

Board of Inquiry into the McCrae landslide

**Before: The Chairperson,
Ms Renée Enbom KC**

**Federal Court of Victoria,
305 William Street, Melbourne, Victoria**

Tuesday, 5 August 2025 at 10.00am

(Day 12)

**Mr M. Costello KC with Mr A. Di Stefano appeared as Counsel
Assisting.**

**Ms K. Evans KC with Ms E. Pepler appeared on behalf of the
State of Victoria.**

**Ms K. Foley SC with Ms E. Bateman appeared on behalf of the
Mornington Peninsula Shire Council.**

**Ms D. Siemensma appeared on behalf of South East Water
Corporation.**

1 CHAIRPERSON: Mr Costello.

2
3 MR COSTELLO: Good morning, Madam Chair.

4
5 CHAIRPERSON: We have the same appearances as yesterday?

6
7 MR COSTELLO: Yes.

8
9 CHAIRPERSON: We do. Just before you start, thank you,
10 experts, for returning this morning. Can I remind you of
11 what I said yesterday, which is that you're here to provide
12 your honest opinions on very important issues. You are not
13 here to advance a position that suits those who engaged
14 you. You're here to provide your honest opinion. You may
15 have noticed that there are many residents from McCrae in
16 the gallery watching this hearing, and they're here because
17 these issues are very important to them and they're here to
18 hear your expert opinions, only your expert opinions, not
19 your client's.

20
21 Mr Costello.

22
23 MR COSTELLO: Thank you, Madam Chair.

24
25 <HONG VU, CONTINUING:

26
27 <CHRISTOPHER MARTIN JEWELL, CONTINUING:

28
29 <HUGO DOUGLAS BOLTON, CONTINUING:

30
31 <DAVID MATTHEW HARTLEY, CONTINUING:

32
33 <DARREN ROSS PAUL, CONTINUING:

34
35 <STEPHEN LEONARD MAKIN, CONTINUING:

36
37 <DANE RICHARD POPE, CONTINUING:

38
39 <PHILLIP WILLIAM HITCHCOCK, CONTINUING:

40
41 <EXAMINATION BY MR COSTELLO:

42
43 MR COSTELLO: Mr Pope, can I start with you. I just want
44 to deal relatively briefly with two remaining preparatory
45 factors that are points of contention. The first is old
46 fill.
47

1 MR POPE: Yes.

2

3 MR COSTELLO: And the second is the retaining wall, and
4 then others will wish to ask you questions on this topic.
5 But let me just orientate us all. Old fill, which is 17 in
6 the joint report concerning the 5 January landslide and 29
7 in the joint report concerning the 14 November - sorry,
8 14 January landslide - and 29 for the 14 January landslide
9 and 17 for the 5 January landslide, this was a topic that
10 you didn't consider in your causation report, is that
11 correct, old fill?

12

13 MR POPE: No, that's incorrect. It's very much a unit
14 identified in the report.

15

16 MR COSTELLO: Sorry, Mr Paul didn't consider it in his
17 causation report but you did; is that your recollection --

18

19 MR POPE: That's my recollection of it, yes.

20

21 MR COSTELLO: Yes. Okay.

22

23 MR POPE: But I think Darren might want to - I think he's
24 considered fill but not much.

25

26 MR COSTELLO: He has.

27

28 MR POPE: Yeah, yeah.

29

30 MR COSTELLO: He has.

31

32 MR POPE: Yep, sorry. Yep.

33

34 MR COSTELLO: He says in the joint report that he hasn't
35 dealt with it in his causation report but has subsequently
36 considered it and made some comment about it in the course
37 of the notes to the joint report.

38

39 MR POPE: Correct; yeah.

40

41 MR COSTELLO: Does that assist? Now, on this factor, it's
42 a preparatory factor, so there's no suggestion by you that
43 fill is a trigger for the landslide occurring; that's
44 correct?

45

46 MR POPE: That's correct, yes.

47

1 MR COSTELLO: It's just a factor that leads to - is it
2 fair to say to potential for greater slope instability?
3 How would you phrase it?
4
5 MR POPE: No, that's correct. I mean, I - side cast fills
6 or fills over steeper existing ground are quite a common
7 hazard. Like, my team's routinely fixing them on roads.
8 So, yeah.
9
10 MR COSTELLO: I see. And would it be even more common in
11 built-up residential areas?
12
13 MR POPE: In big quantums, no, but in small volumes it's
14 pretty common, yep.
15
16 MR COSTELLO: It was established yesterday in the course
17 of the evidence that fill generally - I'm not speaking of
18 the particular fill at the site of the slide here, but fill
19 generally can have been in place for significant periods of
20 time?
21
22 MR POPE: Yes.
23
24 MR COSTELLO: And still meets the definition of fill?
25
26 MR POPE: Yep, absolutely.
27
28 MR COSTELLO: And do you have any view about the fill
29 here? Is it of varying ages; that is, has some been there
30 probably for quite a number of years and other of it might
31 be more recent?
32
33 MR POPE: Yes. So I identify in my report essentially two
34 fill types, so fill associated with construction of the
35 retaining wall on 10-12 View Point, and then everything
36 else is old fill beneath that layer, and so - I touched on
37 it yesterday - there's - a registered surveyor went I think
38 through there in 2014 and did levels in that area. So we
39 have survey records from a surveyor. We have got a series
40 of LiDAR files that predate the retaining wall, and then we
41 have the evacuated land form from - as in post-landslide.
42 So they're essentially the key surveyed surfaces I rely on
43 to bound where the fill is.
44
45 MR COSTELLO: All right.
46
47 MR POPE: Yep. The significance to me of the old fill is

1 if it wasn't there I don't think we're having a landslide.
2 So that's why I've put it as major.
3
4 MR COSTELLO: When you say old fill, do you have a view as
5 to the age?
6
7 MR POPE: Look, I - in the conclave report we discussed
8 it. It's not convincing that - from aerial photos alone
9 that it was the mid-70s. But I feel it's older than the
10 70s.
11
12 MR COSTELLO: I see.
13
14 MR POPE: Yep. It's got VC pipe, or vitrified clay pipe,
15 the old sewer pipe, in it. It's got galvanised pipe in it.
16 Those materials have been around for a long time. So it's
17 not unusual for that to be there that long ago.
18
19 MR COSTELLO: Right. And so the fill from the 70s alone,
20 even absent any newer fill than that, would to your mind be
21 a preparatory factor of some significance?
22
23 MR POPE: Yes.
24
25 MR COSTELLO: And could you just explain briefly what it
26 is about the fill being at that location that creates the
27 problem that means it is a preparatory factor?
28
29 MR POPE: Essentially the fill has been deposited over a
30 steep existing - the escarpment is quite steep, I think as
31 everyone understands. So that fill has been placed over
32 steep slopes. So, if you apply loading to that fill,
33 fundamentally the load has a lot of difficulty getting into
34 the underlying granites and it must go sideways. In
35 engineering we call it a strain incompatibility, but
36 essentially you load the fill up, it will move a lot more
37 than the granite will by comparison. So you place a load
38 on that fill, it wants to translate down the hill. That's
39 the significance of it. It can translate without load as
40 well, though. So if you had water in there it can move.
41 Yeah. That can be the change in load, is the change in
42 water. Trying not to get too technical levels, but if
43 water levels change the stresses so there's a change in
44 load then it can move from that as well.
45
46 MR COSTELLO: Yes, all right. So, just to be clear,
47 you've viewed this in relation to the 5 January landslide

1 as a major contributing factor, and with that you had a
2 high degree of confidence?

3
4 MR POPE: Yes.

5
6 MR COSTELLO: And in respect of the 14 January landslide
7 you also viewed it as a major factor with a high degree of
8 confidence?

9
10 MR POPE: Yep, yes.

11
12 MR COSTELLO: All right. Thank you. I'm going to ask
13 Mr Paul to comment on this issue now, but before I do is
14 there anything else you wanted to mention in connection
15 with fill?

16
17 MR POPE: Just with the old fill model, I mean, PSM has
18 been subjected to independent peer review of that model,
19 and I don't believe it was flagged as a problem during peer
20 review. Yep.

21
22 MR COSTELLO: Mr Paul, you at least at the time of the
23 conclave had a different view on the question of old fill.
24 You thought that it - well, sorry, not - yes, of old fill.
25 You thought that it was a minor factor and you had a
26 moderate degree of certainty in that opinion. Is that
27 still your view as you sit there now?

28
29 MR PAUL: It is.

30
31 MR COSTELLO: All right. Could you explain why?

32
33 MR PAUL: I looked hard at finding physical evidence for
34 the old fill and couldn't find it, is the simple answer.
35 So it might be worth talking to what things we would look
36 for to identify that something is fill compared to natural.
37 We would look for things like does it contain materials
38 that are non-natural, and I can perhaps show an image,
39 actually, to illustrate that.

40
41 MR COSTELLO: Yes, of course.

42
43 MR PAUL: MSC.5087.0001.0405, which is just some photo of
44 the headscarp.

45
46 MR COSTELLO: Is that from your report?

47

1 MR PAUL: No, that is from the PSM causation report.
2
3 MR COSTELLO: So I think it's 5087.0001.0157, and it's at
4 page 0405. What we're looking for here are two pictures
5 side by side?
6
7 MR PAUL: There's two images on that page, and one of them
8 is of the - yes, it's the one on the left there.
9
10 MR COSTELLO: Yes. Perhaps the picture on the left could
11 be --
12
13 MR PAUL: One of the - the picture on the left would be
14 the headscarp. Okay. Great. So that's an image looking
15 towards 6 View Point Road, and you can see the landslide
16 headscarp. And we can see at the top of the headscarp a
17 darker coloured material. We see there's some fabric sort
18 of within the first few metres below the top of the scarp.
19
20 MR COSTELLO: The fabric. That's the mesh that can go
21 into the ground; is that what that --
22
23 MR PAUL: Yes. That's right. So where the red dot is
24 that is on that material. Now that is certainly fill.
25 I have no doubt that's fill because that contains plastic
26 and rubbish and, you know, fills that don't belong. Below
27 that what's exposed in the headscarp does not contain those
28 materials. So that's one of the things we look for.
29
30 We also look for does the soil type that the fill is
31 comprised of, is it natural to that area or not. That's an
32 indicator it's been brought in. The soils below that
33 interface to me are natural to that area.
34
35 We also can look for, you know, historical evidence,
36 things like aerial photos. So - and old survey. So, for
37 example, I took the 1950s survey, contour survey, which was
38 shown yesterday, compared that to the current surface and
39 couldn't find evidence there that that surface had changed
40 significantly. But it's a 1950s survey. It has the
41 accuracy of a 1950 survey. So couldn't see evidence of
42 that. When I look at that escarpment I can see there must
43 be some fill involved in the landslide because I can see
44 fill at the top. But what I don't have evidence for is
45 that that fill essentially filled that entire hole that we
46 can see in that image. I don't have physical evidence for
47 that.

1
2 Now, if that evidence were to appear, of course that
3 would change my view. But at this point I don't have
4 physical evidence for that entire thing containing fill.
5 So that's the difference.
6

7 MR COSTELLO: Does that mean, Mr Paul, that you and
8 Mr Pope are in disagreement about the contour of the
9 headscarp, how it would - the natural contour of the
10 headscarp as opposed to the contour created by the addition
11 of fill?
12

13 MR PAUL: No, we have a survey from 2017, and that survey
14 from 2017 shows the ground surface. Disagreement is in
15 what's below that surface.
16

17 MR COSTELLO: I see. Mr Pope - Mr Hartley, I will come to
18 you. Mr Pope, there has been mention made by Mr Paul about
19 the absence of materials that one might expect to see in
20 fill. I think in your initial answer you pointed to some
21 materials that you had observed or somebody had observed
22 that were in the soil that helped - led you to the belief
23 that it was fill; is that right?
24

25 MR POPE: I mean, high confidence of what Darren talked
26 about is fill. It's 2 metres deep there. When we - when
27 I - not we. When I took the water sample on the water flow
28 rate - sorry, clear that up, didn't take a sample - flow
29 rate on 16 June, briefly put the shovel into the flank of
30 that bottom left-hand side of the material to the - it's to
31 the left of that shrub that's in the photo, and on two or
32 three - I wasn't in there for a long time, so this is
33 something we need to have a better look at when it's more
34 appropriate to go in there. But a couple of digs with the
35 shovel, I'm in a sand matrix and hit a big chunk of clay
36 that is of alluvial origin, and in that area there's
37 gardening gloves and things. So I'm not convinced it isn't
38 fill.
39

40 MR COSTELLO: So you're not convinced it isn't fill?
41

42 MR POPE: I'm confident it's fill. Sorry, I'll be
43 clearer. Yeah.
44

45 MR COSTELLO: Mr Hartley, you seem to bridge the gap
46 somewhat between the opinion of Mr Paul, who thought it was
47 a minor factor, and Mr Pope, who thought it was a major

1 factor. You thought it was a medium factor. But, like
2 Mr Paul, you had a moderate degree of confidence. Is there
3 anything that you would like to add to the discussion
4 that's already occurred on this topic?

5
6 MR HARTLEY: My conclusions have come from reading the
7 evidence from the other two experts and from
8 the photographic evidence and the maps, you know, supplied
9 by Mr Pope. The asymmetric nature of the geology looking
10 on the plan of the gully would seem to explain the
11 asymmetric nature of 5 January. So that would be where my
12 conclusions basically rest.

13
14 MR COSTELLO: Right. And, Mr Pope, you're in the position
15 that Mr Hartley and Mr Paul are not in of having attended
16 at the site?

17
18 MR POPE: Yes.

19
20 MR COSTELLO: And you've just given some evidence about
21 observations you made. Are your observations made at that
22 time of a strong significance to the conclusions that
23 you've come to on this topic?

24
25 MR POPE: The main fill on the flank there is not so
26 significant as the amount that's up the top, and what
27 I talked about yesterday how - it's very difficult to get
28 that fill over the escarpment and not have it translate
29 down the hill. If I can show you - there's two images - or
30 one image in particular in my report.

31
32 MR COSTELLO: Is this from your report?

33
34 MR POPE: Yeah, appendix C.

35
36 MR COSTELLO: It should be the same document. If you just
37 give the last four digits it will --

38
39 MR POPE: 0388.

40
41 MR COSTELLO: This is an aerial shot of some description?

42
43 MR POPE: Yeah, an oblique view. Yep, you just went past
44 it. So --

45
46 MR COSTELLO: Let's understand what this is first --
47

1 MR POPE: Sure.

2

3 MR COSTELLO: -- because it's sort of clearly distorted in
4 the image. But what type of image is this?

5

6 MR POPE: This is a screenshot from Nearmap's 3D models.
7 So, as I said, they're a rough 3D model, but it gives you,
8 as you can see, a rough view of what's going on. If you
9 look to the trees that I've highlighted in the centre of
10 frame, there's a red line with the triangles on it. That
11 is the mark-up for a break in slope. So if you move up the
12 page from that line you can see what looks like brown grass
13 to me. That zone there - and this is validated by the
14 feature survey from 2014 - it's not particularly or it's
15 not as steep as the other slopes around there. So to me -
16 sorry, the red line is metres north of where we identified
17 the fill in the headscarp photo. So to me I can't see how
18 the facts support that you don't have a tip head pushed out
19 off the escarpment there. That break in slope is metres
20 north of where the headscarp is, and it's not a significant
21 distance down the hill. So it's been pushed out and then
22 the fill has to reel down at repose. Like, you can't
23 cutely tie it in neat to a cute flat escarpment.

24

25 MR COSTELLO: Is there another image you wanted to go to?

26

27 MR POPE: To what David was talking about is 255.

28

29 MR COSTELLO: This is a cross-section?

30

31 MR POPE: Yes, correct. So Mr Hartley touched on this.
32 This is looking up the gully towards, like I said, if you
33 were standing down at - if it was possible - somewhere down
34 near 3 Penny Lane and looking towards - so 6 View Point
35 would be on the left-hand side and 10-12 View Point would
36 be on the right-hand side. The dark line is the - is what
37 has been evacuated by the landslide. The blue is what I've
38 called old fill. There is uncertainty about how much
39 colluvium is underneath all that. We're not sure.

40

41 MR COSTELLO: When you say "all that", do you mean
42 underneath the old fill?

43

44 MR POPE: Yeah, correct. Sorry. So when you look at that
45 the gully itself is what we've described in the conclave
46 report. It's out of balance. So if you were to draw a
47 line vertically on the 15-metre X axis there you can't fold

1 it over and - there's no symmetry there. And from the
2 mapping I've done around McCrae a lot of the gullies are
3 quite symmetrical, especially the ones that have recently
4 had water and recent - and take water as we speak, like
5 Coburn Creek in The Eyrie. They're symmetrical - roughly
6 symmetrical on axis, and it's quite unusual, and I'd
7 challenge any of the experts to take me to somewhere in
8 McCrae where you have a gully like this that's this out of
9 balance. I can't place that from windblown deposits.
10 Like, I can't believe the wind blows in one direction for
11 5,000 years, and I can't believe that you've got
12 preferential landslides in that direction and not the other
13 flank. It just doesn't make sense, and I don't think the
14 facts support it.

15
16 MR COSTELLO: So that leads you to conclude that fill is
17 the only plausible explanation?

18
19 MR POPE: Yes.

20
21 MR COSTELLO: Mr Paul, did you want to make any - you
22 don't have to, but did you want to make any comment on
23 either of the pictures that you've just been shown?

24
25 MR PAUL: The one up there, the difference in my model is
26 you can see the yellow on that model, which is colluvium,
27 and it shows it in sort of a uniform thickness layer
28 extending right the way across where - remember we spoke
29 about yesterday the colluvium in my model was channelised.
30 The volume of fill there - I'm not disputing in any way
31 fill has been pushed over the edge. That's fairly normal.
32 I'm disputing the volume. I would say only there's fill
33 just at the top there. The reason for the asymmetry in the
34 gully is the orientation of the gully. It doesn't come -
35 the paleochannel, sort of my model, doesn't come directly
36 out of the slope. It's comes out of the escarpment at an
37 angle. That's what explains the - you know, like, the
38 problems with the geometry --

39
40 MR COSTELLO: I see.

41
42 MR PAUL: -- (indistinct) exits the slope.

43
44 MR COSTELLO: Mr Hartley, did you want to make any
45 comment?

46
47 MR HARTLEY: Only so much as the - I'm not too sure if -

1 well, I think Mr Paul is alluding to the idea that - you
2 can correct me when I'm wrong - the gully turns at an
3 angle. So basically it approaches the escarpment from a
4 south-easterly - a more south-easterly direction, and
5 therefore the turn is almost like a racing car. It swings
6 around on the outside of the bend.

7
8 MR COSTELLO: Mr Paul, is that accurate enough? It's
9 better that the two of you have this conversation for us
10 all to hear rather than Mr Hartley's evidence preceding on
11 a false assumption, that's all.

12
13 MR PAUL: We've probably got to be clear when we talk
14 about channels, there's the paleochannel, which is the
15 channel that's - if you look at that image we see there
16 would be the channel that's defined sort of almost by the
17 dark black line. It's the one that's got the colluvium in
18 it. And then we're talking about the surface channel,
19 which is the - you know, the more recent one rode into it.
20 So we've got to be careful we're not crossed with terms
21 there. So I'm talking about the colluvial channel. It's
22 the one which we consider the water was conveyed along to
23 the landslide site. That channel seems to come out of the
24 escarpment at an angle, and there's multiple pieces of
25 evidence to do with where the seepage was observed that
26 tell us that's the case.

27
28 MR COSTELLO: I see. Does that assist, Mr Hartley?

29
30 MR HARTLEY: It does, although the initial - the situation
31 at the present time, which would be - you know, as we can
32 see from the cross-section is pretty central. I believe
33 that there are - the drone footage points from 15 January
34 would indicate spots of seepage. Basically if you're
35 looking up the gully from about 1 o'clock through to about
36 10 o'clock, something like that, if you're looking at the
37 centre point of the gully, you're looking there, there's
38 seepage points there. It doesn't quite sit comfortably
39 with me that the 5 January failure, which is so viciously
40 on the right-hand side of this gully, would have failed at
41 the point of which it failed, I mean, just this kind of -
42 this angle of approach from the water.

43
44 MR COSTELLO: And what does that tell you about the
45 question of fill, then?

46
47 MR HARTLEY: It strikes me that on the western side of

1 the gully or the right-hand side of the cross-section, you
2 know, change 18 through to 20, that type of thing, is that
3 there is a difference in soil make-up - you know,
4 consistency, compaction, deposition method - compared to
5 the remainder of the channel.
6

7 MR COSTELLO: I see. Thank you. Mr Pope, Mr Paul,
8 Mr Hartley, a general invitation before I move to the
9 question of the retaining wall. Is there anything else on
10 this topic that you felt it was necessary to mention to
11 assist the chair to properly understand the issue?
12

13 MR PAUL: We looked at aerial photos, tried to find
14 evidence the fill was placed in the 70s. I sort of make
15 the comment that 260 cubic metres of fill, which I think is
16 what the estimate is, is something like, you know, 26 dump
17 trucks coming up over the edge, and I make the point that
18 at that time you had the house at 3 Penny Lane there, which
19 was built in the 50s down the bottom, and I just find it
20 improbable that that volume of material - even in the 70s,
21 under the standards in the 70s, that volume of material
22 would be tipped off the edge above a house I'd find quite
23 improbable.
24

25 MR COSTELLO: Mr Pope, I should just give you an
26 opportunity to respond to that. Have you seen any evidence
27 that indicates when or how this fill would have been
28 placed?
29

30 MR POPE: There's - as I said earlier, aerial photos in
31 the 70s have got disturbance to the vegetation and there's
32 exposed slopes at that time. It's not as blatantly clear
33 as the other landslide that I identified in the 70s from
34 those photos. So in the conclave report I basically accept
35 that the photos don't support it that well as being from
36 the mid-70s, but there's no reason it can't be earlier.
37 Yes.
38

39 MR COSTELLO: I see. Thank you.
40

41 MR POPE: The community as in - not the community. The
42 council, the State, there's a lot of legacy of a lot of
43 fill going into deep gullies in the community. So
44 obviously --
45

46 MR COSTELLO: Generally, not this gully --
47

1 MR POPE: Generalising, yes. But the Mornington freeway,
2 the Margaret Street gully, The Eyrie gully. There is a
3 history of significant backfill in gullies around the town,
4 yep.

5
6 MR COSTELLO: Thank you. There might be other questions
7 on that, but I'm just going to move to retaining wall, and
8 others can ask questions on both topics together. On
9 retaining wall I think you each line up with the same
10 degree of contribution and the same degree of confidence as
11 in respect of old fill; that is, Mr Pope, you're major with
12 a high degrees of confidence; Mr Hartley, you're medium,
13 and I think you've got a low degree of confidence on this
14 one, slightly lower than you did with respect to fill; and,
15 Mr Paul, you view it as a minor factor with a medium degree
16 of confidence.

17
18 So I should probably start with you, Mr Pope, and
19 I might just put something on the screen. Could you just
20 take that - I can't remember which document's up.
21 5087.0001. Could we please go to 0210 of that document.
22 Thank you. Mr Pope, I'm just putting this up in case it
23 assists you. You might have something else you want to go
24 to, but I thought this might be a useful way to start.
25 Once again, just to make it plain, this isn't suggested as
26 a trigger; it's suggested as a preparatory factor?

27
28 MR POPE: Correct, yes.

29
30 MR COSTELLO: Something that to your mind destabilises the
31 slope, it's not causative of slide?

32
33 MR POPE: No, it's not a trigger. It is causative of a
34 slide.

35
36 MR COSTELLO: Sorry, yes, you're quite right. It's not
37 the trigger for the slide that occurred, but it's a
38 preparatory factor?

39
40 MR POPE: Correct, yeah.

41
42 MR COSTELLO: And I won't go back to the semantical debate
43 about --

44
45 MR POPE: Yeah, yep.

46
47 MR COSTELLO: Now, why don't we start by you - this is a

1 retaining wall that was built after the 2022 landslide and
2 obviously before the 2025 landslides?

3

4 MR POPE: The front part of it, yes. Yep.

5

6 MR COSTELLO: And why don't you start by explaining why it
7 is that you're of the opinion that this retaining wall is a
8 preparatory factor here?

9

10 MR POPE: The simplest way to start is with the piers. So
11 they're highlighted in grey, centre frame basically, near
12 the --

13

14 MR COSTELLO: Would it help if I had that blown up? There
15 we are.

16

17 MR POPE: Yep. So basically where the leader is saying -
18 that's fine. Where I've got "tension crack at base of
19 retaining wall", where that's pointing, that's pointing -
20 that's over the - in line with the pier. So in that pier
21 is concrete and a steel upright, and what we found post
22 landslide with the Pointerra Reality Model is you can
23 measure the length of these piles, especially the ones that
24 went down the slope, and what we found is the piles were
25 not long enough to go down into the residual granite, or
26 the XW granite, whichever view you take on that material.

27

28 The effect that that has where the piles aren't long
29 enough to go into what I would call a competent material is
30 any stress applied with the fill above does not have an
31 effective mechanism - there isn't an effective mechanism to
32 transfer that stress into the rock below. So what that -
33 simplest terms is, instead of being a piled retaining wall,
34 then you're looking at a gravity retaining wall. What that
35 means is that the zone of influence of all the fill that's
36 been put there is much wider. So if you had 3- to 4-metre
37 long socket in those piles and they were well down into the
38 granite, the stresses can't distribute down the hill the
39 same as if you just have it all sitting up high.

40

41 So basically what this then becomes is an increase in
42 stress on a series of steep planes. So it's complicated
43 enough putting a wide loaded area near an escarpment. But
44 if you put it over buried steep planes the stability is
45 worse or it's more susceptible to landslide, basically.

46

47 MR COSTELLO: So on that thesis the retaining wall becomes

1 a destabilising force?

2

3 MR POPE: Yes, yep. So that orange zone, if you do the
4 equivalent horizontal stresses down in the green and the
5 yellow layers, it's a roughly 40 per cent increase in
6 horizontal stress there, and it has no means to be retained
7 there. The stress must distribute down the hill.

8

9 MR COSTELLO: The means by which the stress could have
10 been better distributed, on your thesis, is by the
11 retaining wall being sunk lower into the granite?

12

13 MR POPE: Correct.

14

15 MR COSTELLO: With a socket joint, did you say?

16

17 MR POPE: With a socket well into the granite. The extent
18 of the retaining wall would have had to gone into 6
19 View Point to deal with the mass that moved. So it's the
20 socket and it's the extent of the wall as well.

21

22 MR COSTELLO: I see. Can I perhaps bring up another
23 photograph, MSC.5056.0001.0003, and if we could go to 0057.
24 Now, this is an image from the 5 January landslide?

25

26 MR POPE: Yes.

27

28 MR COSTELLO: From the headscarp looking back to the
29 retaining wall, which can be seen up on the left; is that
30 right?

31

32 MR POPE: Yep. Yes.

33

34 MR COSTELLO: So at this point in time there's - it's hard
35 to ascertain how much, but there's an amount of ground
36 between the retaining wall and where the headscarp has
37 fallen to?

38

39 MR POPE: Correct. But the original image you showed me
40 will show you what that distance is in section. Like, 210,
41 0210, will give you proximity to the wall.

42

43 MR COSTELLO: 0210 is the image I just showed you.

44

45 MR POPE: The first image you opened with, 0210, yeah.

46

47 MR COSTELLO: Would you like me to go back to that?

1 That's 5087 - it's the immediate past image, 5087.0001.
2 Yes, thanks.

3

4 MR POPE: So the red hatching on the right-hand side of
5 the retaining wall, it represents that evacuated mass that
6 I viewed on 6 January, and the distance between the wall -
7 so this image, to explain it, it's two cross-sections
8 3 metres apart from each other superimposed on each other.
9 The reason I did that is so you can see where the 6 Jan is
10 relative to where the larger volume in the landslide was
11 back to the north. It's only a couple of metres down from
12 the wall. The loaded area in orange from the retaining
13 wall is metres wide. It's first principles engineering
14 that that is well within the zone of influence of that
15 load. There is - the 3D element for me - to me that's the
16 toe of the fill that's dilated. It's what dilated. The
17 stress changes have been in the toe of the slope and, when
18 it dilates, cracks open up, and you've clearly got all of
19 us - I think all of us agreeing that there's plenty of
20 water coming through there. You open up the soil with
21 cracks, the permeability change, and you have a
22 preferential flow path through that area. So, looking at
23 it in a 3D, it's not a surprise to me that it's failed
24 there.

25

26 MR COSTELLO: Can I have on the screen, please,
27 MSC.5087.0001.0157 at 0394. I think it's this document.
28 This is another image of the wall in question; is that
29 right?

30

31 MR POPE: No, it's not. That's a retaining wall that was
32 built in 2022, and that sits in behind the wall built in
33 2024.

34

35 MR COSTELLO: This is the state of it as at 2022?

36

37 MR POPE: No. There's two walls. So, if you go back to
38 my section, that is a wall built in 2022.

39

40 MR COSTELLO: Yes.

41

42 MR POPE: And then the wall that we see there today was
43 built in 2024.

44

45 MR COSTELLO: That's right.

46

47 MR POPE: Yeah.

1
2 MR COSTELLO: Sorry, I just said to you this is a picture
3 of the state of it at 2022.
4

5 MR POPE: You consider them the same wall. It cracked,
6 yes. Yeah, yeah. This photo is in 23 --
7

8 MR COSTELLO: Sorry, don't worry about the other wall. I
9 just want to know this --
10

11 MR POPE: This is in 23, 2023, yeah, yep.
12

13 MR COSTELLO: Thank you. And then there was further work
14 done?
15

16 MR POPE: Yes.
17

18 MR COSTELLO: And either a new wall built or some
19 extension to this wall. How do you classify it?
20

21 MR POPE: I would need to see detailed drawings to know
22 how the - if they were connected to each other or whether
23 they're independent of each other, so --
24

25 MR COSTELLO: Have you seen detailed drawings in respect
26 of the addition - not this, but the addition or work that
27 was done?
28

29 MR POPE: I've seen drawings for a retaining wall, but
30 I don't believe it was built. So Rexicon produced some
31 drawings, but I can't - so, yes, sort of. And then for the
32 wall that was built, no.
33

34 MR COSTELLO: So you haven't seen any plans or any
35 architectural - sorry, any engineering work associated with
36 the wall that's in question now; is that right?
37

38 MR POPE: So in my report I've got - it's page 19, which
39 is 0175.
40

41 MR COSTELLO: This one?
42

43 MR POPE: Correct, yep.
44

45 MR COSTELLO: This is what you've seen in connection with
46 the wall as built?
47

1 MR POPE: Yes.

2

3 MR COSTELLO: I see. Thank you. Could we just go back to
4 the prior picture. The one thing that really I wanted to
5 establish from this picture is that tree that can be seen
6 close to the middle but towards the left-hand side perhaps
7 of the image, which from the wall as at its 2023 state
8 looked some distance away. Of course things then change.
9 And if we go to - try 0056. I'm not sure if that will
10 work. 5087.0001.0003, sorry, and then at 56. 0056. No,
11 that's not it. Sorry, Mr Pope, I just want to find a
12 picture, but I've given the wrong document reference. Let
13 me just pull it up. Actually, I think that's right, and
14 I think it's actually from your risk to life report, and
15 I think that that might be 5056. Try that. In fact, if
16 you try this, 5056.0001.0003, I can do two things at once
17 because I need to tender this document as well.

18

19 CHAIRPERSON: I think that report, Mr Costello, is subject
20 to a non-publication order.

21

22 MR COSTELLO: This one?

23

24 CHAIRPERSON: Yes. Is there a particular drawing in that
25 document you want to go to?

26

27 MR COSTELLO: One photograph. I'll find it somewhere
28 else. I'll come back to it. It's fine. I won't tender
29 that now.

30

31 MR POPE: I thought we did yesterday.

32

33 MR COSTELLO: Yes, we tendered an earlier version
34 yesterday, and this is the revised version. So I do need
35 to tender that --

36

37 CHAIRPERSON: Yes, and we can tender it. It just won't go
38 on the website.

39

40 MR COSTELLO: Yes, I understand. I should just tender
41 that now for the sake of --

42

43 CHAIRPERSON: Yes.

44

45 MR COSTELLO: The version I just pulled up, Mr Pope, to be
46 clear to you, is not the version I tendered yesterday.

47

1 MR POPE: Okay.
2
3 MR COSTELLO: It's a version that you might recall you
4 made some amendments?
5
6 MR POPE: Yeah, rev 1.
7
8 MR COSTELLO: I think mainly mathematical calculations.
9
10 MR POPE: Yep.
11
12 MR COSTELLO: So I should tender that.
13
14 CHAIRPERSON: Yes. PSM's landslide risk assessment
15 dated - what is the date of that document? Is it 28 May?
16
17 MR COSTELLO: May. 28 May.
18
19 CHAIRPERSON: Dated 28 May 2025 is exhibit CA77.
20
21 **EXHIBIT #CA77 PSM's LANDSLIDE RISK ASSESSMENT DATED 28 MAY**
22 **2025**
23
24 MR COSTELLO: The only - that was a long diversion for a
25 small point, Mr Pope. The only point that I was hoping to
26 raise with you from the photograph that I didn't end up
27 putting on the screen was that that tree is still standing?
28
29 MR POPE: It was on the 6th. Yes.
30
31 MR COSTELLO: On the 6th?
32
33 MR POPE: Yes, correct.
34
35 MR COSTELLO: And that tells you something about both the
36 distance between that tree --
37
38 MR POPE: Correct, yeah.
39
40 MR COSTELLO: -- and the wall?
41
42 MR POPE: Yeah.
43
44 MR COSTELLO: And it tells you something, potentially at
45 least, about what's going on with the headscarp?
46
47 MR POPE: Yeah, and you've got to consider that to build

1 the new wall I think the piers are 450 diameter roughly and
2 you've got to have an offset downhill from that wall in the
3 photo, and the headscarp of the 6th, as I viewed it on the
4 6th, was uphill from the gum tree. So the gum tree was
5 what I used for reference, but also --
6

7 MR COSTELLO: Go on, Mr Pope.
8

9 MR POPE: The gum tree has been used for reference.
10 No-one did a survey on the 6th. So I accept that this is -
11 like, there's a limit to what you can measure by hand out
12 there on the 6th. So there is going to be some scope for -
13 do you mind, Gerry? There is scope for error in the
14 measurements.
15

16 MR COSTELLO: All right.
17

18 MR POPE: But, I mean, the new wall is half a metre down
19 the hill. The headscarp is - you can see those photos.
20 The tree is not at the upper limit of the landslide. And
21 even if I'm out by a metre you're still within the zone of
22 influence of the wall.
23

24 MR COSTELLO: I just want to understand this zone of
25 influence concept before I hand over to others to have
26 something to say about this. There has been evidence in
27 the commission prior hearing blocks that in between the two
28 landslides the headscarp was moving up the hill, that is
29 that it was eroding upwards? Do you understand what I mean
30 by --
31

32 MR POPE: Yeah, I know what you mean. I think there's few
33 people aren't across that there was a tension crack at the
34 retaining wall.
35

36 MR COSTELLO: Yes. Underneath?
37

38 MR POPE: Yes.
39

40 MR COSTELLO: That is the headscarp seemed to be moving up
41 and --
42

43 MR POPE: No, no. No, when I was there on the 6th the
44 tension crack was there when I was on site. It didn't come
45 later.
46

47 MR COSTELLO: Two things were happening at once. Just let

1 me finish and you can tell me if I'm wrong. One thing that
2 was occurring was that the headscarp was moving up. That
3 was something that happened over a succession of days?

4
5 MR POPE: You'll naturally get regression that way, yes.

6
7 MR COSTELLO: And another thing you say that you observed
8 on the 6th was a tension crack at the location of the
9 retaining wall?

10
11 MR POPE: Yes.

12
13 MR COSTELLO: All right.

14
15 MR POPE: The base of the retaining wall, yeah.

16
17 MR COSTELLO: And are those two things related, to your
18 mind?

19
20 MR POPE: Yes.

21
22 MR COSTELLO: That the headscarp moving up is related to
23 the tension crack?

24
25 MR POPE: No, sorry. No. The - misunderstood what you
26 meant.

27
28 MR COSTELLO: No, that's all right.

29
30 MR POPE: The tension crack at the base of the wall is a
31 product of the stresses from the loaded area above
32 distributing below the wall. It is literally where
33 there's - as I was saying before, horizontal stresses have
34 increased there and the displacement is observed there.

35
36 MR COSTELLO: So that's going on, and that's going on
37 separately and independently to what's going on with the
38 headscarp moving up?

39
40 MR POPE: No. So on the - stresses from the retaining
41 wall have failed the downhill side of the retaining wall.
42 The reason why there's no tension cracks behind the
43 retaining wall I believe is because there's tensile
44 capacity with a series of tieback anchors from the original
45 retaining wall. So it was clear to everyone that there
46 wasn't much evidence of tension in the vegetable garden
47 area when I was on site on the 6th. There was tension

1 cracking immediately below the wall. There is tiebacks
2 there with the capacity to keep the upper parts of the
3 retaining wall intact.
4

5 MR COSTELLO: The zone of influence that you've spoken
6 about a number of times, is that a concept that's capable
7 of being measured in terms of distance?
8

9 MR POPE: There's a whole bunch of stress distribution
10 charts that you can look at for that, yeah, or we just
11 model it in finite element software most commonly now.
12

13 MR COSTELLO: I see. And do you have a view about how
14 large, if large is the right word, the zone of influence
15 was in this case?
16

17 MR POPE: My view is that that's the toe of the passive
18 wedge failing. So it's moved at the base of the wall. So
19 the displacement is at the base of the wall. It's well
20 within the zone of influence of the wall. It's literally
21 under the wall.
22

23 MR COSTELLO: I see.
24

25 MR POPE: Yeah.
26

27 MR COSTELLO: All right. I'll give you an opportunity to
28 respond, Mr Pope, but I should let others have a go on this
29 topic. Mr Paul, perhaps I'll start with you. You have
30 considered these matters I suspect principally by reference
31 to Mr Pope's work; is that right?
32

33 MR PAUL: When the landslide first happened it was on the
34 news and you could see retaining wall at the top. That was
35 what I focused in on. That's the first sort of hypothesis,
36 is has retaining wall fill been put at the top of the slope
37 and is that involved in the slide --
38

39 MR COSTELLO: I see.
40

41 MR PAUL: -- and that was one of the first things we
42 looked at very early on.
43

44 MR COSTELLO: That would be an unsurprising conclusion?
45

46 MR PAUL: Yeah, it's an obvious hypothesis and thing to
47 explore. But I just found as the evidence came in it just

1 didn't fit that hypothesis and I had to sort of, no, that's
2 not the - that's not the main causation, was not the wall.
3
4 MR COSTELLO: I see. So let me just understand this.
5 When you speak about main causation are you speaking here
6 in terms of preparatory factor or are you speaking in terms
7 of a trigger?
8
9 MR PAUL: Preparatory factor.
10
11 MR COSTELLO: All right. So it is still your view that
12 this is not a significant preparatory factor?
13
14 MR PAUL: Correct.
15
16 MR COSTELLO: Or - I shouldn't use "significant" because
17 the language gets important. A minor preparatory factor is
18 your view. You have considered, no doubt, what Mr Pope has
19 said about it in his report, and what Mr Pope said about it
20 in the course of the conclave as reflected in the conclave
21 joint report. And separately from all of that did you give
22 independent consideration to the question of the role of
23 the retaining wall as a preparatory factor?
24
25 MR PAUL: Yes, I did.
26
27 MR COSTELLO: All right. And could you then perhaps
28 explain as simply as you're able to why it is that you've
29 come to a conclusion different to that of Mr Pope?
30
31 MR PAUL: May I use a whiteboard?
32
33 MR COSTELLO: Yes. Please.
34
35 MR PAUL: To illustrate the zone of influence we're
36 talking about, we've got our slope, and what's been
37 constructed is a retaining wall, these piers, something
38 like that, and we've got fill in behind that. The way the
39 retaining wall works, we saw in one of the images active
40 side, passive side. So this would be what we call a
41 passive wedge. This is the force, this soil is pushing
42 force onto that retaining wall, trying to push it that way.
43 The passive wedge we're talking about is a zone here, and
44 that's approximately - that angle would approximately be
45 45 degrees to 60 degrees, depending on the type of soil.
46 If it's firmer, stiffer soil, that angle's steeper. So
47 that is the zone that's mobilising. There's two pieces of

1 evidence for the 5 January landslide that tells me that the
2 landslide could not have been influenced by the passive
3 wedge. So the 5 January landslide was somewhere down here.
4 It was outside the zone of that passive wedge. So it could
5 not have been loaded.

6
7 The other piece of evidence is that if this is
8 applying a surcharge load down here there's a law in
9 physics called Hooke's law, you can't get stress without
10 strain. So if this had indeed applied a force to the slope
11 here you must see displacement here. You must. That's a
12 simple law of physics. If you didn't, if you don't see
13 displacement there, and we didn't, it tells me it couldn't
14 have applied that load there. So that's for the 5th. So
15 in simple terms this was too far away from the wall for it
16 to be loaded.

17
18 Then when we come to the tension crack - so a tension
19 crack was observed in this area in front of the wall. Now,
20 what that means is that the load from here can't mobilise
21 the passive wedge, and that's what we're hearing from
22 Mr Pope there. This has opened up here, and so this no
23 longer has a resistance. Now, for that tension crack to be
24 there you can't have force coming down here and pushing out
25 there, and a crack open up. It's entirely incompatible.
26 This is a compression force in here.

27
28 The only way to get a tension crack there is if the
29 soil here is moving away from the wall, otherwise you
30 can't - I can't see or conjure up a mechanism that will put
31 a crack in front of it. Soil must be moving away from the
32 wall and the wall is staying there. Now, if that happens,
33 this is now - has lost its passive support. It probably
34 got some stress into this post. It's moving out because
35 it's now lost its resistance here. Then as we went through
36 the 14 January it's just, as we heard, migrated up the
37 slope and it's just undermined the whole lot. But in all
38 of that the retaining wall role is insignificant.

39
40 One more thing to mention. On 5 January - 16 January
41 this was undermined. We had soil - it's a bit messy now,
42 sorry. We had soil drop out from behind the wall. That
43 volume of soil - we can measure by comparing the LiDAR
44 images - was less than 10 cubic metres. So if that is
45 indeed applying a surcharge on 14 January you've got an
46 incompatibility with 10 cubic metres driving 300 cubic
47 metres of soil. It's a very, very small surcharge.

1 Remember the soil that applies the surcharge can only be
2 the soil that's displaced, and that's about 10 cubic
3 metres. So 10 cubic metres pushing 300 cubic metres is a
4 big incompatibility. This would have to be so on the point
5 of equilibrium and so close to failing for this to have any
6 significance.

7
8 So that's why I call it minor. It's not zero
9 surcharge, it's some, but it's very, very small in relation
10 to this. Overwhelmingly the water is the effect, not the
11 retaining wall. So that's the conclusion I get to on the
12 evidence available.

13
14 MR COSTELLO: I see. Thank you, Mr Paul.

15
16 MR PAUL: All right, I'll sit back down.

17
18 MR COSTELLO: Mr Hartley, you're not the tiebreaker, but
19 you're entitled to express an opinion about all of this.

20
21 MR HARTLEY: Would Mr Pope like to respond to that or?

22
23 MR POPE: I'll respond when he asks me.

24
25 MR HARTLEY: Okay. Right. Okay.

26
27 MR COSTELLO: When I say you're entitled to --

28
29 MR HARTLEY: No, no, no, I did have a number of --

30
31 MR COSTELLO: -- I want to make this clear to all of you,
32 none of you are obliged to, but if you have something that
33 you wish to say then you can say it.

34
35 MR HARTLEY: In terms of the - the depth to the passive
36 wedge is dependent on the understood depth of the pile, and
37 I'm not too sure anybody's too convinced about how deep
38 that is. To reinforce Mr Pope's concerns about not seeing
39 any as-builts or construction built constructions, I've had
40 a look at the calculations, the Rexicon calculations --

41
42 MR COSTELLO: Mr Hartley, can I just stop you there for a
43 moment. Mr Bolton, I'm sorry, I should have explained this
44 to you. You can't be on your phone while you're in the
45 witness box, I'm sorry. The material that you can have
46 regard to is material --

1 MR BOLTON: Sorry, (indistinct) a groundwater formula.

2

3 MR COSTELLO: That's all right. If that needs to happen
4 later, you can mention why and we'll sort it out.

5 Mr Hartley, sorry, go on.

6

7 MR HARTLEY: Sorry, gosh, where was I? Oh, yeah, the
8 depth of the pile. I'm not too sure whether we are
9 confident that we know how deep the second retaining wall
10 pile went. Calculations give - that have been supplied
11 give a various range of options. The onsite photographs of
12 the displaced pile - you know, pile foundations, not too
13 sure whether they actually correlate with anything. So I'm
14 very unsure about the depth of that pile, and I've got to -
15 I would side with Mr Pope's assessment that it is unlikely
16 that it's been socketed into the extreme weathered granite.
17 So therefore my suspicion is that it is sat probably,
18 possibly on the refusal, and therefore the tendency for
19 lateral load through the superficial or surficial material
20 is probably greater than what would be the case if it had
21 been socketed into the extra weathered granite.

22

23 The second one is that within Mr Pope's causal report
24 there's a photograph. I think it's on PDF page 307. I put
25 this up during conclave and, apologies, I don't have the --

26

27 MR COSTELLO: Would you like me to bring that up?

28

29 MR HARTLEY: Yeah, as long as Mr Pope's okay.

30

31 MR POPE: It's not got anything to do with me, mate.

32

33 MR COSTELLO: PDF page number what?

34

35 MR HARTLEY: 307, I think it is.

36

37 MR COSTELLO: 307?

38

39 MR HARTLEY: Yep.

40

41 MR COSTELLO: Okay. In Mr Pope's causation report?

42

43 MR HARTLEY: Yes.

44

45 MR COSTELLO: Okay. So that's MSC.5087.0001.0157.
46 I think the actual pagination doesn't go as far as you've
47 said, but you've probably looks at it in PDF form.

1
2 MR HARTLEY: Oh, gosh.
3
4 MR COSTELLO: No, no, no, we'll find it. Is that what
5 you're --
6
7 MR HARTLEY: No, it's not. It's a photograph which was
8 taken somewhere in 2023. It's on the right-hand side of
9 the landscape PDF.
10
11 MR COSTELLO: What was the PDF page number again?
12
13 MR HARTLEY: I thought it was 307. I beg your pardon.
14
15 MR POPE: The photo we had up before?
16
17 MR HARTLEY: Yes. It was related to that.
18
19 MR COSTELLO: Is it that?
20
21 MR HARTLEY: No, it's an oblique photo taken by a chap
22 next to the stonewall.
23
24 MR POPE: You had it up earlier, Mr Costello.
25
26 MR COSTELLO: Did I?
27
28 MR POPE: It was when you were asking me about the wall in
29 23.
30
31 MR COSTELLO: Yes, I see. Right. Try 0394. 0394, try
32 that one.
33
34 MR HARTLEY: You're getting close. Maybe one more on.
35 Maybe. No, let's keep with that, the one that was
36 previously. So this photograph shows a slight distortion
37 of the original wall that was built in 2022. You can see
38 to the right of the green hedgerow that there is a kind
39 of - a moving out of the wall. So, you know, towards us
40 from the green hedgerow which is sat above the retaining
41 wall you can see that there is a - if this was a true line,
42 you know, centre line, of the wall then that particular
43 post is out of true.
44
45 Now, there is another photograph which is probably
46 taken from the same time, definitely during 2023, which
47 shows there is a trench that has been created from the

1 movement of the scoria drainage blanket immediately behind
2 this wall, exposing the tie beams to an extent. Now, my
3 suggestion, which wasn't taken up during conclave, was that
4 that was a sign of movement during that time. It was
5 suggested that it could be the scoria settling. But my
6 feeling is, is that the time difference between the
7 construction of the wall and the time that photograph was
8 taken is too long for that settlement to be the answer. My
9 feeling is that there may have been movement during that
10 time.

11
12 My second or final aspect of this is that the witness
13 statement of - I'm going to screw up the name, but it's the
14 municipal building surveyor who was employed from February
15 onwards by the shire, and his witness statement at
16 paragraph 32 talks about having - talking to the landowner
17 during - between the 5th and the 14th, and that statement
18 includes cracking both in front of and behind that
19 retaining wall, which suggests to me there is movement
20 going on, which, you know, backs up Mr Pope's view that the
21 fact that there is a retaining wall and the fact that there
22 is fill above that retaining wall is having an effect on
23 the general global stability of the slope.

24
25 MR COSTELLO: The types of matters that you have just
26 drawn attention to, Mr Hartley, are really matters from
27 which you've drawn inferences; is that fair?

28
29 MR HARTLEY: I beg your pardon?

30
31 MR COSTELLO: The matters that you've pointed to are
32 indicative of the fact that you've drawn inferences from
33 material?

34
35 MR HARTLEY: Oh, certainly, yeah, yeah.

36
37 MR COSTELLO: And, that being so, can you really have a
38 high degree of confidence on this question?

39
40 MR HARTLEY: In so much as I trust that people are making
41 true statements, yes, and the photographs that have been
42 taken and the dates have, yeah, any - no less or no more
43 than anyone else would take from a desktop study exercise.

44
45 MR COSTELLO: You feel that you've got sufficiency of
46 information as to this topic?

1 MR HARTLEY: Well, to back up Mr Pope's view, we don't
2 have the as-builts of the second retaining wall. It's a
3 really big question. The calculations indicate one thing.
4 The photographs of the - since 14 January indicate another.
5 It's really confusing.

6
7 MR COSTELLO: You accept that some of the physical
8 evidence is inconsistent with the calculations?

9
10 MR HARTLEY: It doesn't match up, so yes.

11
12 MR COSTELLO: Thank you. Mr Pope - sorry, Mr Pope, I'll
13 come to you in one moment. Mr Paul, before I give Mr Pope
14 an opportunity to respond to all of this before you're all
15 asked another range of questions on the same topic by
16 another person, I didn't ask you while you were at the
17 whiteboard about the question of how far the retaining wall
18 had been driven into the ground and whether or not that
19 bears upon the matters that you spoke to. Mr Pope
20 obviously thinks it's quite significant that it wasn't
21 driven into the granite and that that had an effect of - on
22 the amount of load that it was capable of bearing. Is that
23 a matter that you have thought about? Do you have any
24 reflection on that question?

25
26 MR PAUL: We know the length of some of the piles because
27 they were exposed by the landslide and they've been
28 measured. The piles up above the 5 January landslide have
29 not been exposed. So, no, we don't know how long they are.
30 We also don't really know what they're in. But if we can
31 assume they're the similar length to the ones that were
32 exposed - I think it's slightly over 1 metre long; there's
33 an image in Mr Pope's report with a measurement on it -
34 then it can't be - it's too short. If it's a similar
35 length to those other ones, it's too short for a passive
36 wedge to impact or influence the 5 January landslide.

37
38 MR COSTELLO: I think at this point I should hand over to
39 counsel for the shire.

40
41 **<EXAMINATION BY MS FOLEY:**

42
43 MS FOLEY: Mr Paul, I have some questions for you. I'd
44 like to start with your WSP report of 21 July 2025. So if
45 we could have that brought up, please, Bates number DPA
46 .0004.0001.0001. Thank you. And if we could go to PDF
47 page 65. Thank you. Mr Paul, this is a section in your

1 report dealing with planning controls, and I'd like to ask
2 you some questions about the opinion that you express at
3 paragraph 125. So I'll read it out. After discussing the
4 objectives of various planning controls you say in 125,
5 "With moderate confidence I consider the absence of
6 planning controls has led to an increase in the
7 susceptibility of the McCrae escarpment to landslide"; you
8 can see that?

9

10 MR PAUL: Yes.

11

12 MS FOLEY: Do you still hold that view today?

13

14 MR PAUL: Yes.

15

16 MS FOLEY: Now, you're an engineering geologist?

17

18 MR PAUL: Correct.

19

20 MS FOLEY: And you certainly don't hold yourself out to
21 have any expertise in planning?

22

23 MR PAUL: Only to the extent I work a lot with planners
24 and so I have picked up something along the way.

25

26 MS FOLEY: Yes. And, just like I pick up some things
27 along the way, you certainly wouldn't profess to be an
28 expert in that field?

29

30 MR PAUL: I'm not an expert in planning.

31

32 MS FOLEY: All right. To express an opinion about whether
33 planning controls impacted susceptibility to landslide you
34 would accept that one thing would you want to know about,
35 for example, is how planning controls might influence
36 behaviour?

37

38 MR PAUL: Planning controls don't influence susceptibility
39 to landslide. I say because we have susceptibility to
40 landslide we have planning controls.

41

42 MS FOLEY: All right. Well, you've said in 125 the
43 absence of planning controls led to an increase in the
44 susceptibility of the escarpment to landslide?

