

# RIDGE

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PROPERTY & CONSTRUCTION CONSULTANTS

**DALCOUR MACLAREN  
ENVIRONMENT AGENCY – PINKHILL LOCK HOUSE**

**STRUCTURAL ENGINEER'S REPORT  
ON CRACKED WALLS**

6<sup>th</sup> June 2017

Prepared for

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## **1. INTRODUCTION**

This report has been prepared at the request of Dalcour Maclaren for the purposes of commenting on the cracks in the masonry walls at the Environment Agency property Pinkhill Lock House, Oxford Road Enysham, OX29 4JH.

This report has been prepared by Matthew Calvert, MEng, CEng, MStructE, Associate Structural Engineer for and on behalf of Ridge & Partners LLP following four visits to the property on 14<sup>th</sup> October 2016, 27<sup>th</sup> January 2017, 20<sup>th</sup> February 2017 and 22<sup>nd</sup> March 2017. The final three visits were carried out to allow inspection of the trial pits and further enlargement of the pits.

The inspection was carried out from ground level externally and ground and first floor level internally. The trial pit was dug adjacent to the north elevation at the junction between the original house and the infill extension. Please refer to drawing 160506/PINKHILL/S/30-01-17/01 in Appendix B for the location of the trial pits.

The conclusions contained in this report are based upon a visual inspection of the property. We have not carried out any specialist testing or inspected other parts of the construction which are covered, unexposed or inaccessible and we are therefore unable to report that any such part is free from defect. Therefore no responsibility can be accepted for any hidden, latent or inherent defect which a more detailed examination might reveal.

This report is limited to those items outlined above and is for the sole use of the Clients and no responsibility is accepted or implied for any other parties.

## **2. DESCRIPTION**

- The property is located on an island between the main River Thames and the canalised section which serves as access to the lock itself.
- The property comprises a two storey detached building which appears to have been constructed in the early 20<sup>th</sup> century by the Thames Conservancy.
- This report refers to the east elevation, which faces the canal leading to the lock, as the front of the property.
- According the current tenant who lived at the property when he was younger, the property was extended at ground floor level on the north east corner in the early 1990's. This involved enclosing an open area which was covered with the first floor over by building two new walls. This created what is now a bathroom. The outline of the original wall lines can be seen in the outer masonry.
- The property is of traditional load bearing masonry construction with a natural stone facing above ground and brickwork below ground.
- The pitched roof and suspended floors are of timber construction.
- Based on the trial pit excavated the building's foundations appear to be simple strip footings at varying depths.
- Below ground drainage and other buried services run around the perimeter of the building.
- Please refer to the Photographs in Appendix A and drawings in Appendix B which illustrate the above.

### **3. OBSERVATIONS**

- On the north elevation there is a tapered diagonal crack running from ground level up to eaves level. This is wider at the top than at the bottom.
- The diagonal crack is not visible internally as the wall had recently been covered with new bathroom tiles at the time of inspection.
- The infill walls are a cavity construction with a blockwork inner leaf and natural stone masonry outer leaf.
- Trial pit TP01 had to be abandoned because the below ground services prevented it from being extended deep enough to encounter original foundation. It did however uncover the top of the concrete foundation to the new infill.
- Trial Pit TP02 shows the foundation for the original house consists of a concrete strip footing which is at least 600mm wide and founded more than 1600mm below ground level. It was not possible to extend the trial pit deep enough to prove the underside of the foundations to the original house.
- Trial Pit TP02 also shows that the foundation for the new infill walls consist of a concrete strip footing which is at least 600mm and founded at 1300mm below ground level. This founding level coincides with the top of the original foundation. Firm Clay soil was observed below the new foundation which was dry and brittle with signs of roots.
- There are a number of shrubs growing in the garden in front of the property.
- A CCTV survey of the below ground drainage was carried out by OPC Drain Services see extract of report in Appendix C dated 10/03/17. This advises that there are no serious defects.
- There is a small diagonal crack in the outer stone masonry above the first floor window opening on the rear of the building.

#### **4. CONCLUSIONS**

- The cracking observed in the infill extension walls is consistent with that caused by subsidence of the foundations. The subsidence has occurred because the infill walls are founded 1300mm below ground level (bgl) on Firm Clay which is shallower than the foundation for the original main building. These are at least 1600mm bgl but could be much deeper and will bear on firmer, probably original soils. Whoever built the extension took no recognition of the depth of the original house foundations.
- It was not possible to extend the trial pit to confirm the exact depth of foundation or soil type under the original building. The shallower soils at 1300mm are much more likely to be affected by changes in moisture content brought about by changes in ground water level, seasonal variations in rainfall and through the effect of tree roots. This is not necessarily shrinkage and heave but also softening of the soils due to their water content.
- However, the movement observed could have been caused by the initial settlement expected when soils are exposed to new loads and could have now stopped.
- It is not known if the subsidence is ongoing, accurate monitoring of the cracks would be required to verify this.
- The movement observed does not present an immediate risk to the building structure or its users however, if left unchecked it will eventually lead to an unstable situation. Cracks in the stone allow water to penetrate the structure, in winter this can allow freeze thaw action to occur which can degrade the underlying structure. In the long-term it is likely that underpinning of some form (traditional or piled) will be required to prevent further subsidence causing further differential movement.
- The cracking above the first floor window opening on the rear elevation is not structurally significant.

