
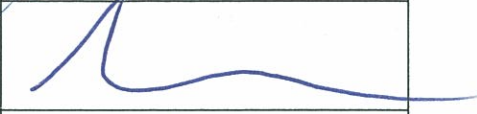





**WATERVIEW RING ROUTE – WATERVIEW CONNECTION**

**GROUNDWATER AND GROUND SETTLEMENT CAUCUSING 26 January 2011, Facilitated by Murray Wallis, ERM NZ Ltd**

**Agreed Statement, 02 February 2011**

Expert's Name and Initials	Affiliation	Agreement with this statement
Ann Williams (AW)	Beca Infrastructure Ltd	
Gavin Alexander (GA)	Beca Infrastructure Ltd	
Aidan Nelson (AN)	Earthtech Consulting Ltd	
Philip Kelsey (PK)	Earthtech Consulting Ltd	
Andrew Stiles (AS) <sup>1</sup>	Tonkin & Taylor Ltd	

**GROUNDWATER**

Issue	Agreement	Disagreement	Experts
1. Groundwater Modelling - General	<ul style="list-style-type: none"> <li>a. Scope of investigations</li> <li>b. Geological model with 7 hydrogeological units</li> <li>c. Groundwater monitoring network is sufficient for the understanding and assessment of project effects</li> <li>d. Hydrogeological parameters</li> <li>e. The overall groundwater modelling approach</li> </ul>		All
2. Groundwater Modelling – Avondale Heights	<ul style="list-style-type: none"> <li>a. Water level data has been interpreted by Beca and Earthtech in different ways; the Earthtech interpretation could result in greater settlement effects in the vicinity of Avondale Heights.</li> </ul>	Description of the perched and regional groundwater tables in the	AW, GA, AN, PK

<sup>1</sup> Andrew Stiles was engaged by the Auckland Council to advise on the potential effects of the proposed Waterview Connection project on the integrity of the previously landfilled materials below the Council owned Phyllis Street, Harbutt and Alan Wood Reserves. His brief did not extend to the review of groundwater or ground settlement issues elsewhere along the proposed alignment and his stated agreement or disagreement to the Issues listed above, and the Proposed Groundwater and Ground Settlement Conditions, therefore relates solely to groundwater and ground settlement effects on those three Council Reserves. In addition Groundwater Issue Nos. 2, 3 and 5, and proposed Groundwater Condition G.13, were outside the scope of Andrew Stiles' brief and it is therefore not applicable for him to sign-off those items. Similarly, Ground Settlement Issue Nos. 3, 5, 6, parts of Issue Nos 1, 2, 7 identified by (Andrew Stiles N/A) and the proposed Ground Settlement Conditions S.10 and S.11 were outside the scope of Andrew Stiles' brief and it is therefore not applicable for him to sign-off those items.

	b. Provided the extent and magnitude of settlement does not exceed that identified in Figure E14 (updated figure attached to the rebuttal evidence of Gavin Alexander), then the difference in interpretation is of little consequence	Waitemata Group in the vicinity of Avondale Heights.	
3. Groundwater users	The potential effects on existing wells are less than minor		AW, GA, AN, PK
4. Whether groundwater drawdown is or is not an effect in itself	a. The project will result in changes to groundwater levels b. The effects of these changes (potential for ground settlement, movement of contaminants, loss of base flow) have been adequately addressed		All
5. Specifying the volume of groundwater take for the purpose of long term aquifer management	a. It is useful to know the volume of groundwater abstracted from the tunnel for long term aquifer management, therefore the volume of water abstracted in the long term should be monitored. b. Part a. of the proposed Earthtech condition preceding G.1 <sup>2</sup> is not needed c. Part b. of the proposed Earthtech condition preceding G.1 <sup>1</sup> can be simplified to a single total volume of 750 m <sup>3</sup> /day (273,750 m <sup>3</sup> /annum) d. New Condition G.13 as attached.		AW, GA, AN, PK
6. Timing of submission of the GWMP, Condition G.1	Proposed revisions by Earthtech to Condition G.1 <sup>1</sup> , but submission of the GWMP to Auckland Council one month prior to commencement of construction dewatering is sufficient		All
7. That the NZTA shall design and construct the tunnels and approaches as described in the Geotechnical Interpretative Report	Provided figure E14 (attached to the rebuttal evidence of Gavin Alexander) forms part of the Ground Settlement Conditions of Consent, then the proposed clause G.10 <sup>1</sup> is not needed		All
8. Details of monitoring bores	a. Extend Condition G.1 to include the requirement for a schedule and plans showing existing and proposed bores and identifying indicative depths of piezometers and geological units b. Extend Condition G.1 to identify that all monitoring bores have a geological log and all standpipe piezometers are developed and have in-situ hydraulic conductivity		All

<sup>2</sup> Appendix C1 of the Earthtech s42A report

	tests carried out within them.		
9. Groundwater Management Plan	<ul style="list-style-type: none"> <li>a. Is appropriate</li> <li>b. Section 6.1.7, tables for shallow bores should state "Shallow bores are screened through fill and/or Tauranga Group Alluvium and/or weathered Parnell Grit and/or weathered East Coast Bays Fm"</li> <li>c. Alarm levels described in Section 6.1.7, tables 2 and 4 should be set within 2 weeks of the alert level being exceeded.</li> </ul>		All

A revised set of groundwater conditions as agreed in caucusing is attached.

