

Masterton District Council
425 Queen Street
PO Box 444
Masterton 5840

Attention: Peter Whisker

Dear Peter,

Geotechnical Seismic Assessment - Site Investigation Masterton Municipal Building & Town Hall

Introduction

Tonkin & Taylor Ltd (T+T) was engaged by Masterton District Council (MDC) to provide a geotechnical seismic assessment and investigation of the Masterton Municipal Building and Town, 64 Chapel Street, Masterton. T+T have carried out this work in accordance with our letter of engagement, dated 30 January 2017.

This letter report supplements our desktop geotechnical seismic assessment¹, completed in March 2017. The purpose of this letter is to:

- Present factual data collected during our site specific investigation
- Reduce the uncertainty of ground conditions assumed in our previous desktop assessment
- Update the register of geotechnical project risks presented in our desktop report
- Further assist Masterton District Council to select a redevelopment scheme, and develop design in the next project stages.

¹ Tonkin & Taylor Ltd, 27 March 2017, *Desktop Geotechnical Seismic Assessment, Masterton Municipal Building & Town Hall*. Job ref: 1001891.

Resource consent and heritage approval

Prior to starting investigation on site, T+T sought advice and approval from the relevant authorities to carry out geotechnical drilling work on the site. A summary is provided below:

Consent / authority	Comments
Resource consent	Greater Wellington Regional Council confirmed that our proposed investigation was considered a <i>permitted activity</i> provided it complied with Rule 146 of their proposed Natural Resources Regional Plan.
Heritage authority	Archive evidence of pre-1900 human development on the site. Heritage New Zealand, written approval was given to drill one borehole on the site.
District council consent	Wairarapa Combined District Plan lists 64 Chapel Street as a heritage site (ref: Hm55). Masterton District Council confirmed no consent required to carry out the proposed geotechnical drilling.

Future investigations or work on the site may require resource consent or heritage approvals.

Site Investigations

Geotechnical investigations were carried out at the project site on 20 and 21 March 2017. The investigations comprised:

- One machine borehole (BH-TT1) including standard penetration tests (SPTs)
- Installation of a standpipe piezometer

The borehole location was selected by T+T to further develop the understanding of geological conditions at the site, with consideration to access and buried services constraints. The location of the borehole is shown in Figure A1, Appendix A.

The borehole was drilled by Griffiths Drilling Ltd under full time supervision of a T+T engineering geologist. The recovered drill core was photographed and logged in accordance with the NZGS 'Field Descriptions of Soil and Rock' guidelines². A geotechnical log of the borehole, and core photographs are presented in Appendix B.

Ground profile

Our desktop study identified that the site was underlain by alluvial deposits comprising gravel, sand, silt and clay. Previous investigations (by others) indicated the north-eastern end of the site was underlain by a thin layer (approximate 1 m thick) of silt followed by very dense granular soil to at least 3.45m below ground.

Our recent investigation identified very similar conditions at the south-western end of the site. In general the soil conditions identified in BH-TT1 can be summarised as follows:

Depth (metres below ground level)	Soil conditions
0.0 to 0.5m	Pavement and granular fill
0.5 to 10.5m	Dominantly gravel and cobbles with a variable matrix of sand, silt and clay. Very dense.
10.5 to 12.45m	Sand and silt, with minor gravel. Medium dense / very stiff.

² *Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes*, New Zealand Geotechnical Society, December 2005.

A standpipe piezometer was installed in the borehole following completion of drilling. No water level readings were possible during our time on site (groundwater in the borehole had insufficient time to equalise with adjacent ground). As-built details are provided on the log in Appendix B.

Re-evaluation of geotechnical issues / risks

The desktop geotechnical seismic assessment presented a number of potential geotechnical risks associated with strengthening the existing buildings or redevelopment of the site. The table of geotechnical issues from our desktop report is included in Appendix C for reference.

Based on the data from BH-TT1, we do not propose any changes to this geotechnical issues register. Some additional comments are provided below.

