

**IN THE HIGH COURT OF NEW ZEALAND
INVERCARGILL REGISTRY**

**CIV 2012-425-596
[2015] NZHC 2057**

BETWEEN DAVID ALLAN CURRIE AND
 LYNETTE FRANCES CURRIE AS
 TRUSTEES RESPECTIVELY OF THE
 D A CURRIE FAMILY TRUST AND
 THE L F CURRIE FAMILY TRUST
 Plaintiffs

AND SCOTT HAMISH GORDON
 First Defendant

AND SOUTHLAND DISTRICT COUNCIL
 Second Defendant

AND DAVID ALLAN CURRIE AND
 LYNETTE FRANCES CURRIE
 Third Parties

Hearing: 4-13 May 2015

Further
Material: 8 June 2015

Counsel: R G R Eagles for Plaintiffs and Third Parties
 C Chapman for First Defendant
 P A Robertson for Second Defendant

Judgment: 28 August 2015

JUDGMENT OF SIMON FRANCE J

Introduction

[1] The plaintiffs owned a residential dwelling that was built for them in 2004 by the first defendant. Around July 2009 cracks started to appear in the internal walls and doors became out of alignment. It is common ground that the reason for this happening is that the house's concrete slab floor has sunk within the perimeter foundations. The perimeter foundations themselves are fine; it is just that for some reason the floor of the dwelling has started to sink. It is clear that something has happened under the floor to cause this to happen.

[2] The plaintiffs bring this case alleging that:¹

- (a) the builder was negligent in the way he prepared the site under the floor; and/or
- (b) the builder was negligent in the type of fill he used under the concrete slab; and/or
- (c) the Southland District Council (the Council) was negligent in its inspection by allowing these two errors.

[3] A brief summary of the issues can be given. Before a concrete pad is laid, the ground must be prepared. This will involve taking at least all the existing grass and vegetation away, and going down about 75 to 100 mm. Sometimes it may be deeper, but that much is the minimum. Fill, using some form of gravel, is then put in and compacted down so that one ends up with a solid base. The concrete pad is then poured on top of it.

[4] Since it was realised that the floor of this house has started sinking, there have been investigations, and two things have been established:

- (a) first, a void has developed between the top of the fill and the bottom of the concrete pad. For some reason the fill has sunk down, creating

¹ The plaintiffs sold the house in a damaged condition and seek to recover the loss in value.

the void. Eventually the concrete floor, to varying degrees, has been falling into the void; and

- (b) second, there is a significant degree of intrusion of the fill into the ground on which it was placed. The plaintiffs' case is that this did not happen when the fill was first put in but has occurred over time, and explains the void developing.

[5] These two observations are what underlie the plaintiffs' case. They claim there are two identifiable causes of the floor sinking which represent human error by Mr Gordon, the builder. The defendants disagree, and say the cause is nature; unexpectedly the ground beneath the fill has compacted due to its unusual composition.

[6] The first claimed error is that it is said Mr Gordon did not excavate before laying the fill. Instead he left all the grass and vegetation in place and put the fill straight on top of it. If that did happen, there is little doubt it could explain what has occurred. The grass, at the time the fill was put down, would act as a membrane. The gravel would just sit on top of it. Eventually, however, the grass and vegetation would rot and decompose. It would ultimately disappear and as that happened the fill would sink down to replace it, with the consequence that a gap is created between the top of the fill and the bottom of the pad. The defendants do not dispute the theory, but do contest the premise. Mr Gordon says he did excavate first.

[7] The second claimed error is the type of gravel that was used as fill – it is known as pea gravel. Its use for this purpose has been common in the Southland area, but in this case it is disputed whether that is permitted under the applicable Building Standard. A characteristic of pea gravel is that it is smooth and regular in size. For those reasons, unlike mixed size gravel, it cannot be compacted. One witness said it is like trying to compact marbles. Because it cannot be bound to itself by compaction, there are inevitably little voids left within the gravel. The plaintiffs' experts say this has allowed, with assistance from a fluctuating water table, the underlying soil to work its way into the voids creating capacity for the fill to drop. The defendants say the theory is flawed, and in any event it is not something that can

be laid at their feet. Pea gravel has been used for many years and there has never been a problem.

Construction of a concrete slab-on-ground

[8] There is no dispute as to how these concrete slab-on-ground pads should be built. There is an applicable New Zealand Standard (NZS 3064) (the Standard) which, if complied with, means the construction will meet the Building Code requirements. The Standard contemplates that the site will first be cleared before any construction is done, but the evidence suggests a common different practice.

[9] With this type of construction, the perimeter walls carry the building load. What happened here, and commonly, is that the perimeter walls were first prepared and built. Normally the walls will be inspected at this point. Once approved, the ground inside them is then cleared in preparation for laying the slab. The advantage of this sequence is that the site becomes less muddy. The grass and topsoil are only removed at the same time as they are immediately replaced by fill.

[10] Once the ground has been prepared, fill in the form of gravel is put down and compacted so that a firm base is created. The depth of the fill will be dictated first by the amount of excavation that has been done as part of the site clearance. Obviously the deeper the excavation, the more fill is required. The other factor determining the depth of the fill is the height at which the floor needs to be. In the present case, because the site was prone to flooding, the consent required the floor of the house (ie top of the concrete slab) to be 600 mm above high ground level. A slab is 100 mm thick, and below it there will be polystyrene. So the combined thickness of those is assessed, and fill put in to bring the level up to the necessary height within the perimeter walls.

[11] Once the fill is put in place, there is then placed on top a polythene layer, followed by the polystyrene and reinforcing mesh. At this point the site is inspected before the concrete floor is laid.

