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19th September 2011

Dear Sirs/ Madams,

RE: Graythwaite Estate, North Sydney – Remedial Works

We report the findings from our site inspections.

1.0 DETAILS OF INSPECTION

This structural assessment report was prepared for Tanner Architects on behalf of Sydney Church of England Grammar School (Shore) for the conservation and adaptive reuse of Graythwaite House, the Coach House and the Tom O'Neill Centre at Graythwaite, 20 Edward Street, North Sydney. The report has been prepared to accompany the revised Part 3A Stage 1 Project Application for the works, and responds to issues raised by North Sydney Council in their assessment dated 8 March 2011.

1.1	**Dates of inspection:**	10th September 2010, 4th March 2011, 16th September 2011
1.2	**Inspected by:**	Alex Been, senior structural engineer with Mott MacDonald Hughes Trueman
1.3	**Purpose:**	To assess the existing condition of structural fabric within Graythwaite House, the Coach House, and the Tom O'Neill Centre, and to provide a schedule of structural remedial works. All proposed remedial works to be approved by a heritage consultant prior to commencement.
1.4	**Limitations:**	Roof spaces were viewed mainly through ceiling hatches from a step ladder, or where the cladding had been stripped away. Lifting of floorboards offers only a limited view of the framing beneath and therefore not all damaged framing may have been found.
1.5	**Reference Documents:**	*Graythwaite Property Schedule of Works* – Graham Edds & Associates - 2009

Graythwaite Property Purchase Contract Reports – Graham Edds & Associates – 1993

All rooms in Graythwaite House have been numbered in the schedule of works according to Tanner Architects' existing condition drawings.

2.0 CONDITION AND REMEDIAL WORKS SCHEDULE

2.1 Graythwaite House

Rising, falling and penetrating damp is common throughout all walls and ceilings. Damp has also caused the decay of external floorboards, laths and top plates. This is mainly due to holes in roof cladding and failing rainwater goods. There are a few minor cracks in plaster walls and ceilings throughout the house.

2.1.1 Floor Structure

Floor joists on the ground floor generally appeared to be in good condition, excepting the areas listed below. All floor joists exposed for inspection on the first floor of the house appeared to be in good condition. Several joists had been notched to allow distribution of services however this does not appear to have affected performance of the framing. Floor framing in the attic level was not visible due to floorboards, floor coverings, and stacked furniture. We recommend during the works that nominated floorboards are lifted for a structural engineer to verify the condition of the floor framing.

Room	Condition	Actions
Basement	Moist ground causing rising damp in stone walls	Install strip drain at lowest point, drainage sump and electric pump connected to stormwater drainage system
G4	Floorboards and joists decayed at doorway to G10 and south wall. Spliced joists have mild decay at east wall. Floor coverings damp.	Cut and replace damaged boards and joists. Remove and replace decayed splice joists at east wall.
G5	Supporting battens and boards for coke breeze topping failed locally. Coke breeze appears intact. Floor joists appear intact.	Reinstate or replace battens and boards as required.
G6	Single joist at middle of room	Remove damaged material. If greater than

	decayed and borer damaged. End joist at north wall termite damaged.	20% of joist width lost install splice beam adjacent bolted to damaged joist. Install new joist adjacent to damaged section, supported on end walls.
G10	Tree growing through concrete slab	Remove tree. Cut out and poison roots to the boundary of room G10.
G13	End joist at north wall termite damaged. Coke breeze partially lost.	Install a new beam and support nogging for topping at 450mm centres. Reinstate the concrete topping.
F14a/ F16b	Floor framing decayed	Remove decayed sections and replace with new hardwood sections to match original.
First floor verandah	Balustrade framing severely decayed. The balustrade is unlikely to conform to current standards in its existing form. Several floorboards severely decayed at outer edge. Joists beyond balustrade severely decayed. Edge beam soffit cladding board decayed and sagging.	Remove balustrade and replace with new balustrade to architect's specifications. Lift floor covering to expose floorboards. Remove all decayed timber boards and joists and replace with new sections to match. Remove cladding boards from edge beam. Replace all joists beyond balustrade.

2.1.2 Roof Structure

Falling damp in walls and ceilings in most rooms below roof spaces suggest some deterioration of cladding has occurred on all roof planes. Most roof spaces were not accessible at the time of inspection. We recommend that during works to repair the roof cladding and rainwater goods an engineer inspect all roof framing. The table below explains the condition of roof framing only where visible from below or by ladder at the time of inspection.