**GROUND SETTLEMENT**

Issue	Agreement	Disagreement	Experts
1. Areas of general agreement	<ul style="list-style-type: none"> <li>a. The geological model, with the description of seven hydrogeological units, proposed by the NZTA is agreed.</li> <li>b. Best practice investigations, interpretation and analysis techniques have been used to assess potential settlements arising from construction of the Waterview Connection Project (SH20 sectors).</li> <li>c. Figure E14 provides a suitable basis for the assessment of settlement induced effects and provides certainty to all parties. Limited areas of building damage are predicted, and are indicated on Figures G1 to G4. (Andrew Stiles : N/A)</li> <li>d. Settlement predictions cannot be precise, so a comprehensive monitoring programme is proposed. This is designed to avoid adverse effects wherever possible and allow mitigation or remediation where damage is unavoidable. Mitigation measures are available to reduce any adverse effects.</li> <li>e. Adequate details are provided of the types of buildings and services within the predicted settlement zone. (Andrew Stiles : N/A)</li> </ul>		AW, GA, AN, PK, AS (part, as noted)
2. Slope stability – properties along Oakley Creek	<ul style="list-style-type: none"> <li>a. The experts agree that localized effects on stream bank stability from the Project will be minor or less than minor.</li> <li>b. The experts agree that the effects of settlement on the stability of the previously landfilled materials below the Council owned Phyllis Street, Harbutt and Alan Wood Reserves</li> </ul>		AW, GA, AN, PK, AS (part, as noted)

	<p>will be no more than minor</p> <p>c. The experts agree that there are likely to be parts of the slopes above Oakley Creek which are over-steep and potentially only marginally stable (or worse). Some of these slopes have houses or other structures built on or near them. The experts agree that effects of the project on these slopes (and in particular ground settlement and groundwater drawdown) need to be assessed, and can be mitigated.</p> <p>d. Many of the potentially affected properties are within the areas identified in Ground Settlement Condition S.7 as potentially being at risk, and will therefore be subject to pre- and post-construction condition assessments. Condition S.7 has been extended (S.7 (m)) to include additional properties on the Oakley Creek slopes on the western side of the alignment. Condition S.16 deals specifically with the slope stability issue, and has been extended to require specific assessment of stability for properties determined from the initial condition assessment as being susceptible to slope movement. Those properties will also receive more frequent monitoring throughout the active construction period. (Andrew Stiles : N/A)</p>		
<p>3. Effects on operational septic tanks (EMS s42A report para 10.10.103</p>	<p>a. Submitter 135, Stella Maris Trust, raises concerns about the effects of the project on a working septic tank on its property at 7 Bollard Avenue. This concern is repeated by EMS in its s42A report, with a recommendation that confirmation be sought that the combination of effects from tunneling and flooding will not have adverse effects on residential areas served by septic tanks.</p> <p>b. With reference to Figure E14, total ground settlement of 5-10mm is estimated at 7 Bollard Avenue, and the experts agree that the potential settlement effects on the septic tank at that site are less than minor.</p> <p>c. Ground Settlement Condition S.7 has been supplemented (S.7 (l)) to include operational septic tanks in areas where more than 50 mm settlement is estimated in the list of</p>		<p>GA, AN, PK</p>

	<p>potentially at risk structures.</p> <p>d. Potential flooding effects are addressed in the EIC of Tim Fisher (para 152), and the experts agree that they will be no more than minor.</p>		
4. Settlement	<p>a. The experts agree to adding reference to Figure E14 (extended to include settlements beyond the northernmost and southernmost cross sections) to Condition S.1, and that new Condition G10 proposed by Earthtech can be deleted.</p> <p>b. The experts agree to add reference to Figures G1-G4 to Condition S.7 to define limiting building damage categories.</p> <p>c. The experts agree to nominating alert and alarm levels for settlement monitoring at 75% and 100% respectively of the values indicated on Figure E14, subject to incorporation of seasonal effects. Condition S.2 has been updated accordingly.</p> <p>d. The experts agree that the effects of settlement on the previously landfilled materials below the Council owned Phyllis Street, Harbutt and Alan Wood Reserves will be no more than minor.</p>		AW, GA, AN, PK, AS
5. Pak n' Save Supermarket	<p>a. EMS, in para 10.9.35, identify the need to confirm there are appropriate conditions to address construction issues associated with the Pakn'Save supermarket on New North Road. Amended conditions have been developed in consultation with the owners of the supermarket, and have been incorporated in the agreed Ground Settlement Conditions attached to this statement.</p>		AW, GA, AN, PK
6. Differential Settlement	<p>a. Earthtech, in its s42A report and proposed edits to Condition S.2, recommended installing pairs of settlement markers either side of the alignment on the control sections used for settlement prediction and monitoring. These pairs of markers are intended to identify potentially damaging local differential ground movements that depart from the broader predictions of settlement. A similar aim is embodied in Condition S.11, which requires specific level and/or wall inclination surveys of particularly</p>		AW, GA, AN, PK