[12] The Standard provides that the permissible amount of fill is between 75 mm and 600 mm. If it does not come within those parameters, a specific engineering

design is required. Here, on the assumption that an excavation of 75 mm to 100 mm would be done, the assessment was made that the amount of fill (once one took into account the thickness of the slab and polystyrene) would be less than 600 mm and that accordingly the construction could be done within the Standard. A specific design was not therefore required.²

[13] Returning to the requirement of clearing the ground of grass and vegetation before fill is used, the Standard provides:

3.5 Site preparation

3.5.1

Before a building is erected on any site, *all rubbish, noxious matter, and organic matter shall be removed from the area to be covered by the building.* (emphasis added)

3.5.2

In suspended floor construction, (but not in slab-on-ground construction, refer section 7) firm turf and close-cut grass may remain provided that for the purposes of complying with 3.3.5, *cleared ground level* shall be taken as the underside of soil containing organic matter.

[14] A key factual dispute in the trial is whether Mr Gordon, the builder, complied with the obligation in 3.5.1 to remove all organic matter. The primary issue as put by the plaintiffs is whether he cleared the grass and vegetation at all before laying in fill. A secondary issue is whether, if he did clear the grass and vegetation, he did so in a manner that complies with the Standard's requirement to remove all organic material. A related issue to this is then whether any non-compliance was causative of the damage.

[15] The second major trial issue is the material that was used as fill, namely pea gravel. The evidence establishes it has routinely been used for fill in the local area. A trial issue is whether it complies with the provisions of the Standard. The Standard requires that all fill be compacted after each 150 mm layer. As noted earlier, pea gravel cannot be compacted. If this commonly used fill is not compliant with the Standard, issues arise as to whether it was an alternative to the Standard

² During trial an application was made to amend the pleadings to allege that the design meant that more than 600 mm of fill would be required, and that accordingly, a specific engineering design should have been required by the Council. I declined the amendment application. Separate reasons are available.

approved by the Council, and either way, whether its use is a reason why the slab has sunk.

Issue one – preparation of the site

Was there removal of grass and vegetation?

[16] The starting point is that removal of the grass and vegetation is a core requirement. No one could really suggest why a builder would not do it. The effort involved is at most a day, using a digger that will need to be there anyway in order to put the fill in place. It would be extraordinary for an experienced builder to decide not to remove the grass, and would represent a significant malpractice. The consequence, as is alleged here, is that the grass and other organic material would decompose over time, inevitably leading to settlement.

[17] Mr Gordon says he did on this occasion what he habitually does. Using his own digger he took a standard scraping of the grass. This is about 75 mm to 100 mm and pulls with it any attached roots. Because the perimeter walls are in place it is not possible for the digger to get it all, so a second person needs to be on the ground with a spade to do areas such as the corners.

[18] The three builders involved in the work – Mr Gordon, Mr Stephen Leighton and Mr Brian O'Connor all testified that the grass was removed. Mr Leighton was foreman on this job. At the time he had been a builder for 25 years; it was he who wielded the spade. Mr O'Connor worked on the site beforehand, but did not assist with this phase. However, he returned to the site at the time the concrete floor was to be poured. He recalls seeing piles of spoil (ie the removed grass, vegetation and inevitably some topsoil).

[19] I saw no reason to doubt the evidence of these witnesses; their bafflement at the idea that one would not remove the grass and vegetation was genuine.

[20] The contrary evidence on which the plaintiffs relied was not convincing. It consisted of four main threads – the lack of evidence of sufficient piles of dirt or spoil such as would have been generated had the scraping been done; second, visual

observations made of the sub-strata when it was excavated in 2013 to 2014; third, analysis of the organic content of samples of soil taken from under the fill, and fourth, calculations by Mr McMillan as to where the original ground level must have been. The import of this evidence would be to say the top of the pit was not 75 mm to 100 mm lower than the original ground level as it should have been if the scraping was done. I address each in turn, noting however that conclusions on one could be influenced by inferences drawn on the other. For example the lack of visual evidence of excavation might take on more importance if Mr McMillan's calculations merited significant weight.

[21] The first topic is the lack of evidence that there were piles of grass and vegetation at the site as one would expect had the grass removal been done. The evidence was that for a house of this size, the scraping work would produce several small truckloads of product.

[22] As previously noted, there will be Council inspections at the time the perimeter foundations are completed, and then again before the concrete pad is laid. However, by that time the fill will be in place, as will the damp proof membrane, and reinforcing steel. So an inspector will typically not be in a position to see the excavated site. To compensate for this I am advised that a builder will leave evidence of the excavation on site so the inspector can be satisfied that it has occurred.

[23] The plaintiffs rely on photographs of the site taken around the time in which there is no evidence of the expected piles of excavated material. They note also rely upon vagueness of the defendant's evidence as to what was done with the excavated material, and submit it reflects the fact that excavation was not done.

[24] Turning first to the photographs, considerable trial time was spent on consideration of the one pile of material that could be seen within the photographs. It was clear that it was insufficient to represent the entire produce of the necessary excavation, but it did appear to represent an example of some excavation. I accept the photographs do not show what would be produced by a proper 75 to 100 mm scraping, and if the one pile represented all that had been done it would be woefully

deficient. However the photographs were not taken at the time for the purposes of creating a continuous record. Rather, they appear to be a somewhat random collection of photos.

[25] It is not possible to infer from the photographs that the excavation was not done. The piles of grass and dirt may not be in picture or may have been removed. It seems likely that the visible pile was the one left for the inspector's benefit. It is relevant to note at this point that if excavation was not done, the Council inspector would have had to have to overlook the lack of evidence, or ignored its absence. The relevant inspector, Mr Wild, was a witness. There was nothing in his evidence or accompanying record keeping that caused me to think he would do either thing. He struck me as a person who was careful in carrying out his obligations. Relevant to this conclusion is the fact that Mr O'Connor believed he saw some piles when he returned to the site.

