BRAMWEST
PROPERTY SERVICES

72a Church Street, Stapleford, Nottingham NG9 8DJ

DRAINAGE DESIGN | REFURBISHMENTS | DAMP CONTROL

DRAINAGE AND DAMP CONTROL REPORT

16th February 2021 BW DR QD 1099

Mr & Mrs J Riddle
'Dawley House'
Longton Lane Residents
Off Bridle lane,
Deepsend
DERBYSHIRE

RE : DRAINAGE ISSUES AND DAMP PROBLEMS AT THE ABOVE PREMISES.

For the purposes of this survey, it is a prerequisite, that in the absence of detail site information, that certain characteristics, are assessed or assumed, and that local knowledge of sub-soils in particular, be applied in a blanket format, without specific reference to on site data.

The weather prevailing at the time of the report, was fine/dry with no precipitation. The ambient temperature was 0 Deg C. Prior to the survey, there had been a sequence of both 'Cyclic' and 'Continuous' freezing. Clearly, this precluded the possibility of a trial hole in the garden to establish the upper level sub soil type by visual inspection, a normal procedure with the problems of this type of site.

The purpose of the survey was to establish the facts surrounding the problem of the accumulation of 'free water' in varying volumes within the confines of the gardens and in one of the three properties moisture transmission into the cellar. On the day of the survey and inspection, there was only limited evidence of moisture ingress through the existing brickwork into the cellar. This following a dry period. As reported by the client, the garden close to the house was under the influence of 'free water' even without 'run off' from the surrounding land. From this information it appears that, when the 'pressure release' of the periodic 'build up' of pressure from the garden hinterland, was allowing, there appeared a

migration of moisture/free water, by gravitational and capillary forces into that zone. Prior to the survey, there had been accumulations of 'free water' in contact with the cellar brickwork, inside the cellar, as reported by the Client. As would be expected the lower levels of the brickwork close to the floor, certainly, within 500mm, exhibited, high levels of moisture content. Above 500mm this decreased on a descending scale, up to 1400mm. Though, that is not to say, that the levels of moisture content were not too high at 1400mm, though by proportion, the level was continuously decreasing, as previously stated.

Generally, within the confines of the cellar, the walls, exhibited evidence, within the brickwork, of salt attack and crystallisation, from 'efflorescence', 'contour scaling' (flaking), and 'Granular Disintegration' (powdering and sanding). Usually, this type of deterioration and damage is caused by 'Salt Phase Transitions', these occur, where the dissolved salt, transported in water, is deposited when the liquid is 'Supersaturated'. This is especially, in building and construction materials with large internal surface areas. Bricks, of course are candidates for this type of activity, with large honeycombs of area for movement to take place. Further, when the 'moisture transport mechanism', turns from 'liquid capillary transport' to 'water vapour transport', some of these salts cannot be transported in the 'Gas Phase', and are left behind. Not surprising, to find this reaction, considering the high levels of exposure, to 'free water', soil particles and the accompanying salts. These are likely to be of, Sulphate and Carbonate compounds, with Sodium, Potassium, Calcium ,Magnesium and Aluminium etc, as some of these at least, are expected to be present.

Continuing the 'over view', and looking particularly at the drainage side of the problems, there appeared to be several conflicting elements to consider. Apart from the fact that the site has a two tier issue status, that is, primarily and directly a drainage issue, then also indirectly, an ancillary damp and moisture issue, then both have to be solved together. Looking at the drainage aspect, the collection of an adversely large amount of 'free water', in close proximity to the front elevation of the dwelling, be it of both, surface and sub-soil, in type, is complex in its requirements. Having examined the Foul drainage, in terms of outfall, and checking, for a 'self cleansing velocity', leads us to this being, an unlikely source of the problem. The main reason being, that having done a simple velocity test, revealed, a 'self cleansing velocity' of 1-14m/sec, which for a gradient of 1 in 60 for a 100mm pipe, is close to text book. (1-39m/sec is ideal with a 1 in 40 gradient for a 100mm pipe) Whilst, the existing foul drainage is in 100mm SG Clay ware, thereby, possibly dating to the 1960's at least, it gives no indication of fault. However, the brickwork to the Man Holes and some of the benching, though, is a more nocuous offender, requiring some attention. Though, it has to be said, is not a contributor to the flooding issues.

Having established the aforementioned, the search for reasons behind the accumulation of free water on the plots in question, leads us to the sub-soil constituents. The area in question, frequently suffers from inherent sub –soil problems. That is the inability, of the sub-soil to allow sufficient percolation. In periods of excessive precipitation, this can be a problem, giving a percolation factor, of a 'low order'. What this means is, it cannot move the

water fast enough. Under normal circumstances, in itself this is not a problem, unless there are complicating factors.