	<p>sensitive buildings during the active construction phase. The buildings identified in S.11 provide some of the site coverage that the Earthtech recommendation would achieve.</p> <p>b. Earthtech has suggested blanket trigger levels for differential settlement in its proposed edits to Condition S.4. These limits are independent of both the gradient of the settlement trough (as defined by Figure E14) and the assessed differential movements underpinning the Building Damage Categories (as defined by Figures G1-G4). As a result, the suggested trigger levels will not necessarily help with interpretation of movements against predictions and consent criteria. They will also trigger unnecessary alerts and alarms in places.</p> <p>c. A new settlement condition has been drafted (S.17 Differential Settlement) which meets Earthtech's aim of directly monitoring differential movement, but with trigger levels derived from settlement predictions and consent limits on building damage and an increased monitoring frequency during the period of active construction. Allowance is made for the specific building monitoring previously proposed (in S.11) to be used for this purpose. The experts agree that this condition is appropriate and reasonable.</p>		
7. Agreed Ground Settlement Conditions	a. The experts support the attached updated ground settlement conditions (S.10 and S.11 Andrew Stiles N/A)		AW, GA, AN, PK, AS (part, as noted)

## PROPOSED GROUNDWATER CONDITIONS

G.1	<p>The NZTA shall finalise, and implement through the CEMP, the Groundwater Management Plan (GWMP), submitted with this application <del>and provide it to the [Auckland Council]</del> prior to commencement of <u>construction dewatering</u>. The GWMP shall include, but not be limited to:</p> <ul style="list-style-type: none"> <li>(a) <u>A schedule of monitoring bores identifying piezometer depth and geological unit;</u></li> <li>(b) <u>The method of bore construction and piezometer installation (including testing carried out in piezometers);</u></li> <li>(c) <u>The location of the groundwater monitoring bores and monitoring cross-sections shown on plans;</u></li> <li>(d) The location of the continuous monitoring stations on Oakley Creek;</li> <li>(e) The methods and frequency for groundwater monitoring;</li> <li>(f) The groundwater trigger levels;</li> <li>(g) Procedures to follow in the event of trigger levels being exceeded;</li> <li>(h) Reporting requirements.</li> </ul> <p><u>The NZTA shall submit the GWMP to the Auckland Council one month prior to the commencement of construction dewatering for written approval of the Manager.</u></p>
G.2	<p>The NZTA shall install and maintain the groundwater monitoring boreholes shown in Appendix A of the GWMP, for the period of monitoring specified in this Consent.</p>
G.3	<p>The NZTA shall monitor groundwater levels in the groundwater monitoring boreholes shown in Appendix A of the GWMP and keep records of the water level measurement and corresponding date in accordance with the GWMP. These records shall be compiled and submitted to the Auckland Council at three monthly intervals.</p>
G.4	<p>The NZTA shall monitor groundwater levels monthly in existing boreholes and in newly installed monitoring boreholes shown in Appendix A of the GWMP (required as part of this consent, as far as practicable) for a period of at least 12 months before the commencement of tunnelling. The variability in groundwater levels over this period, together with the monitoring trends obtained during the investigation and detailed design phases, will be used to establish seasonal groundwater level variability and establish trigger levels.</p>

## PROPOSED GROUNDWATER CONDITIONS

G.5	<p>Prior to the commencement of tunnelling, and then at 3 monthly intervals while tunnelling, the NZTA shall review the results of monitoring as compared with expected effects on groundwater levels due to tunnelling. This review will consider the final tunnel alignment construction methodology and progress at the time of the review.</p> <p>The output of the first review shall be used to define the expected range of groundwater levels at each borehole during tunnelling activities and check the potential for damage to structures due to ground settlement. A factor for natural seasonal variability shall be allowed for in this review based on the monitoring completed under Condition G.4.</p>
G.6	<p>From commencement of tunnelling, the NZTA shall monitor groundwater levels in each borehole at a minimum of monthly intervals and records shall be kept of each monitoring date and the corresponding water level in each borehole. In addition, all boreholes located within 100 metres of the tunnel excavation face shall be monitored for groundwater level at least twice weekly. These records shall be compiled and submitted to the Auckland Council at three monthly intervals.</p>
G.7	<p><u>From commencement of tunnelling, the NZTA shall monitor groundwater level in boreholes established in the Phyllis Street Reserve. Should water levels rise more than 0.6 m above the highest recorded pre-construction water level in the period where tunnelling is taking place within 100 m of the Reserve, then an inspection of the surface of the landfill will be made and the surface re-levelled in areas where cracking of the cap or ponding of water on the surface is indicated (other than exists prior to commencement of the works).</u></p>
G.8	<p>All monitoring data obtained pursuant to Condition G.6 shall be compared to the predicted groundwater levels for each borehole. Where groundwater levels are exceeded the appropriate actions as set out in the GWMP shall be undertaken and the Auckland Council shall be notified, forthwith, advising of the exceedance, the risk of settlement that might cause damage to structures or adverse effects in Oakley Creek, and details of the actions undertaken.</p>