[26] As for point about the general vagueness of the defendants' witnesses, there is nothing suspicious about it. The reality is that the build took place almost 11 years and countless projects ago. A better recollection is not to be expected.

[27] Overall, the nature of the photographs does not cause me to consider the excavation was not done. They are not a complete continuous record, do not cover the full site, and contain evidence of a pile that might well be the product of excavation. If no excavation were done the inspector would have had to ignore the fact or to have forgotten to check. I find neither to be likely. It is much more likely that the pile in the photographs is evidence of excavation and is what the inspector relied upon. Further, there is no sensible explanation to support the proposition that the pile, if the product of excavation, represents the entire product of that expectation. By what method only that much could be produced was not explained, let alone any theory being ventured as to why only that much would be taken.

[28] A second item of evidence relied upon by the plaintiffs were visual observations of organic material being present in samples taken from the strata under the fill. By way of background it needs to be explained that there was an excavation pit dug in the floor of the garage of the affected property. Within this pit the concrete

slab and attached polystyrene were removed, and then also the layer of fill. This had the effect of exposing the ground beneath the fill. Samples were then extracted on different occasions – by an exhaust pipe being driven in and pulled back out, by a more professional method using an auger to obtain samples at sequential 100 mm depths from 0 to 600 mm and on another occasion by digging a shovel into the exposed top.

[29] The two witnesses placing weight on what could be visually observed are Mr Graeme McMillan, an engineer engaged by the plaintiffs from the outset, and Dr Graeme Salt, a geotechnical engineer who was brought in at a later stage. I will be commenting later in more depth on the expert evidence. At this point I refer only to their evidence that the fine traces of hair-like organic material that they observed was significant.

[30] At this stage I am addressing the plaintiffs' primary proposition that no scrapings or grass removal at all was done. As regards that, these visual observations of the two witnesses did not assist the plaintiffs. There are several reasons:

- (a) there was complete confusion as to what samples, taken where and when, were the subject of observation. It emerged that Dr Salt had only been to the pit once, in late 2014, on which occasion the various holes were full of water. So the samples he could recall seeing must have been taken some other time, but when and where he saw them is not known;
- (b) there was no evidence to explain the significance of being able to see the very fine hair-like root traces. Neither witness had expertise, nor the evidence to establish any reliable message from this. It was not at all clear if this observation of fine hairs was unusual or unexpected, let alone suggestive of no grass removal at all; and
- (c) an incident involving Mr McMillan undermines the reliability of his evidence on this aspect. At one point prior to trial Mr McMillan sent

to Mr Gordon, the first defendant, photographs of lumps of clay containing very obvious signs of grass material. The photographs literally spoke for themselves concerning whether grass had been removed. Palpably it had not. Based on these photographs, Mr McMillan urged Mr Gordon, whom he knew, to settle the case. As it happens, however, the photographs were not at all connected to the pit, and indeed Mr McMillan is not sure where the samples in them came from. I accept it was a genuine mistake on his part, but the error is illustrative of the haphazard record keeping that permeated his evidence. Further, it raises real doubts about the value of the evidence on the point.

[31] Accepting as I do that it was a genuine error, then it must be that at the time he sent the photographs to Mr Gordon, Mr McMillan thought they represented what ground would look like if grass had not been removed. He obviously thought the photographs proved the plaintiffs' case. As it happens, none of the samples or photographs of samples actually taken from this site look remotely like these photographs. Yet at trial Mr McMillan persisted with the idea that the wholly different looking samples from the present site were nevertheless equally suggestive of non removal of organic material. When taxed with this apparent inconsistency, Mr McMillan explained that he now thought the images captured in the photographs he wrongly sent were not at all how things would look if grass removal had not been done 10 years prior. This complete change in tack was not adequately explained and his evidence on this aspect could not be given weight.

[32] A third item of evidence relied upon by the plaintiffs were calculations done by Mr McMillan of where the natural ground level was and whether the height of the exposed layer at the top of the pit was consistent with 100 mm of grass, vegetation and topsoil having been removed. The proposition was that the top of the pit should be 75 mm to 100 mm below the normal ground level if Mr Gordon's evidence was true. I prefer to address this evidence more fully once I have discussed my general assessment of the plaintiffs' expert evidence. Suffice to say at this point that it is not evidence which I found persuasive.

[33] Finally there is evidence of the level of organic content in the clay/soil that was taken from the top of the pit. The initial purpose of identifying the organic content seems to have been to bolster the proposition that no grass removal at all was done, but the results were then used to develop a secondary proposition that the proven organic content meant there had been non-compliance with the Standard, which requires removal of all organic material.

[34] The independent testing of the organic content of the samples was done by a laboratory which reported its findings to Mr McMillan, who in turn incorporated the results into his evidence. The key result was that in samples taken at the excavated pit, the organic content 40 mm down was 9.5 per cent in one sample and 8 per cent in the other. The amount of organic content then decreased as the samples went deeper:

Sample one:	40 mm	=	9.5 per cent
	100 mm	=	8.2 per cent
	150 mm	=	7.0 per cent

Sample two:	50 mm	=	8.0 per cent
	100 mm	=	7.0 per cent
	150 mm	=	5.7 per cent
	200 mm	=	5.2 per cent
	250 mm	=	4.8 per cent
	350 mm	=	2.5 per cent
	450 mm	=	1.5 per cent

[35] For comparison purposes, two samples were taken from spots on the property some distance from the building site. As best I can ascertain, in relation to these external samples the grass was first removed and a reading taken at 50 mm below the surface level – the organic content of these samples was 10.5 per cent in one and 13.2 per cent in the other. The proposition then advanced by the plaintiffs is that the figures obtained from the samples under the garage are sufficiently similar at 50 mm to the readings from the external samples to indicate little or no removal of grass.

