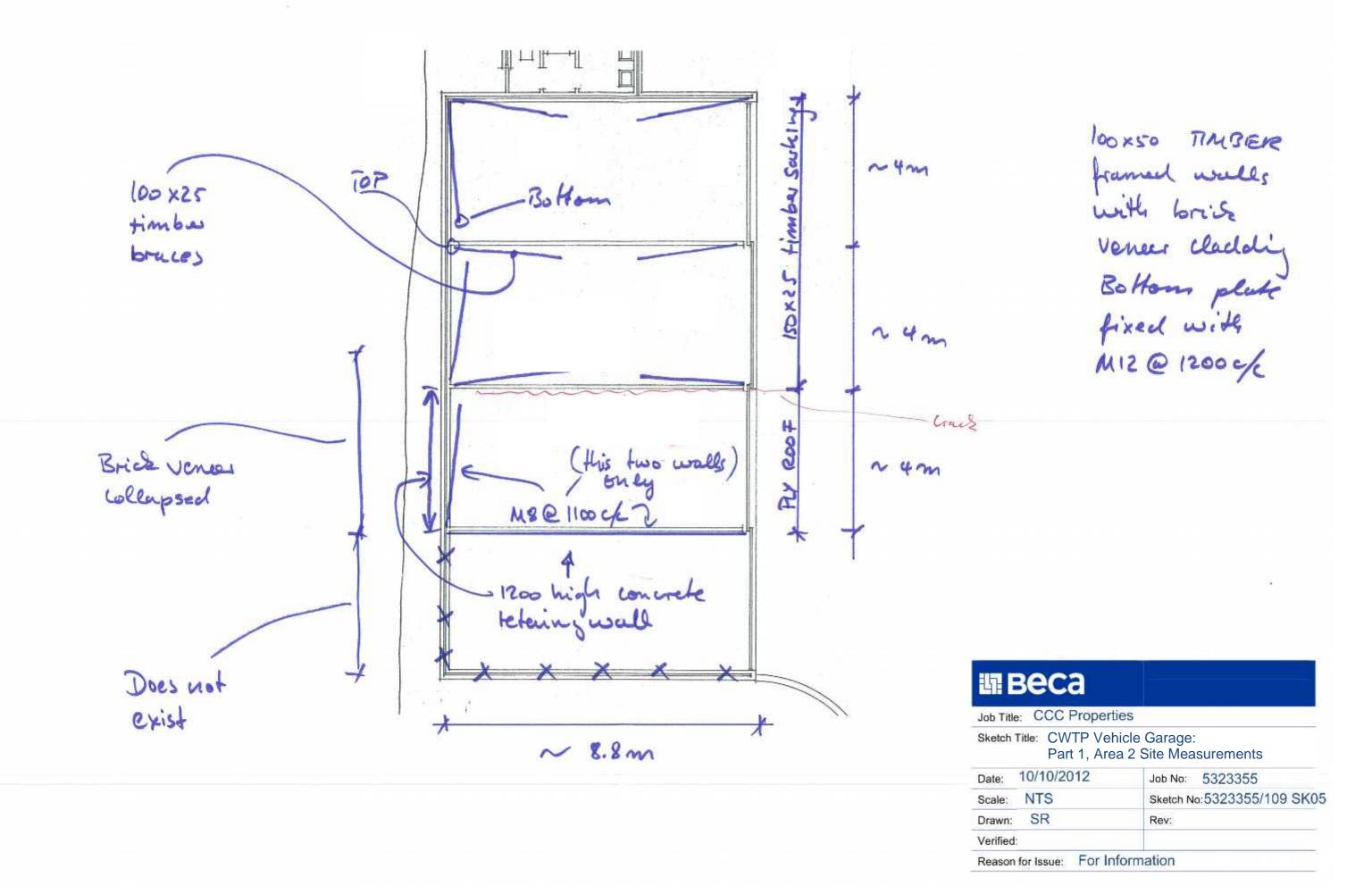
Site Measurements

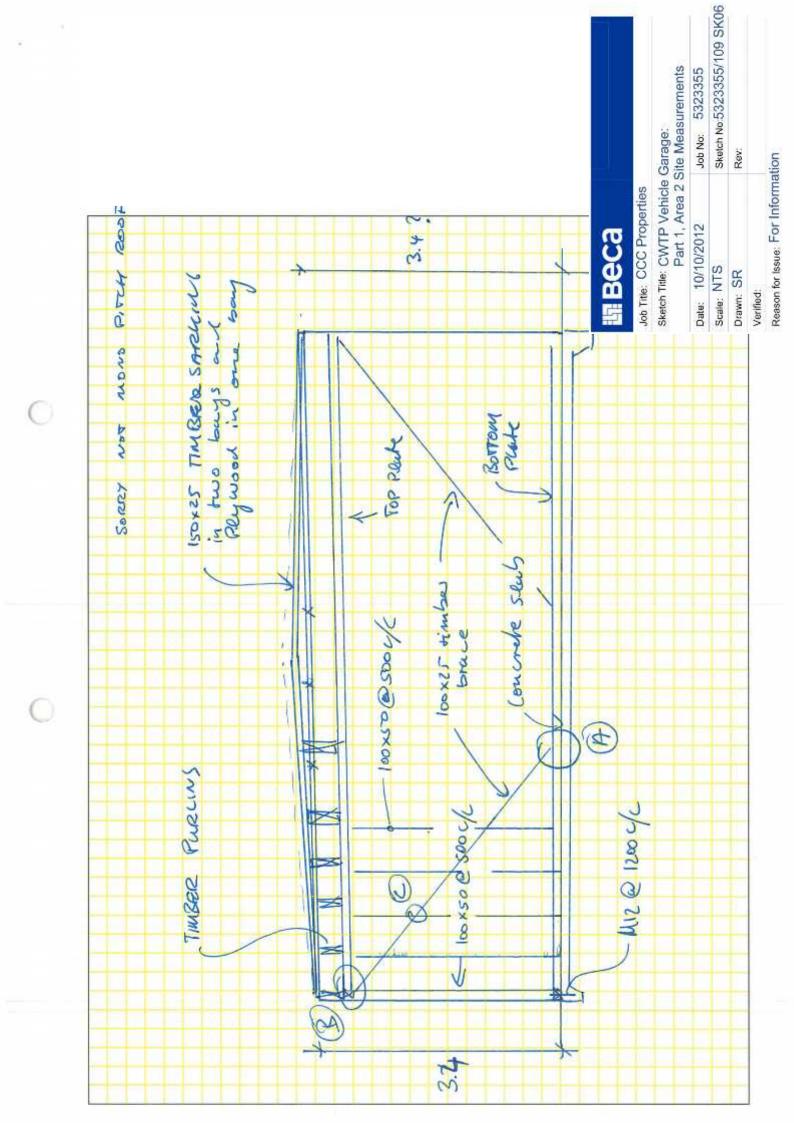












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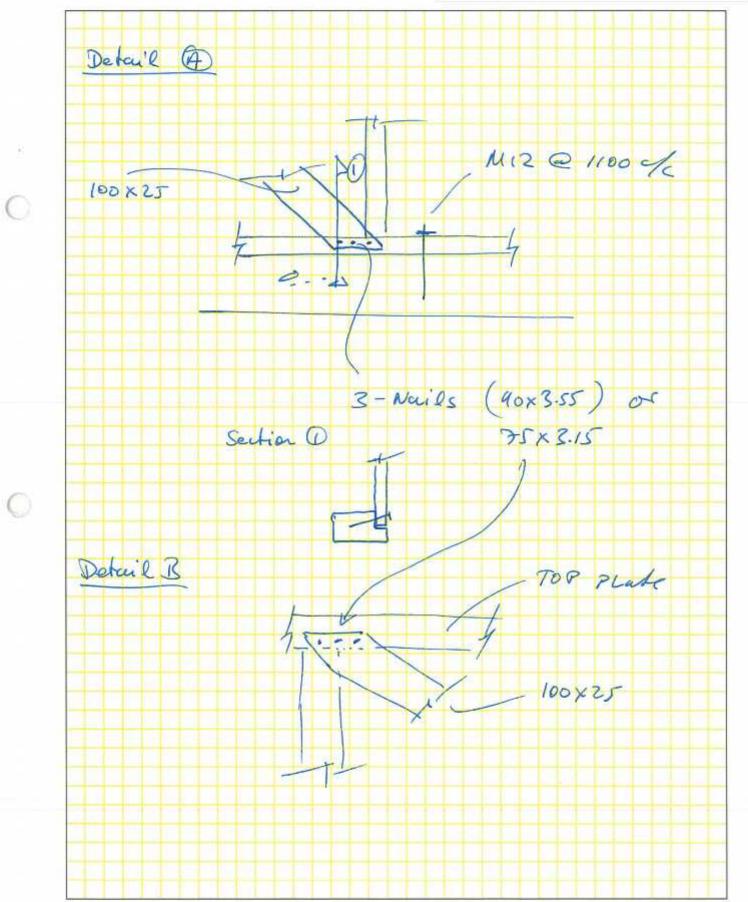
Job Title: CCC Properties

Sketch Title: CWTP Vehicle Garage:

Part 1, Area 2 Site Measurements

Date: 10/10/2012	Job No: 5323355
Scale: NTS	Sketch No: 5323355/109 SK07
Drawn: SR	Rev:
Verified:	

Reason for Issue: For Information



$y \in \mathcal{C}^*$ і веса Job Title: CCC Properties Sketch Title: CWTP Vehicle Garage: Part 1, Area 2 Site Measurements Date: 10/10/2012 Job No: 5323355 Scale: NTS Sketch No:5323355/109 SK08 Drawn: SR Rev: Verified: Reason for Issue: For Information Deteril O stud 0 t 2 NALLS Brane recessed into stud . . 0

Appendix D

CERA DEE Summary Data

Location	g Evaluation Summary Data			V1.11
				a
		CWTP Vehicle Garage Building Part 1. Are Unit	No: Street CPEng No:	David Whittaker 123089
	Building Address: Legal Description	Christchurch Wastewater Treatment Plant BU 0879-019 EQ2	Shuttle Drive Company: Company project number:	Beca 5323355
		Degrees	Company phone number: Min_Sec	03 366 3521
	GPS south: GPS east:		Date of submission:	1/02/2013, 14/02/2012, 24/02/2012
			Revision:	
	Building Unique Identifier (CCC):		Is there a full report with this summary?	ves
Site	Site slope:	flat	Man astaining build (m)	-
	Soil type:	sitv sand	Max retaining height (m): Soil Profile (if available):	Geotech report available for parts of site
	Site Class (to NZS1170.5): Proximity to waterway (m, if <100m):		If Ground improvement on site, describe:	None
	Proximity to clifftop (m, if < 100m): Proximity to cliff base (m, if <100m):		Approx site elevation (m):	17.00
	, , ,			
Building				
	No. of storeys above ground: Ground floor split?	no	single storey = 1 Ground floor elevation (Absolute) (m): Ground floor elevation above ground (m):	17.00
	Storeys below ground Foundation type:	other (describe)	if Foundation type is other, describe:	Pad footing and strip footing
	Building height (m): Floor footprint area (approx):	3.20	height from ground to level of uppermost seismic mass (for IEP only) (m):	3.2
	Age of Building (years):	50	Date of design:	1935-1965
	Strengthening present?		If so, when (year)? And what load level (%q)?	
	Use (ground floor): Use (upper floors):		Brief strengthening description:	
	Use notes (if required): Importance level (to NZS1170.5):			
0	importance level (t0 NZS1170.5):			
Gravity Structure	Gravity System:	frame system		
	Roof:	timber framed	rafter type, purlin type and cladding	UB rafters with timber purlins. Lightweight roof on timber sarking.
	Floors	concrete flat slab	slab thickness (mm)	150mm slab on grade Welded connection at one side and
	Beams	steel non-composite	beam and connector type	bolted connection at other side.
		other (note)	tvoical dimensions (mm x mm)	UB column at one side and timber post at other side.
	Walls:	non-load bearing	0	
Lateral load resisting		lightweight timber framed walls	Note: Define along and across in	Diagonal timber bracing, no lining
	Ductility assumed, µ:	1.25	detailed report! note typical wall length (m)	19
	Period along: Total deflection (ULS) (mm):		0.00 estimate or calculation? estimate or calculation?	
maxi	mum interstorey deflection (ULS) (mm):		estimate or calculation?	
	Lateral system across: Ductility assumed, µ:	lightweight timber framed walls 3.00	note typical wall length (m)	plasterboard lined
	Period across:	0.40	0.00 estimate or calculation?	
maxi	Total deflection (ULS) (mm): mum interstorey deflection (ULS) (mm):		estimate or calculation? estimate or calculation?	estimated
Separations:				
	north (mm): east (mm):		leave blank if not relevant	
	south (mm): west (mm):			
Non-structural element	Stairs:	other (specify)	describe	none
	Wall cladding: Roof Cladding:	Other (specify)	describe (note cavity if exists) describe	brick veneer flexaphalt on top of sarking
	Glazing: Ceilings:	other (specify)		none
	Services(list):			
r				
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Damage Site: (refer DEE Table 4-2) Building: Along Across Diaphragms CSWs: Pounding: Non-structural:	Architectural Structural Mechanical Electrical Geotechreport Site performance: Site performance: Site performance: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Damage to area: Damage ratio: Describe (summary): Damage ratio: Describe (summary): Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage?	partial Widespread liquefaction on site none observed Green Green O%	criginal designer name/date original designer name/date na	extension none for original section Griffiths Molfat & Partners 1968 Widespread liquefaction on site Widespread liquefaction on site Cracking to veneer Damaged brick veneer Force Based Quantitative Assessment
Damage Site: (refer DEE Table 4-2) Building: Along Across Diaphragms CSWs: Pounding: Non-structural: Recommendations Along	Architectural Structural Mechanical Electrical Geotechreport Site performance: Site performance: Site performance: Differential settlement: Differential settlement: Lateral Spread: Differential settlement: Differential settlement: Damage to area: Damage ratio: Describe (summary): Damage ratio: Describe (summary): Damage ratio: Describe (summary): Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage? States of the states of the state	partial Widespread liquefaction on site none observed Green Green O%	original designer name/date original designer name/date <td>extension none for original section Griffiths Molfat & Partners 1968 Widespread liquefaction on site Widespread liquefaction on site Cracking to veneer Damaged brick veneer Force Based Quantitative Assessment</td>	extension none for original section Griffiths Molfat & Partners 1968 Widespread liquefaction on site Widespread liquefaction on site Cracking to veneer Damaged brick veneer Force Based Quantitative Assessment
Damage Site: (refer DEE Table 4-2) Building: Along Across Diaphragms CSWs: Pounding: Non-structural: Recommendations	Architectural Structural Mechanical Electrical Geotechreport Site performance: Site performance: Site performance: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Differential settlement: Damage to area: Damage ratio: Describe (summary): Damage ratio: Describe (summary): Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage? Damage?	partial Widespread liquefaction on site none observed green green 0% 0% 0% 0% 0% 0% 0% 0% 0% 0	criginal designer name/date original designer name/date na	extension none for original section Griffiths Molfat & Partners 1968 Widespread liquefaction on site Widespread liquefaction on site Cracking to veneer Damaged brick veneer Force Based Quantitative Assessment

IEP	Use of this m	ethod is not mandatory - more detailed analysis m	ay give a different answer, which	n would take pr	recedence. Do not	fill in fields if not usin	g IEP.
1	Period of design of building (from above):	1935-1965			h₁ from a	bove: 3.2m	
Seismic Zo	one, if designed between 1965 and 1992:			not requi	ired for this age of bu	ilding	
				not requ	ired for this age of bu	ulding	
			Period (from above): (%NBS)nom from Fig 3.3:		along 0.4		across 0.4
	Note:1 for specifically	design public buildings, to the code of the day. pre-1	965 = 1.25; 1965-1976, Zone A =1. Note 2: for RC building lote 3: for buildings designed prior to	gs designed bet	ween 1976-1984, us	e 1.2	
			Final (%NBS)nom:		along 0%		across 0%
	2.2 Near Fault Scaling Factor		Near Fault	t scaling factor,	from NZS1170.5, cl	3.1.6:	
	•	Near Fault	scaling factor (1/N(T,D), Factor A:		along #DIV/0!		across #DIV/0!
	2.2 Userand Capitra Faster	Near Faux -	_			- 2.2:	#51070:
	2.3 Hazard Scaling Factor		Hazaru i	actor 2 for site i	from AS1170.5, Tabl Z1992, from NZS4203	:1992	
				Hazaro	d scaling factor, Fact	or B:	#DIV/0!
	2.4 Return Period Scaling Factor		Return Perior	Building Impo	ortance level (from ab from Table 3.1, Fact	oove):	2
	2.5 Ductility Scaling Factor	Assessed d Ductility scaling factor: =1 from 1976 onwards;	uctility (less than max in Table 3.2) or =kµ, if pre-1976, fromTable 3.3:		along		across
			Ductiity Scaling Factor, Factor D:		0.00		0.00
	2.6 Structural Performance Scaling I	Factor:	Sp:				
		Structural Perf	ormance Scaling Factor Factor E:		#DIV/0!		#DIV/0!
	2.7 Baseline %NBS, (NBS%)₀ = (%NB	S)nom x A x B x C x D x E	%NBSь:		#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	Table for selection of D1	_	Severe	Significant	Insignificant/none
	3.4. Pounding potential	Pounding effect D1, from Table to right	Alignment of floors within	Separation n 20% of H	0 <sep<.005h 0.7</sep<.005h 	.005 <sep<.01h 0.8</sep<.01h 	Sep>.01H 1
	Heig	ht Difference effect D2, from Table to right	Alignment of floors not within		0.4	0.7	0.8
		Therefore, Factor D: 0	Table for Selection of D2		Severe	Significant	Insignificant/none
	3.5. Site Characteristics	1		Separation	0 <sep<.005h< th=""><th>.005<sep<.01h< th=""><th>Sep>.01H</th></sep<.01h<></th></sep<.005h<>	.005 <sep<.01h< th=""><th>Sep>.01H</th></sep<.01h<>	Sep>.01H
			Height difference Height difference 2 t		0.4 0.7	0.7 0.9	1
			Height difference		1	1	1
			-		Along		Across
	3.6. Other factors, Factor F	For ≤ 3 storeys, max value =2.5, other Ratio	wise max valule =1.5, no minimum onale for choice of F factor, if not 1				
	Detail Critical Structural Weaknesses: List any:	(refer to DEE Procedure section 6) Refer also	o section 6.3.1 of DEE for discussion	n of F factor mo	odification for other cr	itical structural weak ne	sses
	3.7. Overall Performance Achievement	nt ratio (PAR)	Γ		0.00		0.00
	4.3 PAR x (%NBS)b:		PAR x Baselline %NBS:		#DIV/0!		#DIV/0!
	4.4 Percentage New Building Standar	rd (%NBS), (before)					#DIV/0!
Official Use only:	Accepted By						
	Date:						

Detailed Engineering	g Evaluation Summary Data		V1.11
Location	Building Name:	CWTP Vehicle Garage Building Part 1. Are	Area 1 Extension Reviewer: David Whittaker
		Christchurch Wastewater Treatment Plant	nit No: Street CPEng No: 123089
	Legal Description:	BU 0879-019 EQ2	Company project number: 5323355
		Degrees	
	GPS south: GPS east:		Date of submission: Inspection Date: 1/02/2013, 14/02/2012, 24/02/2012
	Building Unique Identifier (CCC):		Revision: Is there a full report with this summary? ves
<u> </u>			
Site			
	Site slope:	flat silty sand	Max retaining height (m): 3 Soil Profile (if available): Geotech report available for parts of site
	Site Class (to NZS1170.5): Proximity to waterway (m, if <100m):	D	If Ground improvement on site, describe: None
	Proximity to clifftop (m, if < 100m):		
	Proximity to cliff base (m,if <100m):		Approx site elevation (m): 17.00
Building			
	No. of storeys above ground: Ground floor split?	1 no	1 single storey = 1 Ground floor elevation (Absolute) (m): 17.00 Ground floor elevation above ground (m): 0.00
	Storeys below ground Foundation type:	other (describe)	0 if Foundation type is other, describe: Pad footing and strip footing
	Building height (m): Floor footprint area (approx):	3.20	20 height from ground to level of uppermost seismic mass (for IEP only) (m): 3.2
	Age of Building (years):		
			K
	Strengthening present?		If so, when (year)? And what load level (%q)?
	Use (ground floor): Use (upper floors):		Brief strengthening description:
	Use notes (if required): Importance level (to NZS1170.5):	Storage	
Gravity Structure			
Siding Oraclure	Gravity System:	frame system	UB rafters with timber purlins. Lightweight
	Roof:	timber framed	rafter type, purlin type and cladding roof on timber sarking.
		concrete flat slab	slab thickness (mm) 150mm slab on orade Welded connection at one side and
		steel non-composite	beam and connector twoe <u>bolted connection at other side.</u> UB column at one side and timber post at
	Columns: Walls:	other (note) non-load bearing	tvoical dimensions (mm x mm) <u>other side.</u> 0
Lateral load resisting			
	Lateral system along: Ductility assumed, µ:	lightweight timber framed walls 1.25	Note: Define along and across in 25 detailed report! Diagonal timber bracing, no lining
	Period along:	0.40	40 0.00 estimate or calculation? estimated
maxi	Total deflection (ULS) (mm): mum interstorey deflection (ULS) (mm):		estimate or calculation? estimated estimate or calculation?
	Lateral system across:	lightweight timber framed walls	plasterboard ined
	Ductility assumed, µ: Period across:	3.00	
	Total deflection (ULS) (mm):		estimate or calculation? estimated
	mum interstorey deflection (ULS) (mm):		estimate or calculation?
Separations:	north (mm):		leave blank if not relevant
	east (mm): south (mm):		
	west (mm):		
Non-structural element	Stairs:	other (specify)	describe none
	Wall cladding: Roof Cladding:	brick or tile Other (specify)	describe (note cavity if exists) <u>brick veneer</u> describe <u>flexaphalt on top of sarking</u>
	Glazing: Ceilings:	other (specify)	none
	Services(list):		
Available document	Architectural		original designer name/date Griffiths Moffat & Partners 1968
	Structural Mechanical		original designer name/date Griffiths Moffat & Partners 1968 original designer name/date
	Electrical Geotech report		original designer name/date
Damage Site:	Site performance:	Widespread liquefaction on site	Describe damage:
(refer DEE Table 4-2)	Settlement:	none observed	notes (if applicable):
	Differential settlement:	none observed 0-2 m ³ /100m ²	notes (if applicable): notes (if applicable): liquefaction on site
	Lateral Spread: Differential lateral spread:	none apparent	notes (if applicable): notes (if applicable):
	Ground cracks:	0-20mm/20m	notes (if applicable): by digester
Duilding	Damage to area:	Longrit	notes (if applicable):
Building:	Current Placard Status:	green	
Along	Damage ratio:	0%	% Describe how damage ratio arrived at:
	Describe (summary):		$Damage _Ratio = \frac{(\% NBS (before) - \% NBS (after))}{(\% NBS (h - form))}$
Across	Damage ratio: Describe (summary):	0%	$\frac{M}{NBS(before)} = \frac{(N)NBS(before)}{NNBS(before)}$
Diaphroans			Describe:
Diaphragms	Damage?:		
CSWs:	Damage?:		Describe:
Pounding:	Damage?:		Describe:
Non-structural:	Damage?:	yes	Describe: Cracking to veneer
Recommendations			
Recommendations	Level of repair/strengthening required:	minor non-structural	Describe: Damaged brick veneer
Recommendations	Level of repair/strengthening required: Building Consent required: Interim occupancy recommendations:	no	Describe: Damaged brick veneer Describe: Describe:
Recommendations	Building Consent required: Interim occupancy recommendations: Assessed %NBS before e'quakes:	no ful occupancy 64%	Describe: Describe: 76, ##### %NBS from IEP below If IEP not used, please detail assessment Force Based Quantitative Assessment
Along	Building Consent required: Interim occupancy recommendations: Assessed %NBS before e'quakes: Assessed %NBS after e'quakes:	no	Describe: Describe: 2% ##### %NBS from IEP below If IEP not used, please detail assessment[Force Based Quantitative Assessment] % methodology.
	Building Consent required: Interim occupancy recommendations: Assessed %NBS before e'quakes:	no ful occupancy 64% 64% 78%	Describe: Describe: Describe: Describe: Via ##### %NBS from IEP below If IEP not used, please detail assessment % ##### %NBS from IEP below % ##### %NBS from IEP below

IEP	Use of this m	nethod is not mandatory - more detailed analysis m	nay give a different answer, which	would take p	recedence. Do not	fill in fields if not usin	g IEP.
P	Period of design of building (from above):	1935-1965			hn from a	bove: 3.2m	
Seismic Zo	ne, if designed between 1965 and 1992:			not requ	uired for this age of bu	ilding	
				not requ	uired for this age of bu	ulding	
			Period (from above): (%NBS)nom from Fig 3.3:		along 0.4		across 0.4
	Note:1 for specifical	y design public buildings, to the code of the day: pre-1	965 = 1.25; 1965-1976, Zone A =1.3 Note 2: for RC building Note 3: for buildings designed prior to	is designed be	tween 1976-1984, us	e 1.2	
			Final (%NBS)nom:		along 0%		across 0%
	2.2 Near Fault Scaling Factor		Near Fault	scaling factor,	from NZS1170.5, cl	3.1.6:	
		Near Fault	scaling factor (1/N(T,D), Factor A:		along #DIV/0!		across #DIV/0!
	2.3 Hazard Scaling Factor			actor Z for site	from AS1170.5, Tabl	e 3.3:	
					Z1992, from NZS4203 rd scaling factor, Fact		#DIV/0!
	2.4 Return Period Scaling Factor		Return Perior	Building Imp	ortance level (from at from Table 3.1, Fact	oove):	
	2.5 Ductility Scaling Factor	Assessed d Ductility scaling factor: =1 from 1976 onwards;	luctility (less than max in Table 3.2) or =kµ, if pre-1976, fromTable 3.3:		along		across
			Ductiity Scaling Factor, Factor D:		0.00		0.00
	2.6 Structural Performance Scaling	Factor:	Sp:]
		Structural Perf	ormance Scaling Factor Factor E:		#DIV/0!		#DIV/0!
	2.7 Baseline %NBS, (NBS%)b = (%NI	BS)nom x A x B x C x D x E	%NBSb:		#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	Table for selection of D1	Separation	Severe 0 <sep<.005h< th=""><th>Significant .005<sep<.01h< th=""><th>Insignificant/none Sep>.01H</th></sep<.01h<></th></sep<.005h<>	Significant .005 <sep<.01h< th=""><th>Insignificant/none Sep>.01H</th></sep<.01h<>	Insignificant/none Sep>.01H
	3.4. Pounding potential	Pounding effect D1, from Table to right	Alignment of floors within	n 20% of H	0.7	0.8	1
	Heij	ght Difference effect D2, from Table to right	Alignment of floors not within	n 20% of H	0.4	0.7	0.8
		Therefore, Factor D: 0	Table for Selection of D2	Separation	Severe 0 <sep<.005h< th=""><th>Significant .005<sep<.01h< th=""><th>Insignificant/none Sep>.01H</th></sep<.01h<></th></sep<.005h<>	Significant .005 <sep<.01h< th=""><th>Insignificant/none Sep>.01H</th></sep<.01h<>	Insignificant/none Sep>.01H
	3.5. Site Characteristics	1	Height difference :		0.4	0.7	1
			Height difference 2 to	o 4 storeys	0.7 1	0.9	1
			Height difference	< 2 storeys		1	1
	3.6. Other factors, Factor F	For ≤ 3 storeys, max value =2.5, other			Along		Across
		Rati	onale for choice of F factor, if not 1				
	Detail Critical Structural Weaknesses: List any:	(refer to DEE Procedure section 6)	o section 6.3.1 of DEE for discussion	n of F factor m	odification for other cr	itical structural weak ne	29.22
	3.7. Overall Performance Achieveme				0.00		0.00
	4.3 PAR x (%NBS)b:		PAR x Baselline %NBS:		#DIV/0!		#DIV/0!
	4.4 Percentage New Building Standa	rd (%NBS), (before)					#DIV/0!
Official Use only:	Accepted By						
	Date:						