## PROPOSED GROUNDWATER CONDITIONS

G.9	<p>The NZTA shall continue to monitor groundwater levels in each borehole at monthly intervals for a period of up to 12 months following completion of tunnelling, then 3 monthly thereafter for a further 24 months, or for a lesser period if groundwater levels in any particular borehole show either:</p> <ul style="list-style-type: none"> <li>(a) Recovery of the groundwater level to within 2 metres of the pre-tunnelling groundwater level as recorded in accordance with Condition G.5; or,</li> <li>(b) A trend of increasing groundwater level in at least 3 consecutive monthly measurements; or,</li> <li>(c) An equilibrium in the groundwater level, allowing for the seasonal variation, has been reached,</li> </ul> <p>In which case monitoring at that borehole may cease, subject to the written approval of the Auckland Council.</p>
G.10	<p>The NZTA shall establish continuous flow monitoring stations at the following approximate locations within Oakley Creek:</p> <ul style="list-style-type: none"> <li>(a) Chainage <u>1800</u> – 1900 (Waterview Connection Operational Plan, Drawing No: 20.1.11-3-D-C-910-117);</li> <li>(b) Chainage <u>2200</u> (Waterview Connection Operational Plan, Drawing No: 20.1.11-3-D-C-910-116);</li> <li>(c) Chainage 3500 (Waterview Connection Operational Plan, Drawing No: 20.1.11-3-D-C-910-114);</li> <li>(d) Between Chainage 3900 to 4200 ((Waterview Connection Operational Plan, Drawing No: 20.1.11-3-D-C-910-113);</li> </ul> <p><u>The NZTA shall establish a continuous flow monitoring station at the upstream major tributary at Chainage 1000.</u></p> <p>The NZTA shall continue to monitor the flow monitoring station installed at CH2900 (Waterview Connection Operational Plan, Drawing No: 20.1.11-3-D-C-910-116).</p> <p>The exact location of the gauges shall be determined based on stream bed conditions such that they record the full range of flows <u>as far as practical</u>, with the locations detailed in the GWMP.</p>

## PROPOSED GROUNDWATER CONDITIONS

G.11	<p>The continuous monitoring required by Condition G.10, shall record in-stream flows, at 15 minute intervals, for a period of:</p> <p>(a) At least 12 months prior to tunnelling commencing;</p> <p>(b) During tunnelling; and</p> <p>(c) Up to 12 months following completion of tunnelling, or a shorter period if no effects on base flows are recorded.</p>
G.12	<p>The continuous monitoring results shall be reviewed on a monthly basis to determine if there is any effect of the tunnelling on base flows in Oakley Creek. The results shall be <a href="#">reviewed by a hydrologist and freshwater ecologist and</a> included in the 3 monthly groundwater reports, and provided to the Auckland Council.</p>
G.13	<p><b><u>Authorised Quantity: Following completion of excavation and construction, the daily quantity diverted and taken shall not exceed 750 m<sup>3</sup> and the annual quantity diverted and taken shall not exceed 273,750 m<sup>3</sup>.</u></b></p>
G.14	<p>The NZTA shall, within 10 working days of completion of tunnelling, advise the Manager Auckland Council, in writing, of the date of completion.</p>

**Proposed Ground Settlement Conditions – Expert Caucusing**

<p>S.1</p>	<p>The NZTA shall finalise, and implement through the CEMP, the Settlement Effects Management Plan (SEMP) lodged with the application prior to construction activities being undertaken. <del>and provide it to the [Auckland Council].</del> <u>Prior to construction (following detailed investigation and design), the total estimated settlements and building damage categories shall be confirmed using the methodology adopted in the preparation of Technical Report G.13 Assessment of Ground Settlement Effects and the SEMP shall be updated accordingly.</u></p> <p><u>In the event that settlement predictions are greater (than E14) or building damage categories increase in ranking or number of buildings (from G1–G4), mitigation measures shall be introduced as part of the detailed design and construction process to avoid any adverse effects greater than predicted by the Application lodged in August 2010.</u></p>
	<p>Settlement Monitoring</p>
<p>S.2</p>	<p>The NZTA shall establish a series of ground settlement monitoring markers to monitor potential settlement in relation to the construction of the tunnels. The survey markers will be located generally as follows:</p> <ul style="list-style-type: none"> <li>(a) Along the tunnel alignment and extending out to a maximum of 400m either side of the tunnels to correlate with cross sections that have been used for the settlement estimates <u>and to infill between them.</u></li> <li>(b) To cover the more extensive eastern zone area of settlement at Chainage 3400 (Figure E.14 in Technical Report G.13 <i>Assessment of Ground Settlement Effects</i>)</li> <li>(c) On or around buildings or features considered to be particularly sensitive as defined in the SEMP <u>(including those buildings identified in Condition S.7) and as may be updated to reflect detailed analysis and interpretation of monitoring results as the project proceeds.</u></li> </ul> <p>Two types of markers shall be established: Framework Markers which shall form the main basis of monitoring, and Intermediate Markers which shall provide additional monitoring information <u>for interpretation of Alerts and Alarms.</u> The locations of each type of settlement monitoring markers shall be confirmed in the SEMP. <u>Each Framework Marker shall have an alert and an alarm level set in relation to Figure E14, where alert = 75% of the theoretical value and alarm = 100% of the theoretical value with due consideration of the seasonal range of ground movement identified by pre-construction monitoring.</u></p>