Room	Condition	Actions
G4	Ceiling joists and roof framing appear to be intact. Slate roofing appears sound. Signs of fungal growth on all timber sections. Ceiling support plate decayed at east wall. Remainder of top plates appear to be in sound condition.	Inspect and repair rainwater goods. Remove and replace east wall ceiling support plate.

G8	Ceiling joists and roof framing appear to be intact. Strong damp smell in roof space. Likely decay of top plates.	Inspect and repair rainwater goods. Expose, inspect and repair as necessary all top plates.
G18	Roof cladding and gutter severely deformed. Framing not inspected.	Structural engineer to inspect roof framing during repairs to roof cladding and specify any required remedial works.
G19	Several missing or broken slates, and large hole in roof. Gutters damaged. Roof framing not generally visible during inspection. Falling damp in ceiling and walls apparent. Ceiling joists and boards at west wall decayed. Mild decay of top plate.	Repair cladding and rainwater goods as necessary. Structural engineer to inspect roof framing during repairs to roof cladding and specify any required remedial works. Cut out decayed length of timber ceiling joists and splice new section to match.
Front verandah	Verandah posts have mild surface rust and peeling paint.	Remove painted coating and add new protective painted coating with appropriate surface preparation.
Kitchen verandah	Verandah roof sheeting partially collapsed, edge beam rotated, loose post base. Missing post.	Re-align edge beam and reinstate roof sheeting connection. Remove and replace timber post and connection to footing, install new post where missing.
F1	Falling damp in ceiling and beam plaster, decayed laths. Evidence of damp on timber ceiling joists and rafters.	Repair roof cladding, flashing and rainwater goods to waterproof roof. Engineer to inspect roof framing during works and advise any required repairs.
F3	Damp ceiling and walls suggest falling damp through roof cladding. Single ceiling joist appears to be split.	Structural engineer to inspect roof framing during repairs to roof cladding and specify any required remedial works. Install 3 through bolts into split ceiling joist to maintain integrity.
F10, F11, F12	Partial view into roof space suggests all roof framing is in good condition.	Structural engineer to inspect roof framing during repairs to roof cladding and specify any required remedial works.
F16	Evidence of falling damp in ceiling and walls.	Repair roof cladding, flashing and rainwater goods to waterproof roof. Engineer to inspect roof framing during works and advise any required repairs.

First floor verandah	Roof sheeting warped and corroded. Painted finish on timber framing peeling.	Replace deteriorated roof sheeting with new corrugated sheet metal to match original profile. Strip all painted finishes from timber framing and re-paint.
A1, A2, A3, A4	Evidence of falling damp, cracked plaster walls	Repair roof cladding, flashing and rainwater goods to waterproof roof. Engineer to inspect roof framing during works and advise any required repairs.
Roof Drainage	Downpipe and sump in central courtyard damaged and disconnected.	Replace damaged downpipes and sumps. Reconnect to in-ground drainage system. Check integrity of in-ground drainage system from sumps to nearest stormwater pit by CCTV, pressure test or similar.
Chimneys	Chimneys appear sound from inspection at ground level.	Inspection to be made from roof during works period by structural engineer. Any identified defects to be corrected.

2.1.3 Walls

Room	Condition	Actions
General	Weathering moderate to severe in stone courses below DPC on external face of all perimeter walls due to rising damp. Hard mortar in joints. DPC generally appears sound, local areas where rising damp has breached the DPC. Corroding ferrous fitments causing mild damage to mortar joints and occasionally ashlar stones. Lost pointing in mortar joints common across all walls. Occasional mild cracking in mortar joints.	Rake out and replace hard mortar with new lime mortar. Stones with greater than 25% section depth lost require indents of new stone. Replace existing slate DPC with new physical barrier where rising damp appears to have breached the DPC. Remove all non-significant ferrous intrusions in wall (by architect). Rake out and re-point all cracked and deteriorated mortar joints
G8	Falling damp on internal face of all walls.	Repair roof cladding and rainwater goods.
G18	Corroded lintels above both door openings.	Remove lintels and replace with stainless steel lintels to match original profile.