## 5. RECOMMENDATIONS

- To verify if the subsidence is ongoing we recommend that accurate crack monitoring is carried out for a period of at least 6 months with readings taken once a month. If the monitoring proves the movement has stopped then the crack can be repaired. If the monitoring proves the movement is ongoing then we recommend the following:
- **Option 1** - If the Environment Agency takes the long-term view, underpinning of the infill extension should be carried out immediately to prevent the subsidence of the extension relative to the main building. Once the underpinning has been completed the repairs to the cracked masonry can be carried out.
- **Option 2** - If the Environment Agency would prefer to avoid the expense of the works now, they can be put off without significant risk to the structure or its inhabitants. Only the repairs to the cracked masonry need to be carried out immediately. It should be noted that it is likely the cracks will reform in the repaired masonry and ongoing movement could affect the internal finishes. The time it takes for the cracks to reform depends on the rate of differential movement which we do not know at this time. If this option is chosen it will be necessary to regularly monitor the cracking to determine the time when underpinning becomes necessary. The longer the cracks are left the more effort will be required to carry out the repairs.
- We recommend that the underpinning of the rear extension is carried out using traditional underpinning techniques (mass concrete 3 bay hit-miss-miss-hit sequence) which would extend the foundations to a similar depth as the original house to be founded on firm original ground. This method of underpinning is currently seen as preferable to piled underpinning techniques because the piled solution could lead to the infill walls being founded on stiffer material than the original house and a similar problem of differential settlement occurring with the main house moving relative to the infill.
- Before the underpinning is designed and costed we recommend that a trial pit is dug to establish the exact depth of the original house foundations and the depth of firm original ground. It is likely that this excavation will require suitable temporary shoring due to the potentially significant depths involved.
- It should be noted that any underpinning operation will cause disturbance to the soil and the existing structure which will lead to superficial damage to the existing finishes in the building. This is unavoidable.
- We recommend that accurate crack monitoring studs are installed on each of the main cracks to monitor any continued movement which may be occurring. Readings should be taken on a monthly basis a period of several months throughout the repair process so that the effect of the remedial works can be assessed.
- We recommend that the Environment Agency check their archives for any record drawings of the building. This information is invaluable when attempting to diagnose problems and prepare designs for repairs and could save a significant amount of time and effort on investigation works.
- Before any of the above actions are taken we recommend that the building Insurers are made aware of the subsidence problem as they may wish to take the monitoring and remedial works into their own hands.



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**APPENDIX A - Photographs**



Photo 1 – General view of front (east) elevation of property which faces the canalised river.



Photo 2 – General view of side (north) elevation.





Photo 3 – General view of rear (west) elevation, northwest corner.



Photo 4 – General view of garden side (south) elevation, southwest corner.



Photo 5 – North elevation line of original house indicated by arrows.





Photo 6 – Rear (west) elevation diagonal crack above first floor window opening.



Photo 7 – Internal view of wall shown in Photo 5, any evidence of cracking is masked by the new tiles.



**Photo 8 – Internal view of wall shown in Photo 5, any evidence of cracking is masked by the new tiles.**





**Photo 9 – Exposed blockwork inner leaf visible below bath.**



Photo 10 – Location of trial pit TP01 on North Elevation.





Photo 11 – View of Trial Pit TP01 red arrow is new foundation, blue arrow is original wall.



Photo 12 – View of Trial Pit TP01 red arrow is new foundation, blue arrow is original wall.





Photo 13 – Trial pit TP02 on front (east) elevation adjacent to front door, red arrow is top of original foundation blue arrow is underside of new foundation.



Photo 14 – Trial pit TP02 on front (east) elevation adjacent to front door, red arrow is top of original foundation blue arrow is underside of new foundation.