		V1.11
Building Name: CWTP Vehicle Garage Building Part 1.Are	2 Paiours	David Whittaker
Unit	No: Street CPEng No:	123089
Building Address: <u>Christchurch Wastewater Treatment Plant</u> Legal Description: <u>BU 0879-019 EQ2</u>	Company project number:	5323355
Degrees	Min_Sec	03 366 3521
GPS south: GPS east:	Date of submission: Inspection Date:	1/02/2013, 14/02/2012, 24/02/2012
Building Unique Identifier (CCC):	Revision: Is there a full report with this summary?	ves
lov.		
Site Site slope: slope < 1in 10 Solit type: sity sand	Max retaining height (m):	3
Soil type: sity sand Site Class (to NZS1170.5): D		Geotech report available for parts of site
Proximity to waterway (m, if <100m): Proximity to clifftop (m, if <100m):	If Ground improvement on site, describe:	None
Proximity to cliff base (m,if <100m):	Approx site elevation (m):	17.00
Building No. of storeys above ground: 1	single storey = 1 Ground floor elevation (Absolute) (m):	17.00
Ground floor split? no Storeys below ground	Ground floor elevation above ground (m):	0.00
Foundation type: other (describe) Building height (m): 3.40	if Foundation type is other, describe: height from ground to level of uppermost seismic mass (for IEP only) (m):	strip footing 3.4
Floor footprint area (approx): 106 Age of Building (years): 50	Date of design:	
rige of Bollong (Johns).		
Strengthening present? no	If so, when (year)?	
Use (ground floor): other (specify)	And what load level (%q)? Brief strengthening description:	
Use (upper floors): Use notes (if required): Offices		
Importance level (to NZS1170.5): IL2]	
Gravity Structure		
Gravity System: <u>load bearing walls</u>		Timber rafter with timber purlins.
Roof: timber framed Floors: concrete flat slab	rafter tvoe. ourlin tvoe and claddino slab thickness (mm)	150mm slab on grade
Beams: <u>timber</u> Columns: <u>timber</u>	type typical dimensions (mm x mm)	timber frame walls 100x50
Walls: non-load bearing	0	
Lateral load resisting structure	Note: Define along and across in	Diagonal timber bracing, no lining
Lateral system along: lightweight timber framed walls Ductility assumed, µ:	detailed report! note typical wall length (m)	4
Period along: 0.40 Total deflection (ULS) (mm):	estimate or calculation?	estimated estimated
maximum interstorey deflection (ULS) (mm):	estimate or calculation?	
Lateral system across: lightweight timber framed walls Ductility assumed, µ: 1.25	note typical wall length (m)	Diagonal timber bracing, no lining
Period across: 0.40	0.00 estimate or calculation?	estimated
Total deflection (ULS) (mm): maximum interstorey deflection (ULS) (mm):	estimate or calculation? estimate or calculation?	estimated
Separations:		
north (mm): east (mm):	leave blank if not relevant	
south (mm): west (mm):		
Non-structural elements		
Stairs: other (specify)	describe	none
Wall cladding: <u>brick or tile</u> Roof Cladding: <u>Other (specify)</u>	describe (note cavity if exists) describe	unknown
Glazing: <u>timber frames</u> Ceilings: <u>fibrous plaster, fixed</u>		
Services(list):		
Available documentation		
Architectural none Structural none	original designer name/date original designer name/date	
Mechanical		
	original designer name/date	
Electrical Geotech report	original designer name/date original designer name/date original designer name/date	
Geotech report	original designer name/date original designer name/date	
Geotech report	original designer name/date original designer name/date original designer name/date	
	original designer name/date original designer name/date original designer name/date Describe damage:	
Geotech report Damage Site: Site: Site performance: Widespread Iquefaction on site Settlement: Differential settlement: D	original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): notes (if appicable):	
Geotech report Damage Site: Site: Site performance: Widespread liquefaction on site (refer DEE Table 4-2) Settlement: Inone observed Differential settlement: Liquefaction: Lateral Spread:	original designer name/date original designer name/date original designer name/date Describe damage: notes (f appicable): notes (f appicable): notes (f appicable): notes (f appicable):	Widespread liquefaction on site
Geotech report	original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable):	
Geotech report Site: Site performance: Widespread Iquefaction on site (refer DEE Table 4-2) Settlement: None observed Differential settlement: Liquefaction Liquefaction: Lateral Spread: Differential settlement: Differential settlement:	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if applicable): notes (if applicable): notes (if applicable): notes (if applicable): notes (if applicable):	
Geotech report Site: Site performance: Site: Site performance: (refor DEE Table 4-2) Settlement: Differential settlement: Liquefaction Liquefaction: Liquefaction Differential settlement: Ground cracks: Differential lateral spread: Ground cracks: Damage to area: Damage to area:	original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable): notes (if appicable):	
Geotech report Site: Site performance: Widespread Iguefaction on site (refer DEE Table 4-2) Site performance: Nidespread Iguefaction on site Differential settlement: Incre observed Differential lateral spread Differential lateral spread Differential lateral spread Differential lateral spread Differential lateral spread Differential lateral spread Building: Current Placard Status: arean	original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable) notes (if appicable) notes (if appicable) notes (if appicable) notes (if appicable) notes (if appicable) notes (if appicable)	Widespread liquefaction on site
Geotech report Site: Site performance: Videspread liquefaction on site Site performance: (refer DEE Table 4-2) Settlement: Differential settlement: Incre observed Differential settlement: Liquefaction Differential settlement: Ground cracks: Differential lateral spread: Differential lateral spread: Differential settlement: Differential lateral spread: Damage to area: Differential lateral spread:	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if applicable):	Widespread liquefaction on site
Geotech report Site: Site performance: Widespread iguefaction on site Site performance: Under DE E Table 4-2) Site performance: Site: Site performance: Differential settement: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Differential lateral spread: Ground cracks: Damage to area: Damage to area: Building: Current Placard Status: 0% Across Damage ratio: 0%	original designer name/date original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes	Widespread liquefaction on site
Geotech report Damage Site: (refer DE E Table 4-2) Site performance: Widespread liquefaction on ste Uterent listerment: Liquefaction Liquefaction Liguefaction Liguefaction Differential lateral spread Ground cracks: Damage to area: Building: Current Placard Status: Operate (summary): Describe (summary): Across Damage ratio: Operate (summary):	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if applicable):	Widespread liquefaction on site
Geotech report Damage Site: Site: (refer DE E Table 4-2) Steperformance: Widespread iguefaction on site Differential settement: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Lateral Spread: Offerential lateral spread: Ground cracks: Damage to area: Building: Current Placard Status: Oren Damage ratio: O% Describe (summary): Across Damage ratio:	original designer name/date original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes	Widespread liquefaction on site
Geotech report Damage Site: (refer DE E Table 4-2) Site performance: Widespread liquefaction on ste Uterent listerment: Liquefaction Liquefaction Liguefaction Liguefaction Differential lateral spread Ground cracks: Damage to area: Building: Current Placard Status: Operate (summary): Describe (summary): Across Damage ratio: Operate (summary):	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if a	Widespread liquefaction on site
Geotech report Damage Site: (refer DEE Table 4-2) Site performance: Widespread liquefaction on site Differential settlement: Differential settlement: Differential lateral spread Ground cracks: Damage to area: Image to area: Damage to area: Building: Along Current Placard Status: Orego area: 0% Opeorche (summary): Describe (summary): Across Damage ratio: Offerential spread: Opeorche (summary): 0% Diaphragms Damage?: Non- Non-	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): NBS (before) - % NBS (after))) % NBS (before) Describe:	Widespread liquefaction on site
Geotech report Damage Site: (refer DEE Table 4-2) Site performance: Widespread Iquefaction on site Differential settement: Liquefaction: Liquefaction: Liquefaction: Damage to area: Inore observed Building: Offerential ister area: Damage to area: Inore observed Building: Current Placard Status: Damage to area: 0% Along Describe (summary): Describe (summary): 0% Diaphragms Damage?: [no 0%	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if a	Widespread liquefaction on site
Geotech report Site: Site performance: Widespread iguefaction on site Differential settlement: Liguefaction Liguefaction Liguefaction Differential settlement: Liguefaction: Lateral Spread: Current Placard Status: Offerential settlement: Lateral Spread: Offerential settement: Offerential settement: Offere	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): notes (if a	Widespread liquefaction on site
Geotech report Site: Site performance: Widespread Iquefaction on site Settement: Inone observed Differential settement: Liquefaction: Differential lateral spread: Offerential lateral spread: Offerential settement: Offerential settement: Offerential settement: Offer	original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): Describe: Describe: Describe: Describe: Describe: Describe: Describe:	Widespread liquefaction on site Widespread liquefaction on site Image: Constraint of the second sec
Geotech report Damage Site: Site performance: Widespread liquefaction on site (refer DEE Table 4-2) Settement Differential settement Ione observed Differential settement Liquefaction: Liquefactor: Liquefactor: Liquefactor: Liquefactor: Bailding: Current Placard Status: Along Damage to area: Building: Offerential settement: Across Damage ratio: 0% Describe (summary): Offerential Diaphragms Damage ratio: 0% Dispragms Damage? 0% CSWs: Damage? 0% Pounding: Damage? 0% Non-structural: Damage? 0 Recommendations Level of repair/strengthening required: Iminor non-structural Building Consent required: Inior non-structural Describe	original designer name/date original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: <td>Widespread liquefaction on site</td>	Widespread liquefaction on site
Geotech report Damage Site: (refer DEE Table 4-2) Site performance: Widespread Iquefaction on site (refer DEE Table 4-2) Settement: Differential settement: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Liquefaction: Differential settement: Differential settement: Differential settement: Damage to area: Building: Current Placard Status: Oround cracks: Damage to area: Building: Current Placard Status: Describe (summary): Across Damage ratio: Describe (summary): 0% Diaphragms Damage ratio: Describe (summary): 0% Diaphragms Damage ratio: Damage?: no 0% CSWs: Damage?: no 0 Non-structural: Damage?: no 0 Recommendations Level of repair/strengthening required: minor non-structural Building Consent required: no minor non-structural Interim occupancy recommendations: Iul occupancy	original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: D	Image: Damaged brick veneer
Geotech report Damage Site: (refer DEE Table 4-2) Site performance: Widespread Iquefaction on site Differential settlement: Liquefaction: Li	original designer name/date original designer name/date original designer name/date original designer name/date Describe damage: notes (if appicable): Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: Describe: <td>Image: Damaged brick veneer</td>	Image: Damaged brick veneer
Geotech report Site: Site performance: Widespread liquefaction on site (refer DE E Table 4-2) Site performance: Differential settlement: Liquefaction: Liquefaction: Liquefaction: Differential lateral spread: Ground cracks: Differential lateral spread: Ground cracks: Damage to area: Damage ratio: Aong Damage ratio: 0% Across Damage ratio: 0% Dispringims Damage ratio: 0% Dispringims Damage ratio: 0% Dispringims Damage? 0% Disphragms Damage? 0% Pounding: Damage? 0 Non-structural: Damage? 0 Recommendations Level of repair/strengthening required: 100 Nong Assessed %NBS before equakes: 100%	original designer name/date original designer name/date original designer name/date original designer name/date Describe damage: notes (if applicable): Describe: Describe: Describe: Describe: Describe: Describe: Describe:	Image Image Damaged brick veneer Image

	Use of this	method is not mandatory - more d	letailed analysis ma	y give a different answer, which	would take p	recedence. Do not	fill in fields if not usin	g IEP.
i	Period of design of building (from above): 1935-1965				h₁ from a	bove: 3.4m	
Seismic Zo	one, if designed between 1965 and 199	2:				uired for this age of bu uired for this age of bu		
					not requ	along		across
				Period (from above): (%NBS)nom from Fig 3.3:		0.4	-	0.4
	Note:1 for specifica	ally design public buildings, to the cod			gs designed bet	tween 1976-1984, us	e 1.2	
				Final (%NBS)nom:		along 0%		across 0%
	2.2 Near Fault Scaling Factor			Near Fault	t scaling factor	from NZS1170.5, cl	316	
			Nees Fault a	caling factor (1/N(T,D), Factor A:		along	0.1.0.	across #DIV/0!
			Near Fault so	-		#DIV/0!		#DIV/0!
	2.3 Hazard Scaling Factor			Hazard ta		from AS1170.5, Tabl Z1992, from NZS4203	:1992	
					Hazar	d scaling factor, Fact	tor B:	#DIV/0!
	2.4 Return Period Scaling Factor			Return Perior		ortance level (from at from Table 3.1, Fact		
						along		across
	2.5 Ductility Scaling Factor	Dustilituseelise festers 4 fe		ctility (less than max in Table 3.2) = =kµ, if pre-1976, fromTable 3.3:		along		801033
		Ducting scaling factor. =1 fro		Ductiity Scaling Factor, Factor D:		0.00		0.00
	2.6. Structural Desfermance Seelin	- F				0.00		0.00
	2.6 Structural Performance Scalin	g Factor:	0	Sp:		"DIV/01		"DI) //01
			Structural Perio	mance Scaling Factor Factor E:		#DIV/0!		#DIV/0!
	2.7 Baseline %NBS, (NBS%)b = (%I	NBS)nom x A x B x C x D x E		%NBS6:		#DIV/0!		#DIV/0!
	Global Critical Structural Weaknesse	s: (refer to NZSEE IEP Table 3.4)						
	3.1. Plan Irregularity, factor A:		1					
	3.2. Vertical irregularity, Factor B:		1					
	3.2. Vertical irregularity, Factor B:3.3. Short columns, Factor C:			Table for selection of D1		Severe	Significant	Insignificant/none
	3.3. Short columns, Factor C: 3.4. Pounding potential	Pounding effect D1, from Table	1 1 e to right		Separation	Severe 0 <sep<.005h 0.7</sep<.005h 	Significant .005 <sep<.01h 0.8</sep<.01h 	Insignificant/none Sep>.01H
	3.3. Short columns, Factor C: 3.4. Pounding potential	Pounding effect D1, from Table	1 1 e to right		n 20% of H	0 <sep<.005h< td=""><td>.005<sep<.01h< td=""><td>Sep>.01H</td></sep<.01h<></td></sep<.005h<>	.005 <sep<.01h< td=""><td>Sep>.01H</td></sep<.01h<>	Sep>.01H
	3.3. Short columns, Factor C: 3.4. Pounding potential	eight Difference effect D2, from Table	1 1 e to right	Alignment of floors within Alignment of floors not within Table for Selection of D2	n 20% of H n 20% of H	0 <sep<.005h 0.7 0.4 Severe</sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant</sep<.01h 	Sep>.01H 1 0.8 Insignificant/none
	3.3. Short columns, Factor C: 3.4. Pounding potential	eight Difference effect D2, from Table	1 1 e to right e to right	Alignment of floors within Alignment of floors not within Table for Selection of D2	n 20% of H n 20% of H Separation	0 <sep<.005h 0.7 0.4 Severe 0<sep<.005h< td=""><td>.005<sep<.01h 0.8 0.7 Significant .005<sep<.01h< td=""><td>Sep>.01H 1 0.8 Insignificant/none Sep>.01H</td></sep<.01h<></sep<.01h </td></sep<.005h<></sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h< td=""><td>Sep>.01H 1 0.8 Insignificant/none Sep>.01H</td></sep<.01h<></sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H
	3.3. Short columns, Factor C: 3.4. Pounding potential Hi	eight Difference effect D2, from Table	1 1 e to right e to right	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys	0 <sep<.005h 0.7 0.4 Severe</sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none
	3.3. Short columns, Factor C: 3.4. Pounding potential Hi	eight Difference effect D2, from Table	1 1 e to right e to right	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference :	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep<.005h 0.4</sep<.005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1
	3.3. Short columns, Factor C: 3.4. Pounding potential H 3.5. Site Characteristics	light Difference effect D2, from Table	1 1 e to right e to right actor D: 0 1	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep<.005h 0.4 0.7</sep<.005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1
	3.3. Short columns, Factor C: 3.4. Pounding potential Hi	light Difference effect D2, from Table	to right	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep<.005h 0.4 0.7 1</sep<.005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 1
	3.3. Short columns, Factor C: 3.4. Pounding potential 3.5. Site Characteristics 3.6. Other factors, Factor F	ight Difference effect D2, from Tabk	1 1 e to right = to right	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t Height difference 3 t Height difference 4 the second sec	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep<.005h 0.4 0.7 1</sep<.005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 1
	3.3. Short columns, Factor C: 3.4. Pounding potential H 3.5. Site Characteristics	light Difference effect D2, from Table Therefore, F For ≤ 3 storevs, ma s: (refer to DEE Procedure section 6	at value =2.5, otherw Ratior	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t Height difference 3 t Height difference 4 the second sec	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys < 2 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep005h 0.4 0.7 1 Along</sep005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9 1</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 Across Across
	3.3. Short columns, Factor C: 3.4. Pounding potential He 3.5. Site Characteristics 3.6. Other factors, Factor F	For < 3 storeys, ma : (refer to DEE Procedure section 6 y.	at value =2.5, otherw Ratior	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t Height difference 3 t Height difference 4 the selection of the se	n 20% of H n 20% of H Separation > 4 storeys o 4 storeys < 2 storeys	0 <sep<.005h 0.7 0.4 Severe 0<sep005h 0.4 0.7 1 Along</sep005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9 1</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 Across Across
	3.3. Short columns, Factor C: 3.4. Pounding potential He 3.5. Site Characteristics 3.6. Other factors, Factor F Detai Critical Structural Weaknesse List an	For < 3 storeys, ma : (refer to DEE Procedure section 6 y.	at value =2.5, otherw Ratior	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 t Height difference 2 t Height difference 3 t Height difference 4 the selection of the se	n 20% of H n 20% of H Separation > 4 storeys < 4 storeys < 2 storeys n of F factor me	0 <sep<.005h 0.7 0.4 Severe 0<sep005h 0.4 0.7 1 Along</sep005h </sep<.005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9 1</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 1 1 Across Sees
	3.3. Short columns, Factor C: 3.4. Pounding potential 3.5. Site Characteristics 3.6. Other factors, Factor F Detail Critical Structural Weaknesse List an 3.7. Overall Performance Achieven	ight Difference effect D2, from Tabk Therefore, F For ≤ 3 storevs, ma s: (refer to DEE Procedure section 6 y: Lent ratio (PAR)	at value =2.5, otherw Ratior	Alignment of floors within Alignment of floors not within Table for Selection of D2 Height difference 2 Height difference 2 He	n 20% of H n 20% of H Separation > 4 storeys < 4 storeys < 2 storeys n of F factor me	0 <sep<:005h 0.7 0.4 0<sep=:005h 0.4 0.7 1 Along 0.4 0.7 1 0.4 0.7 1 0.4 0.7 1 0.4 0.7 1 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 1 0.4 0.7 1 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.7 0.4 0.7 0.7 0.4 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7</sep=:005h </sep<:005h 	.005 <sep<.01h 0.8 0.7 Significant .005<sep<.01h 0.7 0.9 1</sep<.01h </sep<.01h 	Sep>.01H 1 0.8 Insignificant/none Sep>.01H 1 1 1 Across Sees 0.00 Sees

Detailed Engineering Evaluation Summary Data			V1.11
Location Building Name	CWTP Vehicle Garage Building Part 2	Reviewer	David Whittaker
	Unit Christchurch Wastewater Treatment Plant	No: Street CPEng No: Shuttle Drive Company:	123089
	BU 0879-019 EQ2	Company project number: Company project number: Company phone number:	5323355
GPS south:	Degrees	Min_SecDate of submission:	,
GPS south GPS east		Inspection Date: Revision	1/02/2013, 14/02/2012, 24/02/2012
Building Unique Identifier (CCC):		Is there a full report with this summary?	
L			
Site			
	sity sand	Max retaining height (m): Soil Profile (if available):	3 Geotech report available for parts of site
Site Class (to NZS1170.5): Proximity to waterway (m, if <100m):	D	If Ground improvement on site, describe:	None
Proximity to clifftop (m, if < 100m): Proximity to cliff base (m, if <100m):		Approx site elevation (m):	17.00
Building No. of storeys above ground:	1	single storey = 1 Ground floor elevation (Absolute) (m):	17.00
Ground floor split? Storeys below ground	no	Ground floor elevation above ground (m):	
	other (describe) 3.40	if Foundation type is other, describe: height from ground to level of uppermost seismic mass (for IEP only) (m):	strip footing 3.4
Floor footprint area (approx) Age of Building (years):	83	Date of design	
Age of Building (years).		Date of design	1933-1963
Strengthening present?	no	If so, when (year)?	
Use (ground floor):	other (specify)	And what load level (%q)? Brief strengthening description:	
Use (upper floors): Use notes (if required):	Offices		
Importance level (to NZS1170.5):	L2		
Gravity Structure Gravity System:	load bearing walls		
Roof	timber framed concrete flat slab	rafter type, purlin type and cladding slab thickness (mm)	150mm slab on orade
Beams: Columns:	timber		timber frame walls
Walls:	non-load bearing		
Lateral load resisting structure	lightunight timber from of walk	Note: Define along and across in	
Ductility assumed, µ	lightweight timber framed walls 3.00 0.40	detailed report! note typical wall length (m)	
Period along: Total deflection (ULS) (mm):	0.40	estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	
Lateral system across: Ductility assumed, µ:	lightweight timber framed walls 3.00	note typical wall length (m)	4
Period across: Total deflection (ULS) (mm):	0.40	0.00 estimate or calculation? estimate or calculation?	estimated
maximum interstorey deflection (ULS) (mm):		estimate or calculation?	
Separations:			
north (mm): east (mm): south (mm)		leave blank if not relevant	
		leave blank if not relevant	
east (mm) south (mm) west (mm): Non-structural elements	other (specify)		Toope
east (mm) south (mm) west (mm) <u>Non-structural elements</u> Stairs: Wall cladding.	other (specify) brick or tile Other (specify)	describe describe (note cavity if exists)	brick veneer
east (mm) south (mm) west (mm) Non-structural elements Stairs: Wall cladding Roof Cladding Gaizing	brick or tile Other (specify) timber frames	describe describe (note cavity if exists)	none brick veneer unknown
east (mm) south (mm) west (mm) Non-structural elements Stairs: Wall cladding Roof Cladding Gaizing	brick or tile Other (specify) timber frames fibrous plaster, fixed	describe describe (note cavity if exists)	brick veneer
east (mm) souht (mm) Non-structural elements Vall cladding Roof Cladding Ceirings Services(ist)	brick or tile Other (specify) timber frames fibrous plaster, fixed	describe describe (note cavity if exists)	brick veneer
east (mm) souht (mm) Non-structural elements Vall cladding Roof Cladding Celaring Celaring Services(Ist) Available documentation Architectural	brick or tile Other (specify) timber frames fibrous plaster, fixed	describe describe (note cavity if exists) describe original designer name/date	brick veneer unknown
east (mm) souht (mm) Non-structural elements Statis: Wall eladding Roof Cladding Celings Services(ist) Available documentation Architectural Structural Mechanica	brick or tile Other (spectry) timber frames fibrous plaster, fixed	describe describe (note cavity if exists) describe original designer name/date original designer name/date original designer name/date	brick veneer unknown
east (mm) south (mm) west (mm). Non-structural elements Wal cladding Roof Cladding Ceirings Services(ist) Available documentation Architectural Structural	brick or tile Other (specify) timber frames fibrous plaster, fixed none none	describe describe (note cavity if exists) describe original designer name/date original designer name/date	brick veneer unknown
east (mm) souht (mm) Non-structural elements Statis: Wall eladding Roof Cladding Celings Services(ist) Available documentation Architectural Electrical Geotech report	brick or tile Other (specify) timber frames fibrous plaster, fixed none none	describe describe (note cavity if exists) describe original designer name/date original designer name/date original designer name/date original designer name/date	brick veneer unknown
east (mm) souht (mm) Non-structural elements Statis: Wall eladding Roof Cladding Celings Services(ist) Available documentation Architectural Electrical Geotech report Damage Site: Site performance:	brick or tile Other (specify) timber frames fibrous plaster, fixed none none	describe describe (note cavity if exists) describe original designer name/date original designer name/date original designer name/date original designer name/date	
east (rm) south (rm) west (rm): Non-structural elements Wall cladding: Roof Cladding: Cellings: Services(tst) Available documentation Architectural Electrica Geotech report Damage Stat: (refer DE T able 4-2) Site performance:	brick or tile Other (specify) timber frames fibrous plaster, fixed none none Widespread liquefaction on site	describe describe (note cavity) if exists) describe original designer name/date original designer name/date original designer name/date original designer name/date original designer name/date	
east (mm) south (mm) west (mm): Non-structural elements Wall cladding: Roof Cladding: Roof Cladding: Cearings: Services(tst) Available documentation Architectural Structural Geotech report Damage Stat: (refer DEE Table 4-2) Settlement: Differential settlement:	brick or tile Other (specify) timber frames fibrous plaster, fixed none none	describe describe (note cavity) if exists) describe original designer name/date original designer name/date origin	
east (mm) south (mm) west (mm): <u>Non-structural elements</u> Wall claiding: Roof Claiding: Ceirings: Services(ist) Available documentation Architectural Electrical Geotech report Damage Site: (refer DEE Table 4-2) Settlement: Liquefaction. Lateral Spread	brick or tile Other (specify) timber frames fibrous plaster, fixed none none None None None None None Non	describe describe (note cavity) if exists) describe original designer name/date original designer name/date origin	
east (mm) south (mm) West (mm): Wall cladding Roof Cladding Claddi	brick or tile Other (specify) timber frames fibrous plaster, fixed none none None Widespread liquefaction on site	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	
east (mm) south (mm) West (mm): Non-structural elements Wall cladding Roof Cladding	brick or tile Other (specify) timber frames fibrous plaster, fixed none none None Widespread liquefaction on site	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	
east (mm) south (mm) West (mm): Wall cladding Roof Cladding Claddi	brick or tile Other (specify) timber frames fibrous plaster, fixed none none None None None None None Non	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	
east (mm) south (mm) West (mm): Non-structural elements Vall cladding Roof Cladding Clarge Cerings Services(Ist) Available documentation Architectural Structural Mechanica Electrical Geotech report Careford Electrical Geotech report Damage Stat: (refer DE E Table 4-2) Settlement: Liquefaction Liquefaction Liquefaction Liquefaction Conditional Isterial spread Offerential Isterial spread Differential Isterial spread	brick or tile Other (specify) timber frames fibrous plaster, fixed none none none None none additional distribution Widespread liquefaction on site additional distribution green additional distribution	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	brick veneer unknown
east (mm) south (mm) West (mm): Non-structural elements Stairs Wall cladding Roof Cladding Clarge Services(Ist) Available documentation Architectural Structural Centres Stat: (refer DE E Table 4-2) Stateral Spread Differential settement: Liquefaction Lighteration Differential settement: Current Differential settement: Liquefaction Lighteration Differential settement: Convol cracks: Damage to area: Building: Current Placard Status Along Damage ratio: Describe (summary):	brick or tile Other (specify) timber frames fibrous plaster, fixed none none Widespread liquefaction on site none observed green 0%	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	brick veneer unknown
east (mm) south (mm) West (mm): Non-structural elements Stairs Wall cladding Roof Cladding Celings Services(Ist) Available documentation Architectural Structural Mechanica Electrical Geotech report Damage Stat: (refer DE E Table 4-2) Settlement: Liquefaction Liquef	brick or tile Other (specify) timber frames fibrous plaster, fixed none none Widespread liquefaction on site none observed green 0%	describe describe (note cavity if exists) describe original designer name/date original designer name/date origina	brick veneer unknown
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Appendix E

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	S*	E		-	concrete	Unreinforced	
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	Diaphragms, horizontal bracing		B			•		
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	Beam	3-24	R	Ē				
	Non-structural Hazards / Damag	8	- /		-			
	Parapets, ornamentation		B					
	Cladding, glazing		E			2000		
	Ceilings, light fixtures							
	Interior walls, partitions		B					
	Elevators /	VA						
	Stairs/ Edits	1	Ø					<u></u>
	Utilities (eg. gas, electricity, water)		g					
	Other							
C)Geotechnical Hazards / Damage		1770	-	-			
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	Soil buiging, liquefaction		ď		Π.	Evidence of 1	guefaction around	At 10 Digooky 4
	General Comment	_						
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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected	G1. Occupiable, no immediate further investigation required	
Low risk		C2. Occupiable, repairs required	ise recommendations
Madium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Lines damage		R1. Significant damage: repairs, strengthening possible	<u> </u>
Heavy damage Unsafe (Red)	Linsafe (Red)	R2. Severe damage: demolition likely	
High risk		R3. At risk from adjacent premises or from ground failure	

2 Inspection ID: _____ (Office Use Only)

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Sketch (optional) Provide a skatch of the entire								CW	TPB	
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Report

Christchurch Wastewater Treatment Plant: Post-Earthquake Structural Damage Assessment

Prepared for Christchurch City Council (CCC)

By CH2M Beca Ltd (Beca)

1 April 2011

 $\ensuremath{\textcircled{O}}$ Beca 2012 (unless Beca has expressly agreed otherwise with the Client in writing).

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.



Revision History

Revision Nº	Prepared By	Description	Date
А	Nik Stewart	Draft	23 March 2011
В	Nik Stewart	Final	1 April 2011

Document Acceptance

Action	Name	Signed	Date
Prepared by	Nik Stewart		1 April 2011
Reviewed by	lan Billings		1 April 2011
Approved by	Greg Offer		1 April 2011
on behalf of	CH2M Beca Ltd		



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Appendices

Appendix A – Structural Damage Register Spreadsheet Appendix B – Christchurch Earthquake Level 2 Rapid Assessment Forms Appendix C – Sika Products Technical Data Sheets



Executive Summary

CH2M Beca Ltd (Beca) has been engaged by Christchurch City Council (CCC) to undertake postearthquake structural assessments for buildings at the Christchurch Wastewater Treatment Plant (CWTP). These assessments were carried out due to damage caused by the magnitude 7.1 Canterbury Earthquake on 4 September 2010 and the magnitude 6.3 Christchurch Earthquake on 22 February 2011 and subsequent aftershocks

The scope of the structural assessment works include:

- Locating, describing and documenting earthquake damage to the structural components of the buildings to serve as a record to CCC.
- Review of the available construction drawings for the buildings.
- Identification of those areas that require structural remedial works and propose remedial methodologies for each typical defect. Repair methodologies are intended to bring the buildings back to, or as near as reasonably practical to, the buildings' condition prior to the earthquake events.

A visual inspection of damage to the structures at the CWTP and review of the construction drawings shows that in general the primary structural elements behaved adequately and sustained only relatively minor damage.

In general, to return the buildings to as near its original state as possible, all cracking to structural concrete and masonry should be grouted or epoxy injected.

However, a number of additional investigations are recommended which may result in identifying further damage. This damage may be significant. In particular additional investigations are recommended for the primary sedimentation tanks, solids contact tanks, north and south gallery structures, trickling filters and the clarifiers.

This summary is a limited précis of our observations and conclusions. Where any question arises as to the scope of the assessment undertaken by us, or the interpretation of this summary, the full report should be reviewed, or CH2M Beca Ltd consulted.



1 Introduction

1.1 Background

CH2M Beca Ltd (Beca) has been engaged by Christchurch City Council (CCC) to undertake postearthquake structural assessments for buildings at the Christchurch Wastewater Treatment Plant (CWTP). These assessments were carried out due to damage caused by the magnitude 7.1 Canterbury Earthquake on 4 September 2010 and the magnitude 6.3 Christchurch Earthquake on 22 February 2011 and subsequent aftershocks. The 7.1 magnitude and in particular 6.3 magnitude earthquakes resulted in widespread damage to buildings and infrastructure in the Christchurch region.

CCC has requested all buildings at the CWTP to be assessed and structural evaluation reports for buildings be provided. Detailed inspections for buildings at the plant were carried out on 5 and 7 March 2011.

The structural assessment carried out by Beca fulfils the following function:

Locate, describe and document earthquake damage to the structural components of the buildings to serve as a record to CCC. Identify those areas that require structural remedial works and propose remedial methodologies for each typical defect. Repair methodologies are intended to bring the buildings back to, or as near as reasonably practical to, the buildings' condition prior to the earthquake events.

Since the main earthquakes of 4 September 2010 and 22 February 2011, there have been a number of aftershocks. The information in this report provides a snapshot of building damage at the time the detailed inspections were carried out. No further inspections have been completed since these dates. Any questions regarding this report's validity should be referred to Beca in the first instance.

1.2 Scope of Work

This document serves as a record of the structural inspections undertaken and it may also be submitted to CCC as a basis for initial discussion prior to preparation of Building Consent documentation, if required.

The specific Beca scope of work for the detailed structural evaluation is as follows:

- Carry out detailed structural inspections and a damage survey of the structural elements for each building and provide recommendations for any further investigation that may be required.
- Review the original construction drawings for the buildings, if available. The purpose of this
 review will be to identify concealed structural components of the building that may have suffered
 damage and therefore warrant inspection.
- Upon completion of the above, prepare a report to that includes a record of the inspection undertaken, photos of the various areas of damage, findings, repair methodology and associated remedial works.
- The report will highlight areas requiring remedial work and will suggest a basic methodology with the intention of bringing the buildings up to, or as near as reasonably practical to, the buildings' condition prior to the earthquake.

1.3 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. Structural components in this
 instance are primary, secondary or tertiary structural elements constructed from concrete, steel,
 timber or masonry.
- Inspection of building services, pipework, pavement and fire safety systems is excluded from the scope of this report.
- Inspection of the glazing systems, linings, carpets, claddings, finishes, suspended ceilings, partitions, and the general water tightness envelope is excluded from the scope of this report.
- 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.

This report should be read in conjunction with the letter report entitled "CWTP Earthquake Structural Damage Assessment" dated 9 September 2010 and the report entitled "CWTP Earthquake Damage – Minor Structural Repairs" dated 20 October 2010 for the assessed damage and proposed repair methodologies following the 4 September 2010 earthquake.

It is noted that some of the damage noted in this current report may be associated with the 4 September earthquake and subsequent aftershocks.

This report should also be read in conjunction with The Oxidation Pond condition report for the September 2010 earthquake entitled "Christchurch Wastewater Treatment Plant - Damage to Oxidation Ponds in the 2010 Darfield Earthquake".

The damage assessment and reporting following the February 2011 earthquake for the Oxidation Ponds, Civil Works and Mechanical & Electrical Works was not completed at the time of writing this report.



2 Summary of Buildings and Structures

The Christchurch Wastewater Treatment Plant is located the end of Shuttle Drive in Bromley approximately 5 kilometres from central Christchurch. An aerial view of the plant is shown in Figure 1 below.



Figure 1 – Aerial View of CWTP

The plant comprises several buildings / structures as outlined below.

- 1) Administration Building
- 2) Operations Building
- 3) Pump Station A / Basement Storeroom / 11kV Switchroom
- 4) Workshop & Emergency Equipment Store (to the North of PS-A)
- 5) Screen Room
- 6) Engine Room & Workshop to the South
- 7) Thickener Building & Pump Station B
- 8) Education Centre / Garage / Technicians' Workshop
- 9) Dewatering Building
- 10) Dryer Building
- 11) Energy Centre Building
- 12) North Gallery
- 13) South Gallery



- 14) Primary Sedimentation Tanks and Solids Contact Tanks
- 15) Sludge Lagoons
- 16) Influent Structure
- 17) Trickling Filters 1 and 2
- 18) Digesters 1 4
- 19) Digesters 1 4 Control Building
- 20) Digesters 5 & 6 and Underground Gallery
- 21) Digesters 5 & 6 Control Building
- 22) Clarifiers 1 4
- 23) RAS / WAS Pump Station
- 24) Water Tank and Gas Holder Tank



3 Structure Inspection Overview

3.1 Inspection Methodology

The buildings were inspected around the full perimeter of the exterior from the ground. Buried foundation elements were not inspected, but based on observations at the ground level this is not considered to be necessary. All buildings were inspected internally with the exception of the Energy Centre building and the RAS / WAS Pump Station building. The interior of the Digesters, Clarifiers and several of the Primary Sedimentation Tanks could not be inspected. Most of the structural systems such as the concrete and masonry walls were not clad with any material and were typically only covered by paint.