**Proposed Ground Settlement Conditions – Expert Caucusing**

<p>S.3</p>	<p>The NZTA shall survey the settlement monitoring markers at the following frequency:</p> <ul style="list-style-type: none"> <li>(a) Pre-construction             <ul style="list-style-type: none"> <li>i) All Framework Markers – <del>Vertical and selected h</del>Horizontal <del>and-vertical</del> at 3 monthly intervals, starting at least 12 months prior to construction commencing; and</li> <li>ii) All Intermediate Markers – <del>Vertical and selected h</del>Horizontal <del>and-vertical</del> once.</li> </ul> </li> <li>(b) During Construction             <ul style="list-style-type: none"> <li>i) All Framework Markers – Vertical on a monthly basis; and</li> <li>ii) Selected Framework Markers only – Horizontal on a monthly basis.</li> </ul> </li> <li>(c) During Active Construction             <ul style="list-style-type: none"> <li>i) All Framework and Intermediate Markers – Vertical on a weekly basis; and</li> <li>ii) Selected Framework Markers only – Horizontal on a monthly basis.</li> </ul> </li> </ul> <p>“Active construction” shall be defined as:</p> <ul style="list-style-type: none"> <li>(a) Starting when the advancing tunnel face comes within 150m and ending when the final tunnel lining has been installed 150m beyond the section; and</li> <li>(b) When excavation in front of a retaining wall comes within 100m of a section and ending when the permanent wall supports are in place beyond a distance of 100m.</li> </ul>
<p>S.4</p>	<p><del>Immediately following</del><b>Within three days of</b> each monitoring round, the NZTA shall use the settlement monitoring results <del>(together with the results of groundwater monitoring where they may provide an earlier indication of future settlements)</del> to reassess the <del>ground settlements and</del> building damage categories and compare them to those estimated in <del>Figures E14 and G1-G4. Technical Report G.13 Assessment of Ground Settlement Effects, submitted with this application the</del> <b>SEMP.</b></p> <p><b><u>If alert and alarm levels are exceeded, the trigger marker shall be resurveyed within 24 hours.</u></b></p> <p>If the reassessment indicates that a building has increased its damage category from that in <del>Figures G1-G4 Technical Report G.13 Assessment of Ground Settlement Effects, the</del> <b>SEMP,</b> then this shall be considered to be an <del>Alarm-Alert</del> <b>Level</b> and additional specific assessment of the building shall be carried out by the NZTA to confirm this reassessment within 72 hours. If the additional assessment confirms the increase in damage category, this shall be considered to be an <del>Alert-Alarm</del> <b>Level</b> and the property owner and occupier will be notified within 48 hours. Following consultation with the property owner and occupier(s); subsequent actions may include increased frequency and/or extent of monitoring, modification to the construction approach or mitigation works to the affected building.</p>

**Proposed Ground Settlement Conditions – Expert Caucusing**

<p>S.5</p>	<p><u>Settlement monitoring shall be undertaken for a period of 2 years following completion of the tunnels.</u> The NZTA may reduce the frequency of settlement monitoring <u>required by Condition S.3</u> to 6 monthly:</p> <p>(a) Once the active construction stage has passed; and                  (b) Monthly monitoring has been undertaken for a minimum of 6 months; and                  (c) <u>The monitoring indicates that any potential settlement effects are within a satisfactory range as specified in the SEMP; and</u>                  (d) <u>The criteria in (a) to (c) above has been certified by the Auckland Council.</u></p> <p><del>Settlement monitoring shall be undertaken for a period of 2 years following completion of the tunnels.</del></p>
<p>S.6</p>	<p>The NZTA shall collate the results of the settlement monitoring (undertaken pursuant to Conditions S.2 – S.5) and prepare a report that shall be made available to the [Auckland Council]. A settlement monitoring report shall be prepared prior to the commencement of construction, and then at monthly intervals throughout the construction period. Following the completion of construction, a settlement monitoring report shall be prepared following each round of settlement monitoring undertaken (i.e. monthly and then 6 monthly when monitoring is reduced pursuant to Condition S.5).</p> <p><u>The settlement reports shall highlight any alert or alarm level exceedances and provide a full interpretation and/or explanation as to why these levels were exceeded, the likely effects and detail any remedial or mitigation measures initiated as a result of these trigger exceedances.</u></p>