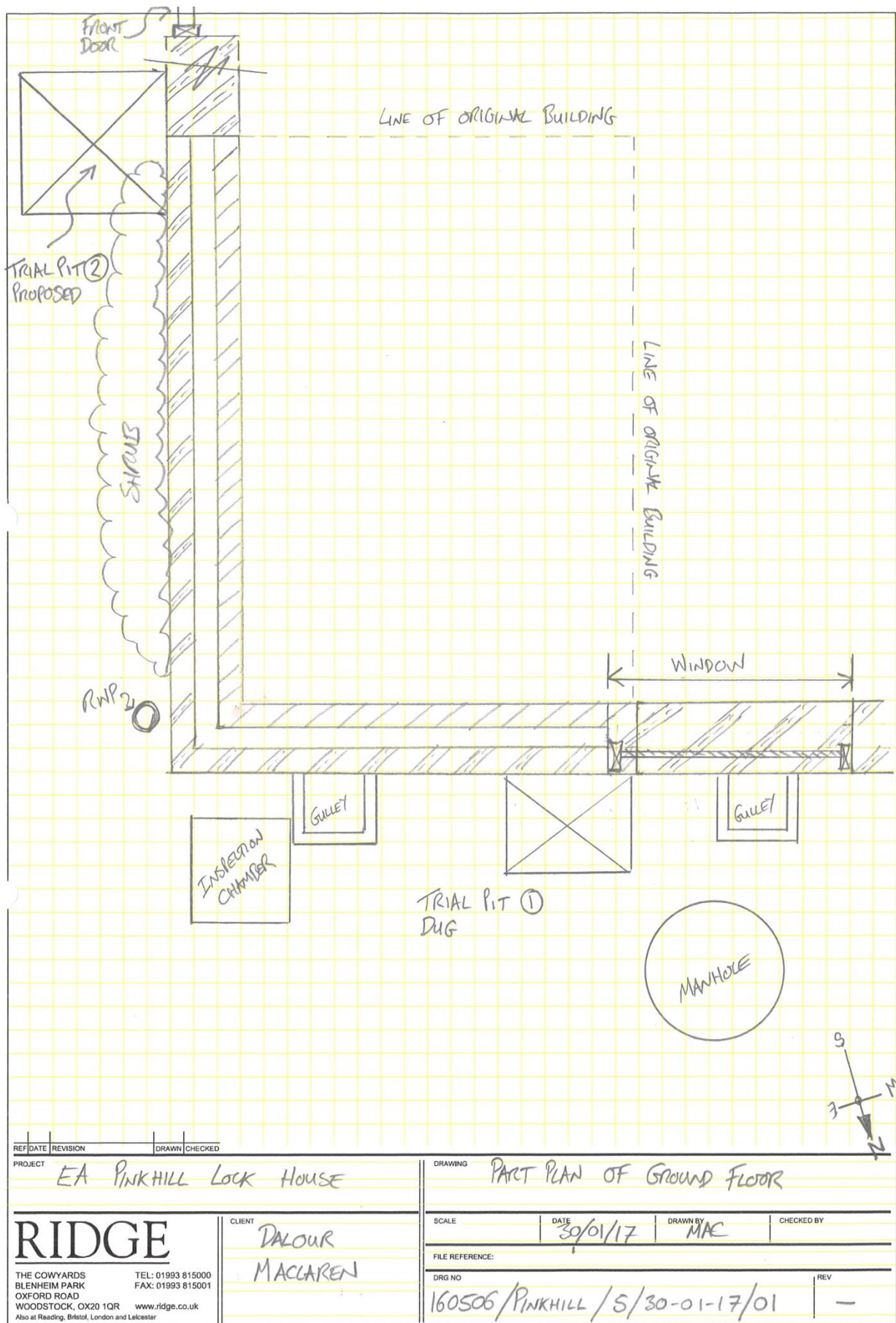




Photo 15 – Trial pit TP02 on front (east) elevation, red arrow is top of original foundation blue arrow is underside of new foundation.




**APPENDIX B – DRAWINGS**








**APPENDIX C – CCTV DRAINAGE SURVEY**

		OPC Drain Services Wantage OX12 8PW Tel: 01235 835999 Fax: 01235 834222 Email: richard@opc.me.uk	
		<b>Project-information</b>	
Project name : 170506__00	Project Number :	Contact :	Date : 16/03/2017
Client: <b>Fergal Contracting</b> Contact Name: Department: Road: <b>Downs Road</b> Town: <b>Standlake</b> County: <b>OX8 7RD</b> Telephone: Fax: Mobile: E-mail:			
Site: <b>Pinkhill Lock</b> Contact Name: Department: Road: Town: <b>Eynsham</b> County: <b>OX29 4JH</b> Telephone: Fax: Mobile: E-mail:			
Contractor: <b>OPC Drain Services</b> Contact Name: Department: <b>Field Barn Farm</b> Road: <b>Wantage</b> Town: <b>OX12 8PW</b> County: <b>Ardington</b> Telephone: <b>01235 835999</b> Fax: <b>01235 834222</b> Mobile: E-mail: <b>richard@opc.me.uk</b>			



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<b>Project-information</b>			
<small>Project name :</small> 170506__06	<small>Project Number :</small>	<small>Contact :</small>	<small>Date :</small> 16/03/2017
<div>Section Pipe length Fault</div> <div>1 MH14 - B1 No defects detected</div> <div>2 MH14 - B2 No defects detected</div> <div>3 MH14 - B3 No defects detected</div> <div>4 MH14 - MH16 Area of standing water 15%</div> <div>5 MH16 - MH18 No defects detected</div> <div>6 MH18 - MH19 No defects detected</div> <div>7 MH19 - MH21 Areas of standing water up to 15%, scale build up throughout.</div> <div>8 MH21 - Tank No defects detected</div> <div>9 MH23 - MH21 Areas of standing water up to 15%</div> <div>10 MH22 - Outfall No defects detected</div> <div>11 Outfall pit - Outfall No defects detected</div> <div>12 Tank outlet - MH23 No defects detected</div>			

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