3.2 Assessment Summary

In general based on the visual inspection, with respect structural load-carrying capacity, all buildings and structures appear to have performed adequately with generally only minor structural damage.

In general, to return the buildings to as near its original state as possible, all cracking to structural concrete and masonry should be grouted or epoxy injected.

However, refer to Section 6 for recommendations for additional investigations which may reveal additional damage which may be significant.

3.3 Damage Classification System

Table 1 below classifies damage into general categories. These categories have been chosen based on several factors, including:

- The effect of the defect on the strength and stiffness of the structure.
- The effect of the defect on the durability of the structural element.
- Suggested repair method.

Structural damage that falls outside the scope of the table will be considered on a case by case basis.



Damage Type	General Damage Description
Type 1	Cracks in concrete structures that do not exceed a width of 0.3 mm. These cracks are not likely to have any adverse effect on structure durability. The structural system will also perform satisfactorily without repair of the damage of this type. There is therefore no requirement to repair Type 1 cracks in order to meet Building Code compliance. However, both the building's aesthetic and stiffness are affected. If left unrepaired, the building's response to loading will not be the same as prior to the earthquake damage. The building will be more flexible than it was prior to the earthquake, and therefore the serviceability limits maybe exceeded in certain conditions i.e. strong winds; however building safety will not be compromised. In order to return the building to as near to the original performance as possible, the cracks should be repaired as far as is practical with an epoxy or grout injection system (Sikadur Injectokit- LV or equivalent). Note it is often not feasible to repair crack widths less than around 0.2 mm. For crack widths less than 0.2 mm the surface shall be cleaned and painted with Sikagard 550 elastomeric paint.
Туре 2	Cracks in concrete structures that exceed a crack width of 0.3mm, but less than 1.0 mm. These cracks require remedial work. In order to restore Building Code durability requirements these cracks should be repaired with a surface treatment of grout or crack sealant, however the building's stiffness will not be improved with this repair and the building will remain more flexible than it was prior to the earthquake. In order to return the building to as near to its original performance as possible, the cracks should be repaired with an epoxy or grout injection system (Sikadur Injectokit-TH or equivalent).
Туре 3	Cracks in a concrete structure that exceed a crack width of 1.0 mm. These cracks require remedial work to the visibly affected area, and further investigation to confirm if remedial work is required to unseen areas. The cracks should be repaired with an epoxy or grout injection system (Sikadur 52 epoxy grout or equivalent)
Туре 4	Spalling to concrete elements. Spalling is unlikely to have a major effect on the structure unless it is particularly severe. However, spalling should be repaired using a structural mortar system to reinstate cover to reinforcement and for aesthetic reasons. Square off edges of concrete spalling with angle grinder to a minimum depth of 10mm. If reinforcement is visible, remove rust and corrosion products from reinforcement using cup brush or rust removing attachment on an angle grinder. Apply Sika MonoTop Primer to reinforcement and concrete substrate as per the manufacturer's recommendations. Apply Sika MonoTop Structural Mortar to build to original profile as per the manufacturer's recommendations. Equivalent products may be used.
Туре 5	Damage to mortar in masonry elements. Mortar damage can reduce the resilience of a masonry façade to earthquake shaking. Damaged mortar should be removed and the masonry repointed.

Table 1– Classification of Damage Type for Primary and Secondary Structural Elements

Note: The 0.3 mm limit is sourced from Concrete Structures Standard NZS 3101 Commentary, stating that corrosion of reinforcing steel is not likely to be affected by crack widths less than 0.3 mm.



4 Detailed Inspection Observations

The following section outlines the results of the visual inspection, a description of the damage and likely repair methodologies. Refer to Appendix A for a damage summary and Appendix B for the Level 2 Rapid Assessment Forms.

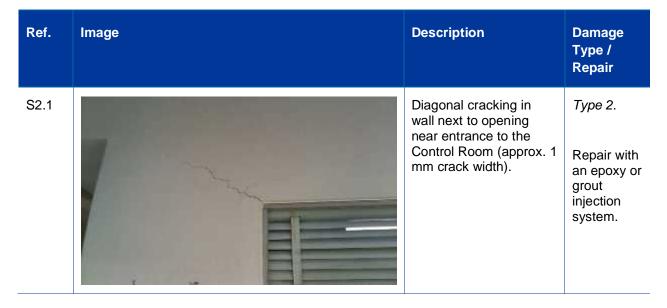
It was noted there was general minor liquefaction around the site as evidenced by sand and silt and by observations by CWTP staff at the time of the earthquake. Ground settlement in the order of 50 mm to 300 mm was widespread around the site.

4.1 Administration Building

The administration building appears to be in good condition for its age and does not appear to show any signs of significant structural damage due to the earthquakes.

4.2 **Operations Building**

The operations building comprises the Control Room, laboratories and offices. Other than the relatively minor damage as outlined below the operations building appeared to be in good condition.





Ref.	Image	Description	Damage Type / Repair
S2.2		Mortar is cracked in brick cladding outside the south-west doorway (view looking upwards towards the eaves).	<i>Type 5.</i> Remove cracked mortar and repoint masonry.
S2.3		The timber purlins connecting to the western timber truss on the new roof structure have separated by approx 30 mm. (The roof structure was currently under construction).	Supply packers between purlins and truss. Install joist hangers.

4.3 Pump Station A / Basement Storeroom / 11kV Switchroom

The building has reasonably large cracks (up to 5 mm) in the southern basement wall and the eastern ground floor wall. There is also a crack across the mezzanine floor from the basement stairs to the eastern wall. As outlined below the crack in the mezzanine floor does not weaken the vertical load-carrying capacity and the cracks in the wall do not compromise the stability of the walls.

The brick veneer cladding on the exterior walls appeared to be in good condition.

The ceiling panels above the pump station had fallen as a result of the earthquake.

It is recommended a level survey be carried out to better understand the damage behaviour. If significant settlement or heaving has occurred, it is recommended that subsurface investigation be carried out to assess the extent of damage to the structure below ground and the whether there are any voids beneath the foundation.



Ref.	Image	Description	Damage Type / Repair
S3.1		Large cracks in south basement wall (up to 5 mm crack width).	<i>Type 3.</i> Repair with an epoxy or grout injection system.
S3.2a & S3.3		Large cracks to eastern ground level wall next to men's changing room (up to 3 mm crack width). View from mezzanine floor.	<i>Type 3.</i> Repair with an epoxy or grout injection system.
S3.2b		Large cracks to eastern ground level wall next to men's changing room. View from inside men's changing room.	<i>Type 3.</i> Repair with an epoxy or grout injection system.
S3.2c		Close-up view of large cracks to eastern ground level wall next to men's changing room.	<i>Type 3.</i> Repair with an epoxy or grout injection system.



Ref.	Image	Description	Damage Type / Repair
S3.4	(no image)	Cracking to eastern basement wall (approx 0.3 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S3.5		Cracking in mezzanine floor. The mezzanine floor is supported by a reinforced concrete beam spanning east- west. Therefore the cracks in the mezzanine floor do not compromise the vertical load capacity of the floor.	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S3.5		Cracking in mezzanine floor with covering removed.	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S3.5		Cracking in mezzanine floor with crack propagating from edge.	<i>Type 2.</i> Repair with an epoxy or grout injection system.



Ref.	Image	Description	Damage Type / Repair
S3.5		Cracking in mezzanine floor.	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S3.6	(no image)	Cracks in basement floor slab (up to approx 1 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S3.7 & S3.8		Cracks in southern column and cracks in reinforced concrete floor slab of 11 kV switchroom.	<i>Type 2.</i> Repair with an epoxy or grout injection system.



Ref.	Image	Description	Damage Type / Repair
S3.9		Gaps between the infill brickwork and the RC column in 11 kV switchroom.	<i>Type 5.</i> Remove cracked mortar and repoint masonry
S3.10		Cracks in walls of storeroom beside PS-A.	<i>Type 2.</i> Repair with an epoxy or grout injection system



4.4 Workshop & Emergency Equipment Store (to the North of PS-A)

Other than the cracking as outlined below, the workshop and emergency equipment store did not appear to have suffered significant structural damage as a result of the earthquakes.

Ref.	Image	Description	Damage Type / Repair
S4.1		Cracking to columns (at two locations).	<i>Type 2.</i> Repair with an epoxy or grout injection system
S4.2a		Cracking to walls at entrance to workshop and inside workshop.	<i>Type 2.</i> Repair with an epoxy or grout injection system
S4.2b		Cracking to walls at entrance to workshop.	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S4.2c		Cracking to walls at entrance to workshop.	<i>Type 2/3.</i> Repair with an epoxy or grout injection system
S4.2d		Cracking to walls in workshop.	<i>Type 2.</i> Repair with an epoxy or grout injection system
S4.3		Cracking in beam at one location	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S4.4	(no image)	Cracking to walls in emergency equipment store (up to 1 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system

4.5 Screen Room

Other than the cracking as outlined below, the screen room did not appear to have suffered significant structural damage as a result of the earthquakes.

Ref.	Image	Description	Damage Type / Repair
S5.1a		Diagonal cracks in north and south walls (approx 0.3 mm crack width)	<i>Type 2.</i> Repair with an epoxy or grout injection system
S5.1b		Diagonal cracks in north and south walls (approx 0.3 mm crack width)	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S5.2		Cracked mortar in blockwork on south-west wall.	<i>Type 5.</i> Remove cracked mortar and repoint masonry
S5.3		Horizontal cracks in walls (approx 0.3 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system



4.6 Engine Room and Workshop to the South

The engine room appears to show no signs of structural damage. However, most of the structure was hidden due to the sound-proof cladding. It is recommended a sample of cladding be removed and the structure behind it inspected for damage.

Other than the damage to the masonry infill the workshop appeared to be structurally sound.

Ref.	Image	Description	Damage Type / Repair
S6.1		In the workshop to the south of the engine room there was cracking in corner join between masonry wall and reinforced concrete columns. This was observed to be typical at all columns.	<i>Type 5</i> . Remove cracked mortar and repoint masonry.

4.7 Thickener Building & Pump Station B

The building does not appear to have suffered significant structural damage as a result of the earthquake. However, the cracked concrete at the pipe may be the result of differential settlement. It is recommended a level survey be carried out to determine the amount of structural differential settlement (if any). If the differential settlement is significant carry out sub-surface investigation to identify if there any voids underneath the structure.



Ref.	Image	Description	Damage Type / Repair
S7.1		Horizontal cracking next to windows on western side of building.	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S7.2		Settlement of the ground at the north-eastern end of the building.	Remove loose soil and broken pavement, backfill, compact and replace pavement.
S7.3		Cracking (approx 0.2 mm crack width) on western wall near door on southern end of building.	<i>Type 1.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S7.4		Damage to concrete paving slab next to building at southern end of building.	<i>Type 4.</i> Repair with structural repair mortar system.
S7.5	(no image)	Cracking on eastern wall between roller doors (approx 0.3 mm crack width)	<i>Type 2.</i> Repair with an epoxy or grout injection system
S7.6		Cracking in eastern wall at northern end of building (approx 0.2 mm crack width)	<i>Type 1.</i> Repair with an epoxy or grout injection system
S7.7		Cracking to corbel supporting the crane rail beam on western side of building next to roller door.	<i>Type 4.</i> Inspect corbel, remove broken concrete and repair with structural repair mortar system.



Ref.	Image	Description	Damage Type / Repair
S7.8		Large crack to concrete where pump station pipe passes through wall.	Break out and replace concrete. Carry out level survey to assess whether the cracked pipe is the result of differential settlement or seismic shaking.
S7.9		Spalling to top of column at south-east end next to wall	<i>Type 4.</i> Repair with structural repair mortar system.
S7.10		Cracking in wall above internal door to southern room (0.2-0.3mm crack width)	<i>Type 1.</i> Repair with an epoxy or grout injection system.



4.8 Education Centre / Garage / Technicians' Workshop

Apart from the cracking to the masonry the buildings appear to have suffered minimal structural damage as a result of the earthquakes.

Ref.	Image	Description	Damage Type / Repair
S8.1a		Large cracks / gaps (30 mm) in brickwork on northern wall next to Digester 4. This appears to be the result of slope movement next to Digester No. 4 (as evidenced by tension cracks in the slope).	Investigate stability of slope. Remove and replace brickwork or remove brickwork completely and replace with timber framed wall (or similar).
S8.1b		Close-up view of large cracks / gaps in brickwork on north- western wall.	As above.
S8.2		Gaps in brickwork between walls on northern face.	<i>Type 5.</i> Remove cracked mortar and repoint masonry.



Ref.	Image	Description	Damage Type / Repair
S8.3		Cracks in brickwork mortar in eastern wall.	<i>Type 5.</i> Remove cracked mortar and repoint masonry.

4.9 Dewatering Building

Structural damage to the bio-solids dewatering building is minor.

Ref.	Image	Description	Damage Type / Repair
S9.1		Cracking / spalled concrete at base of concrete encased steel I-beam columns.	<i>Type 4.</i> Break out loose concrete and repair with structural repair mortar system.



Ref.	Image	Description	Damage Type / Repair
S9.2		Cracking in eastern walls (approx 0.3 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S9.3		Cracking in columns.	<i>Type 2.</i> Repair with an epoxy or grout injection system.
S9.4		Large gap at steps at south-western corner of building.	Reinstate concrete and provide seal.



Ref.	Image	Description	Damage Type / Repair
S9.5		Cracks in walls at weld plate connections. This cracking was observed at several of the weld plate connections.	<i>Type 2.</i> Repair with an epoxy or grout injection system

4.10 Dryer Building

Other than the minor damaged areas as outlined below, the building appears to be structurally sound.

Ref.	Image	Description	Damage Type / Repair
S10.1		Spalling to top of interior wall panel on northern end of building.	<i>Type 4.</i> Break out loose concrete and repair with structural repair mortar system.
S10.2		Cracking in walls next to opening on western wall (approx 0.3 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S10.3	(no image)	Cracking above door on southern side of building (approx 0.3 mm crack width)	<i>Type 2.</i> Repair with an epoxy or grout injection system
S10.4	(no image)	Cracking to panels next to doors / windows on north face (approx 0.3 mm crack width)	<i>Type 2.</i> Repair with an epoxy or grout injection system

4.11 Energy Centre Building

The interior of the building could not be inspected. From the outside there were no apparent structural defects. However, from the inspection carried out by Beca after the 4 September 2010 earthquake, it was noted that the precast panels were cracked at the weld plate connections. It is likely further cracking to these panels will have occurred due to the 22 February 2011 earthquake.

These cracks will need to be repaired using an epoxy or grout injection system (Type 2 repair).

4.12 North Gallery

The most significant damage to the north gallery was the differential movement between the adjacent tunnel sections resulting in damage to the joint seals. This type of damage was observed at most of the joints. The joints did not appear to be leaking.

The construction drawings for the gallery structure show the joint in the channel floors comprises a square-ended slab with a 25 mm thick bitumen-impregnated fibre board with a PVC water-stop placed 75 mm from one edge and sealant on one edge. The drawings show the joint in the walls to have a tongue-and-groove type joint with a bitumen-impregnated fibreboard, a PVC water-stop placed centrally in the wall and sealant to both faces.

Given the amount of movement observed at the joints, it is likely the tongue and groove segments of the concrete and the PVC water-stop may have been damaged and it is recommended a local break out is undertaken on a joint with large movement to assess if there is any damage.

Above the gallery tunnel there is a bypass channel which could not be inspected. The joint requires inspection from inside this channel (if possible) to assess the extent of damage.

To assess the extent of damage on the exterior faces of the walls, it is recommended that local excavations be carried out at each of the joint locations.



Ref.	Image	Description	Damage Type / Repair
S12.1		Cracking around doorway near digester control room.	<i>Type 2.</i> Repair with an epoxy or grout injection system
S12.2a		Differential vertical and horizontal movement at control joints up to 20 mm. This type of damage was observed at most of the joints.	Remove seal, remove loose concrete, reinstate concrete and replace seal



Ref.	Image	Description	Damage Type / Repair
S12.2b		Differential vertical and horizontal movement at control joints.	As above
S12.2c		Differential vertical and horizontal movement at control joints.	As above



Ref.	Image	Description	Damage Type / Repair
S12.3		Large movement (approx 30 mm) at top of stairs next to Digester Control Room.	Remove seal, remove loose concrete, reinstate concrete or provide a cover plate and replace seal.

4.13 South Gallery

Similarly for the north gallery the most significant damage to the south gallery was the differential movement between the adjacent tunnel sections resulting in damage to the joint seals. This type of damage was observed at most of the joints. Two of these joints were leaking and adjacent to one joint there was evidence of sand infiltration.

At two locations the concrete had spalled at the top of the joints.

Above the gallery tunnel there is an influent channel and a return channel which could not be inspected. The joint requires inspection from inside these channels to assess the extent of damage. This will require the channels to be temporarily isolated and drained. To assess the extent of damage on the exterior faces of the walls, it is recommended that local excavations be carried out and the tanks drained at each of the joint locations.

The details of the joints are similar to the joints in the north gallery and it is recommended a local break out is undertaken on a joint with large movement to assess if there is any damage to either the water-stop or the concrete.

Damage to the seals may be such that the leakage cannot be eliminated completely. If this is the case, consideration should be given to providing internal bunds and drainage.



Ref.	Image	Description	Damage Type / Repair
S13.1a		Differential vertical and horizontal movement at control joints up to 20 mm. This type of damage was observed at most of the joints.	Remove seal, remove loose concrete, reinstate concrete and replace seal
S13.1b		Differential vertical and horizontal movement at control joints.	As above



Ref.	Image	Description	Damage Type / Repair
S13.1c		Differential vertical and horizontal movement at control joints.	As above
S13.1d		Differential vertical and horizontal movement at control joints.	As above
S13.1e		Differential vertical and horizontal movement at control joints.	As above



Ref.	Image	Description	Damage Type / Repair
\$13.2		Cracking in walls (approx 0.3 mm crack width).	<i>Type 2.</i> Repair with an epoxy or grout injection system
S13.3a		Spalling at top of walls at control joints.	<i>Type 4.</i> Repair with structural repair mortar system.
S13.3b		Spalling at top of walls at control joints.	<i>Type 4.</i> Repair with structural repair mortar system.



Ref.	Image	Description	Damage Type / Repair
S13.4		Evidence of leakages at joints and sand infiltration.	Remove seal, remove loose concrete, reinstate concrete and replace seal.

4.14 Primary Sedimentation Tanks (PST) and Solids Contact Tanks (SCT)

The beams, walls and columns of the PSTs and SCTs that could be inspected visually did not appear to be cracked or spalled or show any signs of structural damage. Most tanks were full of wastewater or had sand or sludge on the bottom (with the exception of PST1). Therefore these could not be fully inspected.

The tanks had obviously moved during the earthquakes as evidenced by the separation at the joints between adjacent tanks. It is recommended the sealant in these joints be removed and replaced.

The central columns in the tanks appeared to be higher than the walls of the tanks. It is recommended that a level survey be carried out to determine if any structural differential settlement or heaving has occurred.

A leakage was observed in the base slab of PST1 (northern sedimentation tank). It is likely the slabs of the other tanks could be cracked and leaking. Therefore it is recommended that all tanks (PST and SCT) be emptied, cleaned and inspected for any cracks or signs of heaving or settlement. If cracks are present or vertical movement has occurred it is recommended that subsurface investigations (ground penetrating radar or similar) be carried out to ascertain if there are any voids underneath the slab. These voids (if present) will need to be filled using flowable grout.

If the level survey shows the ground has settled or heaved, consideration needs to be given to the operational ability of the tanks. If the function of the tanks is compromised, further investigation will be required and significant repair works may be needed to re-level the tanks.



Ref.	Image	Description	Damage Type / Repair
S14.1a		Separation at joints between tanks by up to approx 15 mm.	Remove and reinstate sealing strip.
S14.1b		Separation at joints between tanks by up to approx 15 mm.	As above.



Ref.	Image	Description	Damage Type / Repair
S14.1c		Separation at joints between tanks by up to approx 15 mm.	As above
S14.2		Leakage at bottom of PST1 (northern tank). Possible leakages at other tanks (could not observe most other tanks due to these either being full of wastewater or bottom being obscured).	Breakout and repair cracks / holes. If voids are present under slab fill these with flowable grout.

4.15 Sludge Lagoons

There was no apparent significant structural damage to the sludge lagoons as a result of the earthquakes. It was noted that the vertical manhole pipe at the southern end of the western tank had spalled concrete near the top of the pipe.

To assess the amount of overall and differential settlement of the sludge lagoons and the associated ability of the lagoons to function as intended, it is recommended a level survey be carried out.



4.16 Influent Structure

The structure was largely covered. Therefore only an external inspection of the top and sides was carried out. Based on this inspection no sign of significant structural damage to the influent structure was observed.

4.17 Trickling Filters 1 & 2

The interior of the filters could not be inspected. From the outside there was no apparent structural damage to the trickling filter structures. However, it was noted from discussions with CWTP staff that the central column in the filters has moved relative to the walls of the filter structure resulting in the rotating arm hitting the tank walls. It is recommended further investigation be carried out to determine whether the tank structure has settled differentially or whether the central column has moved resulting in possible damage to the column foundation or the column itself.

Ref.	Image	Description	Damage Type / Repair
S17.2a		Local heaving of ground or settlement of footing.	Non- structural. However, carry out level survey to confirm if any differential settlement has occurred. Re-grade as necessary.



Ref.	Image	Description	Damage Type / Repair
S17.2b		Evidence of movement at base of trickling filters.	Non- structural.
S17.3a		Cracked pavement at perimeter of trickling filters.	Remove damaged areas of pavement and replace.



Ref.	Image	Description	Damage Type / Repair
S17.3b		Cracked pavement at perimeter of trickling filters.	Remove damaged areas of pavement and replace.

4.18 Digesters 1 – 4

Generally only minor damage was observed. Differential ground settlement was noted around the perimeter of the Digesters. The maximum ground settlements were in the order of:

- Digester 1 up to 70 mm
- Digester 2 up to 40 mm
- Digester 3 up to 70 mm
- Digester 4 up to 130 mm

To the east of Digester No. 4 tension cracks were noted in the slope indicating the earthquake had resulted in slope instability. It is recommended the stability of this slope be checked and the tension cracks be infilled or the slope re-graded.

It is recommended a level survey be carried out to determine the amount of differential structure settlement.



Ref.	Image	Description	Damage Type / Repair
S18.1a		Spalled concrete at pipe on northern edge of Digester No. 3.	<i>Type 4.</i> Breakout loose concrete and repair with structural repair mortar system
S18.1b		Cracked concrete at pipe locations. This cracked concrete was observed at two locations.	<i>Type 4.</i> Breakout loose concrete and repair with structural repair mortar system
S18.2		Guide wheels and guides have broken off at a number of locations on the floating roof structure.	Reinstate guide wheels and install timber packers to stop pounding of lid against the sides of the tank (this was currently being undertaken at the time of the inspection).



Ref.	Image	Description	Damage Type / Repair
S18.3		Cracked pavement concrete around digester tanks.	Remove and reinstate pavement concrete.
S18.4a		Ground settlement around perimeter of digester tanks resulting in a trip hazard at the step foundation.	Provide inclines to step footing.
S18.4b		Ground settlement around perimeter of digester tanks.	Re-grade as necessary.
S18.4c		Ground settlement around perimeter of digester tanks.	Re-grade as necessary.



Ref.	Image	Description	Damage Type / Repair
S18.4d		Tension cracks indicating slope instability next to Digester No. 4	Infill the tension cracks and re-grade as necessary.
S18.4e		Ground settlement around perimeter of digester tanks.	Re-grade as necessary.

4.19 Digesters 1 - 4 Control Building

Other than the minor cracking to the walls, this building appears to have no significant structural damage.

Ref.	Image	Description	Damage Type / Repair
S19.1		Diagonal cracks in walls at corner of doors.	<i>Type 2.</i> Repair with an epoxy or grout injection system



4.20 Digesters 5 & 6 and Underground Gallery

Only minor structural damage was observed for Digesters 5 and 6 and the underground gallery. Differential settlement of the ground was observed around the perimeter of the digester tanks. It is recommended a level survey be carried out to determine the amount of structure differential settlement.

Ref.	Image	Description	Damage Type / Repair
S20.1		Spalled pavement concrete slab around perimeter of tanks.	<i>Type 4.</i> Breakout loose concrete and repair with structural repair mortar system
S20.2		Some leakages were observed at the base of the gallery walls.	<i>Type 2.</i> Repair cracks with an epoxy or grout injection system and provide sealant
S20.3a		Evidence of ground settlement around perimeter of digester tanks up to 80 mm.	Repair pavement slab and re- grade as necessary.



Ref.	Image	Description	Damage Type / Repair
S20.3b		Evidence of ground settlement around perimeter of digester tanks up to 80 mm.	Repair pavement slab and re- grade as necessary.

4.21 Digesters 5 & 6 Control Building

Only minor damage to the control building was observed as outlined below.

Ref.	Image	Description	Damage Type / Repair
S21.1 & S21.2	(no image)	Cracking to reinforced concrete walls on west face above doors and on north face.	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S21.3		Spalled concrete pavement slab on eastern side of building.	<i>Type 4.</i> Breakout loose concrete and repair with structural repair mortar system
S21.4	(no image)	Cracked concrete pavement on western side of building.	<i>Type 2 or</i> <i>4.</i> Repair using reinstate- ment mortar or epoxy crack injection

4.22 Clarifiers 1 – 4

Due to all the clarifiers being full, the only areas of the clarifiers that could be visually inspected were the walls above ground and above the water level, the walkway structures over the clarifiers and the service trench structure from the RAS/WAS pump station to the clarifiers.

Other than the damage as outlined below, the clarifiers and walkway structures showed no signs of significant structural damage as a result of the earthquakes.

It was noted by CWTP staff that the scraper arms of the clarifiers were hitting the sides of the tank. There also appears to be a sideways bow in the walkway over clarifier number 2 and the centre of the bridge appears to be higher at the centre than at the ends for a number of clarifiers. This indicates there may be vertical and horizontal movement of the central pier which possibly indicates damage to the floor slab, pier and pier foundation.

A level survey has been carried out on the clarifiers to assess the levels of the tank walls, base slab and central pier. Preliminary results of the level survey indicate the bottom slab of the clarifier has



heaved upwards and differential settlement has occurred as shown below (these results are preliminary and need to be verified).

	Differential Settlement (maximum difference in levels on the top of the tank walls)	Heave (upward movement of base slab)
Clarifier 1	45 mm	154 mm
Clarifier 2	41 mm	5 mm
Clarifier 3	64 mm	315 mm
Clarifier 4	84 mm	113 mm

For Clarifier 3, the heave of 315 mm is significant and will require further investigation to assess the damage associated with this movement.

Based on the results of the level survey, further investigation is recommended to inspect all the clarifiers. This investigation may entail dewatering the area around the clarifiers and emptying the clarifiers one by one. A full inspection of the walls, base slab and central pier should be carried out and all damaged areas be repaired as necessary.

If the base slab shows signs of significant damage, consideration should be given to designing a more robust slab and one that does not require the area around the clarifiers to be dewatered prior to emptying the contents of the clarifier.

Ref.	Image	Description	Damage Type / Repair
S22.1		Cracking in exterior wall of clarifier No. 4 at southern edge	<i>Type 2.</i> Repair with an epoxy or grout injection system and replace seals



Ref.	Image	Description	Damage Type / Repair
\$22.2		Steelwork to walkway stair landing is deformed due to differential settlement of the stair foundation.	Repair steelwork and provide packers.
S22.3a		There is general settlement around the clarifiers of between 100 and 300 mm. Local slumping was observed around clarifier number 4.	Backfill and re-grade as necessary.
S22.3b		There is general settlement around the clarifiers of between 100 and 300 mm.	Backfill and re-grade as necessary.
S22.3c		Significant settlement around the manhole structure.	Backfill and re-grade as necessary.



Ref.	Image	Description	Damage Type / Repair
S22.3d		Significant settlement around the manhole structure. There was evidence of liquefaction around the site especially to the west of clarifiers 3 and 4.	Backfill and re-grade as necessary.
S22.4a		There is cracking to the trench structure from the pump station to the clarifiers due to the differential settlement.	Epoxy crack injection and replace seals between adjacent precast units.
S22.4b		Differential movement between adjacent precast concrete sections resulting in damage to the seals.	Replace and repair seals.
S22.4c		Differential movement between adjacent precast concrete sections resulting in damage to the seals.	Replace and repair seals.



4.23 RAS / WAS Pump Station

The interior of the building could not be inspected. From the exterior inspection it appears the building has insignificant structural damage (minor cracking and separation at the joints as outlined below). However, it is recommended the interior be inspected to check whether there is any damage to the inside of the building.

Ref.	Image	Description	Damage Type / Repair
S23.1		Cracking to panel near entry door on western side.	<i>Type 2.</i> Repair with an epoxy or grout injection system
S23.2	(no image)	Diagonal cracks in wall at corner of east window.	<i>Type 2.</i> Repair with an epoxy or grout injection system
S23.3		Cracks above door in east side.	<i>Type 2.</i> Repair with an epoxy or grout injection system



Ref.	Image	Description	Damage Type / Repair
S23.4		Approx 10 mm separation at joint between walls on eastern side.	Remove and replace sealants.

4.24 Water Tank & Gas Holder Tank

Both the water tank and the gas holder tank appear to be in good condition with no apparent signs of structural damage due to the earthquakes.

There was evidence of 50 – 60 mm of ground settlement adjacent to the tanks. It is recommended a level survey be carried out to determine the amount of overall and differential structure settlement.



5 Remedial Methodology

The repairs outlined in the above detailed inspection tables provide an overview of the repair requirements to a level that is considered appropriate for preliminary costing. The repair methodologies outlined have been developed from a structural engineering perspective i.e. what is required to bring the building to as near to the original structural performance as possible.

All methodologies shall be approved by the Structural Engineer, and all proprietary products and repair systems must be installed in accordance with the manufacturer's recommendations, and by a person skilled in the application of such products or systems.

A rough-order cost estimate for the repairs is detailed in a spreadsheet issued on 9 March 2011 to CCC entitled "CWTP Earthquake Damage Feb 2011 Cost Assessment Rev04.xls".



6 Recommendations

The following is a summary of our recommendations to bring each of the structures up to, or as near as reasonably practical to, the structures' condition prior to the earthquake. In some cases further investigation is needed to determine the extent of reinstatement works and this is noted in the recommendations. Refer to Section 4 for details and location of the damage and Section 3.3 for details of the typical repair methodology.

Administration Building

 Building appears to have suffered minimal structural damage and does not require any structural repairs.