## Proposed Ground Settlement Conditions – Expert Caucusing

	Building Condition Surveys
S.7	<p>The NZTA shall review and update the schedule of buildings and structures considered to be at risk in accordance with the criteria of the SEMP and maintain this for review by the Auckland Council. This shall include, but not be limited to, the following properties identified in the Technical Report G.13 <i>Assessment of Ground Settlement Effects</i> provided in support of this application:</p> <p>(a) Buildings on properties within the substrata designation;</p> <p>(b) Buildings where total estimated settlement is greater than 50mm <a href="#">(defined in Figure E14)</a>;</p> <p>(c) Buildings in areas estimated to have a risk of damage more than negligible <a href="#">(defined in Figures G1–G4 as categories 1 – 5)</a>;</p> <p>(d) Unitec Buildings 76, <a href="#">310–313</a>;</p> <p>(e) 1510 Great South Road, Unitec Residential Flats (two buildings);</p> <p>(f) Pak’n’Save Supermarket;</p> <p>(g) Metro Football Clubhouse, Phyllis Street;</p> <p>(h) Building at 1550 Great North Road;</p> <p>(i) BP Service station at 1380 Great North Road;</p> <p>(j) Modern Chairs Building (Richardson Road); <del>and</del></p> <p><a href="#">(k) Waterview Primary School;</a></p> <p><a href="#">(l) Operational septic tanks where total estimated settlement is greater than 50mm; and</a></p> <p><a href="#">(m) Buildings on the western side of the alignment between Chainage 3000 and 3400 where total estimated settlement is greater than 20mm.</a></p>
S.8	<p>The NZTA shall consult with owners of buildings and structures identified in Condition <a href="#">S.67</a> and, subject to the owner’s approval of terms acceptable to the NZTA, shall undertake a pre-construction condition assessment of these structures in accordance with the SEMP.</p>
S.9	<p>The NZTA shall employ a suitably qualified person <a href="#">(e.g. a Chartered Professional Engineer)</a> to undertake the building assessments required pursuant to Conditions <a href="#">S.7–S.8 and S.12</a> and identify this person in the SEMP.</p>

## Proposed Ground Settlement Conditions – Expert Caucusing

S.10	<p>The NZTA shall undertake monthly visual inspections of the following buildings during the “active construction” phase of the Project as defined in Condition S.3:</p> <ul style="list-style-type: none"> <li>(a) All Type 1 Dwellings within a zone where “more than negligible” effects have been predicted;</li> <li>(b) All Type 2 Dwellings within a zone where “slight” effects or greater have been predicted</li> <li>(c) Unitec Building 76;</li> <li>(d) 1510 Great North Road, Unitec Residential Flats (two buildings);</li> <li>(e) Pak’n’ Save supermarket; <u>and</u></li> <li>(f) <u>Waterview Primary School (pool and hall).</u></li> </ul> <p>Note: Type 1 and 2 Dwellings are those as defined in Technical Report G.13 <i>Assessment of Ground Settlement Effects</i>.</p>
S.11	<p>The NZTA shall undertake level and/or wall inclination surveys on a monthly basis during the “active construction” phase of the Project on the following buildings:</p> <ul style="list-style-type: none"> <li>(a) All Type 1 Dwellings within a zone where “slight” effects or greater have been predicted;</li> <li>(b) Unitec Building 76; <del>and</del></li> <li>(c) 1510 Great North Road, Unitec Residential Flats (two buildings); <del>and</del></li> <li>(d) <u>Waterview Primary School (pool); and</u></li> <li>(e) <u>Pak’n’Save Supermarket.</u></li> </ul>
S.12	<p>The NZTA shall, subject to the owner(s) approval, ensure that within 6 months of completion of construction activities a post-construction condition assessment covering the matters identified in the SEMP is undertaken <u>and shall be provided to the owner(s)</u>. The assessment report shall include a determination of the cause of damage identified (if any) since the pre-construction condition assessments. <u>The NZTA shall agree with the owner(s) appropriate remedial works (if any) in conjunction with and arrangements for implementation and/or compensation implementing them with the owner.</u> The requirements of this condition need not be fulfilled for any particular building <u>with the written approval of the current owner of a building or</u> where the NZTA can provide reasonable evidence to the Auckland Council that the current owner of that building has agreed they do not require such a survey.</p>