45

46 MR PAUL: Can do.

47

1 MS FOLEY: Can do. Is your opinion there better then
2 expressed as "can lead to an increase"?
3

4 MR PAUL: Yeah, I'd say "can", yes.
5

6 MS FOLEY: All right. So you're not giving an opinion
7 there about whether or not in the facts of this case the
8 absence of planning controls or otherwise in fact led to an
9 increase?
10

11 MR PAUL: No, I'm not saying that. I'm saying that as a
12 general statement. So, as an example, if there were no
13 planning controls to prevent fills being placed on the
14 slope or vegetation being removed or that type of thing,
15 then the susceptibility could increase. But, no, I'm not
16 trying to be specific here.
17

18 MS FOLEY: And that really identifies some of the
19 questions I was going to ask, which now I won't because
20 clearly what you haven't done here is look at what was or
21 wasn't in place, whether things, actions that were taken
22 complied with existing controls or not and so on?
23

24 MR PAUL: No, no. No, all I'm simply saying is this is a
25 susceptible slope, you know, it would warrant planning
26 controls for landslide because it's landslide susceptible,
27 and we know they've not been there. And in a general
28 sense, you know, were there planning controls there, that
29 might mean things like we don't have the vegetation
30 clearance or we don't have the fill placed, we don't have
31 the retaining wall or whatever it is, or maybe we don't
32 even have houses built where they are. So that could
33 happen, but I don't want to say that specific to the extent
34 you're implying.
35

36 MS FOLEY: No, because one thing we know, for example, is
37 that there was no building permit that was applied for in
38 relation to the retaining wall. You understand that?
39

40 MR PAUL: Yes, I understand that.
41

42 MS FOLEY: All right. So you're not making a comment
43 about what was or wasn't in place in these circumstances?
44

45 MR PAUL: No. I would say that if there were, say, an
46 erosion management overlay in place, something like a
47 retaining wall of the height, with the planning - the

1 erosion management overlays I've worked on and drafted,
2 that would not be exempt. A retaining wall of that height
3 would require a permit under an erosion management
4 overlay --

5
6 MS FOLEY: But what we know here is that a permit was not
7 applied for?

8
9 MR PAUL: Not required, no.

10
11 MS FOLEY: All right. So there's an issue there about
12 whether or not people on the ground complying or not
13 complying with planning controls would need to be taken
14 into account if you were going to give an opinion about
15 whether that would impact the circumstances here? You'd
16 accept that?

17
18 MR PAUL: I'm not sure I understand the question, sorry.

19
20 MS FOLEY: That was very unclear on my part. I'll say it
21 again. Because we have a situation here where the
22 retaining wall, for example, was built without a permit,
23 for you to give an opinion about whether the planning
24 controls or absence of them led to an increase in
25 susceptibility you'd need to take that into account if you
26 were going to give an opinion about what actually happened
27 here?

28
29 MR PAUL: Yeah, it sort of goes back to what I was saying
30 there previously. You know, had there been planning
31 controls in place, a permit might have required -
32 I understand one wasn't required in this case.

33
34 MS FOLEY: The permit was in fact required in this case,
35 and that will be one of the issues that the board will --

36
37 MR PAUL: A planning permit or a building permit?

38
39 MS FOLEY: A building permit.

40
41 MR PAUL: Yeah, I'm referring to planning permit, sorry.

42
43 MS FOLEY: And there's an issue, of course, about a
44 planning permit as well. So you haven't assessed that
45 matter? You haven't looked into whether or not permits
46 were or weren't required?

1 MR PAUL: No, no, I'm simply saying that, for example,
2 that retaining wall, were there an erosion management
3 overlay in place, that construction would require a
4 planning permit usually. A planning permit I'm talking
5 about --
6

7 MS FOLEY: And the point I'm making to you is you have not
8 considered whether or not permits were in fact required
9 already and therefore whether what was done was done
10 without the building permit or the planning permit that was
11 required? You haven't considered that?
12

13 MR PAUL: I haven't considered whether that construction's
14 lawful, no.
15

16 MS FOLEY: All right. And similarly you haven't
17 considered informal practices that the shire had in place
18 which might have done the same work as an erosion
19 management overlay in the circumstances of this case?
20

21 MR PAUL: Yeah, I'm aware of the informal practices in
22 place. I don't know how they were applied or if they were
23 applied --
24

25 MS FOLEY: All right. You haven't undertaken that kind of
26 analysis, which is why I think, as you have now said, the
27 opinion that you've expressed in paragraph 125 should now
28 really be read as "the absence of planning controls can"?
29

30 MR PAUL: Yeah, I'm happy for it to say "can". Yeah,
31 that's fine.
32

33 MS FOLEY: All right. And would the same then apply to
34 paragraph 127 of your report? If we can go to the next
35 page, please. You say there, "In addition to increasing
36 landslide susceptibility, the absence of planning controls
37 is also likely to have increased the landslide risk"?
38

39 MR PAUL: Yeah.
40

41 MS FOLEY: In the same way we should qualify that with
42 "can"?
43

44 MR PAUL: Yeah, so what that's talking about is let's say
45 there were planning controls in place for subdivision.
46 Now, if there was an erosion management overlay in place on
47 that escarpment, you know, by today's standards it would

1 not be subdivided to the extent it has been. That I could
2 say, yeah, that's factual, that would not have been
3 subdivided to the extent it had been. But how long would
4 the planning controls have had to have been in place? They
5 would've had to have been there right back to the early 50s
6 or 60s.

7
8 MS FOLEY: Or even earlier for some of these properties
9 perhaps?

10
11 MR PAUL: Even earlier, yeah. Yeah.

12
13 MS FOLEY: Okay.

14
15 MR PAUL: So what I'm saying there is, were there planning
16 controls in place to the standard we have now, then we
17 might not have the risk and susceptibility that we do. But
18 I understand the planning controls were not in place,
19 haven't been in place prior to this.

20
21 MS FOLEY: Understand. And that's how we should
22 understand your evidence at paragraph 127?

23
24 MR PAUL: Yes.

25
26 MS FOLEY: All right. No further questions for Mr Paul.

27
28 **<EXAMINATION BY MR COSTELLO:**

29
30 MR COSTELLO: Mr Pope, two things that I want to ask you
31 about - well, one really and I want to give you an
32 opportunity to say anything else on this topic that you
33 feel needs to be said by reason of everything that's
34 happened already.

35
36 MR POPE: Yeah.

37
38 MR COSTELLO: But on this question of - is piers the right
39 word?

40
41 MR POPE: When you've got a steel upright in concrete,
42 yeah, we call them piers rather than piles, which will have
43 a cage in it.

44
45 MR COSTELLO: That's why I ask because there seems to be
46 reference to piers and piles.

1 MR POPE: It might be a bit loose if it crosses across.
2 But piers, yeah.
3
4 MR COSTELLO: All right. We'll use piers. Do you know
5 how deep the piers would need to have been sunk to have hit
6 the granite, where the wall was placed?
7
8 MR POPE: Do I know how deep they needed --
9
10 MR COSTELLO: Yes.
11
12 MR POPE: If you go back to that - off the top of my head,
13 no. But if you go to that section you had up for me
14 before --
15
16 MR COSTELLO: Your report?
17
18 MR POPE: Page 56 of my report which is 0212.
19
20 MR COSTELLO: Sorry, which page did you say?
21
22 MR POPE: That one will do. I'll shoot myself for not
23 having a scale in it. Give me a sec. I think they're
24 5 metre - so the horizontal lines are 5 metres there.
25 I would expect - for similar walls 2 metres high that we
26 design you'd need to be into the pink layer there and -
27 2 metre retained height, like, crudely to size it, and this
28 is just at concept, you've got one height out of 2 metres.
29 And then you would want at least two in, so that's 4 metres
30 below ground, and then there would be a minimum socket into
31 the granite which I think would be in the order of 2 to
32 3 metres.
33
34 MR COSTELLO: So you think unless the piers were of that
35 length then this - no, let me put it in a different way.
36 If the piers were of that length your conclusion as to
37 whether or not this wall was a preparatory factor might be
38 different?
39
40 MR POPE: Yes, correct. Yeah.
41
42 MR COSTELLO: And the figure you've just come up with
43 there, that's obviously rough and ready? You've just
44 done --
45
46 MR POPE: Yeah, rough as. Like, for a retained height of
47 2 metres, a minimum we would start with when we're doing

1 our analysis is a 4-metre long pile. But you'd want to
2 check pier - you'd want to check you've got enough socket
3 to transfers the load into the granite.
4
5 MR COSTELLO: Is that the rule of thumb, double in the
6 ground as you have above?
7
8 MR POPE: That's where we start from, yeah. It's
9 different if you've got tiebacks and stuff, though. If
10 you've got anchors - yeah. But for a cantilevered wall,
11 2 metres out, 4 metres in, and then check you've got enough
12 socket in the granite.
13
14 MR COSTELLO: Wouldn't need to be as far down if you had
15 tiebacks because you're distributing the load in a
16 different way?
17
18 MR POPE: Depends on the bending in the pile, yeah.
19
20 MR COSTELLO: I see. You accept that if there were
21 tiebacks --
22
23 MR POPE: You generally don't need as long a socket with a
24 tieback wall, yeah.
25
26 MR COSTELLO: Thank you. All right. I just wanted to
27 give you a general opportunity, Mr Pope, if there was
28 anything else you wanted to say on this topic. It's
29 obviously one you've given a lot of consideration to and
30 there's been evidence given by others. Is there anything
31 that you wanted to address to the chair?
32
33 MR POPE: I'm looking at it from a fair old angle, the
34 sketch on the whiteboard.
35
36 MR COSTELLO: You're able to stand up if you want to.
37
38 MR POPE: No, it's simple. The use of that Rankine earth
39 pressure wedge in front of the wall doesn't hold
40 particularly well on steep slopes. It's a fast and - like,
41 a quick and ready check on with flat ground in front of the
42 wall. But you do need to consider how the stress is
43 transferred down the slope. Earth pressures - Rankine
44 earth pressures for retaining walls are a very simple way
45 of looking at retaining walls. If I go put that to my
46 clients they'd be challenging whether we would be
47 pre-qualified. Like, if I put that to my clients, I

1 wouldn't - it's not getting up with State Government at
2 all.

3
4 MR COSTELLO: Madam Chair, I'm going to move on to a
5 radically different topic now. That might be a convenient
6 time.

7
8 CHAIRPERSON: Now is a good time for a break, yes. We'll
9 return at 20 to 12.

10
11 **SHORT ADJOURNMENT**

12
13 MR COSTELLO: Thank you, Madam Chair. I want to move now
14 to the trigger - maybe I should - sorry, I didn't notice.

15
16 MS SIEMENSMA: Madam Chair, if my instructor just goes out
17 to find them (indistinct).

18
19 CHAIRPERSON: Yes.

20
21 MR COSTELLO: It would have made for a more efficient
22 examination.

23
24 I want to move now to the trigger for the 2025
25 landslide. It is agreed I think as amongst you, Mr Pope,
26 you, Mr Paul, and you, Mr Hartley, that the trigger for the
27 slide was a decrease in suction from increased pore
28 pressure caused by water infiltration; is that a fair
29 description?

30
31 MR POPE: No.

32
33 MR COSTELLO: All right. Mr Pope, you tell me what I've
34 got wrong.

35
36 MR POPE: It might save you time. In the conclave report
37 I outline why I don't agree with the suction based model on
38 its own.

39
40 MR COSTELLO: I see.

41
42 MR POPE: But we agree on water being a trigger. I don't
43 agree on that suction was dominating the landslide; yep.

44
45 MR COSTELLO: I see. You agree on an increasing pore
46 pressure?
47

1 MR POPE: I agree on an increasing groundwater level;
2 yeah. But I don't see evidence that there's excess pore
3 pressure in that hill.
4
5 MR COSTELLO: I see.
6
7 MR POPE: Yep.
8
9 MR COSTELLO: Thank you. I might come back to that.
10 Perhaps I put it too precisely in my search for agreement.
11 There's at least agreement that the trigger was water?
12
13 MR POPE: Yes.
14
15 MR PAUL: Yes.
16
17 MR COSTELLO: There is not agreement as to the source of
18 the water? Is that as you understand it from the conclave
19 process, Mr Pope?
20
21 MR POPE: Correct. There is no agreement.
22
23 MR COSTELLO: Yes, thank you. And then there are more
24 technical matters as to the role the water played in
25 causing the landslide to occur which are matters of
26 the type that you just mentioned, Mr Pope?
27
28 MR POPE: Yeah.
29
30 MR COSTELLO: Yes, thank you. And then there are
31 questions that have to do with possible source of water
32 infiltration which mainly centre around the Bayview Road
33 burst and that has a number of topics, most of which
34 overlap but at a reasonably high level of abstraction. One
35 topical area is paths of water flow from burst site to
36 scarp, are there any and, if so, are they such that water
37 could have travelled within the time required; and,
38 secondly, questions of water chemistry from samples taken
39 in the area and what, if anything, can be inferred from
40 those questions. So I want to deal with all of that now in
41 the course of the day.
42
43 We'll come to chemistry I think in the afternoon, and
44 Mr Di Stefano will ask you some questions regarding
45 available pathways. But before that there's a few matters
46 that I want to raise with you that are relevant to some of
47 these matters. I should get some of the language here

1 correct. There might be further questions about some of
2 this later on. But yesterday I asked some questions about
3 aquifers and shallow aquifers. For the purpose of this
4 discussion is there any relevant distinction that any of
5 you wish to make as between an aquifer and a shallow
6 aquifer? Mr Hitchcock, you I think most carefully, if
7 I might say, in your report make some comment about this
8 topic. Did you want to say something about it now?
9

10 MR HITCHCOCK: Yeah. So initially, you know, I looked at
11 shallow or perched water and also water that's deep in the
12 granite to see if - because sometimes the pressures from
13 underneath in the - like, lower aquifer, they can come up
14 and be the source of the water or the pressure to cause the
15 impacts. So my initial look at it was separating it into
16 like a regional granite aquifer, and then anything
17 basically above the granite aquifer was a shallow or
18 perched aquifer which is not a permanent feature over the
19 whole catchment, and certainly not in the upper reaches of
20 it. So I think - we think we've all agreed that the deeper
21 granite aquifer has nothing to do with it. The water's too
22 deep. There's no pathway to get and there's no pressure -
23 there's not enough pressure in that to force water up to
24 cause this. So we're only talking about the water sort of
25 above the granite interface and in the colluvium and sandy
26 soils.
27

28 MR COSTELLO: I might just go to a passage of your report
29 while we're here, Mr Hitchcock. That report is
30 MSC.5087.0001.0001. And if we could go to page 0012.
31 I hadn't intended to do this now, but it might just be
32 useful to see if there's a measure of agreement at least on
33 questions of terminology. If paragraphs 32 and 33 could be
34 expanded. Here, Mr Hitchcock, you're making some comment
35 about what you mean when in your report you refer to
36 groundwater and perched groundwater?
37

38 MR HITCHCOCK: Yes.
39

40 MR COSTELLO: And you say groundwater is defined as water
41 that resides in an aquifer beneath the ground surface. You
42 then define an aquifer as water-bearing strata that
43 provides a constant supply of water. So an aquifer then is
44 different from perched groundwater in that it's constant
45 and perched groundwater is not; is that right?
46

47 MR HITCHCOCK: Yeah. By definition I would say perched

1 water is something that's not permanent. It's sort of
2 water on a pathway, become real groundwater, if you like.

3
4 MR COSTELLO: I see. So there is within those two
5 paragraphs a definition of groundwater, a definition of
6 aquifer being a constant supply of water, and then a
7 definition of perched groundwater being an inconstant
8 subterranean water; is that fair?

9
10 MR HITCHCOCK: Yeah. I can see that that's confusing
11 because I've said an aquifer needs to be permanent and then
12 below have said it doesn't have to be. But it's not the
13 intent of it.

14
15 MR COSTELLO: Well, just to make sure everyone's clear why
16 don't you just state the intent?

17
18 MR HITCHCOCK: Well, the intent of - the shallow aquifer
19 isn't a permanent aquifer that always has water in it,
20 whereas the regional groundwater does.

21
22 MR COSTELLO: I just want to understand from the other
23 witnesses that are in the witness box now is this
24 terminology as described by Mr Hitchcock terminology that
25 you either all use or are content to adopt for the purpose
26 of today's hearing or do you have a disagreement with it?
27 Mr Pope, I might just start with you and move along the
28 table.

29
30 MR POPE: Yeah, I don't have any broad disagreements.

31
32 MR COSTELLO: Thank you. Mr Makin?

33
34 MR MAKIN: Yeah, I agree with those general definitions.
35 I'd just add that the way we're using it here aquifer can
36 also refer to the geological materials with the potential
37 to carry water. So the perched aquifer being inconstant
38 sometimes has water, sometimes doesn't in different areas.
39 So that area that doesn't have water we might still refer
40 to as (indistinct).

41
42 MR COSTELLO: I see. Mr Hitchcock, do you agree with
43 that?

44
45 MR HITCHCOCK: Yeah, yeah. It's a pathway.

46
47 MR COSTELLO: Yes. Thank you. Mr Paul?

1
2 MR PAUL: Yes, I'll adopt what Mr Makin said there as the
3 hydrogeologist.

4
5 MR COSTELLO: Thank you. Yes?

6
7 MR HARTLEY: Defer to Mr Bolton,

8
9 MR COSTELLO: Mr Bolton, are you comfortable enough?

10
11 MR BOLTON: I think the issue that I would have is that
12 perched - I would probably call it a shallow perched
13 aquifer, and the reason for that is that a perched aquifer
14 does not necessarily need to be transient in nature. So it
15 can be, for all intents, permanent. So, for example, at
16 Prospect Hill Avenue, in that area that's bordered between
17 Prospect Hill Avenue and Coburn Avenue, which I sometimes
18 refer to as the Prospect Hill island of houses, that has
19 constant water and yet it's a shallow perched aquifer. And
20 one can see from the - what would you call it - foundation,
21 the watering systems that are there, which are agi-drains,
22 that sort of thing, at number 7 Prospect Hill that there's
23 a constant flow of water. Now, I've only been there for a
24 couple of - a few months. But, having talked to residents,
25 I understand that that area is - I think it was referred to
26 sometimes as the swamp, you know, and prior to the houses
27 being built there there was, you know, longstanding water
28 in that area. So I guess the issue I have is this idea
29 that shallow perched or perched groundwater is indicated as
30 transient in nature, and I don't think that that is the
31 case. I think a better description would be a shallow
32 perched aquifer system and a regional aquifer system,
33 regional being deeper.

34
35 MR COSTELLO: All right. So you don't accept that there's
36 necessarily something inconstant about perched?

37
38 MR BOLTON: Inconstant?

39
40 MR COSTELLO: Yes.

41
42 MR BOLTON: Correct.

43
44 MR COSTELLO: Yes. Okay. I understand that.

45
46 MR HITCHCOCK: Can I just add that --
47

1 MR COSTELLO: Yes, please.

2

3 MR HITCHCOCK: -- when I wrote this I didn't have the
4 causation reports, which had two bores that have perched
5 water sitting in them. There was no evidence of any water
6 at all in the perched water.

7

8 MR COSTELLO: I see.

9

10 MR HITCHCOCK: I have no issue with what was just said.

11

12 MR COSTELLO: Okay. Thank you. That's very useful. All
13 right. In terms of potential water sources here there are
14 a number identified in the joint report that I think we can
15 just put aside quite quickly. In respect of both of these
16 slides, the two slides that is in 2025, numbers 18 and 30
17 concern rainfall and everybody accepts that to be a minor
18 factor here.

19

20 There is then 20 and 32. This is groundwater from an
21 aquifer as a triggering source. This is either viewed as
22 minor or insignificant to minor by each of you. So I don't
23 intend to ask any questions concerning that. And when you
24 have each addressed those questions, that is 20 and 32 in
25 the joint report, I think it's right to say that you've
26 been considering groundwater from a deep aquifer, not a
27 shallow aquifer; is that a correct understanding of the
28 work that's been done?

29

30 MR POPE: Could you bring it up on the screen?

31

32 MR COSTELLO: Yes, of course. I'll bring the joint report
33 up. That's very prompt. I'll show you a few pages,
34 Mr Pope. If we first go to I think it's page 4. So this
35 is 5 January. And can you see number 20, "Water source
36 groundwater from aquifer - triggering". It's number 20
37 there. And then if we go over the page, number 32, this is
38 the 14 January slide, "Water source groundwater from
39 aquifer - triggering." And then I'll take you down to the
40 notes. If we just click through, please, and if we could
41 go down to 18. Sorry, not page 18, sorry. If you go back
42 up to the table. Go down. Just stop there. If you see
43 number 20 there. These are the comments that you've each
44 made in connection with number 20.

45

46 MR POPE: Yep.

47

1 MR COSTELLO: I think I'm right to say, yes, no separate
2 comments made on 32, which is the later slide. So the
3 totality of the comments on this are the comments there.
4 So when considering this as a potential trigger,
5 groundwater from aquifer, are we speaking deep water
6 aquifers, shallow aquifers or aquifers of all kinds, or
7 only deep?

8
9 MR PAUL: So this is talking about shallow aquifers.
10 I think we agreed to rule out the deep aquifer was not
11 involved. But it's specifically referring to natural water
12 flow through the shallow aquifer.

13
14 MR COSTELLO: As opposed to?

15
16 MR PAUL: As opposed to, yeah, water that might have
17 flowed through the aquifer and another source.

18
19 MR COSTELLO: Is that a consensus view by those at the
20 table that reflects the conclave?

21
22 MR POPE: Yes.

23
24 MR COSTELLO: Thank you. If we could go back to the
25 fourth page of that document, please. There's then at 22
26 water source domestic usage irrigation as a triggering
27 factor. Minor, minor, and medium for you, Mr Hartley, with
28 a moderate degree of confidence. That's in many respects -
29 given what medium means in this context, that's peripheral.
30 If we have time I might come back to it, but it's a fair
31 way from the main game.

32
33 And then 24, this is another water source but a
34 preparatory factor, stormwater leakage. Minor, medium and
35 medium. So a small amount only of disagreement on that
36 factor, which really directs attention then to the
37 Bayview Road leak, which is 21 on this table and 33 in the
38 next table. And, Mr Paul, you view this as significant
39 with a high degree of confidence; Mr Pope, you view it as
40 major with a high degree of confidence; as do you,
41 Mr Hitchcock. And I take it I'm to attribute the opinion
42 for South East Water - that's the opinion of both you,
43 Mr Hartley, and you, Mr Bolton, or is that just Mr Bolton's
44 opinion?

45
46 MR HARTLEY: Both of us.
47

1 MR COSTELLO: Both. Thank you. You view it as
2 insignificant to minor. All right. Could I have on
3 screen, please, DPA.0004.0001.0001. Could I have 0084.
4 And could I have that picture at the top, figure 8.19,
5 expanded together with the text just below it just to
6 explain what it is, thank you. Mr Paul, this is a diagram
7 taken from your report. As you see it now you're familiar
8 with it? You recall what this is?

9
10 MR PAUL: Yes.

11
12 MR COSTELLO: Yes. This is to do in some respects with
13 the mechanics of the burst, and I thought it might be a
14 useful introduction into this topic. Would you explain
15 this picture, please?

16
17 MR PAUL: Yes. It's a 3D model. So in order to
18 investigate or just try to really understand how the leak
19 site fits together with the services fits together with
20 geology it's been modelled in three dimensions. So in this
21 model the green are our transported soils, the dark green
22 that's labelled. Residual granite below that. And then
23 based on the services plans available we've put in the
24 locations of the water main and the locations of sewers and
25 stormwater. And the purpose of that is to - you know, how
26 far, for example, was the sewer from the leak location.
27 That's what we're trying to achieve with that.

28
29 MR COSTELLO: I'm going to move to another image, but
30 before I do did anyone want to make comment on this image?
31 I take it that this is relatively elementary, unlikely to
32 be causative of dispute. Thank you.

33
34 Within the same document could we go to page 92,
35 please. If I could have 92 and 93 on the screen together
36 to begin with, thanks. I might start with the top
37 left-hand corner, figure 8.25. Mr Paul, this is still in
38 your report and this concerns potential flow paths, a topic
39 we'll come to in more detail. But the yellow line there is
40 the colluvial gully that runs from Arthurs Seat to the
41 escarpment; is that right?

42
43 MR PAUL: Correct.

44
45 MR COSTELLO: All right. And what's the purpose of this
46 image?

1 MR PAUL: Each of these images, I'll call it a hypothesis
2 of how water may have got from the pipe burst to the
3 landslide site. Each of those are then ones that we can
4 explore with the evidence.
5
6 MR COSTELLO: Yes.
7
8 MR PAUL: So this one at the top assumes water might flow
9 only through colluvium.
10
11 MR COSTELLO: All right. We might blow them up one by one
12 because they're probably a bit hard to see. If the first
13 one in the left-hand top corner could be expanded, please.
14 So this is a potential flow path that is through a
15 colluvial gully; is that correct?
16
17 MR PAUL: Through what I mentioned yesterday, the thalweg,
18 you know, down at the bottom of an infilled gully filled
19 with - containing colluvium.
20
21 MR COSTELLO: That's just a hypothesis of a path?
22
23 MR PAUL: Correct.
24
25 MR COSTELLO: All right. If that one could come down and
26 the next one below it, 8.26.
27
28 MR PAUL: This is another hypothesis which we know water
29 went down - from the burst went down the stormwater. So
30 this is looking at whether it could have got out of the
31 stormwater pipe and then flowed down towards the
32 landslides. So that's what that hypothesis is.
33
34 MR COSTELLO: Could we then move to - thank you; perfect -
35 8.27. This I think shows the sewer lines that run from the
36 burst site to Coburn Avenue and then they pick up again at
37 around Prospect Hill Road; is that right?
38
39 MR PAUL: That's right. So this is a third hypothesis
40 showing how groundwater may have migrated through sewer
41 trenches.
42
43 MR COSTELLO: That can come down, please. Just so the
44 witnesses understand what I'm doing here, I'm really just
45 adducing a generalised explanation of the subject matter
46 area. We will come in detail to paths and the area of
47 debate. Could I have on the screen, please,

1 SEW.0001.0002.4187. Could I have page 61, please, 0061.
2 Thank you. And if that figure 34 could be expanded.

3
4 Mr Hartley, I'm not sure if you or Mr Bolton are best
5 placed to explain this, but as I understand it this is a
6 diagram showing flow paths to stormwater drains from the
7 burst site; is that a fair description?

8
9 MR HARTLEY: Yeah, based on the visual evidence of
10 the sand fan, you know, the deposition of sand that
11 emanates from the point of upwelling over an area which,
12 you know, basically culminates in the stormwater going.

13
14 MR COSTELLO: Yes. And the general relevance of this,
15 although it's relevant in more than one sense, but at least
16 at the most obvious level is whether and how much water
17 that came from the burst site travelled promptly to the
18 stormwater drain and then along the stormwater drain?

19
20 MR HARTLEY: That's a - yeah, that's it. Yeah.

21
22 MR COSTELLO: Thank you. Could I have on screen, please,
23 DPA.0004.0001.0001. And could we go to page 0059, please.
24 If that could be blown up. Mr Paul, I think this is a
25 localised map of stormwater and sewerage infrastructure; is
26 that right?

27
28 MR PAUL: That's correct.

29
30 MR COSTELLO: And this of course is along View Point Road?

31
32 MR PAUL: That's right.

33
34 MR COSTELLO: What's the green?

35
36 MR PAUL: The green of a sewer.

37
38 MR COSTELLO: And blue.

39
40 MR PAUL: Blue is stormwater.

41
42 MR COSTELLO: If we could move across to --

43
44 MR PAUL: I should correct that the blue with the - the
45 blue and white, sorry, is the stormwater. The solid blue
46 is the water main.

1 MR COSTELLO: Yes, quite right. Solid blue is the water
2 main.
3
4 MR PAUL: Yes.
5
6 MR COSTELLO: Blue and white is stormwater.
7
8 MR PAUL: Correct.
9
10 MR COSTELLO: Green is sewer.
11
12 MR PAUL: Correct.
13
14 MR COSTELLO: There's also pink lines there. They're just
15 the boundaries of the properties.
16
17 MR PAUL: Property boundaries, correct.
18
19 MR COSTELLO: Thank you. Could we move two pages forward
20 in the same document, please. If that could be expanded.
21 Again, Mr Paul, we're in your report here. This shows a
22 sewer invert on View Point Road, I think; is that what this
23 is?
24
25 MR PAUL: That's right. This is - again, it's a slice
26 through our 3D model which we put together to try to
27 understand the spatial relationship between the services
28 and the landslide. There are two sewer levels labelled
29 there. The one sort of bottom right label that says "sewer
30 from SEW plans figure 7.13", that is put in at the
31 elevation as shown on the plans. But then the PSM
32 investigation which involved excavating over the sewer
33 trench found that sewer to be high. So we put both in.
34 That's why it's shown there twice as two sewers. There's
35 only one in reality, but we've got two pieces of
36 information communicating them to be at different levels.
37
38 MR COSTELLO: And just so I can make sure that I've got
39 the right information, Mr Pope, in your report - I think
40 you've got your report in front of you, don't you?
41
42 MR POPE: Yes, correct. One of them, yep.
43
44 MR COSTELLO: I can bring it up if you want. You mention
45 at paragraph 171 of your report that - I'll just read it
46 out - "The SEW trunk sewer on View Point Road is
47 approximately 6 metres upstream of the proven flow path."

1
2 MR POPE: Yes, correct. Yes.
3
4 MR COSTELLO: And you then mention it's got gravel at the
5 invert of the trench, which you take from a borehole log,
6 and evidence of a tree root system. But what you're
7 speaking of there, that South East Water trunk sewer on
8 View Point Road, is that what's depicted in this image in
9 front of you?
10
11 MR POPE: One of them, yes.
12
13 MR COSTELLO: There's more than one?
14
15 MR POPE: No, like, as Darren said apparently - I didn't
16 realise there was that much of a difference between the
17 South East Water's drawings but yes, that's what it's --
18
19 MR COSTELLO: Yes, thank you. Could that come down and
20 could we move one page back to page 60, please. Yes, just
21 one page back. That's okay. Thank you. This is also in
22 your report here, Mr Paul, and it's identifying the sewer
23 there close to the bottom right-hand side.
24
25 MR PAUL: Correct.
26
27 MR COSTELLO: That's the same as we've just seen but from
28 a different perspective? Yes, thank you. Also there's a
29 prominent blue arrow in the centre there. That's the dye
30 testing, is it?
31
32 MR PAUL: That's right. We don't know the dyes would have
33 travelled exactly along the arrow, but we do know the dye
34 put into NDT01 emerged at around that location --
35
36 MR COSTELLO: That's the black dot. Yes. So when dye
37 testing was done it was put in at NDT01, which is a bit
38 hard to read, but is the black dot closest to the start of
39 the blue arrow?
40
41 MR PAUL: Correct.
42
43 MR COSTELLO: And the dye emerged - as you say may not
44 have travelled in a perfectly straight line, it may have
45 travelled in all sorts of lines, but in any event emerged
46 at or about the end of that blue arrow?
47

1 MR PAUL: That's right.

2

3 MR COSTELLO: All right. There might be some more
4 questions about dye testing a little later. Could we go to
5 page 84 of that report, please. No, could I have the table
6 below, sorry. This is table 8.1. Mr Paul, this is a table
7 within your report, table 8.1, which sets out water
8 observations. Could you just describe how you put this
9 table together?

10

11 MR PAUL: What we're seeking to do there is to develop a
12 chronology - you see that table is ordered - based on the
13 times at which various observations were made. So the
14 source of this information includes observations from
15 witness statements, includes records from South East Water
16 of when water was observed emerging at the surface, and
17 that's what you see most of those columns. And then the
18 right-hand column based on the chart of inferred leakage
19 out of the Bayview Road leak, which is put together by -
20 I can't remember his name now, but the chart of leakage out
21 of Bayview Road --

22

23 MR COSTELLO: Do you mean Professor van Zyl?

24

25 MR PAUL: No, no, the South East Water leakage estimate.

26

27 MR COSTELLO: Dr Crook.

28

29 MR PAUL: Crook, sorry, that's the one. So using his
30 evidence as to how the leak progressed over time we've
31 tried to, in that column there, match what was leaking out
32 of the pipe with the observation, try to get a chronology
33 there.

34

35 MR COSTELLO: If that could just be brought down and if we
36 could go over the page just to make it clear. That table -
37 what you've just been shown is not the limit; it goes over
38 a number of pages.

39

40 MR PAUL: It does, and it's also shown graphically in the
41 appendix as well.

42

43 MR COSTELLO: Yes, thank you. Could we go to the next
44 page, please. And again. Thank you. Can I have
45 MSC.5087.0001.0157, and could I have point 0245. Mr Pope,
46 this is from your report, and I think it is somewhat
47 related to what I've just been discussing with Mr Paul. It

1 always takes a while to come up. This is the map of
2 I think walks that you did around the area; at least
3 somebody did. I don't know if it was - I thought it was
4 you but, if it wasn't, you'll tell me.

5
6 MR POPE: Yep. That is me.

7
8 MR COSTELLO: This is you connected --

9
10 MR POPE: Darren and I, fortunately or unfortunately, have
11 got the same initials. But it's definitely me.

12
13 MR COSTELLO: Yes, it's proved a real irritation, I can
14 tell you. This is a map where you've been hooked up to a
15 GPS or something --

16
17 MR POPE: Yes.

18
19 MR COSTELLO: -- and it's tracked your movement?

20
21 MR POPE: Yep.

22
23 MR COSTELLO: And you haven't done that for fitness
24 purposes; you've done it for purposes connected with your
25 work here?

26
27 MR POPE: Yes.

28
29 MR COSTELLO: And what was the purpose of the explorations
30 that you were doing and tracking?

31
32 MR POPE: I mean, obviously there's a lot that are acute
33 to the E0, the emergency order, area. So there's a lot of
34 work done there for the landslide risk assessment. The
35 stuff that goes further to the north-east is the same.
36 Bayview Road area was a series of visits, so mapping the
37 extent of the sand plume; returning with the community to
38 have a meeting with them up there one of those days. And
39 then so, for example, the black one that runs to the bottom
40 of frame, I was going upstream of the failure area just to
41 look at - essentially I could find where the sewers were,
42 with not much help from the mapping system. So there was
43 more water - moister soils is what the simplest conclusion
44 I came to. It didn't mean there was water flowing or
45 anything, but certainly there's a lot of green grass around
46 sewer trenches and things in upstream of where the failure
47 was. That was where I was starting to put together flow

1 paths and mechanisms for the water to come down the hill.

2

3 And then just other stuff, like, clearly I've stopped
4 at Browne Street on 27 February. There was a CCTV operator
5 there at that time, and I looked over his shoulder and
6 that's where we initially identified the Browne Street
7 defect. This is the sort of walks I do when I'm trying to
8 assess something of this scale, is the rest of the walks
9 around, trying to have a look at the gullies.

10

11 The eastern limit is looking at the water main coming
12 across the gully, the big 900 diameter water main, but
13 having trouble getting down there. And then the western
14 limit is coming up near the McCrae Homestead, where the
15 community and the old maps talk to springs in that area.
16 And then having a walk down Coburn Creek up near the
17 motorway just to have a look at how much water was flowing
18 in that creek. But that's pretty much it, I think.

19

20 MR COSTELLO: One of the purposes of these walks, by no
21 mean the only purpose, was to make observations of where
22 you identified significant amount of moisture?

23

24 MR POPE: Yeah, true. Yep.

25

26 MR COSTELLO: If we go over the page, I think on this map
27 you identify where you have observed moisture or
28 saturation?

29

30 MR POPE: Yes. There is some - in the legend on the right
31 you'll see "MPSC observations in January". So early days
32 some of their team had done some mapping. So the orange
33 and brown is exclusively from them, but the remainder of it
34 is me.

35

36 MR COSTELLO: Thank you.

37

38 MR POPE: The CCTV stuff is, yeah, indirectly me as well.
39 But the mapping is me. Yep.

40

41 MR COSTELLO: Now, Mr Hartley, in your report there's also
42 some evidence of site walks. Were they done by you?

43

44 MR HARTLEY: Yes, myself and Mr Bolton.

45

46 MR COSTELLO: You and Mr Bolton. I'll just see if I can
47 have one brought up. I think it's SEW.0001.0002.4187, and

1 if we could go to 0052, please. Here in 6.1 you make some
2 observations about site walkovers?

3

4 MR HARTLEY: Yes.

5

6 MR COSTELLO: And you did those walkovers on at least
7 13 March and 13 June, 17 June and 20 June. Were there any
8 other times?

9

10 MR HARTLEY: There was 3 March rather than 13 March,
11 but --

12

13 MR COSTELLO: Sorry, 3 March.

14

15 MR HARTLEY: Mr Bolton has done some other impromptu
16 walkovers as well.

17

18 MR COSTELLO: I see. That's why the word "including" is
19 used, is it?

20

21 MR HARTLEY: Yes.

22

23 MR COSTELLO: Yes. Okay. I understand. Thank you. And
24 were you and Mr Bolton looking for the same things during
25 these walks?

26

27 MR HARTLEY: The objective of them varied slightly, but
28 the 13 June was a walkover to familiarise ourselves with
29 the parts of the region that we hadn't done so on 3 March.
30 But we were also looking at feasible areas to put borehole
31 locations down. The 17th and 20th were opportunistic
32 walkovers which - following on from the landowners' kind
33 acceptance that we could visit the sites of the landslide
34 at those dates, we took the opportunity of, you know,
35 basically really getting as much confidence as we could of
36 the site as possible.

37

38 MR COSTELLO: I see. And in the course of your
39 observations did you make any notes of when and where you
40 identified water in a quantity that you wouldn't expect it
41 to be present? That is saturated ground, for example?

42

43 MR HARTLEY: Oh, gosh. Well, it was in June and the -
44 appendix C of our report - appendix C is basically the
45 views that I - the observations I made of number 6 and
46 number 10-12 View Point Road. The main body of
47 the umbrella report talks about observations in general.

1 We didn't actually find much in the way of saturation as
2 I would've thought, but we did notice constant flowing of
3 the stormwater drains.
4

5 MR COSTELLO: In the course of preparing your report or at
6 least for the purpose of participating in the conclave, did
7 you consider Mr Pope and Mr Paul's evidence of surface
8 water in the general area?
9

10 MR HARTLEY: Mr Pope's, you know, mud map - I don't want
11 to be disrespectful - was certainly considered between the
12 submission of the expert reports and conclave, and, yeah,
13 along with, you know, sketches supplied by the parties,
14 yeah.
15

16 MR COSTELLO: All right. Thank you. Mr Bolton, you don't
17 have to add anything but, if there's anything you'd like to
18 add, by all means do.
19

20 MR BOLTON: Yeah, I'd just add that I was at the site
21 during the time of drilling. So I spent a fair bit of time
22 out there, and drove, walked the streets, you know, all
23 that sort of stuff, spoke to residents, you know, just to
24 get a general sense of the history of (indistinct) in the
25 area, that type of stuff, which did prove important in my
26 assessment.
27

28 MR COSTELLO: I just want to briefly touch on dye testing.
29 Could I have MSC.5087.0001.0157. Could I have it at .0248.
30 Mr Pope, I'll direct this to you since we're in your
31 report. The page that's about to come up will hopefully
32 show the results of dye tests. So you can see there the
33 previously mentioned NDT01, which is where the dye was
34 placed into the ground.
35

36 MR POPE: Yes.
37

38 MR COSTELLO: And then where the dye emerged is evident
39 from the two arrows on the scarp there. This was testing
40 that you performed?
41

42 MR POPE: Yeah, I was there with our senior --
43

44 MR COSTELLO: Sorry, when I say you performed it, you
45 caused it to be performed and --
46

47 MR POPE: I was on site when it happened, yeah, when we

1 put more water than we wanted to into the hole, yep.

2

3 MR COSTELLO: Thank you. Can you explain how NDT01 was
4 chosen as a location?

5

6 MR POPE: Yep. So initially, like I said before, I was
7 looking around sewer trenches that were greener than other
8 parts of the world, and on 6 View Point the private sewer
9 trench - that borehole was in the private sewer trench, and
10 the sewer trench itself runs - literally follows the
11 property boundary at that offset. So if you go straight up
12 the page and follow the property boundary and you come
13 around to a few metres from the headscarp basically in
14 the - yeah, pretty close to where the change in direction
15 there is with the property - to your right. To your right.
16 So, yep. And then if you go up a little bit along the
17 property boundary - that's a grid, sorry. Yep, there.
18 Stop. So it comes roughly up to there, and then all the
19 pipes go into the - come out of the kitchen and - so my
20 early theory was that we were getting water coming down
21 that private trench. So that's hence why I was testing
22 there in particular.

23

24 MR COSTELLO: I see.

25

26 MR POPE: Yep.

27

28 MR COSTELLO: And I might just ask you to comment on what
29 it is that you draw - what conclusions you draw from these
30 dye tests, but I'll just put another photo up first.

31

32 MR POPE: Yes.

33

34 MR COSTELLO: It's in the same report. Actually, if that
35 could be reduced - it might be on the same page. No,
36 sorry, it's not. It's at 0408. This is a photo you'll be
37 well familiar with, Mr Pope. It's the one where you can
38 see the dye coming out of the scarp.

39

40 MR POPE: Yeah, correct.

41

42 MR COSTELLO: So both of those photos are photos of the
43 dye coming out; is that right?

44

45 MR POPE: Yes, correct.

46

47 MR COSTELLO: An untrained eye might just think that was

1 some algae or moss growing or something, but it's green dye
2 out of the --

3

4 MR POPE: Yeah, correct. I think I've discussed that
5 somewhere before. So that was my initial concerns, was it
6 just moss. And we still had supply of water and then the
7 green faded. So I didn't - like, if it's going to grow in
8 water, why's it going to die in water? So for me it's
9 pretty high confidence that it's dye.

10

11 MR COSTELLO: Okay. And where that green dye is emerging
12 that's emerging from the colluvium?

13

14 MR POPE: Yep.

15

16 MR COSTELLO: And so apart from - well, I shouldn't assume
17 anything is obvious. What is it that you took from the
18 results of this dye testing? What did it tell you as --

19

20 MR POPE: So I should clarify NDT01 went well - it was in
21 the sewer trench but we punched way below it. So we were
22 actually into the colluvium below the trench.

23

24 MR COSTELLO: When you put the dye in?

25

26 MR POPE: Yeah, correct.

27

28 MR COSTELLO: So the dye into below the trench?

29

30 MR POPE: Yeah, absolutely. Sorry. There wasn't any - at
31 that point we didn't have standing water in the - because
32 it's quite a big hole. So we put GoPros down it to film it
33 and see what was going on down the bottom, and not much
34 water. So we added plenty, and it took a while to - it
35 didn't drop really quickly in the borehole, but it
36 certainly - 90 minutes later was the start of the evidence
37 of it at the headscarp. And then I came back the next day,
38 I think there's photos to that, or not the next day, within
39 the week, and the borehole's dry sort of thing. So to me
40 it meant that whatever the water source was was a little
41 bit below our borehole. I think at that time it was
42 roughly 4 metres deep, and we came back and extended it to
43 I think 5 or 6. I don't have the exact numbers in my head.
44 But at the time to me the water - the flowing water was
45 below where we placed the dye. The dye's gone down into
46 whatever water was there, rather than being in flow - like,
47 in groundwater, if that makes sense. Yep.

1
2 MR COSTELLO: Let me just see if I can accurately state
3 the position before we move to the question of particular
4 flow paths and their viability. In respect of this issue,
5 the Bayview Road leak as a water source, everybody agrees
6 that it was either - if it was a source, it was a source
7 for both 14 January and - it was a trigger, rather, for
8 both 14 January and 5 January; is that correct?
9 Mr Hartley, you don't accept it was a trigger?

10
11 MR HARTLEY: An insignificant to minor trigger.
12

13 MR COSTELLO: That's right. And to the extent that it was
14 a trigger at all, whether insignificant or minor, you
15 accept that the position is relevantly the same for the two
16 landslides; is that right?
17

18 MR HARTLEY: Oh, gosh. In - I beg your pardon. No,
19 it's --
20

21 MR COSTELLO: It's all right. I had rather hoped it was a
22 simple question, so I was just as surprised by the
23 response.
24

25 MR HARTLEY: My position is, is that the 5 January
26 destabilised the situation so much that the 14 January was
27 going to happen, and therefore insomuch as if one accepts
28 the premise that Bayview Road leak is happening at the time
29 of the 5th it would be happening at the time of the 14th,
30 or water coming down at the same time. But the fact it was
31 there or not, my opinion is, is that it has even less of an
32 impact because the 5 January has happened, destabilising
33 the situation.
34

35 MR COSTELLO: Another way of saying that is the 5 January
36 slide meant that the 14 January slide was inevitable?
37

38 MR HARTLEY: That's a way of saying, yes.
39

40 MR COSTELLO: You accept that?
41

42 MR HARTLEY: "Inevitable" is a strong word, but yes.
43

44 MR COSTELLO: I see. What word would you choose? I don't
45 want to put words in your mouth, Mr Hartley.
46

47 MR HARTLEY: "Even more likely".

1
2 MR COSTELLO: I see. Thank you. Mr Paul, you conclude -
3 I'm only doing this at a high level before we get to the
4 specifics. You conclude that there are plausible flow
5 paths to the site of the - perhaps I'll just call it the
6 scarp.
7
8 MR PAUL: Yes.
9
10 MR COSTELLO: Plausible paths from the burst site to the
11 scarp?
12
13 MR PAUL: Correct.
14
15 MR COSTELLO: You don't have a concluded view on which of
16 the plausible paths is the more likely?
17
18 MR PAUL: That's right. I'm unable to get to a point to
19 say one - what proportion either of those paths might have
20 contributed.
21
22 MR COSTELLO: Thank you. You consider that the only water
23 source within the vicinity of the 2025 landslides of
24 sufficient volume to cause the landslides was the burst?
25
26 MR PAUL: That's right. My model is that the soil, you
27 know, for the weeks probably in December, prior to January,
28 just got wetter and wetter and wetter and wetter, and more
29 of it got wet until it slid. So the only source that was
30 available at the time to do that was the Bayview Road leak.
31
32 MR COSTELLO: Thank you. Mr Pope, I think it's right to
33 say, but you'll no doubt correct me if I'm wrong, that you
34 agree with Mr Paul on each of the matters that I've just
35 put to him?
36
37 MR POPE: Yes.
38
39 MR COSTELLO: Thank you. Mr Hitchcock, you have a
40 particular view about the most probable flow path. You
41 consider that a shallow aquifer was the most likely
42 pathway; is that correct?
43
44 MR HITCHCOCK: Having had the benefit of the causation
45 reports, I think it's more likely a combination of flowing
46 along some of the stormwater and sewerage bedding
47 materials, as well as going down to the colluvium and then

1 following the groundwater path.

2

3 MR COSTELLO: You make reference in your report to
4 embedment material?

5

6 MR HITCHCOCK: Yeah.

7

8 MR COSTELLO: You think the likely combination then is
9 shallow aquifer but also travelling along the path of
10 embedment material?

11

12 MR HITCHCOCK: Yeah. So flowing along embedment material,
13 that being saturated, going into natural soils, going
14 laterally and also down, down to the aquifer and then down
15 to the escarpment. But a combination of those things
16 rather than one or the other. I would think it's unlikely
17 just to follow a trench the whole way down there.

18

19 MR COSTELLO: Thank you. Mr Hartley, I think the starting
20 point for your analysis is that the majority of the water
21 went into the stormwater drain?

22

23 MR HARTLEY: Yes, correct.

24

25 MR COSTELLO: Thank you. You accept the theoretical
26 possibility of a, I think what you call, direct flow path
27 from the burst site to the scarp? Theoretical possibility?

28

29 MR HARTLEY: Theoretical, and that's what we've been
30 trying to establish.

31

32 MR COSTELLO: You think that it's unlikely in large part,
33 I think, because of the question of velocity, that is you
34 don't think the water could have got to the scarp in
35 sufficient time; is that right?

36

37 MR HARTLEY: That's bang on, yes.

38

39 MR COSTELLO: Thank you. Do you accept that there are
40 subsurface trenches that could form a flow path that would
41 be a theoretically possible way of water travelling?

42

43 MR HARTLEY: (Indistinct), yes.

44

45 MR COSTELLO: I think I'm right to say that you are not
46 convinced by the viability of the subsurface trenches as a
47 flow path by reason of the chemical testing. Perhaps when

1 I say "you" I'm perhaps aggregating to you a view that's
2 held by the joint authors of your report. So, if you want
3 to pass to Mr Bolton, of course you can.
4

5 MR BOLTON: Yes, we've looked at geochemical testing and
6 used that as one of our lines of evidence.
7

8 MR COSTELLO: Thank you. And I think, Mr Hartley, at
9 least so far as I understand your joint report, the last
10 critical integer in this question is that you consider the
11 trigger volume to be so low, that is the amount of water
12 that would have been required to be in the scarp to be so
13 low, that you can't rule out other potential water sources
14 as being the water, that is water other than the burst -
15 from the burst site?
16

17 MR HARTLEY: That's correct. Based on working on the
18 5 January failure the volume is very low.
19

20 MR COSTELLO: Thank you. All right.
21

22 MR HITCHCOCK: Can I make a comment there?
23

24 MR COSTELLO: Yes, please.
25

26 MR HITCHCOCK: There's a difference I think between the
27 amount of water to saturate the soil and cause a slip, and
28 the amount of water coming out. That can be a lot greater.
29

30 MR COSTELLO: The amount of water coming out of?
31

32 MR HITCHCOCK: Out of the escarpment.
33

34 MR COSTELLO: Thank you.
35

36 MR HITCHCOCK: So Dane measured 17,000 litres a day at -
37 I think the day after or close to?
38

39 MR POPE: 6th.
40

41 MR HITCHCOCK: And then the only other time access was
42 allowed, 50 litres a day, which is a massive difference.
43 It's 340 times difference. It shows there's some sort of a
44 surge rather than just little bits pushing out.
45

46 MR COSTELLO: Thank you. I appreciate that, Mr Hitchcock.
47 You can be assured that we'll be returning to that. My

1 colleague, Mr Di Stefano, is now going to ask each of you
2 some questions concerning viable water paths.

3

4 <EXAMINATION BY MR DI STEFANO:

5

6 MR DI STEFANO: Madam Chair, before I start I just note
7 that a photograph of the diagram - of Mr Paul's diagram has
8 been taken. We would seek to tender that photograph.

9

10 CHAIRPERSON: The photograph of Mr Paul's whiteboard
11 drawing is exhibit CA78.

12

13 **EXHIBIT #CA78 PHOTOGRAPH OF MR PAUL'S WHITEBOARD DRAWING**

14

15 MR DI STEFANO: Thank you. I'd like to begin by touching
16 on the first topic that Mr Costello addressed in your
17 analysis, Mr Hartley and Mr Bolton, which is the volume of
18 water that entered the stormwater system at the burst site.

19

20 MR HARTLEY: That was Professor van Zyl, but we can talk
21 about it.

22

23 MR DI STEFANO: Yes, yes. So Mr van Zyl is - do you know
24 what his background is or his expertise?

25

26 MR HARTLEY: Professor van Zyl was engaged by South East
27 Water direct, and we had no communication with him, so.

28

29 MR DI STEFANO: But you've read his report, I assume?

30

31 MR HARTLEY: Correct.

32

33 MR DI STEFANO: And do you have any professional
34 experience with him, aside from this?

35

36 MR HARTLEY: No.

37

38 MR DI STEFANO: And is it the same for you, Mr Bolton?

39

40 MR BOLTON: Yes, that's true.

41

42 MR DI STEFANO: So you're not aware of whether he's a
43 hydrogeologist or has expertise in measuring - aside from
44 measuring flow rates from burst pipes, as he appears to do
45 in the report, are you aware of whether he has expertise in
46 measuring absorption rates through soils or through other
47 materials?