Operations Building

- Epoxy inject cracks to concrete walls
- Remove and repoint cracked mortar in brick cladding
- Provide packers and joist hangers to displaced purlins in new roof

Pump Station A / Basement Storeroom / 11kV Switchroom

- Carry out a level survey around the perimeter of the walls and over the base slab and mezzanine floor.
- Depending on the results of the survey, carry out subsurface investigation and further structural investigation to identify potential damage to the structure below ground
- Epoxy inject cracks to concrete walls
- Epoxy inject cracks to mezzanine floor and basement floor slab
- Epoxy inject cracks to columns and beams
- Remove and repoint cracked mortar in brickwork in 11kV switchroom

Workshop & Emergency Equipment Store (to the North of PS-A)

- Epoxy inject cracks to concrete walls
- Epoxy inject cracks to columns and beams

Screen Room

- Epoxy inject cracks to concrete walls
- Remove and repoint cracked mortar in blockwork on south-west wall

Engine Room and Workshop to the South

- Although the engine room appears to show no signs of structural damage, it is recommended a sample of the cladding be removed and the structure behind it inspected for damage. The location for the cladding to be removed will be chosen by the Engineer
- Remove and repoint cracked mortar in blockwork infill in the workshop to the south of the engine room

Thickener Building & Pump Station B

- Carry out a level survey around the perimeter of the walls and over the floor slab
- Depending on the results of the survey, carry out subsurface investigation and further structural investigation to identify potential damage to the structure below ground
- Epoxy inject cracks to concrete walls



- Inspect and repair cracking / spalling to corbel supporting the crane rail beam
- Repair crack at pipe / wall interface
- Reinstate the ground that has settled at the north-eastern end of building by removing loose soil and broken pavement, backfilling and compacting.
- Replace damaged pavement at north-eastern end and southern end of building

Education Centre / Garage / Technicians' Workshop

- Investigate the stability of the slope adjacent to Digester 4 and re-grade if necessary
- Remove and replace damaged brickwork on northern wall next to Digester 4. Consider demolishing if not required or using alternative timber framed wall.
- Remove and repoint cracked mortar in brickwork in northern wall and eastern wall

Dewatering Building

- Break out loose concrete at base of columns and repair with structural repair mortar system
- Epoxy inject cracks to concrete walls and columns
- Reinstate damaged concrete at step at south-west corner of building

Dryer Building

- Epoxy inject cracks to concrete walls
- Repair spalling to top of wall panel using structural repair mortar

Energy Centre Building

- Epoxy inject cracks to concrete walls
- Carry out interior inspection of building to assess whether there is any other damage

North Gallery and South Gallery Structures

- Temporarily isolate and drain the influent channel, return channel and bypass channels above the gallery and carry out an internal inspection of these structures
- Carry out local excavations at each of the joint locations to assess the extent of damage on the exterior faces of the walls
- Carry out a local break-out on a joint in the wall with large movement to assess if there is any damage to either the water-stop or the tongue-and-groove joint.
- Remove damaged seals, remove loose concrete, reinstate concrete and replace seals
- Epoxy inject cracks around doorway to control room
- Epoxy inject cracks to concrete walls
- Repair spalled concrete with structural repair mortar system
- If leakage cannot be eliminated completely, consider providing internal bunds and drainage

Primary Sedimentation Tanks (PST) and Solids Contact Tanks (SCT)

- Carry out a level survey on all tanks to determine if any structural differential settlement or heaving has occurred. Survey around the perimeter of the tank walls and down the centre of the tank.
- Empty and clean all tanks and inspect for any cracks or signs of heaving or settlement. If cracks
 are present or vertical movement has occurred it is recommended that subsurface investigations
 (ground penetrating radar or similar) be carried out to ascertain if there are any voids underneath
 the slab.



- Based on the results of the survey, it is recommended a detailed repair methodology be carried out in conjunction with the operational requirements of the tanks (tanks may need to be relevelled). Repairs that may be required vary from simple epoxy crack injection to complete removal and reinstatement of the base slab.
- Remove and replace the damaged joint seals between the tanks

Sludge Lagoons

 Carry out a level survey to assess the amount of overall and differential settlement and the associated ability of the lagoons to function as intended

Influent Structure

 Structure appears to have suffered minimal structural damage and does not require any structural repairs

Trickling Filters 1 & 2

- Carry out a level survey to determine whether the tank structure has settled differentially or whether the central column has moved vertically or horizontally.
- Carry out an internal inspection of the central column and foundation to assess the extent of damage. This may involve coring through the filter media or accessing the foundation from underneath.
- Depending on the results of the survey and inspection, develop a detailed repair methodology to repair any damage
- Repair cracked / damaged pavement as necessary

Digesters 1 – 4

- Investigate the stability of the slopes around the digesters and re-grade if necessary
- Infill the tension cracks in the slope
- Re-grade the slumped/settled ground around the digesters
- Carry out a level survey to determine the amount of differential structure settlement.
- Breakout loose concrete around the pipes and repair with structural repair mortar system
- Reinstate guide wheels and install timber packers to stop pounding of lid against the sides of the tank (this was currently being undertaken at the time of the inspection).
- Remove and reinstate cracked pavement concrete
- Provide inclines to the raised step footing

Digesters 1 – 4 Control Building

Epoxy inject cracks to concrete walls

Digesters 5 & 6 and Underground Gallery

- Repair cracks in wall / slab junction in the gallery with an epoxy or grout injection system and provide sealant
- Breakout loose concrete in cracked pavement, repair with structural repair mortar system and regrade pavement to remove tripping hazard

Digesters 5 & 6 Control Building

- Epoxy inject cracks to concrete walls
- Breakout loose concrete in cracked pavement and repair with structural repair mortar system



Clarifiers 1 – 4

- Further investigation is recommended to inspect the clarifiers. In particular Clarifier 3 shows signs of significant heave (preliminary survey results indicate over 300 mm). This investigation may entail dewatering the area around the clarifiers and emptying the clarifiers one by one. A full inspection of the walls, base slab and central pier should be carried out and all damaged areas be repaired as necessary.
- Based on the detailed inspection it is recommended a detailed repair methodology be undertaken in conjunction with the operational requirements of the clarifiers. Consideration should be given to designing a more robust base slab.
- Epoxy inject cracks in exterior wall and replace seals
- Repair deformed steelwork to walkway stair landing
- Backfill and re-grade slumped / settled ground as necessary
- Epoxy inject cracks in the channels / service trenches and replace seals between adjacent precast units

RAS / WAS Pump Station

- Inspect the interior to check whether there is any damage to the inside of the building
- Epoxy inject cracks to concrete walls

Water Tank & Gas Holder Tank

Carry out a level survey to determine the amount of overall and differential settlement



Appendix A

Structural Damage Register Spreadsheet

The following is a list of the observed structural damage at the Christchurch Wastewater Treatment Plant as a result of the 4 September 2010 Canterbury earthquake and the 22 February 2011 Christchurch earthquake and subsequent aftershocks. Inspections were carried out on 5 March and 7 March 2011 by Nik Stewart, Ian Billings and Mark Downie. This assessment covers only the structural damage that was observed during the inspections. Damage that could not be seen due to inaccessibility, or where the structure was hidden behind cladding, or where the tanks were full of wastewater could not be assessed. Damage to the civil works, services, mechanical and electrical are not included.

Note: Site North is taken to be parallel with Shuttle Drive

Description of Damage	Proposed Remedial Works			
1.0 Administration Building				
1.1 No apparent structural defects				
2.0 Operations Building				
2.1 Cracking in wall outside entrance to the Control Room (approx 1 mm crack width)	Epoxy crack injection			
2.2 Cracking in brick cladding outside the south-west doorway.	Remove cracked mortar and repoint			
2.3 The timber purlins connecting to the western timber truss on the new timber roof structure have	Supply packers between purlins and truss. Install joist hangars.			
separated by approx 30 mm. (The roof structure was currently under construction).				
3.0 Pump Station A / Basement Storeroom / 11kV Switchroom				
3.1 Large cracks in southern basement wall (up to 5 mm crack width)	Epoxy crack injection			
3.2 Large cracks to eastern ground level wall next to men's changing room (up to 3 mm crack width)	Epoxy crack injection			
3.3 Cracks to eastern ground level wall next to men's changing room (approx 0.3 mm crack width)	Epoxy crack injection			
3.4 Cracking to eastern basement wall (approx 0.3 mm crack width)	Epoxy crack injection			
3.5 Cracking in mezzanine floor	Epoxy crack injection			
3.6 Cracks in basement floor slab (up to approx 1 mm crack width)	Epoxy crack injection			
3.7 Cracks in southern column of 11 kV switchroom near bottom of column	Epoxy crack injection			
3.8 Cracks in RC floor slab of 11 kV switchroom	Epoxy crack injection			
3.9 Gaps between the infill brickwork and the RC column in 11 kV switchroom	Remove cracked mortar and repoint			
3.10 Cracks in walls of storeroom beside PS-A (approx 0.3 mm crack width)	Epoxy crack injection			
4.0 Workshop & Emergency Equipment Store (to the North of PS-A)				
4.1 Cracking to 2 columns (approx 0.2 mm crack width)	Epoxy crack injection			
4.2 Cracking to walls at entrance to workshop and inside workshop (approx 0.3 mm crack width)	Epoxy crack injection			
4.3 Cracking in beam at one location	Epoxy crack injection			
4.4 Cracking to walls in emergency equipment store (up to 1 mm crack width)	Epoxy crack injection			
5.0 Screen Room				
5.1 Diagonal cracks in north and south walls (approx 0.3 mm crack width)	Epoxy crack injection			
5.2 Loose blockwork on south-west wall	Remove cracked mortar and repoint			
5.3 Horizontal cracks in walls (approx 0.3 mm crack width)	Epoxy crack injection			

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6.0 Engine Room & Workshop to the South			
6.1 Workshop to the south of the engine room - gaps between masonry block wall and reinforced	Epoxy crack injection		
6.2 Engine room appears to show no signs of structural damage. However the structure was hidden	Epoxy crack injection		
due to the sound proof cladding. Assume an allowance for cracking to wall panels (say 0.3 mm			
wide cracks).			
7.0 Thickener Building & Pump Station B			
7.1 Minor cracking (approx 0.3 mm crack width) to walls on western side of building near windows	Epoxy crack injection		
7.2 Settlement of ground at north-eastern end of building	Backfill and replace pavement		
7.3 Cracking (approx 0.2 mm crack width) on western wall near door on southern end	Epoxy crack injection		
7.4 Damage to concrete paving slab next to building at southern end of building.	Break out and repair concrete slab		
7.5 Cracking on eastern wall between roller doors (approx 0.3 mm crack width)	Epoxy crack injection		
7.6 Cracking in eastern wall at northern end of building (approx 0.2 mm crack width)	Epoxy crack injection		
7.7 Cracking to corbel supporting the crane rail beam on western side of building next to roller door.	Inspect corbel, remove broken concrete and replace		
7.8 Large crack to concrete where pump station pipe passes through wall	Break out and replace concrete. Carry out level survey to assess		
	whether the cracked pipe is the result of differential settlement or		
	seismic shaking.		
7.9 Spalling to top of column at south-east end next to wall	Break out loose concrete and replace		
7.10 Cracking in wall above internal door to southern room (0.2-0.3mm crack width)	Epoxy crack injection.		
8.0 Education Centre / Garage / Technicians' Workshop			
8.1 Large cracks / gaps (30 mm) in brickwork on north-western wall	Investigate stability of slope. Remove and replace brickwork or remove		
	brickwork completely and replace with timber framed wall (or similar)		
8.2 Gaps in brickwork between walls on northern face	Remove cracked mortar and repoint		
8.3 Cracks in brickwork mortar in eastern wall	Remove cracked mortar and repoint		
9.0 Dewatering Building			
9.1 Cracking / spalled concrete at base of concrete encased steel I-beam columns	Break out and removal of loose concrete and reinstate concrete		
9.2 Cracking in eastern walls (approx 0.3 mm crack width)	Epoxy crack injection		
9.3 Cracking in columns (approx 0.3 mm crack width)	Epoxy crack injection		
9.4 Large gap at steps at south-western corner of building	Reinstatement of concrete / seal		
9.5 Cracks in walls at weld plate connections	Epoxy crack injection		
10.0 Dryer Building			
10.2 Cracking in walls next to opening on western wall (approx 0.3 mm crack width)	Epoxy crack injection		
10.3 Cracking above door on southern side of building (approx 0.3 mm crack width)	Epoxy crack injection		
10.4 Cracking to panels next to doors / windows on north face (approx 0.3 mm crack width)	Epoxy crack injection		
11.0 Energy Centre Building			
11.1 The interior of the building could not be inspected. From the outside there were no apparent	Repair cracks in panels at weld plate connections		
structural defects. However, from the inspection carried out by Beca after the 4 September 2010			
earthquake, it was noted that the precast panels were cracked at the weld plate connections. It is			
likely further cracking to these panels will have occurred due to the 22 February 2011 earthquake.			

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12.0 North Gallery			
12.1 Cracking around doorway near digester control room (1 mm crack width?)	Epoxy crack injection		
12.2 Differential vertical and horizontal movement at control joints up to 20 mm (at 3 - 4 locations).	Remove seal, remove loose concrete, reinstate concrete and replace		
	seal		
12.3 Large movement (approx 30 mm) at top of stairs next to Digester Control Room	Remove seal, remove loose concrete, reinstate concrete or provide a		
1	cover plate and replace seal		
13.0 South Gallery			
13.1 Differential vertical and horizontal movement at control joints up to 20 mm (at 3 - 4 locations).	Remove seal, remove loose concrete, reinstate concrete and replace		
	seal		
13.2 Cracking in walls (approx 0.3 mm crack width)	Epoxy crack injection		
13.3 Spalling at top of walls at control joints	Remove loose concrete, reinstate concrete and replace seal		
13.4 Evidence of leakages at joints and sand infiltration	Repair / replace sealants		
14.0 Primary Sedimentation Tanks and Solids Contact Tanks			
14.1 Separation at joints between tanks by up to approx 15 mm	Removal and reinstatement of sealing strip		
14.2 Leakage at bottom of PST1 (northern tank). Possible leakages at other tanks (could not observe	Breakout and repair of cracks / holes. Recommended that all tanks		
most other tanks due to these either being full of wastewater or bottom being obscured)	(PST and SCT) be emptied, cleaned and inspected for any cracks or		
	signs of heaving or settlement. If cracks are present or vertical		
	movement has occurred it is recommended that subsurface		
	investigations (ground penetrating radar or similar) be carried out to		
	ascertain if there are any voids underneath the slab. These voids (if		
	present) will need to be filled using flowable grout.		
15.0 Sludge Lagoons			
15.1 No apparent structural defects			
16.0 Influent Structure			
16.1 No apparent structural defects			
17.0 Trickling Filters 1 and 2			
17.1 Structurally no apparent structural issues with the trickling filters. However the central column	Allow lump sum to cover costs of any associated investigative and		
may have moved or the tricking filter has moved which has resulted in the rotating arm hitting the	remedial works.		
sides of the tank.			
17.2 Evidence of lateral movement, ground heaving / settlement or structure settlement.	Carry out level survey to confirm if any differential settlement has		
	occurred. Regrade as necessary.		
17.3 Pavement has cracked in several places around the perimeter of the trickling filters	Remove damaged areas of pavement and replace.		
18.0 Digesters 1 - 4			
18.1 Spalled concrete at pipe on northern edge of Digester No. 3 and cracked concrete at two other	Breakout of loose concrete and replace spalled concrete		
pipe locations.			
18.2 Guide wheels and guides have broken off at a number of locations on the floating roof structure.	Reinstatement of guide wheels and install timber packers to stop		
-			
	pounding of lid against the sides of the tank (this was currently being		
18.3 Cracked pavement concrete around digester tanks	undertaken at the time of the inspection). Removal and reinstatement of pavement concrete		

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18.4 Evidence of ground settlement around perimeter of digester tanks and slope instability next to	Carry out a level survey to ascertain the amount of differential
Digester No. 4. Settlements were in the order of:	settlement
Digester 1 up to 70 mm	
Digester 2 up to 40 mm	
Digester 3 up to 70 mm	
Digester 4 up to 130 mm	
19.0 Digesters 1 - 4 Control Building	
19.1 Diagonal cracks in walls at corner of doors	Epoxy crack injection
20.0 Digesters 5 & 6 and Underground Gallery	
20.1 Spalled pavement concrete slab around perimeter of tanks	Break out loose concrete and replace
20.2 Some leakages were observed at the base of the gallery walls	Epoxy inject any cracks and provide sealant
20.3 Evidence of ground settlement around perimeter of digester tanks up to 80 mm.	Carry out a level survey to ascertain the amount of differential
	settlement

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21.0 Digesters 5 & 6 Control Building	
21.1 Cracking to reinf concrete walls on west face above doors	Epoxy crack injection
21.2 Cracking to reinf concrete walls on north face of building	Epoxy crack injection
21.3 Spalled concrete pavement slab on eastern side of building	Repair using reinstatement mortar
21.4 Cracked concrete pavement on western side of building	Repair using reinstatement mortar or epoxy crack injection
22.0 Clarifiers 1 - 4 and Walkways	
22.1 Cracking in exterior wall of clarifier No. 4 southern edge	Epoxy crack injection and replace seals
22.2 Steelwork to walkway stair landing is deformed due to differential settlement of the stair foundation	Repair steelwork (provide packers?)
22.3 There is general settlement around the clarifiers of between 100 and 300 mm. Local slumping	Carry out a level survey to ascertain the amount of differential
22.4 There is cracking to the trench structure from the pump station to the clarifiers due to the differential settlement.	Epoxy crack injection and replace seals between adjacent precast units
22.5 Otherwise appears to be negligible / minimal structural defects to walls of tank and to walkways	
22.6 There is a possibility of damage to the floor slab and central pier of the clarifiers. If this is the case, the area around the clarifiers will need to be de-watered and the clarifier emptied.	De-water around the clarifiers and empty the clarifier
	Remove the broken foundation slab and pier footing
	Cast a new foundation slab (say 400 mm thick slab) and new pier footing.
	Consider anchors to resist ground water pressure so that the clarifiers
	can be emptied in the future without de-watering. Say 32 mm diam
	VSL CTR Stressbar ground anchors on a 3 m x 3 m grid (10 m long?)
	Provide sealants.
23.0 RAS / WAS Pump Station	
23.1 Cracking to panel near entry door on western side	Epoxy crack injection
23.2 Diagonal cracks in wall at corner of east window	Epoxy crack injection
23.3 Cracks above door in east side	Epoxy crack injection
23.4 Approx 10 mm separation at joint between walls on eastern side	Provide sealants
24.0 Water Tank (adjacent to engine room) and Gas Holder Tank	
24.1 No apparent structural defects	

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Appendix B

Christchurch Earthquake Level 2 Rapid Assessment Forms

Inspector Initials	NL.	KISS	 Dat	The second se	ent Form - LEVEL 2
Territorial Authority	Christ	ichurch City	Tim		Final Posting
Building Name	Christon	urch lucs	denster.	Treatment Plant	(e.g. UNSAFE) Gr I
Short Name	· Admin	stration B.	alldian	Type of Construction	
Address	shuffle	ONNE		Timber frame	1
1	Bomles	Chistohu	ruh	Steel frame	Concrete shear wall
GPS Co-ordinates	S*	Eª			Upreinforced masonry
Contact Name	mille	Bourke			Reinforced masonry
Contact Phone	the second se	30698			Confined masoner
Storeys at and above		Below		RC frame with mas	onry infill D Other:
ground level	1	ground	~	Primary Occupancy	
Total gross floor area		level	0	Dwelling	Commercial/Offices
(m ²)	2 800	Year buit	77	Other residential	
No of residential Units	0			•	Industrial
(Public assembly	Government
Photo Taken	Yes	(No)		L School	Heritage Listed
Dvestigate the building of		- Charles		Religious	
Overall Hazards / Dama	in the condition	is listed on pag	ge 1 and 2, ar	nd check the appropriate	column. A sketch may be added on page 3
Collabor partial collabor	ge		Moderate	Sevare	Commentation of page 3
Collapse, partial collapse, of	f foundation	Ø/			Comments
Building or storey leaning		Ľ,			
Wall or other structural dama	ge			<u> </u>	
Overhead falling hazard		W/		<u> </u>	
aound movement, settlemen	it, slips				
leighbouring building hazard	(8)			<u> </u>	
ectrical, gas, sewerage, wat		-			
THE REAL HAR	ent stated lights	4			
				Service Service Services	
	isting placare	on this build	line		
Record any ex	isting placard	l on this build	ling:	Existing	
Record any ex				Placard Ty	
Record any ex Choose a new postin	ng based on th	e new evaluatio	on and team is	Placard Tyj (e.g. UNSA)	FE)
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Structural Hazards/ Damage		Minor/Norie	Moderate	Severe	cwtp]	Comments	12	, , ,
Rools, floors (vertical load)								2
Columns, pilasters, corbeis				П				
Diaphragms, horizontal bracing					•			-
Pre-cast connections	MA	Ω,						
Beam	1.00410025	Ø						-
Non-structural Hazards / Dam	age	_,	40 747 54	_	······································			
Parapets, ornamentation		Ø,						
Cladding, glazing		Ø,						-
Ceilings, light fixtures								-
Interior walls, partitions		e						1
Elevators	N/A					e a di 1. di fi tana eta eta -		<u>101</u>
Stairs/ Exits	0.00	TR .						
Utilities (eg. gas, electricity, water)		B						
Other								-
Geotechnical Hazards / Dama	ge		14	5				
Slope fallure, debris		Ø						
Ground movement, fissures		d/						-
Soil buiging, liquefaction					· Evidence o	t lignotaction a	21448	
General Comment	buil hral	damage	and to b	k in gi the eart	A	with no rep.	the second se	-
	0-01							-
								-

Usability Category

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

2 Inspection ID: _____ (Office Use Only)

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Sketch (optional)
 Provide a sketch of t
 building or damage p
 damage points.

Provide a sketch of the entire									 	wjp	1	
building or damage points. Indicate damage points.	·	-+-	++	-+-								-
- ngo ponta.	-+		+									
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Récommendations for Repair and i	Reconstructi	on or Dem	olition (O	Dtionall					 	-		-
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C	hristchurch E	g RAPID	Assessme	ent Form - LEVEL 2
Territorial Authority	NLS & ITO Christohurch City	Date	7/3/11	Final Posting
Building Name Short Name	Christenwich	Wastewate	1 Treatment	(e.g. UNSAFE) G2
Address	* Operation Bu Shuffle Orise	Iding	Type of Construction	
GPS Co-ordinates Contact Name Contact Phone	Bromley, Chr. 50 ED MIKE BOWK	1	Steel frame Steel frame Steel frame Concrete frame	Concrete shear wall Unreinforced masonry Reinforced masonry Confined masonry
Storeys at and above ground level Total gross floor area	2_ Below groun level	H I	RC frame with mas Primary Occupancy Dwelling	sonry infill Other: Commercial/Offices
(m²)	C GOD Year built	? [Other residential	
No of residential Units Photo Taken		נ נ	 Public assembly School 	Government
and the second se	Yes No		Religious	Heritage Listed Other
Overall Hazards / Dama, Collapse, partial collapse, of Building or storey leaning Wall or other structural dama Overhead falling hazard Ground movement, settlemen Neighbouring building hazard Electrical, gas, sewerage, wat	foundation 2 ge 2 t, süps 2 2	e Moderate	0	Comments hung to wall entrance to 1 Arran
Choose a new postin	isting placard on this bu ng based on the new evalue VE posting. Localized Se	ation and team iud	Existing Placard Ty (e.g. UNSA gement. Severe condi	FE)
		RESTRICTE	very significant entran	ce. Transfer the chosen posting to the top
GRE Record any restriction			LLOW YI YZ	RED R1 R2 R3
Further Action Reco	7,0			
Tick the boxes below Barricades are new Detailed engineering	only if further actions are rec aded (state location): ng evaluation recommended			
Other recommenda	tions; - hele week	eotechnical	C Other	1
imated Overall Building D	amage (Exclude Content	s)	·	/
None D -1 % D -10 % D 1-30 % D spection ID:	31-60 % 61-99 % 100 % (Office Use Only)	000	Dett.	Sign here on corriptetion NStawA (Becg) B & Time 2/3/10 NW

Structural Hazards/ Damage	Minor/None	Moderate	Severe LWTP1 Comments
Foundations	Ø,		
Roofs, floors (vertical load)	GZ ,		- The finder pulling connecting to the
Columns, pilasters, corbels	UZ/		see weatern finker trave un the new
Diaphragms, horizontal bracing	IZ		I root structure have separated by
Pre-cast connections	VIA D,		and a number of the second of the
Beam	C		aurently under construction)
Non-structural Hazards / Damage	/		Desit of the Marker Depopulation
Parapets, ornamentation	Ø/		
Cladding, glazing	Ø,		
Cellings, light fixtures	E,		· Cracking in brick cladding antishe
Interior walls, partitions			south-west drawing support
Elevators /-	VIA D,		
Stairs/ Exits			
Utilities (eg. gas, electricity, water)	Z		
Other			
Geotechnical Hazards / Damage	,		·
Slope failure, debris	\Box'		
Ground movement, fissures	ď,		
Soli bulging, liquefaction	ď		O . Evidence of liquefaction around site
General Comment _ 0 ther	than the al	buse min	ir damages, the building appears
to be in	good con		
10	· ·	185 - 1861 1966 - 19	
1018 - AV			

Usability Category

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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected	G1. Occuptable, no immediate further investigation required	
Low that	(Green)	GZ Octupiable, repairs required	· See rocommenditioning.
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	· · · · · · · · · · · · · · · · · · ·
	Unsafe (Red)	R2. Severe damage: demotition likely	
High risk	1632C	R3. At risk from adjacent premises or from ground failure	

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Sketch (optional)		11					CUT	P2
Provide a sketch of the entire building or damage points. Indicate damage points.		+-+						
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Image: Authority Childbark Image:	Inspector Initials	NU	KITA	-				
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Overhead falling hazard Image: Stand Contents Image: Child Co	Building or storey leaning			\Box	Π -			
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	1-30 % 🗖	STATE 1 1997	(109) (1 1 -			Date & Time	5/3/11	

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Inspection ID: _____ (Office Use Only)

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16	Structural Hazards/ D	amage	Minor/Nope	Moderate	Severe	CWTP 3 14 Comments
	loofs, floors (vertical load	ß				
	olumns, pilasters, corbel		E,			· Shore compting to floor slab.
	laphragms, horizontal br					Chaseman fins slab r miletance flow slat
	re-cast connections	400				to conching to columns in withis hop area and
		14				
	eam on-structural Hazard	- 10	Ø			· cracking to end of beam in
	arapets, omameniation					weiksing even.
	ladding, glazing	N/N		ц П		
					Ξ.	Brick senser cludding officars of
	ailings, light fodures			y		Leiling panels have Talien above
	lerior walls, partitions		2			purpo station her
Ek	evators	W/N				
St	airs/ Exits		Q,			
Ųŧ	lities (eg. gas, electricity,	, water)	M			
Df	her					
Ģ	eotechnical Hazards	/ Damage	1			·······
Slo	ope failure, debris		也,			
Gn	ound movement, fissures	Č.	ď,			
Soi	t bulging, liquefaction		G		Π.	Evidence of lignetaction around
		Building Hansed A	walers	for sad		ent standard damage which
		Recomme		ans be	Lainch	out as noted oscillat.
	•	The meta	anine flo	1 is sugar	ited by	a reinf. concrete beam samain
Usi	ability Category	the mercu east-west vertical la	anine flo	1 is sugar	ited by	
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	ability Category	The meter east-west vertical la Posting	Anine file There fall id Lannah Usabi G1. Occupiable investigation	1 is support the crack of the free lity Category	nted by in the flell.	a result concrete beam spanning measurance floor do not compromise the
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	ability Category Damage intensity Light damage Low risk	The meter east-west vertical la Posting (Green)	G2. Occupiable Y1. Short term	(is Smpp) (k. Crack) It fin. (ity Category) no immediate fu on required (repairs required entry parts until repaire	the by in the flour.	A result concrete beam spanning meteorime floor do not compromise like Remarks
	ability Category Damage Intensity Light damage Low risk Medium damage Medium risk	The meter east-west vertical la Posting Restricted Use	An ince file These (effect international Usable G1. Occupiable investigation G2. Occupiable Y1. Short term of Y2. No entry to demolished R1. Significant of	(is Smpp) (k. Crack) It fin. (ity Category) no immediate fu on required (repairs required entry parts until repaire	the by in the flour.	A result concrete beam spanning meteorime floor do not compromise like Remarks
	ability Category Damage Intensity Light damage Low risk Medium damage Medium risk Heavy damage	The meter east-west vertical la Posting Restricted Use	 These file G1. Occupiable investigation G2. Occupiable G3. Occupiable G4. Occupiable G4	It's Support the Concept of the Concept of the Concept the Conceptor the	dor	A result concrete beam spanning meteorime floor do not compromise like Remarks

2 Inspection ID: _____ (Office Use Only)

Sketch (optional)

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Provide a sketch of the entire building or damage points. Indicate damage points.

CWTP 3k4

Recommendations for Repair and Reconstruction or Demolition (Optional)

and beens and columns Recommend cracks walls \$1) be repaire. b 910:51 ec) Lecom end Gorts in (10:15 repayed ; be creeks and sign Recommend leve) SHiver he Lairied 44 452653 D 1 Cracks he/ 10 ne WATH Rre. the regul o. Seismil ellement. or differ estil

CI	hristchurch E	a RAPID	Assessme	دير nt Form - LEVE	P 5
Inspector Initials Territorial Authority	NLS K IJB Christchurch City	Dale	5/3/11 DQ10	Final Posting	
Building Name Short Name Address	Christmuch u Screen Rucm Shuffle Driso	instewater 1	Type of Construction	(e.g. UNSAFE)	<u>G2</u>
GPS Co-ordinates Contact Name Contact Phone	 A second s second second s second second se		Timber frame Steel frame Till-up concrete Concrete frame RC frame with masoi	Concrete she.	masonry asonry
Storeys at and above ground level Total gross floor area (m²) No of residential Units	Below groun level ↑ ISB Vear buill	4 7 -	rimary Occupancy Dweiling Other residential	iny initial Diffeer;	ffices
Photo Taken	(Yes) No		 Public assembly School Religious 	Government Heritage Listed	
Collapse, partial collapse, off Building or storey leaning Wall or other structural damas Overhead falling hazard Ground movement, settlement Neighbouring building hazard Electrical, gas, sewerage, wate	foundation	Moderate		Other column. A sketch may be added Comments Asl compling in nort . Completed months work in surth-west	h and south
Choose a new postin		tion and team judy fere and overall Mi ther placards at ev RESTRICTED	ery significant entrance		are tree to the top R3
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imated Overall Building D lone	tions: See recomme	and drive		Sign here on corriptetion NSHWAN CBCCG	

	Structural Hazards/ Damage *Foundations	ł	linor/Norie	Moderate	Severe	CWTPS comments
	Roofs, floors (vertical load)		DZ/			
	Columns, pitasters, corbels					
	Diaphragms, horizontal bracing		Ø			
	Pre-cast connections	NIA				
	Beam	1.40	Ø			
	Non-structural Hazards / Dam	age				
	Parapets, ornamentation	NIL				
	Cladding, glazing	~~~	Ø,			
	Ceilings, light focures		Ø/			
	Interior walls, partitions		œ			
	Elevators	MIA				
	Stairs/ Exits				Π	
	Utilities (eg. gas, electricity, water)		9	ā		
	Other			Π		
C	Geotechnical Hazards / Damag	ge		-		······································
*	Slope failure, debris		Ø			
	Ground movement, fissures		Q1			
	Soil bulging, liquefaction					Evidence of liquetartin arman site
	General Comment					
			110000	12	<u> </u>	
	Usability Category	the I	11-11	NM. D.A.		
	Damage Intensity Pos	ting		ility Category		Remarks
(. Gight damage Repects	N		a, no immediate fu on required		
	h Cman	1 -				

Oght damage	Repected	G1. Occupiable, no immediate further investigation required	
LOWISK		G2. Okcupiable, repairs required_	· See recommendation
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Usern demons		R1. Significant damage: repairs, strengthening possible	
Heavy damage	Unsafe (Red)	R2, Severe damage: demolition likely	
High risk		R3. At risk from adjacent premises or from ground failure	

2 Inspection ID: _____ (Office Use Only)

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Sketch (option Provide a sketch building or dama damage points.