[36] This evidence, like much of the expert evidence presented by the plaintiff, was unsatisfactory. There is no reason to doubt the correctness of the readings, but no one with appropriate expertise was called to interpret the results. Put simply, no one with relevant expertise sought to say that a 9 per cent organic content is indicative of some grass being taken, or no grass being taken, or of 75 mm of grass and soil being taken. Nor, to project this point through to the issue that actually matters in the case, did anyone with sufficient expertise seek to explain what dangers, if any, are presented by an organic content of the levels disclosed.

[37] Picking up briefly on this last point, Mr Chapman made the fair point that there needed to be some better explanation of what “organic content” might include. He cited the possibility of leachate being present and whether that would register. If the results were being advanced as a sign of a problem that might have contributed to the concrete pad subsiding, he submitted much clearer evidence on the results was required. I accept that submission.

[38] Mr McMillan and Mr Guerten, a defence expert, both indicated that when engineers do a specific design they aim to dig down until a 3 per cent organic content point is reached. Neither attributed any magic to that figure other than that it was common practice. There was no evidence, for example, about what greater risks are presented by, for example, a 5 per cent content nor whether those risks apply equally to concrete slab-on-ground construction. I also note that on the one sample where the organic content of the strata below the pad was tested to that depth, 3 per cent would have required excavation to around 350 mm. I got no sense from the totality of the evidence that such a depth of excavation would generally be expected on this sort of build.

[39] To summarise this aspect, I accept that the organic content is as shown in the results of the laboratory testing. Beyond that the plaintiffs have failed to demonstrate what significance should be attached to it.

[40] Overall on this topic the plaintiffs set themselves a difficult task. Removing the grass, vegetation and topsoil to a depth of at least 75 mm to 100 mm is a very basic, fundamental construction step. It would, as already said, be extraordinary for

a builder not to do it. There was no chance of it being an oversight on Mr Gordon's part. First, the fill needs to be put over the whole site. One could not possibly overlook the presence of grass through that whole exercise. Even less so could two builders overlook it. Further, the fill is delivered and left outside the perimeter foundations in recognition that the grass will have to be first removed. That is what happened here, another point that illustrates that Mr Gordon was alert to the need to remove grass. The plaintiffs' proposition has therefore to be that Mr Gordon deliberately did not remove grass and topsoil.

[41] Why he would not do so is unclear. It would be thoroughly unprofessional, and not particularly cost-saving. Further, Mr Currie was his friend and indeed subsequent to building this home, they together built an investment property. It is inconceivable he would choose to undertake such an exercise of malpractice on the home he was building for his friend.

[42] Bearing in mind this background context, there was then direct evidence from three people that the grass has been removed. Further, if the grass had not been removed, the inspector would have had to not check, or ignore the point. Neither is likely. Matched against this package, the plaintiffs could rely only on inferences sourced in incomplete photographic evidence, some unconvincing, poorly documented, visual observation of samples, and some science about the organic content of the soil, concerning which no authoritative interpretive evidence was led. I accordingly answer the first key factual issue in favour of the first defendant. I am satisfied that a standard scraping of 75 mm to 100 mm of grass, vegetation and accompanying topsoil was taken.

Removal of "all" organic material

[43] The modified alternative submission of the plaintiffs was that a scraping of 75 to 100 mm did not meet the obligations of the applicable Building Standard. It is plain that the Standard, on its face, suggests all organic material is to be removed (see [13] above). None of the witnesses, however, suggested this could be read literally, and it is not clear to me on the evidence whether it is possible to reach a zero organic content, or at what depth that would be achieved. A difficulty, however,

is that once it is accepted the rule cannot literally be that all organic material under the surface beneath the site is to be removed, the evidence I have does not provide a basis on which I can authoritatively say what is meant by the wording of the Standard.

[44] The general thrust of the evidence is that a scraping of 75 mm to 100 mm is a standard starting point, and then it seems, one looks at what has been achieved and assesses whether more is needed. Any obvious roots must be removed if the scraping has not done so. Sometimes, I gather, the nature of the soil or clay thereby exposed may give rise to concerns, and advice will be sought. But most times, 75 mm to 100 mm will be seen as sufficient.

[45] Consistent with this overview, one can point first to the standard itemised inspection checklist used by the Council inspectors. One of the matters to be checked is whether “Topsoil 75 mm to 100 mm” has been removed. Next, there was the independent evidence of Mr John Mouat, a builder of more than 30 years experience who was called by the plaintiffs. He was asked in cross-examination about the normal practice as regards removal of grass and topsoil:

Q. Now there’s also been some discussion about what you have to remove from the surface before you pour the pea gravel and there’s a provision in the code that you’re probably aware of which requires all rubbish, noxious matter and organic matter to be removed?

A. Yes.

Q. And what in practice does that mean for the builder who is scraping the ground in order to preparing for pea gravel?

A. Right, um, it certainly includes removing any turf or grass or weeds or your tree roots or whatever you might come across there, yeah.

Q. Yes, so the council for example has a box on its building inspector form which refers to the need to remove 75–100 millimetres of grass and topsoil –

A. Yep, that would be –

Q. – is that what the average builder considers needs to be done in order to prepare?

A. Yeah that would be normal, yes.

Q. That would be bog standard in Southland?

- A. Yes I would suggest so, I mean, there's obviously different soils and that, I mean if you are concerned about it, I mean you would obviously take some more.
- Q. So when you did that you might encounter something interesting in which case you would perhaps need to talk to somebody about whether some further work might be done?
- A. Yes.
- Q. But if you remove 75 to 100 millimetres and there was nothing exceptional under that then that would be enough?
- A. Yes, that's right.
- Q. We don't know anything about the Invercargill City Council, which is different to the Southland District Council, but is the approach of the Invercargill City Council the same as the Southland District Council?
- A. Very much, yes.
- Q. So it's not as if the builders are encountering a different point of view from the Invercargill City Council to the Southland District Council?
- A. They have their differences, but no not in that case no.