1
2 MR HARTLEY: Not from my own research, no.
3
4 MR DI STEFANO: Yes. And the same for you, Mr Bolton?
5
6 MR BOLTON: Yes.
7
8 MR DI STEFANO: Mr van Zyl's report includes the most
9 up-to-date, I infer, analysis of the total leak volume from
10 the burst site, and he provides an estimate of
11 40,300,000 litres. Is that consistent with both of your
12 understandings of the volume of water that leaked from the
13 Bayview Road burst?
14
15 MR HARTLEY: 40, 4-0?
16
17 MR DI STEFANO: Yes, 40.3.
18
19 MR HARTLEY: Cumulative.
20
21 MR DI STEFANO: Cumulative, yes.
22
23 MR HARTLEY: That's our understanding.
24
25 MR DI STEFANO: Yes. The same for you, Mr Bolton,
26 I assume?
27
28 MR BOLTON: I tend to deal with litres per second, but
29 total volume, yes.
30
31 MR DI STEFANO: If we could have Professor van Zyl's
32 report put on the screen, please. It's SEW.0001.0002.4191.
33 Thank you. Can I have page 12 of that report on screen.
34 So this graph, one we've all seen many times, figure 2 at
35 the bottom shows the flow rate over time, and it shows the
36 cumulative - the bottom graph shows the cumulative leak and
37 the top graph shows the daily leakage rate, and you can see
38 there that it peaks at 1.4 to the 6, which is 1.4 million
39 litres per day. That's correct?
40
41 MR HARTLEY: Yes.
42
43 MR DI STEFANO: And if we go further on in Mr van Zyl's
44 report to page 31, here he's produced a chart which
45 estimates or, rather, summarises his estimates of the
46 modelled leakage volume per day, which is the second
47 column, over time, and then deducts from that the estimated

1 flow within pipe and sewer bedding materials per day,
2 leading to his conclusion of the leakage volume reaching
3 the surface per day?
4

5 MR HARTLEY: That's my understanding, yeah.
6

7 MR DI STEFANO: Yes. So in his view as at 6 October -
8 I mean, of course accepting that these are
9 approximate - 3,800 litres are reaching the surface per day
10 of a total leakage of 14,800, so 14,000 minus 11,000, and
11 then by the end he estimates that 1.38 million litres are
12 reaching the surface each day?
13

14 MR HARTLEY: That's my understanding too, yeah.
15

16 MR DI STEFANO: And in your analysis of the volume of
17 water that entered the sewer trenches for the purposes of
18 considering the flow path through the sewer trenches, is
19 that 11,000 litres per day the number that you used to
20 estimate the total volume that was in the sewer trenches,
21 or was it some other number or is it not related?
22

23 MR HARTLEY: When we were doing the analysis of the volume
24 of water that was needed to create a failure, it was
25 independent. It was a fairly straightforward geotechnical
26 slope stability analysis where you said, "Okay, how much
27 volume of water is needed to get the initial slope," and
28 that was that. So the flow path, the volume of water that
29 was available wasn't part of that analysis.
30

31 MR DI STEFANO: Yes. So in your analysis, though, of the
32 plausibility of the sewer trench's flow path or the service
33 trench's flow path did you compute an amount of water that
34 you estimated to be flowing into those service trenches
35 from the burst?
36

37 MR HARTLEY: I don't think we did, no.
38

39 MR DI STEFANO: No. So you would accept, though, that it
40 would be not less than 11,000 litres per day flowing into
41 that pipe and sewer bedding materials based on Professor
42 van Zyl's analysis?
43

44 MR HARTLEY: That's reasonable, yeah.
45

46 MR DI STEFANO: Yes. I don't think much of Professor van
47 Zyl's report is contested. But for the benefit of

1 the chair I might explain his conclusions and you can
2 correct me if I'm wrong. If we turn back to page 26 of the
3 report and we zoom in on the diagram at the bottom, this
4 diagram, as I understand it, depicts the water main, the
5 burst in the main and the relation of that to the sewer?
6

7 MR HARTLEY: Yeah.
8

9 MR DI STEFANO: And you can see there that the surface -
10 the ground level, the green line at the top, is
11 approximately 1.4 metres above the water main, and the
12 sewer - the edge of the trench material around the sewer
13 pipe is approximately 1.45 metres away from the burst. And
14 Professor van Zyl's estimate - evidence, if we move to the
15 next page and we zoom in on the next diagram, is that over
16 time as the volume of water increased from the burst up
17 until 11,000 litres per day effectively a channel was
18 formed of turbulent water to the surface, and that that
19 channel - through that channel any water above
20 11,000 litres per day would flow to the surface and then
21 spread out across the surface?
22

23 MR HARTLEY: Yes, effectively the difference between the
24 leak volume and the volume capable of being taken up by the
25 service trenches goes up to the surface.
26

27 MR DI STEFANO: Yes. And so his evidence is, because of
28 the pressure - the amount of pressure in the pipe and the
29 fact that that was being released in - you know, like a
30 high-pressure hose into the soil, it created a turbulent
31 zone of water which then erupted, effectively, out of the
32 surface, forming a kind of low geyser, I guess?
33

34 MR HARTLEY: Yes, yes. It wasn't as spectacular as that,
35 but yes.
36

37 MR DI STEFANO: I'm trying my best to be neutral, but,
38 yes, however you would describe it.
39

40 MR HARTLEY: Yeah, yeah.
41

42 MR DI STEFANO: And if we zoom out of that and we look at
43 the bottom of that page, these are Professor van Zyl's
44 calculations that lead to his 11,000 litres figure.
45 They're described as sample calculations. Do you have any
46 explanation for why they would be described that way?
47

1 MR HARTLEY: No, I don't, I'm afraid.

2

3 MR DI STEFANO: That's okay. Have you separately
4 calculated what you consider to be the permeability of the
5 bedding material flow?

6

7 MR HARTLEY: I think we've got some samples from other
8 people's, you know, excavations which we've done some tests
9 on, embedment material, trench backfill. Hugo, please tell
10 me if I'm wrong.

11

12 MR BOLTON: Yeah. We've done tracer tests at different
13 locations, and we did a tracer test in the sewer embedment
14 material.

15

16 MR DI STEFANO: Yes.

17

18 MR BOLTON: (Indistinct).

19

20 MR DI STEFANO: And was that this particular sewer
21 embedment material, as in this part of the sewer main that
22 runs closest to the burst location?

23

24 MR BOLTON: It's not at this location, but it's on
25 Charlesworth Road, the one that we had, but it's similar
26 material.

27

28 MR DI STEFANO: But aside from that you haven't sought to
29 independently verify Professor van Zyl's flow rate there of
30 10,000 litres per day through that sewer embedment
31 material?

32

33 MR HARTLEY: No.

34

35 MR DI STEFANO: No. And if we turn to the next page you
36 can see that Professor van Zyl estimates 1,000 litres per
37 day in the top of that chart. He's estimated the flow
38 capacity of the pipe bedding material, and then the sewer
39 bedding material is estimated to be 10,000 litres per day.
40 Then he estimates the capacity of soil between the pipe
41 bedding and the sewer bedding material as being negligible.
42 So in his view a negligible amount of water would be
43 permeating through the soil itself as opposed to travelling
44 to the sewer embedment material or to the pipe embedment
45 material; is that a correct interpretation?

46

47 MR HARTLEY: That's a correct interpretation.

1
2 MR DI STEFANO: Mr Bolton, do you think that's a plausible
3 analysis, a negligible amount? Sorry, do you think that
4 that negligible figure there for the permeability of soil
5 between the pipe bedding and the sewer bedding, do you
6 think that a negligible amount of water would have leached
7 through that material?

8
9 MR BOLTON: The embedment material is much more permeable
10 than the surrounding soil material. So it would be - it
11 would prefer to go down that embedment material until it
12 reached capacity.

13
14 MR DI STEFANO: Yes, and once it reaches capacity, though,
15 wouldn't it then leach through less permeable materials,
16 including the soils around it?

17
18 MR BOLTON: It would, unless it had a pathway to the
19 surface, in which case it would take the surface because
20 that's an easier route.

21
22 MR DI STEFANO: Yes. So, correct me if I'm wrong, but my
23 understanding is that water will of course take the path of
24 least resistance, and where a particular material has a
25 permeability of a particular volume of water over time it
26 will absorb that amount of water, and then the back
27 pressure effectively causes the water that's behind that
28 water to find the next available path?

29
30 MR BOLTON: That's right, and that could either be the
31 soil or a pathway to the surface.

32
33 MR DI STEFANO: Yes. So wouldn't it only be the case that
34 no water would permeate through the soil if that had an
35 effectively zero permeability, because there would still be
36 water pressurising against that wall even if there is a
37 geyser, to use my colourful expression - there would still
38 be water against the soil along the side of that geyser?

39
40 MR BOLTON: Well, if the permeability of the soil was
41 zero, as you say, then it would go to the surface.

42
43 MR DI STEFANO: Yes. And what I'm suggesting to you is
44 that --

45
46 MR BOLTON: But that's not possible.
47

1 MR DI STEFANO: Yes, quite. Thank you. Madam Chair --
2
3 MR BOLTON: It's impossible to have a permeability of
4 zero; I guess it's not possible.
5
6 MR DI STEFANO: Yes. Noting the time, I might just ask if
7 any of the other experts have anything they wanted to add
8 to that analysis, and otherwise --
9
10 MR POPE: Just very briefly, that's quite a high
11 permeability when you look at what we actually found in our
12 boreholes in that below the sewer there, NDT13. We
13 intentionally put the photo of the boulder and the sand in
14 the report for that reason. I think that's orders of
15 magnitude lower than I would expect of what we found in
16 that borehole.
17
18 MR DI STEFANO: So, just to be clear, the permeability in
19 respect of the soil bedding?
20
21 MR POPE: No, the soil between the two pipes.
22
23 MR DI STEFANO: Yes.
24
25 MR POPE: Yeah, correct.
26
27 MR DI STEFANO: Sorry.
28
29 MR POPE: Yeah, yeah. No, no, no, that's good.
30
31 MR DI STEFANO: So the tested permeability of the soil,
32 and you're inferring here being effectively the same soil
33 as between the pipe, the burst pipe and the sewer embedment
34 material, in your view those numbers included here in
35 Professor van Zyl's report underestimate the flow rate of
36 what water - the permeability --
37
38 MR POPE: They would underestimate it, yes.
39
40 MR DI STEFANO: Yes. Thank you. Anyone else? Did you,
41 Mr Hartley, have anything to add there?
42
43 MR HARTLEY: The only thing I would suggest about that is
44 that a sewer is underneath the mains, and therefore the
45 sewer to be built would have been built in a trench, and so
46 the material between the mains and the sewer is effectively
47 made ground or fill, and it wouldn't have been in its

1 natural state, maybe compacted, probably not compacted to a
2 great extent so that the sewer doesn't get damaged, and
3 therefore there will be a difference in the material
4 directly between the mains and the sewer compared to that
5 if you go back to the --

6
7 MR DI STEFANO: Yes, the diagram that showed it at --

8
9 MR HARTLEY: The kind of point that the crows fly or the
10 worms burrow between the point of the leak and the sewer,
11 that is - that's likely to be a different animal.

12
13 MR DI STEFANO: Yes. You are not suggesting that that
14 would make it impermeable or mean that a negligible amount
15 of water would travel between the burst and the - in that
16 soil?

17
18 MR HARTLEY: The relative path of least resistance. Once
19 the 1,000 litres per day in the mains, in the mains
20 embedment material, as it chunters along and then falls -
21 it's more likely to fall into the sewer trench below, and
22 then from there it's likely to get up, one would expect it.
23 I'm going outside my area of a great deal of expertise,
24 but, to back you up, then you can't say it's zero in the
25 surrounding trenches, but you can say the amount of water
26 that's being, you know, taken up by the trench surrounds is
27 considerably lower than what's going on in the embedment
28 material.

29
30 MR DI STEFANO: Yes. If that's a convenient time?

31
32 CHAIRPERSON: Mr Hitchcock may want to respond.

33
34 MR HITCHCOCK: You read my face. I just think
35 conceptually broadly you've got your geyser, lots of water
36 is saturating the soils above the pipes, between the pipes
37 and sideways in the sand and gravel. To say there would be
38 negligible losses aside from what's going into the trench
39 doesn't make sense, or I can't agree with it, sorry.

40
41 CHAIRPERSON: We'll break now for lunch and return at
42 2 o'clock.

43
44 **LUNCHEON ADJOURNMENT**

45
46 **UPON RESUMING**

47

1 MR DI STEFANO: Thank you, Madam Chair. We left off on
2 the report of Professor van Zyl. I'd like to move on now
3 to a related aspect of the first question which we're
4 dealing with, which is the amount of water that made its
5 way from the burst into the stormwater. So appendix G of
6 the supplementary SMEC report deals with what I understand
7 is the absorption - the spread of water from the leak
8 location along the ground and into the stormwater pipe.
9 And it in effect takes as read Professor van Zyl's number
10 of water that reaches the surface but independently
11 assesses what amount as a proportion of that water that
12 would reach the surface would make its way to the
13 stormwater; is that a fair summation?
14

15 MR HARTLEY: We actually carried out - independently
16 carried out before Professor van Zyl's report was written.
17 So it actually took almost as read the majority of the leak
18 volume or the flow rate that came out of the surface.
19

20 MR DI STEFANO: So in that sense it doesn't depend on any
21 particular numbers from Professor van Zyl's report, but
22 independently assesses for an amount of water that would
23 reach the surface how much would that reach - how much of
24 that would reach the stormwater.
25

26 MR HARTLEY: Yes, it was a pleasing - it was pleasing to
27 read Professor van Zyl's report when it came through that
28 the flow rates and the volumes sat nicely with the
29 independent conclusions of that appendix.
30

31 MR DI STEFANO: Yes. So the appendix is prepared by a
32 Mr Tim Rhodes.
33

34 MR HARTLEY: Correct.
35

36 MR DI STEFANO: And did either of you have any involvement
37 in the preparation of the appendix?
38

39 MR HARTLEY: I had a read through. And Hugo had some
40 involvement because he went out on site to do some
41 infiltration tests.
42

43 MR DI STEFANO: Yes. Okay. So if I turn - if we can have
44 on screen, please, SEW.0001.0002.4187, yes, thank you, at
45 page 349. Great. And if we could just zoom in on the top
46 portion of that. Perhaps, Mr Bolton, are you able to
47 explain what this image depicts?

1
2 MR BOLTON: The red is the sand fan, so to speak, and then
3 the remainder is some outputs of hydraulic testing that was
4 undertaken which I wasn't involved with.

5
6 MR DI STEFANO: And so am I right in inferring that the
7 shaded areas superlaid over the top of the photo are
8 outputs from hydraulic modelling that predicts where water
9 would flow from the burst site?

10
11 MR BOLTON: I didn't undertake this work; it's Tim Rhodes.
12 But, in essence, that's what I understand it to be, yes.

13
14 MR DI STEFANO: Yes. And I assume that's the same for
15 you, Mr Hartley?

16
17 MR HARTLEY: Yeah. Basically this is what happens when
18 20 litres a second comes out of the burst location and
19 where it's likely to flow to.

20
21 MR DI STEFANO: Yes. And if we can just look down at
22 the - thank you. The second paragraph there provides, "The
23 surface area of the inundation extent is estimated to be
24 around 400 metres squared. Applying an infiltration rate
25 of 50 millimetres per hour suggests that an infiltration
26 into the subsoil of up to 5 litres per second could have
27 occurred." So that's an explanation of how much water that
28 reaches the surface at the burst site but then travels
29 along the surface towards the stormwater, how much of that
30 could have then infiltrated the soil back through
31 absorption through the soil itself?

32
33 MR HARTLEY: Yes, over that area on the assumption that
34 there was so much of water flowing over, 5-litres per
35 second, over that area.

36
37 MR DI STEFANO: Yes. And you adopt that number or at
38 least the 5 litres a second across the course of a day. If
39 we can turn back to page 62 of this report and we zoom in
40 on 9.42 at the bottom of that. So you can see there in the
41 top paragraph you adopt Professor van Zyl's number of
42 11,000 litres per day entering the embedment waters of
43 mains water and sewage. And then in the second paragraph
44 you refer to appendix H, which I infer is a typo, it should
45 be appendix G.

46
47 MR HARTLEY: Yeah, my apologies.

1
2 MR DI STEFANO: No, not at all. Which estimates that the
3 velocity of flow required to create the sand deposits
4 downstream is between 10 and 20 litres per second, with
5 approximate infiltration of 5 litres per second, which
6 equates to 0.4 megalitres per day.

7
8 MR HARTLEY: Correct.

9
10 MR DI STEFANO: So I'm right in understanding, aren't I,
11 that that paragraph states that approximately 0.4
12 megalitres per day will infiltrate the soil between the
13 burst location and the stormwater drain on the assumptions
14 that are in appendix G?

15
16 MR HARTLEY: The only thing I would add to that is that's
17 on the worst case. So that's on 31 December.

18
19 MR DI STEFANO: Yes. So explain that a little bit
20 further?

21
22 MR HARTLEY: So a lot of the calculations which are
23 summarised in this section and, you know, in appendix G is
24 on 31 December, which is modelled as the worst day, the
25 most amount of water during the day that went through. So
26 we've seen the charts from Professor van Zyl's reports.
27 It's a fairly exponential shaped chart which gives you the
28 cumulative volume of water that's been lost and the charter
29 path which gives you the daily rate. So there is a steep
30 incline during the latter half of 2024, let's say. And
31 therefore taking 31 December, which is 1.4 megalitres a
32 day, that didn't happen on the 30th, it didn't happen on
33 the 29th, 28th. They were moderately less.

34
35 MR DI STEFANO: So then correct me if I'm misunderstanding
36 this .4 to .5 megalitres per day of infiltration. Is that
37 a function of the amount of water, the depth of the water
38 on the soil, or is it a function of the absorption
39 potential of that soil over that area?

40
41 MR HARTLEY: Right. Okay. So they're kind of intertwined
42 because you need a certain head to get that kind of
43 infiltration going. So if you had a metre's worth of water
44 above that the infiltration would be worser. So we take -
45 it would be reasonable to say that it's generally a
46 centimetre, 10 millimetres, of flow of thickness is assumed
47 to have required to have that sand deposit, as it turned

1 out and, yes, so if you have that over an area, that gives
2 you 5 litres per second. If that area reduces or indeed
3 the head reduces, that 5 litres a second reduces.
4
5 MR DI STEFANO: Yes, because there's a smaller area that's
6 being covered by the water?
7
8 MR HARTLEY: Absolutely.
9
10 MR DI STEFANO: Yes. But it's not that soil becomes more
11 conductive of water the thicker the layer of water is on
12 top of the soil? That might be a question for Mr Bolton,
13 but --
14
15 MR HARTLEY: Do you want to say anything? I'm going to
16 end up --
17
18 MR BOLTON: Yeah, I mean, it's a relatively shallow depth
19 of water. Yeah, I guess obviously if you had a very deep
20 amount of water, then obviously that would be a bigger
21 driving force in a sense. But it's a shallow depth of
22 water over 400 square metres, to give an estimate of what
23 we consider to be the infiltration.
24
25 MR DI STEFANO: So maybe I can ask it this way. If you
26 have a metre squared of a particular soil material and you
27 have 100 millimetres of water sitting on top of it or you
28 have 200 millimetres of water sitting on top of it, does
29 the rate at which that water is absorbed into that soil
30 change?
31
32 MR BOLTON: It will be greater for the one that is deeper.
33
34 MR DI STEFANO: So the more water on top of the soil, the
35 greater the absorption rate: is that correct?
36
37 MR BOLTON: That's right.
38
39 MR DI STEFANO: Yes. And the other experts agree with
40 that too? Yes. So if --
41
42 MR HITCHCOCK: I think what you're asking is does the soil
43 properties change because you've got more water over it?
44
45 MR DI STEFANO: Yes.
46
47 MR HITCHCOCK: No.

1
2 MR DI STEFANO: No. Okay. So are you able to explain the
3 difference in opinion?
4
5 MR BOLTON: Well, it's just the head of water rather
6 than - like, you're right, the soil properties don't
7 change. It's the head of water driving the infiltration.
8
9 MR DI STEFANO: So as the area increases there's more
10 infiltration, but not as --
11
12 MR HITCHCOCK: And the height of the water pushing it
13 through.
14
15 MR DI STEFANO: So the force of the gravity on top of
16 the - increases the mass driving the water into the soil;
17 is that right? Okay. Then if we consider that four to
18 five hundred thousand litres per day absorption rate on the
19 assumed area of 400 metres squared, you would expect then
20 that, as the burst rate increases, water is exiting the
21 burst location and it's spreading along the site, and some
22 portion of that is being absorbed as the area increases and
23 as the depth of that water increases, but once it reaches
24 the stormwater some portion of it goes into the stormwater?
25
26 MR HARTLEY: Yeah, absolutely. It's a bit like when you -
27 gosh, you know, you have a bucket full of water in the -
28 you take the bucket - you're at the sand. You're taking a
29 bucket of water from the sea. You take it up to your
30 sandcastle to create a moat. It flows over. It doesn't
31 quite get back to the sea. It kind of absorbs.
32 Eventually, you know, if you had a big enough bucket, the
33 channel would get back to the sea.
34
35 MR DI STEFANO: Yes. And in your example the sea is the
36 stormwater drain and the bucket is the burst, and the sand
37 is the distance between the ground between the burst and
38 the stormwater?
39
40 MR HARTLEY: Yes.
41
42 MR DI STEFANO: Yes.
43
44 MR HARTLEY: Now, the point is - apologies, I'm butting
45 in, but the point is that that 5 litres a second is not
46 going to be constant because it depends on the area.
47

1 MR DI STEFANO: Yes.

2

3 MR HARTLEY: So there's going to be some infiltration, but
4 it's going to be pretty smidgen because the thickness - the
5 depth of the head and the breadth of the channel up until
6 the point where everything's really quite, you know,
7 covering 400 square metres, it's going to be relatively
8 small.

9

10 MR DI STEFANO: So have you performed any analysis which
11 determines what the relative infiltration rate is over
12 time?

13

14 MR HARTLEY: Hugo's been out on site and doing some in
15 situ infiltration tests to back these numbers up.

16

17 MR BOLTON: We haven't done any, say, modelling or
18 something like that of how that might change over time. Is
19 that what the question is?

20

21 MR DI STEFANO: Yes. So just so I understand what you've
22 done, so you've performed an analysis which gives you the
23 four to five hundred thousand litres per day at the maximum
24 flow rate from the burst?

25

26 MR HARTLEY: Yes, because appendix G was, "Can a flow rate
27 of litres per second that we understand came from the leak,
28 can that create a sand fan?"

29

30 MR DI STEFANO: Yes.

31

32 MR HARTLEY: And we've done the model to say that if you
33 do a model between 10 litres per second and 20 litres per
34 second the kind of flow from the - you know, those figures
35 is basically consistent with what we found on site, yes.

36

37 MR DI STEFANO: Yes. And so from that you infer that at
38 its peak four to five hundred thousand litres of water
39 would not reach the stormwater, it would be absorbed into
40 the ground, but 1.1 or 1 million-odd litres of water would
41 reach the stormwater on effectively the final day of the
42 burst?

43

44 MR HARTLEY: It sort of comes from Hugo's in situ testing.
45 The infiltration tests gave us that kind of 5 litres per
46 second.

47

1 MR DI STEFANO: Yes.

2

3 MR HARTLEY: So the in situ tests which were done
4 effectively separately to the modelling but sit within the
5 scope of appendix G, you know, give us that 5 litres per
6 second.

7

8 MR DI STEFANO: Yes, but is my explanation of it to you
9 correct, that at the peak flow rate from the burst on your
10 best estimate between four and five hundred thousand litres
11 would have infiltrated the ground between the burst site
12 and the stormwater drain?

13

14 MR HARTLEY: That's right, yeah.

15

16 MR DI STEFANO: Yes. So if we were to - if I can have
17 SEW.0001.0002.4191 at page 31, which is the Professor van
18 Zyl report. So we went to this before. Professor van Zyl
19 says 11,000 litres constant reaches the surface per day,
20 and then --

21

22 MR HARTLEY: I beg your pardon, in the mains.

23

24 MR DI STEFANO: I was - I misstated. Eleven
25 thousand litres per day reaches the pipe and sewer bedding
26 materials, and is transported through that. We had some
27 engagement around whether the assumptions to that were
28 accurate, et cetera, which we don't need to rehearse. But
29 you have never prepared in effect a second column after
30 leakage volume reaching surface per day which estimates the
31 volume of that - that reaches the surface that actually
32 then, instead of infiltrating the ground, reaches the
33 stormwater?

34

35 MR HARTLEY: That's correct, because we'd be expected to
36 basically do a model for every day because every day the
37 flow rate would be different.

38

39 MR DI STEFANO: Yes. Quite. So that sort of modelling
40 hasn't been done. All we could do is we could add a second
41 column next to "leakage volume reaching surface" and at the
42 bottom of that we could say four to five hundred
43 thousand litres don't reach the stormwater. But, inferring
44 back from that, we don't know how much for each previous
45 volume of water that reached the surface what volume
46 actually reached the stormwater?

47

1 MR HARTLEY: No, that's right. But, you know - yeah, I'll
2 just cut myself off, if that's --

3
4 MR DI STEFANO: Yes. But what we do know is that, once
5 the water plume reached 400 metres squared and had a depth
6 of approximately 50 mills, at least 400,000 to
7 500,000 litres of that was being absorbed into the ground?

8
9 MR HARTLEY: That's the - that's what our calculations and
10 testing suggests.

11
12 MR DI STEFANO: Yes, that's the modelling, and you adopt
13 that number in your report. So can you be confident then
14 when you form the conclusion that the majority of water
15 would have reached the stormwater when you haven't
16 performed an analysis on even the days indicated in
17 Professor van Zyl's report as to what portion would have
18 actually been absorbed into the ground?

19
20 MR HARTLEY: I think it's reasonable to say that the ratio
21 between absorption and getting into the stormwater once the
22 flow reaches the stormwater is reasonable. The tendency
23 would be for the water to actually keep on the surface,
24 would be my estimate. Hugo?

25
26 MR BOLTON: I mean, this calculation was largely done to
27 try and understand the amount that was coming out of the -
28 you know, the burst. So it was, you know, done in that
29 sort of light, I guess, was trying to understand does
30 everything fit in in terms of the water balance, I suppose,
31 if that's to makes sense - what I'm saying makes sense.

32
33 MR DI STEFANO: It does make sense. I can perfectly
34 understand the purpose of Professor van Zyl's analysis, and
35 it appears to me that it's an essential integer in the
36 maths required to work out what volume reached the
37 stormwater. What I don't understand is where the analysis
38 is that sits between the stormwater and the burst, and
39 analyses the absorption rate, which you accept applies at
40 the maximum volume, but in between the maximum volume and
41 the volume of water first starting to breach the surface,
42 and it seems to me there is no such analysis in your
43 evidence of that amount, as a proportion or otherwise.

44
45 MR HARTLEY: Only on the worst day.

46
47 MR DI STEFANO: Yes.

1
2 MR HARTLEY: Yep.
3
4 MR DI STEFANO: Thank you. So on the worst day we know
5 that it is approximately a third of the water, on the
6 Professor van Zyl's numbers, that reaches the stormwater;
7 do you accept that? Sorry, I withdraw that. It's
8 two-thirds that reach the stormwater, one-third
9 approximately that is absorbed?
10
11 MR HARTLEY: Yeah, yeah.
12
13 MR DI STEFANO: Yes. And is that the basis for your
14 majority number, your --
15
16 MR HARTLEY: Yeah.
17
18 MR DI STEFANO: Yes. So, really, I should understand your
19 evidence has been, or the inquiry should understand your
20 evidence, that on the worst day the majority of the water
21 reached the stormwater, but prior to that, aside from just
22 an inference from the ratio on the worst day, you have not
23 performed separate analysis of how much actually reaches
24 the stormwater?
25
26 MR HARTLEY: I'm going to go for yes, but could I just say
27 that on 31 December there was a photograph taken down the -
28 effectively the grate - the chamber below a grate at Waller
29 Place, where there was a still of flow coming out of that
30 water - out of the pipe, and part of the analysis that we
31 used was based on that - on calculations done by others to
32 say that there's between, I don't know, 7 - I do know,
33 I beg your pardon, between 7 and 12 litres per second at
34 that time.
35
36 MR DI STEFANO: And that was on which day, sorry? The
37 31st?
38
39 MR HARTLEY: That was 31 December. So our analysis was,
40 "Okay, do these add up? You know, can you get the flow
41 coming out with 400 square metres doing that thing?"
42
43 MR DI STEFANO: Yes.
44
45 MR HARTLEY: "Do we have the 5 litres a second? Does it
46 correlate roughly with the bow? Yes, it does." So you're
47 right, we didn't do things on 1 November and such like

1 that. But on the other hand, of course, we'd have another
2 variable, which would have made the modelling really quite,
3 you know, academic.

4
5 MR DI STEFANO: Yes. And I accept that that photograph
6 provides practical evidence to verify the model's result
7 that, of the 1.4-odd million that reached - left the pipe,
8 around 1 million of it must have flowed through the
9 stormwater. So I accept that that's practical evidence of
10 that. I'm just trying to understand the basis for the
11 inference drawn as to the majority on the other days.

12
13 MR HARTLEY: Yes.

14
15 MR DI STEFANO: So can I open it up to the balance of the
16 experts as to whether or not that ratio, i.e. two-thirds
17 reaching the stormwater and one-third being absorbed, is a
18 safe assumption for the days between the water reaching the
19 surface and the peak flow rate day? Mr Paul, I don't know
20 if you have an opinion on this?

21
22 MR PAUL: This type of analysis is not really my field of
23 expertise, but there is evidence I've seen talks about when
24 the stormwater flow was observed to have increased.

25
26 MR DI STEFANO: Yes.

27
28 MR PAUL: I can't remember the name of the witness. But
29 it was around about --

30
31 MR DI STEFANO: Brett Cooper perhaps?

32
33 MR PAUL: Was it Brett Cooper? Yeah, around about 10,
34 15 December it's noted that - that sort of mid-week of
35 December is when there was observational evidence of a big
36 increase in the stormwater flowing down the drain. So that
37 would be later than what's implied here by, you know, water
38 leaking to the surface.

39
40 MR DI STEFANO: So if Mr Cooper's evidence represented the
41 first date of which a significant amount of water reached
42 the stormwater, which is an inference that is a matter for
43 your expertise, not mine, any suggestion from me, there
44 wouldn't be a significant - a significant amount of water
45 would be being absorbed up until early December?

46
47 MR PAUL: Yes, that's right, or absorbed - we've got to

1 understand with any analysis like this it must be based on
2 a series of assumptions - assumptions about the ground,
3 assumptions about the permeability of the ground, the
4 consistency of the permeability, the connectivity to
5 coarser materials at depth. All of these are variables
6 that are largely unknown. So, you know, I'd be sort of
7 careful - you know, if I was doing an analysis like this
8 I wouldn't be quoting such precise figures. That
9 3,867 litres per day in my view is far more precise than
10 you could really provide given the uncertainties and the
11 variables involved in the analysis.
12

13 MR DI STEFANO: Yes. Mr Makin or Mr Hitchcock, any
14 comment on the ratio, whether it's appropriate to apply the
15 same ratio between the peak volume day and the first day or
16 any of the days in between? Mr Makin first, perhaps?
17

18 MR MAKIN: I couldn't say exactly, but I'd expect it to be
19 somewhere in that range. As discussed (indistinct) area
20 flooded as well as the depth. But that is infiltration
21 once the water has come up to the surface, spread out and
22 then gone back down.
23

24 MR DI STEFANO: Yes.
25

26 MR MAKIN: Could also be infiltration direct from the
27 subsurface.
28

29 MR DI STEFANO: Yes, and presumably for a period of time
30 water would reach the surface and then not traverse far
31 enough to reach the drain at all. In the sandcastle, sand
32 on the beach example, unless you had a sufficient volume in
33 the bucket it would just be fully absorbed before it
34 reached the - as it fanned out and thinned out and
35 saturated the pores in the soil. Mr Hitchcock?
36

37 MR HITCHCOCK: I think those ratios probably sound sort of
38 ballpark, but I didn't have the report and haven't really
39 looked at it apart from your discussion of it, which has
40 been good, but --
41

42 MR DI STEFANO: Sorry, did you say you didn't have that
43 report?
44

45 MR HITCHCOCK: No.
46

47 MR DI STEFANO: Okay. So can I return to page 62 of

1 the SMEC supplementary report, which is SEW.0001.0002 -
2 thank you very much. In light of our discussion,
3 Mr Hartley, do you want to revisit your conclusions at the
4 top there where you say, "Total volume of water entering
5 the embedment material and mains water and sewage is
6 11,000 litres per day"?

7

8 MR HARTLEY: Well, the term "volume" probably could do
9 with revising, really, because it's the total - the total
10 volume of water per day is - we've just got to be
11 consistent with the units.

12

13 MR DI STEFANO: Yes.

14

15 MR HARTLEY: So that first part or that part of
16 the sentence is probably correct, and therefore the volume
17 of leaked water that flowed to the surface, 1.39 megalitres
18 per day, should be caveated to the, you know, 31 December,
19 or worst case scenario.

20

21 MR DI STEFANO: Yes.

22

23 MR HARTLEY: Yep. And, in fairness, the last sentence,
24 although written to help the reader, doesn't actually say,
25 "Well, yeah, we've just gone for the worst case scenario as
26 opposed to things can get worse from those" --

27

28 MR DI STEFANO: Yes. And it's fair to say, isn't it, that
29 the 11,000 litres per day is just the amount of water that
30 is estimated to have travelled directly from the burst into
31 the embedment materials, not the total amount of water that
32 could have travelled to the embedment materials?

33

34 MR HARTLEY: Yes, it's the capacity of the surface
35 trenches - of the embedment materials.

36

37 MR DI STEFANO: Yes. And it's an estimate of the direct
38 transfer from the burst subterraneanly to the embedment
39 materials as opposed to infiltration from the surface back
40 down to the embedment materials?

41

42 MR HARTLEY: That's definitely right.

43

44 MR DI STEFANO: Yes. And that's where our .4 to 5 - .5
45 megalitres per day number comes in?

46

47 MR HARTLEY: That's correct. And, again, it should have

1 been worst case scenario.

2

3 MR DI STEFANO: Yes. So can I have DPA.0004.0001.0001 up,
4 which is at page 83. And can I have a zoom-in on the top
5 chart, please. So this is, I assume, a street view photo
6 overlaid with the locations of the burst, the sewer and the
7 stormwater?

8

9 MR HARTLEY: That's correct.

10

11 MR DI STEFANO: And I infer that Professor van Zyl's
12 opinion relates to the distance between that yellow pipe
13 burst mark and the blue sewer main?

14

15 MR HARTLEY: Yes, correct.

16

17 MR DI STEFANO: And if one in one's mind can superimpose
18 the fan diagram that we saw before of the sand plume over
19 the top you would see that down to those two nodes in the
20 upper left portion of the image labelled "sewer pits" -
21 "stormwater pits", rather, the water would fan out from the
22 burst location to those locations?

23

24 MR HARTLEY: It wouldn't go - there's no evidence on site
25 to suggest it went to the stormwater pit adjacent to the
26 southbound carriageway. There's a bund which basically
27 channelises runoff to the first or the - you know, the one,
28 say, 20 metres or so south-east.

29

30 MR DI STEFANO: Yes. So that four to five
31 hundred thousand litres per day absorption at peak we would
32 expect to be absorbed into the ground and to travel to the
33 path of least resistance subterraneanly?

34

35 MR HARTLEY: Yes.

36

37 MR DI STEFANO: And you'd accept, wouldn't you, that that
38 would either be the sewer embedment materials or any more
39 permeable colluvial channels that might flow in that area?

40

41 MR HARTLEY: Yes, yes. I'll pass to Hugo, but does water
42 know where these permeable things are, because everything
43 fans out and so things go down. It doesn't make a beeline
44 for the nearby trench. It doesn't actually know where the
45 trench is. Is that right or am I wrong?

46

47 MR BOLTON: Yeah, I mean, it is unsaturated flow, I mean,

1 because it's - well, unless there is a water table there,
2 but we - well, I think it would likely be unsaturated, so
3 it does make it a bit tricky. But in general I would have
4 thought it's going to travel downhill and, yes, some of it
5 I guess could go into the sewer embedment material. But
6 I understand it's reached capacity, though, at 11,000. So
7 I guess it's not going to want to go into that easily.
8 There's also other pathways, you know, going just through
9 natural soil also. So it's not going to all go to one
10 place in particular. It's going to go in a number of
11 different places.

12
13 MR DI STEFANO: Yes. So as the path of least resistance
14 saturates the water flow will then go to the next path of
15 relative least resistance?

16
17 MR BOLTON: I guess it has, you know, infiltrated into the
18 ground from the sand fan and it's now going through,
19 I would assume, one material, you know, at that point. It
20 doesn't have choices then. It 's just got the one material
21 that it's going through. Eventually it's going to continue
22 to go down through the ground, and when it's unsaturated
23 it's going to have a tendency - unless it hits layers, it's
24 going to have a tendency to go down until it hits a clay
25 layer or some other impediment, or if it were to come
26 eventually to, let's say, a sewer or something, sewer
27 embedment, if it has capacity to accept that it could go
28 into there also.

29
30 MR DI STEFANO: Yes.

31
32 MR BOLTON: It's not as simple as I think you're trying to
33 describe it, really.

34
35 MR DI STEFANO: Yes, I'm trying to understand your
36 evidence about how the water would flow. So what
37 I understand your evidence is is that it would - the sewer
38 material - the sewer embedment material, once it reaches
39 capacity, would not receive further water?

40
41 MR BOLTON: Yeah.

42
43 MR DI STEFANO: And then water that would otherwise have
44 gone into that material would flow to the next least
45 resisting preferential pathway, and there might be a
46 variety of those?

1 MR BOLTON: Yes, if it's in its path.

2

3 MR DI STEFANO: Yes. Quite. So water that is, you know,
4 20 metres away from the - underground seeping vertically
5 20 metres away from the sewer embedment material is
6 unlikely - it doesn't find out the sewer embedment material
7 and redirect?

8

9 MR BOLTON: Yeah, it's not like a magnet where all of a
10 sudden you're drawn to it like a planet and gravity or
11 something like that, you know.

12

13 MR DI STEFANO: Yes. But we're aware, aren't we, that
14 under this - and there's a chart of Mr Pope's, which I can
15 bring up if necessary. There's also a kind of historic
16 gully and associated colluvial channel that runs from this
17 location downslope?

18

19 MR HARTLEY: Is this the wide one or is this the one
20 that's assumed to be the Kings Creek?

21

22 MR DI STEFANO: I infer it's the one that's assumed to be
23 the Kings Creek, but perhaps I'll bring the cart up and
24 we'll --

25

26 MR HARTLEY: Yes, that would be --

27

28 MR DI STEFANO: It's in Mr Pope's causation report, which
29 is MSC .5087.0001.0157, at Bates number 0204. Thank you.
30 Just that chart there. This is the gully that I'm
31 referring to. So what I'm suggesting to you is that water
32 that didn't make its way into the stormwater - I withdraw
33 that. Water that didn't make its way into the sewer
34 embedment materials would travel along the known gullies in
35 preference to just otherwise seeping through the ground?

36

37 MR HARTLEY: If it found that, yes.

38

39 MR DI STEFANO: Yes. Quite. Would any of the other
40 experts like to comment on where they consider water that's
41 seeped - the four hundred to five hundred thousand,
42 assuming just at the peak flow day, where they would expect
43 that water to flow with what they understand of
44 the topography? Maybe we'll start with Mr Hitchcock in
45 reverse order.

46

47 MR HITCHCOCK: Down.

1
2 MR DI STEFANO: Okay. And --

3
4 MR HITCHCOCK: Over colluvium, down to the gully, base of
5 the gully, follow the gully.

6
7 MR DI STEFANO: Yes. And would you expect any to make its
8 way to a deep aquifer or a groundwater?

9
10 MR HITCHCOCK: No. The permeability difference is too
11 much at the interface.

12
13 MR DI STEFANO: Yes. So that's at the interface of the
14 extremely weathered granite and the inferred colluvium
15 material?

16
17 MR HITCHCOCK: Yep.

18
19 MR DI STEFANO: Does anyone have anything contrary to that
20 to say or otherwise agree?

21
22 MR POPE: No, not contrary at all. When you're
23 considering where this water - what's infiltrated into just
24 natural ground, you've got to consider that the freeway's
25 fill batter is retarding flow in itself. Like, it's not a
26 dam but it will act as a dam and in - informally, and
27 you've got to consider what's been buried by the motorway.
28 So we don't really know how they treated Henry street and
29 the lots that were resumed and what was on those lots and
30 what trenches were on those lots. You had shoulder drains
31 in Henry street. So it will go into the colluvium
32 definitely, and it can come out at surface below the fill
33 embankment.

34
35 MR DI STEFANO: Yes.

36
37 MR HITCHCOCK: Wouldn't the freeway itself slightly
38 compact the soil, make it slightly less permeable in that
39 direction underneath the soil or?

40
41 MR POPE: Without talking too much about the Country Roads
42 Board, maybe. Yeah, if they did the compaction properly,
43 yep. Yep. I daresay by the - sorry, by the performance of
44 the motorway, there's not a lot of - there is settlement in
45 Coburn Creek which I think is related to a stormwater pipe.
46 But that fill side of the highway doesn't have blatantly
47 obvious settlement issues. So yes to what Mr Hitchcock's

1 saying regarding if it's compacted it will change how water
2 flows as well.

3

4 MR DI STEFANO: Yes. Thank you. Can I turn then to the -
5 sorry, Mr Makin, did you want to say anything? Sorry,
6 I just was looking at my notes.

7

8 MR MAKIN: Just to add to, as Mr Bolton says, it's
9 initially unsaturated flow. So the flow would tend to be
10 vertically downwards until it reaches a barrier, which may
11 be the base of the colluvium or, if that's already become
12 saturated, then you can't put more water in beyond a
13 certain capacity. So once that saturated ground beneath
14 the leak fills up then it will tend to head off down the
15 hill.

16

17 MR DI STEFANO: Yes. Thank you. Can we turn then to a
18 related topic, which is velocity and the ability of water
19 to move through materials over time. Mr Hartley and
20 Mr Bolton, what I'm particularly interested in
21 understanding is the basis for the 230 day number which is
22 quoted in your conclusions. Perhaps we can go there as the
23 place to start. If we go to the SMEC report, the
24 supplementary report, at page 63, please, and if you look
25 at the top of that, where we are here again in part 9.42,
26 for your benefit, which concerns the Bayview Road leak, and
27 the last sentence there states that a period of 230 days
28 would be required for water from the leak to reach the
29 site, whereas the time estimated between the start of
30 the leak and the 5 January failure, 157 days. So that
31 230-day period, I assume that doesn't relate to water
32 moving through the sewer embedment materials?

33

34 MR HARTLEY: Correct.

35

36 MR DI STEFANO: Because we know that water - and you
37 accepted elsewhere that water went through the sewer
38 embedment materials and reached as low as Prospect Hill to
39 trigger the sump pumps; the testing - the water chemistry
40 testing has confirmed that aspect. So what does this
41 230 days apply to?

42

43 MR HARTLEY: 230 days applying to? It's the direct flow
44 from the location of the leak through natural material to
45 the location of the landslide.

46

47 MR DI STEFANO: So it assumes that the water would flow

1 through - direct material, is that a colluvial channel?

2

3 MR HARTLEY: It's the material that - you know, that we've
4 been finding throughout the site with the honourable
5 exception of borehole 2, which was a bit of an outlier.

6

7 MR DI STEFANO: Yes. So, in terms of the height within
8 the ground that you're performing this assessment at, where
9 in the ground is the - maybe I should break this down into
10 stages. So can you explain to me where in the analysis of
11 the 230 day number comes from? Where is the maths for that
12 number? Have you included that in the report or in the
13 annexures?

14

15 MR HARTLEY: Well, it comes from the assessed flow
16 velocity. I keep on getting the term wrong, so Hugo can
17 stamp on my foot when I do.

18

19 MR BOLTON: I can explain it if it is easier?

20

21 MR DI STEFANO: Yes, please.

22

23 MR BOLTON: So it's based on testing that we did on the
24 soils that is - we've done flood testing, which is an
25 aquifer permeability test. We've also done permeameter
26 testing, and the values ranged up to approximately 5 metres
27 per day permeability or hydraulic conductivity. So that
28 value, the upper end of that, the 5 metres per day, towards
29 the upper end, was used, and then using a hydraulic
30 gradient of .1 and I think it was a porosity of .3 you come
31 up to a - the groundwater will travel 2 metres per day,
32 which would take - if you take 460, divide it by 2, gives
33 you the 230.

34

35 MR DI STEFANO: Yes. So it's in effect an average
36 permeability --

37

38 MR BOLTON: Well, it's the upper - of what we have tested?

39

40 MR DI STEFANO: Yes.

41

42 MR BOLTON: It's towards the upper end of that.

43

44 MR DI STEFANO: And applied as a constant across the
45 450-odd metres?

46

47 MR BOLTON: So assuming that the water goes in a straight

1 line from the burst to the landslide you get 460 metres.
2 Divide that by 2 and you get --

3

4 MR DI STEFANO: The number of days - of the rate. And it
5 assumes, doesn't it, that water doesn't, for example,
6 leave - take a faster route, for example, through a sewer
7 trench and then leave a sewer trench and then enter a
8 colluvial channel? You'd assume the 230 days is from the
9 one particle of water leaving the burst site and arriving
10 at the headscarp?

11

12 MR HARTLEY: In this instance, yes, the direct route;
13 absolutely.

14

15 MR DI STEFANO: Mr Makin, you performed independent
16 analysis of a similar question; is that fair to say?

17

18 MR MAKIN: Correct, yep.

19

20 MR DI STEFANO: And that is at 166 and following of
21 Mr Paul's report, or the WSP report. Are you able to
22 explain how your conclusions differ from those of Mr Bolton
23 in respect to the time it would take water to travel from
24 the burst site to the escarpment?

25

26 MR MAKIN: Firstly, what was similar. Used the same
27 equation, Darcy's law, and used a range of parameters based
28 on the different observations, both the in situ testing and
29 the observations of the soil type, and then various
30 scenarios for how the water may have moved. For the - it's
31 different terms for flow, the volumetric flow or the speed
32 of that water particle or the time it takes to get from A
33 to B. So if we're talking about that last one, from this
34 point to that point, then the range that we came up with
35 for the purely through the ground encompassed the
36 conclusion. It could be slower than that if it was a finer
37 grain material or faster than that if there was more gravel
38 along the pathway. But then applying a similar calculation
39 to material characteristic of the trench gravel you could
40 get faster rates as well.

41

42 MR DI STEFANO: Yes. So on that point can I ask that
43 Mr Paul's report, DPA.0004.0001.0001 at 0095 be brought up,
44 please, and the table at the top of the page zoomed in on.
45 So you said a moment ago, Mr Makin, that depending on the
46 assumptions you made about the material the flow - the time
47 it could take could vary significantly?

1
2 MR MAKIN: Yeah.
3
4 MR DI STEFANO: And is that reflected in that travel time
5 in days row in this chart?
6
7 MR MAKIN: Correct.
8
9 MR DI STEFANO: So I'm correct in understanding that if
10 the material was uniformly sand at that hydraulic gradient
11 it would take 1,465 days, whereas if it was gravel it would
12 take 12 days?
13
14 MR MAKIN: If it was the same material all along the
15 pathway.
16
17 MR DI STEFANO: Yes. And perhaps, Mr Hitchcock, do you
18 agree with the approach that's been taken - the analyses of
19 both of these gentlemen, and do you have any comment?
20
21 MR HITCHCOCK: I couldn't find calculations of how SMEC
22 came up with 2 metres a day. So I can't really verify
23 that. I understand it's come from a variety of tests, how
24 they've come up with the permeability number to do it.
25 Usually with these things you report a range, as in this
26 report, because you recognise that it's not a very exact
27 science. Soil can vary by a few per cent and in fine
28 content can change permeability by an order of magnitude.
29 So to report something as one number is not very common,
30 I don't think, because usually you think about a range and
31 you mean in that range sort of thing. So while I don't
32 know how they have calculated their 2 metres a day, I think
33 if that number is correct, still don't think it negates the
34 flow path or, like groundwater, it's within the same
35 ballpark as the time available. It's not 10 times or 100
36 times out. It's sort of in the order of magnitude of doing
37 the tests and analysis. And - yeah. So, you know,
38 obviously the calculation is the calculation. So that's -
39 that method's fine. I just think it's the accuracy of the
40 - of saying - I think it's more supportive than against it
41 because it didn't quite make it, but it's the range you can
42 think about, not a precise number.
43
44 MR DI STEFANO: So supportive in what sense, sorry?
45
46 MR HITCHCOCK: Well, I think to say it's only 150 days but
47 it should have taken 230, I think that's sort of the same

1 ballpark; it's within the axes of the testing.

2

3 MR DI STEFANO: So, within the level of accuracy that this
4 test can be relied on for, that's close to a positive
5 result?

6

7 MR HITCHCOCK: Yeah.

8

9 MR DI STEFANO: Because it should really be a plus or
10 minus range, and in your opinion it would be within that
11 plus or minus range?

12

13 MR HITCHCOCK: Yep.

14

15 MR DI STEFANO: And, Mr Makin, do you have a similar view
16 to that?

17

18 MR MAKIN: Yeah, you have the days within that range that
19 I have calculated.

20

21 MR DI STEFANO: Yes. And I note that in your passages of
22 your part of this report, Mr Makin, you rely on physical
23 evidence of observed water in the sense of water breaching
24 ground or water otherwise being in places where you
25 wouldn't expect it to be. Are you able to comment on how
26 that relates to a consideration of the overall number of
27 days it would take?

28

29 MR MAKIN: That's more supporting evidence for points
30 along the flow path, and not just the leak started on this
31 date and came out here on the other date. More
32 observations that things were changing along the way in the
33 intervening time.

34

35 MR DI STEFANO: Yes. Thank you. Would anyone else like
36 to say anything further on that? Mr Bolton perhaps?

37

38 MR BOLTON: I would just like to add that I have gone
39 through some of the calculations that have been done in
40 another part of this report, and I found that they're in
41 error. Therefore I would like to check these calculations
42 with my spreadsheet that I've used to make sure that
43 they're correct because I don't have confidence in them.

44

45 MR DI STEFANO: Do you know if that spreadsheet's been
46 produced or was placed into the expert dataroom?

47

1 MR BOLTON: No, it's my own personal spreadsheet that
2 I use. This has only just come up because I've seen this
3 and I've, you know - I just don't want to - the question
4 might be, "Do you believe these" - "Hugo Bolton, do you
5 believe that," and I have to say I don't have confidence.
6

7 MR DI STEFANO: Yes. So in respect of 230 day number is
8 that what you're referring to?
9

10 MR BOLTON: No, no, what I've got in front of me right
11 now.
12

13 MR DI STEFANO: Okay. Well, it would be useful if that
14 spreadsheet could be produced to the inquiry and to the
15 other experts so that --
16

17 MR BOLTON: It's on my laptop.
18

19 MR DI STEFANO: So that the other experts can consider the
20 workings. As Mr Hitchcock noted, he hasn't seen it, and
21 I asked you earlier about it and I hadn't seen the workings
22 either of it. Mr Hartley?
23

24 MR HARTLEY: Sorry to interrupt. In our first report of
25 5 May we created a similar kind of assessment of, you know,
26 flow paths and permeabilities and all that, all that kind
27 of thing. We have done the tests throughout the region.
28 We've done permeability test results, porosity test
29 results. They are provided in the admittedly late
30 submission, late last week. They are available for
31 everybody.
32

33 Obviously permeability tests carried out in
34 undisturbed samples tend to be done in impermeable
35 material. If they're permeable material they fall out of
36 the tube. But the vast majority of the material that we
37 were encountering, particularly at the hole that was dug at
38 the Waller Place South East Water, you know, tank, if you
39 will, had a certain amount of impermeability, off the top
40 of my head, 10 to the minus 18 (indistinct).
41

42 MR DI STEFANO: Yes. Thank you. On the topic of
43 practical evidence, i.e. evidence of actual occurrences of
44 otherwise unexplained excess water, did you take into
45 account in your 230 days number in any way the fact that
46 water was seen in places that it otherwise wouldn't have
47 been expected to, which you accept came from the burst, in

1 periods much shorter than the - what you would infer would
2 be required if 230 days was required from the burst to the
3 scarp?
4

5 MR HARTLEY: Are you talking about the upwelling?
6

7 MR HARTLEY: Yes, the upwelling and the water in Prospect
8 Hill Road, number 7.
9

10 MR HARTLEY: We've got to apologise. If that
11 acknowledgment of the potential hasn't been made clear, it
12 really is. The idea that water flows through the sewerage
13 trench down through - underneath the M11, Waller Place,
14 Charlesworth, hits Coburn, is very much something that we
15 think is a high likelihood, and what we've been able to
16 do - and it gets all geochemistry breadcrumby from
17 thereon - is understand that there is a trend of water with
18 similar characteristics that go down the sewerage down to
19 Coburn Avenue, then get into the natural material and find
20 themselves underneath the property in the agi-drain system
21 of 7 Prospect Hill Road.
22

23 MR DI STEFANO: Yes. Can I just then return to the sewer
24 diagram, which I will find. It's in the South East Water
25 report, the SMEC report, which is the one ending 4187.
26 It's at page 39. And could we just zoom in on the middle
27 of that. So what we can see there bisecting the image from
28 top right corner to mid-left is Coburn Avenue, and the
29 island, as you referred to it earlier, Mr Bolton, is in the
30 upper middle of the frame, and you can see a T-intersection
31 there, which is the corner of Coburn and Charlesworth
32 Street, where we're discussing the - well, you just
33 explained that you're of the view that it's highly likely
34 water flowed to. Can you see there that the sewer main
35 connects back into - I withdraw that. On the other side of
36 Coburn Avenue, underneath and to the outside of the houses
37 on Coburn Avenue near that corner, you can see there's a
38 sewer main that runs to that point; yes?
39

40 MR HARTLEY: Yes. Could the red dot be shown just to --
41

42 MR DI STEFANO: Yes. Yes, that's a good idea. So to the
43 right of that, if you go just down and follow that branch.
44 Yes. In there, yes. So the distance we're talking about
45 that would - is non-trench flow, if I can put it that,
46 between that corner of Coburn and Charlesworth, and then
47 re-entering a trench - there's no scale on this - oh, there

1 is a scale, but it appears to me to be something like
2 10 metres or less. So if we were focusing on trench flow
3 alone the velocity question would apply only to that
4 10 metres at the rate - the 230-day rate, wouldn't it?
5
6 MR HARTLEY: The 230 days is avoiding all trenches.
7
8 MR DI STEFANO: Yes.
9
10 MR HARTLEY: Because everything's going to be quicker
11 through trenches.
12
13 MR DI STEFANO: Yes.
14
15 MR HARTLEY: The expectation will be is that if natural -
16 oh, golly. If water from the Coburn Avenue/Charlesworth
17 T-junction gets into the natural material, for it to get
18 down to 7 Prospect Hill Road is about 30-odd days. For it
19 to get into that kind of spur of the sewerage network, that
20 isn't something that we've calculated, but it's going to be
21 in the region of, say - if it's 10 metres distance, then
22 you're looking at five metres - five --
23
24 MR DI STEFANO: Five days.
25
26 MR HARTLEY: I beg your pardon - and then shoots through.
27
28 MR DI STEFANO: Yes.
29
30 MR BOLTON: If it's --
31
32 MR DI STEFANO: Sorry?
33
34 MR BOLTON: Yeah, no, I'm just doing the math in my head
35 trying to make sure that what he said is correct.
36
37 MR DI STEFANO: Yes.
38
39 MR BOLTON: That's all.
40
41 MR POPE: If I can just quickly jump in there?
42
43 MR DI STEFANO: Yes, please.
44
45 MR POPE: I would have thought if we've got 230-day time
46 frames that it would have been blatantly obvious the peak
47 surface water observations would have peaked in May and not

1 in January. There's a blatant disconnect between that
2 number and what we've seen in the community.