 Sketch (optional) Provide a sketch of the entire building or damage points. Indica 	te						NTPS	
damage points.							-+-+	-+-
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Inspector Initials		5 4150						. 4
Territorial Authority		hurch City	Date Time	5/3/1		Final Postin	-	6.6
Building Name	Church	hich Was		2		(e.g.	UNSAFE)	62
Short Name . E	ngine room	and wide	the bills	Type of Construct	Plant			
Address	shuffle	Dine	shaft	Timber fram		-1	/	
	Branles		huch	Steel frame		1000	Concrete shear	
GPS Co-ordinates	So	E					Unreinforced m	asonry
Contact Name	mike 1	Bourke		Concrete fra			Reinforced mas	
Contact Phone	0272	130646		-			Confined masor	nry
Storeys at and above		Below			th masonry inf		Other:	
ground level	2	ground	7. AN 19	Primary Occupan	су	1176-116-17 - 22		
Total gross floor area		level Year	0	C owening			ommercial/Off	ices
(m²)	~ 400	built		Other resider	ntial	P	ndustrial	
No of residential Units	$-\partial$	-		D Public assem	bły	-	0.3//55	
DLater				School			overnment	
Photo Taken	Yes	No		Religious		-	eritage Listed	
nvestigate the building fo Overali Hazards / Dama	or the condition	s listed on pac	te 1 and 2 and	I check the area	andata d		ther	
)verall Hazards / Dama	ge	Minor/None	Moderate	Severe	spriate colum	n. A sketch m	iay be added (on page 3
collapse, partial collapse, of	f foundation	Ħ,				c	omments	
uilding or storey leaning		R						
all or other structural dama	ige	e,		-	-			N-Saul
verhead falling hazard		Z.			and the second	re gaps	between	The MASSAL
ound movement, settlemer	nt, slins	e .	п	_	blockwall	and the		Mr. columns
		_/						
sighbouring building hazard				_				
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Structural Hazards/ Damage *Foundations	MinoriNone	Moderate	Severe	CWTP6	Comments	1. A
Roots, floors (vertical load)	e,					
Columns, pliasters, corbels	U.					
Diaphragms, horizontal bracing	9					100
Pre-cast connections						
Beam				-115		
Non-structural Hazards / Damage	1		0.00			
Parapets, ornamentation	$\mathbf{\nabla}$					
Cladding, glazing	Ø,			·		
Cellings, light fixtures						
Interior walls, partitions	e					
Elevators ~/A	\Box					
Stairs/ Exits						
Utilities (eg. gas, electricity, water)						
Other						
Geotechnical Hazards / Damage	1		_			
Slope failure, debris	ø,					
Ground movement, fissures	Ø/					
Soil bulging, liquefaction	Ø			Esidence o	f liquefactions a	trand
General Comment				The rife		
· Engine ,	orm appe	as to	shiw no	signs of st	milara) Annany	
Hiwave	the strange	the was	hidden	due to the		
						cladding-

Usability Category

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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected	G1. Occupiable, no immediate further investigation required	
Low risk	(Green)	G2. Occupiable, repairs required	· see recommendations
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	8
	Unsafe (Red)	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.

	T	T	T	T	T	-	-	-	-		- ,-		CL	TP	6	
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Recommendations for Repair and

· Recommend Re the masing 20193 between blocks and The. concrete reint grented. time he Pecommont ï R SAmple e ludeling of be Nember stmiture Dehind ann the đ he. mader 111 damage. -

CI	ristchu	rch Ea	PADID	۸			LWI	PJ
Internation In Mich.	nristchu		NAPIDI	Assessn	nent F	orm - L	EVEL	2
Inspector Initials Territorial Authority	NLS Christch	Vich City	Date Time	5/3/11		Final Posting		
Building Name	the second se			tment Plan		(e.g. Ul	NSAFE)	G.7
Short Name	· Thicken	er Building	/PS-B TY	pe of Construction	1	23	1715-237	
Address	Shuffle	Orne	HIS .] Timber frame	UII .			
	BAMles	2, Chinte	hwih [] Steel frame		L Co	Acrete shear	wall / Dysare
GPS Co-ordinates	S° -	Eº] Jill-up concret	0		reinforced ma	1122220
Contact Name	Mike	Bourke		/			morced mass	50
Contact Phone	027 22						ifined mason	Ŷ
Storeys at and above		Below	Pri	mary Occupancy		L) Oth	er	
ground level	1	ground levei	1 0	Dwelling		—		
Total gross floor area		Year		a takan antar S			rmercial/ Offi	ces
(m²)	= 500	bullt		Other residentia	al	🖸 Indu	istria!	
No of residential Units				Public assembly	y	D Gen	emment	
Photo Taken	3			School			lage Usted	
	(Yes)	No		Religious		-		2
Investigate the building fo Overall Hazards / Dama	or the conditions	listed on page	1 and 2, and d	heck the approp	riate column	A skotsh		\sim
Overall Hazards / Dama	ge N		Moderate	Severe	ooning	n a weitan may	be added o nments	n page 3
Collapse, partial collapse, of	f foundation					CON	unents	
Building or storey leaning		DZ/						
Wall or other structural dama	ige			0 . m		k : 1	0	
Overhead falling bazard		Ø,			Mer Cru	ching to	R.L.	ر(1 مى
Ground movement, settlement	nt, slips	B,						
Neighbouring building hazard		\Box		<u> </u>				
Electrical, gas, sewerage, wa	ter, hazmats	Ø		<u> </u>				
Record any ev	isting placard							
	asong piacaro	on this building	ng:	Existin				
				lan III	d Type NSAFE)			
Choose a new post grounds for an UNS	ng based on the	new evaluation	and team judg		construction and the	Inctine the state		
grounds for an UNS INSPECTED placard	are posting. Lo	calised Severa e. Post all other	and overall No	derate condition	s may requir	a RESTRICTE	DUSE Play	re
INSPECTED placard		- <u>-</u>		ery significant er	Mrance. Tra	nsfer the chose	n posting to	the top
INSPEC			RESTRICTED					
	EEN G1	G2)		LOW YI	Y2]	UNSAFE		
Record any restrict	ion on use or e	intry:				REDR	R2	R3
Further Action Rec	mmended							
Tick the boxes below		1000						
Semcades are po	seded (state locat	ion):						1
Detailed engineer	ring evaluation rec	commended -	Le ra	commendal	ins			
LLO Struct	ural	🖾 Geota	chnical	Other:	1999-199 3			
Other recommend				- sout				
timated Overall Building	Damage (Exclu	de Contents)		1		_		
None						Sign here on	completion	
2-10%	31-60	11.2.2	3			NHEWAN	(Be	(1)
11-30 % D	61-99 100 %]		Dete & Tim		In	
	100 %		1		ID	N	5-	-
spection ID:	(Office U	se Only)		L				

Structural Hazards/ Damage Foundations	Minor/None	Moderate	Severe CWTP 7 Comments
Roofs, floors (vertical load)	9/		
Columns, pilasters, corbels			- Cracking to carbel supportion france
Diaphragms, horizontal bracing	D,		alogail here is the
Pre-cast connections			I of roller dur.
Beam	U		- minir wanking ground precent wall
Non-structural Hazards / Damage			pract connections
Parapets, ornamentation	\Box_{\prime}		
Cladding, glazing	Ø,		
Ceilings, light fixtures	I,		
interior walks, partitions	e		
Elevators N/A			
Stairs/ Exits			
Utilities (eg. gas, electricity, water)	Ø		
Other	Ø		· concrete pipe film pump statui
Geotechnical Hazards / Damage	/		has weaken at well.
Slope failure, debris	Dr,		
Ground movement, fissures			- settlement of ground at north-easters and.
Soil bulging, liquefaction	D/		L' Evidence of Ingnetation Arrived
General Comment			The
· Building 1	dow not	have a	signoficiant structural damage which
will Loup	e a con	cern fo	
Decomment		1	with out as noted oscilent

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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspecied)	G1. Occupiable, no immediate further investigation required	
Low risk	(Green)	G2. Occupiable, repairs required	· See recommentations
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	0
High risk	Unsafe (Red)	R2. Severe damage: demoirtion likely	
ngar ran.		R3. At risk from adjacent premises or from ground failure	

PmW/9 3 Ekoloh of the e-th-			CWTI		
Provide a sketch of the entire building or damage points, Indicate				1	-
damage points.			+-+-		
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Recommendations for Repair and Reconstruction or Demolition (Optional)			I		
« Recommend instruction of Demolition (Optional) « Recommend instructed corbet be Recommend precisit with ponct Lon and represed	incodes		. 1 .		
as appropriate	maren	and re	pared		
· Recommend precisit wall proved in	e e la i i				
and repassed	MACTINA D	1Aspec	es		_
· Decomment the courts in the	le he				_
ne likely to cause durablily issu	m (J)	PAVER A	these		_
minempi investigativa be iaci		L A			
The marked pipe - did \$ differon	the) settle	no la	12 1 fil		
out level survey?	<u>~</u>	ITEN & BLLUI	Carry		-

CI	ristchurch F		1	6	wip &
Inspector Initials Territorial Authority	NLS L 1JE Christohurch City	Date	7/3/11	nt Form - LEVE	
Building Name Short Name	Christehusch Wa Education centre, (How the Turn	timen Plant Sype of Construction	(e.g. UNSAFE)	G2
Address	Technicians' WII	Kshup	I Timber frame		
GPS Co-ordinates Contact Name	He Drive Branky (50 E. Mike Bonike		Steel frame Filt-up concrete Concrete frame	Concrete she Unreinforced Reinforced m	masonry
Contact Phone	02, 2230696		RC frame with mason		onry
Storeys at and above ground level	Below group level		imary Occupancy		
Total gross floor area (m²)	2 600 Year	; [] Other residential	Commercial/ C	Offices
No of residential Units	0	C	Public assembly	Industrial	
Photo Taken	Yes) No		School	Government Government Heritage Listed	
Investigate the building for			Religious	Other	
Collapse, partial collapse, of Building or storey leaning Wall or other structural dama Overhead falling hazard Ground movement, settlement Neighbouring building hazard Electrical, gas, severage, wate Record any exit	foundation	Iding:	Charles Charles Charles Charles Charles Charles Charles Charles Charles Charles Cha	Comments gaps (230mm) IN A-weatern will (by h brickwich between h face. Cracks in bi h-Bastern edge.	brick work digeole 4) wells on 11-Mwerk Imetar
Detailed engineerit Detailed Structur	only if further actions are rect aded (state location): ing evaluation recommended rat	onechnical			t.
Other recommenda	tions: See recomm	Padatura	C Other:)
Estimated Overall Building D None D 0-1 % D 2-10 % D 11-30 % D Inspection ID:	31-60 % 61-99 % 100 %		Date ID	Sign here on completion P shown A $CBc I6 Time \frac{7/3}{11}P$ W	2) 2)

чғ с D P B N P C	Structural Hazards/ D Foundations Roofs, floors (vertical load Columns, pilasters, corbel Xaphragms, horizontal br he-cast connections leam fon-structural Hazard arapets, omamentation ladding, glazing eilings, light fixtures	i) Is acling M				ζω1β8	Comments	**
	terior walls, partitions	1	ľ					
	evators	MA						
	airs/ Exits		Ø					0.000120400-000
	ilities (eg. gas, electricity,	, water}	Ø					
-	her							
-	eotechnical Hazards	Damage	-	_	-			8
	ope failure, debris		Ø					
	ound movement, fissures Il bulging, liquefaction				· [tridence of s	slope movement no loguefaction aroan	est to Disont
Ge	meral Comment							
Usi	ability Category Damage Intensity	Posting	Usabi	lity Category		R	emarks	
	Light damage	6		, no immediate further				
C	Low risk	(Green)	G2. Occupiable	on required	ije	e recommen	deliving	
		Restricted Use	Y1. Short term e	antry				
	Medium risk	(Yellow)	Y2. No entry to p demolished	parts until repaired or				
	Heavy damage		R1. Significant d strengthenin	lamage: repairs,			<u>.</u>	
	e prosecta con con concessos V	Unsafe (Red)	R2. Severe dam	age: demolition likely	-			

2 Inspection ID: _____ (Office Use Only)

R3. At risk from adjacent premises or from ground failure

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Recommendations

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Sketch (optional Provide a skatch o building or damag damage points.

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Repair and Reconstruction or Demolition (Optional)	

Ci	iristchu	irch Eq	RAP	ID A	Assessme	ent	Form		-
Territorial Authority	NLS	K. JJB hurch City	ם	ate irre	7/10	71	Final Po	sting	
Building Name	Christehi	non woster	water 7	Frent	1 AT			e.g. UNSAFE)	G2
Short Name	VEWAR	114 ISW14	Alle	Ty	pe of Construction			1755 1751	
Address	Shull (), sie	,		(17		
000	Branley	, Christe	hurzh		/		0	Concrete shea	
GPS Co-ordinates	Se	٤٩			Tilt-up concrete		Ļ	Unreinforced a	
Contact Name	Mike I	Leiss Me			Concrete frame			Reinforced man	
Contact Phone	12) 22	10696				RODD(ini	. L	Cocanico maso	nry
Storeys at and above		Below		Prim	ary Occupancy	south un		Other:	
ground level	1	ground level	D		Dwelling		-	12	
Total gross floor area (m²)	(L. 140)	Year						Commercial/ Of	lces
	~ 400	built	1		Other residential			Industrial	
No of residential Units	_0				Public assembly			Government	
Photo Taken	R				School			Heritage Listed	
	Yes	No			Religious				
vestigate the building for verall Hazards / Damag	the conditions	listed on page	a 1 and 2, a	and chi	eck the appropriate	e colum	A skatel		
eran mazards / Damag	e 1		Moderat	æ	Severe	e obigili	II. A SKEIC	n may be added o	xh page 3
lapse, partial collapse, offi	roundation	ø,						Comments	
ding or storey leaning		Ø				100			
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rhead falling hazard		Ø			D	Ming	in eas	ten walls	
ind movement, settlement,	slips	Ø	П		<u> </u>				
hbouring building hazard		\mathbf{D}_{1}	Π						
rical, gas, sewerage, water	r, hazmats	R			<u> </u>				1000
Record any exis					Existing Placard Ty (e.g. UNSA	FE)			
grounds for an inight	FE posting. Lo	new evaluation	and team	judgen	nent Severa condi	tions al	fecting the	whole building a	<u>_</u>
Choose a new posting grounds for an UNSAU INSPECTED plecard at of this page. INSPECTE GREE Record any restriction	ED EN <u>61 (1</u>	2 G2	RESTRIC	af every ~	significant entran	ice. Tra	a RESTR Insfer the c INSAFE RED	CTED USE Plac hosen posting to	e the top R3
INSPECTE INSPECTE GREE Record any restriction	ED EN <u>G1</u>	2 G2	RESTRIC	nt every TED U	significant entran	ice. Tra	INSAFE	hosen posting to	e the top
INSPECTE GREE Record any restriction Further Action Recom Tick the boxes below or Barricades are need Detailed engineering	D FN G1 (1) In on use or eff amended: hly If further actionication ied (state location) evaluation reco	2 3 3 3 3 3 3 3 3 3 3 3 3 3	RESTRIC	nt every TED U	significant entran	ice. Tra	INSAFE	hosen posting to	e the top
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•	Structural Hazards/	Damage	Minor/None	Moderate	Severa	cwipg	Comments	
	Roofs, floors (vertical lo	ගේ						1.
	Columns, pilasters, corb		DZ/	п		aliente La		
	Diaphragms, horizontal I		Ū,			· Cracking / 101	en concrete	at base of
	Pre-cast connections	na 6223 - n.	ē		n	CALLA ENCA	the special for	beam columns
	Beam		e	n			is a wew.	plate connections
	Non-structural Hazar	rds / Damage			5			
	Parapets, ornamentation	yova decemb ra e ur N	Ø					
	Cladding, giazing		Ø,				<u></u>	
(Cellings, light fixtures		Ø.		n			
1	nterior walls, partitions		R			11 -3031 (3-50-05-05-		
	Bevators	NI			П			
5	Stairs/ Extts		ĪZ,		П	i i well and i	I i i	
ι	Milities (eg. gas, electrica	lv. waler)	TT I	n	П	· Large gap a	T steps at	south-weat
	Other	916 - RE	Ē	П		Loiner of bi	noring	
-	eotechnical Hazards	/ Damage	ц,					
× .	lope fallure, debris	200 D-100 D-100 D-	ø					
G	iound movement, fissure	s						
S	oil bulging, liquefaction					Eurodemic of	1 .1.1	
	-							
Us	ability Category	1						
	Damage Intensity	Posting	Usabil	ity Category		Re	marks	
C	Light damage	Inspected	G1. Occupiable, investigation	no immediate furthe n required	-			
•	Low risk	Green	G2. Opcupiable	_beniuper, anleger,	÷	ver recommence	lations	
	Medium damage	Restricted Use	Y1. Short term er	ntry	-			
	Medium risk	Welland	Y2. No entry to p demoilshed	arts until repaired or				
			R1. Significant da strengthenin		-			
	Heavy damage	Unsafe (Red)	R2. Severe dama	ge: demolition likely	-			
	High risk	ALCEN S	R3. At risk from a from ground	djacent premises or failure	-		· · · ·	

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Sketch (opti Provide a ske building or da damage point

Sketch (optional) Provide a sketch of the entire building or damage points. Indic damage points.	ate						CWT	Pa
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commendations for Repair an	d Reconstruction	n or Demolit	ion (Optional)	l				
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· Recommender	rend the	100se/H	palles is	nuede	et the	hose	of the	
Recomme	be remained	p at 1	he step	stated.	anda			
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i Gh	instenuren	Eq RAP	PID Asse	ssmer	دلا nt Form - LEVE	10
inspector initials	NUKIJE		Sec. 19 19 19 19 19 19 19 19 19 19 19 19 19			- 4
Territorial Authority	Christchurch Cit		-11	50	Final Posting	
Building Name	Christehurch				(e.g. UNSAFE)	G2
Short Name	· Orver Build	line	Type of Co	int Plant		
Address	Shuffle Drive	19			/	
	0	The		a frame	Concrete she	3r wali
GPS Co-ordinates	Sº E	ofe Anich	Steel		Unreinforced (
Contact Name			· · · · ·	concrete	Reinforced ma	
Contact Phone	Mike Burke		_ Concr	ete frame	Confined mass	
and 04122545070055550	02) 2230616	>	_ RC fra	me with mason	iny inf# Other:	мну
Storeys at and above	(Q) (20)	slow	Primary Occ			
ground level	I grd	ound D	Dwellir			
Total gross floor area (m ²)	2 400 Ye				Commercial/ O	ffices
	bui	n <u>1</u>	U Othern	esidential	Industrial	
No of residential Units	_0		D Publica	ssembly	2 <u>22</u> (2))	
5 0L-1	\sim		School		Government	
Photo Taken	Yes No		D Dellate		Heritage Listed	
investigate the building for	the conditions listed o	0 page 1 and 0	and I have	5	L Other	
Overall Hazards / Damag	e Minor/M	n page rano z	and check the	appropriate c	olumn. A sketch may be added	00 0200 2
Collapse, partial collapse, off	foundation	one Moder		Ð	Comments	ou hage 2
Building or storey leaning						
	e	, 🗆				
Wall or other structural damag	e 🖌			· Cracks	4	
Overhead falling hazard	G			The second se	J PACING ALL PA	opensing on
Ground movement, settlement,	siips 🖸	П	п	wester	wall cracking about	ve dail an
Neighbouring building hazard		/ 1	_	10-115 Com	sinc of Ding Crai	k. La.
Electrical, gas, sewerage, wate		́ Ц		next fo	doors windows on	and I have
· · · · · · · · · · · · · · · · · · ·		Ц				1917 79/21
Record any evic	sting placard on this					
	and histate of this	building:		Existing		
			1	Placard Type		
Choose a new posting	based on the new eva	instian and tax		e.g. UNSAF		
grounds for an UNSA	FE posting. Localised	Severe and ove	n judgement. S	evere conditio	ons affecting the whole building require a RESTRICTED USE. Pla	are
of this pape.	t main entrance. Post a	il other placard	s at every signifi	cant entrance	Transfer the chosen posting to	ICE
			-	-		o the top
INSPECTI GREE		RESTR	CTED USE		UNSAFE	
11.57755			YELLOW	Y1 Y2	0 mm	T
Record any restrictio	n on use or entry:				RED R1 R2	R3
Further Action Recon	611 000 0001 0 PD5 000					
Tick the boxes below o	nly if further actions are i	recommended				<i>x</i>
La pamcades are nee	ded (state location)					///
Li Detalled engineerin	g evaluation recommend					
D Other recommendat		Geotechnical		Other:		
	a server a server s	mmendatio	A)			1
mated Overall Building Da	smage (Exclude Conti	ents)				
one D					Sign here on completion	
1% D2 10% D	31-60 %				NSLAWAR CBri	
-30 %	61-99 %				1047Z - 32 - 53	1/
00 /0	100 %			Date (Time 2/3/V	
				I ID	the second se	

,	Structural Hazards/ Da Foundations	amage	Minor/None	Moderate	Severe	LWTPID	Comments	ż
	Roofs, floors (vertical load	0	Ø,					
	Columns, pliasters, corbel	5	B					
	Diaphragms, horizontal bra	acing				the second second		
	Pre-cast connections		Ø,					
	Seam		C					
	Non-structural Hazard	s / Damage						
	Parapets, ornamentation	M	A D					
	Cladding, glazing		Ø,					
	Ceilings, light fixtures		e.					
	interior walls, partitions		M	п				
	Elevators	N)			D			
	Stairs/ Extts		Z					
	Uffities (eg. gas, electricity,	water)	R	П		1.1		
	Other		Π		ö			
	Geotechnical Hazards /	Damage	_		U	Realized and write white		
5	Slope failure, debris	1999 - Carlos Ca le ra	ø					
	Ground movement, fissures				Π	hanne cha the state		
	Soil bulging, liquefaction					· Evidence of	lieve tailor an	and it.
	General Comment		-0 <u></u>					
3	Usability Catagory							
2	Damage Intensity	Posting	Usabi	lity Category		Re	marks	
6	Light damage	Inspected	G1. Occupiable investigatio	e, no immediate funt on required	her			
	Low risk	(Green)	62 Occupiable	, napairs required		jes recomment	nativi	
	Medium damage	Restricted Use	Y1. Short term	entry				
		(Yellow)	Y2. No entry to	parts until repaired	or			

Unsafe

(Red)

Heavy damage

High risk

R1, Significant damage; repairs, strengthening possible

R2. Severe damage: demolition likely

R3. At risk from adjacent premises or from ground failure .

Sketch (optional)

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Provide a sketch of the entire building or damage points. Indicate damage points.

CWTPIO Recommendations for Repair and Reconstruction or Demolition (Optional) · peromment marks in walls be repaired using our eporty -

Inspector Initials Territorial Authority	Christot	urch City	Date Tkne	7/3/1	Final Posting	
Building Name	Christehu	123 Wast	ewster Tru	stment Plant	(e.g. (JNSAFE) G'L
Short Name e	Evergy	Lente B.	ildina	Type of Construction		·
Address	Shuffle	Dive		Timber frame	1	
6700 c	Bomles	y, Chaste	thush	Steel frame	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Oncrete shear wall
GPS Co-ordinates	<u></u>	Ee		Till-up concrete	Access to a second s	nreinforced masonry
Contact Name	mike	Boarke		Concrete frame		einforced masonry
Contact Phone	_027 21	130696		RC frame with m	and the second second	onfined masonry ther:
Storeys at and above		Below		rimary Occupancy		aver,
ground level		ground level	\wedge	Dwelling		mmercial/Offices
Total gross floor area (m ²)	= 400	Year built	20081	Other residential		Contraction of the second s
No of residential Units	-5-		1000:0		K in	lustrial
		- \		Public assambly		wemment
Photo Taken	Yes	(N_0)		School	🛛 Не	ritage Listed
stigate the building for	the conditions	listed on per		Religious	Ot	Ner
rall Hazards / Damag	e /	Minor/None	Moderate	check the appropri-	ate column. A sketch ma	y be added on page 3
pse, partial collapse, off	foundation	M		Severe	Co	mments
ing or storey leaning		R	-			
or other structural damag	в	<u>ष</u> .				
nead falling hazard		TT I		<u> </u>		
nd movement, settlement,	sline	đ	1.20		1	
bouring building hazard						
ical, gas, sewerage, wate	r, hazmats					
Record any exis	sting placard	on this built				
1999-900 - 000 - 1999	S Preserve	on this build	ung:	Existing Placard		
				fe a Liki	DAFF	
grounds for an UNSA	g based on the	new evaluation	on and team ju	gement. Severe co	nditions affecting the wh	ole huiking
INSPECTED placard a	it main entranc	e. Post all oth	re and overall fi ler placards at (oderate conditions	nditions affecting the whi may require a RESTRICT rance. Transfer the chos	ED USE. Place
		-			mance. Transfer the chos	en posting to the top
INSPECT GRE	and a second	<u>_</u>	RESTRICTE	DUSE	UNSAFE	
Record any restriction		G2 entry:	YE	LLOW Y1	145	R1 R2 R3
Further Action Recor	nmended:					
Tick the boxes below (eded (state local	tion):	nmended			
	g evaluation rel	commended				
Detailed engineering		Geot	100.00	D Other:		
Detailed engineerir				2 2		
Detailed engineerir Structur Other recommenda	tions: - sca	e rumi	mentity (1)			
Detailed engineerin Structur Other recommenda ed Overall Building D	tions: - sca	e recemi ide Contents)	()	Г	Phone barrier	
Detailed engineerir	tions: - sca	ude Contents)		·	Sign here o NSHWA	(Beca)

Structural Hazards/ Damage *Foundations Roots, floors (vertical load) Columns, pilasters, corbels Diaphragms, horizontal bracing Pre-cast connections Beam Non-structural Hazards / Damage	Minor/None Mode		· see general comments
Parapets, ornamentation Cladding, glazing Ceilings, light fixtures interior walls, partitions Elevators Stairs/ Exits Utilities (eg. gas, electricity, water) Other Geotechnical Hazards / Damage			
Slope failure, debris Ground movement, fissures Soil bulging, liquefaction General Comment <u>The interior</u> <u>Ac building</u> <u>univert</u> by <u>out after 11</u> were crache	the earthqueke	0 nDt app 1+1.weve 0 earthquak	leanerthing it is that C. b
Usability Category	Usability Cat		Remarks
Low risk	G1. Occupiable, no imm investigation requir G2. Occupiable, repairs	red	le recommendation
Medium damage Restricted Use (Yeliow)	Y1. Short term entry Y2. No entry to parts un demolished	tāl repai;red or	
Heavy damage	R1. Significant damage: strengthening poss		2
(Red)	R2, Severe damage: de R3. At risk from adjacen from ground failure	it premises or	

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

, Sketch (optional)	Г		Т	-								Lu	TP	11	
Provide a sketch of the entire building or damage points. Indicate	1		+	+-	_	-						1	1	T	T
damage points.	L					l		1		T	1	+	+	+	+-
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commendations for Repair and F	Reconst	truction	or De	moliti	on (Opt	ional)					25				
· Recommen	Arepa	irs f	o th	i Con	alle	1 000	erail	M1 .	1.	1 +1					
connections	he	Mar	. es	. 1	A . 1	A	LAN N	1400	1) 41	the	wei	a ply	k		
· Recommentions	111	land	1	For	an	1 din	50	ther	was	uff3	be ,	egti	ch		
	3	- Party	- IM	C1-11-	m2							1			-

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Inspector Initials Territorial Authonity		k 170		ite	7/3/1		Inal Pos	ting	G2
Building Name	Christian,	ch wast	ewster T	real	ment Plant		(e.	g. UNSAFE)	42
Short Name	North G	allen		Typ	e of Constructio	'n			
Address	shuffle D.	jue	and Alberton Reconstruction		Timber frame			0	
Cho e e	Brimley	Chrut	hunb		Steel frame			Concrete shea	
GPS Co-ordinates	<u>S</u> •	٤٥			Tilt-up concrete	8		Upreinforced m	
Contact Name	mike Bo	vike			Concrete frame			Reinforced max	
Contact Phone	027 2230	696			RC frame with a	82	T	Confined maso	
Storeys at and above		Below		Prin	ary Occupancy		10	Other: Rein	t concrete H structure
ground lavel	0	ground fevel	1		Owelling				e - Altores Marsell
Totai gross floor area (m²)	0400	Year			ा है। इन्हें के		Ц	Commercial/ Of	fices
1534741	1400	bullt	31		Other residentia	al .	4	Industrial	
No of residential Units	_0				Public assembly	/	П	Government	
Photo Taken	c				School			Heritage Listed	
	(Yes)	No			Religious	er ser		The second s	
Investigate the building for Overall Hazards / Damag	the conditions li	sted on pag	e 1 and 2,	and ch	eck the accord	ríate column	Ashetd	Valica	
Overall Hazards / Damag	e Mi	nor/None	Modera	te	Severe		A SKEICH	may be added	on page 3
Collapse, partial collapse, off	foundation	Ø						Comments	
Building or storey leaning									
Vali or other structural damag	je	e,							
Werhead falling hazard		ď,			<u> </u>				
cund movement, settlement	alios	2							
eighbouring building hazard		d,						1995) 19-00 Marco - 10	
ectrical, gas, sewerage, wate	e harmota	19							
	a, councilates	13				9 - 92 - 99 - 99 - 99 S			
Record any exi	sting placard o	n this build	lina			_			
	27.00		ang.		Existin)
					(a a 11)	UDA PP			
Choose a new postin grounds for an UNS/ INSPECTED placard of this page.	g based on the n VE posting. Loc at main entrance.	ew evaluati alised Seve Post all oth	on and tean re and over ter placards	n judge all Moc at eve	ment. Severe ci lerate conditions ry significant en	onditions aff s may requin strance. Tran	ecting the e a RESTR Isfer the c	whole building OCTED USE. Pla hosen posting to	are ice
INSPECT		-				23	1999-1		
	THE DE T	52)	RESTRI	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			NSAFE		
Record any restriction	on on use or en	itry:		r Ambrid		Y2	RED	R1 R2	R3
Further Action Reco	mmended:	0.000							0.576
Tick the boxes below	only if further actic	ons are recon	nmandad						
Samosdes are ner	eded (state locatio	n):	-14490473						
Detailed engineeri Structu	ng evaluation reco		530						
	Barre see		technical	1.	Other:				
Le Other recommende	i i i i i i i i i i i i i i i i i i i	i reco.	nmenda	NW					
Other recommendation		e Contents)		Г		P1-1		
nated Overall Building (Jamage (Exclud				1		SIM DA	ATA AA AA AA	
	110004000011000000		_					are on completion	
nated Overall Building (31-60 9 61-99 9	%				<u>(0</u>	sign ni itawa) l		

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	tructural Hazards/ Da oundations	amage	Minor/None	Moderate	Severe	CWTPN	Comments	
Ŕ	oofs, floors (vartical load	9	R					
G	olumns, pilasters, corbel:	s MA						
Di	iaphragms, horizontai bra				ū			
Pr	re-cast connections	MA						
Be	Barn	M						
Ne	on-structural Hazard			_	_			
Pa	arapets, omamentation	NIA						
Cli	adding, glazing	MA						
Ce	ilings, light fixtures	1						
Int	erior walls, partitions	N/A						
Ek	evators	N/A						
Sta	airs/ Exits		Ø					
Us	ilities (eg. gas, electricity,	, water)	I,					
Ót	her		EZ			+ 500 . 00.0.1		
Ge	otechnical Hazards /	/ Damage		-		· see general	comments	
Slo	pe failure, debris		Ø					
Gr	ound movement, fissures	1	e,			· sec general	lan a la	
Soi	il bulging, ilquefaction		ত			· Evidence of light	duli and	}
Ge	<u></u>	h must ju	ib.	ny 19 Aar	raye to	the joint seals	The was typ	nal at
	a	ngester Low	tiel Room				t of pictro neg	T T
Usa					dorway	near Discoler	Loutie) room,	
	Damage Intensity	Posting	Usab	ility Category		Re	marks	
C	Light damage	Inspectad		e, no immediate f	urther			
6	Low risk	Greep	G2. Occupiable	e, repairs require	d	le recommend	yton	
	Medium damage	Restricted Use	Y1. Short term	entry	-			
	Medium risk	(Yellow)	Y2. No entry to demolishe	parts until repair d	red or			
				damage: repairs ing possible	-		\	
	Heavy damage	Unsafe (Red)	R2. Severe dar	mage: demolition	līkely			
	High risk		R3. At risk from from groun	n adjacent premis nd failure	es or			