One of the complicating factors, in this instance, concerns the ditch to the front elevations of all three properties. Currently, the ditch contains and collects surface water from the road. In a sense, this is behaving physically as a protecting barrier to the properties. However, since the recent developments in the village and considering the contours and topography, of the existing surfaces, the volume of water to the ditch has increased considerably. Whist the purpose of the ditch, is in essence to act as a 'holding area', thus preventing flooding, and allowing the physical process of 'percolation' and 'water/moisture migration' to the 'air/void ratio' of the soil. The purpose is certainly NOT to contain ever larger volumes of water 'run off' from the roads and associated impervious paved areas, with 100% 'run off'. Of course, the natural process of evaporation can likewise be effected during the holding time. Nor when instituted, was the ditch intended, to be neglected, in terms of its outfall into the natural watercourse. Currently, the outfall is 'clogged' with vegetation and soil particles. Naturally, this is a primary factor in the equation of the flooding issues. The Local Authority, of course being responsible for this neglect. None of these factors helps the situation. Indeed, from our analysis, this condition is one of the root causes of the problems. Despite this, though, there is a considerable frontage, in terms of area, to all three properties, though this is strongly, 'over ridden' by the prevailing gradient, which is towards the dwellings. Therefore, as the ditch 'overspills' the offending water approaches the dwellings. Also, when considering 'Judson's Theory', the expected 'run off', from surrounding land in heavy precipitation, aggregates with the ditch water. We estimate, that this could surmount to some 30% extra volume, over and above. Several thousand litres of water in a 50mm/hr precipitation.

Another root cause, is that of the sub-soil itself. A subject we have touched on previously. Why is it the case, that the sub-soil could be a problem? From the known characteristics of the local sub soils, it would be anticipated, that this would be at best a clay composite and at worst a heavy clay. If the sub-soil is of a cohesive clay/and a non-cohesive composite, sometimes referred to as an impregnate, as the particles are very integrated, then this result, would lessen the issue, but still remain a problem. The problem is, given the extent of the clay element, the soil will perform poorly from a drainage point of view. Clays, or clay composites with high clay contents, are notorious for having 'high optimum moisture' contents and maximum 'dry density'. The reason for this, is that for example, the 'particle size distribution', involves particles less than 0.002mm. (To give this some perspective, a sand by contrast would be 2mm to 0.06mm. Most people assuming sand to be fine). Further to this, there are two types of water held in soil, 'Adsorbed' and 'Absorbed'. 'Adsorbed' is the water, held round the soil particle. The soil particle being negatively charged, is attracted to the 'di-polar' water and its positive element. 'Absorbed water is that held between the particles, by 'surface tension'. It follows that, a soil with a numerically large number of particles, clay, will therefore, hold more water. If precipitation ceases, the soil will move towards 'equilibrium', which for a clay will take longer. This would explain, the problem continuing after precipitation has ceased. Indeed, if the soil content is at fault, as

looks likely, (A soil survey would confirm this assertion), this would cause water migration to the front elevations, due to topography. This is accounted for by 'capillary action' and 'gravitational force', as a distinct part of the 'porosity' changes. If, there is a non- cohesive element, the cohesive clay element, will be the dominant portion, and the non- cohesive element, is the non- dominant portion. For this reason, any free water, should always be piped away or contained to prevent situations developing with high moisture contents, especially in close proximity to brickwork for the reasons as outlined previously. Without further investigation this cannot be confirmed. Though it is necessary to ascertain the validity of these considerations, by excavation of some pilot holes, as a first measure to solving the problem.

How do we control this problem? The most commonly applied route is to install a sub-soil drain. This would artificially, lower, the water contained within the sub soil. Generally, in most cases this would be a simple procedure to install some sub-soil drainage. Ironically, this installation would intercept surplus surface water also, an asset in this case. This is usually, achieved by the installation of a CCD system. That is, collect, clean and discharge. What this means is the water is collected in an aggregate filled area in perforated pipes discharged to a silt trap, with an entry and exit pipe the soil particles falling out of 'suspension' down into the trap, whilst the clean water is discharged. This could be added to the existing storm water apparatus, out falling into the natural water course. By our calculations, the gross volume total, would be of the order of 20Litres/sec, within the capability of a 160mm pipe. (A 160mm pipe can discharge at full bore 25-30Litres/sec). (Based on a gradient of close to 1 in 70). This should not be a problem, lying within parameters. (1 in 60 is the ideal gradient).

There is certainly, a large volume of water close to the front of the buildings. High moisture content readings were obtained near the bay windows and along the wall sides. In fact these continue up to the rear. There is a question over the condition of the DPC, and of it being life expired, in all cases. Attention to this detail by a new installation would remedy this.