3
4 MR DI STEFANO: Yes. Well, in fairness to Mr Bolton and
5 Mr Hartley, and I think this is part of the disconnect, is
6 that - the way I understand that figure to be calculated -
7 it is purely through the ground without taking into account
8 any jumping or preferential flow from ground to sewer
9 trench back to ground, but - yes, so it's in effect the
10 absolute worst case. If there were no sewer mains in that
11 area and there were no more permeable pathways, it would be
12 a worst case of 230 days.

13
14 MR POPE: Yep, yep.

15
16 MR DI STEFANO: I'm planning on moving off this onto
17 leakage from stormwater. So if anyone wants to jump in and
18 ask any questions?

19
20 MS SIEMENSMA: Madam Chair, while my friend is making her
21 way to the lectern I should indicate in terms of pathways
22 of water I haven't divvied it up in this way, and my
23 preference would be, rather than to try and work out which
24 (indistinct), if I cross-examine (indistinct).

25
26 CHAIRPERSON: Of course. Yes.

27
28 **<CROSS-EXAMINATION BY MS FOLEY:**

29
30 MS FOLEY: I have some questions for either Mr Hartley or
31 Mr Bolton, and I just want to test which one of you
32 I should be directing these to. So if you can go to the
33 SMEC report Bates number - we're already there - SEW - yes,
34 we're in the right one. If we could go to page 62 of
35 the PDF, please. I want to ask some questions about
36 section 9.4.2, which we've already been dealing with.
37 Which one of you drafted that section of the report?

38
39 MR HARTLEY: It's going to be me, probably.

40
41 MS FOLEY: Okay. And, Mr Hartley, at any point if you
42 feel that what you relied upon was based on Mr Bolton's
43 work, feel free to pass over to him, as you've been doing.
44 As we know, in this part of the report the conclusion is
45 expressed that in considering the flow of water from the
46 Bayview Road leak the water could not have travelled the
47 distance between the leak and the site fast enough. That's

1 the position that's taken in the report?

2

3 MR HARTLEY: Through the natural material, correct.

4

5 MS FOLEY: Through the natural materials, exactly. And in
6 this section, as we've also heard, it has been put to you
7 there's a statement that the velocity of water through the
8 natural material estimated from in situ infiltration tests
9 and water velocity tests is 2 metres per day?

10

11 MR HARTLEY: Correct.

12

13 MS FOLEY: All right. And from that you then say that the
14 velocity is too slow to have impacted the landslide?

15

16 MR HARTLEY: That's the - that's the --

17

18 MS FOLEY: So those are the building blocks; all right.
19 If you can help me out, I'd like to know where in the
20 report do you set out the testing and the calculations that
21 have led you to the 2 metre per day figure, given its
22 importance to this part of the report?

23

24 MR HARTLEY: It's actually going to be in appendix E.

25

26 MR BOLTON: Only it's - it's based on the permeability
27 values. I don't think --

28

29 MS FOLEY: Can you take us to the part of the report --

30

31 MR BOLTON: I don't think we have the calculation laid out
32 anywhere.

33

34 MS FOLEY: No. So you'd agree it's a really important
35 part of the analysis in this report, this figure, the
36 2 metres per day? Nowhere in the report have you set out
37 the underlying data, the calculations that led to that
38 figure?

39

40 MR BOLTON: No, I'll have to go - let me just look through
41 the --

42

43 MR HARTLEY: We may have the factual data because the
44 factual data of the lateral tests whereby dyed water was
45 placed in one span pipe piezometer and timed, and then
46 recorded when and if it was received in the second --

47

1 MS FOLEY: I'll just stop you there because what I'm
2 interested in is where is it in the report.
3
4 MR HARTLEY: Yep.
5
6 MS FOLEY: And I've scoured the report and I can't see it.
7
8 MR BOLTON: If that's the case, then the calculations
9 aren't there probably because - that's true then, I guess.
10
11 MS FOLEY: I'll just wait for a moment. Okay. All right.
12 So the question I'm asking is where it is in the report,
13 and the reason I'm asking that is if it's not in the report
14 we can't test it here in this forum. And so it's very
15 important for us to be able to see the calculations and be
16 able to see the data so that can test the basis for your
17 conclusion as you've expressed it on this important issue
18 in your report.
19
20 MR HARTLEY: We don't seem to have it, I'm afraid.
21
22 MS FOLEY: All right. Is there a reason it wasn't
23 included in the report? You've accepted it's a building
24 block of an important conclusion. The 2 metres per day is
25 very important to understanding the opinion you give, which
26 is effectively the water could not have travelled that far.
27 Why was that information not included in your report?
28
29 MR HARTLEY: That's purely human error. We have done the
30 calculations, we have done the tests on site, we genuinely
31 have, to the best of our capabilities on site to assess the
32 soils that we were able to get hold of and do the tests.
33
34 MS FOLEY: But it wasn't seen necessary to put it in or it
35 was just an oversight?
36
37 MR BOLTON: Oversight.
38
39 MR HARTLEY: It was an oversight. It should have been in,
40 yep.
41
42 MS FOLEY: Right. You'd accept that the kind of testing
43 you would have done to come up with that figure is not a
44 precise science?
45
46 MR HARTLEY: That's correct.
47

1 MS FOLEY: All right. There are many unknowns and
2 variables that need to be taken into account?
3
4 MR HARTLEY: Are the tests representative of the entire
5 colluvium band or the transported soils? No.
6
7 MS FOLEY: And because it's not a precise science that's
8 one reason why - I believe it was Mr Makin who gave this
9 evidence - one would ordinarily give a range in providing
10 an estimate of this kind rather than a single figure?
11
12 MR BOLTON: Just on that, I mean, we - the 2 metres per
13 day was the upper end of what we had available to us in
14 terms of the data that we collected.
15
16 MS FOLEY: Well, you say that. I can't test that. So
17 I guess the proposition I'm putting to you is would you
18 accept that ordinarily with tests of this kind, given the
19 uncertainties and it's not a precise science, a scientist
20 in your position would offer a range?
21
22 MR BOLTON: Or a maximum.
23
24 MS FOLEY: Right. And you're saying it's the maximum, but
25 we can't test that?
26
27 MR BOLTON: Because we've - well, I can show you now, but
28 obviously it's an oversight we didn't put that in the
29 report.
30
31 MS FOLEY: All right. Based on the material that is
32 currently available, you'd agree, I expect, that it is
33 possible in your opinion for the water to have reached the
34 site by 5 January? I'm asking about whether it's possible,
35 given the evidence you've now heard?
36
37 MR HARTLEY: Well, if possible - if there's only two
38 choices between possible and impossible, then possible is
39 the answer.
40
41 MS FOLEY: Right. And you accept that the opinions you've
42 given in paragraph 9.4.2 of your report are based on
43 testing that's not revealed in the report; we agree with
44 that? Yes?
45
46 MR HARTLEY: Yes.
47

1 MS FOLEY: That the testing is not a precise science;
2 you've agreed with that?
3
4 MR HARTLEY: I prefer to say, look, it's incomplete.
5
6 MS FOLEY: All right.
7
8 MR BOLTON: I mean, it's imprecise, but we've put the
9 higher end of what we had the data for.
10
11 MS FOLEY: Well, you say that. Again, I can't test that
12 with you. But hearing what you say --
13
14 MR BOLTON: But you were asking about a precise science,
15 and I'm giving you an answer to that specific question that
16 it is an imprecise science and so we are providing what we
17 consider to be the upper end, you know, which I thought was
18 conservative.
19
20 MS FOLEY: I might pass to the other experts to see if
21 they have any comments about this particular issue, and
22 I appreciate you've already been asked some questions by my
23 learned friend and it may be you've got nothing more to
24 say, but given what we've just heard I just wanted to ask,
25 Mr Hitchcock, in the first instance, whether you have any
26 comments in relation to the 2 metre per day figure?
27
28 MR HITCHCOCK: Well, I agree that I can't check or
29 validate it, and that I usually would give some sort of
30 range, and it's an imprecise science of lots of variables.
31 That's why you have to give a range, and I can't check
32 that, and the first thing I did looking at this report was,
33 "Where did that come from?" Couldn't find it. Also don't
34 know how the tests were undertaken. Were they (indistinct)
35 tests; what the test data looked like. You graph these
36 things up. You look at how - what the graph looks like,
37 "Yeah, that makes sense," or it's a (indistinct) curve.
38 There's all these things you to look at, which you can't do
39 at the moment.
40
41 MS FOLEY: Thank you. Mr Makin, any additional comments
42 you'd like to make?
43
44 MR MAKIN: Yes. The results of the flood testing reported
45 in the table (indistinct) worked out independently.
46
47 MS FOLEY: No further questions on that topic.

1
2 CHAIRPERSON: Just on that topic, I can see from the first
3 few pages of your report that seven other experts were
4 involved in this report. Did any of the seven other
5 experts draw this oversight to your attention? Did any of
6 them ask you where the calculation is for the 2 metres per
7 day?

8
9 MR HARTLEY: I'm afraid not.

10
11 **<EXAMINATION BY MR DI STEFANO:**

12
13 MR DI STEFANO: The last topic that I have questions for
14 before I return you to Mr Costello is about leakages from
15 stormwater and the potential contribution of water that
16 breached the stormwater system to the excess moisture in
17 the headscarp. So we've dealt with direct flow, if we call
18 it that. We've dealt with sewer trench flow. In terms of
19 leakage from stormwater, I just would like to firstly start
20 by confirming the language used in the joint report. So at
21 numbers 24 and 36 of the joint report there are references
22 to stormwater leakage as preparatory, and the same for 36.
23 I take it what the opinion is that's expressed in respect
24 of that factor is just whether pre-burst, if I can put it
25 that way, leakage from the stormwater contributed to the
26 excess moisture in the scarp making it more susceptible to
27 landslide?

28
29 MR PAUL: That's what that means. So part of the
30 stormwater drains sort of leaking is in general operation,
31 which provides a high background moisture --

32
33 MR DI STEFANO: Yes, thank you. So it's not - it's
34 stormwater drains in a general sense as opposed to in
35 particular the main stormwater - that conduit that the
36 burst water went into at Bayview Road and flowed down
37 towards Margaret Street. Yes. Is that correct? And
38 Mr Pope?

39
40 MR POPE: Can we go to the page?

41
42 MR DI STEFANO: Yes, yes, of course.

43
44 MR POPE: I think it broadly is. We did talk about Browne
45 Street in the conclave.

46
47 MR DI STEFANO: Yes. Well, I'm coming to that.

1
2 MR POPE: Yep.
3

4 MR DI STEFANO: Thank you. Perfect. Page 4 there. I'm
5 talking here about number 24, which is a stormwater leakage
6 preparatory factor, and the same factor in respect of the
7 14 Jan, which appears to me to have all of the same
8 responses given. So I was correct before in the way
9 I described the consideration of that?
10

11 MR POPE: Yes, yes.
12

13 MR DI STEFANO: Thank you. In terms of stormwater as a
14 part of - I withdraw that - as a flow path of Bayview Road
15 leak water to the escarpment I understand the analysis
16 centres on a series of breaches in the stormwater drain
17 and, Mr Pope, you performed CCTV analysis, video feed
18 analysis, of the inside of the drain and identified a
19 series of breaches in it?
20

21 MR POPE: Yes.
22

23 MR DI STEFANO: So if I can have Mr Pope's report brought
24 up, which is MSC.5087.0001.0157, and if we can go to page
25 0247. Yes, thank you. This is the page I'm referring to,
26 Mr Pope. So, as I understand it, we can see here in the
27 bottom right the - Bayview Road, the location approximately
28 of the leak, and we can see after that the two stormwater
29 inlets where water that would have - that wasn't absorbed
30 that reached the surface would have flowed to, and then
31 further down that branch of the stormwater network we can
32 see a series of numbers which are individual stormwater
33 defects; is that correct?
34

35 MR POPE: Correct, yes.
36

37 MR DI STEFANO: And there's a red shaded section that says
38 "See detail 1"?
39

40 MR POPE: Yep.
41

42 MR DI STEFANO: And there you can see numbers 4, 1 and 2,
43 which are stormwater defects, and then you can see a number
44 there, number 5, which is what I understand is being
45 referred to as the Browne Street repair out the front of 25
46 Coburn Avenue?
47

1 MR POPE: So 1, 2 and 4 are the repair - like, so in the
2 middle of the street is 1 and 4, was where the repairs
3 were.
4
5 MR DI STEFANO: Okay. So perhaps - so that's what you're
6 referring to when you say the Browne Street repair?
7
8 MR POPE: 1 and 4, yeah.
9
10 MR DI STEFANO: Is 1 and 4; okay. And, Mr Paul,
11 I understand in your report you refer to repairs to a
12 stormwater pit, which is - do you recognise that as being
13 number 5 on this image?
14
15 MR PAUL: It might be between 5 and 6 at the bend.
16
17 MR DI STEFANO: Yes. Yes, is it your understanding as
18 well, Mr Pope?
19
20 MR POPE: Yeah, at the bend.
21
22 MR DI STEFANO: Thank you. If we could go to page 0418 of
23 this same document, please. Where we're going is the
24 screen captures from the CCTV footage of the burst that
25 correspond - I withdraw that - from the breaches in the
26 stormwater that correspond with the previous page that
27 we've just seen, the map. 0418, please. So that's the
28 intersection of Browne Street and Coburn Avenue, and we can
29 see there the description of the breach. The description
30 says "Joint displaced radial displacement void visible
31 through defect". If we can just zoom in on that image,
32 please. That's the image in the top right, yes. So it's a
33 600-millimetre diameter pipe, concrete pipe? Is that
34 correct? It says it in the table. It's not a memory test.
35
36 MR POPE: Yeah, no, it's not something (indistinct). But,
37 yeah, I believe it is. Yep.
38
39 MR DI STEFANO: And you can see there what I would suggest
40 is a very obvious defect in that pipe, quite a significant
41 radial displacement between the incoming pipe and the
42 outgoing pipe?
43
44 MR POPE: Absolutely, yep.
45
46 MR DI STEFANO: And you performed analysis, did you, of
47 the potential for water to leak out of this and the other

1 similar breaches along the stormwater, Mr Pope?

2

3 MR POPE: Only here because it was such a significant
4 defect. So I haven't done the full lines. I have tested
5 flow rates in View Point, but I haven't done a detailed
6 analysis of the whole loss on this line.

7

8 MR DI STEFANO: Yes, okay.

9

10 MR POPE: Given all this discussion about infiltration
11 rates, it was a very simple and (indistinct) soil science
12 based infiltration number. I just used a very big number,
13 300mm a day. But it's quite complex in this location in
14 that it's literally over the 900mm diameter water main. So
15 where the water goes from here, it's very complicated to
16 work out where it goes.

17

18 MR DI STEFANO: Yes. And if we can just zoom out in this
19 photo and scroll down through the image below, detail of
20 another broken joint with what looks like a slug in it.
21 And the next page, please. You can see there that's the
22 intersection of Browne Street and Coburn Avenue in the
23 bottom right, another quite significant radial displacement
24 between --

25

26 MR POPE: 1 and 4, essentially as that pipe transitioned
27 over the steel water main there was a noticeable amount of
28 displacement.

29

30 MR DI STEFANO: So it's the second side of the same
31 displacement?

32

33 MR POPE: Yes. I can't remember whether it was one or two
34 lengths they pulled out. But, yeah, it's associated with
35 that transition over the large diameter water main.

36

37 MR DI STEFANO: Yes. And if we can just go to the next
38 page to number 5. There in the bottom right you can see
39 another void in the side of the pipe, and so - I asked
40 you - you explained this a moment ago, Mr Pope, but you
41 conducted a kind of absorption analysis, if I can put it
42 that way?

43

44 MR POPE: Yes.

45

46 MR DI STEFANO: But just in respect of one of those
47 breaches?

1
2 MR POPE: Correct.
3
4 MR DI STEFANO: Yes. And can I have Mr Paul's report back
5 on screen, which is DPA.0004.0001.0001. Paragraph 163(c),
6 which is page 89, please. Mr Paul, this is a different
7 breach to the ones we were just looking at?
8
9 MR PAUL: That's right.
10
11 MR DI STEFANO: So that's a sewage pit - sorry, I withdraw
12 that - a stormwater pit, and you can see there you've
13 identified what you say is a section of broken pipe?
14
15 MR PAUL: Yeah, that's what - so I identify it. That's
16 from the Mornington Peninsula Shire Council maintenance
17 record. (Indistinct) identify it. I'm quoting what's in
18 that report.
19
20 MR DI STEFANO: And, Mr Pope, that's consistent with your
21 understanding, that that was a --
22
23 MR POPE: Yes, it's an oversight that's not in my drawing.
24 It was certainly brought to my attention earlier in the
25 year. Yeah.
26
27 MR DI STEFANO: Yes. And do any of you have any basis to
28 think that any of these breaches in the stormwater system
29 occurred after the landslides in 2025?
30
31 MR PAUL: This particular one, the date of this is - it's
32 on there - March 25, so it's after. So we just have to
33 make an assessment on looking at it and looking how old it
34 is, is the best we've got, to identify whether it was
35 before. But when I do look at that you can see water's
36 come out of the pipe on the left. You can see pitting on
37 the pipe where it has the inlet and sort of a little bit of
38 erosion on the inlet, which is consistent with water coming
39 out, bringing sediment with it, bringing gravel with it,
40 you know, hitting with velocity to that side. So not
41 surprising you would see that's where the void is. So,
42 yes, based on the age of that, the pitting, the erosion
43 that's gone on, my view would be it was like that prior to
44 January 25. Most unlikely that occurred before.
45
46 MR DI STEFANO: Yes. Mr Pope, do you agree with that
47 assessment?

1
2 MR POPE: Yeah, yes.
3

4 MR DI STEFANO: And in respect of the other breaches, the
5 ones around Browne Street, do you have any --
6

7 MR POPE: I had asked for older CCTV. I believe, given
8 the nature of the backfill, it's more likely that it
9 pre-dates the landslide.

10
11 MR DI STEFANO: Yes. Thank you. So I'm right then in
12 understanding that, of the water that flowed through the
13 stormwater system, some portion of that would have exited
14 at these breaches in the stormwater system?
15

16 MR POPE: Yes, yep.
17

18 MR DI STEFANO: And, Mr Paul, is it your evidence that
19 that some portion of that water may have made its way to
20 the landslide site?
21

22 MR PAUL: That's an unknown. We know water came out of
23 the pipe, and it goes back - similar to the evidence we
24 were giving yesterday, there are voids, there are potential
25 pathways, but we haven't been able to trace them. So we
26 can't say with certainty it would've got out of the pipe
27 and got to the landslide, only the potential.
28

29 MR DI STEFANO: Yes. Does anyone have a contrary view to
30 that for the water that would have escaped the stormwater
31 system and the Browne Street breaches?
32

33 MR POPE: Not contrary at all. Probably important is
34 Browne Street was fixed in May.
35

36 MR DI STEFANO: May of this year?
37

38 MR POPE: May of this year when - probably in the last
39 hearing, I think it was happening around that time. My
40 observations of groundwater levels at the landslide,
41 they've mapped with time, like, against the Pointerra - the
42 reality model, and the groundwater levels there had
43 decreased significantly well before the repairs were made,
44 which only conclusion is that the base flows that come
45 through that stormwater drain which are coming through
46 today from up at Bayview, the base flows didn't materially
47 contribute. What happened with this water during the

1 landslide event, I'm not sure.

2

3 MR DI STEFANO: Yes, okay. And perhaps I can just bring
4 up one last document, which is SEW - sorry, I should say,
5 Mr Makin, do you have anything to add to that?

6

7 MR HARTLEY: Only so much as we had been hoping to do some
8 works along Prospect Hill Road and such. (Indistinct)
9 excavation works, but we found that the services and the
10 verge - the verge angles made it almost impossible to do
11 some excavation works at the location we would have liked.

12

13 MR DI STEFANO: Okay. So can I take it from that that you
14 otherwise agree with what Mr Paul and Mr Pope have said
15 about the --

16

17 MR HARTLEY: Other than that, based on the information
18 that we have and the summations, based on that, yeah,
19 I agree.

20

21 MR DI STEFANO: Thank you. And Mr Makin as well?

22

23 MR MAKIN: No, it's all right.

24

25 MR DI STEFANO: Thank you. Can I ask for one last
26 document, SEW.0001.0002.4187, which is the SMEC
27 supplementary report, at page 40, please. I bring this up
28 just to illustrate one thing, which is, Mr Pope, you
29 identified a moment ago that there is a water main that
30 runs under the corner of the - under the Browne Street
31 stormwater?

32

33 MR POPE: Yeah, correct.

34

35 MR DI STEFANO: Yes. And we can see there that there's
36 kind of a network of water mains that appears on that
37 corner of Browne Street and Coburn Avenue?

38

39 MR POPE: Yes.

40

41 MR DI STEFANO: And that those water mains run down to the
42 location of the November 2022 burst water main and then
43 they bisect, one heading down towards View Point Road and
44 the other continuing down Coburn?

45

46 MR POPE: Correct, yep.

47

1 MR DI STEFANO: So there's a plausible flow paths through
2 water main trenching from the location of the stormwater
3 breaches on Browne Street, and Browne and Coburn, and 10-12
4 View Point Road; is that correct?

5
6 MR POPE: Through trenches in general, yeah, but those
7 ones, the only complexity is the 900 - it's the
8 Dromana-Portsea water main. It's 900 diameter --

9
10 MR DI STEFANO: So it's big.

11
12 MR POPE: -- and it's underneath the stormwater pipe. So
13 it's quite deep, and it strikes across the whole community.
14 So it comes from the top right corner, it's in the air
15 across a gully there, along Coburn, comes underneath the
16 stormwater defect and then - it was built well before the
17 storm, as I understand it, and then comes down towards the
18 bottom left corner of the image and does the same thing
19 across the gully over there. So it's deeper than the other
20 conventional domestic mains, and it's a big cutoff drain.
21 So what happens there, I don't know.

22
23 MR DI STEFANO: Yes, I understand.

24
25 MR POPE: The drawing I haven't seen. The invert level of
26 the 900 and how it was built, I've got no idea.

27
28 MR DI STEFANO: Yes. Thank you. So it's another unknown
29 that --

30
31 MR POPE: Yes.

32
33 MR DI STEFANO: -- cautions against confidence about that?
34 Mr Paul or Mr Makin or anyone else, Mr Hartley, any further
35 comments? Thank you. No further questions from me. Is it
36 a convenient time, Madam Chair, to have a break? We were
37 going to break at 3.30.

38
39 CHAIRPERSON: How long will you be, Ms Foley?

40
41 MS FOLEY: Just maybe five minutes. I understand there
42 will be some questions from some others after me on this
43 same topic.

44
45 CHAIRPERSON: On pathways? Yes. And how long will you
46 be, Ms Siemensma?

47

1 MS SIEMENSMA: Difficult to say. I think on pathways
2 maybe 20 minutes.

3

4 CHAIRPERSON: All right. Let's have a break. We'll have
5 a break now. Let's just have a 10-minute break and return
6 at 3.35.

7

8 **SHORT ADJOURNMENT**

9

10 **<EXAMINATION BY MS FOLEY:**

11

12 MS FOLEY: Thank you, Chair. I have some questions for
13 either Mr Hartley or Mr Bolton in relation to water exiting
14 service trenches, and again I'll leave it up to you to
15 decide who should be answering the question. You'll recall
16 that in the joint conclave report Mr Paul, Mr Makin,
17 Mr Hitchcock and Mr Pope all agreed that, although it's not
18 possible to know the exact flow path that the water took
19 from the leak site to the landslide, there are credible
20 flow paths, including through sewer trenches? You'll
21 recall that evidence or that opinion expressed in the joint
22 report?

23

24 MR HARTLEY: Yes, yeah.

25

26 MS FOLEY: All right. And the two of you didn't join in
27 that opinion. Given what we've heard in the course of
28 yesterday and today, you wouldn't dispute, would you, the
29 fact that there are in fact credible flow paths for the
30 water from the leak site to the landslide?

31

32 MR HARTLEY: There are credible flow paths from the leak
33 site to the landslide? Yeah, possible, correct.

34

35 MS FOLEY: Do you accept that it was possible for water in
36 the service trenches to seep into natural surrounding
37 material?

38

39 MR HARTLEY: Correct.

40

41 MS FOLEY: And that that could have occurred at different
42 points along the trenches?

43

44 MR HARTLEY: Throughout given, you know, infiltration
45 rates, and they'll vary, yes.

46

47 MS FOLEY: And the seepage would generally occur where the

1 flow rates fall; would you agree with that?

2

3 MR HARTLEY: Infiltration through the trenches would vary
4 based on the amount of water going through. So the head
5 within the embedment material. Also the gradient of
6 the trench as well as the permeability of the surrounding
7 material.

8

9 MS FOLEY: I want to take you to a figure in your report,
10 and this is the SMEC report SEW.0001.0002.4187. Bring that
11 one up, please. And if we could go to page 41 of the PDF,
12 thank you. And I'd like to ask you some questions about
13 figure 19, if you can see that there?

14

15 MR HARTLEY: Yep.

16

17 MS FOLEY: And this is a figure which shows the sewer
18 invert level?

19

20 MR HARTLEY: Yes.

21

22 MS FOLEY: So you'd agree that seepage might occur where
23 the invert level is relatively flat? It might occur at
24 other places, but it might occur there?

25

26 MR HARTLEY: Yes.

27

28 MS FOLEY: All right. And if we - I wonder if we can zoom
29 in and look at Charlesworth Street in particular.
30 Actually, in the figure below; thank you. Now, if you can
31 see there - at Charlesworth Street you can see there are
32 points where the invert level is relatively flat?

33

34 MR HARTLEY: Yeah.

35

36 MS FOLEY: And so that's one of those points where we
37 might see seepage?

38

39 MR HARTLEY: We see infiltration into the trench or - from
40 the trench into surroundings, yes.

41

42 MS FOLEY: Yes. And water could also exit the trenches at
43 points where the flow is restricted, for example, by a
44 tight turn in the service trenches?

45

46 MR HARTLEY: Tight turn, manhole, chambers, yes.

47

1 MS FOLEY: All right. And one example is, looking at
2 this, if we look at Charlesworth - sorry, the Coburn
3 Avenue - at the top there, sorry, in the map - you can see
4 near Coburn Avenue there's a sharp turn in that top map?

5
6 MR HARTLEY: The sharp left-hand turn if you're going
7 downhill, yes.

8
9 MS FOLEY: And that's one of those places where you might
10 see an upswelling?

11
12 MR HARTLEY: Certainly. That tight turn doesn't exist as
13 a tight turn. It's a T junction. But, yes.

14
15 MS FOLEY: And in fact we did see upswelling near the
16 sewer trench at that location, didn't we? All right. So
17 if water was pushing up at that location it might have also
18 been infiltrating the natural soils at the bend or at the
19 T junction?

20
21 MR HARTLEY: Effectively the velocity in that direction
22 goes to zero and then it needs to translate, it will go
23 either side, but, yes, there's a likelihood - there's a
24 distinct possibility, I beg your pardon, that infiltration
25 occurs there.

26
27 MS FOLEY: All right. In your first report - and I'll
28 take you to it. If we could go to SEW.0001.0002.0001,
29 please. This is your report of 5 May 2025, and if we
30 could - I'm sorry, I don't have the PDF page, but I need to
31 go to 8.2.4. Thank you. It's at about page 73. 82, thank
32 you. PDF page 82, thank you. All right. In this section
33 of the report back in May there's a discussion about the
34 upwelling through Coburn Avenue and Waller Place, and you
35 tied it to the Bayview Road leak; do you recall that?

36
37 MR HARTLEY: Yes.

38
39 MS FOLEY: All right. And you accept, of course, that
40 that was mains water that was upwelling?

41
42 MR HARTLEY: Since then there's been further analysis of
43 geochem, but at that time, yes.

44
45 MS FOLEY: All right. So at that time you thought it was
46 mains water?

1 MR HARTLEY: At that time, yeah, the upwelling observed,
2 yes.

3
4 MS FOLEY: All right. Have you discussed a change of
5 position on this in your most recent report, because
6 I couldn't see that you had?

7
8 MR HARTLEY: Hugo, this is your analysis which has changed
9 the matter a bit. During December and the residents
10 calling up, that's not - and the upwelling as a result of
11 that, that hasn't changed.

12
13 MS FOLEY: All right. You don't discuss that issue in
14 your most recent report, though, do you?

15
16 MR HARTLEY: No.

17
18 MS FOLEY: Is there a reason for that, a reason why you
19 discussed this upwelling and you tied it to the
20 Bayview Road leak in your May report but you haven't
21 discussed it in your latest report?

22
23 MR HARTLEY: Only so much as it's a supplementary, not
24 something that supersedes this report.

25
26 MS FOLEY: All right. So you remain of the same view that
27 you expressed in that earlier report --

28
29 MR HARTLEY: Yes.

30
31 MS FOLEY: -- that that upwelling came from
32 the Bayview Road leak?

33
34 MR HARTLEY: During December and Jan - and parts of
35 January, yes.

36
37 MS FOLEY: All right. No further questions from me.
38 Thank you.

39
40 **<EXAMINATION BY MS SIEMENSMA:**

41
42 MS SIEMENSMA: I want to ask some questions about
43 pathways, and I might start with Mr Paul, to see if you
44 accept this proposition. To have confidence that the
45 Bayview burst water contributed to the 2025 landslides you
46 need to clear two hurdles at least. The first is you need
47 evidence of a pathway from the burst site to the landslide

1 465 metres away; true?

2

3 MR PAUL: I agree with that, you need a pathway.

4

5 MS SIEMENSMA: And the second is you need evidence that
6 the water seeping from the escarpment immediately after the
7 2025 landslide is burst water; true?

8

9 MR PAUL: I wouldn't necessarily agree with that because
10 water from the burst site can mix with other water. So to
11 say it would just be mains water, I wouldn't agree with
12 that.

13

14 MS SIEMENSMA: We might put that to one side pending some
15 questions about water chemistry in any event. Let me ask
16 you about the first point, the route of travel. Now, in
17 your report you say there are potential flow paths, and you
18 say water could have travelled through channels in soil, in
19 stormwater, in sewer trenches, and, as I understand your
20 evidence, what you're saying is the actual path water took
21 on your hypothesis is uncertain and that these are
22 possibilities in your view?

23

24 MR PAUL: It could be one or multiple at the same time.
25 I haven't gathered enough evidence to know exactly which
26 way the water went. May never get that evidence.

27

28 MS SIEMENSMA: And you would agree then that, as to
29 whether water flowed directly or came in and out, that all
30 depends on certain assumptions - and you're nodding, you
31 agree with that. As to where the water went and whether it
32 was in, whether it was out, there are a lot of variables we
33 don't know?

34

35 MR PAUL: Not necessarily assumptions. I'd call them
36 there are unknowns.

37

38 MS SIEMENSMA: Unknown variables?

39

40 MR PAUL: A lot of water went into the ground and we don't
41 know where it went, but it has to go somewhere, though.

42

43 MS SIEMENSMA: And, Mr Pope, you referred in your report
44 to paleochannels, and you've said it's possible that there
45 are several buried paleochannels, and then you go on to
46 give an example of a continuous 10-metre to 20-metre wide
47 buried shallow paleochannel backfilled with colluvium and

1 alluvium, and at the bottom of it it's 1 metre with
2 colluvium, it's saturated, the channel is 500 metres in
3 length. All of those are assumptions, aren't they?
4

5 MR POPE: Yeah, of course they are. Yep. The land form
6 does give you an indication of how frequent these gullies
7 are, though. Like, the slope contour shows you how many
8 gullies there are, and then we know that there's more
9 buried ones. So they are there. But it's fundamentally an
10 assumption, yes. Yep.
11

12 MS SIEMENSMA: And it's possible - Mr Paul agreed
13 yesterday to my question whether it's possible to test for
14 these paleochannels and underground channels, and he said
15 it was. And I take it you don't dispute that, that they
16 can be tested for?
17

18 MR POPE: Correct, you can. You could do - like, if - cut
19 to the chase. If South East Water is so confident it's not
20 their water and it takes that long to get to the
21 escarpment, then they can do a full-scale aquifer stress
22 test and prove it's not theirs.
23

24 MS SIEMENSMA: And my question to you is you haven't
25 undertaken any of those geophysical tests to search for the
26 geo - sorry, to search for the paleochannels?
27

28 MR POPE: I wouldn't be going around doing geophysics.
29 You've got to validate it with boreholes -- -
30

31 MS SIEMENSMA: It's not a criticism. I just want to
32 understand.
33

34 MR POPE: No, no, no, like - so I didn't jump on
35 geophysics bandwagon, so.
36

37 MS SIEMENSMA: Okay. So you've raised this as a
38 theoretical possibility, as I understand it?
39

40 MR POPE: Yes.
41

42 MS SIEMENSMA: Okay. Do you accept that to be a plausible
43 theory that the burst water made its way to the landslide
44 site you would really need to undertake the testing to be
45 able to demonstrate the path of these channels if you were
46 going to rely upon them?
47

1 MR POPE: I don't see another credible water source for
2 the landslide water. That's - if there were other credible
3 water sources, then I would go testing.
4

5 MS SIEMENSMA: Okay. Let's come back to my question. Do
6 you accept that to be a plausible theory and rely upon
7 these underground channels you need to be able to work out
8 where they are and where they flow to?
9

10 MR POPE: Yeah, you can. Yep.
11

12 MS SIEMENSMA: And not just you can; to be plausible you
13 need to?
14

15 MR POPE: I don't think so. I think the land form's
16 telling us they're there in terms of the drainage lines.
17

18 MS SIEMENSMA: Mr Paul, yesterday you said in relation to
19 the 2022 landslide that you've got low certainty on it
20 because you don't know exactly where the channels go. That
21 was in relation to an area of some 125 metres. It's fair
22 to say you don't know exactly where the channels go over
23 the 450, 465 metres either; do you accept that?
24

25 MR PAUL: We know where some of the channel is because we
26 have observation of the headscarp of the channel, we have
27 observation from some boreholes. We don't know exactly the
28 path it takes between those observations.
29

30 MS SIEMENSMA: You don't have the path from A through to
31 B; is that --
32

33 MR PAUL: It would be like going down to a river and
34 saying, "Well, there's the river there and there's the
35 river there," and I would say with any geological models
36 there are unknowns. We haven't got x-ray vision, we can't
37 look behind all the ground. So we have to use our
38 geological sciences and knowledge of geological process to
39 fill in the gap. So for mine it would be not completely,
40 you know, without uncertainty. But if I see a channel
41 here, a channel there, it's a reasonable assumption they're
42 connected.
43

44 MS SIEMENSMA: You said yesterday that there can be - or
45 the thrust of your evidence, rather, was that there could
46 be numerous paleochannels in the area. Do you - you
47 maintain that?

1
2 MR PAUL: There would definitely be more than one in the
3 area. That's how landscape evolves.
4
5 MS SIEMENSMA: And there's nothing special about 10-12
6 View Point that would lead all of those paleochannels
7 carrying burst water, on your theory, to discharge at that
8 one site; do you accept that?
9
10 MR PAUL: Well, there's discharge at that site, and it was
11 my understanding, not of others --
12
13 MS SIEMENSMA: Well, there would --
14
15 MR PAUL: -- during the time of the January landslide.
16
17 MS SIEMENSMA: There would be some paleochannels, for
18 instance, that might go down towards the historic gully, we
19 looked yesterday on the map?
20
21 MR PAUL: I would say all the paleochannels need to come
22 out of this gully at some point.
23
24 MS SIEMENSMA: You would say they all in effect lead to
25 Rome, do you? They --
26
27 MR PAUL: No, they would have to come out at the
28 escarpment, remembering of course the escarpment runs, you
29 know, a few kilometres parallel to the coastline. But if
30 the channel didn't - you know, if it didn't come out at the
31 escarpment or flow to the sea, in effect, you'd have a dam,
32 you'd have a lake.
33
34 MS SIEMENSMA: And some of the paleochannels might go out
35 to The Eyrie, do you agree?
36
37 MR PAUL: There could be some that go to The Eyrie, sure.
38
39 MS SIEMENSMA: And some might go towards Margaret Street?
40
41 MR PAUL: Yeah, there could be some at Margaret Street.
42 We don't know.
43
44 MS SIEMENSMA: Mr Hartley, you've heard some evidence this
45 afternoon about what has been said to be three potential
46 pathways, in summary the subsurface channels through the
47 natural soil, stormwater, sewerage trenches. Now, you,

1 SMEC, have undertaken or had undertaken some geophysical
2 testing. Taking, for example, Mr Pope's example of the
3 paleochannel that is 10 to 20 metres wide, that is
4 500 metres long, is it likely that you would have picked
5 that up, a channel of that nature, with your geophysical
6 testing?

7
8 MR HARTLEY: The geophys testing included the entire
9 length - well, the length of Coburn Avenue right up to
10 number 40-odd, which is just the other side of The Eyrie
11 catchment, if you will. And it also included Connell's
12 Lane, I seem to remember, and the entire length of Waller
13 Street up until the pedestrian public footpath. To that
14 extent, that area of the geophys would have gone beyond
15 this broad area. Yeah, the geophys is highly dependent on
16 interpretation. But, you know, we've managed to find quite
17 a bit from that geophys, and, you know, it's quite
18 plausible that a significant change related to that channel
19 could have been identified due to the fact that we go a
20 certain depth.

21
22 MS SIEMENSMA: And did you identify such a channel?

23
24 MR HARTLEY: No, not that we saw.

25
26 MS SIEMENSMA: You were shown a photograph earlier today
27 of some deficiencies or a deficiency in the stormwater at
28 Browne Street. Let me ask you this: if there were a leak
29 or a void, how long - in the stormwater, how long would
30 that have taken the water to get to the landslide site from
31 Bayview?

32
33 MR HARTLEY: So the leak from Browne Street to the
34 landslide site?

35
36 MS SIEMENSMA: Well, how long would it have taken from the
37 burst site if it had gone through the stormwater --

38
39 MR HARTLEY: Oh, yes, the burst site. My expectation is,
40 is that, okay, so on the assumption that it goes - you have
41 to go 30-odd metres from the upwelling, right, and then
42 flow across the water - flow across the surface and then
43 into the stormwater drain and then down a stormwater drain.
44 I'd say it's going to be in the same - couple of hours, I'd
45 expect. Hugo?

46
47 MR BOLTON: Once it gets to surface and into the

1 stormwater it's going to be reasonably quick, I would say.
2
3 MS SIEMENSMA: And "reasonably quick", do you ascribe to
4 Mr Hartley's view that it would take hours or days? What
5 are we --
6
7 MR BOLTON: Once it goes to the surface and flowing
8 30 metres downhill and into the stormwater, I would agree
9 with what David has said.
10
11 MS SIEMENSMA: I can't remember whether my questioning
12 included voids, but if there were a deficiency or a void is
13 that your view, that it would have taken days from the
14 burst site to the landslide site?
15
16 MR HARTLEY: The voids would act a bit like - almost like
17 an open channel, with the exception of the fact there would
18 be some infiltrations, so there may be some volume lost.
19 But the flow through a void would be similar to a pipe.
20
21 MS SIEMENSMA: Now, Ms Foley asked you, Mr Hartley,
22 whether you agreed that the pathways were credible -
23 whether these credible pathways were possible. I'm sorry,
24 I don't have the language right, but you said "yes". My
25 question to you is why do you say they aren't likely or
26 plausible in that you haven't joined with the others in
27 that view?
28
29 MR HARTLEY: It's mainly on the geochemistry problem, so
30 to speak, that we have. The speed or the permeability of
31 embedment material is such that you don't spend enough -
32 the water doesn't spend enough time in the trenches to
33 actually pick up a certain chemical footprint to basically
34 justify, for want of a better word, the chemical footprint
35 that was found from the sample taken on 6 January.
36
37 MS SIEMENSMA: So let me see if this is - this is
38 accurate. Are you saying that if it had gone through the
39 trenches the EC level is too low, although it might have
40 gotten there quickly; had it gone via the ground, it takes
41 too long but it could pick up the chemical composition?
42
43 MR HARTLEY: That's a very simple, you know, juxtaposition
44 we're in.
45
46 MS SIEMENSMA: I'm sorry, do you agree or disagree?
47

1 MR HARTLEY: Yes, you're right.
2
3 MS SIEMENSMA: Can I ask Mr Pope now some questions about
4 the dye testing. As I understand it, the dye testing was
5 to test your theories on the pathway of travel; is that
6 correct?
7
8 MR POPE: Yes, correct.
9
10 MS SIEMENSMA: And we see that from your factual report on
11 12 February some dye has been poured into a borehole at
12 NDT1. Now, NDT1 is not at the sewer main.
13
14 MR POPE: Correct.
15
16 MS SIEMENSMA: It's 6 metres away in the front yard of
17 10-12 View Point; correct?
18
19 MR POPE: 6 View Point, yep.
20
21 MS SIEMENSMA: Sorry?
22
23 MR POPE: 6 View Point.
24
25 MS SIEMENSMA: 6 View Point.
26
27 MR POPE: Yep.
28
29 MS SIEMENSMA: And it was on the owner's pipework, not
30 South East Water's pipework; true?
31
32 MR POPE: Correct. Yes.
33
34 MS SIEMENSMA: And you poured a lot of water --
35
36 MR POPE: Below - sorry, below their pipework. It was
37 well below their trench, yep.
38
39 MS SIEMENSMA: But not the South East Water main?
40
41 MR POPE: Correct. Yep.
42
43 MS SIEMENSMA: And you poured a lot of water into NDT1?
44
45 MR POPE: Basically lifted the - the fill is from - was
46 4 metres deep, and started at 2.8 metres. I can check
47 those. I don't have that factually in my head, but it's -

1 yeah, I put probably more than I needed to. But, yeah.
2
3 MS SIEMENSMA: And that test at NDT1 revealed that dye
4 could get from the front yard to the escarpment? You
5 showed us before the dye?
6
7 MR POPE: Yes. Yep.
8
9 MS SIEMENSMA: It doesn't test the ability of the water to
10 get from Bayview Road through to NDT1; correct?
11
12 MR POPE: That's correct.
13
14 MS SIEMENSMA: And of all the dye tests that you undertook
15 NDT1 was the only one that showed dye at the landslide
16 site; true?
17
18 MR POPE: That's correct. We run out of time when we had
19 elevated groundwater levels --
20
21 MS SIEMENSMA: I'm come back to that. About two weeks
22 later you then undertake a dye test in NDT2, being the hole
23 at the South East Water service trench; correct?
24
25 MR POPE: Yeah, correct. I couldn't get that to the
26 bottom of the sewer trench. So it's not very helpful.
27
28 MS SIEMENSMA: So the outcome of that, as I understand it,
29 is that no dye went from South East Water sewer trench
30 through to the escarpment; correct?
31
32 MR POPE: Correct, yep.
33
34 MS SIEMENSMA: And the test result for that supports the
35 fact that the sewer main didn't transport water to the
36 landslide site; do you agree?
37
38 MR POPE: Not that one, but certainly NDT04 supports that.
39
40 MS SIEMENSMA: Well, let me ask you about NDT2.
41
42 MR POPE: Yep.
43
44 MS SIEMENSMA: It supports the fact it can't go from the
45 sewer trench NDT2 to the landslide site?
46
47 MR POPE: It doesn't say - it's not it can't get there.

1 With the base flow in - like, there was clearly groundwater
2 below the trenches. I didn't put enough water in to get
3 any connectivity, or there might not have been - there
4 isn't enough water there for connectivity. It doesn't
5 disprove a flow path, but.

6

7 MS SIEMENSMA: I'll come back to water elevation then.
8 But, putting water elevation to one side, if there were a
9 path from NDT2 to the escarpment you would expect to see
10 dye at the escarpment?

11

12 MR POPE: That time in the test, yes.

13

14 MS SIEMENSMA: And from 7 to 10 January you had dye poured
15 into the stormwater pit at 7 Prospect Hill Road; true?

16

17 MR POPE: The MBS - various members of the MBS team did
18 that, yep.

19

20 MS SIEMENSMA: And again that water didn't reach the
21 headscarp; correct?

22

23 MR POPE: Stormi; correct, yes.

24

25 MS SIEMENSMA: And, again, water elevation issues aside,
26 do you accept that if there were a path from the stormwater
27 pit from 7 Prospect Hill Road it would have emerged at the
28 landslide site? Do you agree?

29

30 MR POPE: There was a path, yes.

31

32 MS SIEMENSMA: Now, you've mentioned water elevation, and,
33 as I understand it, what you're saying is the reason NDT2
34 didn't make it to the escarpment is because of the level of
35 water elevation; is that correct?

36

37 MR POPE: A reason. It's not - yeah, it might never get
38 there from there. I don't know.

39

40 MS SIEMENSMA: And can I suggest that that's speculative,
41 you're just speculating that that's the reason?

42

43 MR POPE: NDT02?

44

45 MS SIEMENSMA: Yes.

46

47 MR POPE: I'm saying it's not a very useful test. I'm not

1 speculating on it. We didn't execute the borehole well.
2 So asking me about it, it - we didn't achieve the outcome.
3 We didn't get to the invert. We stopped, contacted South
4 East Water and said, "This is very hard to do. How can we
5 do this properly," and that was the delay between that test
6 and the rest of the testing. It was a failed test. The
7 borehole in itself was not - I didn't get to the invert of
8 the trench.

9

10 MS SIEMENSMA: So you don't rely on NDT2's water elevation
11 as a reason why it didn't make it out to the escarpment?

12

13 MR POPE: I don't really rely on NDT2 at all. I would
14 prefer to use 4. It's in your gravel - it's in the gravel
15 backfill, and that didn't get to the escarpment.

16

17 MS SIEMENSMA: Now, as at March 2025 when you were
18 undertaking the NDT2 test - and I don't have in front of me
19 the date you did NDT4, but do you accept that water was
20 still seeping from the escarpment in March of 2025?

21

22 MR POPE: Yes.

23

24 MS SIEMENSMA: And in fact Mr Willigenburg had given
25 evidence that he couldn't return to his property in April
26 because water was still flowing from the escarpment, and
27 you accept that as at April it was still seeping, the water
28 from the escarpment?

29

30 MR POPE: Yes. Yeah, yeah.

31

32 MS SIEMENSMA: And I suggest that there was sufficient
33 water flowing in the area at the time to make water
34 elevation a non-issue?

35

36 MR POPE: Yeah, I'm not sure that's true. I put dye into
37 borehole 1A on 10-12 View Point. Didn't make it there.
38 That's - that was literally apart - or a metre away from
39 another borehole that said there was water there, and that
40 dye didn't get there, so

41

42 MS SIEMENSMA: Isn't the most likely explanation for that
43 that in fact there is no pathway?

44

45 MR POPE: No. My team did a lot of mapping, Tim Nash did
46 a lot of mapping. That's director of our firm. I did a
47 lot of mapping. We only saw large volumes of water coming

1 out of this gully. There's a flow path. We've just got a
2 gap between - to your point, Browne Street, 7 Prospect
3 Hill, there is a gap. We ran out of time to get gear in to
4 actually measure what was going on.

5
6 MS SIEMENSMA: You can't rule out the possibility, though,
7 that the reason why the dye didn't emerge is because there
8 is no pathway; true?

9
10 MR POPE: Can you rephrase that?

11
12 MS SIEMENSMA: You can't rule out the possibility that one
13 of the reasons or the reason --

14
15 MR POPE: Yeah, so the sewers might not be connected on
16 View Point. That's a possibility, yes.

17
18 MS SIEMENSMA: And just before I leave this topic tell me,
19 Mr Pope, when you were doing the vibrating wire piezometer
20 tests did you take readings at the site or did you use
21 factory settings?

22
23 MR POPE: Very much site readings. One of the first VW
24 piers I put in in my career 20-odd years ago I made that
25 mistake, and I haven't made that mistake since.

26
27 MS SIEMENSMA: I want to ask a few questions now about the
28 time period it takes to go from the burst site to various
29 locations, starting perhaps with Mr Hartley and Mr Bolton.
30 Now, Mr Hartley and Mr Bolton, you've said that I think
31 based on the modelling by Professor van Zyl you've
32 calculated water velocity and found that it would take the
33 burst 230 or over 200 days going through the natural
34 velocity, which on your analysis means it wouldn't have
35 reached the landslide site by January. Can I ask you - and
36 forgive me if you answered this earlier, but if it had gone
37 through the trenches how long would the water take, if it
38 had gone entirely through the trenches?

39
40 MR HARTLEY: Entirely through the trenches? Oh, gosh.
41 I'm not too sure it can get to the trenches because it
42 needs to jump services, service trenches, and I don't think
43 we've got the linkage to do that. There's the fresh
44 water - beg your pardon, there's the water mains underneath
45 Coburn Avenue, where there's an argument that it could
46 upwell from the sewerage trench into the fresh water trench
47 and - but the trouble with that is that the expected

1 embedment material of the mains water is a finer sand than
2 the gritty granular stuff in the sewerage. So it doesn't
3 feel likely that it's the case. If it did go through there
4 and then found its way down Prospect Hill Road and such,
5 we're talking a matter of days.

6
7 MS SIEMENSMA: Days from the surfacing of the burst?

8
9 MR HARTLEY: No, not really. I mean, the days - around
10 about - well, the capacity from Professor van Zyl is
11 11,000, and from the expected - the anticipated start date
12 of the - is somewhere in August. You'd expect it to be in
13 the service trenches flowing downhill, as per what water
14 does. So from the get-go, albeit probably on a very low
15 volume.

16
17 MS SIEMENSMA: Mr Bolton, you were asked about the
18 2 metres a day calculation?

19
20 MR BOLTON: Yes.

21
22 MS SIEMENSMA: And, just to be clear, on what basis have
23 you come up with 2 metres a day, the movement of the water?

24
25 MR BOLTON: Two metres per day, that's based on the
26 permeability testing that we did at the bore sites and the
27 permeameter testing we did, and the upper range of that
28 permeability results that we got was in the order of
29 5 metres per day, and, as I mentioned, using a velocity of
30 .3 and a hydraulic grading of .1 you come to this, you
31 know, 2 metres per day travel.

32
33 MS SIEMENSMA: And you - sorry, you said that that was the
34 upper - the 2 metres was the upper end of the range for
35 you?

36
37 MR BOLTON: Yes, it was, yeah --

38
39 MS SIEMENSMA: And had to use --

40
41 MR BOLTON: Testing was done, yes.

42
43 MS SIEMENSMA: Had you used the lower end of the range,
44 how many days are we talking about?