2 Inspection ID: _____ (Office Use Only)

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

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			tion or Demolition (Optional) lacement of Annaged junt sents who be separated vising epory contrained in at stairs be made good Linner plate:)												
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Repair and Reconstruction or Demolition (Optional) Repair and Reconstruction or Demolition (Optional) Recommend replacement of damaged just seals recommend replacement of damaged just seals recommend eracts be repaired using epery cravit in certains recommend gap at stairs be made good Lewer glade:)															
Repair and Reconstruction or Demolition (Optional) Repair and Reconstruction or Demolition (Optional) Reconstruction															
Repair and Reconstruction or Demolition (Optional) Repair and Reconstruction or Demolition (Optional) Recommend replacement of damaged junt seals recommend cracks be repaired vising epory crack injections recommend gap at statics be made good Linver plate:)	-														
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Recommendations for R

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Ch	ristchu	rch Ea	RAPID	Assass	mant P	cwif orm - LEVEL	213
Territorial Authority	NUS	K 150 urch City	Date Time	7/2/11		al Posting	
Building Name Short Name Address	· 304th 0		wrter T	Continent Pl Type of Constru	#yf	(e.g. UNSAFE)	42
GPS Co-ordinales Contact Name Contact Phone	Shuffle 1 Bronley So Mike D U27 22	En Lihringer En Lihringer	bysh	Timber fram Steel frame TNL-up conc Concrete fra RC frame w	rete	Concrete shea	asonry sonry nry
Storeys at and above ground level	D	Below ground fevel	1	Primary Occupan	ith mascory infill cy	bet turnel	1. concrete structure
Total gross floor area (m²) No of residential Units	= 600	Year -	U)	Other reside	000770		hces
Photo Taken	(Yes)	Na	l	Public assen School Religious	nbly	Government Government	
Wall or other structural dama; Overhead failing hazard Ground movement, settlemen Neighbouring building hazard Electrical, gas, sewarage, wat	t, slips	<u>ण</u> व व ब ब			minor chailer	ng to walls	
of this page.	ng based on the AFE posting. Lo at main entranc TED TEN <u>G1</u>	new evaluatio ocalised Sever e. Post all othe G2	n and team ju e and overall ar placards at RESTRICT	(e.g. Idgement. Seven Moderate conditi every significant	ard Type UNSAFE) e conditions affect ons may require entrance. Trans	cting the whole building a RESTRICTED USE, Pla fer the chosen posting to RSAFE RED R1 R2	are the the top R3
Further Action Reco Tick the boxes below Batricades are ne Detailed engineeri Structu Other recommend timated Overall Building (only if further act eded (state locat ing evaluation re- iral ations: Sec	ion): xmmended Geote	echnical	D Othe	£.		
None 0-1 % 2-10 % 11-30 % Spection ID:	31-60 61-99 100 %	% C % C	מח		Dete & Time	Sign here on completion I wan (Bec. 7/2/V NES	S

Structural Hazards/ Damage	N	linor/None	Moderate	Severe	CWTPB	Comments	
Roofs, floors (vertical load)		đ					
Columns, pilasters, corbels	WIA						
Diaphragms, horizontal bracing	MA						
Pre-cast connections	NA						
Beam	NA						
Non-structural Hazards / Dama	age						
Parapets, ornamentation	MA						
Cladding, glazing	NA						
Ceilings, light fixtures		Ø					
Interior walls, partitions	MA						
Elevators	NIA	Π,					
Stairs/ Exits		e,					
Utilities (eg. gas, electricity, water)							
Other		Ø		Ξ,	See general	Comme to b	
Geotechnical Hazards / Damag)e					Comment,	
Slope fallure, debris		EI.					
Ground movement, fissures		I /		Π,	see general	lanneshi	
Soil bulging, liquefaction		ſ			ENiknue of li	quefaction Arman	A site
General Comment . Diffe	stin?	vertical	and hereit	ental mo	vement betwe	en the innute	Innel
Section	روس لأ	observe	d really	in da	mage to the it	int seals at	Cause
loigtion	s and	soulle	d concrede	at in	e location		serveral
		Leakage.			sand infiltrat	10,0	
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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected	G1. Occupiable, no immediate further investigation required	
Low risk	Green	62. Occupiable, repairs required	· SLR recommendations
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy demans		R1. Significant damage: repairs, strengthening possible	3
Heavy damage High risk	Unsafe (Red)	R2. Severe damage; demolition likely	
- Bar then		R3. At risk from adjacent premises or from ground failure	

Sketch (optional) Provide a sketch of the entire

building	or damage	points.	Indicate
Jamane	noints	23	

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Recommendations for Repair and Reconstruction or Demolition (Optional)

Recommend get replacement of damaged joint seals
 Recommend cracks be repaired using epery crack injection
 Recommend spalled concrete be replaced using availage montain

- · · ·	nristchu	Irch Ed	RAP	D A	Assessme	nt Fo	The second second	LWIPI	4
Territorial Authority	NLS	te 178 thurch City		Dale Time	5/3/0 0950	- 1025 S	I Posting	1	
Building Name	Christehu	uch west	evert,	Ter			(e.g. UNSAFE)	G2	_
Short Name	Primary	sedimental	hen tanks	Ty	prent Plant pe of Construction				
Address	Kanden	elet lik			.		~		
Shi	He Dive	Brake	Charles		Steel frame		Concrete she	tar wal	
GPS Co-ordinates	5.	E	C 10 - HTLAN	-			Unreinforced	masonry	
Contact Name	Mike	Bunnke		-2	Till-up concrete		Reinforced m		
Contact Phone		230696		_2	and the intelling		Confined may		
and a second sec	<u></u>				RC frame with masc	inry infit	Other,		
Storeys at and above ground level	~	Below ground	1	Prin	ary Occupancy				
1 Second and the second second	0	ievel	1		Dwelling		Commercial/ (
Total gross floor area (m²)	- 13000	Year						Offices	
		bu'it	1;	Ц	Other residential		De Industrial		
No of residential Units	_0	<u></u>			Public assembly				
Charles T.	-1				School		Government		
Photo Taken	(Tes)	No		Ē	Deff		Heritage Lister		
Investigate the building for	the condition	s listed on pro-	no f end f		- 10031003		L Other		
Investigate the building fo Overall Hazards / Damag	ae	Minor/Man	ye rand 2,	and chi	eck the appropriate	column. A ;	sketch may be adde	100 0000 3	_
Collapse, partial collapse, off	foundation			te			Comments	- on page 3	
	COLUMBER OF	Ø							
Building or storey leaning		Ø							-
Waa or other structural damag	ge .				<u> </u>				
Overhead falling hazard		Ø							
Ground movement, settlemen	t, slips	e,	п						-
leighbouring building hazard	N (S. 1997)	/	_		1 jee	geren	1 commonto		-
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lectrical, gas, sewerage, wat	ar, hazmats	Ø							
Record on	inting to the second	1		-					
necolu any ex	isting placard	on this build	ling:		Existing				5
12 Page					Placard Typ				1
12.24					DO LINCAR				
Chones a new section	in hazard on the		20 - D		(e.g. UNSAF				
Choose a new postin	ig based on the VE posting. Lo at main entranc	new evaluati xalised Seve s. Post all oth	on and tean re and over ler placards	n judger all Node at ever	nent Severe and		ng the whole building RESTRICTED USE P the chosen posting	are lace to the top	
Chones a new section		new evaluati xalised Seve a. Post all oth	ier placards	at ever	nent. Severe conditi erate conditions may y significant entranc		ng the whole building RESTRICTED USE. P the chosen posting	are lace to the top	
Choose a new postir grounds for an UNSA WSPECTED placard of this page.	ED	new evaluati scalised Seven e. Post all oth G2	on and tean re and over ler placards RESTRIC	CTED U	nent. Severe conditions may y significant entranc		the chosen posting	are lace to the top	
Choose a new postir grounds for an UNSA MSPECTED placard of fbls page. INSPECT GRE Record any restriction	ED EN <u>G1</u>	G2	ier placards	CTED U	nent. Severe conditi erate conditions may y significant entranc	ions affectir require a F E. Transfer UNS/	the chosen posting	are lace to the top R3	
Choose a new postin grounds for an UNSA INSPECTED placard of fbls page. INSPECT GRE Record any restriction Further Action Record	ED EN on on use or e mmended:	G2 Hntry:	RESTRIC	CTED U	nent. Severe conditions may y significant entranc	ions affectir require a F E. Transfer UNS/	the chosen posting	lace to the top	
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Structural Hazards/ I	Damage	Minor/None	Moderate	Severe	CWTP 14 Comments
Roofs, floors (vertical loa	d)			-	
Columns, pilasters, corbo	.05	ğ			see general comments
Diaphragms, horizontal b	racing N				
Pre-cast connections	M	_			
Beam	1.4	°	ō		
Non-structural Hazar	ds / Damage		-		
Parapets, ornamentation	N/A				
Cladding, giazing	MA				
Ceilings, light fixtures	MA	Π,			
Interior walls, partitions	9 /N	Ø			
Elevators	HIN	n	П		
Stairs/ Exits	MA				
Utilities (eg. gas, electricit					
Other	(; = ato;)			1000	
Geotechnical Hazards	(Damage	14			see general comments
Slope fallure, debris	, samage	M			
Ground movement, fissure	5				
Soil builging, liquefaction			п		Ex. dence of tignetaction around site
1.0	isk was	Leaking 1	to the La	nots tan	K. H is possible leakages could be
10.04	is absente	de la compañía de la	CIN LEGIN. 1	har see	offer fanks as these were full or biffin
Usability Category #	The centi	a) Lelamas	present	to be	higher than the walls of the fank
Damage Intensity	Posting	Usabi	lity Category		Remarks
Light damage	Inspected		e, no immediate fu on required	rther	
Low risk	(Green)		, repairs required		ce recommend fixed
Medium damage	Restricted Use	Y1. Short term a	antry		
Medium risk	(Yellow)	Y2. No entry to demolished	parts until repaire	d or	
line of demonstration			lamage: repairs, ng possible		,
Heavy damage High risk	Unsafe (Red)	R2. Severe dam	age: demosition is	kely	
In 1944 LIDER		R3. At risk from from ground	adjacent premise d failure	sor	

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

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onstruction or Demolition (Optional)		
and joint seals be remised and repl the tranks be emptied at the trank cracks in the wells and floor slab, Repair		
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Recommendations for Repair an

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slak Gad with Necessary 11 ter 15 fill voids. 9184 to

Inspector Initials Territorial Authority	ristchu Nus Christeh	K 15B urch City	Dat	e 7	13/11		Inal Post		
Building Name	Christehu			_ 1-	140			UNSAFE)	GI
Short Name		LAGOUNI	ewster T	reatmen	nt Plant				
Address	Shuffle	Divis			onstruction			/	
	Bamley	Christoh		-	ber frame		B	Concrete she	ar wali
GPS Co-ordinates	5.	E	with		el frame			Unterniorced	masonry
Contact Name	mike	Bourke			up concrete			Reinforced m	
Contact Phone	027 22	Statement Statement			crete frame			Confined mas	
Sloreys at and above		Below	-		rame with ma	asonry infiï	y	Other: Re	12f- Lincue
ground level	0	ground	1	Primary O				tank stu	uture
Total gross floor area		level	1	Dwe	lling			Commercial/ C	
(m²)	n 6000	Year built	71	D Othe	r residentia!				
No of residential Units	D	1977 - 19 7		C			Ц	Industrial	
	>			-	c assembly			Government	
Photo Taken	(Yes)	No		Scho				Heritage Listed	
estigate the building for	the conditions	listed on part		Relig	ous			Other	
estigate the building for erall Hazards / Damag	e M	linor/Nana	e 1 and 2, a Moderate	nd check th	e appropria	te column	A sketch	may be added	ion nana 3
lapse, partial collapse, off	foundation		_		CIE .			Comments	en page p
ding or storey leaning	(), (), (), (), (), (), (), (), (), (),	e		C	10.200				
or other structural damag		_/		E]				
rhead falling hazard	la Ia	দ্র		E					
		Q							
and movement, settlement	, slips	DZ,							
hbouring building hazard		d,							
rical, gas, sewerage, wate	ir, hazmats				1				
Record any exi	sting placard (on this build	in au						
36:	04400000000	in and pario	mg.		Existing Placard 1		Gurnare		· · · · · · · · · · · · · · · · · · ·
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Choose a new postin grounds for an UNSA INSPECTED placed	g based on the	new evaluatio	n and team	udgement.	Severa con	different all	antin a fl		l
grounds for an UNSA INSPECTED placard a of this page.	it main entrance	calised Seven 2. Post all oth	e and overal	Moderate	conditions n	nay requir	e a RESTRI	Whole building	are
of this page				-	uticant entra	ance. Trai	isfer the ch	osen posting	to the top
INSPECT	ED		RESTRIC						
		G2		YELLOW	YI	12	INSAFE		
Record any restriction	on on use or e	ntry:				12	RED	R1 R2	R3
Further Action Record									
Tick the boxes below	only if further act	ions are recom	mended						
L camcades are nee	eded (state locati	ion):							
	ig evaluation rec								
Detailed engineerin		Geote Geote	echnical	[] Other:				
L Structur	ADDUDS.								
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Other recommendated Overall Building D		de Contents)		0.000	Г		Sinn her	D An en de lan	
		D/ -				2	Sign her	e on corriplétion CB ec	

Structural Hazards/ Damage		Minor/None	Moderate	Severe	CUTP 15 Comments
*Foundations		D			
Roofs, floors (vertical load)					
Columns, pilasters, corbels	MA				
Diaphragms, horizontal bracing	MA				
Pre-cast connections	MA				
Beam	NA				
Non-structural Hazards / Dam	age				
Parapets, ornamentation	MA				
Cladding, glazing	NA				
Ceilings, light fixtures	NIA				
Interior walls, partitions	WA				
Elevators	MA				
Stairs/ Exits		d,			
Utilities (eg. gas, electricity, water)		ø,			
Other		P			· The verticit markale pipe of the
Geotechnical Hazards / Damag	je	/			southern and of the western lagorn
Slope failure, debris		Ľ,			has spalled concrete near the fup of the
Ground movement, fissures		Ľí/			pipe.
Soil buiging, liquefaction		ď			· Evidence of liquetarbun around site
	e do. sult	e nit , of the	eastly wol	be an	y structural damage as

	Damage Intensity	Posting	Usability Category	Remarks
ϵ	Light damage	hspected (C1. Occupiable, no immediate further investigation required	
`	Low risk		<u>G2, Occupiable, repairs required</u>	
	Medium damage	Restricted Use	Y1. Short term entry	
	Medīum risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
			R1. Significant damage: repairs, strengthening possible	· · · · · · · · · · · · · · · · · · ·
		Unsafe (Red)	R2. Severe damage: demolition likely	
	righ nas		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.

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Recommendations for Repair and Reconstruction or Demolition (Optional

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3 Inspection ID: _____ (Office Use Only)

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Inspector Initials					essmer	n Forr	n - LEVEL	- 2
Territorial Authority .	Christo	K 1512 Turch City	1		13/11	Final	Posting (e.g. UNSAFE)	G1
Building Name Short Name		in write		regiment	Plant		Teldi OlioAre)	
Address	Influent	structur	0	Type of (onstruction			
an North and	Shuffle			Tin	ber frame		Concrete shea	ອັພວມີ
GPS Co-ordinates	SI	y think	hwe h		el frame		Upreinforced n	1111000
Contact Name	<u> </u>	EP O		_	up concrete		Reinforced ma	
Contact Phone	MIKe 027 22	Bourke			crete frame		Confined masc	
Dista			_		frame with masor	nry infill	Other: Dur	ied real
Storeys at and above ground level	0	Below ground	N.	Primary O	- CV - CF		concrete cut	sent structs
Total gross floor area		level Year		_ Dwe	fiing	i i	Commercial/ Of	fices
(m²)	-300	built	21	C Othe	r residential	1	Industrial	
No of residential Units	D	2000 A		-	c assembly			
\				Scho		L	Government	
Photo Taken	Yes	(No)		D Rolle	iou io	1	Heritage Listed	
hvestigate the building fo Overall Hazards / Dama	or the conditions	listed on pag	ge 1 and 2	, and check the	P appropriate	L	Other	
Overall Hazards / Dama	ge i	Minor/None	Moder	ate Sev	ere ere	olumn, Aske	etch may be added	on page 3
Collapse, partial collapse, of	f foundation	ø		E			Comments	
Building or storey leaning				E				
Vall or other structural dama	ge	Ø			-			
overhe ad failing hazard		DY,	ū		5			
round movement, settlemer	nt, slips	Z,	Π				1.000	·
sighbouring building hazard		21	П					
ectrical, gas, sewerage, wat	ter, hazmets	Ø	п					
Record any ex Choose a new posti grounds for an UNS INSPECTED placard of this pace	ng based on the	new evaluati	on and tea	m judgement. rall Moderate	Existing Placard Typ (e.g. UNSAF Severe conditions may	E)	the whole building	
INSPEC GRI	TED EEN G1	G2		ICTED USE	-	UNSAF	e chosen posting to	ce) the top
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INSPEC GRI Record any restrict Further Action Reco Tick the boxes below Barricades are no Detailed engineer	TED EEN G1 ion on use or i ommanded: only if further ac reded (state loca ing evaluation re urat	G2 entry: tions are recortion): commended	RESTR	ICTED USE YELLOW	-	UNSAF	E	ce) the top
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INSPEC GRI Record any restricts Further Action Reco Tick the boxes below Barricades are no Detailed engineer Structs	TED EEN G1 ion on use or o ommanded: only if further ac eeded (state loca ing evaluation re urat lations: Damage (Exclu	G2 entry: tions are recor tion): commended Geo ide Contents	RESTR mmended technical	ICTED USE YELLOW	<u>Y1 Y2</u>	UNSAF	TRICTED USE. Pla te chosen posting to E D R1 R2	R3
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Structural Hazards/ Damage		Minor/None	Moderate	Severe	Comments ,
Roofs, floors (vertical load)		E			
Columns, pilasters, corbels		Ø			
Diaphragms, horizontal bracing	MA				
Pre-cast connections	NIA				
Beam	1-10				
Non-structural Hazards / Dan	nage	-			
Parapets, ornamentation	MA				
Cladding, glazing	+1A				
Ceilings, light fixtures	1000	Ξ.		n	
Interior walls, partitions	MA	P	Π		
Bevators	MA			П	
Stairs/ Exits	NIA			П	
Utilities (eg. gas, electricity, water)	1.114	F			
Other		m	П		
Geotechnical Hazards / Dama	ge			U	
Slope failure, debris		മ,			
Ground movement, fissures		ď/		Ē	
Soil buiging, liquefaction		ď		,	Evidence of liquidation around site
	where	is largely	waved.	Theefin	contraction and internet
the	10 4	A INNO	WAS LAIN	col int.	Rosed on this inspection of
51941	of	structure)	damage w	the ebe	eved.

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

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

Provide a sketch of the entire building or damage points. Indicate damage points.	-	$\left \right $		-			1_						T
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Recommendations for Repair and F	Reconstru	ction or	Demoli	ion (Ord	ional)						1		
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			<u>- 1998 - 10</u>										
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how part of the set	-		Sold Del	Const Const	000021	ment	Form	- LEVE	-2
wapector maais	NL	5+150		ala	-				
Territorial Authority		hurch City	Ti	me	5/2/11		Final P		
Building Name	Christenn	16 Wal	and a	ter	tment Pla			(e.g. UNSAFE)	G1
Short Name *	Trickling	Filters	2	Tu	ment Pla	nt.	1000		
Address	shuffle (Ane.	-	- 195	e of Construction	on			
			1		Timber frame		T.	Concreta shea	at mail
GPS Co-ordinates	SIMIC	, Charle	huick		Steel frame				
Contact Name	- <u> </u>	E			Till-up concret	e	- -	Unreinforced n	
Contact Phone	_mike				Concrete fram	0		Reinforced ma	
An interest L Infillia	_0272	130646			RC frame with		1_ fN FT		
Sloreys at and above		Below		Prim	ary Occupancy			P Other: Lin	what ionis
ground level	١	ground	6	Π	Dweiling			tanks	(2 Ng)
Total gross floor area	and the second	level Year	0		awarang.		L] Commercial/ Of	
(m²)	25000	built 🥵	990		Other residentia	al	To	1	
No of residential Units	\hat{D}	-					2	Industrial	
	17			1	Public assembly	Y		Government	
Photo Taken	(Yes)	No		5	School			Heritage Listed	
estinate the building of				<u> </u>	Religious			Other	
estigate the building fo erall Hazards / Dama	ine conditions	listed on page	e 1 and 2, a	and che	eck the appropri	iste colum			
onun mazards / Dama	ge l	Ainor/None	Moderat	e	Severe		ASKEL	an may be added	on page 3
apse, partial collapse, of	roundation	Ø,						Comments	
ding or storey leaning		d ,			<u> </u>		-		
or other structural dama	ige	CT			Contraction (1997)			and the second second	
rhead falling hazard		DZÍ						1.00 March 1.00	
ind movement, settlemen	t eline		Ц			er sensenan. Dit		CO. C. C. C.	
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hoouring building hazard		\Box			Π -				
rical, gas, sewerage, wat	er, hazmats	d			0 -	_			
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Record any ex	isting placard of	on this building	ng:		Exten.		_		
		10000			Existing Placard				
Choose a new posting grounds for an UNS/	ng based on the	new evaluation	and team	judoen	nent Causes	Contractors and			
grounds for an UNS/ INSPECTED placard of this page.	at main entrance	calised Severe	and overal	Mode	rate conditions	monions a	ire a Pro-	e whole building a	re
INSPECTED placard		- rusi all othe	piscards a	st every	significant ent	rance. Tri	ansfer the	chosen overlage	Ce
INSPECT						-	-	in posting to	the top
GRE		61	RESTRIC	TED U	SE		UNSAFE		
		<u>G2</u>		YELLO	W YI	Y2	RED		
Record any restricti		ntry:						<u>R1</u> R2	R3
Further Action Perso									
Further Action Reco		ons are recomm	nended						Υ.
Tick the boxes below	only if further activ								
Tick the boxes below	eded (state location	ינסר							
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Tick the boxes below Barricades are new Detailed engineeri Structur Other recommende	eded (state location ng evaluation reco rai ations:	on); ommended D Geotec	tinical ucristi fisi	1)	Other:				
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Tick the boxes below Barricades are new Detailed engineerin Detailed engineerin Structur Other recommender ed Overall Building D	eded (state location ng evaluation reco rai ntions: Damage (Exclud	on): Dimmended Directorite (e Contents)	thnical ten 19 fist)	Other:		Sign h	ere on completion	
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	Structural Hazards/ Damage *Foundations	Minor/None	Moderate	Severe	LWIPIT Comments
	Roofs, floors (vertical load)	e,			<u> </u>
	Columns, pilasters, corbets	5			
	Diaphragms, horizontal bracing	e			
	Pre-cast connections				· · · · · · · · · · · · · · · · · · ·
	Beam				
	Non-structural Hazards / Damage				
	Parapets, omamentation N/	A 🗆			
	Cladding, glazing				
	Ceilings, light fixtures	5			
	interior walls, partitions				
	Elevators N/I				· · · · · · · · · · · · · · · · · · ·
	Stairs/ Exits	ď,			
	Utilities (eg. gas, electricity, water)	ų		\Box ,	No problems notes
	Other	ά.	П		NO UNDER J NOICEI
Ć	Geotechnical Hazards / Damage	—		-	
-	Slope failure, debris	Ø,			
	Ground movement, fassures				
	Soil buiging, liquefaction	Ø		Π.	Evidence of Ingue faction exernat site
	General Comment Stants	rilly no a	placent st		Annage to the frickling fillers.
	HINA	er would	not alle	is the ju	stories of the tanks.
	· It was	noted th	e central	column	may have filted which has
	roultes	1 m the	retating		King the side of the took
	Peron				iquied out (see reprimendations)
		1.1.1			reprimer dation))

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Damage Intensity Posting		Usability Category	Remarks
light damage	Inspected (Green)	G1. Occupiable, resigned and further	
Low risk		G2. Occupiable, repairs required	
Medium damage	Restricted Use (Yellow)	Y1. Short term entry	
Medium risk		Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	
	Unsafe (Red)	R2. Severe damage: demolition likely	
figh risk	28	R3. At risk from adjacent premises or from ground failure	

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

 Sketch (optional) Provide a sketch of the entire building or damage points. Indicate damage points. 	-	$\left\{ -\right\}$			\vdash		-		Π	T	T	T
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	-									+-	+-	++
		_								+-	+	++
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	++		1							1	+	++
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ecommendations for Repair and F	teconstru	ction or ()emolitio	on (Optic	nal)			-				
" Recommen why the Mayer co	1 fact	her w	A	gatin	he	allie	1 1	ut,	ita ti	he n	Call	
These co	uld b	e de	mach	Lolum.	n ha	五	M	1seo	1.			
· Decommen	A	lance	7		1100	un	4.M 1	K	Lelym.	n fin	and afor	n.
maginitude	et	1 ser	nl) a	nd 1	iften	spa)	54	lim	10 LA	nfilm	the	
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	menenti	rch Eq.	RAPID /	Assessi	ment Fo	Cwi orm - LEVEI	2
Inspector initials Territorial Authority	NU	k 17B nurch City	Date Time	7/3/1		nal Posting	
Building Name	Christekus	ob worker				(e.g. UNSAFE)	<u>G2</u>
Short Name	Discoler	31-4	The The States	pe of Construct	ion		
Address	Shuffle D	and the second se	ŕ	Timber frame			
	Branley	Christehun	,* [Concrete shee	
GPS Co-ordinates	S.	ED	C	18 (1997) - 171/1318 (1997) - 19	2210	Upreinforced (nasonry
Contact Name	mike	0				Reinforced ma	isonry
Contact Phone	027 22		<u>_</u> _	Constraint dates 11 GH		Confined mase	onry
			C	0.0000000000000000000000000000000000000	n masonry in∰∥	Other Com	le el
Storeys at and above ground level		Below ground	Pri	mary Occupancy	у	tank (4 No) RADA: 30
Total gross floor area		level	D	Dweiling		Commercial/ C	flices diams
(m ²)	: 2000	Year built	11 0	Other resident	8. I	-1	unos sul vist
No of residential Units					12707	Der Industrial	
The price of the state of the s	- l			Public assemb	oly	Government	
Photo Taken	(m.)	1210		School		Heritage Listed	
and the second s	(Yes)	No		Religious		1	
Investigate the building fo Overail Hazards / Dama	or the condition:	s listed on page	1 and 2, and c	teck the approx	priate colume	A skotsk	
Overall Hazards / Dama	ge	Minor/None	Moderate	Severe		A sketch may be added	on page 3
Collapse, partial collapse, or	f foundation	Ø,				Comments	
Building or storey leaning		I					
Vall or other structural dama)ge						
Verhead falling hazard	23) 	1					
		B/					
round movement, settlement		Lar .					
eighbouring building hazard		Ø,					
ectrical, gas, sewerage, wa	ter, hazmats	\mathbf{Q}		α -			
Record any ex	disting placer	on this built					
		on the Duildi	ny:	Existi			
				lan I	rd Type JNSAFE)		
Choose a new post	ing based on the	e new evaluation	n and team judo		ee aa ah oo ah i	cting the whole building	<u> </u>
INSPECTED placer	AFE posting. L	ocalised Severa	and overall Mo	derate conditio	ns may require	cting the whole building a RESTRICTED USE. P	are
		.e. rost all othe	r placards at ev	ery significant e	intrance. Trans	fer the chosen posting	ace to the top
of this page,		>		-	-		
unus.page,	TED						
INSPEC		(a)	RESTRICTED			VSAFE	
INSPEC	EEN G1	G2 entry:		USE LOW Y	Y2	RED R1 R2	R3
INSPEC	EEN G1 tion on use or						R3
INSPEC GR Record any restrict Further Action Reco Tick the boxes below	EEN G1 tion on use or ommended:	entry:	YEL				R3
INSPEC GR. Record any restrict Further Action Rec Tick the boxes below Barricades are n	EEN G1 tion on use or ommended: wonly if further at esded (state loca	tions are recomm	YEL				R3
INSPEC GR. Record any restrict Further Action Reco Tick the boxes below Barricades are n Detailed enginee	EEN G1 tion on use or ommended: v only if further at esded (state loca ring evaluation re	tions are recomm	YEL				<u>R3</u>
INSPEC GR. Record any restrict Further Action Reco Tick the baxes below Barricades are to Detailed enginee	EEN G1 tion on use or ommended: v only if further at esded (state loca ring evaluation re tural	tions are recomm tion): commended	YEL mended	LOW YI	Y2		R3
INSPEC GR. Record any restrict Further Action Record Tick the boxes below Barricades are in Detailed enginee Struct	EEN G1 tion on use or ommended: v only if further at eeded (state loca ring evaluation re ural dations: We	tions are recomm tion): commended Geote	YEL mended		Y2		<u>R3</u>
INSPEC GR. Record any restrict Further Action Reco Tick the boxes below Barricades are n Detailed enginee Struct	EEN G1 tion on use or ommended: v only if further at eeded (state loca ring evaluation re ural dations: We	tions are recomm tion): commended Geote	YEL mended	LOW YI	Y2		R3
INSPEC GR. Record any restrict Further Action Reco Tick the boxes below Barricades are in Detailed enginee Struct Bother recomment mated Overall Building one	EEN G1 tion on use or ommended: v only if further at eeded (state loca ring evaluation re ural dations: We	tions are recomm tion): commended Geote	YEL mended	LOW YI	Y2		
INSPEC GR. Record any restrict Further Action Record Tick the boxes below Barricades are n Detailed enginee Struct Other recomment mated Overall Building one	EEN G1 tion on use or ommended: v only if further at eeded (state loca ring evaluation re ural dations: We	tions are recomm tion): commended Geote Contents)	YEL mended	LOW YI	Y2	RED R1 R2	
INSPEC GR. Record any restrict Further Action Record Tick the boxes below Barricades are n Detailed engines Struct Other recomment mated Overall Building one	EEN G1 tion on use or ommended: wonly if further at eeded (state loca ring evaluation re tural dations: CCC Damage (Excl	tions are recomm tion): commended Geote Vicco minico ude Contents)	YEL mended schnical Sodatens	LOW YI	Y2	Sign here on completion	
INSPEC GR. Record any restrict Further Action Record Tick the boxes below Barricades are n Detailed enginee Struct Other recomment mated Overall Building one	EEN G1 tion on use or ommended: wonly if further at eeded (state loca ring evaluation re tural dations: CC Damage (Excl 31-60	entry: stions are recommission): commended Geote Commended Geote Commended Geote Commended	YEL mended schnical holeftens	LOW YI	Y2	Sign here on completion	