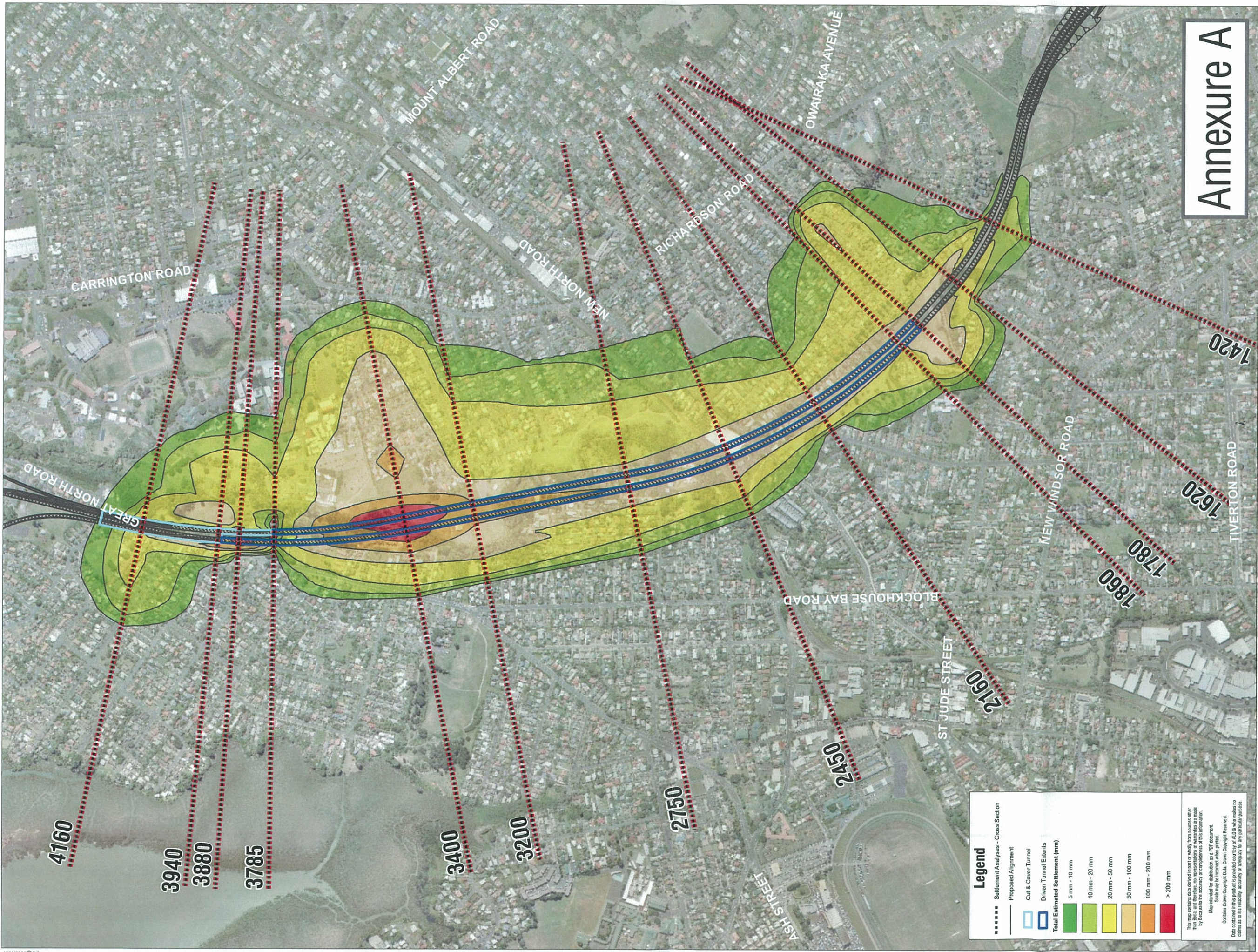
### Proposed Ground Settlement Conditions – Expert Caucusing

S.13	<p>The NZTA shall ensure that a copy of the pre, post-construction and any additional building condition assessment reports for each building be forwarded to the respective property owner(s) within 15 working days of completing the reports. The NZTA shall notify the Auckland Council that the assessments have been completed. <u>The construction liaison person appointed in Pl.1 shall be the contact person for owner(s) subject to assessment and reporting under these conditions and remedial works or compensation payments under Condition S.12.</u></p>
	<p><b>Retaining Wall Monitoring</b></p>
S.14	<p>The NZTA shall establish inclinometer and surface monitoring of the retaining walls for the tunnel portals and cut and cover tunnel to determine any potential effect from the tunnels. The nature and timing of the monitoring shall be determined during detailed design of the retaining walls and specified in the SEMP.</p>
	<p><b>Services Monitoring</b></p>
S.15	<p>Prior to construction commencing, the NZTA shall undertake CCTV surveys of services identified in the SEMP as being susceptible to damage or particularly critical. This shall include, but not be limited to:</p> <p>(a) Waterview Orakei No. 9 trunk sewer.</p> <p>The NZTA shall <u>monitor these services by undertaking</u> <del>undertake</del> additional CCTV surveys throughout the construction period, <del>to ensure that there has been no significant damage to these services, and undertake</del> <u>If any damage is determined in relation to the Project, the NZTA shall undertake any</u> remedial action as required in consultation with the service provider.</p>



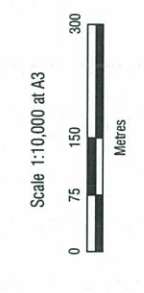
Proposed Ground Settlement Conditions – Expert Caucusing