45
46 MR BOLTON: At least half that - no, actually 5, so it's -
47 the 1 was - that's 20 - you'd have to multiply by 5,

1 I guess, if you're talking about the - you know, let's say
2 200 - let's say 240 times 5. It's going to be over
3 1,000 days.
4

5 MS SIEMENSMA: You were then asked - I think it was you,
6 Mr Hartley - whether water could reach the landslide site
7 by 5 January, and you were given two options: one, whether
8 it was possible, or whether it was impossible. My question
9 for you is: is it likely, and what's the basis of your
10 response?
11

12 MR HARTLEY: Okay. So we're talking about water from the
13 leak going via whatever way we want and getting to the
14 landslide at 5 January?
15

16 MS SIEMENSMA: Well, it was put in general terms. So,
17 yes.
18

19 MR HARTLEY: If you're going through natural material - if
20 you're going through natural material, based on Hugo's site
21 works and computations, no. If you're going through a
22 combination of - well, if you're going through an entire
23 manmade trenched pathway you're going to get there earlier.
24 And if you're going through what is our preferred -
25 apologies to Hugo if that isn't the word - the preferred
26 line of going through the trenches, getting to Coburn
27 Avenue, sitting there because the velocity goes to zip and
28 going through the natural material underneath the houses,
29 including number 5 Prospect Hill, getting into the
30 agi-drains or the sewer trench situation of 7 Prospect Hill
31 Road, and then going down there, you're looking in the
32 region of about 30 days. And so, yes, it could get there
33 on the 5th, but if it's going to get there on the 5th it's
34 going to get there beforehand.
35

36 MS SIEMENSMA: What do you mean beforehand?
37

38 MR HARTLEY: Well, if the - if Professor van Zyl's
39 calculations are correct and it's going - and 11,000 litres
40 per day are getting into the service network from about
41 1 October, something like that, then we're looking at 1 -
42 November - thank you very much, everybody - 1 November for
43 getting to View Point Road, View Point Road and other
44 locations it has to be said. But, yeah.
45

46 MS SIEMENSMA: You were asked some questions about
47 permeability and by reference to the van Zyl report. Can

1 I just ask if you can be shown - if we could pop up a copy
2 of the van Zyl report. Unfortunately I don't have the
3 Bates number on me. Thank you. I'm indebted to my friend.
4 SEW.0001.0002.4191, and if I could ask the operator to turn
5 to page 28. The first thing I might ask is the
6 10,000 litres, do I understand this to be the biggest value
7 and that in fact the table shows a plausible range between
8 1,000 and 10,000 litres a day?
9

10 MR HARTLEY: From my reading of this report, the
11 1,000 litres per day is associated with the capacity of the
12 embedment material around the mains. So that's the stuff
13 that leaked. So the water has to go through that before
14 finding its way into the sewerage trench, which has the
15 10,000, and therefore Professor van Zyl, from my reading of
16 it, has basically created the capacity, which is, you know,
17 just adding 1,000 to 10,000.
18

19 MS SIEMENSMA: Mr Bolton, as I understand it, you were on
20 site when there was some excavation of a sewer pipe in
21 Bayview Road; is that correct?
22

23 MR BOLTON: Yes, I was there when they excavated the sewer
24 pipe at Bayview Road, yes.
25

26 MS SIEMENSMA: And what observations did you make about
27 the soil while that was being excavated?
28

29 MR BOLTON: So the sewer - the invert of the sewer had
30 surrounding it quite, I guess, impermeable soils, yeah, to
31 probably about - trying to think - maybe about - to me, it
32 was about one and a-half metres, from a depth of one and
33 a-half metres down - this is going off memory - and then
34 above that it gets a bit less - it was very impermeable
35 where the sewer was embedded, and above that it was more
36 permeable, and then towards the surface where the sand fan
37 and all that sort of is it's about - from the testing
38 I did, it was about one metre per day at that material.
39

40 MS SIEMENSMA: While we've got the van Zyl report up there
41 could I take you to 0021, page 0021. Do I understand
42 correctly that here Professor van Zyl is talking about
43 lab-tested results by which he determined grain size? Is
44 that a correct understanding of --
45

46 MR HARTLEY: Yes.
47

1 MS SIEMENSMA: And you can infer permeability of the
2 natural soil from the grain size?

3
4 MR HARTLEY: When it's granular, yes.

5
6 MS SIEMENSMA: And is that a basis on which you have -
7 that has also fed into your understanding and analysis of
8 permeability?

9
10 MR BOLTON: Well, these - my permeability information that
11 I have used is mainly to do with the aquifer material and
12 the tests that I did. That range of approximately 1 metre
13 per day to, you know, 5 metres per day is largely based on
14 those tests. I mean, these ones there, I mean, on the face
15 of it, they look like they're push tubes, I would say, and
16 they are - I wouldn't - I based mine on my testing that
17 I had done, yeah.

18
19 MS SIEMENSMA: Thank you. And just to clarify one issue,
20 Mr Hartley, you had spoken of a photograph I think of water
21 flowing at Waller Place. I just want to ask if this
22 document can be shown to you to ensure that we're talking
23 about the same photograph. So it's SEW.0001.0001.0500.
24 And this is a document that was I think part of a notice to
25 produce. I'm not sure whether it's in evidence as yet.
26 And I'll ask, Mr Hartley, for that to be popped up on the
27 screen for you. It's a photograph of water flowing near
28 Waller Place. SEW.0001.0001.0500. The document that was
29 produced as part of a notice to produce.

30
31 CHAIRPERSON: It may not be in the hearing book. It will
32 be only in the hearing book if it was proposed by counsel
33 assisting to go through the document. So if counsel
34 assisting had proposed to go to the document it would be in
35 the hearing book.

36
37 MS SIEMENSMA: Yes. So, Mr Hartley, you're talking about
38 a photograph in your 5 May 2025 report and it's the
39 photographs at page 52 and 53 of that first report?

40
41 MR HARTLEY: Yes.

42
43 MS SIEMENSMA: Thank you.

44
45 CHAIRPERSON: Ms Siemensma, that report is in the - that's
46 an exhibit, so you can bring that up if you want it.

47

1 MS SIEMENSMA: Well, I think Mr Hartley's confirmed that
2 those are the photographs. So thank you. I want to ask
3 you some questions, Mr Paul, just about flow rate and flow
4 rates from the landslide. You have said that based on the
5 PSM measurements that as at 6 January 2025 as much as
6 0.2 litres per second, being 17,280 litres a day, was
7 coming from the landslide escarpment; you recall that?
8
9 MR PAUL: Yes, based on PSM measurements.
10
11 MS SIEMENSMA: And do I understand you've used the highest
12 end of the PSM scale, the range being 0.1 to 0.2 in
13 calculating that figure?
14
15 MR PAUL: No, I don't remember if I used the highest end
16 of the range, because I can't remember which end of the
17 range I used.
18
19 MS SIEMENSMA: In any event, that flow did not remain
20 steady at that rate, rather it dropped off substantially,
21 do you accept that?
22
23 MR PAUL: It decreased from there until, say, now, a few
24 weeks ago it's decreased a lot.
25
26 MS SIEMENSMA: Well, from 5 January to 10 January
27 I suggest it dropped to 5 litres a minute; do you --
28
29 MR PAUL: I don't have that measurement. Is the 5 litres
30 in a measurement?
31
32 MS SIEMENSMA: Well, if I could ask you to go to page 276
33 of your report, 0276, and we see here just upper centre of
34 the page 5 January to 10 January 2025, reduces to 5 litres
35 a minute on 10 January.
36
37 MR PAUL: Yeah, okay. I'll just confirm is that a PSM
38 measurement?
39
40 MR POPE: No.
41
42 MR PAUL: It's not?
43
44 MR POPE: Definitely not.
45
46 MS SIEMENSMA: This is part of your report, Mr Paul.
47

1 MR PAUL: Yeah, that's right; part of my report. I'm just
2 not too sure what the reference is for that measurement is
3 all. But that's fine; we can take that.

4
5 MS SIEMENSMA: Mr Bolton, I wanted to ask you about that.
6 What, if anything, with such a substantial drop in the flow
7 generally indicate?

8
9 MR BOLTON: Well, when you have a spring, I guess, that's
10 covered over that sort of a seal has been removed under,
11 I guess, natural conditions you would expect the flow to
12 drop off. You know, if there was a source of water behind
13 that you wouldn't expect it to drop off, i.e. source of
14 water being the substantial amount of water from a leak,
15 you know.

16
17 MS SIEMENSMA: So, if I understand what you've just said
18 correctly, do you say that tends towards or tends to
19 suggest another source other than the Bayview leak?

20
21 MR BOLTON: No, the drop-off indicates that it does not
22 appear to be a substantial amount of water behind it
23 otherwise it would, you know, continue to be, you know,
24 relatively within four days or five days, it is, between
25 the - five days between those periods that you would - you
26 wouldn't expect it to drop off so rapidly because you've
27 got this, you know, source of water that would be keeping
28 the flows up.

29
30 MS SIEMENSMA: Now, you have assessed, Mr Hartley and
31 Mr Bolton, how much water was required in your view to be
32 introduced at the site to induce a landslide event, and
33 I think you gave a range of between 2,000 to 2,300 litres.
34 On what basis was that calculated?

35
36 MR HARTLEY: The raw data was from Mr Pope's slope
37 stability analysis from 2022. During the conclave he
38 warned against using that but was kind enough to, you know,
39 do a calculation very quickly to indicate that the impact
40 of using preferred parameters didn't make a great deal of
41 difference. The slope topography was based on LiDAR data
42 which had been marginally manipulated to include the
43 retaining wall construction. And the ground model was
44 based on our interpretations of the raw data from PSM's
45 ground investigation of I think it was February and various
46 interpretations from CivilTest.

1 MS SIEMENSMA: And so are you still comfortable with the
2 range of 2,000 to 2,300 litres a day?

3

4 MR HARTLEY: 2,000 to 2,300 full stop. It was using
5 slope - you know, basically a balance of forces approach
6 which has been disputed quite honourably by Mr Paul. But
7 I think the critical thing is is that the volume of
8 material that we were looking for is for purely the
9 5 January failure which, from was Victorian Gazette, was
10 20 cubic metres as opposed to the entire 14 January. So,
11 yes, we are.

12

13 MS SIEMENSMA: And I misspoke by saying per day. So 2,000
14 to 2,300 full stop. What do you say as to Mr Paul's figure
15 of 35,000?

16

17 MR HARTLEY: Mr Paul, I think it's in his report, talks
18 about I think 35, maybe 36, I can't remember. It uses
19 the - he uses - as long as I'm not speaking over him -
20 suction theory, so the tendency for suction, the ability of
21 material to reduce suction as moisture content increases.
22 And he has assessed that the moisture change needed to
23 reduce suction is between 0.1 and 0.3, and he needs to have
24 a porosity which is taken at 0.4, and the volume of slide
25 to be 300 cubic metres.

26

27 My feeling is that, although initially 36,000 and
28 2,300 can't be - you know, can't be married together, what
29 I would honourably suggest is that, although the 0.4 is on
30 the upper limits of the permeability tests that we received
31 from our borehole that was taken at Waller Place, if you
32 were to use Mr Paul's calculations purely to work out what
33 the 5 January slide needed you would come up with something
34 in the region of between 800 litres and 2,400 litres. So
35 based on that taking of Mr Paul's calculations we tend to
36 marry up very nicely.

37

38 MS SIEMENSMA: You've mentioned suction theory. In the
39 joint report, the conclave report, Mr Pope made a comment
40 that Mr Paul's variations in the suction model are
41 speculative and can't be meaningfully measured. Do you
42 agree with that?

43

44 MR HARTLEY: Me?

45

46 MS SIEMENSMA: Yes.

47

1 MR HARTLEY: Oh, gosh. Mr Paul is - we're all decent
2 engineers. We have different - we have different
3 comfortable ways of trying to interpret what we can see.
4 There is merit in everybody's ways of doing it.

5
6 MS SIEMENSMA: Now, on the basis that all this landslide -
7 all the water it needed would be on your calculations
8 between 2,000 to 2,300 or using Mr Pope's equation up to
9 2,400 - Mr Paul's, I'm sorry - sort of having regard to
10 weather events, private leaks, irrigation, do you have a
11 view as to whether or not this was a landslide waiting to
12 happen?

13
14 MR HARTLEY: The grand assumption from this, and it's a
15 reasonable one, is that once the 5 January occurred the
16 14 January was highly - was much more likely to occur.
17 We've got to think about the fact that 2,300, 2,400 upper
18 limit, you know, litres, the volume is the size of a
19 telephone box. A telephone box seems a very small volume
20 of water or a very small trigger to, you know, create
21 something that would otherwise assume to be stable forever,
22 for a reasonable amount of time. 2,400 litres,
23 2,300 litres is a volume which we can all imagine. And
24 therefore it's a volume which can be reasonably created
25 from local, inert, inadvert and very regular sources. And
26 therefore I would say you're right. It was - at the time
27 of 5 January at the calculations that we've got it was on a
28 knife edge and it was likely to happen anyway.

29
30 MS SIEMENSMA: And, just to clarify, when you say it was
31 likely to happen are you talking about the 5 January or
32 both?

33
34 MR HARTLEY: The 5 January was likely to happen. And, if
35 the 5 January was to happen, the 14 January was very likely
36 to happen.

37
38 MS SIEMENSMA: Okay. No further questions.

39
40 CHAIRPERSON: Do you have any further questions on this
41 topic, Mr Costello?

42
43 **<EXAMINATION BY MR COSTELLO:**

44
45 MR COSTELLO: Yes. Before I move to the next topic
46 I think the other witnesses should be given the opportunity
47 to answer some of the questions that have just been put by

1 counsel for SMEC to SMEC's own witnesses and to no others.
2 So, Mr Paul, would you like to comment on anything that
3 you've just heard?
4

5 MR PAUL: My model for the landslide is that water was
6 seeping into this slope over a period of time, probably
7 from within - from December, and as that water was seeping
8 in that soil was getting wetter and wetter and wetter, and
9 therefore getting heavier. The volume of soil that is
10 getting wet is increasing. And this process just keeps
11 continuing until we have a tipping point. And it flows.
12 And the important thing is it flows downhill. For the soil
13 to get that much water in it that it flows as a liquid,
14 we've got images of that, it must absorb a lot of water.
15 You know, 300 cubic metres and 2,000 litres would be like
16 getting a bowl of flour and putting a thimble of water in
17 it and expecting it to turn into batter. You don't have
18 enough water to make it flow. And I think it's a really
19 important thing to convey. It flowed. We know it flowed.
20

21 So the suction model, without getting too much into
22 it, when the slope is, you know, in its normal condition,
23 it's facing north, it's about 30 degrees, it's getting
24 maximum sun on it, it's got evapotranspiration drawing
25 water out, it's really only around the springs that it's
26 wet, and that's the normal condition. Something really had
27 to change to get that much water into the slope to take it
28 from that condition to a state where that soil was able to
29 flow, and that's a lot of water. And my calculation is
30 based on how much water you need to get it (indistinct),
31 take out the suction, perhaps increase the pore pressure in
32 it and make it flow.
33

34 MR COSTELLO: Mr Pope?
35

36 MR POPE: If you remember, Mr Costello, the calcs I did
37 for the 2022 rainfall event. If you apply that rainfall
38 event to this slope setting and just use a small 50 square
39 metre area I get 4,000 litres. So the numbers aren't
40 calibrated against slope performance at all. Like, it
41 hammered rain in November 22. We had a landslide on the
42 site. We did not have a landslide at the retaining wall
43 location. So on that basis I think the numbers are
44 inaccurate.
45

46 MR COSTELLO: You saved me a question, Mr Pope, although,
47 Mr Hartley, I should allow you to respond. 2,000 litres is

1 an almost insignificant amount of water for an area of this
2 magnitude; do you accept that?

3
4 MR HARTLEY: For the 300 cubic metres, yes, the --

5
6 MR COSTELLO: You know in 2022 there was 80 millimetres of
7 rain that was assessed as being the cause and trigger of
8 the landslide. On your theory why wasn't there a landslide
9 in the landslide site for 2025 at that point in time?

10
11 MR HARTLEY: Things have changed on the landslide - at the
12 location of this current landslide. For example - oh,
13 gosh, I will stand corrected about when the original
14 retaining wall was constructed, but the most recent
15 construction - retaining wall constructed was on the - oh,
16 gosh, in 2024. There's - and I would suspect, although
17 I can't think of - can't think off the top of my head, that
18 the horizontal terracing, if you will, there's been some
19 modifications to the slope itself since 2024.

20
21 MR COSTELLO: And do you think those modifications are
22 decisive in the sense that by reason of those modifications
23 2,000 litres of water was sufficient to generate the 2025
24 slides?

25
26 MR HARTLEY: Yes, with the - with the - if the
27 (indistinct) changes in vegetation and the construction of
28 these things can actually reduce things, you know, the
29 factor of safety of this site relatively significantly.

30
31 MR COSTELLO: Can or did? Can or did? I'm asking for
32 your opinion as to why it happened. I don't want theories
33 anymore. Is your evidence now that the condition of
34 the slope was so altered by the factors you've just pointed
35 to that 2,000 litres was sufficient but before those
36 changes 2,000 litres would have been insufficient?

37
38 MR HARTLEY: I haven't done that analysis. I've done the
39 analysis based on the LiDAR survey to say that there is -
40 you can get a slope failure using 2,000 litres.

41
42 MR COSTELLO: By reason of? And that is a function in
43 part of what you consider to be the changes in the dynamics
44 of the slope?

45
46 MR HARTLEY: I didn't analyse the stability of the
47 cross-section that is subject to the 2025 landslide to

1 model 2022.

2

3 MR COSTELLO: No.

4

5 MR HARTLEY: I just did it. So I'm speculating as to why
6 80 millimetres of rain did not cause a failure.

7

8 MR COSTELLO: Yes.

9

10 MR HARTLEY: All I'm saying is that my model for 5 January
11 and for the volume of material, material that slipped,
12 according to briefing notes you can get that to fail with
13 2,300 litres.

14

15 MR COSTELLO: So the only way that you can make your model
16 work in the face of what occurred in 2022 is by pointing to
17 changes between 2022 and the date of the slides, otherwise
18 there must be something fundamentally wrong in your model;
19 is that fair?

20

21 MR HARTLEY: I would have to think very hard about what
22 does rainfall do to that cross-section because obviously
23 you've got rainfall, the direct rainfall on the surface and
24 such, infiltration, run-off, it's a very steep slope, and
25 things like that. Then you've got the infiltration of, you
26 know, upstream, the fact it's hardstanding for the most
27 part, the majority of it goes into the stormwater drains.
28 I really am thinking off the top of my head here. But
29 I would have to think very hard about how does
30 80 millimetres affect the slope that we're looking at in
31 the same way that yesterday morning everybody's thought
32 very hard about where does rainwater flow and get to the
33 failure of 2022.

34

35 MR COSTELLO: You accept 80 millimetres is an enormous
36 amount of rain in a short period?

37

38 MR HARTLEY: It is a substantial amount of rain.

39

40 MR COSTELLO: It's described as a one in 100-year
41 rainfall; you're aware of that?

42

43 MR HARTLEY: Yes.

44

45 MR COSTELLO: And do you think that there's seriously some
46 differential in the scarp such that where the rain was
47 hitting in 2022 it was hitting the slope in 2025 but

1 somehow not being absorbed?

2

3 MR HARTLEY: I genuinely do not know. I cannot - as
4 someone of a profession I'm not able to be confident in the
5 answer I can give you with that one. All I know is that
6 from the data that I was able to get and from the - and
7 from the topography and from the ground model that
8 I produced for this, 2,300 litres could create a -
9 remember, it's a small failure. The 5 January is a small
10 failure. So, yeah, I cannot answer why it didn't happen in
11 2022.

12

13 MR COSTELLO: As you sit there now and you reflect upon
14 what happened in 2022 and the volume of water, does it
15 cause you to have concern as to the veracity of your model?

16

17 MR HARTLEY: On the one hand, yes, because, you know,
18 80 millimetres is a lot of - is a lot of water to occur
19 and, you're right, it's a rarity. But, on the other hand,
20 I mean, thinking off the top of my head, the worst - if
21 you're going to do a - if you're going to have a failure
22 which is 20 cubic metres, okay, the most that you can get
23 water into is - well, you're going to have an RU of
24 something like 0.5 - you're going to have a third of that
25 basically, off the top of my head, is the maximum amount of
26 water you can actually get in there. So what is that? A
27 third of 20 is - let's say it's 7. So it's 7,000 cubic
28 metres, which is 70 - 70,000 litres. I'm going down a
29 rabbit hole here.

30

31 MR COSTELLO: Yes.

32

33 MR HARTLEY: So I'll stop. But --

34

35 MR COSTELLO: Is the answer that it does cause you to
36 doubt whether or not your model might be correct?

37

38 MR HARTLEY: There's plenty of things that cause it to --

39

40 MR COSTELLO: I'm just asking whether this particular
41 factor causes you to have concerns that your model might
42 not be correct?

43

44 MR HARTLEY: Because we were able to prove that it failed.

45

46 MR COSTELLO: Did you take into account 2022 as a test
47 when you prepared your model?

1
2 MR HARTLEY: No. No.
3
4 MR COSTELLO: Thank you. Mr Hitchcock, I want to give you
5 an opportunity to comment on anything that you have just
6 heard in connection with this matter.
7
8 MR HITCHCOCK: I'm not a geotechnical expert, but I'm
9 hearing that two to three thousand is the amount of water
10 that loads it up or reduces the suction, and we're all
11 thinking about that. But Mr Pope measured 17,000 litres
12 coming out, which is a lot more than that, and it's a lot
13 of telephone boxes.
14
15 MR COSTELLO: On any view, Mr Hartley, when we're talking
16 about the possibility of 2,000 being sufficient for a
17 trigger, there's no suggestion by you or anyone else that
18 that's all that there was here?
19
20 MR HARTLEY: No, no. With the measurement that was done
21 which suggested there was 200 millimetres in a second,
22 12 hours after the event.
23
24 MR COSTELLO: That's right.
25
26 MR HARTLEY: Yes. It was just the amount that was needed.
27
28 MR COSTELLO: On your model it was the amount that was
29 needed. It wasn't the amount that was there. Far in
30 excess of the amount that was needed was in fact there?
31
32 MR HARTLEY: That's correct.
33
34 MR COSTELLO: And, depending on flow paths and velocity
35 rates, there may well have been 2,000 litres there a long
36 time before 5 January, depending on velocity rates? And
37 not only velocity rates because other sources of water --
38
39 MR HARTLEY: Yes, and that's - yes, and that is something
40 which weighs on my mind. I mean, why is it that 5 January
41 was so special? Because, whatever the volume that we're
42 looking at, the 5 January doesn't seem to be particularly
43 unique other than the fact - well, no, forget that.
44 I can't see why it's unique.
45
46 MR COSTELLO: I was going to move on, but I am conscious
47 of the time. This has taken - we're almost on track, but

1 we're just not quite on track. I can't predict how long
2 this will take because it will depend on others. I can do
3 my start part fairly quickly.

4
5 CHAIRPERSON: Let's start and see how we go.

6
7 MR COSTELLO: All right. Thank you. If anyone has a
8 problem. Mr Paul, do you have a difficulty? Do you need
9 to be away?

10
11 MR PAUL: I just need to get the kids picked up. I just
12 need to make a call.

13
14 MR COSTELLO: It's a very legitimate problem.

15
16 MS FOLEY: I actually wonder, Chair, I'm in a similar
17 situation, whether we can just have five minutes to make
18 calls?

19
20 CHAIRPERSON: Yes, let's do that. We'll return in five
21 minutes.

22
23 **SHORT ADJOURNMENT**

24
25 CHAIRPERSON: Mr Costello.

26
27 MR COSTELLO: I think we're largely sorted, but if anybody
28 has anything they need to say I'm sure they'll say it --

29
30 CHAIRPERSON: The children are sorted?

31
32 MR COSTELLO: -- except for Mr Hitchcock, who is trying to
33 change his flight. He's on his phone in the witness box
34 for that reason. I have asked Mr Pope to step out of the
35 witness box, but to remain in court. And Dr Vu has gone in
36 in his place, and Mr Jewell has gone in in the place of
37 Mr Hartley.

38
39 I want to turn to some questions concerning water
40 chemistry. Before I do that there's just a couple of
41 preliminary things. Mr Jewell, your involvement is
42 slightly more mysterious than the involvement of others
43 because you haven't provided a written report; is that
44 correct?

45
46 MR JEWELL: That's correct.

1 MR COSTELLO: And were you involved in the production of
2 the SMEC report?
3
4 MR JEWELL: I reviewed the SMEC report; yeah.
5
6 MR COSTELLO: You reviewed it, did you say?
7
8 MR JEWELL: Yes.
9
10 MR COSTELLO: Thank you.
11
12 MR JEWELL: (Indistinct) comments on.
13
14 MR COSTELLO: I see. And are you employed by SMEC?
15
16 MR JEWELL: No.
17
18 MR COSTELLO: All right. Who are you employed by?
19
20 MR JEWELL: I have my own company, CM Jewell & Associates.
21
22 MR COSTELLO: Thank you. And what's your area of
23 expertise?
24
25 MR JEWELL: By qualification I'm a hydrogeologist.
26 I've just had an interest in groundwater geochemistry
27 throughout my career.
28
29 MR COSTELLO: Thank you. There was some evidence given by
30 Mr Hartley earlier yesterday I think about meetings that
31 he's attended by Zoom with South East Water and South East
32 Water's solicitors. Have you been involved in any of those
33 meetings?
34
35 MR JEWELL: No.
36
37 MR COSTELLO: All right. Mr Bolton, have you been
38 involved in those meetings?
39
40 MR BOLTON: Yes, yeah.
41
42 MR COSTELLO: You have. This is the weekly meeting that
43 was spoken of?
44
45 MR BOLTON: Yes, it's roughly about then.
46
47 MR COSTELLO: Thank you.

1
2 MR BOLTON: During our drilling phase and other parts,
3 yes.
4
5 MR COSTELLO: And who are the ordinary attendees at those
6 meetings?
7
8 MR BOLTON: So it would be myself, David, and across the
9 year staff.
10
11 MR COSTELLO: And no doubt people from South East Water.
12
13 MR BOLTON: Not on every occasion. I can't say - wouldn't
14 be able to say that on every - certainly not on every
15 occasion someone from South East Water was there, but they
16 were there - they were there - I'm trying to think of it,
17 such a rush of things that we were doing - 50 per cent at
18 least, I would say.
19
20 MR COSTELLO: And were these formal meetings? Were
21 minutes kept?
22
23 MR BOLTON: (Indistinct).
24
25 MR COSTELLO: Did you take notes at these meetings?
26
27 MR BOLTON: I didn't take notes.
28
29 MR COSTELLO: Okay. Thank you. Mr Jewell, when were you
30 engaged?
31
32 MR JEWELL: In late June. 16 June. In the middle of
33 June.
34
35 MR COSTELLO: Thank you. And what was the scope of your
36 engagement?
37
38 MR JEWELL: It was to provide assistance to SMEC
39 specifically with regard to geochemistry and possibly
40 geochemical modelling.
41
42 MR COSTELLO: I see. And you have had regard to the
43 written reports that have been tendered in the course of
44 the last couple of days of hearings?
45
46 MR JEWELL: Yes.
47

1 MR COSTELLO: And in having regard to those written
2 reports you've paid particular attention to questions
3 concerning geo or hydrochemistry.

4
5 MR JEWELL: Yes.

6
7 MR COSTELLO: All right. Thank you. I want to try and
8 move through this fairly quickly, but I just want to start
9 with some basic propositions before we move to some
10 conclusions that have been reached in the various reports.
11 There's a lot of technical jargon and phrases here. So
12 let's see if we can at least isolate the key ones. Dr Vu,
13 perhaps if I could start with you. Is it right to say that
14 cations, like sodium, potassium, calcium, contribute to the
15 salinity and electrical conductivity of water?

16
17 DR VU: Correct.

18
19 MR COSTELLO: Thank you. And, for that reason, chemical
20 analysis of water to reveal the presence of cations is an
21 important step in determining likely sources of water?

22
23 DR VU: Correct, but not complete.

24
25 MR COSTELLO: Yes.

26
27 DR VU: I think when you talk about the source of the
28 water you need to consider other factor or component in the
29 water such as anions. And in this case we can talk about
30 chloride, one of the chemicals we as a geochemist or
31 hydrogeologist could consider a tracer in assessing our
32 work, and chloride is very important as well. So we cannot
33 leave it out.

34
35 MR COSTELLO: Yes. I didn't mean to suggest that cations
36 were alone decisive. I just meant that in the course of an
37 analysis that is one factor that you would almost always
38 have regard to.

39
40 DR VU: Yes. So cations consider, yeah.

41
42 MR COSTELLO: Particularly in seeking to determine, for
43 example, the source of a water and whether it was mains
44 water or another source?

45
46 DR VU: Yeah. So, speaking of the sources, among the
47 cations you mentioned sodium and potassium are most

1 important because again, like I said, they are considered
2 the inert chemical or metals that will not interact with
3 any soil metals. So that will be important to carry the
4 source. Other cations like magnesium calcium are also
5 important because it can tell you that it might be along
6 the pathway. Those cations are picked up by the water
7 along the pathway. So they're also important.

8
9 MR COSTELLO: Thank you. I'll come back to them being
10 picked up along the pathway in a moment. Can I come to
11 anions. Perhaps, Mr Jewell, I'll put this to you. In
12 terms of the analysis that's been undertaken here it seems
13 to me at least that the principal anions that have been
14 looked for are chloride, sulphide, carbonite and
15 bicarbonate. Would you consider those the major anions?

16
17 MR JEWELL: Yes, those are the major ones that you would
18 normally look at and have been analysed for some of the
19 samples here.

20
21 MR COSTELLO: Thank you. And the carbonates, bicarbonate
22 and carbonate, they're relevant in a number of senses
23 including that they have a buffering effect in terms of
24 maintaining alkalinity; is that a fair description?

25
26 MR JEWELL: Yes. They can buffer it and to an extent can
27 control it as well.

28
29 MR COSTELLO: Thank you. There's been quite a bit of
30 evidence in prior hearing blocks about electroconductivity
31 and electroconductivity testing. Is electroconductivity at
32 least in part a function of salinity?

33
34 MR JEWELL: Yeah, the electrical conductivity of
35 a solution reflects the effect of all the ions that are
36 dissolved, both cations and anions, on the ability of the
37 solution to transmit electric current. It's a reasonable
38 indication of the overall salinity of water. But because
39 it's contributed to by all the different ions, and
40 different ions will affect it to a different extent, it's
41 not a good way of comparing waters unless they have a
42 similar ionic composition.

43
44 MR COSTELLO: I see. When you say not a good way of
45 comparing do you mean not a good way of comparing at single
46 test; that is, electroconductivity alone is not a good way
47 of comparing, or does it cease to be of any utility?

1
2 MR JEWELL: Unless you understand from other means that
3 from other analysis that the waters are both similar
4 overall balance of ions present.

5
6 MR COSTELLO: I see. And as water travels along different
7 surfaces and through different geological structures there
8 can be an ion exchanges along the path; is that right?
9

10 MR JEWELL: That's right. And also absorption. So, yes,
11 the ions can interact with the rock they travel through.
12

13 MR COSTELLO: And so what that means at the simplest level
14 is that the fact of the water travelling through geological
15 structures can be causative of changes in the chemistry of
16 the water as it travels?
17

18 MR JEWELL: Yes.
19

20 MR COSTELLO: Thank you. Have you had regard in the
21 course of considering the materials that you've been
22 provided with before today the relevance of aeolian soils
23 to the question of changes to chemical composition of
24 water?
25

26 MR JEWELL: Yes. The presence of aeolian sands within the
27 transported material has been raised. It was raised at the
28 conclave.
29

30 MR COSTELLO: Is one of the common enough features of
31 aeolian sands or soils that there are carbonate minerals
32 within it?
33

34 MR JEWELL: Well, it depends on the source of the sand.
35 If the sands have been eroded - and aeolian deposits are
36 normally sands. If they've been eroded from a calcareous
37 rock then they would contain carbonates. If they have been
38 eroded from a granite then they generally wouldn't.
39

40 MR COSTELLO: Thank you. I was just coming to granite.
41 Are you able to say at least in general terms - let me take
42 one step back. We know that this is a geology that
43 includes granite --
44

45 MR JEWELL: Yes.
46

47 MR COSTELLO: -- in the area here. Are you able to say

1 anything at a general level about the interaction between
2 water and granite and what that can reveal - what could be
3 revealed by those interactions by way of chemical testing?
4

5 MR JEWELL: So granite is not very soluble in water.
6 That's why, you know, granites tend to form mountains and
7 hills and be resistant to erosion, or one of the reasons.
8 But everything is soluble to some degree. And so the
9 minerals in granite will dissolve in water in which they're
10 in contact with, you know, water flowing over the surface
11 or water within fractures, until an equilibrium is reached
12 between, so the solid mineral phases and the dissolved
13 components of those minerals in water.
14

15 MR COSTELLO: Dr Vu, sticking with granite, is it right to
16 say that as granite weathers it releases or can at least
17 release ions into water, and those ions may be revealed in
18 the form of sodium, potassium, calcium or magnesium?
19

20 DR VU: Potentially. Like he explained, the granite is
21 quite insoluble with the water, but over the time, we're
22 talking about geological time record, thousands, billions
23 of years, then it will be dissolved to some extent. And we
24 - geologist or hydrogeologist or geochemist - consider it's
25 like an equilibrium state, and then it would expect some
26 kind of chemical which are the signature (indistinct)
27 interact or exposed to granite.
28

29 MR COSTELLO: I see. And, just to finish off on this
30 general topic, we've already established, Dr Vu, that as
31 water travels through different geological structures there
32 can be different chemical reactions. And so that
33 necessarily means, does it, that depending on the path of
34 travel there may be different chemical reactions that will
35 reveal themselves in different water chemistry at the final
36 source?
37

38 DR VU: Correct. And Chris Jewell comment about the
39 processes could be happening during the water movement. So
40 it's not only absorption and resorption but it can also be
41 mineral (indistinct) and mineral dissolution. So that all
42 will be considered into the equation then contribute to the
43 water chemistry of the water we see.
44

45 MR COSTELLO: Thank you, Dr Vu. I mentioned before that
46 there's been evidence regarding electroconductivity testing
47 at earlier hearings. There's a range of tests that can be

1 done to test the electroconductivity of water. Some of the
2 tests are at the more simple end. A handheld test can be
3 taken into the field. And, Dr Vu, are you aware that there
4 was a variety of those types of tests done from time to
5 time by South East Water?

6
7 DR VU: Yes.

8
9 MR COSTELLO: That's something you're aware of?

10
11 DR VU: Yes.

12
13 MR COSTELLO: I just want to ask you a question generally
14 about that style of testing, the accuracy of testing by
15 taking a sample in the field with the small device rather
16 than sending something off to the lab. Is it right to say
17 that that type - what I might call non-laboratory testing -
18 is unlikely to be able to point to the source of water with
19 any real degree of confidence?

20
21 DR VU: I would disagree with that. So what you referred
22 to we consider in the field testing. And we use, like, a
23 probe like a (indistinct) and then measure the water on
24 site. So we are quite confident with the field
25 measurement, normally because before we measure it, the
26 field staff, normally we do the calibration step to make
27 sure that the reading from the sample we have of standard
28 had to be in a range of a standard range of equipment. So
29 that's one of the QAQC steps we do. And then also based on
30 my experience normally the field testing is quite
31 consistent with the lab testing. So I would trust the
32 result provided by the South East Water, if they done the
33 calibration properly.

34
35 MR COSTELLO: If they've calibrated the device properly;
36 yes, thank you. In terms of that type of non-laboratory
37 electroconductivity testing it might be sufficiently
38 accurate on the question of electroconductivity, but would
39 you agree that the answer to that question, the state of
40 the electroconductivity of the water itself, will often not
41 be conclusive as to the source of the water?

42
43 DR VU: It depending. But then for this particular
44 question we are talking about different type of water.
45 Phil can elaborate on this. But when we're talking about
46 the rainwater, which have very low conductivity or
47 (indistinct).

1
2 MR COSTELLO: Yes.
3

4 DR VU: And the other one, the deep aquifer groundwater
5 have high TDS. So if we have, like, a variety of different
6 type water then perhaps the EC total will be one of the
7 indicators we can use to differentiate the source of the
8 water.
9

10 MR COSTELLO: Thank you. Mr Hitchcock, did you wish to
11 add anything to that?
12

13 MR HITCHCOCK: Yeah, I think the EC meter will tell you
14 how salty something is and give you a relative indication
15 around the catchment. The anions and cations, looking at
16 the geochemistry, is telling you the type of water and that
17 dissolution and the equilibrium that's happening in the
18 aquifer, which is different.
19

20 MR COSTELLO: Thank you.
21

22 MR HITCHCOCK: So it's the type of water and how salty it
23 is.
24

25 MR COSTELLO: Yes, thank you. Could we please have on
26 screen DPA.0004.0001.0001_0106. Dr Vu, this is your
27 report - sorry, this is appendix E to the joint report
28 which I'll bring up. And if I could have paragraph 182 up
29 to and including subparagraph (c) made larger, please.
30 This looks familiar to you, Dr Vu?
31

32 DR VU: Yeah, that my part; yeah.
33

34 MR COSTELLO: You're the person principally responsible
35 for this part of the report?
36

37 DR VU: I am.
38

39 MR COSTELLO: Thank you. I just wanted to give you an
40 opportunity to comment on a couple of paragraphs in your
41 report that appear to me at least to be of significance.
42 Here you're speaking about laboratory test results, and you
43 start in (a) by speaking about pH values being consistent
44 with field measurements. In (b) you talk about TDS and EC
45 values being consistent with field measurements. And then
46 in (c) you say, "The seepage that issued from the headscarp
47 of the January 2025 landslide is enriched in major cations

1 and anions, including sodium, potassium, calcium,
2 magnesium" - is HCO_3 , is that bicarbonate?

3
4 DR VU: Bicarbonate.

5
6 MR COSTELLO: SO_4 , that's sulphate, and chlorine?
7 Chloride?

8
9 DR VU: Chloride.

10
11 MR COSTELLO: Chloride, "compared to rainwater and water
12 from stormwater pits. Sodium and chloride are considered
13 conservative traces." What does that mean?

14
15 DR VU: Sodium and chloride normally don't interact with
16 any soil material. It flow through different type soil,
17 but no - sodium and chloride would not be change their
18 composition unless it would mix with other water. But if
19 it's interacting with any soil metal, no change. So that's
20 why we often - if we don't have tracer, then we use sodium
21 and chloride as a tracer to estimate the (indistinct), also
22 the source of the water. And then when we follow the
23 tracer it's different from the tracer. Mr Pope, in his
24 study, I believe that he used the kind of plumbing tracer
25 or dye. But as a hydrogeologist or geochemist we often use
26 different type of chemical as a tracer. But we didn't have
27 a chance to do it here. So then that's why I had to use
28 sodium chloride as a tracer to evaluate the source of the
29 water.

30
31 MR COSTELLO: I see. And you go on to say that, "Their
32 enrichment suggests some mixing of mains water, stormwater
33 or rainwater with other water which has higher sodium and
34 chloride concentrations or an accumulation of these ions,
35 for instance, via mineral salt dissolution downstream."

36
37 DR VU: Correct.

38
39 MR COSTELLO: Now, you're talking there about there being
40 a mixing of different types of water, and you've inferred
41 that fact from in particular the presence of sodium and
42 chloride.

43
44 DR VU: Yeah, and also calcium and magnesium, and
45 bicarbonate as well. And that conclusive work based on
46 only geochemical data I have. I don't really use different
47 data here at this stage. This is, like, pure observation

1 from my water chemistry analysis.

2

3 MR COSTELLO: Yes. Yes, I understand. But what that
4 observation means is that you had inferred that the
5 particular water sample was not mains water alone?

6

7 DR VU: Yeah.

8

9 MR COSTELLO: But nor was it stormwater or rainwater
10 alone?

11

12 DR VU: No, because it could be any kind of low salinity
13 or low electrical conductivity water travel along the
14 pathway, along the storm pits system, picking up or mixing
15 up with other waters.

16

17 MR COSTELLO: I see. I'm going to move to another
18 subparagraph of this but, before I do, Mr Hitchcock, is
19 there any comment that you would wish to make on that
20 paragraph?

21

22 MR HITCHCOCK: No.

23

24 MR COSTELLO: You agree with it?

25

26 MR HITCHCOCK: Yes.

27

28 MR COSTELLO: Thank you. Mr Jewell, do you agree with
29 that paragraph?

30

31 MR JEWELL: Yes.

32

33 MR COSTELLO: Thank you. Could we move to subparagraph
34 (e), please. Here, Dr Vu, you say, "Most water samples
35 have fluoride concentrations less than or equal to
36 0.1 milligrams a litre, with the groundwater and seepage
37 reporting concentrations of 0.3 and below 0.5 respectively.
38 The source of the seepage based on fluoride concentrations
39 alone cannot be assessed conclusively. However, if mains
40 water contributed to the observed seepage at the landslide
41 location, fluoride in the mains water was likely retained
42 in soil via absorption on to soil components such as ion
43 hydroxides, oxides and clay minerals." All right. It's a
44 bit of a mouthful so let me break it down.

45

46 Fluoride - and I'll come to fluoride in connection
47 with your report, too, Mr Hitchcock, because you have

1 something to say about fluoride. Fluoride's an important
2 chemical for the purpose of testing. One of the reasons
3 it's an important chemical is because it's commonly added
4 to mains water, and so the presence of fluoride may be
5 suggestive of the fact that it's mains water?
6

7 DR VU: Correct. And I would add to that, because we are
8 talking about some of the soil type in here like granite,
9 which is known to have enrich in fluoride as well. So have
10 to be careful with that. But then obviously fluoride is
11 one of the parameters we are looking at or assess.
12

13 MR COSTELLO: Yes. So is it right that what you're saying
14 there the fact of fluoride being revealed in the testing is
15 indicative of at least the potential that mains water has
16 been involved but it is not alone conclusive?
17

18 DR VU: Yes. But then later on I think I mention that the
19 deep aquifer, which is in the granite, could have high
20 fluoride concentration. But then the deep aquifer is
21 excluded in the equation because its location cannot really
22 contribute to the progress at the headscarp. So that's why
23 fluoride is very important for this guide. And you can see
24 from the SMEC report that they conducted some column
25 testing, and some of the material show that they have
26 capability to retain fluoride in the result there. So that
27 why it back up with my observation here. It reported that
28 fluoride can be absorbed by metal hydroxide or clay
29 minerals.
30

31 MR COSTELLO: Thank you. Mr Hitchcock, I can take you to
32 the particular paragraphs of your report if you wish, but
33 perhaps I'll start at the more general level. Could you
34 explain to the chair the significance of fluoride and
35 conclusions that you have drawn from the laboratory testing
36 that you've seen as to the presence of fluoride?
37

38 MR HITCHCOCK: Okay. A lot of people think fluoride's a
39 conservative tracer, and it's not.
40

41 MR COSTELLO: It is not a conservative tracer?
42

43 MR HITCHCOCK: It is not - yeah. It does like to stick to
44 soil. I spent a couple of years in a laboratory working
45 that out. So the fact that it's - yeah, it doesn't need a
46 lot of fine material to stick to and then change. So it's
47 very inconclusive to use fluoride. Initially when I looked

1 at the results and saw 0.3, 0.4 fluoride hanging around
2 I thought, "That's a little bit unusual. But perhaps
3 that's a background natural rather than for mains being
4 diluted." But the samples from the colluvium and the
5 deeper groundwater at interface also had similar levels of
6 fluoride. So I think it's naturally occurring for a
7 mineral called fluoride which is in the granite and
8 represents an equilibrium with that. So unfortunately it's
9 not a smoking gun.

10
11 MR COSTELLO: No. So you agree that the presence of
12 fluoride in the water is certainly not alone suggestive
13 of - sorry, certainly not alone definitive in answering the
14 question, "Is this mains water?"

15
16 MR HITCHCOCK: M'hmm.

17
18 MR COSTELLO: Do you rule out fluoride? Do you say that
19 it is irrelevant to that question or do you just say it's
20 inconclusive?

21
22 MR HITCHCOCK: I think it's irrelevant.

23
24 MR COSTELLO: I see. Thank you. Mr Jewell, you agree
25 with all of that I take it?

26
27 MR JEWELL: Yes, it's not useful in this context.

28
29 MR COSTELLO: It's not useful in this particular context.
30 Thank you.

31
32 MR HITCHCOCK: I think you wanted to say something?

33
34 DR VU: Yes, to add to your comment that the fluoride from
35 shallow perch water also have some kind of level there.
36 But then we had to consider what the source of the perch
37 water. If it is from the main, then obviously we have
38 fluoride. So we can't really --

39
40 MR HITCHCOCK: Okay.

41
42 MR COSTELLO: That was (e). Can I have paragraph 183 up,
43 please. It goes over the page. Dr Vu, I think it was you
44 that just mentioned column leach testing?

45
46 DR VU: Correct.
47

1 MR COSTELLO: And you've clearly got an orderly mind
2 because that's the next paragraph in your report.

3
4 DR VU: Yes.

5
6 MR COSTELLO: Perhaps can I just start with - Mr Bolton,
7 were you responsible for the column leach testing or is it
8 unfair to put that at your door?

9
10 MR BOLTON: No, I organised that to be done, yes.

11
12 MR COSTELLO: Could you just give a general explanation of
13 what it is, column leach testing?

14
15 MR BOLTON: So it's based on a LEAF - we call it LEAF
16 test, which is done by ALS. And essentially you're taking
17 a column, which is about I think 30 centimetres long, and
18 you're placing in that soil. And then you are feeding
19 through that water, and we chose South East Water water to
20 do that. And then you're letting that percolate through
21 and then taking samples at the other end. And we did a
22 number of samples of that and got those analysed. And we
23 measured the blank, which is the South East Water water,
24 and then we did five samples that were coming out of
25 the other end, the exit point, of that column.

26
27 MR COSTELLO: Thank you.

28
29 MR BOLTON: That was done to help inform the geochemical
30 modelling that was being undertaken so that we at least had
31 something to go on. That was the purpose, the primary
32 purpose, of it.

33
34 MR COSTELLO: Thank you. Mr Hitchcock, Dr Vu states here
35 that the presence of ions - calcium, sodium, chloride and
36 fluoride - are consistent with a sample of water that
37 issued from the headscarp of the January 2025 landslide,
38 which were chemically enriched with similar ions. Do you
39 agree with that?

40
41 MR HITCHCOCK: I don't pay any weight to the column tests
42 at all.

43
44 MR COSTELLO: Why's that?

45
46 MR HITCHCOCK: There's a number of things. A standard
47 leach test you get some sample, shake it up with water, and

1 see how much goes in the solution. A LEAF test is meant to
2 simulate what happens over time. So what it does is you
3 put your water through a column, and you do that a number
4 of times to simulate a long-term contact not just a one-off
5 shaking or agitation. We don't know - all the report says
6 it's a modified LEAF test. There's no information about
7 how much water's gone, through residence time, how the soil
8 was put in columns. With granular materials you can have
9 preferred float paths and, if the things aren't compacted
10 quite properly or put in correctly, then you get similar
11 results - in is out - and, apart from one of the samples
12 which showed an increase in salinity, I just think the
13 results are too consistent to tell you anything.

14
15 MR COSTELLO: I see. Do you disagree with that, Dr Vu?

16
17 DR VU: To some extent I agree with it; to some extent
18 I disagree. So, for example, the report mentioned that
19 they conducted by LEAF test and then again, like Phillip
20 said, they didn't mention about the wet of the sample put
21 in the column. I think they mentioned about 600 ml of
22 water was used. Also they didn't mention the timeframe the
23 column test was conducted. And for us, as a geochemist,
24 normally the leaching test is an indicator to see the
25 evolution of the chemistry in the bottle. But we don't
26 expect that could be happen exactly in the field because
27 (a) we don't have exact the ratio of solid over liquid. So
28 the columns have to be the same solid over liquid ratio
29 with the real condition. The (indistinct) used the water.
30 But then the period and readouts might be different from
31 the in situ condition. Same the retention time, doesn't
32 mention in the report. We're talking about maybe a couple
33 of days conducting the test, while in the in situ condition
34 we're talking about maybe 150 days, 60 days.

35
36 And then (b) the particle size might be different from
37 the in situ and the one in the column test. And I would
38 like to point out that the study and column material they
39 used were - some of them were like a few metres up gradient
40 from the leakage, and then shallow (indistinct). I don't
41 think it would be representative of the whole soil profile
42 or would consider from the leak location to the scarp. We
43 talk about the complexity of natural soil. We expect,
44 like, different type soil like fill, like aeolian, like
45 transported soil, (indistinct) different types. And even
46 the same type soil but different location you will see the
47 variety changes. So, to me, the column test provides some

1 indication or some information, but it's not the one you
2 are expecting to see in the in situ condition.

3
4 MR COSTELLO: You don't rule out the relevance of the
5 column leach testing in the way Mr Hitchcock does, but you
6 acknowledge that it does have some limits in what you can
7 draw from it?

8
9 DR VU: Yeah, yeah.

10
11 MR COSTELLO: All right. Mr Jewell?

12
13 MR HITCHCOCK: The other thing, if I can just say --

14
15 MR COSTELLO: Sorry.

16
17 MR HITCHCOCK: So usually when you look at how things are
18 changing you do the major cations and anions, and you chuck
19 them on a plot. There's no bicarbonate in this test done.
20 So we can't - it's one of the main - it's one of the
21 missing things. And so it means you can't do that analysis
22 to see how it plots against the other waters and see if
23 it's changed, has it flowed through the column, has it
24 become more like groundwater or groundwater. We can't do
25 that because that bicarbonate wasn't analysed for in the
26 analysis.

27
28 MR COSTELLO: Mr Jewell, do you think this column leach
29 testing to the extent that you've been able to understand
30 the way it was done from the material you've read is
31 sufficiently reliable and robust to draw conclusions from
32 it?

33
34 MR JEWELL: I think it has some use and, you know, I agree
35 that it can't represent all the conditions in the natural
36 environment. You know, it's an artificially repacked
37 column. I think what it does show is that after the first
38 step, if you like, all the solution stabilise, all the
39 (indistinct) stabilise fairly well. I think that initial
40 increase is quite possibly due to either fine particulate
41 material that was colloidal material or that came through -
42 was washed off and came through in that first step or
43 possibly to desorption in that first step, and then
44 receives relatively consistent results throughout the test,
45 apart from I think one of them. I don't have - yeah. But,
46 yeah, I think it had some utility, but it doesn't tell you
47 everything.

1
2 MR COSTELLO: Thank you. We can cut to the chase then and
3 go to 184. Dr Vu, this is in many respects your primary
4 conclusion, I think it's fair to say. You conclude at the
5 start of that paragraph that the chemical profile of the
6 seepage from the headscarp at January 2025 was not
7 consistent with typical mains water, nor was it consistent
8 with natural groundwater, nor was it consistent with
9 rainwater or stormwater, and that's consistent with your
10 earlier statement that I've already taken you to that there
11 had been a mixing of water sources going on.
12

13 DR VU: Or could be picking up ion along the pathway.
14

15 MR COSTELLO: Thank you. And then in the final sentence
16 that starts "the testing indicates" in the fourth last
17 line, you say, "The testing indicates that a plausible
18 model is that water issuing from the pipe burst travelled
19 along a pathway that included seepage through soil, service
20 trenches or both, mixed with shallow subsurface flow or
21 stormwater and accumulated ions along the pathway."
22

23 DR VU: Correct. I have this conclusion because here
24 until considering all the data I have I also considered the
25 assessment from my colleague, the geotechnical assessment,
26 geological assessment, that we have no possible other
27 source of water other than the main have potentially
28 contribute to the increased progress in the headscarp.
29 That's why I put it in when considering the overall lay
30 evidence, because at the time we normally don't - our
31 assessment or conclusion in one live evidence; we try to
32 use multiple evidence.
33

34 MR COSTELLO: You've quite properly said in the next
35 paragraph that contribution of other water sources can't be
36 excluded.
37

38 DR VU: Yes.
39

40 MR COSTELLO: But that doesn't affect the conclusion that
41 you reach in paragraph 184 that there at least is a
42 plausible model that the water that issued from the burst
43 pipe found its way to the scarp?
44

45 DR VU: Yes. So considering the volume of water lost
46 through the burst, like, from 37 megalitre to 40 megalitre,
47 and then consider the pathway we examine, like, via the

1 stormwater drain system or from the colluvium aquifer or
2 soil, then potentially, yes, there is a possibility in all
3 of that it can go from the leak to the landslide; yeah.

4
5 MR COSTELLO: Thank you. Now, this might be an unfair
6 question, Dr Vu, but it won't stop me asking it. Are you
7 able to state your degree of confidence in that conclusion?

8
9 DR VU: With the geochemical or the chemical data only the
10 confidence will be moderate. But then with
11 the hydrogeological assessment and the geotechnical
12 assessment I think will be high.

13
14 MR COSTELLO: I see. Is a fair way of describing that
15 that if this was a conclusion based on chemical analysis
16 alone you would have a moderate degree of confidence.

17
18 DR VU: Yes.

19
20 MR COSTELLO: But inferring from all of the available
21 data, including the work done by allied disciplines to
22 yours --

23
24 DR VU: Yep.

25
26 MR COSTELLO: -- that in assessing all of that data you
27 have a high degree of confidence that there is mains water
28 involved in the water leaving the escarpment?

29
30 DR VU: And, speaking of that, we talk about this water
31 sample from potholes in the different places like
32 Charlesworth Street and Waller Place. South East Water, we
33 quoted some data. That also support the evidence that the
34 main water travelled from the leak to those potholes, and
35 then could move to the landslide.

36
37 MR COSTELLO: Thank you.

38
39 DR VU: I'll provide later on when we talk about the
40 differences and agreement between the experts.

41
42 MR COSTELLO: If we get to that. Mr Jewell, of course I'm
43 going to give you an opportunity to respond to all of this.
44 But, first, given, Mr Hitchcock, your opinion is at least
45 to a lay person of which I am not dissimilar to that of
46 Dr Vu, you say that groundwater is an unlikely source?

1 MR HITCHCOCK: I think some of the salt's been picked up
2 from groundwater along the way.

3
4 MR COSTELLO: Perhaps rather than verbal you I'll bring
5 your report up. It's MSC.5087.0001.0001. And if we go to
6 page 0036. And if I could have paragraphs 100 and 101
7 enlarged, please. Now, we can ignore the table for now --

8
9 MR HITCHCOCK: Sorry, I thought you said "unlikely
10 source".

11
12 MR COSTELLO: Sorry, what did you say?

13
14 MR HITCHCOCK: I thought you said groundwater is an
15 unlikely source.

16
17 MR COSTELLO: Sorry. It's unlikely that groundwater is a
18 likely source; I was trying to take --

19
20 MR HITCHCOCK: Can I reduce it and say that this was
21 before the causation reports, which have about 30 sets of
22 analysis, and I'm basing this on salinity and about three
23 sets of analysis.

24
25 MR COSTELLO: I see. Well, then let me give the
26 opportunity for you to - to the extent you have more
27 developed or different views, can you just express what
28 your concluded view is now if you have one?