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Structural Hazards/ Damage *Foundations	Minor/Norie	Moderate	Severe	LWTP 18 Comments	1999 - 1999 1997 - 1999 -
Roofs, floors (vertical load)	E				
Columns, pilasters, corbels	MA 🗆				
Diaphragms, horizontal bracing	MA 🗆				
Pre-cast connections	NA D				
Beam	N/A D				
Non-structural Hazards / Dam:	aga				
Parapets, ornamentation	/Λ D,				
Cladding, glazing	1				
Ceilings, light fixtures	14 🗆				
Interior walls, partitions	₩/A 🗆				
Elevators	MA D/				
Stairs/ Exits	Ø,				
Utilities (eg. gas, electricity, water)	Ø,				
Other	LA			see general comment	
Geotechnical Hazards / Damag	je				
Slope failure, debris				Evidence of shope musement on	Pada
Ground movement, fissures	۲ <u>۲</u>			Evidence of ground sofferne.	due to
Soil builging, liquefaction				Evidence of lique lation	Around site
	el concrete of	two other	wi en No	then edge of Displayer	
- Guide	wheels and	guides he	Ne bre	Ken off at a number of 1	heatings
· Crack				erimotor of tanks.	
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Damage Intensity	Posting	Usability Category	Remarks				
Light damage	(papected (Grean)	G1. Occupiable, no immediate further investigation required					
Low risk		G2. Occupiable, repairs required	· See recomprendations				
Medium damage	Restricted Use (Yellow)	Y1. Short term entry					
Medium risk		Y2. No entry to parts until repaired or demolished					
Heavy damage		R1. Significant damage: repairs, strengthening possible	N7				
High risk	(neu)	R2. Severe damage; demolition likely					
		R3. At risk from adjacent premises or from ground failure					

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

 Sketch (optional) Provide a sketch of the entire 			T	T	T	T	Т	T	T	—	LW	TP 18	
building or damage points. Indicate damage points.		1		+	+-	+-	+-	+		-	-		
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	-+	-+-	-+-	+									
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Récommendations for Repair and R	econstruct	ion or D	amolitic										1
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De repair be repair Decomment Leuisently	ed uni	le ser	a data		L'ML	4.10	Lonch	c#	@ PI	2 4	ennec	IAN	
· Recomment	midd	2 when	di a	Regt	marta	1 Ano	<u>1</u> e	pry	- in	ed)	F.+		
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Peromnen	Deng	10.0 million	interior de	1		_			/	7-			
· Recomment	¥2	11	wenc			liver							
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	1 sciple	nent	_(i1	any	1	_			-				

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3 Inspection ID: _____ (Office Use Only)

Inspector Initials Territorial Authority	NL.	k ITE	Date Time	7/1/1	10000	rm - LEVEL	
Building Name	Christehn	uster da	the Treat	the second se		(e.g. UNSAFE)	<u>G2</u>
Short Name	· Digester	5 1-4 40 mm	Building Ty	pe of Construi	ction	520	- 60 C
Address	Shuffle L), ine	í E] Timber fram			
	Branley	Christopharet		1 - NAKARANA		Concrete shear	
GPS Co-ordinates	_Se	E°		and the second second			
Contact Name	Mike 1	Sourke				Reinforced mask	
Contact Phone	027 22	30696			ith masonry infil	Confined mason	Ŋ
Storeys at and above		Below	Prir	nary Occupan		C Other:	
ground level	_ 1	ground levei) 0	Dwelling	-,		
Total gross floor area (m²)	2150	Year	·	1220 303		Commercial/Offi	Ces
No of residential Units	-190	built	<u>. </u>	Other reside	ntial	industrial	
no prasidendal Units	<u>_</u>			Public assen	nbly	Government	
Photo Taken	(Yes)	22		School		Heritage Usted	
		No		Religious		the second state of the second second	
vestigate the building fo verall Hazards / Damag	r the condition:	s listed on page	1 and 2, and ch	leck the appn	opriate column. A	sketch may be added a	
ilapse, partial collapse, of	je formation	Minor/Mone	1000-000-000-000-000-000-000-000-000-00	Severe		Comments	n page 3
ilding or storey leaning	Incountration	1					
		D					
all or other structural dama	ge	ця,		0.1	hinor diaco	(1) cracking	,
erhead failing hazard		Ø,			+ COINCY 0	1 days	M WAI
und movement, settlemen		Ø,				UN VIII	
ghbouring building hazard		Ø,					
ctrical, gas, sewerage, wat	er, hazmats	র্ত্র					
Record any ex	inting alassa			-			
the state of the s	isting piacato	on this building	ng:	Exis			
				100	ard Type UNSAFE)		
Choose a new post	ng based on th	e new evaluation	and team judge			ing the whole building a	<u>_</u>
INSPECTED placard	at main entran	ocalised Severe	and overall Mos	ierate conditi	ons may require a	ing the whole building a RESTRICTED USE. Place or the chosen posting to	re T
of this page.				y significant	entrance. Transfe	er the chosen posting to	the top
INSPECT		2	RESTRICTED	1155	2002		1 1000
	EN G1	G2		OW YI	1 Y2 UNS	RED RI R	
Record any restricti	on on use or	entry:			<u> </u>	RED R1 R2	RJ
Further Action Reco	mmended:						
Tick the boxes below	only if further at	tions are recome	nanded				
L Barricades are ne	eded (state loca	tion):	Nerkoeg				1
Detailed engineer	ing evaluation re	commended					
Other recommend	last	Geoter Geoter		🗆 Othe	r,		
		e recomm	chelytion				
ted Overall Building	JAIDADA (EVA	Ude Contents)					
ated Overall Building	Parinage (EVDI	(and the second s			1	Sinn how and	
ne D	31-6				nd.	Sign here on completion MGA (Becch)	

Structural Hazards/ Damage	Minor/None	Moderate	Severe	CWSPIG Comments
Roofs, floors (vertica) load)	Ø,			
Columns, pilasters, corbels	ø,			
Diaphragms, horizontal bracing	Ø,			
Pre-cast connections	অ/			
Beam	TA I			
Non-structural Hazards / Damage	,			
Parapets, omamentation	\square			
Cladding, glazing	ø,			
Ceilings, light fixtures				
Interior walls, partitions	\mathbf{Q}			
Elevators 12/1				
Stairs/Exits	Z,			
Utilities (eg. gas, electricity, water)	Ø			
Other				
Geotechnical Hazards / Damage	1			
Slope faiture, debris	Ø.			
Ground movement, fissures	Ø,			
Soil bulging, liquefaction	G/		ο.	Evidence of liquefaction around inte
General Comment	lhan min	in inacki	1 1	he wells, this building
appeors	to have	no sig	noticant	structural damage.

Usability Category

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Damage Intensity	Posting	Usability Category	Remarks
löght damage	Inspected	G1. Occupiable, no immediate further investigation required	
LOWTER	(Grean))	62 Occupiable, repairs required	· Lee recommendation
Medium damage	Restricted Use	Yf. Short term entry	
Medium rísk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	
	Unsafe (Red)	R2, Severe damage: demolition likely	
NUT IN		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.

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Recommendations for Repair and Reconstruction or Demolition (Optional)

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· Recommend warks in walls be repaired using eporty crack injection.

Territorial Authority	Christo	hurch City	Dat Tim		7/3/1	Final Pos		
Building Name	Christian	erch wart			144P	(9	g. UNSAFE)	42
Short Name	· Oigest	3 5-68	under	JIVDE O	f Construction		10	
Address	Shuffle	anse	Jellem		Imber frame	-		
	Binter	, Charleh	with	_	teel frame		Concrete shear w	2.0
GPS Co-ordinates	S⁰ ⊂	E°			llt-up concrete		Unreinforced mas	
Contact Name	Mike	Sou, RC		-	oncrete frame		Reinforced masor	1.00 M (1.0
Contact Phone	02722	30696	- Seden alt	_	C frame with mason		Confined masonry	Y
Storeys at and above		Below		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Occupancy	Sector Sector Sector	Other: Giral	ar warefu
ground level	1	ground level	1	102-1, 817 ()-25	velling	1	40KI (2 NO),	110+ 14
Total gross floor area	a surrai	Year		- []		Ц	Commercial/Offic	es diam.
	1 1500	built	2005	Оч	her residential		Industriai	
No of residential Units	_ <u>_</u>			🛛 Pu	blic assembly	П	Government	
Photo Taken	$\overline{\mathbb{C}}$			Sd Sd	hool	П	Heritage Ustad	
	(Yes)	No		D Rei	ligious	П		
ivestigate the building fo Iverall Hazards / Damag	r the condition	s listed on pa	ge 1 and 2, a	and check	the appropriate o			
verall Hazards / Damag	le		Moderate	e Se	Were	Munari, A Sketch	may be added on	page 3
ollapse, partial collapse, off	foundation	M,					Comments	
ilding or storey leaning		e,		J.				
all or other structural damag	je	Ø						
erhead falling hazard		$\Box'_{,}$						
ound movement, settlemen	t, slips	D.						
ghbouring building hazard		R						
ctrical, gas, sewerage, wate	er, hazmats	ਕ		L T]			
				L				
Record any exi	sting placard	l on this buil	ding:		Existing			
					Placard Type			
Choose a new postir	va based on th				(e.g. UNSAF			
Choose a new postin grounds for an UNS/ INSPECTED placard	VFE posting. L	ocalised Sevi	ere and overa	judgemer Ul Moderat	t. Severe condition	ons affecting the	whole building are	
INSPECTED placard	at main entran	ce. Post all ot	her placards	at every si	gnificant entrance	Transfer the c	RICTED USE. Place	
INSPECT							invarin posting to t	ne top
	ED G1	(G2)	RESTRIC			UNSAFE		
Record any restriction				YELLOW	Y1 Y2	RED	R1 R2	R3
Further Action Reco	mmended;							
Tick the boxes below	only If further a	ctions are race	mondad					
La barricades are ne	eded (state loca	tion):						(4)
Detailed engineer:	ng evaluation re	commended						
Other recommende	tal Moneto -	Geo Geo	otechnical		Other:			
Other recommenda	auons: - Se	e ruo.	mandafilt	,				
ated Overall Building (Jamage (Excl	ude Contents	5)					
	31-6					Sign ha	are on completion	
					1	A 1/ 14.14	(Berg)	

Structural Hazards/ Damage Foundations		Minor/None	Moderate	Severe	LWIPLD Comments
Roofs, floors (vertical load)		Ø			
Columns, pilasters, corbels	MA				
Diaphragms, horizontal bracing	MA				
Pre-cast connections	MA				
Beam	MA				
Non-structural Hazards / Dama					
Parapets, ornamentation	NI				
Cladding, glazing	MA				
Cellings, light fixtures		Ø,			
Interior walls, partitions		Ľ			
Elevators	MIN	Π,			
Stairs/ Exits		ø,			
Utilities (eg. gas, electricity, water)		£,			
Other				Π,	see general comments
Geotechnical Hazards / Damage	ė	12			The Joseph (comment)
Slope fallure, debris		Ш.			
Ground movement, fissures		\Box'		Π,	Evidence of grand settlement of up to 20mm
Soil builging, liquefaction			D		Didence of liquetust up around the
General Comment . 504 Hee	d co	where prove	ement slab	Aronal	perimeter of fank.
+ spml	lea	Mages w	ere obser	ver at	base of gelleny walls
					· · · · · · · · · · · · · · · · · · ·

Usability Category

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Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected	G1. Occupiable, no immediate further investigation required	
Low risk	(Green)	G2. Docupiable, repairs required.	· See recommendations
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Heavy damage		R1. Significant damage: repairs, strengthening possible	
	Unsafe (Red)	R2. Severe damage: demolition likely	
ngur nan.		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.

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Recommendations for Repair and

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· Recommend repairs to concrete Casement slab be caused unt · Recommend the cracks 111Ats base of gelleny wells be redailed epsy chark injection and USING providing sh ants. · peronment level survey be Lainer out to ascertion ONSUN diffe. etterm é (11 414

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Inspector Initials Territorial Authority	Christchu	\$ 153	Da Tir	ste	7/3/11		ai Pos	ting	
Building Name	Chastely	in was	dewale 1	i.l	neyt Ylast		(0.	g. UNSAFE)	G2
Short Name	1 Digesters 5	16 600	rel Building	Ty	pe of Constructi	ion			1.1450
Address	Shuttle Dr	Ne			Timber frame			1	
1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Branky,	Chartch	inh	-		53	E D	Concrete shea	
GPS Co-ordinates	So J	E°				to.	ц П	Unreinforced n	
Contact Name	Mike Bi	surke						Reinforced ma	
Contact Phone	027 2230	5646				n masonry infil	Ц	Confined maso	inry
Storeys at and above		Below			nary Occupancy			Other;	
ground level	1	ground level	Ð	П	Dwelling	Y	_	2010-00-00-00-00-00-00-00-00-00-00-00-00-	
Total gross floor area (m²)	a	Year					Ц	Commercial/ Of	fices
	= 200	built	~ 2005		Other residenti	ial	V	Industrial	
No of residential Units	<u>D</u>				Public assemb	ly		Government	
Photo Taken		325			School			Heritage Listed	
	Yes	No			Religious				
ivestigate the building fo iverall Hazards / Damag	r the conditions li	sted on pa	ige 1 and 2,	and ch	eck the appropriate	riste column	abut i		
verall Hazards / Damag	je Mi	nor/None	Moderat	8	Severe	Anado Conditini, A	sketch	may be added	on page 3
ollapse, partial collapse, off	foundation	Ø,						Comments	
ilding or storey leaning		\Box ,			—				
all or other structural damag	je	IN/				1			
erhead failing hazard		Ľ.				age AN) LITEL	King	to walls on	Auth (
ound movement, settlement	t, slips	E,				n above du	ing	en nest	face.
ghbouring building hazard		Z.			Ľ –				
ctrical, gas, sewerage, wat	er, hazmets	ē							
Record any exi	isting placard or	n this bui	dina:		E.L.O				
					Existir Placar	ng d Type			
Chapters					10 0 11	110 1 0 0			
Choose a new postir grounds for an UNS/ INSPECTED placard : of this page	g based on the n VFE posting. Loc	ew evaluat alised Sev	tion and team ere and over	judge III Moc	ment. Severe c	conditions affec	ting the	whole building	are
INSPECTED placard	- main entrance,	Post all of	her placards	at eve	ry significant er	ntrance. Transf	er the cl	hosen posting fr	ice the tap
INSPECT									
		2	RESTRIC		USE OW Y1		SAFE .		
Record any restriction	on on use or en	try:		· Article		Y2	RED	R1 R2	R3
Further Action Reco									
	only if further actio	US AIP ISON	monded						
Tick the boxes below	eded (state looptio	n):							
Tick the boxes below Barricades are ne	onen (srefe jonstio	mmended							
Tick the boxes below Barricades are ne Detailed engineeri	ng evaluation reco				Other:				
Tick the boxes below Barricades are new Detailed engineerit Structur	ng evaluation raco ral	🛛 Ga	otechnical		L Uner;				
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Tick the boxes below Barricades are ne Detailed engineeri Structu Other recommends ated Overall Building C	ng evaluation raco ral ations: <u>(</u>) Damage (Exclude	Geo Hecomi e Contents	1 al bist					re on completion	
Tick the boxes below Barricades are ne Detailed engineeri Structu Other recommends ated Overall Building C	ng evaluation raco ral ations:	Geo Geo Contents	1 al bist			P St	Sign he	1	

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Structural Hazards/ Damage	MinoriNone	Moderate	Severe	CUTP 21 Comments
Roofs, floors (vertical load)	E.			
Columns, pilasters, corbeis				
Diaphiragms, horizontal bracing				
Pre-cast connections	四,			
Beam				
Non-structural Hazards / Damage	/			
Parapets, ornamentation	Ľ			
Cladding, glazing	Ø			
Ceilings, light fixtures	V			
Interior walls, partitions	Q			
Elevators N	IA D,			
Stairs/ Exits				
Utilities (eg. gas, electricity, water)	£,			
Other	DV			see comments
Geotechnical Hazards / Damage				per Withings
Slope failure, debris	Ľ,			
Ground movement, fissures	\mathbf{D}_{i}			
Soil bulging, liquefaction				· Evidence of liquelaition around site
General Comment	pavements	145 spalle		enstern side of building on western side of building

Usability Category

Damage Intensity	Posting	Usability Category	Remarks
Light damage	Inspected -	G1. Occupiable, no immediate further investigation required	
Low risk	(Gréen)	32. Graupiable, repairs required_	· see recommendation
Medium damage	Restricted Use	Y1. Short term entry	
Medium risk	(Yellow)	Y2. No entry to parts until repaired or demolished	
Janu daran		R1. Significant damage: repairs, strangthening possible	×
Heavy damage	Unsafe (Red)	R2. Severe damage: demolition likely	
High risk		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.

	CWTP 21
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Recommendations for Repair and Reconstruction or Demolition (Optional)

· Recommend Light be, 30 Wills repaves 41,19 ation CHIN A Salles enve ment Louiste be using reinstatement KO BILA mintar

an'	and the state of the		_		Cu	TP 22
	ristchur	ch Eq R/	APID /	Assessme	nt Form - LEVE	
Inspector Initials Territorial Authority	NLS Christohu	<118	Date Time	5/3/11	Final Posting	T
Building Name	Charle hur	h Wastewa	1		(e.g. UNSAFE	G2
Short Name	·Clarifier	3 1-4 kw	Ikuni Ty	threat Plant pe of Construction		
Address	shu tit	Urise	The second secon	Timber frame	-)
1	Brimley	Christiahan		Steel frame	Concrete st	
GPS Co-ordinates	\$°	Es				
Contact Name	Mike Bi	inske		Concrete frame	Reinforced	
Contact Phone	127 223	0696		RC frame with maso		soniy
Stoneys at and above		Below	Prin	nary Occupancy		vied circular concrete
ground level	0	ground		Dwelling	TAHINS	ppun som ding 4
Total gross floor area (m ²)	10 - 0-00	Year		000000	Commercial/	Offices
	1000 4000	built		Other residential	19 Industrial	
No of residential Units	_0	14		Public assembly	Government	
Photo Taken	(Yes)			School		. 1
The second se		No		Religious	Heritage Liste	d j
Overall Needed to a	the conditions list	sted on page 1 an	d 2, and ch	eck the appropriate	column. A sketch may be adde	
Overall Hazards / Damage	e Miu	nor/None Mor	ierate	Severe	- sketch may be adde	d on page 3
Collapse, partial collapse, off f	oundation				Comments	
Building or storey leaning				D		
Wali or other structural damage	e			388 (Broken)	a cont	
Overhead falling hazard		D I		D Clastic	13 conching 10 the ex	term wall of
Sound movement, settlement,	slips		7		+4 on southern edge	•
leighbouring building hazard		d, 0		U Mape	is general settlement	Arrand the
iectrical, gas, sewerage, water	, hazmats			-1041718	rs of between 100	10 202
			1			14 11 10 14 10
Record any exist	ting placard on	this building:	- Maria	Existing		
				Placard Typ	e	
Choose a new posting	based on the ne	tir mali atta a sa	2 122	(e.g. UNSAF		
grounds for an UNSAF	E posting. Loca	lised Severe and o	team judger Werall Mode	nent. Severe condition	E) ons affecting the whole building require a RESTRICTED USE P	
of this page	main entrance. F	ost all other place	uds at even	significant entrance	ons affecting the whole building require a RESTRICTED USE. P e. Transfer the chosen posting	lace
INSPECTE	<u> </u>	S			the chosen posting	to the top
GREE		REST	RICTED U		UNSAFE	
Record any restriction			YELLO	W Y1 Y2	RED R1 R2	R3
Further Action Recom						
Tick the boxes below on	ly if further action:	818 /900mmandes				
L gancades are need	ed (state location)					2
Detailed engineering	evaluation recom	mendee - E	e n	emmental pas		
- Studura		T Contrat in		O Other:		
Other recommendation	ns: ue	ccommend 4	1+11			
ated Overall Building Dat	mage (Exclude (Contents)		F		
					Sign here on completion	
% D	31-60 %				NHAVER (Be	(a)
	31-60 % 61-99 % 100 %		-63	Date	DAMUIN (Bei BTime 5/3/1)	<u>(a)</u>

,	Structural Hazards/ Damage Foundations	1	MinorNens	Moderate	Seven	e comments
	Roofs, floors (vertical load)	M)				
	Columns, pilasters, corbels	M		Ē		
	Diaphragms, horizontal bracing	41)				
	Pre-cast connections	M				
78	Beam					
li	Non-structural Hazards / Dan	nage			-	
- ji	Parapets, ornamentation	MA				
	Cladding, glazing	¥/A				
(Ceilings, light fixtures	MA				
	nterior walls, partitions	MA				
	levators	MA	Ē			
5	tairs/ Exits	P1/4	দ্র	0	П	steelwork to the Walkway the charter
U	tilities (eg. gas, electricity, water)	90) 1	Π			adjutent to the Walkway starr landing
	ther		2	ū		And to settlement et the landing
CP	eotechnical Hazards / Dama	ge .		0		* See general comments
~	lope failure, debris		 Ø,			· Local slumping oround classifier 4
G	round movement, fissures		四,			
S	at bulging, liquefaction		e			· Esidence of liquefaction around site
~						especially to the west of claritions 324
G	eneral Comment • There	is 1	macking to	the french	-l.	I C II
			17		lem	
	·Olher		-			
	Contract of the local division of the local		ne sign a.thgnap.e.	is of struct	1ra i	damage as a result of
		1	an ing mailies	<u> </u>	-	
Us	ability Category				-	
	Damage Intensity Pos	ting	Usabi	lity Category	T	Remarks
C	Light damage Inspecta	6	G1. Occupiable, investigatio	, no immediate further n required	-	
•	Low risk			repairs.required	1.5	ce recommendations
	Medium damage Restricts	ed Use	Y1. Short term e	ntry	-	
	Medium risk (Yellow)	1000000	Y2. No entry to p demolished	parts until repaired or	-	

Unsafe

(Red)

R1. Significant damage: repairs, strengthening possible

R2. Severa damage: demolition likely

R3. At risk from adjacent premises or from ground failure

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Heavy damage

High risk

< Sketch (optional)

Provide a sketch of the entire building or damage points. Indicate damage points.

Recommendations for Repair and Reconstruction or Demolition (Optional)

Recompany the cloud of periodicion (Optional)
Recompany the cloud of the extension with a scalart
Recommand the deforment steel work at the day landing be repaired
Recommand the deforment steel work at the day landing be repaired
Recommand the transh / during structure be repaired by eputy injecting
Recommand the transh / during structure be repaired by eputy injecting
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Recommand the transh / during structure be repaired by eputy injecting
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Recommand a level survey be carried on all clarities to assess
Recommand the transh wills flow slab and central prev.
Recommand the clarities has accoursed of it significant lateral movement of the contral previate the clarities. This may entrail decoding the day for any of the clarities. This may entrail decoding the of full inspect of the clarities and complying the clarities. Clarity of the walls base slab and central pier.

C	hristchurcl	1 Ea RAP	D Assoc	Simont F	cwq prm - LEVEI	P23
Territorial Authority	Christohurch (Chy 1	Date 5/3/1) Fir	al Posting	
Building Name Short Name Address	Shuttle Dir	Je	Treatment P Type of Constr Timber fra	Vant uction	(e.g. UNSAFE)	62
GPS Co-ordinates Contact Name Contact Phone	BEMlez (50 MIKE BOD UZ7 22306	and the second se	Steel fram Tilt-up con Concrete f	icrete	Concrete shea	sasonry sonry
Storeys at and above ground level Total gross floor area		Below ground 07	Primary Occupa	with masonry infil: ncy	Commercial/ Of	-
(m ²) No of residential Units	0.1.1.1.1	Year Duilt 1	Other resid	2010/20		lues
Photo Taken Investigate the building fo Overall Hazards / Damag	(Fes) N	0	Public asse School Religious	2074	Government Heritage Listed	
Collapse, partial collapse, off wilding or storey leaning vali or other structural damag verhead falling hazard bund movement, settlement wighbouring building hazard ectrical, gas, sewerage, wata	foundation			mines cough workern sid	Comments	as dues on
Choose a new postin		valuation and team d Severe and over all other placards	(e.g. Niddement Course	ard Type UNSAFE) a conditions affections ons may require a entrance. Transfe UNS	ing the whole building a RESTRICTED USE. Plac If the chosen posting to AFE RED R1 R2	re e the top
Detailed engineerin Detailed engineerin Structure Dother recommendation	nly if further actions are ded (state location): g evaluation recommen al lons: Sue you	ded] Geotechnical	D Offer	R.		
ated Overall Building Di ne % 22 0 % 30 % Constant Logical Constant Statements of the second statement of the second	amage (Exclude Con 31-60 % 61-99 % 100 %	tents)		1	ign here on completion ward (Beca 5/3/8	

Structural Hazards/ Damage	Minor/None	Moderate	Severe	Comments
*Foundations	e			
Roofs, floors (vertical load)	ø			
Columns, pilasters, corbels	Ø			
Diaphragms, horizontal bracing	ত			19
Pre-cast connections	Ø,			
Beam	Ľ			
Non-structural Hazards / Damage	- 2			
Parape/s, ornamentation	Ø			
Cladding, glazing	Ø			
Ceilings, light fixtures	Ø			
Interior walls, partitions	Ø			
Elevators MA	Ω,			
Stairs/ Exits	Ø,			
Utilities (eg. gas, electricity, water)	Ø			
Other				
Geotechnical Hazards / Damage		1000 F	-	
Slope failure, debris				
Ground movement, fissures	\mathbf{Q}'			
Soit builging, liquefaction	G/		□.	Evidence of liquetuction around site
General Comment . Gruin no	ALCOSS	interius 3		
. These	WAS AFTIN		Sef. hor	1 11
the wall			1	common damage to the call

Usability Category

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

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Sketch (optional) Provide a sketch of the entire	Γ	1	\square	T	T	П				Zu	TPL	3
building or damage points. Indicat damage points.	e	1	++	-+-		++						
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3 Inspection ID: _____ (Office Use Only)

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Inspector Initials Territorial Authority	L NLS	K IJA urch City)ate ime	5/3/11	Final Posting
Building Name Ch		the second se			rent Phot	(e.g. UNSAFE) Gr)
	as Heider	TANKACU	Notes To	k TV	rent Phat be of Construction	
Address	shuffle D	INC			Timber frame	
(Sranky,	Chastel	1 Prish	-0	Steel frame	Concrets shear wall
5.8 X2	So J	Eº.		-0	Till-up concrete	Unreinforced masonry
	Mike	Bourke			Concrete frame	Reinforced masonry
Contact Phone	027 22	30696			RC frame with mason	Confined masonry
Storeys at and above		Below	1798-199	Prim	ary Occupancy	truks (2 No) clad in bis
ground level		ground level	0		Dwelling	Veneer, Clad in bise
Total gross floor area (m²)	100	Year	-	-	1991 bill 199 1	Commercial Offices Cappion 6.4
No of residential Units	10.5	built			Other residential	Industrial
	D	_			Public assembly	Government
Photo Taken / Pe	s)	No			School	Heritage Lister
		nu .		1	Religious	
erall Hazards / Damage	CUNDIDONS	isted on pag	ge 1 and 2,	and che	eck the appropriate c	olumn. A sketch may be added on page 3
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i or other structural damage						
rhead failing hazard						
ind movement, settlement, slip						
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hbouring building hazard nical, gas, sewerage, water, ha	zmats					to tenks.
Record any existing	g placard o used on the r	n this build	ling:	judgen II Mode	Existing Placard Type (e.g. UNSAFE	
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Structural Hazards/ D	amage	Minor/None	Moderate	Severe	CWTP24 Comments
Roofs, floors (vertical load	0	Ø			
Columns, pilasters, corbei	s MA				
Diaphragms, horizontal bri	acing N/A				
Pre-cast connections	N/A				
Beam	NI	_	Π	Π	
Non-structural Hazard	s / Damage	-			
Parapets, ornamentation	NIA				
Cladding, giazing	N/A				
Ceilings, light fixtures	MA			Π	
Interior walls, partitions	MA		Π	n	
Elevators	NA		n		
Stairs/ Exits	MA	Ξ,	П		
Utilities (eg. gas, electricity,		ī	П		
Other	1979 1 9	ñ	n	п	
Geotechnical Hazards /	Damage		6		
Slope failure, debris	ā.	ď,		П	
Ground movement, fissures					
Soil bulging, liquefaction					Endence of liquefaction evoluted inte
	n h	tank an ith no iquishes.	appenent	le fank signs i	if A Husturn ! defects the
Usability Category					
Damage Intensity	Posting	De-L3	ity Category		

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

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Sketch (optional) Provide a sketch of t building or damage ; dama

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 Provide a sketch of the entire building or damage points. Indicate damage points. 	+		+-	+	Ŧ	-	T	T	T	T	T	Τ	T	\square	
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Récommendations for Repair and Re	constru	uction (or Dem	olition	Ontio	na/1								1	_
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Appendix C

Sika Products Technical Data Sheets

Sikagard[®]-550 Elastic (NZ) Crack bridging protective coating for concrete

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Product Description	Sikagard [®] -550 Elastic (NZ) is a one part, plasto-elastic coating based on UV-curing acrylic dispersion with excellent crack-bridging properties even at temperatures below 0°C.	
Uses	 Protection and enhancement of concrete structures (normal and lightweight concrete), especially exposed concrete surfaces with a risk of cracking With concrete repair works as an elastic protective top coating on Sika[®] MonoTop mortar repairs (refer to separate Sika MonoTop product data sheet) 	
Characteristics / Advantages	 Crack-bridging even at low temperatures (-20°C) High diffusion resistance against CO₂ reducing the rate of carbonation Water vapour permeable Very good resistance against weathering and ageing Can be diluted with water Environmentally friendly (solvent free) Reduced tendency to dirt pick up and contamination 	
Product Data		
Form		
Appearance	Thixotropic liquid.	
Packaging	20 litre plastic pails	
Storage/Shelf Life	Twenty four (24) months from date of production if stored properly in undamaged and unopened original sealed packaging in cool and dry conditions. Protect from direct sunlight and frost.	
Technical Data		
Chemical Base	Acrylate dispersion	
Colours	Available in a wide range of colours which are made to order	
Appearance	Low semi-gloss finish	
Density	~ 1.3 kg/l (at +20°C)	
Solid Content by Volume	~ 50%	
Solid Content by Weight	~ 65%	
Layer Thickness	Minimum required dry film thickness to achieve the required anti-carbonation characteristics (CO ₂ equivalent air thickness of 50 m) \approx 160 microns.	
	Minimum required dry film thickness to achieve full durability characteristics (CO_2 diffusion, adhesion after thermal cycling and crack bridging) \cong 340 microns.	