Geotechnical risk	Comments based on BH-TT1 data
Liquefaction	<p>Conclusions of desktop report remain the same.</p> <p>The soils identified in the borehole are unlikely to be susceptible to liquefaction.</p> <p>There remains a risk of localised pockets of liquefaction and the impact should be considered in future design.</p>
Foundation capacity	<p>Assessed bearing capacity of shallow foundations remains unchanged. Localised weak soils may be encountered, however this could be addressed by subgrade inspection and undercutting as required.</p> <p>Assessed vertical capacity of anchors remains unchanged. If anchors are required, further investigation and design will be required.</p>

Summary and conclusions

The investigation data generally supports the assumptions we have made in our desktop assessment report. The conclusions stated in that report, and the suggestions for future stages of work remain unchanged. For clarity, the suggested future work is included again below:

- T+T to issue factual investigation data from site investigation (this letter)
- Project team to select preferred scheme for strengthening and / or rebuilding
- Structural and geotechnical engineer to inform the client of the required scope of works to develop the selected scheme. Depending on the chosen scheme, further geotechnical investigation and analysis may be required
- Structural and geotechnical engineer to proceed with the preliminary design stage.

Applicability

This report has been prepared for the exclusive use of our client Masterton District Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on limited borehole data. The nature and continuity of subsoil away from the borehole is inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:



.....
Michael Blakely
Engineering Geologist

.....
Chris Hillman
Project Director

Reviewed for Tonkin & Taylor Ltd by Ayoub Rimam (Senior Geotechnical Engineer).

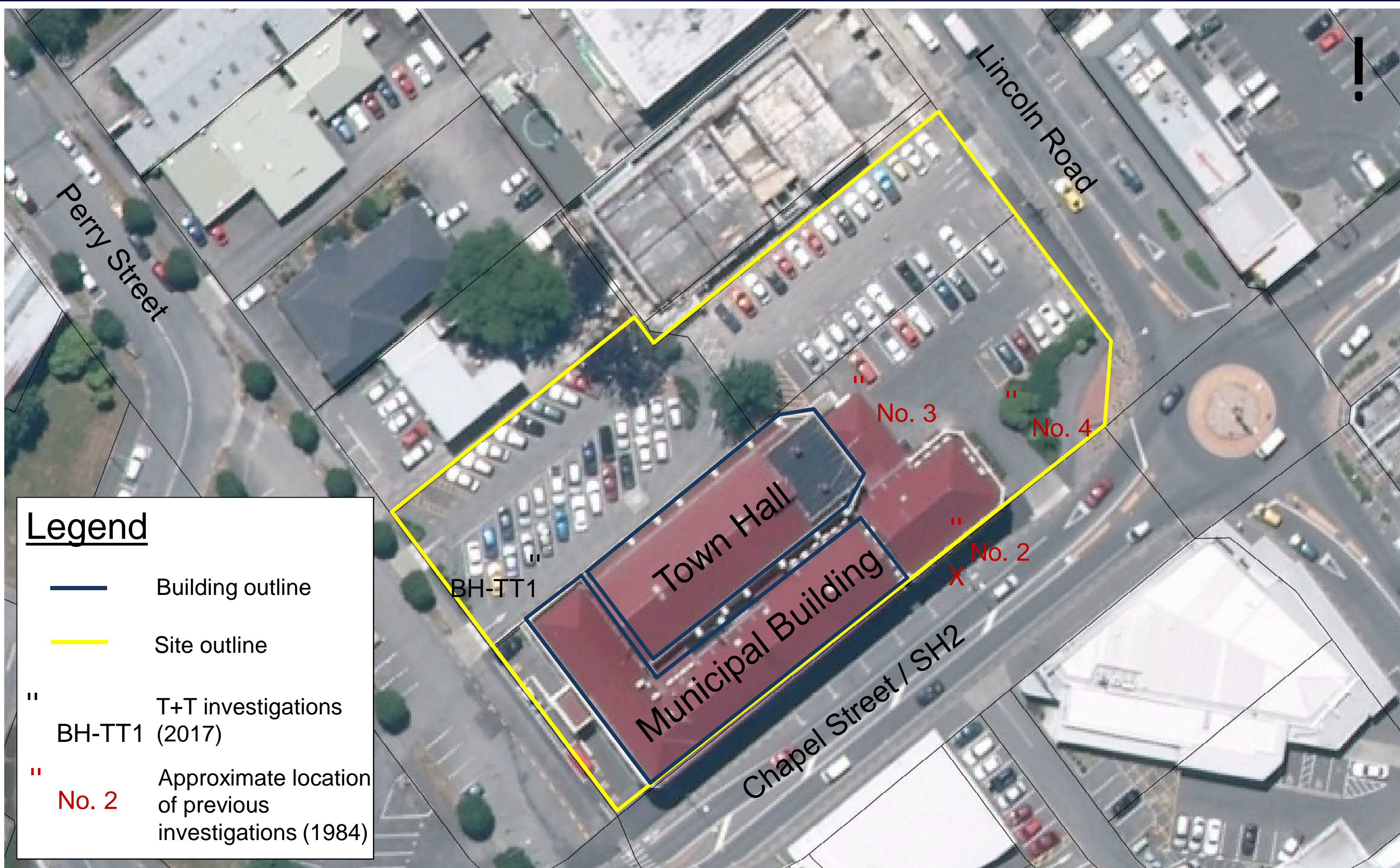
Attachments:

- Appendix A: Site plan
- Appendix B: Investigation data
- Appendix C: Geotechnical issues register

29-Mar-17
p:\1001891\issueddocuments\1001891_t+t investigations report.docx

Appendix A: Site plan

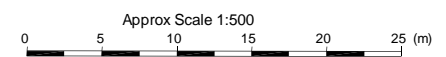
- Figure A1: Site plan
- Figure A2: Site photograph



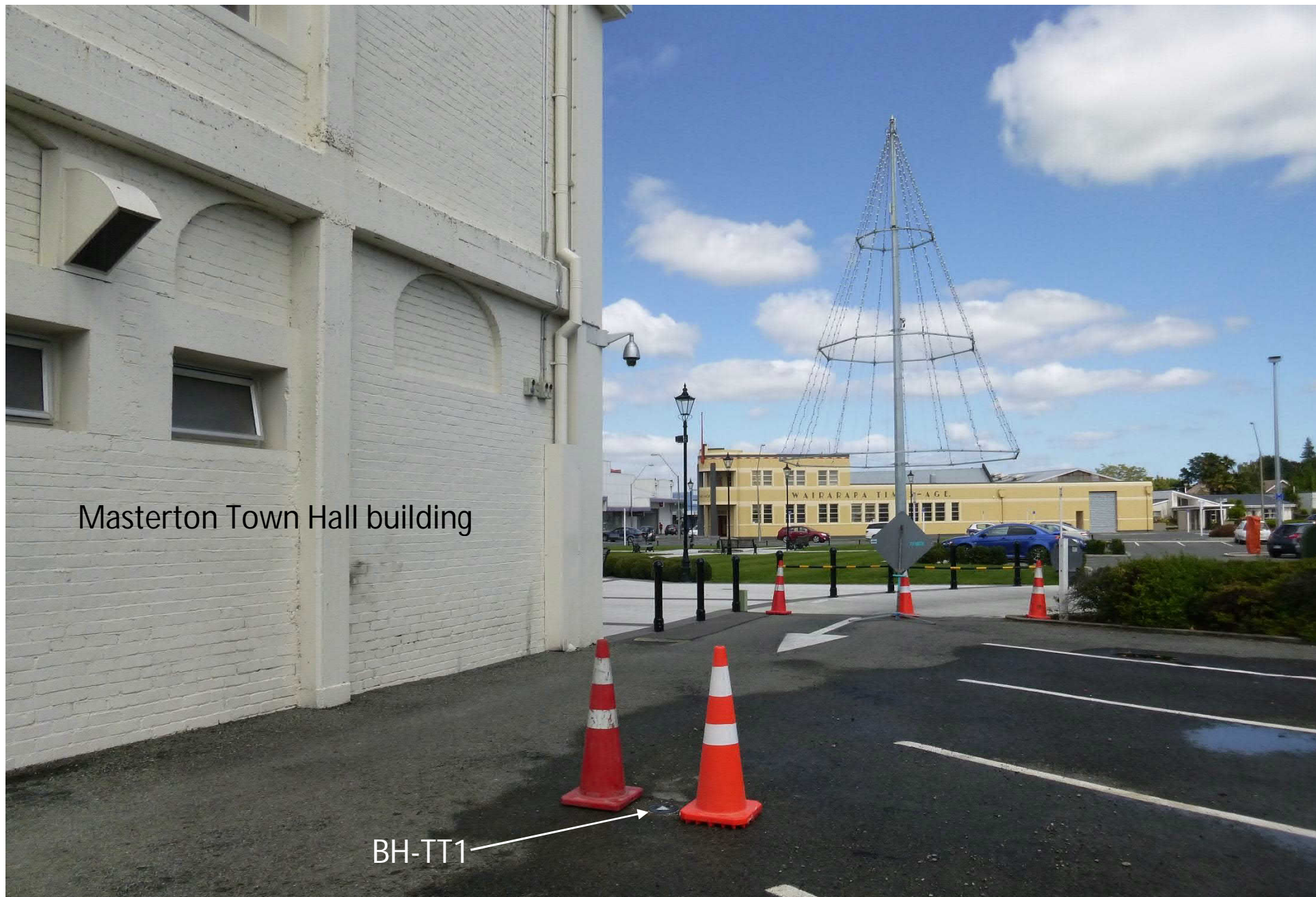
Legend

- Building outline
- Site outline
- " BH-TT1 T+T investigations (2017)
- " No. 2 Approximate location of previous investigations (1984)

Notes:
 1. Image sourced from Land Information New Zealand. Licenced under Creative Commons 3.0 NZ.



 Tonkin + Taylor Environmental & Engineering Consultants 2 Hunter Street, Wellington, New Zealand www.tonkintaylor.co.nz	DRAWN MJRB Mar 17 DRAFTING CHECKED AKR Mar 17 APPROVED CJHH Mar 17	MASTERTON DISTRICT COUNCIL Municipal Building and Town Hall Geotechnical seismic assessment Site investigation	FIG. No. Figure A1 REV. 0
	FILE : P:\1001891\WorkingMaterial APPROX. SCALE (AT A3 SIZE) 1:500		
	PROJECT No. 1001891		
	PROJECT No. 1001891		



Masterton Town Hall building

BH-TT1

Figure A2: Location of BH-TT1 relative to the Masterton Town Hall building. NB: BH-TT1 includes a standpipe piezometer, finished with a flush-mount toby cover.

Appendix B: Investigation data

- BH-TT1 borehole log
- BH-TT1 core photographs