29
30 MR HITCHCOCK: I think there's - as Dr Vu said, the
31 confidence in the chemistry's moderate, perhaps even
32 slightly lower than moderate. But combined with
33 hydrogeological and geotechnical facts and also the fact
34 that there's a lot of water coming out of there gives me a
35 high confidence that this is a result of a mixing of
36 waters. Mains water, shallow groundwater are the main
37 sources.

38
39 MR COSTELLO: Before I pass to you, Mr Jewell, on this
40 question of shallow groundwater, perched water, springs,
41 one things that we have learnt in the course of earlier
42 hearings is that springs often have a recharge area. Now,
43 quite how that sits within the scheme of perched water or
44 shallow aquifers I'm not entirely sure anymore. I thought
45 I was, but I'm not now. But is there a chance that to the
46 extent some of this is groundwater it's groundwater that
47 has emerged from a spring that's been recharged by mains

1 water?

2

3 MR HITCHCOCK: Yes.

4

5 MR COSTELLO: Thank you.

6

7 MR HITCHCOCK: And picking up salts along the way from
8 perhaps overland sands, other sources.

9

10 MR COSTELLO: You agree with that, Dr Vu?

11

12 DR VU: I just want to add in since we submitted our
13 report and had more chance to read the causation report -
14 because when we prepared our report we didn't have a chance
15 to see other reports from other experts. Can I ask you to
16 bring the SMEC report, either the original one or the
17 revised one, you have on the record?

18

19 MR COSTELLO: Not the technical memorandum but the report?

20

21 DR VU: The causation report.

22

23 MR COSTELLO: Is it appendix C you're after?

24

25 DR VU: Appendix E.

26

27 MR COSTELLO: Yes, I'll bring it up. It's
28 SEW.0001.0001.0501, and it starts relevantly I think at
29 0266. That's in the updated version of the report.

30

31 DR VU: Madam Chair, can I ask other experts some kind of
32 clarification because when I read their report there's
33 some information that I'm not quite sure. Can I ask them
34 to verify their --

35

36 CHAIRPERSON: Yes, you can.

37

38 MR COSTELLO: I think it's SME.0001.0001.0501. Thank you.
39 And then it starts at 0266. You go ahead, Dr Vu. You ask
40 the question.

41

42 DR VU: So can we go to the PDF number - is it the
43 original one or the --

44

45 MR COSTELLO: This is the revised.

46

47 DR VU: Revised, okay. So the PDF page number 260,

1 please.
2
3 MR COSTELLO: 260.
4
5 DR VU: So that's starting appendix E.
6
7 MR COSTELLO: Is it this one?
8
9 DR VU: No, I think the SMEC appendix E. Or maybe 286.
10
11 MR COSTELLO: 266?
12
13 DR VU: Could you move to a few more page where we see the
14 graph when they show the different or the change in
15 electrical conductivity in chloride? Sorry, I don't have
16 that page.
17
18 CHAIRPERSON: I think you need to go back to appendix E;
19 is that right?
20
21 MR COSTELLO: This is E. This is E.
22
23 DR VU: The graph, please.
24
25 MR COSTELLO: What paragraph number is it at, Dr Vu? The
26 bar chart?
27
28 DR VU: The bar chart, please. Keep going, please.
29
30 MR COSTELLO: Just keep cycling through. Dr Vu will tell
31 you --
32
33 DR VU: That's the one.
34
35 MR COSTELLO: Yes, I know the one. It's a few pages
36 further on. Just go through.
37
38 DR VU: Yeah, that paragraph.
39
40 MR COSTELLO: It's in part 6, yes, about three more pages
41 on. Keep going. We seem to be going backwards. Just go
42 forward. Yes, it should be there. Go back.
43
44 DR VU: The other one, please.
45
46 MR COSTELLO: Is this the page?
47

1 DR VU: Yes, this is the one.
2
3 MR COSTELLO: Sorry, Dr Vu.
4
5 DR VU: I ask, Mr Bolton, where was the data for this
6 graph, please?
7
8 MR BOLTON: They're from the --
9
10 DR VU: Is it from the same appendix, appendix E?
11
12 MR BOLTON: So the data is taken from laboratory testing
13 that was done principally by - organised by SEW, and that
14 data is contained in this table that was in the May report.
15 So there's --
16
17 DR VU: Maybe perhaps page --
18
19 MR BOLTON: It is summarised. Let's just see.
20
21 DR VU: (Indistinct) of this appendix?
22
23 MR BOLTON: Yes, it is I believe in the appendix to, but
24 it's principally taken from the May report, which I did
25 refer when I explained where the data came from.
26
27 MR COSTELLO: Dr Vu, you're asking the source of the data
28 for these two graphs because you were unable to ascertain
29 it when you read the report; is that right?
30
31 DR VU: Yeah, and also I will discuss about the mixing and
32 the presence of the perched shallow water. So I think to
33 identify the data source before I elaborate my opinion
34 further.
35
36 MR COSTELLO: I see. These are --
37
38 MR BOLTON: Yes, a large part of it has come from this May
39 report, which I think most - I think by and large it should
40 be in that back appendix, but it's from this table 12,
41 which is in the May --
42
43 DR VU: Can we bring that expert report in May, please?
44
45 MR COSTELLO: Are you asking to have that data on the
46 screen, Dr Vu?
47

1 DR VU: Yeah, please, can we bring that up?
2
3 MR COSTELLO: 5 May report.
4
5 DR VU: I think we've seen it earlier this morning.
6
7 MR COSTELLO: That's the initial SMEC report.
8
9 DR VU: And can I see table 12, please?
10
11 MR BOLTON: Page 67.
12
13 MR COSTELLO: PDF 67, hopefully.
14
15 MR BOLTON: Not PDF. Number 67.
16
17 MR COSTELLO: Actual internal page.
18
19 MR BOLTON: I don't know if that actually lines up with
20 the PDF number.
21
22 MR COSTELLO: This table?
23
24 DR VU: Yes.
25
26 MR COSTELLO: Is this the table you're referring to,
27 Mr Bolton?
28
29 MR BOLTON: Yes.
30
31 MR COSTELLO: Thank you.
32
33 DR VU: Because we've seen the graph in their report
34 previously which suggested that the data were before and
35 after the repair. But in this table I see that most of the
36 sample are after the repair, which I believe that it is on
37 1 January 2025. So I'm not quite sure where the data from
38 before repair was, unless only one sample from the
39 location. Here we have some result from 24 and 30 of
40 December, which I consider before. But are the location -
41 I don't see after the repair. I'm bringing it up because
42 it seemed to me that on my understanding - correct me if
43 I'm wrong - SMEC team considered no change in the
44 electrical conductivity in chloride as the result of mixing
45 between the main water and the localised shallow perched
46 water. So to me there's no localised perched water or, if
47 like this, there will be some different story.

1
2 Let me tell you what because I base my results, for
3 example - we talk about the mixing between water like
4 perched water and then main water. And if we use the local
5 or perched water chloride concentration of 250 milligram
6 per litre, and then the main water I used 20 milligram per
7 litre chloride, how the mixing ratio between the two,
8 roughly - and if I use the - so the mixing ratio will be,
9 like, 55 and 45. And then if we use the volume of water
10 lost through the burst, which is 35 megalitres, then the
11 perched water had to be from 17 megalitres to 28
12 megalitres.

13
14 MR COSTELLO: I see.

15
16 DR VU: And then that's the calculation for 70 per cent of
17 the main burst travel to the pothole. And then in the text
18 here they mention about upwelling. So I don't think the
19 perched water can be uprising. It's mainly the main water
20 core pressuring can bring the water up into the pothole.
21 So I believe the question of possibility of having that
22 huge amount of perched water for hydrogeologist or geotech
23 expert, but for my opinion that amount of water, perched
24 water, cannot be there.

25
26 MR COSTELLO: I see. Thank you, Dr Vu. Mr Bolton, do you
27 wish to respond to that?

28
29 MR BOLTON: Yeah, so in my explanation, so the embedment
30 material is very permeable. So the water has entered in
31 embedment material for the sewer, has made its way down to
32 what I'm calling A, which is Charlesworth and Waller Place.
33 It's also made it to B, which is Charlesworth and Coburn.
34 And it's come to surface there. And you can see the EC is
35 lower. And I've taken samples that are prior to and
36 shortly after the repair was done. And you can see those
37 samples are at a certain level. So we sort of look at the
38 one that's upwelling at the juncture of Waller Place and
39 Charlesworth. If I can read that correctly it's about 600
40 there.

41
42 And then after the burst, like, some time after the
43 burst has been repaired the level jumps up again. It jumps
44 from 600 up to 1,200. And I take that to indicate that the
45 water from the burst has made it to that place and has
46 caused the EC to drop. And then once the repair has been
47 done in some weeks after that, a week or two after that,

1 the natural groundwater has come back again. And so you
2 get this change from, let's say, 600 back up to 1,200.

3
4 CHAIRPERSON: And I think Mr Vu's looking for the before
5 data.

6
7 MR BOLTON: Well, that's - so as the burst is repaired on
8 the 31st it takes some time for that water, which continues
9 on its path through the embedment material, before it
10 dissipates and is then replaced by the natural background
11 water. So I've used data - and I say it here - prior to
12 and shortly after the repairing of the SEW burst. So that
13 concept of because you repair the leak doesn't mean that,
14 you know, there is a delay as it travels through.

15
16 DR VU: In my opinion, the increase in electric
17 conductivity in chloride has two options. The later one
18 have higher conductivity in chloride maybe because it has
19 the higher or longer time to travel and interact with
20 the soil. That's why it dilutes and it dissolves more
21 salts. That's why it brings up the electrical conductivity
22 in chloride. And (b) maybe the water we observe at the
23 potholes at later dates travelled from different pathway
24 which is less permeable to the original pathway we see in
25 the first few days, and then in the new pathway it may pick
26 more ion on this way.

27
28 Again I say that there's no data for before the
29 repair; only sample from location. And, like I said,
30 I used the data location to estimate the missing volume,
31 and that was the 17 megalitre to 28 megalitre where perched
32 water come from using the chloride concentration.

33
34 And then in addition to that the shallow perched water
35 might exist but then is not consistent. So I'm saying that
36 because talking about the PSM borehole 03A there was some
37 time we put (indistinct) and even the PSM. But then during
38 the site visit or site work in July it was reported to have
39 the water. So it is an indicator telling me that the
40 perched water could be there, but likely this is source
41 from the rainfall event, not natural water.

42
43 MR COSTELLO: Thank you.

44
45 DR VU: And then another question I want to put in is a
46 creek, the Coburn Creek.

1 MR COSTELLO: Yes.

2

3 DR VU: We visit the Coburn Creek in June and it is dry.
4 But then in July when SMEC's crew conducted their site
5 investigation then they reported that there's some water
6 there. So again, like, between June and July there's some
7 rainfall. Then maybe the Coburn Creek now I think at the
8 stormwater drainage is not natural springwater. So that's
9 my observation.

10

11 MR COSTELLO: I see. Mr Makin and Mr Hitchcock, I want to
12 give you each an opportunity to speak to this issue if you
13 will. I know that it's arisen in the course and then you
14 might not have any concluded views, but if there's anything
15 you'd like to add please feel free. Mr Makin, I might
16 start with you.

17

18 MR MAKIN: No. (Indistinct).

19

20 MR COSTELLO: Okay. Mr Hitchcock?

21

22 MR HITCHCOCK: Yeah, I couldn't find the before data as
23 well. I don't quite think there would be enough perched
24 water there to mix and cause that - what's observed.

25

26 MR COSTELLO: Sorry, it's a little hard to hear you. Did
27 you say there's not enough perched water?

28

29 MR HITCHCOCK: Yeah. I don't think there would be enough
30 shallow perched water to cause the mixing that Dr Vu has
31 calculated from the chloride.

32

33 CHAIRPERSON: How are we going for time, Mr Costello? How
34 much longer do you think you'll be?

35

36 MR COSTELLO: I'm conscious that others are going to want
37 to ask questions.

38

39 CHAIRPERSON: Yes. How much longer will you be?

40

41 MR COSTELLO: I imagine I'll be another 10 minutes, if
42 I do it in light speed.

43

44 CHAIRPERSON: And, Ms Foley, how long do you think you'll
45 need?

46

47 MS FOLEY: On the chemistry issues as well as mop-up

1 I think I have about 20 minutes.
2
3 CHAIRPERSON: Ms Siemensma?
4
5 MS SIEMENSMA: Maybe 15 minutes.
6
7 CHAIRPERSON: That takes us to three-quarters of an hour.
8
9 MR COSTELLO: At best, I suspect.
10
11 CHAIRPERSON: Yes. So let's say an hour. So it will be
12 just before 7. I'm very conscious it's been a long day.
13 Is your preference to press on or return?
14
15 MR COSTELLO: Could we just - perhaps we'll go down the
16 line starting with you, Mr Bolton.
17
18 MR BOLTON: I think we have to go on. Like, what are we
19 going to do otherwise?
20
21 MR COSTELLO: Otherwise we'd be back tomorrow. That's the
22 alternative.
23
24 CHAIRPERSON: Mr Jewell?
25
26 MR JEWELL: I'd probably need to change a flight to
27 tomorrow if we're going to go on that long, I think.
28 I don't think I want to get to the airport at half past 8
29 if we're going on here until 7 o'clock.
30
31 CHAIRPERSON: You're flying back tonight?
32
33 MR JEWELL: I'm flying back tonight, yes. I'll do that,
34 but I need a couple of minutes to - well, yeah.
35
36 CHAIRPERSON: Mr Paul?
37
38 MR PAUL: Happy to stay.
39
40 CHAIRPERSON: Mr Makin?
41
42 MR MAKIN: (Indistinct).
43
44 MR HITCHCOCK: Happy to stay.
45
46 CHAIRPERSON: Mr Costello, how are you feeling?
47

1 MR COSTELLO: Yes, I might just ask Mr Di Stefano to hold
2 me up, but I'll be all right.
3
4 CHAIRPERSON: What do you want to do?
5
6 MR COSTELLO: I'm here at your convenience, Madam Chair.
7 It's a matter for you. But I'm conscious of the
8 convenience of others at the Bar table as well. If we need
9 to be here tomorrow then it will be - if we need to be here
10 tomorrow and there's a hearing room, which there might not
11 be, then we can do it in an hour or so tomorrow. I'll be
12 leaving it in Mr Di Stefano's hands if that's where we get
13 to. But I'm conscious of the views of others that ought be
14 taken into account.
15
16 CHAIRPERSON: Ms Foley, what's your preference?
17
18 MS FOLEY: I think for our part pressing on seems
19 desirable.
20
21 CHAIRPERSON: Press on?
22
23 MS SIEMENSMA: I'm in the board's hands.
24
25 CHAIRPERSON: Let's press on. Mr Jewell?
26
27 MR JEWELL: We can press on.
28
29 CHAIRPERSON: Do you need some time to make arrangements
30 or --
31
32 MR JEWELL: Going on past experience, it would take a
33 while. So, no, we'll just leave it. I would need
34 10 minutes, I think.
35
36 MS SIEMENSMA: Madam Chair, I wouldn't mind a comfort
37 break just for a minute or two anyway.
38
39 CHAIRPERSON: Yes . Let's take a quick break until 6, and
40 then we'll have a hard finish at 7 o'clock. We finish by
41 7.
42
43 **SHORT ADJOURNMENT**
44
45 CHAIRPERSON: Mr Costello, you're very welcome to sit if
46 you want to.
47

1 MR COSTELLO: Thank you. No, I would never do that.
2 Thank you. It's very generous. Apart from anything,
3 I wouldn't be able to see anybody. It's hard enough
4 standing here. Mr Jewell, were you able to make
5 arrangements?
6
7 MR JEWELL: I've changed my flight to a bit later.
8
9 MR COSTELLO: All right.
10
11 CHAIRPERSON: Thank you, Mr Jewell.
12
13 MR COSTELLO: I want to close off on this issue that Dr Vu
14 has raised, Mr Bolton, before I get back to the matters
15 that I was seeking to give Mr Jewell an opportunity to
16 respond on. The two bar graphs, I won't bring them back
17 up, you know what I'm talking about, one concerns
18 electroconductivity and the other chloride concentration.
19 They are representative of something that you discerned
20 which was an increase in EC and chloride post-repair of
21 the burst pipe; that's what you draw from the data?
22
23 MR BOLTON: Yes. Return back towards the background
24 conditions, yeah.
25
26 MR COSTELLO: Yes. And is it right that your evidence is
27 the data that concerns the post-repair period is data that
28 is to be found in the table that's in front of you? On the
29 screen, I mean?
30
31 MR BOLTON: Yes, it's that and --
32
33 MR COSTELLO: Sorry, your screens are not working.
34 They've gone on strike. The one behind you is, or the one
35 over here. I know you can't see it very clearly.
36
37 CHAIRPERSON: Mr Vu, is Mr Makin's screen working? No.
38
39 MR COSTELLO: Mr Bolton, we'll try and get the screens
40 repaired, but I just want to understand that is your
41 evidence, that the data is found in that table?
42
43 MR BOLTON: The data is found in that table, and then plus
44 7 Prospect Hill wasn't sampled by SEW, it is sampled by
45 PSM, that's before or during the burst sample was PSM's SW2
46 value, which I state there. And then the after is the
47 sample that we had taken, you know, of the site.

1
2 MR COSTELLO: "After" means post-repair?
3
4 MR BOLTON: Correct. Yes, yes. And then I think that's
5 the data I relied upon.
6
7 MR COSTELLO: So in respect of the post-repair period it's
8 a single sample; is that right?
9
10 MR BOLTON: It's - no, there's - well, looking at the
11 table there is the post-repair. Yes, so for A it's one
12 sample. For --
13
14 MR COSTELLO: A's Waller Place and Charlesworth Street; is
15 that right.
16
17 MR BOLTON: That's right. And then Coburn, that's one
18 sample, yeah. And then the 7 Prospect Hill is - one sample
19 is shown, but I think there were two that were taken. But
20 the value of the EC is roughly the same.
21
22 MR COSTELLO: Have you got the table in front of you?
23
24 MR BOLTON: Yes, this one here?
25
26 MR COSTELLO: Yes, the one that is still on the screen
27 behind you. When you say Coburn Avenue is one sample is
28 that the sample that in the table is sample D?
29
30 MR BOLTON: Yeah, the one at Coburn and Charlesworth is D.
31 So you can see that on 6 January the EC was at 750. And
32 then on the 22nd there's two samples there. One is 1,000
33 on the 22nd and then another one in the same spot on the
34 same date is 1,400.
35
36 MR COSTELLO: Yes.
37
38 MR BOLTON: And similarly with Waller and Charlesworth
39 there's a number of samples there. So on 24 December
40 there's a sample - what's that?
41
42 MR COSTELLO: That's 670, I think.
43
44 MR BOLTON: 670. And then the one after that on the 30th
45 and then on the 6th, and then there's another one on the
46 16th which jumps up to 1,200. And then with, you know,
47 Prospect Hill there's the SW02, which that one was at

1 I think 400. And then the sample that we took, i.e. SMEC
2 took, that was around 800.
3
4 MR COSTELLO: So if we stick with D in the table for the
5 moment this is upwelling at the pothole, Coburn Avenue and
6 Charlesworth.
7
8 MR BOLTON: Yes.
9
10 MR COSTELLO: Two samples, 6 January. Concentrate on EC
11 for now.
12
13 MR BOLTON: Yes.
14
15 MR COSTELLO: EC reading of 750.
16
17 MR BOLTON: Yes.
18
19 MR COSTELLO: 22nd, EC reading of 1,000.
20
21 MR BOLTON: Yes.
22
23 MR COSTELLO: And so do you say that the uptick in
24 electroconductivity from the 6th to the 20 - sorry, between
25 the period 6 January and 22 January is indicative of
26 the fact that the groundwater is returning to a more normal
27 level rather than being diluted by another source?
28
29 MR BOLTON: That's correct. So the burst has been
30 repaired. The water that was coming down the embedment
31 material is now dispersing, I suppose, if that's the way to
32 put it. And we are now seeing the background water,
33 I guess, filling in, you know, replacing it, I guess, if
34 that's the (indistinct).
35
36 MR COSTELLO: I see. And so as at 6 January then there
37 was still a mixture of what you describe as background
38 water with another source that was not background water?
39
40 MR BOLTON: Well, it takes some time on the 6th. So the
41 repair was on the 31st.
42
43 MR COSTELLO: Yes.
44
45 MR BOLTON: And it takes some time for that --
46
47 MR COSTELLO: That's right. We're back to the water

1 velocity question, accepting that it stopped at one end but
2 it's continuing to move, presumably.

3

4 MR BOLTON: I know, but it doesn't just sort of - you
5 know, it's backing up at Charlesworth and Coburn because
6 it's hitting that intersection, and so it's almost like a
7 dam and it's taking a while for that water to get out of
8 the way, so to speak.

9

10 CHAIRPERSON: Mr Costello, before you move on I think
11 others have --

12

13 DR VU: If we can bring the graph and the table together,
14 I don't think the graph really represents that. For
15 example, we're talking about the location D, and he said
16 that on the 22nd the EC was 1,000 but in the graph I saw it
17 1,500. Maybe I'm wrong. But graph was not good quality,
18 but I see that it's --

19

20 MR COSTELLO: You're concerned that the data presented in
21 the graphs is an accurate reflection of the data in the
22 table?

23

24 DR VU: Yeah.

25

26 MR COSTELLO: And I just don't know if I can have it done.
27 I'll try and have it done. But if I can get the graph up
28 at the same time is that something that you can discern?

29

30 DR VU: Yeah, yeah.

31

32 MR COSTELLO: All right.

33

34 DR VU: And also, like, again, I put my opinion that the
35 6th is after the repair, not before the repair.

36

37 MR COSTELLO: Right. Okay.

38

39 CHAIRPERSON: Mr Bolton, did you prepare the bar chart or
40 did someone prepare it?

41

42 MR BOLTON: I did. I prepared it and I tried to keep it -
43 I use - I try to keep it fairly straightforward, I guess,
44 because I was a bit worried coming into here that to try to
45 make things complicated it would, yeah, be difficult.

46

47 CHAIRPERSON: Yes. So you prepared that yourself?

1
2 MR BOLTON: Yes, I did.
3
4 MR COSTELLO: Dr Vu, I'll try and do that for you for the
5 moment. Just let me continue with Mr Bolton for a moment.
6 Mr Bolton, I've just been asking you about D.
7
8 MR BOLTON: M'hmm.
9
10 MR COSTELLO: And I pointed out the two tests, 6 January,
11 22 January. 22 January, 1,000.
12
13 MR BOLTON: And 1,400.
14
15 MR COSTELLO: EC. No, for D, 1,000. 1,400 is Coburn and
16 Charlesworth in the next one down. But just sticking to
17 the --
18
19 MR BOLTON: That is the same place.
20
21 MR COSTELLO: Yes, but just sticking to those. We've done
22 750 and 1,000. There's then 1,400 as you point out in the
23 next column down. And then if you drop down to F you'll
24 see the verge opposite Waller Place. This is higher up the
25 hill; aware of that? You're aware that that's higher up
26 the hill? You see the testing on the same day,
27 electroconductivity test of 600?
28
29 MR BOLTON: Yes, that says "verge opposite 5 Waller
30 Place".
31
32 MR COSTELLO: That is higher up the hill.
33
34 MR BOLTON: I'm not sure where that 5 Waller Place is.
35
36 MR COSTELLO: Are you aware that that's higher up the hill
37 or you're not aware of that?
38
39 MR BOLTON: Waller Place is higher up the hill; that's
40 true.
41
42 MR COSTELLO: Yes. And yet the electroconductivity of
43 that measured on the same day is lower.
44
45 MR BOLTON: Yes, that's --
46
47 MR COSTELLO: Lower by more than half from the 1,400

1 reading that you were very keen to tell me about a minute
2 ago.
3
4 MR BOLTON: Yeah, I can't explain why that's lower. It
5 must be --
6
7 MR COSTELLO: It doesn't sit consistently with --
8
9 MR BOLTON: -- complexities, I guess.
10
11 MR COSTELLO: Yes. And undeniably this is complex, but do
12 you accept that doesn't sit well with your theory?
13
14 MR BOLTON: No, it doesn't.
15
16 MR COSTELLO: Thank you. Dr Vu, I'm going to move to a
17 different topic now and we're going to have to investigate
18 the table as against the graphs outside of the forum
19 because I need to give other people an opportunity to ask
20 some questions as well. Before I do that, Mr Jewell,
21 I apologise, I've been trying to get to you. You'll recall
22 that I have taken Dr Vu to his ultimate conclusion, and he
23 supplemented his written evidence and conclusion with some
24 additional evidence which was to the effect that by reason
25 of all of the factors combined, chemistry and other, he had
26 a quite high degree of confidence. But, based on chemistry
27 alone, he had come to the conclusion that he's come to in
28 his report that you're aware of, and he had a moderate
29 degree of confidence based on chemistry alone in that. And
30 you've heard what Mr Hitchcock said about his opinion. Do
31 you have a different opinion to the opinion of those two
32 gentlemen?
33
34 MR JEWELL: Well, I just say that the water arriving at
35 the scarp, right, has to be a mixture of mains - on the
36 assumption that mains water is contributing to it, it has
37 to be a mixture of mains water and other water, I think,
38 and a significant amount of other water in order to raise
39 the salinity to the (indistinct) at the scarp,
40 350 milligrams per kilogram of chloride. It's probably
41 about a 1 to 4 mixing ratio. So the water arrives at the
42 scarp and presumably the water which triggered the slide,
43 you know, if we accept the views that have been forcefully
44 presented today, is a mixture of mains water and natural
45 groundwater.
46
47 MR COSTELLO: That's your concluded view as to the water

1 that was exiting the scarp?

2

3 MR JEWELL: Yes.

4

5 MR COSTELLO: After the 5 January landslide?

6

7 MR JEWELL: Yes.

8

9 MR COSTELLO: Thank you.

10

11 CHAIRPERSON: Mr Costello, just quickly --

12

13 MR JEWELL: I have a high degree of confidence.

14

15 MR COSTELLO: You have a high degree of confidence?

16

17 MR JEWELL: In that statement.

18

19 MR COSTELLO: Thank you. Mr Jewell, did you say in the
20 course of your answer on the assumption that it's reaching
21 the scarp, or was your view that based on the chemical
22 analysis that you've seen of water that the water that was
23 leaving the scarp is a mixture in a 4 to 1 ratio involving
24 mains water?

25

26 MR JEWELL: That is what I said. That's my view.

27

28 MR COSTELLO: Mr Bolton, before I hand over to others,
29 really as a matter of fairness more than anything else,
30 I should mention the technical memorandum of which you're
31 the principal or sole author.

32

33 MR BOLTON: Yes.

34

35 MR COSTELLO: What was the purpose of the technical
36 memorandum?

37

38 MR BOLTON: It was just to add, you know, further
39 geochemical analysis that had already been done. So that
40 included a Durov plot to try to explain the signatures of
41 the groundwater.

42

43 MR COSTELLO: This was a report that was issued on
44 25 July; do you recall that?

45

46 MR BOLTON: This technical memorandum, yes, that's right,
47 and it's after when we put the appendix E in.

1
2 MR COSTELLO: Do you present any additional views in this
3 technical memorandum or is it really a description of the
4 workings for views you've already reached, you've already
5 expressed?
6

7 MR BOLTON: It's a description of the signatures of the
8 water, but to try to categorise them into granite. That
9 water (indistinct) interface granite, so at the surface of
10 the granite, and then colluvium to help our understanding.
11

12 MR COSTELLO: I see. You've just heard what Mr Jewell has
13 said as to his conclusion. Do you accept what Mr Jewell
14 said? Do you agree with it?
15

16 MR BOLTON: I mean, I do - it's difficult for me because
17 he's a geochemist and knows more than me, I guess. My view
18 was that the water exiting the slope was of 1,600. So it
19 was closer in chemistry to background water. And therefore
20 I didn't - you know, it didn't appear to be any indication
21 of contribution from mains water. But that also can't be
22 ruled out, and that's why I put down minor or insignificant
23 to minor on the conclave that we had.
24

25 MR COSTELLO: That was your view before the start of this
26 hearing block. Having heard what you've heard from your
27 colleagues, have you changed your view?
28

29 MR BOLTON: No, I still believe that, and I guess that's
30 in addition to the 1,600 and the Durov plot there which
31 shows the water being of an interface granite water coming
32 from the slope, and also the fact that, you know, at 7
33 Prospect Hill we still see into February this water that is
34 diluted water, meaning that there's - the mains water is
35 still in that area. And the fact that the flows did drop
36 off quite quickly coming from the scarp between the 6th and
37 the 10th I was of the view that the contribution was, you
38 know, minor.
39

40 MR COSTELLO: And have you been able to identify an
41 alternative source of water other than the burst that could
42 properly explain the volume of water that was seen passing
43 through the scarp in the period from the first landslide
44 and through and to and including and after the second
45 landslide?
46

47 MR BOLTON: The volume of water, you know, on the 6th,

1 which was measured up to I think 0.2 litres per second,
2 that sort of a volume equal to about 50 per cent of a
3 garden hose. So it wasn't - I didn't feel, you know, a --
4

5 MR COSTELLO: I thought Mr Pope's evidence - and if I'm
6 wrong I'll be corrected - was when he did the measurement
7 on the 6th it was 17,000 litres a day.
8

9 MR BOLTON: I know, that's the 17,000 litres per day. But
10 when you go down to litres per second --
11

12 MR COSTELLO: You're reducing it to litres --
13

14 MR BOLTON: That's litres per second.
15

16 MR COSTELLO: You mean a constantly running garden hose
17 for 24 hours would deliver 17,000 litres in the course of a
18 day?
19

20 MR BOLTON: Well, it would deliver more than that.
21

22 MR COSTELLO: I see. And my question was if you had
23 identified any available source other than the burst that
24 could explain the fact that there was 17,000 litres
25 observed on the 6th, then a mass of water observed in the
26 period from the burst until the second landslide throughout
27 the McCrae area.
28

29 MR BOLTON: So the way I've looked at it is there is this
30 skin of fill material which has been holding back the
31 aquifer water as a preparatory factor. The landslide has
32 occurred, and that's caused that material to - the bandaid,
33 so to speak, to be ripped off. And, as a result, the water
34 that was building up behind that has now been able to
35 release itself.
36

37 MR COSTELLO: Yes, Mr Bolton, I'm sorry, I don't want to
38 rush you. I understand the mechanics. The question is not
39 whether or not there was fill or other features of the
40 scarp that were holding back water and were saturated. The
41 question is the source of the saturation. One thing as
42 plain as day it wasn't rain. There had been very little
43 rainfall in the period. I'm just asking you - and if the
44 answer is "no" it's fine - do you have a plausible
45 alternative source of water that is not the burst?
46

47 MR BOLTON: Well, one plausible source to my mind was

1 irrigation, that with the preparatory - and this is getting
2 into the geotech realm, but with the wetting up of the
3 slope due to the influx of water from the shallow aquifer
4 that was - you know, you've got this wet area that's
5 identified towards the downward slope. You can see that
6 in --

7

8 MR COSTELLO: Mr Bolton.

9

10 MR BOLTON: It's page 28, on the 28 May report. So inset
11 40 that shows us. And then with the addition of irrigation
12 that has - well, this is where it's getting into geotech
13 and I'd have to refer to --

14

15 MR COSTELLO: You accept that what you've just said is a
16 speculative theory?

17

18 MR BOLTON: Yes, and that's why I did put down moderate in
19 my conclusion.

20

21 MR COSTELLO: And that would mean, wouldn't it, that this
22 speculative theory as being triggering of the slide would
23 be an event that would be disconnected from the other water
24 events observed throughout the McCrae area, in particular
25 the breaches of road surfaces by upwelling of water in the
26 path roughly between, say, Coburn and the burst site? All
27 of that might be attributable under this theory to the
28 burst?

29

30 MR BOLTON: Correct.

31

32 MR COSTELLO: But the slide happening not far from Coburn
33 would be attributable, on your view, to domestic
34 irrigation?

35

36 MR BOLTON: That was prepared through groundwater that
37 had - and also the fact that the slope is steep.

38

39 MR COSTELLO: And accepting that there's no certainty in
40 any of this and that a flow path is accepted by others to
41 be plausible but not definitively established, accepting
42 all of that, just standing back with all of your training
43 and as a matter of commonsense, does that strike you as a
44 realistic circumstance that throughout the McCrae area
45 there has been a noticeable saturation, upwelling of water
46 that has damaged public infrastructure, it has got on any
47 view at least very close to the escarpment, that somehow by

1 sheer coincidence domestic irrigation has led to not one
2 but two landslides in or around the same time, and water
3 ceased flowing out of the escarpment some time after the
4 landslide being a period after the pipe had been repaired,
5 just standing back applying both your experience and your
6 commonsense is that a plausible suggestion that you can
7 stand by as a professional?

8

9 MR BOLTON: It's based on - I'm just going off the
10 chemistry data that we have. And I couldn't see that.
11 But, you know, I do rely heavily on Mr Jewell. So if his
12 conclusion is otherwise, you know, I have to go with that,
13 really.

14

15 MR COSTELLO: I think I must make way for others.

16

17 CHAIRPERSON: Yes. Ms Foley.

18

19 MS FOLEY: Pardon me, Chair, given some of the evidence
20 that's just been given, what I was planning to do is much
21 shorter.

22

23 CHAIRPERSON: Yes.

24

25 MS FOLEY: Which I'm sure everyone's relieved to hear.

26

27 CHAIRPERSON: I am.

28

29 MS FOLEY: So I just have a couple of questions.

30

31 CHAIRPERSON: Yes.

32

33 **<EXAMINATION BY MS FOLEY:**

34

35 MS FOLEY: Mr Bolton, I just have a couple of short
36 questions for you.

37

38 MR BOLTON: Sure.

39

40 MS FOLEY: Earlier in the afternoon you'll recall that
41 I asked Mr Hartley some questions about SMEC's earlier
42 report.

43

44 MR BOLTON: Yeah.

45

46 MS FOLEY: And in particular the upwelling at Coburn
47 Avenue and Waller Place, and that the upwelling in that

1 report had been tied to the Bayview Road leak.

2

3 MR BOLTON: Yes.

4

5 MS FOLEY: The EC figures for that Coburn Avenue upwelling
6 are comparable, aren't they, with the water that came out
7 of the escarpment?

8

9 MR BOLTON: After the ones - the after ones you're saying?
10 Yes.

11

12 MS FOLEY: Yes. The water that came out of the
13 escarpment, the testing that was done, yes, is comparable
14 with what was identified from that Coburn Avenue upwelling?

15

16 MR BOLTON: So that Coburn Avenue upwelling you're talking
17 about the one that I refer to as after - the after the
18 burst?

19

20 MS FOLEY: Yes, the one in January, and the test results
21 that are in - the SMEC test results and also the Pope test
22 results that are identified in the Paul report; do you
23 recall those?

24

25 MR BOLTON: Could you give me a value, like --

26

27 MS FOLEY: Yes, we'll bring them up to make it easier.
28 And I'll compare two different documents, if we can. Can
29 we go first to SMEC - sorry, this is the SMEC report,
30 SEW.0001.0002.4187, and if we can go to PDF 270. All
31 right. So we can see here the results for EC. Have you
32 got that there in front of you? Sorry, if we can zoom in
33 onto the landslide seepage. All right. So you can see the
34 column "landslide seepage" and you can see there the 1,600?

35

36 MR BOLTON: Yes.

37

38 MS FOLEY: And then you can see the figure for chloride?

39

40 MR BOLTON: The 330, yes.

41

42 MS FOLEY: All right. Keep those figures in mind. This
43 is the landslide seepage.

44

45 MR BOLTON: Yes.

46

47 MS FOLEY: And then I'm going to take you to another

1 document. This is in Mr Paul's report, DPA.0004.0001.0001.
2 Thank you. And if we can go to PDF page 102. All right.
3 We might need to zoom in table 8.7, and I'm going to take
4 you to the column that says "Upwelling within pothole at
5 junction of Waller Place and Charlesworth Street"; you can
6 see that? And you can see the EC figure of 1,200 and the
7 chloride figure of 250?

8
9 MR BOLTON: Yes.

10
11 MS FOLEY: All right. So you'd agree that those sets of
12 figures are comparable?

13
14 MR BOLTON: They're similar.

15
16 MS FOLEY: They're similar.

17
18 MR BOLTON: But the data's - that's what I'm considering
19 as after the burst.

20
21 MS FOLEY: Understand. Let's just take it in stages. So
22 you agree that the two results, one from the upwelling and
23 one from the seepage out of the escarpment, are broadly
24 similar?

25
26 MR BOLTON: Yes.

27
28 MS FOLEY: The EC figures?

29
30 MR BOLTON: Yes.

31
32 MS FOLEY: All right. You'd agree that one way of
33 interpreting that is that it shows that water from the leak
34 could reach the level of salinity in that area that we saw
35 in the Waller Place area?

36
37 MR BOLTON: I would have to refer to Chris Jewell.
38 I would rely on him to provide advice on the ability for
39 that water to take on salinity. It's not an area that
40 I can --

41
42 MS FOLEY: I'm asking you for your view based on the data
43 that I've presented to you, and you've presented plenty of
44 opinions in your report --

45
46 MR BOLTON: Yes.

1 MS FOLEY: -- based on data that other people have
2 created. So the simple proposition is this: we've got
3 water that comes up, an upwelling of water at Coburn Avenue
4 and Waller Place; correct?

5
6 MR BOLTON: Yes.

7
8 MS FOLEY: And SMEC had accepted that that was connected
9 to the Bayview Road leak?

10
11 MR BOLTON: Yes.

12
13 MS FOLEY: And we see some data about the EC figures for
14 that water; correct?

15
16 MR BOLTON: Yes, yes.

17
18 MS FOLEY: And my proposition which you've agreed with is
19 that that EC data is consistent or broadly similar with the
20 EC data we see coming out of the escarpment; you agree with
21 that?

22
23 MR BOLTON: Yes, from a background point of view; yes.

24
25 MS FOLEY: And what I'm putting to you as a professional,
26 as a scientist capable of interpreting data, one way of
27 looking at that is that it shows that water from the leak
28 could reach that level of salinity, what we see at Waller
29 Place, in this area in the same way that we see coming out
30 of the escarpment?

31
32 MR BOLTON: Yes, but that's assuming that the 1,200 has
33 picked up salts, I guess, along the way, which my
34 understanding was that that was not likely when I was
35 discussing it with Chris Jewell.

36
37 MS FOLEY: All right. And --

38
39 MR BOLTON: (Indistinct) forms a different view, then
40 I would just have to follow - if he's telling me that it
41 does, well, then that's possible.

42
43 MS FOLEY: All right. I have no further questions in
44 relation to the geochemistry. We may have some mop-up
45 questions, but that might be best done after others have
46 had their questions on this topic.

47

1 CHAIRPERSON: Yes. Ms Siemensma?

2

3

<EXAMINATION BY MS SIEMENSMA:

4

5 MS SIEMENSMA: Mr Bolton, I just wanted to clarify one
6 issue. You made a few comments about background tests,
7 background testing. The water sample that was taken from
8 the landslide site on 6 January had an EC of 1,600.

9

10 MR BOLTON: Yes.

11

12 MS SIEMENSMA: And I think it seems to be uncontentious
13 that that is higher than the typical EC for mains water.

14

15 MR BOLTON: Yes.

16

17 MS SIEMENSMA: And then on 20 January, after the test,
18 there is some sampling by PSM we see in the factual report
19 of water flowing on the east side of Penny Lane which has
20 an EC of over 1,000.

21

22 MR BOLTON: 1,200.

23

24 MS SIEMENSMA: I think it's 1,051.

25

26 MR BOLTON: The one on Penny Lane was 1,200 EC.

27

28 MS SIEMENSMA: And then SMEC, as I understand it,
29 undertook some background testing in May up until July --

30

31 MR BOLTON: Just a second. So you said Penny Lane; right?

32

33 MS SIEMENSMA: Penny Lane, yes.

34

35 MR BOLTON: Penny Lane, yes. That's the 1,200.

36

37 MS SIEMENSMA: And then there was some background testing
38 by SMEC in May up until July 2025, and you've said in your
39 report that the shallow perched aquifer at the site and
40 surrounds was between 1,000 and 1,300 EC.

41

42 MR BOLTON: Yes, that's right.

43

44 MS SIEMENSMA: Can I ask you those background tests were
45 taken, I suppose, in the cooler months in winter and many
46 months after the landslide. Is there anything we can draw
47 from that, the fact that it's cooler and it's months later?

1
2 MR BOLTON: Not necessarily. It's just, you know, that
3 was some time after the leak had occurred, like months
4 after the leak had occurred, and water quality had, you
5 know, returned to background levels. And so that sort of
6 value of those ones you said there are indicative of sort
7 of the background water quality.

8
9 MS SIEMENSMA: And broadly consistent with the water that
10 was coming out of the escarpment in terms of an EC?

11
12 MR BOLTON: So we plotted on the Durov - in terms of an
13 EC, yes, I mean, more or less similar; yes.

14
15 MS SIEMENSMA: Mr Vu, I had some questions for you. As
16 I understand it you were taken to your conclusion earlier
17 in paragraph 184. I just wanted to check that
18 I understand. Your sentence that says, "The testing
19 indicates that a plausible model is that water issuing from
20 the pipe burst travelled along the pathway that included
21 seepage through soil, service trenches or both, mixed with
22 shallow subsurface flow or stormwater and accumulated ions
23 along the pathway," and I understood your evidence to be
24 that there was a mixture of mains water but you don't know
25 whether it was burst water or mains water from another
26 source; is that correct?

27
28 DR VU: Yeah, at the time we wrote the report we didn't
29 have chance to read other causation reports. So that
30 conclusion was basically - the main water can travel from
31 the burst location along the pathway, can mix with other
32 perched water or some sort of other water have higher
33 concentration of metals and higher conductivity, or it can
34 pick up the ions by absorbing the ions in the soil profile.
35 Yes.

36
37 But then recently we have more data presented to us
38 and, like I mentioned previously, earlier, when we assessed
39 the travel of the main water from the leak location to the
40 potholes and then I used chloride - as I mentioned, it's
41 one of the tracers or inert chemical to assess the mixing
42 ratio and work out the volume of the perched water needed
43 to come up with the concentration of the background water.
44 As I mentioned, there was a huge amount of volume of the
45 perched water needed saying from 17 megalitres to, like, 28
46 megalitres. Then based on that calculation I don't think
47 that would be, like, available to mix with the main water.

1
2 MS SIEMENSMA: So, sorry, you're not excluding in that
3 conclusion other sources of mains water? You're just
4 using this --

5
6 DR VU: Based on the time when I have data available to me
7 to write the report. But then later on when we saw the
8 other causation report, when we prepare for the hearing
9 I need to reassess the data available to me, then I change
10 my mind. I would say that the only possible source for the
11 perched water likely, highly likely, is from the main water
12 burst.

13
14 MS SIEMENSMA: Let me also understand - I'm not sure
15 I followed what you were saying earlier, but with your
16 calculations you were referring I think to 17,000, 17,000
17 megalitres. I wanted to ask --

18
19 DR VU: 17 megalitres.

20
21 MS SIEMENSMA: Have you assumed that 40 megalitres of
22 water got to testing location A?

23
24 DR VU: I assume for 37 megalitres were leaked.

25
26 MS SIEMENSMA: Got to testing location A?

27
28 DR VU: No, from the main leak, the burst location then
29 travelled to the pothole, yeah.

30
31 MS SIEMENSMA: And how much have you assumed at testing
32 location A? How much mains water?

33
34 DR VU: So 70 per cent of 37, then the number will be 17
35 megalitres.

36
37 MS SIEMENSMA: 17 megalitres.

38
39 DR VU: Based on 70 per cent travelled to the pothole.

40
41 MS SIEMENSMA: Mr Jewell, can I ask you if mains water had
42 travelled from the Bayview burst site in service trenches,
43 wholly or partly, would it have an EC of 1,600?

44
45 MR JEWELL: I don't believe that the mains water can
46 acquire very much in the way of dissolved solids by
47 reaction with the granitic backfill material or embedment

1 material or, you know, with the granitic rock. And
2 therefore if it's going - you know, we've seen that
3 salinities increase as we move down the flow path, although
4 not in a really regular way, but they do increase down the
5 flow path. And the most likely source of that additional
6 salinity or the salt solids is mixing with shallow
7 groundwater or existing groundwater. I can't sort of
8 create that salinity by reaction with the rocks. It's got
9 to be from - hence, you know, it's been demonstrated it's
10 got to be from water.

11
12 MS SIEMENSMA: For mains water to travel through the soil
13 to have an EC of 1,600 how much time would it need to be in
14 the soil for?

15
16 MR JEWELL: Even at equilibrium it will not gain that much
17 of an increase in salinity simply from reaction with the
18 rocks.

19
20 MS SIEMENSMA: No further questions.

21
22 CHAIRPERSON: Do you have any further questions,
23 Mr Costello? No? Ms Foley, did you have some mop-up
24 questions?

25
26 MS FOLEY: Yes.

27
28 MR COSTELLO: Mr Jewell, could I ask that you and
29 Mr Hartley swap back now?

30
31 MR JEWELL: Yes, sure.

32
33 MR COSTELLO: Thank you.

34
35 MR JEWELL: Does that mean that you have concluded with
36 me?

37
38 MR COSTELLO: I suspect that it's appropriate for
39 Mr Jewell to now be excused, particularly given he needs to
40 make arrangements.

41
42 CHAIRPERSON: Yes. Can I just check no-one else has any
43 questions for Mr Jewell before he heads to the airport?
44 No. Mr Jewell, thank you very much for coming and thank
45 you for staying so late and for changing your flight.

46
47 MR JEWELL: That's okay.

1
2 <EXAMINATION BY MS FOLEY:
3

4 MS FOLEY: I just have a couple of questions for you,
5 Mr Hartley, and it could be depending on the nature of the
6 questions also for Mr Bolton. There's been evidence, quite
7 a lot of evidence, about the volume of water that has been
8 released as a result of the South East Water leak. To give
9 a lay person an idea of how much water that really is a
10 megalitre is a million litres, as we know. One of the ways
11 to measure the size of a dam is its capacity using
12 megalitres; you'd be familiar with that?
13

14 MR HARTLEY: I'm afraid not. I'm not a dams engineer.
15 But, yeah, we'll go for it.
16

17 MS FOLEY: You can take that from me. The water released
18 by South East Water based on the numbers that we've been
19 talking over the past couple of days could be in the order
20 of two times 20 megalitre dams. So a 20 megalitre dam is a
21 type of dam, and we're talking two of those dams in terms
22 of the sheer volume of water that has been released.
23 Despite that amount of water being released by South East
24 Water, at least until today it's been the opinion of SMEC
25 that the landslide was not caused by the leak, noting
26 there's been further evidence today and some qualifications
27 and some concessions which submissions will be made about
28 in due course.
29

30 But what I want to ask you about is the alternative
31 theory that had been advanced, if I can call it that, by
32 SMEC in some of the documents which was that it might have
33 been domestic water usage. Again, noting that some things
34 might have changed today - and tell me if any of this has
35 changed - it has been a position advanced by SMEC that only
36 2,000 to 2,300 litres of water was needed to cause the
37 slip. You're familiar with that idea and you've been asked
38 some questions about that. If the board finds that
39 36,000 litres was needed to cause the slip, and there's
40 some evidence about that figure, needless to say the
41 irrigation could not have been that cause; you'd agree with
42 that?
43

44 MR HARTLEY: For that volume, yeah.
45

46 MS FOLEY: So to look at the alternative theory that SMEC
47 had proposed in its report, and I just want to ask you a

1 couple of questions about this, if we could go to the SMEC
2 report - the supplementary report, SEW.0001.0002.4187,
3 please, and if we could go to PDF page 64. Thank you.
4 Just above section 10 you can see there - and this, as
5 you'll know, comes at the end of a discussion about
6 irrigation, and in the penultimate paragraph in that
7 section you'll see the last sentence says, "For such water
8 to contribute to the landslides it would need to be within
9 the colluvial layer over the surface of the slope within
10 the site raising the moisture content of this layer, but
11 not infiltrate the underlying material." You can see that?
12

13 MR HARTLEY: Yeah.
14

15 MS FOLEY: And then it says, "In effect, the likelihood of
16 such activities impacting groundwater levels and
17 influencing the McCrae landslide, albeit on a very
18 localised scale, is considered slightly higher compared to
19 other sources." So there's the way that the opinion has
20 been framed in relation to this other theory.
21

22 MR HARTLEY: Yes.
23

24 MS FOLEY: All right. Has SMEC done any testing to show
25 that infiltration could have occurred in the way that it's
26 described there; namely, within the colluvial layer, over
27 the surface, but not infiltrating the underlying material?
28

29 MR HARTLEY: No.
30

31 MS FOLEY: All right. What evidence was relied upon to
32 express that view in this part of the report?
33

34 MR HARTLEY: Based on the slope stability analysis of the
35 volume of the material and, yeah, basically understanding,
36 "Okay, if we only need that amount of - that volume of
37 material, what are the other sources of water that could be
38 feasible to actually create that amount of water?"
39

40 MS FOLEY: And not going further and saying, "But did that
41 actually happen; is there any evidence that it happened?"
42

43 MR HARTLEY: Creating that in real life would be very
44 tricky because obviously the landslides occurred and
45 another landslide on top of that. It is theoretical.
46

47 MS FOLEY: All right. And maybe I can just ask the

1 question directly. Really what you've said there in that
2 couple of sentences that I put to you is it's speculation
3 about a possible alternative?
4

5 MR HARTLEY: I think you'd be fair to say that. The thing
6 is is that I was - the flow of water that came through on
7 6 January - if it's 17,000 litres per day, right, then it's
8 obviously 2,000 litres or so is going to be done in,
9 I don't know, a few minutes or so. But also 33,000 litres
10 - 36,000 litres, I beg your pardon, also is also going to
11 be created, you know, in a couple of days.
12

13 My thing or our thing was, okay, so how can one get a
14 situation where a failure occurred, that failure occurs
15 with a finite volume of water where the potential source of
16 the water, let's say for example the Bayview Road leak, has
17 been chuntering along since - well, start August, probably
18 most certainly affecting things since October, and from
19 residents calling up in Waller Place, what's been going on
20 until December, it was that kind of trying to separate what
21 is going on here.
22

23 And then if you take the small volume that we've got
24 you can then say, "Okay, there are numerous places where
25 this can take place." You release the skin, as Mr Bolton
26 was suggesting, and then you basically have got this
27 outflowing of water which is basically coming from release
28 of the skin which can possibly be backed up by the fact
29 that on the 6th there was 200 millilitres per second
30 getting out, and then a few days later on the 10th
31 apparently from other sources it's down to 5 litres a
32 minute, I think - no, it wasn't, it was by - it was a
33 smaller amount anyway. So it was a "how on earth did this
34 happen" kind of thing.
35

36 MS FOLEY: Would it be right for me to say that instead of
37 coming to this set of issues and asking yourselves as
38 scientists, "All the things that we've seen and all the
39 investigations that we've done what was the most likely
40 cause of this landslide," what you've done is come in and
41 say, "What could it have been other than South East Water's
42 water" and tried to find a set of facts and put them
43 together in a way that could come up with some kind of
44 alternative theory?
45

46 MR HARTLEY: No, I think that's a little bit unfair.
47

1 MS FOLEY: What facts then do you have to back up this
2 alternative theory?
3
4 MR HARTLEY: It's more about the facts that make it
5 difficult to link the Bayview Road leak with the landslide.
6
7 MS FOLEY: So does that mean we are in reality in a
8 situation where you don't have a viable alternative theory
9 for what happened? It's one thing to say, "We don't think
10 it was Bayview Road." It's another thing to say, "We've
11 put forward an alternative theory." And what I'm putting
12 to you is that this alternative theory, as you've already
13 accepted --
14
15 MR HARTLEY: Yeah.
16
17 MS FOLEY: -- is speculation.
18
19 MR HARTLEY: Yes, it's speculation based on - well, look,
20 I don't - I'm not going to be cruel to my other colleagues.
21 But, in effect, it is speculation that you've got a lump of
22 water 400 metres away, but you don't have a direct line,
23 but you have geological theory - which is reasonable; I'm
24 not going to go the other way, you have geological theory -
25 and you have a landslide which occurred five days and then
26 another nine days after that. After the repair was done
27 you need to assess how is it happening, and we've tried to
28 do that.
29
30 MS FOLEY: And what we've seen - if I can interrupt you
31 there --
32
33 MS SIEMENSMA: He's been interrupted, I'm sorry, the last
34 three answers he's tried to give.
35
36 MS FOLEY: I'm sorry. We'll let him continue. Go for it.
37
38 MR HARTLEY: Sorry, my train of thought. We are being
39 scientific. We are robustly testing the theories. The
40 geochemistry thing really foxed us. We couldn't work out
41 how you can get a flow of water which picks up the
42 chemistry footprint and gets to the place on time. And,
43 you know, this afternoon has been obviously very
44 interesting. I would suggest that mains water also can
45 come from the leak that happened at 5 Prospect Hill and
46 such. But the conclusions from my more experienced
47 colleagues as such would suggest that the mixing of water

1 is a viable reason for the chemical make-up on the 6th.