	<p><u>Slope Stability Assessments</u></p>
<p>S.16</p>	<p><u>Prior to construction commencing, the NZTA shall undertake geotechnical investigations of slopes or sites that have been identified as potentially being susceptible to movement. This shall include, but not be limited to:</u></p> <ul style="list-style-type: none"> <li>(a) <u>14H and 14J Cradock Street</u></li> <li>(b) <u>34 Cradock Street</u></li> <li>(c) <u>40 Cradock Street</u></li> <li>(d) <u>56 Powell Street; <del>and</del></u></li> <li>(e) <u>1590A Great North Road; and</u></li> <li>(f) <u>Other sites on the western slopes of Oakley Creek identified under Conditions S.7(b) and S.7(m) which are assessed in the course of a pre-construction condition assessment undertaken in accordance with Condition S.8 as potentially being susceptible to slope movement.</u></li> </ul> <p><u>The NZTA shall undertake monitoring throughout the active construction period in accordance with S.10 above and shall assess and agree remedial action as required in consultation with the owner in accordance with S.12 above.</u></p>
	<p><u>Differential Settlement</u></p>
<p>S.17</p>	<p><u>Pairs of settlement markers shall be established on each side of the cross sections identified on Figure E14 to monitor differential movements. The markers in each pair shall be no more than 20m apart, and each pair shall be within 100m of the centreline of the closest tunnel. Monitoring installed in accordance with Condition S.11 can be utilised for this purpose. Each pair of markers shall have alert and alarm values set based on the calculated differential settlements at that location and consistent with the relevant calculated Building Damage Category (Figures G1–G4). Alert and Alarm levels shall be as defined in Condition S.2. Monitoring frequency shall be as defined for Framework Markers in Condition S.3.</u></p>



# Annexure A

Revision		By	Verified	Appr	Date	Title:	
1	AF	OK	AH	05/05/10	Waterview Connection Project- SH20		
2	CM3	OK	AH	04/06/10	Total Estimated Settlement - Tunnels & Approaches		
3	BAP	AF	AH	21/07/10	Client: NZ Transport Agency		
4	SD	AF	AH	27/01/11	Project: SH20 Waterview Connection Combined Surface Tunnel		
						Discipline: GIS	
						Drawing No: Figure E14	



**Legend**

- Settlement Analyses - Cross Section
- Proposed Alignment
- Cut & Cover Tunnel
- Driven Tunnel Extents
- Total Estimated Settlement (mm)
  - 5 mm - 10 mm
  - 10 mm - 20 mm
  - 20 mm - 50 mm
  - 50 mm - 100 mm
  - 100 mm - 200 mm
  - > 200 mm

This map contains data derived in part or wholly from sources other than Bechtel and therefore, no representations or warranties are made by Bechtel as to the accuracy or completeness of this information. Map prepared for distribution as a PDF document. Contains Crown Copyright Data. Crown Copyright Reserved. Data collected by Bechtel is provided in the courtesy of GCS who makes no claims as to its reliability, accuracy or adequacy for any particular purpose.







Unique foundation issue results in damage category '2' 1510 Great North Road, Unitec Residential Flats

Unitec Building 76

1550 Great North Road

Metro Football Clubhouse

# Annexure B

**Legend**

Damage Category

- 1
- 2
- 3
- 4+5

— Proposed Alignment

..... Settlement - Cross Sections

This map contains data derived in part or wholly from sources other than Beca, and therefore, no representations or warranties are made by Beca as to the accuracy or completeness of this information.  
Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.  
Contains Crown Copyright Data. Crown Copyright Reserved.

Scale 1:1,700 at A3		Title:		Settlement - Building Damage Categories		Client: New Zealand Transport Agency		Discipline: GIS	
0 12.5 25 50 Metres		Revision		[L = 10m, H = 3m]		Project: SH20 Waterview Connection Combined Surface Tunnel		Drawing No: GIS-3814238-18	
		By		Figure: G - 3		Logo: BECA			
		Verified							
		Appd							
		Date							
		Rev01		10/06/10					
		Rev2		21/07/10					



# Annexure B

**Legend**

Damage Category

- 1 (Green)
- 2 (Light Green)
- 3 (Yellow)
- 4+5 (Red)

— Proposed Alignment

..... Settlement - Cross Sections

This map contains data derived in part or wholly from sources other than Becca, and therefore, no representations or warranties are made by Becca as to the accuracy or completeness of this information.  
Map intended for distribution as a PDF document.  
Scale may be incorrect when printed.  
Contains Crown Copyright Data. Crown Copyright Reserved.

Scale 1:1,700 at A3		Revision		By		Title:		Client:		Discipline:	
0 12.5 25 50 Metres		Rev01	Rev2	JYG	BAP	Settlement - Building Damage Categories [L = 10m, H = 3m]	New Zealand Transport Agency	SH20 Waterview Connection Combined Surface Tunnel	GIS	New Zealand Transport Agency	
		10/06/10	21/07/10	AYF	AYF					Beca	
										Drawing No: GIS-3814238-18	
										Project: SH20 Waterview Connection Combined Surface Tunnel	
										Figure: G - 4	