Now turning attention to the inside again, the markings on the Chimney breast internally, at No 3 are likely to be none damp related. Moisture readings taken of the stains gave almost moisture free. These could be one of two sources. One is, salts attributed to 'deliquescence'. Hygroscopic Salts, which are associated with this, for example Calcium Chloride, Potassium Hydroxide, and Sodium Hydroxide, are substances absorbing moisture from the atmosphere. These will deliquesce, if the air is humid enough. This often brown coloured stain is mistaken as damp. When in fact it is vapour bound salts condensing on the wall, if the conditions are right. Given the right temperature, evaporation can assist in this respect. Indeed, the constant cold/warm syndrome of central heating, is the enemy of such situations. A constant warm environment, with good insulation and air flow characteristics is the target to aim for. There may be a consideration, for future refurbishment, including attention to, insulation and air circulation, both of which are minor problems at the moment. The second source concerns open fire places, which over the years deposit salts

into the brickwork, or more correctly are absorbed into the brickwork. These can be stubborn to remove, and frequently mar successive decorating layers. These salts are trapped in the wall materials and plaster, removing the plaster can occasionally, at least partially remedy this phenomenon. There is a system, by way of 'poulticing' these marks, but in reality, physically and chemically, this is only temporarily successful, as it drives the salts further into the brickwork, and into the 'pores' and 'micro pores', eventually causing 'degradation', by salt concentration in the 'micro pores'. This process, has the tendency to 'clog' up the 'micro pores', by 'capillary suction', in a sense a self/perpetuation of drawing in more and more moisture, which in turn clogs or breaks down the walls of the micro pores. Not a good idea in the fabric of the building.

In addition there were examples of 'mould' on some walls, this is almost certainly connected to an air flow situation, easily remedied. As would be expected, the formation of this had condensed in the corners, a typical reaction.

Looking further into readings taken within the dwellings. The cellar, at No3, produced a high but not too high 'Relative Humidity' reading of 80% (Normal 20%- 60%), giving a Dew Point of 6 Deg C, all things considered not the worst result. (Dew point is the saturation temperature of moisture within the air. The temperature at which, vapour changes into liquid and condenses (condensation). Interestingly, the temperature was 12 Deg C, two reasons for this, firstly below ground in certain conditions temperatures remain up, and secondly, there appeared no evidence of underfloor insulation, consequently, heat is passing to the cellar. The reception rooms, at all three properties, of course gave better readings, with temperatures of 14-18 Deg C and Relative Humidity of 48-52 and a Dew Point of 4-40. Overall, well within parameters.

In conclusion, as far as is possible to tell, there was and has been no lasting damage within the fabric of the building. Certainly, there is a distinct absence, of the obvious signs. However, it is important to state, that protracted neglect of water ingress, can only be seen as very negative to the fabric of the building. Further, the situation is exacerbated by the soil type.
It may be prudent at this stage to install a new DPC, as this is not helping matters, with capillary moisture rising up the brickwork, which examining the existing DPC at No 3 and at No2, may well benefit from replacement. (This assessment we considered did not conflict with the flood water problem, the rising damp being a 'stand alone' issue, it being present where there was no influence of flood water).
Upgrading the existing storm outfall with additional sub-soil drainage, can only benefit the situation, which is clearly, dyer.

RECOMMENDATIONS.

1 Contact the Local Authority, and ask for a cleaning of the ditch outfall, and request the provision of a Silt Trap before pipework to the water course. (If requested we can approach the Local Authority on your behalf, which of course is beyond the scope of the survey).

2 Introduce sub-soil drainage, complete with a Silt Trap and connect to the existing storm water apparatus, which seems efficient. This across all three frontages and connect to the outfall at No3.

3 Install a new DPC using the 'Dry Rod' method. (This is more effective and less disturbance) It is not always necessary to re-plaster totally, using the dry rod system, though some re plastering will be required in the extensively salt damaged areas. This be applied across all three frontages.
Walls should only be re plastered where, the surface is in less than 'sound condition', as per B.S.6576 2005. The aim is moisture 'equilibrium', as much salt/moisture evaporation as possible, by delaying plastering. BRE (Building Research Establishment) Digest 245 states, 'the wall should be allowed to dry as long as possible'. Something to adhere to under the circumstances.

4 Ensure air flow on internal walls

5. It is understood that the Cellar at No3 is not to be plastered, since this has not been done previously. This is just as well, since a protracted evaporation period is essential.

6. Consideration should be given to refurbishment works, in the future, to include, further insulation, air flow improvement, and temperature 'equilibrium'.

7. Maintenance to brickwork and benching to the Man Hole at No3.

Hopefully the content of this report is understandable. However, if any part of it is confusing, then please contact and we will endeavour to explain. Unfortunately, 'Soil Mechanics', Drainage, and Building Materials are a complicated scientific subject, hopefully we have explained adequately.

Regards

Peter G Edge-Stenson/ Civil Engineer.

Smith/Bramwest