PROJECT: MDC Town Hall & Municipal Building	LOCATION: 64 Chapel Street, Masterton	JOB No.: 1001891.0000
CO-ORDINATES: 5463479 mN (NZTM) 1823862 mE	DRILL TYPE: Fraste XL Sonic	HOLE STARTED: 20/03/2017
R.L.: 112m	DRILL METHOD: SNC	HOLE FINISHED: 21/03/2017
DATUM: ELLIPSOID	DRILL FLUID: WATER	DRILLED BY: Griffiths Drilling
		LOGGED BY: M Blakely CHECKED: N Peters





GEOLOGICAL		ENGINEERING DESCRIPTION													
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION		Description and Additional Observations													
FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)
NONE RECORDED	NONE RECORDED	0	VACUUM EXCAVATION	NONE REQUIRED						N/A	LP				
		80	SPT		7/16 21/27 2 for 15mm N>=50 No liner		111	1		W	L				
		100	HFS				110	2			VD				
		46	SPT		3/9 12/11 13/11 N=47 No liner		109	3			D				
		42	HFS				108	4		W					
		88	SPT		13/10 13/13 19 for 65mm N>=50 No liner		107	5		W	VD				
		100	HFS				106	6			M				
		100	SPT		9/18 24/26 for 75mm N>=50 No liner		105	7							
		82	SPT		5/15 24/24 for 65mm N>=50 No liner		104	8							
		100	HFS				103	9							
		87	SPT		5/15 15/15 15/5 for 35mm N>=50 No liner										

COMMENTS: Automatic SPT hammer used with 87.9% energy efficiency. 'No liner' refers to SPT sampler, sampling spoon capable of including liner but none used.