[46] Next, the plaintiffs called a different expert to comment primarily on the Council's inspection obligations. Unfortunately his evidence was coloured by a desire to prove the consent was flawed from the outset as the level of fill would necessarily exceed 600 mm. This in turn would mean a specific design should have been required. This focus was unfortunate because it was not a pleaded defect.

[47] That aside, Mr Saul also commented on the issue of removing grass and vegetation. His observation in his evidence-in-chief (albeit as part of his desire to show the 600 mm maximum would inevitably be breached) was:

- c) The builder (First Defendant) should have removed vegetation in the topsoil. This would have been at least a 75-100mm layer exacerbating the fill requirement. Indeed, as NZS 3604 required the removal of 'all organic matter' this could have been substantially more as even grass roots can easily penetrate 150mm deep into soil.

[48] In cross-examination Mr Saul accepted that removal of 75 mm to 100 mm was an absolutely standard practice which he himself followed when he was a builder. He surmised that in the present case Mr Gordon's failure to remove grass

and topsoil (an unarticulated assumption by him which underlay his evidence) was because Mr Gordon did not want to exceed 600 mm of fill and be required to get a specific design. It was not clear to me why Mr Saul thought Mr Gordon, if concerned about this, would indulge in such poor building practice rather than just exceed the 600 mm maximum, but Mr Saul's opinion on this issue is not really of moment to the case. What can be noted is his acceptance, along with the other witnesses that the standard practice of builders is to take the 75 mm to 100 mm scrape.

[49] All this leads to two conclusions which are sufficient for the purposes of the case. The first is that all organic content in the Standard is not generally interpreted literally. What exactly it means, however, I am not in a position to say. The second conclusion is that Mr Gordon's removal of 75 mm to 100 mm was standard industry practice which would generally be seen as sufficient unless the particular site indicated more was required. I am satisfied for reasons already given that he took that standard amount. If, and I emphasise it is an "if", that practice did not strictly comply with the Standard, nothing in the evidence supports the proposition that it was causative of the damage.

Initial liability discussion

[50] The proposition that no grass had been removed was a central plank in the plaintiffs' case. To illustrate this centrality, I refer to the evidence of another of the plaintiffs' experts, Dr Graeme Salt. Dr Salt is a geotechnical engineer who identified five contributing causes for the floor sinking. Having done so, Dr Salt attributed maximum and minimum values to the extent to which each cause could individually have contributed to the sinking:

- subgrade consolidating 10–20 mm
- seasonal wetting and drying 5–10 mm
- turf and roots rot 10–20 mm
- intrusion occurring later once unremoved turf rots 20–40 mm
- earthquake damage 10–20 mm

[51] Brief comment on the last two options is needed. In relation to the fourth option, which is that there has been deferred intrusion of the gravel into the subgrade subsequent to the rotting of the unremoved grass, the Commentary in Dr Salt's list records:

Had the ground been stripped, much of this intrusion would have taken place immediately as the pea gravel was placed (in winter) and more as the weight of wet concrete came on to it. The presence of turf preventing intrusion during construction sets up the site for longer term damage. *If the intrusion occurs at the outset when placed, that is fine.* (my emphasis)

[52] My conclusion that the grass and roots were removed brings into play the first and third sentences. The import of those is that intrusion of the pea gravel into the soil would have occurred at the time the pea gravel and concrete were laid. This scenario corresponds exactly to the opinion of the defence geotechnical engineer, Mr Guerten, as to what occurred at the time the fill was placed. The point should also be made that to the extent this intrusion of the pea gravel into the soil occurs when the pea gravel is laid, it is corrected at the time. If a certain amount of gravel penetrates into the ground below, more gravel will necessarily be added on top until the desired height is achieved. Thus, intrusion of the gravel into the ground, if occurring when the fill is laid, cannot account for the void.

[53] The last of Dr Salt's five contributors is earthquake damage. The relevance of this is that it was immediately after an earthquake that the internal cracks in the wall were first noted. However, all parties agreed that the earthquake was not a cause of the sinking. This was the plaintiffs' position despite Dr Salt's graph suggesting it was a contributor.

[54] The end result of this is that three of the five contributors (numbers 3 to 5) identified by the plaintiffs' expert are not relevant on the facts as I find them to be. This accounts for 40 to 80 mm of the 55 to 110 mm band identified by Dr Salt. Further, the primary contributor left, option 1, is the primary cause advanced by the defence expert, namely consolidation of the subgrade under the fill (Dr Salt's option one). Crucially, that is not something for which the defendants are legally responsible.

[55] Where this leaves the plaintiffs is with one contributing cause which could possibly be linked to the defendants (seasonal wetting and drying). Of itself this is obviously not the defendants fault, but it is submitted by the plaintiffs that the wetting cycle becomes relevant because of the fact that pea gravel was used as fill. I will return to this later. For now, two points emerge. First, only one of Dr Salt's causes remains of assistance to the plaintiffs, and second, the extent to which it could contribute on Dr Salt's assessment is so low (5 to 10 mm) as to not account for the void that has developed. This highlights the centrality to the plaintiffs' case of the unsuccessful proposition that grass and vegetation was not removed.

[56] The idea of the grass not being removed was also central to the evidence of the plaintiffs' other expert, Mr McMillan. For that reason the value of his evidence is lessened. However, I am obliged more generally to observe that I am not in any event prepared to accord significant weight to Mr McMillan's evidence. Mr Chapman submitted, and I accept, he was not on this occasion a satisfactory expert witness. In general terms, where there was a conflict between them, I much preferred the evidence of the defence expert Mr Guerten to that of Mr McMillan and Dr Salt.