2

3 MS FOLEY: Yes. And really your opinion about the
4 Bayview Road leak being the cause not being viable had two
5 prongs. One was the speed. You said that it couldn't have
6 got there in time. And what we've heard over the course of
7 today is that the tests you've relied upon to reach that
8 view haven't been provided; you agree with that?

9

10 MR HARTLEY: Yeah, they haven't been provided. But God's
11 honest truth they're not, you know, numbers plucked out of
12 the air. It's just a human error.

13

14 MS FOLEY: What I put to you is that plank, we don't have
15 the testing before us.

16

17 MR HARTLEY: Yeah.

18

19 MS FOLEY: All right. And the second plank was the
20 chemistry.

21

22 MR HARTLEY: Yes.

23

24 MS FOLEY: And you'd agree with me that over the course of
25 today the evidence that we've heard now puts us in a
26 position where the SMEC position, which was, "It couldn't
27 have been our water," is no longer a viable position to
28 take.

29

30 MR HARTLEY: Yes, I think that's a - it's - we can still
31 stand by that, but the likelihood is low.

32

33 MS FOLEY: All right. No further questions.

34

35 CHAIRPERSON: Thanks, Ms Foley.

36

37 MS SIEMENSMA: Could I just ask, Madam Chair, if the SMEC
38 report that was provided on 31 July could be tendered?

39

40 CHAIRPERSON: I think it has been.

41

42 MS SIEMENSMA: I thought it was just the first --

43

44 MR COSTELLO: I thought I did it this morning.

45

46 CHAIRPERSON: Let me just check the exhibit list. It
47 should be exhibit CA69.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

MR COSTELLO: CA69.

MS SIEMENSMA: Thank you.

MR COSTELLO: Ms Siemensma, if that turns out to be incorrect, I'll have it tendered out of session.

CHAIRPERSON: No further questions?

MR COSTELLO: Not from me, thank you.

CHAIRPERSON: No. Thank you to all the experts in the witness box for coming along. And thank you very much for all the work you've done. I know that a considerable amount of work has been done over the course of many months. So thank you very much for all of your effort and for your assistance over the last two days.

Thank you to counsel for a very long day. Thank you to all the solicitors for a very long day and other staff. We'll adjourn until 18 August.

AT 7.00PM THE HEARING WAS ADJOURNED UNTIL MONDAY, 18 AUGUST 2025

#	1266:8, 1266:10, 1267:26, 1277:1, 1287:30, 1287:47, 1288:41, 1288:42, 1290:12, 1322:37, 1333:41, 1334:23 1,000 [14] - 1231:36, 1234:19, 1288:3, 1289:8, 1289:11, 1289:17, 1329:32, 1330:19, 1331:16, 1332:11, 1332:15, 1332:22, 1342:20, 1342:40 1,051 [1] - 1342:24 1,200 [8] - 1323:44, 1324:2, 1329:46, 1340:6, 1341:32, 1342:22, 1342:26, 1342:35 1,300 [1] - 1342:40 1,400 [5] - 1329:34, 1332:13, 1332:15, 1332:22, 1332:47 1,465 [1] - 1254:11 1,500 [1] - 1331:17 1,600 [6] - 1335:18, 1335:30, 1339:34, 1342:8, 1344:43, 1345:13 1.1 [1] - 1240:40 1.38 [1] - 1229:11 1.39 [1] - 1246:17 1.4 [4] - 1228:38, 1230:11, 1237:31 1.4-odd [1] - 1244:7 1.45 [1] - 1230:13 10 [22] - 1178:36, 1191:44, 1191:46, 1192:2, 1192:3, 1237:4, 1237:46, 1240:33, 1244:33, 1254:35, 1256:40, 1258:2, 1258:4, 1258:21, 1280:3, 1284:14, 1291:26, 1291:34, 1291:35, 1325:41, 1327:34, 1347:4 10,000 [6] - 1231:30, 1231:39, 1289:6, 1289:8, 1289:15, 1289:17 10-12 [7] - 1170:35, 1176:35, 1219:46, 1271:3, 1279:5, 1282:17, 1285:37 10-metre [1] - 1276:46 10-minute [1] - 1272:5 10.00am [1] - 1167:24	100 [3] - 1238:27, 1254:35, 1318:6 100-year [1] - 1297:40 101 [1] - 1318:6 102 [1] - 1340:2 10th [2] - 1335:37, 1348:30 11,000 [13] - 1229:10, 1229:19, 1229:40, 1230:17, 1230:20, 1230:44, 1236:42, 1241:19, 1246:6, 1246:29, 1248:6, 1287:11, 1288:39 12 [9] - 1167:28, 1204:9, 1228:33, 1243:33, 1254:12, 1282:11, 1299:22, 1321:40, 1322:9 125 [5] - 1197:3, 1197:4, 1197:42, 1200:27, 1278:21 127 [2] - 1200:34, 1201:22 13 [4] - 1219:7, 1219:10, 1219:28 14 [16] - 1169:7, 1169:8, 1172:6, 1191:36, 1191:45, 1196:4, 1209:38, 1223:7, 1223:8, 1223:26, 1223:36, 1265:7, 1293:10, 1294:16, 1294:35 14,000 [1] - 1229:10 14,800 [1] - 1229:10 14th [2] - 1195:17, 1223:29 15 [3] - 1178:33, 1244:34, 1326:5 15-metre [1] - 1176:47 150 [2] - 1254:46, 1314:34 157 [1] - 1251:30 16 [3] - 1174:29, 1191:40, 1302:32 163(c) [1] - 1268:5 166 [1] - 1253:20 16th [1] - 1329:46 17 [9] - 1169:5, 1169:9, 1219:7, 1323:11, 1324:31, 1343:45, 1344:19, 1344:34, 1344:37 17,000 [9] - 1226:36, 1299:11, 1336:7, 1336:9, 1336:17, 1336:24, 1344:16, 1348:7 17,280 [1] - 1291:6	171 [1] - 1214:45 17th [1] - 1219:31 18 [7] - 1179:2, 1209:16, 1209:41, 1256:40, 1351:22, 1351:24 182 [1] - 1308:28 183 [1] - 1312:42 184 [3] - 1316:3, 1316:41, 1343:17 19 [2] - 1184:38, 1273:13 1950 [1] - 1173:41 1950s [2] - 1173:37, 1173:40 1A [1] - 1285:37	2 2 [28] - 1174:26, 1202:25, 1202:27, 1202:28, 1202:31, 1202:47, 1203:11, 1228:34, 1234:42, 1252:5, 1252:31, 1252:32, 1253:2, 1254:22, 1254:32, 1260:9, 1260:21, 1260:36, 1261:24, 1262:12, 1263:26, 1264:6, 1265:42, 1266:1, 1287:18, 1287:23, 1287:31, 1287:34 2,000 [15] - 1292:33, 1293:2, 1293:4, 1293:13, 1294:8, 1295:15, 1295:47, 1296:23, 1296:35, 1296:36, 1296:40, 1299:16, 1299:35, 1346:36, 1348:8 2,300 [11] - 1292:33, 1293:2, 1293:4, 1293:14, 1293:28, 1294:8, 1294:17, 1294:23, 1297:13, 1298:8, 1346:36 2,400 [4] - 1293:34, 1294:9, 1294:17, 1294:22 2.8 [1] - 1282:46 20 [27] - 1179:2, 1204:9, 1209:20, 1209:24, 1209:35, 1209:36, 1209:43, 1209:44, 1219:7, 1236:18, 1237:4, 1240:33, 1247:28, 1249:4, 1249:5, 1272:2, 1280:3, 1287:47, 1293:10, 1298:22, 1298:27, 1323:6, 1326:1, 1330:24, 1342:17, 1346:20 20-metre [1] - 1276:46 20-odd [1] - 1286:24 200 [5] - 1238:28, 1286:33, 1288:2, 1299:21, 1348:29 2014 [2] - 1170:38, 1176:14 2017 [2] - 1174:13, 1174:14 2022 [19] - 1181:1, 1183:32, 1183:35, 1183:38, 1184:3, 1194:37, 1270:42, 1278:19, 1292:37, 1295:37, 1296:6, 1297:1, 1297:16, 1297:17, 1297:33, 1297:47, 1298:11, 1298:14, 1298:46 2023 [4] - 1184:11, 1185:7, 1194:8, 1194:46 2024 [5] - 1183:33, 1183:43, 1237:30, 1296:16, 1296:19 2025 [27] - 1167:24, 1181:2, 1186:19, 1186:22, 1196:44, 1204:24, 1209:16, 1224:23, 1268:29, 1274:29, 1275:45, 1276:7, 1285:17, 1285:20, 1290:38, 1291:5, 1291:34, 1296:9, 1296:23, 1296:47, 1297:47, 1308:47, 1313:37, 1316:6, 1322:37, 1342:38, 1351:25 20th [1] - 1219:31 21 [2] - 1196:44, 1210:37 210 [1] - 1182:40 22 [5] - 1210:25, 1295:41, 1330:25, 1332:11 22nd [4] - 1329:32, 1329:33, 1330:19, 1331:16 23 [3] - 1184:6, 1184:11, 1194:29 230 [14] - 1251:21, 1251:27, 1251:41, 1251:43, 1252:11,
0	0.1 [3] - 1291:12, 1293:23, 1310:36 0.2 [3] - 1291:6, 1291:12, 1336:1 0.3 [3] - 1293:23, 1310:37, 1312:1 0.4 [5] - 1237:6, 1237:11, 1293:24, 1293:29, 1312:1 0.5 [2] - 1298:24, 1310:37 0004.0001.0001 [1] - 1196:46 0012 [1] - 1206:30 0021 [2] - 1289:41 0036 [1] - 1318:6 0052 [1] - 1219:1 0056 [2] - 1185:9, 1185:10 0057 [1] - 1182:23 0059 [1] - 1213:23 0061 [1] - 1213:1 0084 [1] - 1211:3 0095 [1] - 1253:43 0175 [1] - 1184:39 0204 [1] - 1249:29 0210 [4] - 1180:21, 1182:41, 1182:43, 1182:45 0212 [1] - 1202:18 0245 [1] - 1216:45 0247 [1] - 1265:25 0248 [1] - 1220:29 0266 [2] - 1319:29, 1319:39 0276 [1] - 1291:33 0388 [1] - 1175:39 0394 [3] - 1183:27, 1194:31 03A [1] - 1324:36 0405 [1] - 1173:4 0408 [1] - 1221:36 0418 [2] - 1266:22, 1266:27	100 [3] - 1238:27, 1254:35, 1318:6 100-year [1] - 1297:40 101 [1] - 1318:6 102 [1] - 1340:2 10th [2] - 1335:37, 1348:30 11,000 [13] - 1229:10, 1229:19, 1229:40, 1230:17, 1230:20, 1230:44, 1236:42, 1241:19, 1246:6, 1246:29, 1248:6, 1287:11, 1288:39 12 [9] - 1167:28, 1204:9, 1228:33, 1243:33, 1254:12, 1282:11, 1299:22, 1321:40, 1322:9 125 [5] - 1197:3, 1197:4, 1197:42, 1200:27, 1278:21 127 [2] - 1200:34, 1201:22 13 [4] - 1219:7, 1219:10, 1219:28 14 [16] - 1169:7, 1169:8, 1172:6, 1191:36, 1191:45, 1196:4, 1209:38, 1223:7, 1223:8, 1223:26, 1223:36, 1265:7, 1293:10, 1294:16, 1294:35 14,000 [1] - 1229:10 14,800 [1] - 1229:10 14th [2] - 1195:17, 1223:29 15 [3] - 1178:33, 1244:34, 1326:5 15-metre [1] - 1176:47 150 [2] - 1254:46, 1314:34 157 [1] - 1251:30 16 [3] - 1174:29, 1191:40, 1302:32 163(c) [1] - 1268:5 166 [1] - 1253:20 16th [1] - 1329:46 17 [9] - 1169:5, 1169:9, 1219:7, 1323:11, 1324:31, 1343:45, 1344:19, 1344:34, 1344:37 17,000 [9] - 1226:36, 1299:11, 1336:7, 1336:9, 1336:17, 1336:24, 1344:16, 1348:7 17,280 [1] - 1291:6	171 [1] - 1214:45 17th [1] - 1219:31 18 [7] - 1179:2, 1209:16, 1209:41, 1256:40, 1351:22, 1351:24 182 [1] - 1308:28 183 [1] - 1312:42 184 [3] - 1316:3, 1316:41, 1343:17 19 [2] - 1184:38, 1273:13 1950 [1] - 1173:41 1950s [2] - 1173:37, 1173:40 1A [1] - 1285:37	2 2 [28] - 1174:26, 1202:25, 1202:27, 1202:28, 1202:31, 1202:47, 1203:11, 1228:34, 1234:42, 1252:5, 1252:31, 1252:32, 1253:2, 1254:22, 1254:32, 1260:9, 1260:21, 1260:36, 1261:24, 1262:12, 1263:26, 1264:6, 1265:42, 1266:1, 1287:18, 1287:23, 1287:31, 1287:34 2,000 [15] - 1292:33, 1293:2, 1293:4, 1293:13, 1294:8, 1295:15, 1295:47, 1296:23, 1296:35, 1296:36, 1296:40, 1299:16, 1299:35, 1346:36, 1348:8 2,300 [11] - 1292:33, 1293:2, 1293:4, 1293:14, 1293:28, 1294:8, 1294:17, 1294:23, 1297:13, 1298:8, 1346:36 2,400 [4] - 1293:34, 1294:9, 1294:17, 1294:22 2.8 [1] - 1282:46 20 [27] - 1179:2, 1204:9, 1209:20, 1209:24, 1209:35, 1209:36, 1209:43, 1209:44, 1219:7, 1236:18, 1237:4, 1240:33, 1247:28, 1249:4, 1249:5,
1	1 [24] - 1178:35, 1186:6, 1196:32, 1240:40, 1243:47, 1244:8, 1252:30, 1265:38, 1265:42, 1266:1, 1266:2,	100 [3] - 1238:27, 1254:35, 1318:6 100-year [1] - 1297:40 101 [1] - 1318:6 102 [1] - 1340:2 10th [2] - 1335:37, 1348:30 11,000 [13] - 1229:10, 1229:19, 1229:40, 1230:17, 1230:20, 1230:44, 1236:42, 1241:19, 1246:6, 1246:29, 1248:6, 1287:11, 1288:39 12 [9] - 1167:28, 1204:9, 1228:33, 1243:33, 1254:12, 1282:11, 1299:22, 1321:40, 1322:9 125 [5] - 1197:3, 1197:4, 1197:42, 1200:27, 1278:21 127 [2] - 1200:34, 1201:22 13 [4] - 1219:7, 1219:10, 1219:28 14 [16] - 1169:7, 1169:8, 1172:6, 1191:36, 1191:45, 1196:4, 1209:38, 1223:7, 1223:8, 1223:26, 1223:36, 1265:7, 1293:10, 1294:16, 1294:35 14,000 [1] - 1229:10 14,800 [1] - 1229:10 14th [2] - 1195:17, 1223:29 15 [3] - 1178:33, 1244:34, 1326:5 15-metre [1] - 1176:47 150 [2] - 1254:46, 1314:34 157 [1] - 1251:30 16 [3] - 1174:29, 1191:40, 1302:32 163(c) [1] - 1268:5 166 [1] - 1253:20 16th [1] - 1329:46 17 [9] - 1169:5, 1169:9, 1219:7, 1323:11, 1324:31, 1343:45, 1344:19, 1344:34, 1344:37 17,000 [9] - 1226:36, 1299:11, 1336:7, 1336:9, 1336:17, 1336:24, 1344:16, 1348:7 17,280 [1] - 1291:6	171 [1] - 1214:45 17th [1] - 1219:31 18 [7] - 1179:2, 1209:16, 1209:41, 1256:40, 1351:22, 1351:24 182 [1] - 1308:28 183 [1] - 1312:42 184 [3] - 1316:3, 1316:41, 1343:17 19 [2] - 1184:38, 1273:13 1950 [1] - 1173:41 1950s [2] - 1173:37, 1173:40 1A [1] - 1285:37	2 2 [28] - 1174:26, 1202:25, 1202:27, 1202:28, 1202:31, 1202:47, 1203:11, 1228:34, 1234:42, 1252:5, 1252:31, 1252:32, 1253:2, 1254:22, 1254:32, 1260:9, 1260:21, 1260:36, 1261:24, 1262:12, 1263:26, 1264:6, 1265:42, 1266:1, 1287:18, 1287:23, 1287:31, 1287:34 2,000 [15] - 1292:33, 1293:2, 1293:4, 1293:13, 1294:8, 1295:15, 1295:47, 1296:23, 1296:35, 1296:36, 1296:40, 1299:16, 1299:35, 1346:36, 1348:8 2,300 [11] - 1292:33, 1293:2, 1293:4, 1293:14, 1293:28, 1294:8, 1294:17, 1294:23, 1297:13, 1298:8, 1346:36 2,400 [4] - 1293:34, 1294:9, 1294:17, 1294:22 2.8 [1] - 1282:46 20 [27] - 1179:2, 1204:9, 1209:20, 1209:24, 1209:35, 1209:36, 1209:43, 1209:44, 1219:7, 1236:18, 1237:4, 1240:33, 1247:28, 1249:4, 1249:5,

1252:33, 1253:8, 1254:47, 1256:7, 1256:45, 1257:2, 1258:6, 1259:12, 1286:33 230-day [3] - 1251:31, 1258:4, 1258:45 24 [6] - 1210:33, 1264:21, 1265:5, 1322:39, 1329:39, 1336:17 240 [1] - 1288:2 25 [4] - 1265:45, 1268:32, 1268:44, 1334:44 250 [2] - 1323:5, 1340:7 255 [1] - 1176:27 26 [2] - 1179:16, 1230:2 260 [3] - 1179:15, 1319:47, 1320:3 266 [1] - 1320:11 27 [1] - 1218:4 270 [1] - 1339:30 276 [1] - 1291:32 28 [10] - 1186:15, 1186:17, 1186:19, 1186:21, 1289:5, 1323:11, 1324:31, 1337:10, 1343:45 286 [1] - 1320:9 28th [1] - 1237:33 29 [2] - 1169:6, 1169:8 29th [1] - 1237:33	1193:35, 1193:37, 1194:13 30th [2] - 1237:32, 1329:44 31 [9] - 1228:44, 1237:17, 1237:24, 1237:31, 1241:17, 1243:27, 1243:39, 1246:18, 1350:38 31st [3] - 1243:37, 1324:8, 1330:41 32 [6] - 1195:16, 1206:33, 1209:20, 1209:24, 1209:37, 1210:2 33 [2] - 1206:33, 1210:37 33,000 [1] - 1348:9 330 [1] - 1339:40 34 [1] - 1213:2 340 [1] - 1226:43 349 [1] - 1235:45 35 [2] - 1293:18, 1323:10 35,000 [1] - 1293:15 350 [1] - 1333:40 36 [3] - 1264:21, 1264:22, 1293:18 36,000 [3] - 1293:27, 1346:39, 1348:10 37 [3] - 1316:46, 1344:24, 1344:34 39 [1] - 1257:26 3D [6] - 1176:6, 1176:7, 1183:15, 1183:23, 1211:17, 1214:26	40.3 [1] - 1228:17 400 [8] - 1236:24, 1238:22, 1239:19, 1240:7, 1242:5, 1243:41, 1330:1, 1349:22 400,000 [1] - 1242:6 41 [1] - 1273:11 4187 [1] - 1257:25 45 [2] - 1190:45, 1323:9 450 [2] - 1187:1, 1278:23 450-odd [1] - 1252:45 460 [2] - 1252:32, 1253:1 465 [2] - 1276:1, 1278:23	50 [6] - 1226:42, 1236:25, 1242:6, 1295:38, 1302:17, 1336:2 500 [2] - 1277:2, 1280:4 500,000 [1] - 1242:7 5056 [1] - 1185:15 5056.0001.0003 [1] - 1185:16 5087 [1] - 1183:1 5087.0001 [2] - 1180:21, 1183:1 5087.0001.0003 [1] - 1185:10 5087.0001.0157 [2] - 1173:3, 1249:29 50s [2] - 1179:19, 1201:5 52 [1] - 1290:39 53 [1] - 1290:39 55 [1] - 1323:9 56 [2] - 1185:10, 1202:18 5th [5] - 1191:14, 1195:17, 1223:29, 1288:33	1322:13, 1322:15 670 [2] - 1329:42, 1329:44 6th [20] - 1186:29, 1186:31, 1187:3, 1187:4, 1187:10, 1187:12, 1187:43, 1188:8, 1188:47, 1226:39, 1329:45, 1330:24, 1330:40, 1331:35, 1335:36, 1335:47, 1336:7, 1336:25, 1348:29, 1350:1
3		5		
3 [10] - 1176:34, 1179:18, 1181:36, 1183:8, 1202:32, 1219:10, 1219:13, 1219:29, 1252:30, 1287:30 3,800 [1] - 1229:9 3,867 [1] - 1245:9 3.30 [1] - 1271:37 3.35 [1] - 1272:6 30 [7] - 1209:16, 1281:8, 1288:32, 1295:23, 1313:17, 1318:21, 1322:39 30-odd [2] - 1258:18, 1280:41 300 [5] - 1191:46, 1192:3, 1293:25, 1295:15, 1296:4 300mm [1] - 1267:13 305 [1] - 1167:18 307 [4] - 1193:24,	4 4 [17] - 1202:29, 1203:11, 1209:34, 1222:42, 1237:36, 1246:44, 1265:4, 1265:42, 1266:1, 1266:2, 1266:8, 1266:10, 1267:26, 1282:46, 1285:14, 1333:41, 1334:23 4,000 [1] - 1295:39 4-0 [1] - 1228:15 4-metre [2] - 1181:36, 1203:1 40 [6] - 1182:5, 1228:15, 1270:27, 1316:46, 1337:11, 1344:21 40,300,000 [1] - 1228:11 40-odd [1] - 1280:10	5 [75] - 1167:24, 1169:6, 1169:9, 1171:47, 1175:11, 1178:39, 1182:24, 1191:1, 1191:3, 1191:40, 1196:28, 1196:36, 1202:24, 1209:35, 1222:43, 1223:8, 1223:25, 1223:32, 1223:35, 1226:18, 1236:26, 1236:38, 1237:5, 1237:36, 1238:2, 1238:3, 1239:45, 1240:45, 1241:5, 1243:45, 1246:44, 1251:30, 1252:26, 1252:28, 1256:25, 1262:34, 1265:44, 1266:13, 1266:15, 1267:38, 1274:29, 1287:29, 1287:46, 1287:47, 1288:2, 1288:7, 1288:14, 1288:29, 1290:13, 1290:38, 1291:26, 1291:27, 1291:29, 1291:34, 1293:9, 1293:33, 1294:15, 1294:27, 1294:31, 1294:34, 1294:35, 1297:10, 1298:9, 1299:36, 1299:40, 1299:42, 1322:3, 1332:29, 1332:34, 1334:5, 1348:31, 1349:45 5,000 [1] - 1177:11 5-litres [1] - 1236:34	6 [27] - 1173:15, 1176:34, 1182:18, 1183:6, 1183:9, 1214:47, 1219:45, 1221:8, 1222:43, 1228:38, 1229:7, 1266:15, 1281:35, 1282:16, 1282:19, 1282:23, 1282:25, 1291:5, 1320:40, 1327:39, 1329:31, 1330:10, 1330:25, 1330:36, 1332:10, 1342:8, 1348:7 6.1 [1] - 1219:1 60 [3] - 1190:45, 1215:20, 1314:34 600 [5] - 1314:21, 1323:39, 1323:44, 1324:2, 1332:27 600-millimetre [1] - 1266:33 60s [1] - 1201:6 61 [1] - 1213:1 62 [3] - 1236:39, 1245:47, 1259:34 63 [1] - 1251:24 64 [1] - 1347:3 65 [1] - 1196:47 67 [3] - 1322:11,	7 [19] - 1208:22, 1243:32, 1243:33, 1257:8, 1257:21, 1258:18, 1284:14, 1284:15, 1284:27, 1286:2, 1288:30, 1298:27, 1326:12, 1326:29, 1327:40, 1327:41, 1328:44, 1329:18, 1335:32 7,000 [1] - 1298:27 7.00PM [1] - 1351:24 7.13 [1] - 1214:30 70 [4] - 1298:28, 1323:16, 1344:34, 1344:39 70,000 [1] - 1298:28 70s [7] - 1171:10, 1171:19, 1179:14, 1179:20, 1179:21, 1179:31, 1179:33 73 [1] - 1274:31 750 [3] - 1329:31, 1330:15, 1332:22
		8		
		8 [1] - 1326:28 8.1 [2] - 1216:6, 1216:7 8.19 [1] - 1211:4 8.2.4 [1] - 1274:31 8.25 [1] - 1211:37 8.26 [1] - 1212:26 8.27 [1] - 1212:35 8.7 [1] - 1340:3 80 [5] - 1296:6, 1297:6, 1297:30, 1297:35, 1298:18 800 [2] - 1293:34, 1330:2 82 [2] - 1274:31, 1274:32		

83 ^[1] - 1247:4 84 ^[1] - 1216:5 89 ^[1] - 1268:6	1298:1, 1311:28 absorbing ^[1] - 1343:34 absorbs ^[1] - 1239:31 absorption ^[13] - 1227:46, 1235:7, 1236:31, 1237:38, 1238:35, 1239:18, 1242:21, 1242:39, 1247:31, 1267:41, 1305:10, 1306:40, 1310:42 abstraction ^[1] - 1205:34 academic ^[1] - 1244:3 accept ^[40] - 1179:34, 1187:10, 1196:7, 1197:34, 1199:16, 1203:20, 1208:35, 1223:9, 1223:15, 1223:40, 1225:25, 1225:39, 1229:39, 1242:39, 1243:7, 1244:5, 1244:9, 1247:37, 1248:27, 1256:47, 1261:42, 1262:18, 1262:41, 1272:35, 1274:39, 1275:44, 1277:42, 1278:6, 1278:23, 1279:8, 1284:26, 1285:19, 1285:27, 1291:21, 1296:2, 1297:35, 1333:12, 1333:43, 1335:13, 1337:15 acceptance ^[1] - 1219:33 accepted ^[5] - 1251:37, 1261:23, 1337:40, 1341:8, 1349:13 accepting ^[4] - 1229:8, 1331:1, 1337:39, 1337:41 accepts ^[2] - 1209:17, 1223:27 access ^[1] - 1226:41 according ^[1] - 1297:12 account ^[7] - 1199:14, 1199:25, 1256:45, 1259:7, 1262:2, 1298:46, 1327:14 accumulated ^[2] - 1316:21, 1343:22 accumulation ^[1] - 1309:34 accuracy ^[4] - 1173:41, 1254:39,	1255:3, 1307:14 accurate ^[5] - 1178:8, 1241:28, 1281:38, 1307:38, 1331:21 accurately ^[1] - 1223:2 achieve ^[2] - 1211:27, 1285:2 acknowledge ^[1] - 1315:6 acknowledgment ^[1] - 1257:11 acquire ^[1] - 1344:46 act ^[2] - 1250:26, 1281:16 actions ^[1] - 1198:21 active ^[1] - 1190:39 activities ^[1] - 1347:16 actual ^[4] - 1193:46, 1256:43, 1276:20, 1322:17 acute ^[1] - 1217:32 add ^[20] - 1175:3, 1207:35, 1208:46, 1220:17, 1220:18, 1220:20, 1233:7, 1233:41, 1237:16, 1241:40, 1243:40, 1251:8, 1255:38, 1270:5, 1308:11, 1311:7, 1312:34, 1319:12, 1325:15, 1334:38 added ^[2] - 1222:34, 1311:3 adding ^[1] - 1289:17 addition ^[7] - 1174:10, 1184:26, 1200:35, 1324:34, 1335:30, 1337:11 additional ^[4] - 1263:41, 1333:24, 1335:2, 1345:5 address ^[1] - 1203:31 addressed ^[2] - 1209:24, 1227:16 adducing ^[1] - 1212:45 adjacent ^[1] - 1247:25 adjourn ^[1] - 1351:22 ADJOURNED ^[1] - 1351:24 ADJOURNMENT ^[5] - 1204:11, 1234:44, 1272:8, 1300:23, 1327:43 admittedly ^[1] - 1256:29 adopt ^[5] - 1207:25, 1208:2, 1236:37,	1236:41, 1242:12 advance ^[1] - 1168:13 advanced ^[2] - 1346:31, 1346:35 advice ^[1] - 1340:38 aeolian ^[5] - 1305:22, 1305:26, 1305:31, 1305:35, 1314:44 aerial ^[5] - 1171:8, 1173:36, 1175:41, 1179:13, 1179:30 affect ^[3] - 1297:30, 1304:40, 1316:40 affecting ^[1] - 1348:18 afraid ^[4] - 1231:1, 1261:20, 1264:9, 1346:14 afternoon ^[4] - 1205:43, 1279:45, 1338:40, 1349:43 age ^[2] - 1171:5, 1268:42 ages ^[1] - 1170:29 aggregating ^[1] - 1226:1 agi ^[3] - 1208:21, 1257:20, 1288:30 agi-drain ^[1] - 1257:20 agi-drains ^[2] - 1208:21, 1288:30 agitation ^[1] - 1314:5 ago ^[7] - 1171:17, 1253:45, 1267:40, 1270:29, 1286:24, 1291:24, 1333:2 agree ^[49] - 1204:37, 1204:42, 1204:43, 1204:45, 1205:1, 1207:34, 1207:42, 1224:34, 1234:39, 1238:39, 1250:20, 1254:18, 1260:34, 1262:32, 1262:43, 1263:28, 1268:46, 1270:14, 1270:19, 1273:1, 1273:22, 1276:3, 1276:9, 1276:11, 1276:28, 1276:31, 1279:35, 1281:8, 1281:46, 1283:36, 1284:28, 1293:42, 1307:39, 1310:24, 1310:28, 1312:11, 1312:24, 1313:39, 1314:17, 1315:34, 1319:10, 1335:14, 1340:11, 1340:22, 1340:32, 1341:20, 1346:41, 1350:8, 1350:24	agreed ^[8] - 1204:25, 1206:20, 1210:10, 1263:2, 1272:17, 1277:12, 1281:22, 1341:18 agreeing ^[1] - 1183:19 agreement ^[6] - 1205:10, 1205:11, 1205:17, 1205:21, 1206:32, 1317:40 agrees ^[1] - 1223:5 ahead ^[1] - 1319:39 air ^[2] - 1271:14, 1350:12 airport ^[2] - 1326:28, 1345:43 albeit ^[2] - 1287:14, 1347:17 algae ^[1] - 1222:1 alkalinity ^[1] - 1304:24 allied ^[1] - 1317:21 allow ^[1] - 1295:47 allowed ^[1] - 1226:42 alluding ^[1] - 1178:1 alluvial ^[1] - 1174:36 alluvium ^[1] - 1277:1 almost ^[9] - 1178:5, 1178:16, 1235:17, 1270:10, 1281:16, 1296:1, 1299:47, 1303:37, 1331:6 alone ^[14] - 1171:8, 1171:19, 1258:3, 1303:36, 1304:46, 1310:5, 1310:10, 1310:39, 1311:16, 1312:12, 1312:13, 1317:16, 1333:27, 1333:29 ALS ^[1] - 1313:16 altered ^[1] - 1296:34 alternative ^[11] - 1326:22, 1335:41, 1336:45, 1346:30, 1346:46, 1348:3, 1348:44, 1349:2, 1349:8, 1349:11, 1349:12 amendments ^[1] - 1186:4 amount ^[53] - 1175:26, 1182:35, 1196:22, 1210:35, 1218:22, 1226:11, 1226:27, 1226:28, 1226:30, 1229:33, 1230:28, 1231:42, 1232:3, 1232:6, 1232:26, 1234:14, 1234:25, 1235:4, 1235:11,
---	---	--	---	--

<p>1235:22, 1237:25, 1237:37, 1238:20, 1242:27, 1242:43, 1244:41, 1244:44, 1246:29, 1246:31, 1256:39, 1267:27, 1273:4, 1292:14, 1292:22, 1294:22, 1296:1, 1297:36, 1297:38, 1298:25, 1299:9, 1299:26, 1299:28, 1299:29, 1299:30, 1323:22, 1323:23, 1333:38, 1343:44, 1346:23, 1347:36, 1347:38, 1348:33, 1351:16</p> <p>analyse [1] - 1296:46</p> <p>analysed [3] - 1304:18, 1313:22, 1315:25</p> <p>analyses [2] - 1242:39, 1254:18</p> <p>analysis [56] - 1200:26, 1203:1, 1225:20, 1227:17, 1228:9, 1229:16, 1229:23, 1229:26, 1229:29, 1229:31, 1229:42, 1232:3, 1233:8, 1240:10, 1240:22, 1242:16, 1242:34, 1242:37, 1242:42, 1243:23, 1243:30, 1243:39, 1244:22, 1245:1, 1245:7, 1245:11, 1252:10, 1253:16, 1254:37, 1260:35, 1265:15, 1265:17, 1265:18, 1266:46, 1267:6, 1267:41, 1274:42, 1275:8, 1286:34, 1290:7, 1292:37, 1296:38, 1296:39, 1303:20, 1303:37, 1304:12, 1305:3, 1310:1, 1315:21, 1315:26, 1317:15, 1318:22, 1318:23, 1334:22, 1334:39, 1347:34</p> <p>anchors [2] - 1188:44, 1203:10</p> <p>angle [6] - 1177:37, 1178:3, 1178:24, 1178:42, 1190:44, 1203:33</p> <p>angle's [1] - 1190:46</p> <p>angles [1] - 1270:10</p>	<p>animal [1] - 1234:11</p> <p>anions [8] - 1303:29, 1304:11, 1304:13, 1304:15, 1304:36, 1308:15, 1309:1, 1315:18</p> <p>annexures [1] - 1252:13</p> <p>answer [12] - 1172:34, 1174:20, 1195:8, 1262:39, 1263:15, 1294:47, 1298:5, 1298:10, 1298:35, 1307:39, 1334:20, 1336:44</p> <p>answered [1] - 1286:36</p> <p>answering [2] - 1272:15, 1312:13</p> <p>answers [1] - 1349:34</p> <p>anticipated [1] - 1287:11</p> <p>anyway [3] - 1294:28, 1327:37, 1348:33</p> <p>apart [7] - 1183:8, 1222:16, 1245:39, 1285:38, 1314:11, 1315:45, 1328:2</p> <p>apologies [4] - 1193:25, 1236:47, 1239:44, 1288:25</p> <p>apologise [2] - 1257:10, 1333:21</p> <p>appear [4] - 1174:2, 1292:22, 1308:41, 1335:20</p> <p>appearances [1] - 1168:5</p> <p>appeared [4] - 1167:32, 1167:35, 1167:38, 1167:41</p> <p>appendix [27] - 1175:34, 1216:41, 1219:44, 1235:5, 1235:29, 1235:31, 1235:37, 1236:44, 1236:45, 1237:14, 1237:23, 1240:26, 1241:5, 1260:24, 1308:27, 1319:23, 1319:25, 1320:5, 1320:9, 1320:18, 1321:10, 1321:21, 1321:23, 1321:40, 1334:47</p> <p>applied [8] - 1181:30, 1191:10, 1191:14, 1198:37, 1199:7, 1200:22, 1200:23, 1252:44</p>	<p>applies [2] - 1192:1, 1242:39</p> <p>apply [6] - 1171:32, 1200:33, 1245:14, 1251:41, 1258:3, 1295:37</p> <p>applying [6] - 1191:8, 1191:45, 1236:24, 1251:43, 1253:38, 1338:5</p> <p>appreciate [2] - 1226:46, 1263:22</p> <p>approach [3] - 1178:42, 1254:18, 1293:5</p> <p>approaches [1] - 1178:3</p> <p>appropriate [3] - 1174:34, 1245:14, 1345:38</p> <p>approximate [2] - 1229:9, 1237:5</p> <p>April [2] - 1285:25, 1285:27</p> <p>aquifer [45] - 1206:5, 1206:6, 1206:13, 1206:16, 1206:17, 1206:18, 1206:21, 1206:41, 1206:42, 1206:43, 1207:6, 1207:11, 1207:18, 1207:19, 1207:35, 1207:37, 1208:13, 1208:19, 1208:32, 1209:21, 1209:26, 1209:27, 1209:36, 1209:39, 1210:5, 1210:10, 1210:12, 1210:17, 1224:41, 1225:9, 1225:14, 1250:8, 1252:25, 1277:21, 1290:11, 1308:4, 1308:18, 1311:19, 1311:20, 1317:1, 1336:31, 1337:3, 1342:39</p> <p>aquifers [7] - 1206:3, 1210:6, 1210:9, 1318:44</p> <p>architectural [1] - 1184:35</p> <p>area [61] - 1170:38, 1173:31, 1173:33, 1174:36, 1181:43, 1183:12, 1183:22, 1188:31, 1188:47, 1191:19, 1205:35, 1205:39, 1207:39, 1208:16, 1208:25, 1208:28, 1212:46,</p>	<p>1213:11, 1217:2, 1217:33, 1217:36, 1217:40, 1218:15, 1220:8, 1220:25, 1234:23, 1236:23, 1236:33, 1236:35, 1237:39, 1238:1, 1238:2, 1238:5, 1239:9, 1239:19, 1239:22, 1239:46, 1245:19, 1247:39, 1259:11, 1278:21, 1278:46, 1279:3, 1280:14, 1280:15, 1285:33, 1295:39, 1296:1, 1301:22, 1305:47, 1318:42, 1335:35, 1336:27, 1337:4, 1337:24, 1337:44, 1340:34, 1340:35, 1340:39, 1341:29</p> <p>areas [4] - 1170:11, 1207:38, 1219:30, 1236:7</p> <p>argument [1] - 1286:45</p> <p>arisen [1] - 1325:13</p> <p>arrangements [3] - 1327:29, 1328:5, 1345:40</p> <p>arrives [1] - 1333:41</p> <p>arriving [2] - 1253:9, 1333:34</p> <p>arrow [4] - 1215:29, 1215:33, 1215:39, 1215:46</p> <p>arrows [1] - 1220:39</p> <p>Arthurs [1] - 1211:40</p> <p>artificially [1] - 1315:36</p> <p>as-builts [2] - 1192:39, 1196:2</p> <p>ascertain [2] - 1182:35, 1321:28</p> <p>ascribe [1] - 1281:3</p> <p>aside [7] - 1209:15, 1227:34, 1227:43, 1231:28, 1234:38, 1243:21, 1284:25</p> <p>aspect [3] - 1195:12, 1235:3, 1251:40</p> <p>assess [5] - 1218:8, 1261:31, 1311:11, 1343:41, 1349:27</p> <p>assessed [7] - 1199:44, 1252:15, 1292:30, 1293:22, 1296:7, 1310:39, 1343:38</p>	<p>assesses [2] - 1235:11, 1235:22</p> <p>assessing [2] - 1303:31, 1317:26</p> <p>assessment [14] - 1186:14, 1193:15, 1217:34, 1220:26, 1252:8, 1256:25, 1268:33, 1268:47, 1316:25, 1316:26, 1316:31, 1317:11, 1317:12</p> <p>ASSESSMENT [1] - 1186:21</p> <p>assist [3] - 1169:41, 1178:28, 1179:11</p> <p>assistance [2] - 1302:38, 1351:18</p> <p>Assisting [1] - 1167:33</p> <p>assisting [2] - 1290:33, 1290:34</p> <p>assists [1] - 1180:23</p> <p>associated [5] - 1170:34, 1184:35, 1249:16, 1267:34, 1289:11</p> <p>Associates [1] - 1301:20</p> <p>assume [11] - 1196:31, 1222:16, 1227:29, 1228:26, 1236:14, 1247:5, 1248:19, 1251:31, 1253:8, 1294:21, 1344:24</p> <p>assumed [6] - 1237:46, 1239:19, 1249:20, 1249:22, 1344:21, 1344:31</p> <p>assumes [3] - 1212:8, 1251:47, 1253:5</p> <p>assuming [3] - 1249:42, 1252:47, 1341:32</p> <p>assumption [9] - 1178:11, 1236:33, 1244:18, 1277:10, 1278:41, 1280:40, 1294:14, 1333:36, 1334:20</p> <p>assumptions [9] - 1237:13, 1241:27, 1245:2, 1245:3, 1253:46, 1276:30, 1276:35, 1277:3</p> <p>assured [1] - 1226:47</p> <p>asymmetric [2] - 1175:9, 1175:11</p> <p>asymmetry [1] -</p>
---	---	---	---	--

1177:33 AT ^[1] - 1351:24 attended ^[2] - 1175:15, 1301:31 attendees ^[1] - 1302:5 attention ^[5] - 1195:26, 1210:36, 1264:5, 1268:24, 1303:2 attributable ^[2] - 1337:27, 1337:33 attribute ^[1] - 1210:41 AUGUST ^[1] - 1351:24 August ^[4] - 1167:24, 1287:12, 1348:17, 1351:22 author ^[1] - 1334:31 authors ^[1] - 1226:2 available ^[15] - 1192:12, 1205:45, 1211:23, 1224:30, 1229:29, 1232:28, 1254:35, 1256:30, 1262:13, 1262:32, 1317:20, 1336:23, 1343:47, 1344:6, 1344:9 Avenue ^[25] - 1208:16, 1208:17, 1212:36, 1257:19, 1257:28, 1257:36, 1257:37, 1265:46, 1266:28, 1267:22, 1270:37, 1274:3, 1274:4, 1274:34, 1280:9, 1286:45, 1288:27, 1329:27, 1330:5, 1338:47, 1339:5, 1339:14, 1339:16, 1341:3 Avenue/ Charlesworth ^[1] - 1258:16 average ^[1] - 1252:35 avoiding ^[1] - 1258:6 aware ^[12] - 1200:21, 1227:42, 1227:45, 1249:13, 1297:41, 1307:3, 1307:9, 1332:25, 1332:36, 1332:37, 1333:28 axes ^[1] - 1255:1 axis ^[2] - 1176:47, 1177:6	1285:15, 1344:47 backfilled ^[1] - 1276:47 background ^[18] - 1227:24, 1264:31, 1312:3, 1324:10, 1328:23, 1330:32, 1330:37, 1330:38, 1335:19, 1341:23, 1342:6, 1342:7, 1342:29, 1342:37, 1342:44, 1343:5, 1343:7, 1343:43 backing ^[1] - 1331:5 backs ^[1] - 1195:20 backwards ^[1] - 1320:41 balance ^[6] - 1176:46, 1177:9, 1242:30, 1244:15, 1293:5, 1305:4 ballpark ^[3] - 1245:38, 1254:35, 1255:1 band ^[1] - 1262:5 bandaid ^[1] - 1336:32 bandwagon ^[1] - 1277:35 bang ^[1] - 1225:37 bar ^[4] - 1320:26, 1320:28, 1328:16, 1331:39 Bar ^[1] - 1327:8 barrier ^[1] - 1251:10 base ^[11] - 1181:18, 1188:15, 1188:30, 1189:18, 1189:19, 1250:4, 1251:11, 1269:44, 1269:46, 1284:1, 1323:2 based ^[49] - 1204:37, 1211:23, 1213:9, 1216:12, 1216:18, 1226:17, 1229:41, 1243:31, 1245:1, 1252:23, 1253:27, 1259:42, 1260:26, 1262:31, 1262:42, 1267:12, 1268:42, 1270:17, 1270:18, 1273:4, 1286:31, 1287:25, 1288:20, 1290:13, 1290:16, 1291:4, 1291:9, 1292:41, 1292:44, 1293:35, 1295:30, 1296:39, 1307:29, 1309:45, 1310:38, 1313:15, 1317:15, 1333:26, 1333:29, 1334:21, 1338:9,	1340:42, 1341:1, 1343:46, 1344:6, 1344:39, 1346:18, 1347:34, 1349:19 basic ^[1] - 1303:9 basing ^[1] - 1318:22 basis ^[11] - 1243:13, 1244:10, 1251:21, 1261:16, 1268:27, 1287:22, 1288:9, 1290:6, 1292:34, 1294:6, 1295:43 Bateman ^[1] - 1167:38 Bates ^[4] - 1196:45, 1249:29, 1259:33, 1289:3 batter ^[2] - 1250:25, 1295:17 Bayview ^[31] - 1205:32, 1210:37, 1216:19, 1216:21, 1217:36, 1223:5, 1223:28, 1224:30, 1228:13, 1251:26, 1259:46, 1264:36, 1265:14, 1265:27, 1269:46, 1274:35, 1275:20, 1275:32, 1275:45, 1280:31, 1283:10, 1289:21, 1289:24, 1292:19, 1339:1, 1341:9, 1344:42, 1348:16, 1349:5, 1349:10, 1350:4 beach ^[1] - 1245:32 beams ^[1] - 1195:2 bearing ^[2] - 1196:22, 1206:42 bears ^[1] - 1196:19 become ^[3] - 1207:2, 1251:11, 1315:24 becomes ^[3] - 1181:41, 1181:47, 1238:10 bedding ^[12] - 1224:46, 1229:1, 1229:41, 1231:5, 1231:38, 1231:39, 1231:41, 1232:5, 1233:19, 1241:25 beeline ^[1] - 1247:43 beforehand ^[2] - 1288:34, 1288:36 beg ^[9] - 1194:13, 1195:29, 1223:18, 1241:22, 1243:33, 1258:26, 1274:24, 1286:44, 1348:10 begin ^[2] - 1211:36,	1227:15 behalf ^[3] - 1167:35, 1167:38, 1167:41 behaviour ^[1] - 1197:36 behind ^[13] - 1183:32, 1188:42, 1190:38, 1191:42, 1195:1, 1195:18, 1232:27, 1278:37, 1292:12, 1292:22, 1328:34, 1329:27, 1336:34 belief ^[1] - 1174:22 belong ^[1] - 1173:26 below ^[29] - 1173:18, 1173:26, 1173:32, 1174:15, 1181:32, 1188:32, 1189:1, 1202:30, 1207:12, 1211:5, 1211:22, 1212:26, 1216:6, 1222:21, 1222:22, 1222:28, 1222:41, 1222:45, 1233:12, 1234:21, 1243:28, 1250:32, 1267:19, 1273:30, 1282:36, 1282:37, 1284:2, 1310:37 bend ^[4] - 1178:6, 1266:15, 1266:20, 1274:18 bending ^[1] - 1203:18 beneath ^[3] - 1170:36, 1206:41, 1251:13 benefit ^[3] - 1224:44, 1229:47, 1251:26 best ^[7] - 1213:4, 1230:37, 1241:10, 1261:31, 1268:34, 1326:9, 1341:45 better ^[6] - 1174:33, 1178:9, 1182:10, 1198:1, 1208:31, 1281:34 between ^[69] - 1174:46, 1182:36, 1183:6, 1186:36, 1187:27, 1195:6, 1195:17, 1206:5, 1208:16, 1214:27, 1215:16, 1220:11, 1226:26, 1230:23, 1231:40, 1232:5, 1233:21, 1233:33, 1233:46, 1234:4, 1234:10, 1234:15, 1234:36, 1237:4, 1237:12, 1239:37, 1240:33, 1241:10,	1241:11, 1242:21, 1242:38, 1242:40, 1243:32, 1243:33, 1244:18, 1245:15, 1245:16, 1247:12, 1251:29, 1257:46, 1259:1, 1259:47, 1262:38, 1266:15, 1266:41, 1267:24, 1278:28, 1285:5, 1286:2, 1289:7, 1292:24, 1292:25, 1292:33, 1293:23, 1293:34, 1294:8, 1297:17, 1306:1, 1306:12, 1317:40, 1322:45, 1323:3, 1323:7, 1325:6, 1330:24, 1335:36, 1337:26, 1342:40 beyond ^[2] - 1251:12, 1280:14 bicarbonate ^[7] - 1304:15, 1304:21, 1309:2, 1309:4, 1309:45, 1315:19, 1315:25 big ^[11] - 1170:13, 1174:35, 1192:4, 1196:3, 1218:12, 1222:32, 1239:32, 1244:35, 1267:12, 1271:10, 1271:20 bigger ^[1] - 1238:20 biggest ^[1] - 1289:6 billions ^[1] - 1306:22 bisect ^[1] - 1270:43 bisecting ^[1] - 1257:27 bit ^[22] - 1191:41, 1202:1, 1212:12, 1215:37, 1220:21, 1221:16, 1222:41, 1237:19, 1239:26, 1248:3, 1252:5, 1268:37, 1275:9, 1280:17, 1281:16, 1289:34, 1304:29, 1310:44, 1312:2, 1328:7, 1331:44, 1348:46 bits ^[1] - 1226:44 black ^[4] - 1178:17, 1215:36, 1215:38, 1217:39 blank ^[1] - 1313:23 blanket ^[1] - 1195:1 blatant ^[1] - 1259:1 blatantly ^[3] - 1179:32, 1250:46,
B				
backed ^[1] - 1348:28 backfill ^[5] - 1180:3, 1231:9, 1269:8,				