Hole Depth
12.45m

Scale 1:50

PROJECT: MDC Town Hall & Municipal Building	LOCATION: 64 Chapel Street, Masterton	JOB No.: 1001891.0000
CO-ORDINATES: 5463479 mN (NZTM) 1823862 mE	DRILL TYPE: Fraste XL Sonic	HOLE STARTED: 20/03/2017
R.L.: 112m	DRILL METHOD: SNC	HOLE FINISHED: 21/03/2017
DATUM: ELLIPSOID	DRILL FLUID: WATER	DRILLED BY: Griffiths Drilling
		LOGGED BY: M Blakely CHECKED: N Peters

GEOLOGICAL		ENGINEERING DESCRIPTION															
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION		FLUID LOSS (%)	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (cm)	Description and Additional Observations
Alluvial Deposits				100	HFS		2/4 4/6 5/8 N=23 No liner		101	11		M	MD				[CONT] 8.95m: changes to silty GRAVEL, as above (more silt observed)
				66	SPT												SAND, minor silt; blue-grey. Medium dense, moist.
				100	HFS												11.0m: trace medium gravel.
				100	SPT		2/1 3/4 6/5 N=18 No liner		100	12		W	LP				Fine to medium GRAVEL, some silt and coarse sand; blue-grey. Loosely packed, wet.
																	12.45m: END OF BOREHOLE
									99	13							Standpipe piezometer: - 32mm PN15 PVC pipe - Finished with flush mount cover (5mm allen key to access) Depths (below ground level): 0.00 - 1.75m: Concrete and gravel backfill 1.75 - 2.50m: Bentonite 2.50 - 5.00m: Pea metal (response zone) 3.00 - 5.00m: Slotted pipe screen with filter sock 5.00 - 5.50m: Bentonite 5.50 - 12.45m: Gravel backfill
									98	14							
									97	15							
									96	16							
									95	17							
									94	18							
									93	19							

COMMENTS: Automatic SPT hammer used with 87.9% energy efficiency. 'No liner' refers to SPT sampler; sampling spoon capable of including liner but none used.

Hole Depth
12.45m
Scale 1:50

BH-TT1 core photographs



Photograph 1: Core box 1 of 5 - 0.0 to 5.0m depth



Photograph 2: Core box 2 of 5 - 5.0 to 7.2m depth



Photograph 3: Core box 3 of 5 – 7.2 to 9.64m depth



Photograph 4: Core box 4 of 5 – 9.64 to 11.4m depth



Photograph 5: Core box 5 of 5 – 11.4 to 12.45m depth

Appendix C: Geotechnical issues register

Table 4.1: Geotechnical issues identified (*reproduced for reference from T+T desktop geotechnical seismic assessment report*³).

Issue	Comments	Control
Liquefaction	Site wide liquefaction not expected. Localised pockets of liquefaction cannot be discounted. The ultimate bearing capacity of shallow footings is not expected to be compromised by liquefaction. Liquefaction induced settlement of up to 50mm cannot be discounted. Lateral spread is unlikely. Cyclic displacement is unlikely.	Refer Note 1. Foundation to be designed to accommodate up to 50mm of differential settlement.
Weak soil layers at founding depth (within Lower alluvium)	Possible as localised pockets.	Inspect subgrade during construction and undercut as required.
Limited uplift / compression capacity of shallow foundations	Current scheme does not require uplift resistance. Compression capacity preliminary design parameters are provided in Section 5.1	Refer Note 1. Consider at preliminary design once scheme chosen. Anchors could be installed if required.
Limited lateral capacity for base shear resistance of shallow foundations	Passive resistance and base friction preliminary design parameters are provided in Section 5.2	Refer Note 1. Consider at preliminary design once scheme chosen.
Groundwater	If shallower than 2m below surface there will be a reduced bearing capacity for shallow foundations.	Refer Note 1. Monitor groundwater (standpipe piezometer installed during T+T investigation).
Fault rupture	Not expected. Masterton Fault is mapped to either side of Masterton township. The location, recurrence interval and event magnitude is uncertain. It is possible, but unlikely, that the fault trace passes through the site. Other known faults are distant from the site.	Very low risk. Further investigation not considered necessary.
Notes:		
1. Site specific investigation is currently being carried out by T+T to reduce uncertainty of soil conditions and support these assessment conclusions. Preliminary assessment of the investigation data generally supports our conclusions to date.		

³ Tonkin & Taylor Ltd, 27 March 2017, *Desktop Geotechnical Seismic Assessment, Masterton Municipal Building & Town Hall*. Job ref: 1001891.