[57] I address first Mr McMillan. There are several reasons why I found his evidence undoubtedly honest but not able to be relied upon. First, I do not consider he understood the requirements of giving expert evidence in this type of litigation context. His record keeping during his investigations was very poor, as was his familiarity with the material when testifying. The case was bedevilled by ongoing confusion over what samples, or photographs of samples, were being used to inform his opinions. When photographs were taken, and by whom, was totally unclear. There was likewise frustrating confusion on Mr McMillan's part about what bore holes he was talking about when referring to samples. For example, when challenged on a chart he himself had prepared (Exhibit B-S001-4827), his evidence contradicted the statements on the chart. He then sought to resolve this confusion by saying, unconvincingly, that some of the captions on the chart were wrong. This incident reflected more generally a lack of proper process as regards recording methodology.

[58] Mr McMillan was responsible for three reports. The latter two formed his evidence; the first written two years earlier was an initial report which reached different conclusions from those he advanced at the trial. When counsel sought to question him at trial about the change, Mr McMillan said he had not read his initial report for two years. This was simply not good enough and again displayed a lack of familiarity with the obligations on experts. It was his material and it was legitimately part of the common bundle. The end result is that I was never clear or satisfied as to why there was a shift from the conclusion in that initial report (which reflects the defence theory of what has happened) to his present evidence which identifies different causes for the subsidence. It was also disappointing that the opportunity was not taken by Mr McMillan overnight while testifying to refresh memory of the earlier report, nor for that matter clarify issues about the photos as he had been asked to. I consider this attitude, together with a lack of preparation, unfairly hampered proper cross-examination.

[59] Concerning the two subsequent reports that were his evidence, it became clear during cross-examination that they had been jointly drafted by he and an associate. Mr McMillan is the principal and properly accepted responsibility. However when challenged on aspects of the reports he resiled from the contents with the observation that it was not his wording and in parts was overstated.

[60] Finally, I observe I did not find Mr McMillan's oral evidence helpful. Too often his answers tried to anticipate a question still to be asked or were used as a vehicle to simply restate what he wanted to say. More can be expected of an expert. This package of issues, sourced primarily I suspect in a lack of familiarity with the standards and preparation required of experts in this sort of litigation, leads me to significantly discount the weight I am prepared to attach to his evidence.

[61] Those general assessments are the reason why I did not place weight on Mr McMillan's evidence about where the natural ground level was (see [28] above). The other concern on that issue was that the methodology did not seem convincing as it involved an assumption of routinely level ground on the site and under the house. Mr Currie, the plaintiff, himself accepted there were variations in the ground heights.

[62] Turning to Dr Salt, I felt with respect that his role as an expert misfired from the beginning. He is undoubtedly an experienced and skilled geotechnical engineer, but the context for his evidence was puzzling. I have already detailed the five contributing causes of subsidence that he identified in his chart. It transpires that this document was prepared by him as a discussion point to assist the parties to move forward. Dr Salt took the view that if he conducted that exercise, the other side would counter with different values for each cause, and discussion could then again progress.

[63] That never happened, yet this discussion document was put in essentially as his evidence. It is not a self-explanatory document and yet his accompanying brief of evidence did not at all seek to explain or expand on it. It was left to oral evidence to try and do this, and the whole exercise was unsatisfactory. This was exacerbated by Dr Salt's apparent misunderstanding that once put in evidence it no longer had this "discussion document context" but was being advanced as expert opinion that the plaintiffs relied upon. This misunderstanding meant Dr Salt was also not properly prepared to give evidence. Some answers given by him hinted at knowledge that may well have assisted the Court but as the evidence emerged I could not place reliance on it, especially once I concluded that the grass had been removed.

[64] These assessments of the evidence of the two primary expert witnesses for the plaintiffs, along with my conclusions on the issue of grass removal, are largely determinative of the proceeding. The inevitable consequence is that the plaintiffs have failed to prove their case. However, for completeness I move on to the second key issue, namely the use of pea gravel.

Pea gravel as a fill

[65] Attention was directed to the issue of whether pea gravel is a permissible fill in terms of the Standard. More important to the case, however, is whether the plaintiffs' evidence shows that its use here is responsible for the damage, and I turn first to that.

[66] Two starting points can be ventured:

- (a) pea gravel has been commonly used in the Southland area for these purposes for many years and has not been known to cause a problem;
- (b) based on a relatively small sample of evidence, it is not generally used for these purposes in other parts of the country.

[67] The problem with pea gravel is that it cannot be compacted. The Standard contemplates fill being compacted in 150 mm increments and that simply cannot happen with pea gravel. Compacting works by forcing irregular size and shape pieces of gravel to bind to each other through pressure. Pea gravel is smooth and regular shaped. It will not bind and it will not compact.

[68] That being so, why might its use not generally have been a source of trouble? The answer would seem to be two-fold. First, it is encased within the perimeter walls so, even though not compacted, it cannot go anywhere. To that extent it still provides a stable base. Second, as Mr Guerten explained, its advantage or disadvantage is its porosity – because it does not bind things can filter down through it. However, with this form of construction there is nothing to filter down – the pea gravel is trapped in its framing, and then on top of it goes a damp proof membrane, polystyrene and a solid concrete pad. It is therefore sealed in.

[69] The plaintiffs' theory through their experts, leaving to one side the removal of grass issue, was that this porosity allowed the substrata to be forced up into the pea gravel by repetitive cycles of water as the water table rose and fell. This in turn, as I understand the theory, allowed the pea gravel to sink further into the substrata. The evidence of this is the intrusion of the pea gravel into the soil. This would not have happened, it is submitted, if a compacted gravel with no voids was used.