G19a	Creeping vine likely causing damage to external face of northern wall of stables. Concrete slab on ground causing rising damp in masonry/ stone walls Occasional loose bricks in dividing wall.	Remove creeping vine. Remove concrete slab, replace with suitable flooring (by architect). Rake out damaged mortar joints. Re-lay loose bricks and re-point.
G19c	Deteriorated mortar joints in all stone walls	Rake out joints and re-point with suitable mortar.
Ground level verandah	Lowest course of stone below DPC severely fretting in discrete locations.	Stones with greater than 25% section depth lost require indents of new stone. Remove concrete slabs and excavate ground adjacent to the basement wall to install a waterproof membrane and damp proof course below floor level. Desalinate internal face of basement wall.

2.1.4 Chimneys

The chimneys were inspected from outside the roof access hatch as due to constraints on access across the roofs detailed inspection was not possible. Two chimneys collapsed in 1996 and were re-built with strengthening rods installed in the flue cavities. All chimneys appeared to be plumb and in sound condition. No structural remediation appears to be necessary at this stage.

2.2 The Coach House

Room	Condition	Actions
East Wall external	Mild corrosion of lintel over window opening and bursting mortar	Remove existing painted finish and corrosion on lintel, re-paint.
Roof framing	Termite damage in 2 rafters in west room. Some strengthening of rafters completed during last refurbishment.	Install new rafters adjacent to damaged rafters using matching sections. Support new rafters at top plate and ridge board as necessary.

2.3 Tom O'Neill Centre

Room	Condition	Actions
External Walls	Raised garden beds on east and west sides causing rising damp in external walls. Drainage trench at north wall not maintained. Gutter collapsed along west wall	Lower all garden beds to below the internal floor level and exiting damp proof course. Check and repair damp proof course. Grade soil away from the building on all sides. Strip damaged painted finishes and monitor moisture content of brickwork. Apply new finishes when stable. Clear drainage trenches and install a guard over the trenches to prevent future blockage. Check in-ground drainage system by CCTV, pressure test or similar to nearest sump. Repair collapsed gutter. Clear all gutters and downpipes.
Floor structure	Timber floor framing appears sound. No inspection was made.	No works expected.
Roof structure	Roof framing appears sound.	No repairs proposed.

3.0 FLOOR CAPACITIES

The suspended timber floors on the ground, first, and attic floors of Graythwaite House were assessed for their capacity to support live loads under the latest codes of practice. The most critical joist sections for each floor are presented below:

Ground Floor – 145x60 joists span 2.0m between bearers or stone walls at 450mm centres. Maximum live load capacity is in the order of 3.0kPa, suitable for residential or general office use.

First Floor – 200x70 joists span up to 6.0m between stone walls at 450mm centres. Maximum live load capacity is negligible. The floors in the east and west rooms were highly sensitive to vibration. We suggest the floor joists are significantly undersized for any potential re-use and should be strengthened by some means in order to perform satisfactorily.

Attic Floor – 230x70 joists span up to 6.0m between stone walls at 450mm centres. The maximum live load capacity is in the order of 1.0kPa, generally unsuitable for any specific usage.

Floors requiring additional live load capacity can be strengthened by installation of cold formed steel sections alongside the existing timber joists. We would expect the use of 150-175mm deep channel sections would increase the load carrying capacity of the suspended floors significantly.

4.0 FIRE RATING LIMITS

Fire rating periods are written in minutes for Structural Adequacy/ Integrity/ Insulation.

4.1 Graythwaite House:

External loadbearing walls of the ground, first and attic floors are 400mm thick sandstone or 230mm thick solid brick masonry, providing a fire rating period of 240/240/240.

Internal loadbearing walls of the ground floor are 400mm thick sandstone or 230mm thick solid brick masonry, providing a fire rating period of 240/240/240.

Internal loadbearing walls of the first floor are 110mm brick masonry with rendered finish providing a fire rating period of 120/90/90.

Internal walls of the attic floor are non-loadbearing timber stud walls with a lath and plaster finish.

4.2 Coach House

External loadbearing walls are 230mm thick solid brick masonry, providing a fire rating period of 240/240/240.

Internal loadbearing walls are 110mm solid brick masonry providing a fire rating period of 120/90/90.

4.3 Tom O'Neill Centre:

External loadbearing walls are 230mm thick solid brick masonry, providing a fire rating period of 240/240/240.

Internal loadbearing walls are 110mm solid brick masonry providing a fire rating period of 120/90/90.

We trust that the foregoing is of assistance. Please contact the undersigned for any further information.

Yours faithfully

Mott MacDonald
Hughes Trueman
ALEX BEEN
Senior Structural Engineer