Carbon Dioxide Diffusion			
Co-efficient (µCO ₂)			
	Dry film thickness	d = 160 µm	
	Equivalent air layer thickness	$S_{D_1} CO_2 = 51 m$	
	Diffusion coefficient CO ₂	μCO ₂ = 3.1 x 10 ⁵	
	Requirements for protection	S _D , CO₂ ≥ 50 m	
Water Vapour Diffusion Coefficient (µH ₂ O)			
	Dry film thickness	d = 230 µm	
	Equivalent air layer thickness	S _{D, 2} O = 0.35 m	
	Diffusion coefficient 20	$\mu_{2}O = 1.5 \times 10^{3}$	
	Requirements for breathability	S _D , ₂0 ≝ 5 m	
Mechanical / Physical Properties			
Elongation at Break	Elongation at break at +20°C (not expose Elongation at break at -20°C: 70%	d to weathering): 120%	
Crack-Bridging Capacity	Class A1 (-20°C)	EN1062-7	
Total minimum recommended dry film build	200 microns (340 microns is required to achieve stated crack-bridging capacity)		
Application rate	4-5m²/litre/coat		
Minimum number of coats	2		
Rain resistance time @	10°C: 10 hours		
70% - 80% relative humidity	15°C: 4 hours		
namary	20°C: 2 hours		
Recoat time, 20°C, 75%Rh	4 hours		
Clean Up	Water		
Primer	Sika Primer W or Sika Primer S		
	Note: For very difficult substrates (very dense or weak) and at low temperatures use Sika Primer S		
Application Details			
Substrate Preparation	 New concrete should be 28 days old The substrate must be sound, dry and free from any dust or other surface contaminants such as oil, grease, chemicals rust, unsound existing coatings etc. Honeycombing or surface irregularities should be filled and flushed off with Sika MonoTop Fairing Coat (NZ), Sika MonoTop High Build Mortar or Sika Meshkote to achieve a smooth and uniform surface. 		
Mixing	Sikagard-550 Elastic (NZ) and the primers thoroughly before application		



Application	 Sika Primer W or S may be applied by brush, roller or airless spray method.
	 Provide adequate ventilation when using Sika Primer S, as it contains flammable solvents. Ensure that the primer penetrates completely into the substrate without forming a glaze on the surface. If two coats of primer are required, due to substrate porosity, allow 2 hours to
	 dry between coats – depending on temperature and air movement. The primer should be completely dry (at least 4 hours at 20°C) before
	 overcoating with Sikagard-550 Elastic (NZ). Apply the Sikagard-550 Elastic (NZ) using either a brush, roller or airless spray equipment (see Important Notes) to achieve a uniform and even coating thickness.
	 Waiting time between coating applications is approximately 8 hours at 20°. At lower temperatures this time will be delayed.
Cleaning	 For Sika Primer S use Sika Colma Cleaner to clean brushes and equipment. For Sikagard-550 elastic (NZ) and Sika Primer W use water to clean brushes and equipment.
Important Notes	 Sikagard-550 Elastic (NZ) is resistant to normal aggressive atmospheric pollutants however owing to its elastic nature slight surface contamination may occur, particularly on horizontal surfaces.
	 If applying Sikagard-550 Elastic (NZ) over existing coatings the surface must be thoroughly clean and sound. Adhesion and compatibility tests should be carried out first to determine the suitability of using Sikagard-550 Elastic (NZ). Sika MonoTop repair systems should be allowed to dry for at least 48 hours
	 before applying Sikagard-550 Elastic (NZ). Application rates for Sika Primer S or W and Sikagard-550 Elastic (NZ) may vary depending on the surface texture of the substrate, the method of application and the coating thickness.
	 The primer coat must be thoroughly dry before overcoating.
	Remove all concrete cure or release materials prior to coating.
Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.
Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.
Transportation Class	Sikagard-550 Elastic (NZ) is classified as non hazardous.
Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary
	measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet
Legal Notes	The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties
	of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.
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0800 SIKA NZ 0800 SIKA FAX info@nz.sika.com Phone: Fax: Email:



Sikadur[®] Injectokit-LV Pre-packaged low viscosity epoxy crack injection system

The Sikadur Injectokit-LV system consists of a low viscosity two part epoxy crack injection resin contained in a patented single cartridge, complete with injection nipples, hoses, and air release pins. The kit is designed for those contracts where a complete injection system is required.				
For injecting cracks in concrete and masonry wherever there is a need to consolidate a structure or exclude water and air from contact with reinforcement. Due to its low viscosity, cracks down to 0.2 mm at the surface can be filled. Cracks tapering internally down to 0.01 mm can be filled. Ideal for small scale repairs on site. Can be used for insitu or precast concrete elements.				
 Convenient to use, disposable single cartridge contains both resin and hardener. Safe and clean to use, non return valves avoid leakage and spills. High strength, excellent bond to concrete, brickwork and masonry, either wet or dry. Modular nature, effective and economical use even for the smallest repair. 				
Shelf life 12 mo			t 10°C – 40°C in	dry
 The following Sikadur Injectokit-LV components are sold as separate items: 0.25 litre cartridges Injection nipples Sikadur Injectokit-LV hoses Air release pins 				
Lisabla Lifa	10°C	20°C	30°C	40°C
(minutes)	100	50	25	15
Viscosity (mPas)	400-800	250-500	100-250	-
Set time (hours)	12	7	5	3
>70 N/mm ² (BS	6319) (/	After 7 days curing a	t 20°C)	
	, ,			
	, , ,	After 7 days curing a	t 20°C)	
Approx. 2,800 N	N/mm ²			
2.5%				
When tested to BS3900 Pt E10 in both dry and wet states is greater than normal concrete.				
 The surface sealant needs to retain the injection system under pressure. Care must be taken to provide a bond surface which is clean, dry, sound and free from contamination by oil or grease. 				
 The surface Care must 	be taken to provide a	a bond surface which		
	injection resin of hoses, and air r injection system For injecting cra a structure or e viscosity, crack internally down used for insitu of Convenien hardener. Safe and c High streng wet or dry. Modular na Low viscosity tw Shelf life 12 mo conditions. The following 0.25 litre ca Injection ni Sikadur Inj Air release Usable Life (minutes) Viscosity (mPas) Set time (hours) >70 N/mm ² (ISC Approx. 2,800 N 2.5% When tested to concrete.	injection resin contained in a patente hoses, and air release pins. The kit i injection system is required. For injecting cracks in concrete and a structure or exclude water and air viscosity, cracks down to 0.2 mm at internally down to 0.01 mm can be fi used for insitu or precast concrete e • Convenient to use, disposable s hardener. • Safe and clean to use, non retu • High strength, excellent bond to wet or dry. • Modular nature, effective and e Low viscosity two part crack injection Shelf life 12 months when stored in conditions. The following Sikadur Injectokit-L • 0.25 litre cartridges • Injection nipples • Sikadur Injectokit-LV hoses • Air release pins	injection resin contained in a patented single cartridge, c hoses, and air release pins. The kit is designed for those injection system is required. For injecting cracks in concrete and masonry wherever the a structure or exclude water and air from contact with rei- viscosity, cracks down to 0.2 mm at the surface can be fi- internally down to 0.01 mm can be filled. Ideal for small s used for insitu or precast concrete elements. Convenient to use, disposable single cartridge conta- hardener. Safe and clean to use, non return valves avoid leaka High strength, excellent bond to concrete, brickwork wet or dry. Modular nature, effective and economical use even Low viscosity two part crack injection resin Shelf life 12 months when stored in original containers at conditions. The following Sikadur Injectokit-LV components are 0.25 litre cartridges Injection nipples Sikadur Injectokit-LV hoses Air release pins Cusable Life 100 50 Viscosity 400-800 250-500 Set time 12 7 >70 N/mm ² (ISO R178) (After 7 days curing ai >45 N/mm ² (ISO S27) (After 7 days curing ai >55 N/mm ² (ISO S27) (After 7 days curing ai 	injection resin contained in a patented single cartridge, complete with injectoses, and air release pins. The kit is designed for those contracts where injection system is required. For injecting cracks in concrete and masonry wherever there is a need to a structure or exclude water and air from contact with reinforcement. Duviscosity, cracks down to 0.2 mm at the surface can be filled. Cracks tap internally down to 0.01 mm can be filled. Ideal for small scale repairs on sused for insitu or precast concrete elements. • Convenient to use, disposable single cartridge contains both resin a hardener. • Safe and clean to use, non return valves avoid leakage and spills. • High strength, excellent bond to concrete, brickwork and masonry, ewet or dry. • Modular nature, effective and economical use even for the smallest Low viscosity two part crack injection resin Shelf life 12 months when stored in original containers at 10°C – 40°C in conditions. The following Sikadur Injectokit-LV components are sold as separat • 0.25 litre cartridges • Injection ripples • Sikadur Injectokit-LV hoses • Air release pins $\frac{10^{\circ}C}{Viscosity}}$ 400-800 250-500 100-250 Set time 12 7 5 >70 N/mm ² (BS6319) (After 7 days curing at 20°C) >45 N/mm ² (ISO R178) (After 7 days curing at 20°C) >55 N/mm ² (ISO R178) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55 N/mm ² (ISO S27) (After 7 days curing at 20°C) >55

	 Nipples should be placed between 200 mm and 500 mm apart dependent on crack size. Additional sealant should be applied onto the flange of the nipple to ensure a resin tight seal to the substrate. Surface sealant should be knifed into the crack between nipples to ensure a resin tight seal. Continue the sealant 50 mm beyond the end of the line of the visible crack.
	 Application of the injection system may be commenced as soon as the surface sealant has fully hardened (5 Minute Epoxy: 5 minutes at 20°C)
Injection of the Sikadur Injectokit-LV	
epoxy resin	 Hit the side of the capsule near the base with a hammer 2 or 3 times on different sides to break the internal glass container of hardener. (The glass can be heard moving when broken.) To mix the resin, invert the cartridge 20-30 times slowly. Do not shake vigorously otherwise air will be incorporated.
	 Use the mixed material within the usable life.
	 Pierce the foil seal in the threaded end of the cartridge.
	 Screw the Sikadur Injectokit-LV hose onto the cartridge. Ensure that the rubber 'Q' ring is in place on the cartridge.
	 Ensure that the rubber 'O' ring is in place on the cartridge. Do not over tighten the fitting as this may distort the 'O' ring.
	 Place the cartridge into a standard gun.
	 Push the free end of the Sikadur Injectokit-LV hose onto the first (lowest) nipple and tighten down the locking cap. Do not ever tighten
	Do not over tighten.Insert an air release pin into the next nipple above the injection point.
	 Note: Do not start pumping until the air release pin is inserted to open the non return valve and release trapped air.
	 Commence pumping slowly, do not use excessive pressure.
	 The rate of acceptance on fine cracks may be very slow. When resin appears at the nipple next to the injection point: (a) stop pumping
	 (b) release the pressure on the injection gun (c) remove the air release pin (d) unscrew the cap and with a twisting movement pull off the Sikadur Injectokit-LV hose.
	 Attach the Sikadur Injectokit-LV hose to the next nipple.
	 Insert air release pin in nipple beyond and recommence pumping. Repeat the process until the entire length of crack has been injected. On completion of pumping, the last cartridge can be left connected and pressurised slightly to allow for possible seepage into deep seated cracks.
Making good	After the Sikadur Injectokit-LV injection resin has set, remove the nipples.
	 These can be knocked off with a hammer. Make good any holes or voids with the selected surface sealant.
	 The existing surface sealant can then be removed by either grinding or heating with a hot air gun and scraping the surface until the original substrate profile is restored.
Cleaning	Tools and application equipment should be cleaned using Sika Colma Cleaner.
Important Notes	
Limitations	 Sikadur Injectokit-LV should only be used for cracks where access to all sides f sealing is available. In other cases Sikadur Injectokit-TH (thixotropic - see separate data sheet)
	 In other cases Sikadur Injectokit-TH (thixotropic - see separate data sheet) should be used. Sikadur Injectokit-LV should not be used for cracks where movement is expected.
100	 to continue. Sikadur Injectokit-LV is recommended for use only as described in the Uses section of this datasheet.

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Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.		
Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.		
Health & Safety Ins	structions		
Protective Measures	 To avoid rare allergic reactions, we recommend the use of protective gloves. Change soiled work clothes and wash hands before breaks and after finishing work. Local regulations as well as health and safety advice on packaging labels must be observed. For further information refer to the Sika Material Safety Data Sheet which is available on request. If in doubt always follow the directions given on the pack or label. 		
Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet. 		
Legal Notes	The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.		





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Sikadur[®] Injectokit-TH Pre-packaged thixotropic epoxy crack injection system

Positioning Description	The Sikadur Injectokit-TH system consists of a thixotropic two part epoxy crack injection resin contained in a patented single cartridge, complete with injection nipples, hoses, air release pins, and stirring rods. The kit is designed for those contracts where a complete injection system is required.				
Use	For injecting cracks in concrete and masonry wherever there is a need to consolidate a structure or exclude water and air from contact with reinforcement. Due to its thixotropic nature it can be injected into open ended cracks where depth and quantity of resin need to be controlled. Crack widths from 0.2 - 2 mm can be filled. Ideal for small scale repairs on site. Can be used for insitu or precast concrete elements.				
Advantages	 Convenient to use, disposable single cartridge contains both resin and hardener. Thixotropic, can be injected into fine cracks where access to all sides for sealing is not available. High strength, excellent bond to concrete, brickwork and masonry, either wet or dry. Modular nature, effective and economical use even for the smallest repair. 				
Product Data	Thissterniature				
Form:	•	part crack injection			
Storage & Shelf life:	Shelf life 12 mc conditions.	Shelf life 12 months when stored in original containers at $10^{\circ}C - 40^{\circ}C$ in dry conditions.			dry
Packaging: Technical Data	 The following Sikadur Injectokit-TH components are sold as separate items: 0.25 litre cartridges Injection nipples Sikadur Injectokit-TH hoses Air release pins Stirring rods 				
r comincal Data		10°C	20°C	30°C	40°C
	Usable life (minutes)	100	50	25	15
	Viscosity (mPas)	400-800	250-500	100-250	-
	Set time (hours)	12	7	5	3
Compressive strength: Flexural strength: Tensile strength:	>70 N/mm² (BS 6319)(After 7 days curing at 20°C)>45 N/mm² (ISO R178)(After 7 days curing at 20°C)>55 N/mm² (ISO 527)(After 7 days curing at 20°C)				
Modulus of elasticity:	Approx. 2,800	N/mm ⁻			
Elongation at break: Tensile bond strength:	2.5% When tested to concrete.	BS3900 Pt E10 in b	ooth dry and wet stat	es is greater than	normal
Application Condition Surface preparation	The surfacCare must		etain the injection sy a bond surface whic / oil or grease.		



Surface sealant	 5 Minute Epoxy should be used where preparation and injection need to be completed in a short space of time.
	 Where it is desirable or acceptable to inject the crack at least 24 hours after preparation, Sikadur UA CONCRETE FIX can be used as a surface sealant.
Application of the	
surface sealant	 Immediately after mixing, apply a small amount of compound to the back of each nipple making sure that the valve will not be blocked and place the nipple over the crack.
	 The valve (centre) should be placed over the crack.
	Nipples should be placed between 200 mm and 500 mm apart dependent
	 on crack size. Additional sealant should be applied onto the flange of the nipple to ensure
	a resin tight seal to the substrate.Surface sealant should be knifed into the crack between nipples to ensure a
	resin tight seal.
	 Where cracks can be sealed on one side only, nipples should be placed at centres which are 80% of the depth to which the resin is required to pondrate
	 penetrate. Application of the injection system may be commenced as soon as the epoxy has fully hardened. (5 Minute Epoxy: 5 minutes at 20°C)
njection of the Sikadu	
epoxy resin	Cut the top off the conical nozzle.
· · · · · · · · · · · · · · · · · · ·	 Insert T-shaped rod and turn clockwise to engage stirring head in cartridge.
	 Push rod down the full length of the cartridge to break the membrane separating the resin and hardener.
	 Pump up and down 30 to 40 times to mix resin and hardener.
	 Turn the T-shaped rod anticlockwise to disengage and then remove.
	 Do not shake.
	 Unscrew the conical nozzle and discard.
	 Use the mixed material within the usable life.
	 Screw the Sikadur Injectokit-TH hose onto the cartridge.
	 Ensure the rubber 'O' ring is in place on the cartridge. Do not even tighten the litting on this may distant the 'O' ring.
	 Do not over tighten the fitting as this may distort the 'O' ring. Place cartridge into a standard gun.
	 Push the free end of the Sikadur Injectokit-TH hose onto the nipple positioned
	over the widest point of the crack and tighten down the locking cap.
	 Do not over tighten. Insert an air release pin into the nipple adjacent to the injection point.
	 Note: Do not start pumping until the air release pin is inserted to release the
	non return valve and release trapped air.
	 Commence pumping slowly, do not use excessive pressure.
	 The rate of acceptance on fine cracks may be very slow.
	When resin appears at the nipple next to the injection point:
	(a) Stop pumping.
	(b) Release the pressure on the injection gun.
	(c) Remove the air release pin. (d) Unscrew the cap and with a twisting movement pull off the Sikadur Injectoki TH hose.
	 Attach the Sikadur Injectokit-TH hose to the next nipple.
	 Insert air release pin in nipple beyond and recommence pumping.
	 Repeat the process until the entire length of crack has been injected.
	 On completion of pumping, the last cartridge can be left connected and pressurised slightly to allow for possible seepage into deep-seated cracks.
Making good	After Sikadur Injectokit-TH injection resin has set, remove the nipples.
	These can be knocked off with a hammer.
	 Fill any holes or voids with the selected surface sealant.
	 The existing surface sealant can then be removed by either grinding or heating with a hot air gun and scraping the surface until the original substrate profile is restored.



Important Notes Limitations	Sikadur Injectokit-TH should not be used for cracks where movement is expected to continue.
Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.
Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.
Health & Safety In	structions
Protective Measures	 To avoid rare allergic reactions, we recommend the use of protective gloves. Change soiled work clothes and wash hands before breaks and after finishing work. Local regulations as well as health and safety advice on packaging labels must be observed. For further information refer to the Sika Material Safety Data Sheet which is available on request. If in doubt always follow the directions given on the pack or label.
Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet.
Legal Notes	The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.



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Sikadur[®] 52 Low viscosity crack injection epoxy

qualities.

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B)

< 70°C 5°C to 30°C Negligible

7 davs

5°C

٠

75 mins.

14 MPa approx. 25 MPa approx.

3,500 MPa approx. Sandblasted Steel

Sandblasted Concrete

integrity of the element.

Shrinkage free hardening.

High early strength.

Type 1, Grade 1, Class B + C.

Solvent free epoxy resin liquid. Clear Straw colour when mixed.

24 hours = 35 MPa approx.

= 45 MPa approx.

10°C

60 mins.

together for at least 3 minutes.

=

between 5°C and 25°C.

Approx. 1.1 kg/litre

	Uses
S	Advantages
ž.	
	Tests Approvals / Standards
	Product Data
	Туре:
	Colours:
5	Packaging:
č.	Storage & Shelf Life:
5	Technical Data Density:
	Service temp:
	Application temp:
	Shrinkage:
	Compressive strength:
	(at 20°C)
	Flexural strength:
	Tensile strength:
	Elastic modulus:

Positioning Description

Bond strength: Pot life (1 Litre mix): (approx. time) Coverage rate:

Application Conditions Surface Preparation

on	٠	All concrete surfaces must be clean and free from any loosely adhering particles, or contaminants such as dirt, oil, dust, grease, etc.
	٠	All cement laitance should be removed by scabbling, sandblasting, etc.
	•	When Sikadur 52 is used for injection purposes the cracks must be blown out with oil free, dry compressed air. Crack widths between 0.2 mm and 5 mm may be successfully injected.

20°C

Approx. 3 to 5 m²/litre/coat on floors, depending on porosity.

proportioned pack, is observed and adhered to.

20 mins.

A solvent free, two component, low viscosity liquid based on high strength epoxy resins. After mixing it becomes a deeply penetrative liquid with strong adhesive

For injecting and filling cracks (0.2 to 5 mm wide) in precast and insitu concrete components to bond the sections together, thereby restoring the structural

Does not become brittle – retains a very slightly flexible nature.
 Tested in accordance with BS6319. Complies with ASTM C881-78,

Supplied in 0.9 litre (1.0kg), 2.78 litre (3kg), 7.43 litre (8kg) units (Component A +

Three (3) years in unopened, original containers when stored in dry conditions

15 MPa approx.

3.5 MPa approx.

Add the entire contents of Component B to Component A. Using a Sika

mixing paddle attached to a low speed electric drill (max. 500 rpm) mix

of the components, in accordance with the mix ratio of the factory

Part batching of Sikadur 52 is not recommended unless strict measurement

30°C

10 mins.

Highly flowable, penetrating and solvent free.

Chemical resistance typical of epoxy resins.

Excellent adhesion to most substrates. High mechanical and adhesive strength.

Mixing

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Application	 Basic guidelines for crack injection are as follows: Using Sikadur 31 epoxy adhesive, fasten Sika Injection Flanges over the cleaned and prepared cracks at 300 to 500 mm intervals. The remainder of crack is also sealed off with Sikadur 31. Once the Sikadur 31 has cured the flanges should be blown through in a continuous sequence with clean compressed air. After the Sikadur 52 has been mixed it can be loaded into a Sika bulk dispensing gun, adapted to take liquid epoxies. The Sikadur 52 should be injected (approx. 25 – 30 psi) into the first and lowest flange over the crack until epoxy starts oozing out of the flange immediately above. Seal off the lower flange and transfer the gun to the new flange above. Continue this sequence until all flanges have been injected and sealed. After Sikadur 52 has cured the flanges and Sikadur 31 can be ground from the surface of the crack using an angle grinder or similar. Allow 5 to 7 days curing for full structural integrity of the repair component to be achieved. Sika (NZ) Ltd can recommend approved applicators for this specialised work. 		
Cleaning	 Clean all tools and equipment immediately after use with Sika Colma Cleaner. It is recommended that protective gloves and clothing be worn during application, however, uncured Sikadur 52 may be removed from skin with Sikaflex Hand Cleaner or warm soapy water. Cured Sikadur 52 can only be removed mechanically. 		
Important Notes	 Crack injection work should be left for 5 to 7 days to fully cure before full structural integrity is achieved. Do not dilute Sikadur 52 with solvent. In cases where fine cracks occur it may be difficult to attain satisfactory injection of epoxy with hand operated equipment. We suggest a specialist applicator be used for this type of work. Sikadur 52 will not cure at temperatures below 5°C. The temperature at which Sikadur 52 is stored during the 24 hours before mixing will govern its pot life when mixed. 		
Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.		
Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.		
Safety Instructions Protective Measures	 To avoid rare allergic reactions, we recommend the use of protective gloves. Change soiled work clothes and wash hands before breaks and after finishing work. Local regulations as well as health and safety advice on packaging labels must be observed. For further information refer to the Sika Material Safety Data Sheet which is available on request. If in doubt always follow the directions given on the pack or label. 		
Transportation Class	Sikadur 52, Component B has a dangerous goods classification for transportation: Haz. Class 8, UN No. 1760, Haz. Chem. 2R, Packing Group III.		
Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet. 		
Legal Notes	The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request. Sika (NZ) Ltd PO Box 19192 Avondale Phone: 0800 SIKA NZ 0800 745 269 Auckland Fax: 0800 SIKA FAX 0800 745 269 Auckland Fax: 0800 SIKA FAX 0800 745 232 Www.sika.co.nz Sikadur [®] 52 2/2		

Sika[®] MonoTop[®] Primer (NZ) 1) Corrosion protection for steel reinforcement 2) Bonding slurry for concrete and mortar

Positioning Description	A cement based, polymer modified, one component coating material containing microsilica and corrosion inhibiting materials.		
Uses	 Sika MonoTop Primer provides two primary functions in the Sika MonoTop Repair Mortar System. As a corrosion inhibiting coating for reinforcement in concrete repair. As a bonding slurry onto concrete surfaces prior to the application of MonoTop Repair Mortars. 		
Advantages	 One product for two different applications. One component - just add water. Excellent adhesion to concrete and steel. High resistance to water and chloride ion penetration. Silica fume and polymer modified. Contains corrosion inhibitors. Good mechanical strength. Non toxic, easy and safe to use. Can be brush or spray applied - long pot life. Waterproof once dry - will not re-emulsify when re-wetted. 		
Product Data Form:	Light Grey powder		
Packaging:	Available in 4 kg plastic pails.		
Storage & Shelf Life:	Six (6) months in unopened original container when stored in cool, dry conditio below 25°C.		
Technical Data Density:	1.15 kg/litre - bulk density of powder 2.1 kg/litre - density of freshly mixed mortar		
Compressive strength: Flexural tensile strength: Adhesive tensile strength: Mixing ratio:	45 - 55 MPa at 28 days 5.5 - 7.5 MPa at 28 days : 3 MPa approx. on concrete Brush application Water : Powder		
	Approx. 210 mls : 1 kg Spray application Water : Powder Approx. 200 mls : 1 kg		
Pot life (at 20°C): Application temp: Material consumption:	Approx. 90 - 120 minutes Minimum 5°C – Maximum 30°C 1 x 4 kg unit = approx. 2.5 litres when mixed with water. <u>As a bonding slurry</u> - Approx. 0.9 - 1.2 litres/m ² depending on condition of substrate. <u>As an anti-corrosion coating on reinforcement</u> - Approx. 2 litres/m ² for 2 coats a		
Application Condition	1 mm dry film thickness per coat.		
Application Condition Surface Preparation	 Steel Reinforcement All reinforcement shall be clean, free from oil, grease, rust scale, pitting deposits and concrete. Optimum preparation = sandblasting to Sa 2.5. Minimum preparation = thorough scrubbing with a wire brush. Note: Preparation of steel will depend on the extent of corrosion damage present. 		
ka	 Concrete Substrate All concrete or mortar substrates must be sound, clean and free from oils, grease or surface contaminants. All loose or weak materials and surface laitance must be removed. Dry substrates should be thoroughly pre-wetted, and the surface allowed to dry (to achieve what is referred to as a 'saturated surface dry' condition) before the bonding slurry is applied. 		

Ī	Mixing	Pour a measured volume of clean fresh water into a suitable mixing vessel. While stirring slowly add the weighed amount of powder. Mechanically mix using a Sika mixing paddle attached to a low speed electric drill (max. 500 rpm), for a minimum of 3 minutes, and until a smooth, lump free consistency is achieved.
	Application	 <u>Reinforcement protection</u> Apply the first coat of approx. 1 mm thickness using a medium/hard brush, roller or suitable spray equipment to the cleaned and prepared steel reinforcement. After a waiting time of 4 - 5 hours (at 20°C) to allow for drying, apply a second coat of MonoTop Primer at the same thickness, ensuring an even and uniform coverage has been achieved. <u>Bonding slurry for concrete/mortar</u> Apply by brush, roller or suitable spray equipment to the prepared, prewetted ('saturated surface dry') surface. The slurry should be worked well into the substrate to ensure that the whole area has been fully coated to achieve maximum bond. Subsequent repair mortars must be applied while the bonding slurry is still wet/tacky.
	Important Notes	 Any steel reinforcement should be exposed and treated approx. 20mm beyond its corroded length. It may be necessary to cut and remove concrete from behind affected steel reinforcement to expose all corrosion. This should be done only after consultation with the project engineer. This procedure is also required if concrete is contaminated with chloride ions. The exposed reinforcement should be cleaned to Sa 2.5 before applying MonoTop Primer. Generally it is recognised that reinforcement corroded to less than 80% of its original dimension should be cut out and replaced. If in doubt always consult the structural engineer for the project. In some cases, when delays occur, it may be necessary to apply a second coat of MonoTop Primer bonding slurry to the concrete or mortar substrate to ensure a "wet on wet" application for the subsequent repair mortar. It is recommended that chemical based rust removers/passivators are not used for the removal of rust from steel reinforcement, prior to the application of Sika MonoTop Primer.
Ī	Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.
	Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.
	Safety Instructions Protective Measures	 To avoid rare allergic reactions, we recommend the use of protective gloves. Change soiled work clothes and wash hands before breaks and after finishing work. Local regulations as well as health and safety advice on packaging labels must be observed.
I	Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet.
4	Legal Notes	The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.
11	ka (Sika (NZ) Ltd PO Box 19 192 Avondale Auckland 1746 New Zealand Email: 0800 SIKA NZ Email: 0800 SIKA FAX info@nz.sika.com 0800 745 269 0800 745 232 www.sika.conz Sika [®] MonoTop [®] Primer (NZ) 2/2

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Sika[®] MonoTop[®] Structural Mortar (NZ) Fibre reinforced concrete repair mortar

Positioning Description	Sika MonoTop Structural Mortar is a one component, synthetic fibre reinforced, polymer modified cementitious repair mortar that contains reactive microsilica. Sika MonoTop Structural Mortar is part of the MonoTop System for concrete repair and protection.		
Uses	 Sika MonoTop Structural Mortar is used for repair and reinstatement work to concrete structures and components where high performance and durability properties are required. Typical applications are: Building facades. Column and beam repair. Concrete bridges. Marine structures. 		
Advantages	 One component, mix with water only. Excellent non-sag properties for vertical and overhead applications – can be applied in layers up to 30 mm thick overhead without the use of formwork. Excellent workability - can be wet sprayed, if required. Contains non-corroding synthetic fibre reinforcement. Good mechanical strength. Microsilica and polymer modified. Shrinkage compensated. Improved sulphate resistance. High resistance to water and chloride ion penetration. Non toxic, non-corrosive. 		
Product Data Form / Colour:	Light grey powder / Mid grey when applied.		
Storage & Shelf Life:	Six (6) months in unopened original packaging when stored in cool dry conditions below 25°C.		
Packaging:	25 kg multi-wall paper bags.		
Technical Data Density:	Approx. 1.85 kg/litre - wet density of freshly mixed mortar.		
Application temp:	Minimum 5°C to maximum 30°C.		
Compressive strength:	> 40MPa at 28 days (when mixed with 4.0 litres of water).		
Flexural strength:	7 MPa approx. at 28 days.		
Bond strength:	To concrete > 3 MPa (concrete failure).		
Elastic modulus:	27,000 MPa approx.		
Pot life:): 0.002 ml/m ² /sec - (satisfies low classification). 50 - 60 minutes at 20°C.		
Application	30 - 00 minutes at 20 0.		
thickness/layer:	Minimum 5 mm; Max. unsupported thickness in overhead application 30 mm		
Yield:	25 kg = approx. 15.7 litres when mixed with 4.0 litres of water.		
Mixing ratio by weight:	1 part water : 6.25 parts powder (approx.)		
Application Conditions	\$ •		
Surface Preparation	 Sika MonoTop Structural Mortar should be applied over a bonding slurry of Sika MonoTop Primer. Refer to the Sika MonoTop Primer technical data sheet for information on surface preparation and priming. All 'feathered' edges around the area to be repaired should be squared off with an angle grinder and chiselled down to a minimum depth of 10 mm. 		



Mixing	 For a hand applied mortar, pour 3.75 – 4.0 litres (maximum) of clean fresh water into a suitable mixing container and slowly add all of the powder while mixing continuously with a Sika Propeller Mixer attached to a slow speed (500 rpm) electric drill. Thoroughly mix until a smooth, lump free consistency is achieved. A minimum mixing time of 3 minutes is recommended. The water content can be reduced slightly to produce a stiffer mortar if desired.
Application	 While the bonding coat of Sika MonoTop Primer is still 'tacky', pack the mortar well into the cavity or repair. Use a placing rather than a rendering technique to fill all voids and ensure thorough compaction is achieved. Force the Sika MonoTop Structural Mortar against the edge of the repair and progressively work towards the centre. For overhead repairs in excess of 30mm thick and vertical repairs in excess of 40mm thick apply in layers. If more than one layer is required score the first layer and allow to harden. Dampen the surface before applying subsequent layer. If more than 48 hours lapses the first layer will need to be re-primed with Sika MonoTop Primer. Steel trowel the final layer, if required, to achieve a smooth, tight finish.
Cleaning	 Clean all tools and equipment with water immediately after use. Hardened Sika MonoTop Structural Mortar can only be removed mechanically.
Important Notes	 Only apply Sika MonoTop Structural Mortar to sound substrates that have been dampened and primed with Sika MonoTop Primer. Sika MonoTop Fairing Coat can be used to provide a very fine fairing/ levelling coat over the whole surface, if required, after repair work has been completely undertaken. As with all concrete and mortars, it is essential to protect Sika MonoTop Structural Mortar from water evaporation during the crucial early age curing period, with water spray, wet hessian or polythene sheets. If no further coatings are to be applied to the finished surface, a membrane curing compound may be used. Refer to Antisol data sheet for further information. High quality, long term repairs can only be achieved if they are carried out conscientiously by experienced applicators giving adequate detail to surface preparation, priming of concrete and steel, mixing of repair mortars, application and curing.
Notes	All technical data stated in this Product Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.
Local Restrictions	Please note that as a result of specific local regulations the performance of this product may vary from country to country. Please consult the local Product Data Sheet for the exact description of the application fields.
Safety Instructions Protective Measures	 To avoid rare allergic reactions, we recommend the use of protective gloves. Change soiled work clothes and wash hands before breaks and after finishing work. Local regulations as well as health and safety advice on packaging labels must be observed. If in doubt always follow the directions given on the pack or label.
Important Notes	 Residues of material must be removed according to local regulations. Fully cured material can be disposed of as household waste under agreement with the responsible local authorities. Detailed health and safety information as well as detailed precautionary measures e.g. physical, toxicological and ecological data can be obtained from the safety data sheet.
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	Application Cleaning Important Notes Notes Local Restrictions Protective Measures Important Notes

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