[70] The primary proponents of this theory were Mr McMillan and Dr Salt. Even putting to one side the general observations already made on their evidence, I was not satisfied it has been established that this was the cause of the void. There are several reasons, sourced primarily in Mr Guerten and in submissions from Mr Chapman.

[71] First, the theory was said to be evidenced by the intrusion of the pea gravel into the substrata. However, as Dr Salt's chart accepts in the passages already cited, if the grass was first removed, as it was, considerable intrusion will occur when the pea gravel is initially put down, and then a bit more when the weight of the concrete goes on top.

[72] Mr Guerten explained that as the pea gravel is laid, the force of men and a digger working on it, together with the weight of the pea gravel itself, will force the pea gravel into the very soft soil (it being winter). The softer the substrata is, the more intrusion there will be, but a limit will be reached. Resistance from the subsoil will slow and then stop the process. Mr Guerten considered the intrusion was a good thing because the layers are thereby locked together.

[73] I generally accepted this evidence which was consistent with Dr Salt's option 4 on his chart. Mr McMillan did convince me that the effect of the weight of the digger at the time of laying should not be overstated for two reasons. First, in his experience the pea gravel is generally spread by the digger pushing the gravel out in front of it rather than compacting down on it. Second, the force exerted by a digger is not that much more a person walking. I accept these limits, but it must nevertheless be accepted that intrusion will have occurred as a result of the digger, the workers, the weight of the pea gravel and the weight of the concrete. This undermines the idea that the visible intrusion is a result of the annual cycle of the water table.

[74] Second, in relation to that, there was again a dearth of evidence on the water levels. The pit existed for more than two years but no attempt was made to monitor water within it. Mr Guerten was dubious about the theory because it seemed to assume flood level cycles occurring on an annual basis. This seemed unlikely, and

more so in his opinion when, as here, there was a nearby stream which would take water. Mr Guerten may be right in this; I am not really in a position to say on the state of the evidence, but I do consider better evidence was needed from the plaintiffs to establish the correctness of the assumption underlying their theory.

[75] The next reason I do not accept the plaintiffs' case on this is that there is another explanation. As Mr Chapman submitted, the defendants do not have to prove this is the reason, but in my view, the totality of the evidence makes it the most likely cause of the void under the concrete pad.

[76] It appears there is in the Southland area (but not uniquely there) a variant of clay known as blue pug. It may have other names elsewhere. The predominant clay is a yellow clay which provides a sound surface once exposed. By contrast blue pug is much softer, and so prone to compaction over time. There is no doubt that there was a vein of blue pug under the Curries' house. Mr McMillan's various bores kept discovering it.

[77] In his initial 2012 report Mr McMillan concluded:

The test results indicate that the gravel fill was laid on a soil containing a high content of blue pug which has high shrinkage characteristics. As a result the pea gravel has penetrated the soil and caused a drop in the slab level throughout the house.

[78] This conclusion attributes the void to the pea gravel intrusion whereas Mr Guerten would say it is a sinking of the entire fill structure onto the shrinking clay substrata. The common ground, though, is that there is compaction of the blue pug.

[79] Mr McMillan suggested in evidence that his initial report involved preliminary conclusions, and that his thinking had moved on. That is of course entirely reasonable but there still needs to be an explanation as to why the initial conclusions are no longer thought correct. No clear explanation for why blue pug was no longer thought significant was given. Further, as Mr Guerten noted, there has since that report been no analysis of the soil undertaken such as might allow one to debunk the original theory. The reporting of the presence of blue pug continued after

this initial report; it is just that the plaintiffs' witnesses for uncertain reasons lessened their emphasis on it.

[80] It should be noted that in oral evidence Dr Salt rejected the very concept of blue pug. He considered it was just the same yellow clay which had changed colour due to exposure to oxygen. This was contrary to the experience of many witnesses for both sides, including one who had encountered it in the Wellington area. It was obviously a substance known to people such as Mr McMillan. Dr Salt has extensive experience in the region; I can only explain the conflict by concluding he misunderstood what was being talked about. The matter had only arisen in passing in his oral evidence.

[81] A fourth reason why one can discount pea gravel itself as a cause of the void is the lack of any evidence that it has ever otherwise been a problem. Mr Wild, the Council building inspector for this project, gave evidence he was satisfied that pea gravel was an appropriate material. It had been used extensively in the area and no problems had been reported. For the purposes of giving evidence he contacted other inspectors and councils. He advises he believes pea gravel has been used in the area for 35 years. In the last nine years it is estimated inspectors from the second defendant had dealt with between 300 to 500 houses where pea gravel has been used. No issues have ever arisen. His inquiries suggest it is also used in Invercargill City Council and Gore District Council areas with similar reports of no issues.

[82] In conclusion I am not satisfied any subsidence mechanism has been established that is attributable to the use of pea gravel. It is not necessary to conclude the exact cause but Mr McMillan's original focus on the nature of the clay, reinforced by Mr Guerten's evidence, appears the most likely. In this regard it is proper to record there was no evidence that would suggest there was fault in not discovering the blue pug.

[83] These conclusions are depositive of the case. However, it is appropriate to address the balance of the argument presented on this topic of pea gravel.

Does pea gravel meet the requirements of the Standard?

[84] The relevant Standard provides:

7.5.3.1

Granular fill material complying with 7.5.3.2 shall be placed and compacted in layers of 150 mm maximum thickness, over the area beneath the proposed ground slab, so that the total thickness of granular base is not less than 75 mm nor more than 600 mm.

Compact each layer until the material is tightly bound together and does not visibly deform under the weight of a pressed adult heel.

Specific design is required if filling in excess of 600 mm.

7.5.3.2

Granular fill material shall be composed of rounded gravel, crushed rock, or scoria or material approved by the *Territorial Authority* and:

- (a) Not more than 5% shall pass through a 2.2 mm sieve excepting conditions in 7.5.3.3;
- (b) 100% shall pass either:
 - (i) A 19 mm sieve for any fill thickness; or
 - (ii) A 37.5 mm sieve for a fill thickness exceeding 100 mm.

Commentary

C7.5.3.2

Proper grading of granular fill material is important. Excessively fine material such as sand will cause problems with drainage, capillary action, compaction and settlement and must be avoided.

[85] The debate about whether pea gravel is permitted by the Standard is sourced primarily in the requirements of C7.5.3.1. However, I first address an alternative basis for non-compliance advanced by Mr McMillan.

[86] Clause 7.5.3.2 sets out the dimensions that any fill must come within. The accompanying commentary stresses the importance of compliance. Relying on the wording in the Commentary, Mr McMillan placed emphasis on the use of the term “grading”. He explained this was a technical expression used to denote that the product being graded is of variable dimensions, and therefore that is what C7.5.3.2 requires. This reading would be consistent with C7.5.3.1 which speaks of compacting, something that can only be done if the gravel in question is of variable dimensions. Drawing these two threads together, Mr McMillan suggested that

C7.5.3.2 not only requires the gravel to be of the sizes identified, but to consist of a mixture of those available sizes. Pea gravel is uniform in size, so non compliant.

[87] I cannot accept this interpretation. The Standard itself provides that the Commentary accompany specific rules is for guidance and is not part of the Rule. Further, there is nothing in the wording of the Rule itself that at all suggests that the fill must be a mixture of sizes. The Commentary can be read consistently with this since its plain focus is on warning of the dangers of using a fill that is too small in its dimensions. So again, the focus is on size *per se*, and not the idea of variable sizes.

[88] Turning, however, to C7.5.3.1, there cannot be any real suggestion that pea gravel is compliant. There is really no part of C7.5.3.1 that it is capable of meeting:

- (a) it cannot be compacted at all, let alone in 150 mm layers;
- (b) it will not ever become tightly bound together; and
- (c) it will always visibly deform under the weight of a pressed adult heel.

[89] Mr Robertson for the Council submitted that because the pea gravel as a whole is contained within the perimeter wall, as a whole it cannot deform. Accordingly, it should be regarded as meeting C7.5.3.1. I am not prepared to accept this as reasonable compliance – it simply ignores both the concept of repeated compaction at each 150 mm and the standard set for sufficient compaction – the deformed heel test.

[90] As an alternative to a rule in the Standard, the Code permits what are known as “alternative solutions”. The decision on such alternative solutions lies with the Council which must reasonably believe the alternative will meet the performance requirements of the Code. I take it from Mr Wild’s evidence that as inspector he would have approved pea gravel as such an alternative solution had he thought it necessary (which he did not because he believed it was compliant with the Standard).

[91] Issues then arise, however, as to what process is needed, and what degree of formality should exist, for there to be a valid alternative solution. It may be the answer is very little where the alternative is truly a one off exception. Here, however, pea gravel was routinely approved in hundreds of builds. It is difficult to characterise these decisions as ad hoc site by site approvals. Rather, there seems to be a general approval in existence. In such cases one might expect a more formal recorded decision by the Council, with some articulation of why pea gravel is generally an acceptable alternative to the Standard requirement in C7.5.3.1. Further, given, as I understand it, that other types of compliant fill are readily available, one might think that the reasons would also address the need for a general alternative solution at all. None of this exists in relation to pea gravel.

[92] It is not necessary to determine this issue as, for reasons already given, I have not been persuaded that the use of pea gravel in this case caused any loss. I have addressed the alternative solution point to the extent I have only because I am aware the use of pea gravel as fill has been suspended because of this litigation. If it assists, my conclusions on the point are:

- (a) is it not compliant with C7.5.3.1;
- (b) whether it was actually an approved alternative solution in the particular case is questionable. However, had the inspector seen pea gravel as non-compliant, I am satisfied approval as an alternative would have been given;
- (c) I have doubts, given there existed a routine acceptance in the Southland District Council area of pea gravel as fill, that this case could properly be analysed as an example of an individual alternative solution. If, as appears, the approval was rather by way of a more general exception, I consider it would be expected that there would be a formal decision recording the existence of a general exception, why it is regarded as an acceptable alternative and why it is thought necessary or desirable to have a general exception. This last requirement is more debateable in terms of whether it is a necessary

component of an approval, but it is an obvious and legitimate question.

Conclusion

[93] Other matters were raised in the case but they do not require consideration given my conclusions on the fundamental factual issues. Nor do I need to consider separately the position of the two defendants.

[94] The plaintiffs' claims fail because the factual premises on which they are based have not been established. First, I am satisfied that the first defendant did remove grass, vegetation and topsoil to a depth of around 75 mm to 100 mm. Further, if what was thereby left was non-compliant with the Standard in that it did not amount to the removal of "all organic material", there is no evidence to establish this non-compliance was causative of the concrete floor sinking.

[95] Second, the evidence does not establish that the use of pea gravel as fill is causative of the loss suffered in this case. It is not necessary to determine why the floor is sinking, but on the evidence available the most likely reason is unexpected compaction of the substrata causing the fill to sink, and thereby creating a void.

[96] Given these two conclusions, the proceedings must be dismissed. No negligence on the part of the defendants has been shown.

[97] On the basis of what is known to me, I consider costs should follow the event on the scale agreed for the proceedings. I indicate that my present view is that, notwithstanding observations made about some of the plaintiffs' evidence, there is no case for any increased costs. Each defendant is entitled to a separate award of costs.

[98] These indications are intended to assist the parties to bring the matter to an end. If agreement cannot be reached, costs memoranda may be filed. Otherwise, the Registrar will fix reasonable disbursements if necessary.

Simon France J

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