<p>1258:46</p> <p>block [2] - 1261:24, 1335:26</p> <p>blocks [3] - 1187:27, 1260:18, 1304:30</p> <p>blow [1] - 1212:11</p> <p>blown [2] - 1181:14, 1213:24</p> <p>blows [1] - 1177:10</p> <p>blue [12] - 1176:37, 1213:38, 1213:40, 1213:44, 1213:45, 1214:1, 1214:6, 1215:29, 1215:39, 1215:46, 1247:13</p> <p>Board [2] - 1167:4, 1250:42</p> <p>board [2] - 1199:35, 1346:38</p> <p>board's [1] - 1327:23</p> <p>body [1] - 1219:46</p> <p>Bolton [51] - 1192:43, 1208:7, 1208:9, 1210:43, 1213:4, 1218:44, 1218:46, 1219:15, 1219:24, 1220:16, 1226:3, 1227:17, 1227:38, 1228:4, 1228:25, 1232:2, 1235:46, 1238:12, 1251:8, 1251:20, 1253:22, 1255:36, 1256:4, 1257:29, 1259:4, 1259:31, 1272:13, 1286:29, 1286:30, 1287:17, 1289:19, 1292:5, 1292:31, 1301:37, 1313:6, 1321:5, 1322:27, 1323:26, 1326:16, 1328:14, 1328:39, 1331:39, 1332:5, 1332:6, 1334:28, 1336:37, 1337:8, 1338:35, 1342:5, 1346:6, 1348:25</p> <p>BOLTON [167] - 1168:29, 1193:1, 1208:11, 1208:38, 1208:42, 1220:20, 1226:5, 1227:40, 1228:6, 1228:28, 1231:12, 1231:18, 1231:24, 1232:9, 1232:18, 1232:30, 1232:40, 1232:46, 1233:3, 1236:2, 1236:11, 1238:18, 1238:32, 1238:37,</p>	<p>1239:5, 1240:17, 1242:26, 1247:47, 1248:17, 1248:32, 1248:41, 1249:1, 1249:9, 1252:19, 1252:23, 1252:38, 1252:42, 1252:47, 1255:38, 1256:1, 1256:10, 1256:17, 1258:30, 1258:34, 1258:39, 1260:26, 1260:31, 1260:40, 1261:8, 1261:37, 1262:12, 1262:22, 1262:27, 1263:8, 1263:14, 1280:47, 1281:7, 1287:20, 1287:25, 1287:37, 1287:41, 1287:46, 1289:23, 1289:29, 1290:10, 1292:9, 1292:21, 1301:40, 1301:45, 1302:2, 1302:8, 1302:13, 1302:23, 1302:27, 1313:10, 1313:15, 1313:29, 1321:8, 1321:12, 1321:19, 1321:23, 1321:38, 1322:11, 1322:15, 1322:19, 1322:29, 1323:29, 1324:7, 1326:18, 1328:23, 1328:31, 1328:43, 1329:4, 1329:10, 1329:17, 1329:24, 1329:30, 1329:38, 1329:44, 1330:8, 1330:13, 1330:17, 1330:21, 1330:29, 1330:40, 1330:45, 1331:4, 1331:42, 1332:2, 1332:8, 1332:13, 1332:19, 1332:29, 1332:34, 1332:39, 1332:45, 1333:4, 1333:9, 1333:14, 1334:33, 1334:38, 1334:46, 1335:7, 1335:16, 1335:29, 1335:47, 1336:9, 1336:14, 1336:20, 1336:29, 1336:47, 1337:10, 1337:18, 1337:30, 1337:36, 1338:9, 1338:38, 1338:44, 1339:3, 1339:9, 1339:16, 1339:25, 1339:36, 1339:40, 1339:45, 1340:9,</p>	<p>1340:14, 1340:18, 1340:26, 1340:30, 1340:37, 1340:46, 1341:6, 1341:11, 1341:16, 1341:23, 1341:32, 1341:39, 1342:10, 1342:15, 1342:22, 1342:26, 1342:31, 1342:35, 1342:42, 1343:2, 1343:12</p> <p>Bolton's [2] - 1210:43, 1259:42</p> <p>book [3] - 1290:31, 1290:32, 1290:35</p> <p>bordered [1] - 1208:16</p> <p>bore [1] - 1287:26</p> <p>borehole [14] - 1215:5, 1219:30, 1221:9, 1222:35, 1222:41, 1233:16, 1252:5, 1282:11, 1285:1, 1285:7, 1285:37, 1285:39, 1293:31, 1324:36</p> <p>borehole's [1] - 1222:39</p> <p>boreholes [3] - 1233:12, 1277:29, 1278:27</p> <p>bores [1] - 1209:4</p> <p>bottle [1] - 1314:25</p> <p>bottom [19] - 1174:30, 1179:19, 1212:18, 1214:29, 1215:23, 1217:39, 1222:33, 1228:35, 1228:36, 1230:3, 1230:43, 1236:40, 1241:42, 1265:27, 1267:23, 1267:38, 1271:18, 1277:1, 1283:26</p> <p>boulder [1] - 1233:13</p> <p>bound [1] - 1170:43</p> <p>boundaries [2] - 1214:15, 1214:17</p> <p>boundary [3] - 1221:11, 1221:12, 1221:17</p> <p>bow [1] - 1243:46</p> <p>bowl [1] - 1295:16</p> <p>box [7] - 1192:45, 1207:23, 1294:19, 1300:33, 1300:35, 1351:14</p> <p>boxes [1] - 1299:13</p> <p>branch [2] - 1257:43, 1265:31</p> <p>breach [3] - 1242:41, 1266:29, 1268:7</p>	<p>breached [1] - 1264:16</p> <p>breaches [11] - 1265:16, 1265:19, 1266:25, 1267:1, 1267:47, 1268:28, 1269:4, 1269:14, 1269:31, 1271:3, 1337:25</p> <p>breaching [1] - 1255:23</p> <p>breadcrumb [1] - 1257:16</p> <p>breadth [1] - 1240:5</p> <p>break [13] - 1176:11, 1176:19, 1204:8, 1234:41, 1252:9, 1271:36, 1271:37, 1272:4, 1272:5, 1310:44, 1327:37, 1327:39</p> <p>Brett [2] - 1244:31, 1244:33</p> <p>bridge [1] - 1174:45</p> <p>briefing [1] - 1297:12</p> <p>briefly [5] - 1168:44, 1171:25, 1174:29, 1220:28, 1233:10</p> <p>bring [21] - 1182:22, 1193:27, 1209:30, 1209:32, 1214:44, 1249:15, 1249:23, 1270:3, 1270:27, 1273:10, 1290:46, 1308:28, 1318:4, 1319:16, 1319:27, 1321:43, 1322:1, 1323:20, 1328:16, 1331:13, 1339:27</p> <p>bringing [3] - 1268:39, 1322:41</p> <p>brings [1] - 1324:21</p> <p>broad [2] - 1207:30, 1280:15</p> <p>broadly [5] - 1234:35, 1264:44, 1340:23, 1341:19, 1343:9</p> <p>broken [2] - 1267:20, 1268:13</p> <p>brought [7] - 1173:32, 1196:45, 1216:35, 1218:47, 1253:43, 1265:23, 1268:24</p> <p>brown [2] - 1176:12, 1218:33</p> <p>Browne [17] - 1218:4, 1218:6, 1264:44, 1265:45, 1266:6, 1266:28, 1267:22, 1269:5, 1269:31,</p>	<p>1269:34, 1270:30, 1270:37, 1271:3, 1280:28, 1280:33, 1286:2</p> <p>bucket [6] - 1239:27, 1239:28, 1239:29, 1239:32, 1239:36, 1245:33</p> <p>buffer [1] - 1304:26</p> <p>buffering [1] - 1304:23</p> <p>build [1] - 1186:47</p> <p>building [8] - 1195:14, 1198:37, 1199:37, 1199:39, 1200:10, 1260:18, 1261:23, 1336:34</p> <p>built [20] - 1170:11, 1179:19, 1181:1, 1183:32, 1183:38, 1183:43, 1184:18, 1184:30, 1184:32, 1184:46, 1192:39, 1194:37, 1198:32, 1199:22, 1208:27, 1233:45, 1271:16, 1271:26</p> <p>built-up [1] - 1170:11</p> <p>builts [2] - 1192:39, 1196:2</p> <p>bunch [1] - 1189:9</p> <p>bund [1] - 1247:26</p> <p>buried [5] - 1181:44, 1250:27, 1276:45, 1276:47, 1277:9</p> <p>burrow [1] - 1234:10</p> <p>burst [92] - 1205:33, 1205:35, 1211:13, 1212:2, 1212:29, 1212:36, 1213:7, 1213:17, 1224:10, 1224:24, 1225:27, 1226:14, 1226:15, 1227:18, 1227:44, 1228:10, 1228:13, 1229:35, 1230:5, 1230:13, 1230:16, 1231:22, 1233:33, 1234:15, 1235:5, 1236:9, 1236:18, 1236:28, 1237:13, 1239:20, 1239:21, 1239:36, 1239:37, 1240:24, 1240:42, 1241:9, 1241:11, 1242:28, 1242:38, 1246:30, 1246:38, 1247:6, 1247:13, 1247:22, 1253:1, 1253:9, 1253:24,</p>
--	---	---	---	--

<p>1256:47, 1257:2, 1264:24, 1264:36, 1266:24, 1270:42, 1275:45, 1275:47, 1276:7, 1276:10, 1277:43, 1279:7, 1280:37, 1280:39, 1281:14, 1286:28, 1286:33, 1287:7, 1316:18, 1316:42, 1316:46, 1323:10, 1323:17, 1323:42, 1323:43, 1323:45, 1324:7, 1324:12, 1328:21, 1328:45, 1330:29, 1335:41, 1336:23, 1336:26, 1336:45, 1337:26, 1337:28, 1339:18, 1340:19, 1343:20, 1343:25, 1343:31, 1344:12, 1344:28, 1344:42</p> <p>butting [1] - 1239:44 BY [12] - 1168:41, 1196:41, 1201:28, 1227:4, 1259:28, 1264:11, 1272:10, 1275:40, 1294:43, 1338:33, 1342:3, 1346:2</p>	<p>1186:8, 1192:40, 1193:10, 1196:3, 1196:8, 1230:44, 1230:45, 1237:22, 1242:9, 1243:31, 1254:21, 1255:39, 1255:41, 1260:20, 1260:37, 1261:8, 1261:15, 1261:30, 1288:39, 1293:32, 1293:35, 1294:7, 1294:27, 1344:16</p> <p>calibrated [2] - 1295:40, 1307:35 calibration [2] - 1307:26, 1307:33 can [1] - 1200:30 cannot [6] - 1298:3, 1298:10, 1303:32, 1310:39, 1311:21, 1323:24 cantilevered [1] - 1203:10 capabilities [1] - 1261:31 capability [1] - 1311:26 capable [4] - 1189:6, 1196:22, 1230:24, 1341:26 capacity [15] - 1188:44, 1189:2, 1231:38, 1231:40, 1232:12, 1232:14, 1246:34, 1248:6, 1248:27, 1248:39, 1251:13, 1287:10, 1289:11, 1289:16, 1346:11 captures [1] - 1266:24 car [1] - 1178:5 carbonate [2] - 1304:22, 1305:31 carbonates [2] - 1304:21, 1305:37 carbonite [1] - 1304:14 career [2] - 1286:24, 1301:27 careful [3] - 1178:20, 1245:7, 1311:10 carefully [1] - 1206:6 carriageway [1] - 1247:26 carried [3] - 1235:15, 1235:16, 1256:33 carry [2] - 1207:37, 1304:3 carrying [1] - 1279:7 cart [1] - 1249:23</p>	<p>case [20] - 1178:26, 1180:22, 1189:15, 1193:20, 1198:7, 1199:32, 1199:34, 1200:19, 1208:31, 1232:19, 1232:33, 1237:17, 1246:19, 1246:25, 1247:1, 1259:10, 1259:12, 1261:8, 1287:3, 1303:29 cast [1] - 1170:5 catchment [3] - 1206:19, 1280:11, 1308:15 categorise [1] - 1335:8 cations [11] - 1303:14, 1303:20, 1303:35, 1303:40, 1303:47, 1304:4, 1304:6, 1304:36, 1308:15, 1308:47, 1315:18 causal [1] - 1193:23 causation [15] - 1169:10, 1169:17, 1169:35, 1173:1, 1190:2, 1190:5, 1193:41, 1209:4, 1224:44, 1249:28, 1318:21, 1319:13, 1319:21, 1343:29, 1344:8 causative [4] - 1180:31, 1180:33, 1211:32, 1305:15 caused [5] - 1204:28, 1220:45, 1323:46, 1336:32, 1346:25 causes [2] - 1232:27, 1298:41 causing [1] - 1205:25 cautions [1] - 1271:33 caveated [1] - 1246:18 CCTV [5] - 1218:4, 1218:38, 1265:17, 1266:24, 1269:7 cease [1] - 1304:47 ceased [1] - 1338:3 cent [7] - 1182:5, 1254:27, 1302:17, 1323:16, 1336:2, 1344:34, 1344:39 centimetre [1] - 1237:46 centimetres [1] - 1313:17 central [1] - 1178:32 centre [7] - 1176:9, 1178:37, 1181:11,</p>	<p>1194:42, 1205:32, 1215:29, 1291:33 centres [1] - 1265:16 certain [7] - 1237:42, 1251:13, 1256:39, 1276:30, 1280:20, 1281:33, 1323:37 certainly [15] - 1173:24, 1195:35, 1197:20, 1197:27, 1206:19, 1217:45, 1220:11, 1222:36, 1268:24, 1274:12, 1283:38, 1302:14, 1312:12, 1312:13, 1348:18 certainty [4] - 1172:26, 1269:26, 1278:19, 1337:39 cetera [1] - 1241:28 chair [5] - 1179:11, 1203:31, 1230:1, 1300:16, 1311:34 Chair [16] - 1168:3, 1168:23, 1204:4, 1204:13, 1204:16, 1227:6, 1233:1, 1235:1, 1259:20, 1271:36, 1272:12, 1319:31, 1327:6, 1327:36, 1338:19, 1350:37 Chairperson [1] - 1167:10 CHAIRPERSON [65] - 1168:1, 1168:5, 1168:9, 1185:19, 1185:24, 1185:37, 1185:43, 1186:14, 1186:19, 1204:8, 1204:19, 1227:10, 1234:32, 1234:41, 1259:26, 1264:2, 1271:39, 1271:45, 1272:4, 1290:31, 1290:45, 1294:40, 1300:5, 1300:20, 1300:25, 1300:30, 1319:36, 1320:18, 1324:4, 1325:33, 1325:39, 1325:44, 1326:3, 1326:7, 1326:11, 1326:24, 1326:31, 1326:36, 1326:40, 1326:46, 1327:4, 1327:16, 1327:21, 1327:25, 1327:29, 1327:39, 1327:45, 1328:11, 1328:37, 1331:10,</p>	<p>1331:39, 1331:47, 1334:11, 1338:17, 1338:23, 1338:27, 1338:31, 1342:1, 1345:22, 1345:42, 1350:35, 1350:40, 1350:46, 1351:9, 1351:13 challenge [1] - 1177:7 challenging [1] - 1203:46 chamber [1] - 1243:28 chambers [1] - 1273:46 chance [5] - 1309:27, 1318:45, 1319:13, 1319:14, 1343:29 change [28] - 1171:41, 1171:43, 1174:3, 1179:2, 1183:21, 1185:8, 1221:14, 1238:30, 1238:43, 1239:7, 1240:18, 1251:1, 1254:28, 1275:4, 1280:18, 1293:22, 1295:27, 1300:33, 1309:17, 1309:19, 1311:46, 1320:14, 1322:43, 1324:2, 1326:26, 1344:9 changed [9] - 1173:39, 1275:8, 1275:11, 1296:11, 1315:23, 1328:7, 1335:27, 1346:34, 1346:35 changes [8] - 1183:17, 1296:27, 1296:36, 1296:43, 1297:17, 1305:15, 1305:23, 1314:47 changing [3] - 1255:32, 1315:18, 1345:45 channel [24] - 1178:15, 1178:16, 1178:18, 1178:21, 1178:23, 1179:5, 1230:17, 1230:19, 1239:33, 1240:5, 1249:16, 1252:1, 1253:8, 1277:2, 1278:25, 1278:26, 1278:40, 1278:41, 1279:30, 1280:5, 1280:18, 1280:22, 1281:17 channelised [1] - 1177:29</p>
C				
<p>CA69 [2] - 1350:47, 1351:2 CA77 [1] - 1186:19 CA78 [1] - 1227:11 cage [1] - 1201:43 calcareous [1] - 1305:36 calcium [6] - 1303:14, 1304:4, 1306:18, 1309:1, 1309:44, 1313:35 calcs [1] - 1295:36 calculated [8] - 1231:4, 1254:32, 1255:19, 1258:20, 1259:6, 1286:32, 1292:34, 1325:31 calculating [1] - 1291:13 calculation [11] - 1242:26, 1253:38, 1254:38, 1260:31, 1264:6, 1287:18, 1292:39, 1295:29, 1323:16, 1343:46 calculations [25] -</p>				

<p>channelises [1] - 1247:27</p> <p>channels [9] - 1178:14, 1247:39, 1276:18, 1277:14, 1277:45, 1278:7, 1278:20, 1278:22, 1279:46</p> <p>chap [1] - 1194:21</p> <p>characteristic [1] - 1253:39</p> <p>characteristics [1] - 1257:18</p> <p>Charlesworth [18] - 1231:25, 1257:14, 1257:31, 1257:46, 1273:29, 1273:31, 1274:2, 1317:32, 1323:32, 1323:33, 1323:39, 1329:14, 1329:30, 1329:38, 1330:6, 1331:5, 1332:16, 1340:5</p> <p>chart [12] - 1216:18, 1216:20, 1228:44, 1231:37, 1237:27, 1247:5, 1249:14, 1249:30, 1254:5, 1320:26, 1320:28, 1331:39</p> <p>charter [1] - 1237:28</p> <p>charts [2] - 1189:10, 1237:26</p> <p>chase [2] - 1277:19, 1316:2</p> <p>check [11] - 1203:2, 1203:11, 1203:41, 1255:41, 1263:28, 1263:31, 1282:46, 1343:17, 1345:42, 1350:46</p> <p>chemical [20] - 1225:47, 1281:33, 1281:34, 1281:41, 1303:19, 1304:2, 1305:23, 1306:3, 1306:26, 1306:32, 1306:34, 1309:26, 1311:2, 1311:3, 1316:5, 1317:9, 1317:15, 1334:21, 1343:41, 1350:1</p> <p>chemically [1] - 1313:38</p> <p>chemicals [1] - 1303:30</p> <p>chemistry [18] - 1205:38, 1205:43, 1251:39, 1276:15, 1300:40, 1305:15,</p>	<p>1306:35, 1306:43, 1310:1, 1314:25, 1325:47, 1333:25, 1333:26, 1333:29, 1335:19, 1338:10, 1349:42, 1350:20</p> <p>chemistry's [1] - 1318:31</p> <p>children [1] - 1300:30</p> <p>chloride [29] - 1303:30, 1303:32, 1304:14, 1309:7, 1309:9, 1309:11, 1309:12, 1309:15, 1309:17, 1309:21, 1309:28, 1309:34, 1309:42, 1313:35, 1320:15, 1322:44, 1323:5, 1323:7, 1324:17, 1324:18, 1324:22, 1324:32, 1325:31, 1328:18, 1328:20, 1333:40, 1339:38, 1340:7, 1343:40</p> <p>chlorine [1] - 1309:6</p> <p>choices [2] - 1248:20, 1262:38</p> <p>choose [1] - 1223:44</p> <p>chose [1] - 1313:19</p> <p>chosen [1] - 1221:4</p> <p>Chris [3] - 1306:38, 1340:37, 1341:35</p> <p>CHRISTOPHER [1] - 1168:27</p> <p>chronology [2] - 1216:12, 1216:32</p> <p>chuck [1] - 1315:18</p> <p>chunk [1] - 1174:35</p> <p>chuntering [1] - 1348:17</p> <p>chunters [1] - 1234:20</p> <p>circumstance [1] - 1337:44</p> <p>circumstances [3] - 1198:43, 1199:15, 1200:19</p> <p>CivilTest [1] - 1292:46</p> <p>clarification [1] - 1319:32</p> <p>clarify [4] - 1222:20, 1290:19, 1294:30, 1342:5</p> <p>classify [1] - 1184:19</p> <p>clay [5] - 1171:14, 1174:35, 1248:24, 1310:43, 1311:28</p> <p>clear [13] - 1171:46, 1174:28, 1178:13, 1179:32, 1185:46,</p>	<p>1188:45, 1192:31, 1207:15, 1216:36, 1233:18, 1257:11, 1275:46, 1287:22</p> <p>clearance [1] - 1198:30</p> <p>clearer [1] - 1174:43</p> <p>clearly [7] - 1176:3, 1183:18, 1198:20, 1218:3, 1284:1, 1313:1, 1328:35</p> <p>click [1] - 1209:40</p> <p>client's [1] - 1168:19</p> <p>clients [2] - 1203:46, 1203:47</p> <p>close [9] - 1185:6, 1192:5, 1194:34, 1215:23, 1221:14, 1226:37, 1255:4, 1328:13, 1337:47</p> <p>closer [1] - 1335:19</p> <p>closest [2] - 1215:38, 1231:22</p> <p>CM [1] - 1301:20</p> <p>coarser [1] - 1245:5</p> <p>coastline [1] - 1279:29</p> <p>Coburn [43] - 1177:5, 1208:17, 1212:36, 1218:16, 1250:45, 1257:14, 1257:19, 1257:28, 1257:31, 1257:36, 1257:37, 1257:46, 1258:16, 1265:46, 1266:28, 1267:22, 1270:37, 1270:44, 1271:3, 1271:15, 1274:2, 1274:4, 1274:34, 1280:9, 1286:45, 1288:26, 1323:33, 1324:46, 1325:3, 1325:7, 1329:17, 1329:27, 1329:30, 1330:5, 1331:5, 1332:15, 1337:26, 1337:32, 1338:46, 1339:5, 1339:14, 1339:16, 1341:3</p> <p>coincidence [1] - 1338:1</p> <p>colleague [2] - 1227:1, 1316:25</p> <p>colleagues [3] - 1335:27, 1349:20, 1349:47</p> <p>collected [1] - 1262:14</p> <p>collodial [1] - 1315:41</p> <p>colluvial [9] - 1178:21,</p>	<p>1211:40, 1212:15, 1247:39, 1249:16, 1252:1, 1253:8, 1347:9, 1347:26</p> <p>colluvium [20] - 1176:39, 1177:26, 1177:29, 1178:17, 1206:25, 1212:9, 1212:19, 1222:12, 1222:22, 1224:47, 1250:4, 1250:14, 1250:31, 1251:11, 1262:5, 1276:47, 1277:2, 1312:4, 1317:1, 1335:10</p> <p>coloured [1] - 1173:17</p> <p>colourful [1] - 1232:37</p> <p>column [25] - 1216:18, 1216:31, 1228:47, 1241:29, 1241:41, 1311:24, 1312:44, 1313:7, 1313:13, 1313:17, 1313:25, 1313:41, 1314:3, 1314:21, 1314:23, 1314:37, 1314:38, 1314:47, 1315:5, 1315:23, 1315:28, 1315:37, 1332:23, 1339:34, 1340:4</p> <p>columns [3] - 1216:17, 1314:8, 1314:28</p> <p>combination [4] - 1224:45, 1225:8, 1225:15, 1288:22</p> <p>combined [2] - 1318:32, 1333:25</p> <p>comfort [1] - 1327:36</p> <p>comfortable [3] - 1208:9, 1293:1, 1294:3</p> <p>comfortably [1] - 1178:38</p> <p>coming [34] - 1179:17, 1183:20, 1191:24, 1218:11, 1218:14, 1221:20, 1221:38, 1221:43, 1223:30, 1226:28, 1226:30, 1242:27, 1243:29, 1243:41, 1264:47, 1268:38, 1269:45, 1285:47, 1291:7, 1299:12, 1305:40, 1313:24, 1318:34, 1330:30, 1331:44, 1335:31, 1335:36, 1341:20, 1341:29, 1343:10, 1345:44,</p>	<p>1348:27, 1348:37, 1351:14</p> <p>comment [22] - 1169:36, 1172:13, 1177:22, 1177:45, 1179:15, 1198:42, 1206:7, 1206:34, 1211:30, 1221:28, 1226:22, 1245:14, 1249:40, 1254:19, 1255:25, 1293:39, 1295:2, 1299:5, 1306:38, 1308:40, 1310:19, 1312:34</p> <p>comments [10] - 1209:43, 1210:2, 1210:3, 1263:21, 1263:26, 1263:41, 1271:35, 1301:12, 1342:6</p> <p>commission [1] - 1187:27</p> <p>common [5] - 1170:6, 1170:10, 1170:14, 1254:29, 1305:30</p> <p>commonly [2] - 1189:11, 1311:3</p> <p>commonsense [2] - 1337:43, 1338:6</p> <p>communicating [1] - 1214:36</p> <p>communication [1] - 1227:27</p> <p>community [7] - 1179:41, 1179:43, 1217:37, 1218:15, 1259:2, 1271:13</p> <p>compact [1] - 1250:38</p> <p>compacted [4] - 1234:1, 1251:1, 1314:9</p> <p>compaction [2] - 1179:4, 1250:42</p> <p>company [1] - 1301:20</p> <p>comparable [3] - 1339:6, 1339:13, 1340:12</p> <p>compare [1] - 1339:28</p> <p>compared [6] - 1172:36, 1173:38, 1179:4, 1234:4, 1309:11, 1347:18</p> <p>comparing [5] - 1191:43, 1304:41, 1304:45, 1304:47</p> <p>comparison [1] - 1171:37</p> <p>competent [1] - 1181:29</p>
---	---	--	---	--

<p>complete [1] - 1303:23</p> <p>completely [1] - 1278:39</p> <p>complex [2] - 1267:13, 1333:11</p> <p>complexities [1] - 1333:9</p> <p>complexity [2] - 1271:7, 1314:43</p> <p>complicated [3] - 1181:42, 1267:15, 1331:45</p> <p>complied [1] - 1198:22</p> <p>complying [2] - 1199:12, 1199:13</p> <p>component [1] - 1303:28</p> <p>components [2] - 1306:13, 1310:42</p> <p>composition [4] - 1281:41, 1304:42, 1305:23, 1309:18</p> <p>compression [1] - 1191:26</p> <p>comprised [1] - 1173:31</p> <p>computations [1] - 1288:21</p> <p>compute [1] - 1229:33</p> <p>concentrate [1] - 1330:10</p> <p>concentration [6] - 1311:20, 1323:5, 1324:32, 1328:18, 1343:33, 1343:43</p> <p>concentrations [4] - 1309:34, 1310:35, 1310:37, 1310:38</p> <p>concept [4] - 1187:25, 1189:6, 1202:28, 1324:13</p> <p>conceptually [1] - 1234:35</p> <p>concern [2] - 1209:17, 1298:15</p> <p>concerned [1] - 1331:20</p> <p>concerning [6] - 1169:6, 1169:7, 1209:23, 1227:2, 1300:39, 1303:3</p> <p>concerns [7] - 1192:38, 1211:38, 1222:5, 1251:26, 1298:41, 1328:17, 1328:27</p> <p>concessions [1] - 1346:27</p>	<p>conclave [19] - 1171:7, 1172:23, 1176:45, 1179:34, 1190:20, 1193:25, 1195:3, 1204:36, 1205:18, 1210:20, 1220:6, 1220:12, 1264:45, 1272:16, 1292:37, 1293:39, 1305:28, 1335:23</p> <p>conclude [4] - 1177:16, 1224:2, 1224:4, 1316:4</p> <p>concluded [5] - 1224:15, 1318:28, 1325:14, 1333:47, 1345:35</p> <p>conclusion [27] - 1189:44, 1190:29, 1192:11, 1202:36, 1217:43, 1229:2, 1242:14, 1253:36, 1259:44, 1261:17, 1261:24, 1269:44, 1316:4, 1316:23, 1316:31, 1316:40, 1317:7, 1317:15, 1333:22, 1333:23, 1333:27, 1335:13, 1337:19, 1338:12, 1343:16, 1343:30, 1344:3</p> <p>conclusions [13] - 1175:6, 1175:12, 1175:22, 1221:29, 1230:1, 1235:29, 1246:3, 1251:22, 1253:22, 1303:10, 1311:35, 1315:31, 1349:46</p> <p>conclusive [3] - 1307:41, 1309:45, 1311:16</p> <p>conclusively [1] - 1310:39</p> <p>concrete [3] - 1181:21, 1201:41, 1266:33</p> <p>condition [8] - 1295:22, 1295:26, 1295:28, 1296:33, 1314:29, 1314:31, 1314:33, 1315:2</p> <p>conditions [3] - 1292:11, 1315:35, 1328:24</p> <p>conducted [5] - 1267:41, 1311:24, 1314:19, 1314:23, 1325:4</p>	<p>conducting [1] - 1314:33</p> <p>conductive [1] - 1238:11</p> <p>conductivity [11] - 1252:27, 1303:15, 1304:34, 1307:46, 1310:13, 1320:15, 1322:44, 1324:17, 1324:18, 1324:21, 1343:33</p> <p>conduit [1] - 1264:35</p> <p>confidence [30] - 1172:2, 1172:8, 1174:25, 1175:2, 1180:10, 1180:12, 1180:13, 1180:16, 1195:38, 1197:5, 1210:28, 1210:39, 1210:40, 1219:35, 1222:9, 1255:43, 1256:5, 1271:33, 1275:44, 1307:19, 1317:7, 1317:10, 1317:16, 1317:27, 1318:31, 1318:35, 1333:26, 1333:29, 1334:13, 1334:15</p> <p>confident [6] - 1174:42, 1193:9, 1242:13, 1277:19, 1298:4, 1307:24</p> <p>confirm [1] - 1291:37</p> <p>confirmed [2] - 1251:40, 1291:1</p> <p>confirming [1] - 1264:20</p> <p>confusing [2] - 1196:5, 1207:10</p> <p>conjure [1] - 1191:30</p> <p>connected [6] - 1184:22, 1217:8, 1217:24, 1278:42, 1286:15, 1341:8</p> <p>connection [5] - 1172:14, 1184:45, 1209:44, 1299:6, 1310:46</p> <p>connectivity [3] - 1245:4, 1284:3, 1284:4</p> <p>connects [1] - 1257:35</p> <p>Connell's [1] - 1280:11</p> <p>conscious [5] - 1299:46, 1325:36, 1326:12, 1327:7, 1327:13</p> <p>consensus [1] -</p>	<p>1210:19</p> <p>conservative [4] - 1263:18, 1309:13, 1311:39, 1311:41</p> <p>consider [30] - 1169:10, 1169:16, 1178:22, 1184:5, 1186:47, 1197:5, 1203:42, 1220:7, 1224:22, 1224:41, 1226:10, 1231:4, 1238:23, 1239:17, 1249:40, 1250:24, 1250:27, 1256:19, 1263:17, 1296:43, 1303:28, 1303:31, 1303:40, 1304:15, 1306:24, 1307:22, 1312:36, 1314:42, 1316:47, 1322:40</p> <p>considerable [1] - 1351:15</p> <p>considerably [1] - 1234:27</p> <p>consideration [4] - 1190:22, 1203:29, 1255:26, 1265:9</p> <p>considered [15] - 1169:24, 1169:36, 1189:30, 1190:18, 1200:8, 1200:11, 1200:13, 1200:17, 1220:11, 1304:1, 1306:42, 1309:12, 1316:24, 1322:43, 1347:18</p> <p>considering [10] - 1209:26, 1210:4, 1229:18, 1250:23, 1259:45, 1305:21, 1316:24, 1316:29, 1316:45, 1340:18</p> <p>consistency [2] - 1179:4, 1245:4</p> <p>consistent [18] - 1228:11, 1240:35, 1246:11, 1268:20, 1268:38, 1307:31, 1308:43, 1308:45, 1313:36, 1314:13, 1315:44, 1316:7, 1316:8, 1316:9, 1324:35, 1341:19, 1343:9</p> <p>consistently [1] - 1333:7</p> <p>constant [9] - 1206:43, 1206:44, 1207:6, 1208:19, 1208:23, 1220:2,</p>	<p>1239:46, 1241:19, 1252:44</p> <p>constantly [1] - 1336:16</p> <p>constructed [3] - 1190:37, 1296:14, 1296:15</p> <p>construction [7] - 1170:34, 1192:39, 1195:7, 1200:3, 1292:43, 1296:15, 1296:27</p> <p>construction's [1] - 1200:13</p> <p>constructions [1] - 1192:39</p> <p>contact [2] - 1306:10, 1314:4</p> <p>contacted [1] - 1285:3</p> <p>contain [3] - 1172:37, 1173:27, 1305:37</p> <p>contained [1] - 1321:14</p> <p>containing [2] - 1174:4, 1212:19</p> <p>contains [1] - 1173:25</p> <p>content [4] - 1207:25, 1254:28, 1293:21, 1347:10</p> <p>contention [1] - 1168:45</p> <p>contested [1] - 1229:47</p> <p>context [3] - 1210:29, 1312:27, 1312:29</p> <p>continue [4] - 1248:21, 1292:23, 1332:5, 1349:36</p> <p>continues [1] - 1324:8</p> <p>CONTINUING [8] - 1168:25, 1168:27, 1168:29, 1168:31, 1168:33, 1168:35, 1168:37, 1168:39</p> <p>continuing [3] - 1270:44, 1295:11, 1331:2</p> <p>continuous [1] - 1276:46</p> <p>contour [5] - 1173:37, 1174:8, 1174:9, 1174:10, 1277:7</p> <p>contrary [4] - 1250:19, 1250:22, 1269:29, 1269:33</p> <p>contribute [6] - 1269:47, 1303:14, 1306:42, 1311:22, 1316:28, 1347:8</p> <p>contributed [5] -</p>
---	---	--	--	---

<p>1224:20, 1264:25, 1275:45, 1304:39, 1310:40</p> <p>contributing [2] - 1172:1, 1333:36</p> <p>contribution [5] - 1180:10, 1264:15, 1316:35, 1335:21, 1335:37</p> <p>control [1] - 1304:27</p> <p>controls [22] - 1197:1, 1197:4, 1197:6, 1197:33, 1197:35, 1197:38, 1197:40, 1197:43, 1198:8, 1198:13, 1198:22, 1198:26, 1198:28, 1199:13, 1199:24, 1199:31, 1200:28, 1200:36, 1200:45, 1201:4, 1201:16, 1201:18</p> <p>convenience [2] - 1327:6, 1327:8</p> <p>convenient [3] - 1204:5, 1234:30, 1271:36</p> <p>conventional [1] - 1271:20</p> <p>conversation [1] - 1178:9</p> <p>convey [1] - 1295:19</p> <p>conveyed [1] - 1178:22</p> <p>convinced [4] - 1174:37, 1174:40, 1192:37, 1225:46</p> <p>convincing [1] - 1171:8</p> <p>cooler [2] - 1342:45, 1342:47</p> <p>Cooper [2] - 1244:31, 1244:33</p> <p>Cooper's [1] - 1244:40</p> <p>copy [1] - 1289:1</p> <p>core [1] - 1323:20</p> <p>corner [10] - 1211:37, 1212:13, 1257:28, 1257:31, 1257:37, 1257:46, 1270:30, 1270:37, 1271:14, 1271:18</p> <p>Corporation [1] - 1167:42</p> <p>correct [121] - 1169:11, 1169:39, 1169:44, 1169:46, 1170:5, 1176:31, 1176:44, 1178:2, 1180:28, 1180:40,</p>	<p>1182:13, 1182:39, 1184:43, 1186:33, 1186:38, 1190:14, 1197:18, 1202:40, 1205:21, 1206:1, 1208:42, 1209:27, 1211:43, 1212:15, 1212:23, 1213:28, 1213:44, 1214:8, 1214:12, 1214:17, 1214:42, 1215:2, 1215:25, 1215:41, 1221:40, 1221:45, 1222:4, 1222:26, 1223:8, 1224:13, 1224:33, 1224:42, 1225:23, 1226:17, 1227:31, 1228:39, 1230:2, 1231:45, 1231:47, 1232:22, 1233:25, 1235:34, 1237:8, 1237:35, 1238:35, 1241:9, 1241:35, 1246:16, 1246:47, 1247:9, 1247:15, 1251:34, 1253:18, 1254:7, 1254:9, 1254:33, 1255:43, 1258:35, 1260:3, 1260:11, 1261:46, 1264:37, 1265:8, 1265:33, 1265:35, 1266:34, 1268:2, 1270:33, 1270:46, 1271:4, 1272:33, 1272:39, 1277:18, 1282:6, 1282:8, 1282:14, 1282:17, 1282:32, 1282:41, 1283:10, 1283:12, 1283:18, 1283:23, 1283:25, 1283:30, 1283:32, 1284:21, 1284:23, 1284:35, 1288:39, 1289:21, 1289:44, 1298:36, 1298:42, 1299:32, 1300:44, 1300:46, 1303:17, 1303:23, 1306:38, 1309:37, 1311:7, 1312:46, 1316:23, 1322:42, 1329:4, 1330:29, 1337:30, 1341:4, 1341:14, 1343:26</p> <p>corrected [2] - 1296:13, 1336:6</p> <p>correctly [4] - 1289:42, 1292:18, 1314:10, 1323:39</p>	<p>correlate [2] - 1193:13, 1243:46</p> <p>correspond [2] - 1266:25, 1266:26</p> <p>Costello [16] - 1167:32, 1168:1, 1168:21, 1185:19, 1194:24, 1227:16, 1264:14, 1294:41, 1295:36, 1300:25, 1325:33, 1326:46, 1327:45, 1331:10, 1334:11, 1345:23</p> <p>COSTELLO [506] - 1168:3, 1168:7, 1168:23, 1168:41, 1168:43, 1169:3, 1169:16, 1169:21, 1169:26, 1169:30, 1169:34, 1169:41, 1170:1, 1170:10, 1170:16, 1170:24, 1170:28, 1170:45, 1171:4, 1171:12, 1171:19, 1171:25, 1171:46, 1172:6, 1172:12, 1172:22, 1172:31, 1172:41, 1172:46, 1173:3, 1173:10, 1173:20, 1174:7, 1174:17, 1174:40, 1174:45, 1175:14, 1175:20, 1175:32, 1175:36, 1175:41, 1175:46, 1176:3, 1176:25, 1176:29, 1176:41, 1177:16, 1177:21, 1177:40, 1177:44, 1178:8, 1178:28, 1178:44, 1179:7, 1179:25, 1179:39, 1179:46, 1180:6, 1180:30, 1180:36, 1180:42, 1180:47, 1181:6, 1181:14, 1181:47, 1182:9, 1182:15, 1182:22, 1182:28, 1182:34, 1182:43, 1182:47, 1183:26, 1183:35, 1183:40, 1183:45, 1184:2, 1184:8, 1184:13, 1184:18, 1184:25, 1184:34, 1184:41, 1184:45, 1185:3, 1185:22, 1185:27, 1185:33, 1185:40, 1185:45, 1186:3, 1186:8, 1186:12, 1186:17,</p>	<p>1186:24, 1186:31, 1186:35, 1186:40, 1186:44, 1187:7, 1187:16, 1187:24, 1187:36, 1187:40, 1187:47, 1188:7, 1188:13, 1188:17, 1188:22, 1188:28, 1188:36, 1189:5, 1189:13, 1189:23, 1189:27, 1189:39, 1189:44, 1190:4, 1190:11, 1190:16, 1190:27, 1190:33, 1192:14, 1192:18, 1192:27, 1192:31, 1192:42, 1193:3, 1193:27, 1193:33, 1193:37, 1193:41, 1193:45, 1194:4, 1194:11, 1194:19, 1194:26, 1194:31, 1195:25, 1195:31, 1195:37, 1195:45, 1196:7, 1196:12, 1196:38, 1201:28, 1201:30, 1201:38, 1201:45, 1202:4, 1202:10, 1202:16, 1202:20, 1202:34, 1202:42, 1203:5, 1203:14, 1203:20, 1203:26, 1203:36, 1204:4, 1204:13, 1204:21, 1204:33, 1204:40, 1204:45, 1205:5, 1205:9, 1205:17, 1205:23, 1205:30, 1206:28, 1206:40, 1207:4, 1207:15, 1207:22, 1207:32, 1207:42, 1207:47, 1208:5, 1208:9, 1208:35, 1208:40, 1208:44, 1209:1, 1209:8, 1209:12, 1209:32, 1210:1, 1210:14, 1210:19, 1210:24, 1211:1, 1211:12, 1211:29, 1211:45, 1212:6, 1212:11, 1212:21, 1212:25, 1212:34, 1212:43, 1213:14, 1213:22, 1213:30, 1213:34, 1213:38, 1213:42, 1214:1, 1214:6, 1214:10, 1214:14, 1214:19, 1214:38, 1214:44, 1215:4,</p>	<p>1215:13, 1215:19, 1215:27, 1215:36, 1215:43, 1216:3, 1216:23, 1216:27, 1216:35, 1216:43, 1217:8, 1217:13, 1217:19, 1217:23, 1217:29, 1218:20, 1218:26, 1218:36, 1218:41, 1218:46, 1219:6, 1219:13, 1219:18, 1219:23, 1219:38, 1220:5, 1220:16, 1220:28, 1220:38, 1220:44, 1221:3, 1221:24, 1221:28, 1221:34, 1221:42, 1221:47, 1222:11, 1222:16, 1222:24, 1222:28, 1223:2, 1223:13, 1223:21, 1223:35, 1223:40, 1223:44, 1224:2, 1224:10, 1224:15, 1224:22, 1224:32, 1224:39, 1225:3, 1225:8, 1225:19, 1225:25, 1225:32, 1225:39, 1225:45, 1226:8, 1226:20, 1226:24, 1226:30, 1226:34, 1226:46, 1294:43, 1294:45, 1295:34, 1295:46, 1296:6, 1296:21, 1296:31, 1296:42, 1297:3, 1297:8, 1297:15, 1297:35, 1297:40, 1297:45, 1298:13, 1298:31, 1298:35, 1298:40, 1298:46, 1299:4, 1299:15, 1299:24, 1299:28, 1299:34, 1299:46, 1300:7, 1300:14, 1300:27, 1300:32, 1301:1, 1301:6, 1301:10, 1301:14, 1301:18, 1301:22, 1301:29, 1301:37, 1301:42, 1301:47, 1302:5, 1302:11, 1302:20, 1302:25, 1302:29, 1302:35, 1302:42, 1303:1, 1303:7, 1303:19, 1303:25, 1303:35, 1303:42, 1304:9, 1304:21, 1304:29, 1304:44, 1305:6,</p>
--	---	--	---	--

<p>1305:13, 1305:20, 1305:30, 1305:40, 1305:47, 1306:15, 1306:29, 1306:45, 1307:9, 1307:13, 1307:35, 1308:2, 1308:10, 1308:20, 1308:25, 1308:34, 1308:39, 1309:6, 1309:11, 1309:31, 1309:39, 1310:3, 1310:9, 1310:17, 1310:24, 1310:28, 1310:33, 1311:13, 1311:31, 1311:41, 1312:11, 1312:18, 1312:24, 1312:29, 1312:42, 1313:1, 1313:6, 1313:12, 1313:27, 1313:34, 1313:44, 1314:15, 1315:4, 1315:11, 1315:15, 1315:28, 1316:2, 1316:15, 1316:34, 1316:40, 1317:5, 1317:14, 1317:20, 1317:26, 1317:37, 1317:42, 1318:4, 1318:12, 1318:17, 1318:25, 1318:39, 1319:5, 1319:10, 1319:19, 1319:23, 1319:27, 1319:38, 1319:45, 1320:3, 1320:7, 1320:11, 1320:21, 1320:25, 1320:30, 1320:35, 1320:40, 1320:46, 1321:3, 1321:27, 1321:36, 1321:45, 1322:3, 1322:7, 1322:13, 1322:17, 1322:22, 1322:26, 1322:31, 1323:14, 1323:26, 1324:43, 1325:1, 1325:11, 1325:20, 1325:26, 1325:36, 1325:41, 1326:9, 1326:15, 1326:21, 1327:1, 1327:6, 1328:1, 1328:9, 1328:13, 1328:26, 1328:33, 1328:39, 1329:2, 1329:7, 1329:14, 1329:22, 1329:26, 1329:36, 1329:42, 1330:4, 1330:10, 1330:15, 1330:19, 1330:23, 1330:36, 1330:43,</p>	<p>1330:47, 1331:20, 1331:26, 1331:32, 1331:37, 1332:4, 1332:10, 1332:15, 1332:21, 1332:32, 1332:36, 1332:42, 1332:47, 1333:7, 1333:11, 1333:16, 1333:47, 1334:5, 1334:9, 1334:15, 1334:19, 1334:28, 1334:35, 1334:43, 1335:2, 1335:12, 1335:25, 1335:40, 1336:5, 1336:12, 1336:16, 1336:22, 1336:37, 1337:8, 1337:15, 1337:21, 1337:32, 1337:39, 1338:15, 1345:28, 1345:33, 1345:38, 1350:44, 1351:2, 1351:6, 1351:11 council [1] - 1179:42 Council [2] - 1167:39, 1268:16 counsel [5] - 1196:39, 1290:32, 1290:33, 1295:1, 1351:20 Counsel [1] - 1167:32 Country [1] - 1250:41 couple [17] - 1174:34, 1183:11, 1208:24, 1280:44, 1300:40, 1302:44, 1308:40, 1311:44, 1314:32, 1326:34, 1338:29, 1338:35, 1346:4, 1346:19, 1347:1, 1348:2, 1348:11 course [35] - 1169:36, 1170:16, 1172:41, 1174:2, 1185:8, 1190:20, 1199:43, 1205:41, 1209:32, 1213:30, 1219:38, 1220:5, 1226:3, 1229:8, 1232:23, 1236:38, 1244:1, 1259:26, 1264:42, 1272:27, 1274:39, 1277:5, 1279:28, 1302:43, 1303:36, 1305:21, 1317:42, 1318:41, 1325:13, 1334:20, 1336:17, 1346:28, 1350:6, 1350:24, 1351:16 court [1] - 1300:35 Court [1] - 1167:17</p>	<p>covered [2] - 1238:6, 1292:10 covering [1] - 1240:7 crack [12] - 1181:18, 1187:33, 1187:44, 1188:8, 1188:23, 1188:30, 1191:18, 1191:19, 1191:23, 1191:25, 1191:28, 1191:31 cracked [1] - 1184:5 cracking [2] - 1189:1, 1195:18 cracks [3] - 1183:18, 1183:21, 1188:42 create [8] - 1229:24, 1237:3, 1239:30, 1240:28, 1294:20, 1298:8, 1345:8, 1347:38 created [8] - 1174:10, 1194:47, 1230:30, 1256:25, 1289:16, 1294:24, 1341:2, 1348:11 creates [1] - 1171:26 creating [1] - 1347:43 credible [7] - 1272:19, 1272:29, 1272:32, 1278:1, 1278:2, 1281:22, 1281:23 creek [2] - 1218:18, 1324:46 Creek [8] - 1177:5, 1218:16, 1249:20, 1249:23, 1250:45, 1324:46, 1325:3, 1325:7 crew [1] - 1325:4 critical [2] - 1226:10, 1293:7 criticism [1] - 1277:31 crook [1] - 1216:27 Crook [1] - 1216:29 CROSS [1] - 1259:28 cross [7] - 1176:29, 1178:32, 1179:1, 1183:7, 1259:24, 1296:47, 1297:22 CROSS- EXAMINATION [1] - 1259:28 cross-examine [1] - 1259:24 cross-section [5] - 1176:29, 1178:32, 1179:1, 1296:47, 1297:22 cross-sections [1] - 1183:7</p>	<p>crossed [1] - 1178:20 crosses [1] - 1202:1 crow [1] - 1234:9 crudely [1] - 1202:27 cruel [1] - 1349:20 cubic [13] - 1179:15, 1191:44, 1191:46, 1192:2, 1192:3, 1293:10, 1293:25, 1295:15, 1296:4, 1298:22, 1298:27 culminates [1] - 1213:12 cumulative [5] - 1228:19, 1228:21, 1228:36, 1237:28 current [3] - 1173:38, 1296:12, 1304:37 curve [1] - 1263:37 cut [3] - 1242:2, 1277:18, 1316:2 cute [1] - 1176:23 cutely [1] - 1176:23 cutoff [1] - 1271:20 cycling [1] - 1320:30</p>	<p>1321:25, 1321:27, 1321:33, 1321:45, 1322:34, 1322:37, 1324:5, 1324:11, 1324:28, 1324:30, 1325:22, 1328:21, 1328:27, 1328:41, 1328:43, 1329:5, 1331:20, 1331:21, 1338:10, 1340:42, 1341:1, 1341:13, 1341:19, 1341:20, 1341:26, 1343:37, 1344:6, 1344:9 data's [1] - 1340:18 dataroom [1] - 1255:46 date [10] - 1186:15, 1228:9, 1244:41, 1255:31, 1268:31, 1285:19, 1287:11, 1297:17, 1329:34 dated [2] - 1186:15, 1186:19 DATED [1] - 1186:21 dates [4] - 1195:42, 1219:34, 1269:9, 1324:23 DAVID [1] - 1168:31 David [3] - 1176:27, 1281:9, 1302:8 days [48] - 1188:3, 1217:38, 1218:31, 1242:16, 1244:11, 1244:18, 1245:16, 1251:27, 1251:30, 1251:41, 1251:43, 1253:4, 1253:8, 1254:5, 1254:11, 1254:12, 1254:46, 1255:18, 1255:27, 1256:45, 1257:2, 1258:6, 1258:18, 1258:24, 1259:12, 1281:4, 1281:13, 1286:33, 1287:5, 1287:7, 1287:9, 1287:44, 1288:3, 1288:32, 1292:24, 1292:25, 1302:44, 1314:33, 1314:34, 1324:25, 1346:19, 1348:11, 1348:30, 1349:25, 1349:26, 1351:18 deal [6] - 1168:44, 1182:19, 1205:40, 1228:28, 1234:23, 1292:40 dealing [3] - 1197:1,</p>
--	--	---	--	---

<p>1235:4, 1259:36 deals [1] - 1235:6 dealt [3] - 1169:35, 1264:17, 1264:18 debate [2] - 1180:42, 1212:47 December [16] - 1224:27, 1237:17, 1237:24, 1237:31, 1243:27, 1243:39, 1244:34, 1244:35, 1244:45, 1246:18, 1275:9, 1275:34, 1295:7, 1322:40, 1329:39, 1348:20 decent [1] - 1294:1 decide [1] - 1272:15 decisive [2] - 1296:22, 1303:36 decrease [1] - 1204:27 decreased [3] - 1269:43, 1291:23, 1291:24 deducts [1] - 1228:47 deep [20] - 1174:26, 1179:43, 1192:37, 1193:9, 1202:5, 1202:8, 1206:11, 1206:22, 1209:26, 1210:5, 1210:7, 1210:10, 1222:42, 1238:19, 1250:8, 1271:13, 1282:46, 1308:4, 1311:19, 1311:20 deeper [5] - 1206:20, 1208:33, 1238:32, 1271:19, 1312:5 defect [4] - 1218:7, 1266:40, 1267:4, 1271:16 defect" [1] - 1266:31 defects [2] - 1265:33, 1265:43 Defer [1] - 1208:7 deficiencies [1] - 1280:27 deficiency [2] - 1280:27, 1281:12 define [1] - 1206:42 defined [2] - 1178:16, 1206:40 definitely [6] - 1194:46, 1217:11, 1246:42, 1250:32, 1279:2, 1291:44 definition [5] - 1170:24, 1206:47, 1207:5, 1207:7 definitions [1] -</p>	<p>1207:34 definitive [1] - 1312:13 definitively [1] - 1337:41 degree [21] - 1172:2, 1172:7, 1172:26, 1175:2, 1180:10, 1180:13, 1180:15, 1195:38, 1210:28, 1210:39, 1210:40, 1306:8, 1307:19, 1317:7, 1317:16, 1317:27, 1333:26, 1333:29, 1334:13, 1334:15 degrees [4] - 1180:12, 1190:45, 1295:23 delay [2] - 1285:5, 1324:14 deliver [2] - 1336:17, 1336:20 demonstrate [1] - 1277:45 demonstrated [1] - 1345:9 dependent [2] - 1192:36, 1280:15 depicted [1] - 1215:8 depicts [2] - 1230:4, 1235:47 deposit [1] - 1237:47 deposited [1] - 1171:29 deposition [2] - 1179:4, 1213:10 deposits [3] - 1177:9, 1237:3, 1305:35 depth [14] - 1192:35, 1192:36, 1193:8, 1193:14, 1237:37, 1238:18, 1238:21, 1239:23, 1240:5, 1242:5, 1245:5, 1245:20, 1280:20, 1289:32 describe [4] - 1216:8, 1230:38, 1248:33, 1330:37 described [7] - 1176:45, 1207:24, 1230:45, 1230:46, 1265:9, 1297:40, 1347:26 describing [1] - 1317:14 description [9] - 1175:41, 1204:29, 1208:31, 1213:7, 1266:29, 1304:24,</p>	<p>1335:3, 1335:7 design [1] - 1202:26 desirable [1] - 1327:19 desktop [1] - 1195:43 desorption [1] - 1315:43 despite [1] - 1346:23 destabilised [1] - 1223:26 destabilises [1] - 1180:30 destabilising [2] - 1182:1, 1223:32 detail [4] - 1211:39, 1212:46, 1265:38, 1267:19 detailed [3] - 1184:21, 1184:25, 1267:5 determine [1] - 1303:42 determined [1] - 1289:43 determines [1] - 1240:11 determining [1] - 1303:21 develop [1] - 1216:11 developed [1] - 1318:27 device [2] - 1307:15, 1307:35 Di [5] - 1167:32, 1205:44, 1227:1, 1327:1, 1327:12 DI [201] - 1227:4, 1227:6, 1227:15, 1227:23, 1227:29, 1227:33, 1227:38, 1227:42, 1228:4, 1228:8, 1228:17, 1228:21, 1228:25, 1228:31, 1228:43, 1229:7, 1229:16, 1229:31, 1229:39, 1229:46, 1230:9, 1230:27, 1230:37, 1230:42, 1231:3, 1231:16, 1231:20, 1231:28, 1231:35, 1232:2, 1232:14, 1232:22, 1232:33, 1232:43, 1233:1, 1233:6, 1233:18, 1233:23, 1233:27, 1233:31, 1233:40, 1234:7, 1234:13, 1234:30, 1235:1, 1235:20, 1235:31, 1235:36, 1235:43,</p>	<p>1236:6, 1236:14, 1236:21, 1236:37, 1237:2, 1237:10, 1237:19, 1237:35, 1238:5, 1238:10, 1238:25, 1238:34, 1238:39, 1238:45, 1239:2, 1239:9, 1239:15, 1239:35, 1239:42, 1240:1, 1240:10, 1240:21, 1240:30, 1240:37, 1241:1, 1241:8, 1241:16, 1241:24, 1241:39, 1242:4, 1242:12, 1242:33, 1242:47, 1243:4, 1243:13, 1243:18, 1243:36, 1243:43, 1244:5, 1244:15, 1244:26, 1244:31, 1244:40, 1245:13, 1245:24, 1245:29, 1245:42, 1245:47, 1246:13, 1246:21, 1246:28, 1246:37, 1246:44, 1247:3, 1247:11, 1247:17, 1247:30, 1247:37, 1248:13, 1248:30, 1248:35, 1248:43, 1249:3, 1249:13, 1249:22, 1249:28, 1249:39, 1250:2, 1250:7, 1250:13, 1250:19, 1250:35, 1251:4, 1251:17, 1251:36, 1251:47, 1252:7, 1252:21, 1252:35, 1252:40, 1252:44, 1253:4, 1253:15, 1253:20, 1253:42, 1254:4, 1254:9, 1254:17, 1254:44, 1255:3, 1255:9, 1255:15, 1255:21, 1255:35, 1255:45, 1256:7, 1256:13, 1256:19, 1256:42, 1257:23, 1257:42, 1258:8, 1258:13, 1258:24, 1258:28, 1258:32, 1258:37, 1258:43, 1259:4, 1259:16, 1264:11, 1264:13, 1264:33, 1264:42, 1264:47, 1265:4, 1265:13, 1265:23, 1265:37, 1265:42, 1266:5, 1266:10,</p>	<p>1266:17, 1266:22, 1266:39, 1266:46, 1267:8, 1267:18, 1267:30, 1267:37, 1267:46, 1268:4, 1268:11, 1268:20, 1268:27, 1268:46, 1269:4, 1269:11, 1269:18, 1269:29, 1269:36, 1270:3, 1270:13, 1270:21, 1270:25, 1270:35, 1270:41, 1271:1, 1271:10, 1271:23, 1271:28, 1271:33 diagram [10] - 1211:6, 1213:6, 1227:7, 1230:3, 1230:4, 1230:15, 1234:7, 1247:18, 1257:24 diameter [6] - 1187:1, 1218:12, 1266:33, 1267:14, 1267:35, 1271:8 die [1] - 1222:8 differ [1] - 1253:22 difference [13] - 1174:5, 1177:25, 1179:3, 1195:6, 1215:16, 1226:26, 1226:42, 1226:43, 1230:23, 1234:3, 1239:3, 1250:10, 1292:41 differences [1] - 1317:40 different [52] - 1172:23, 1190:29, 1202:35, 1202:38, 1203:9, 1203:16, 1204:5, 1206:44, 1207:38, 1214:36, 1215:28, 1231:12, 1234:11, 1241:37, 1248:11, 1253:28, 1253:31, 1268:6, 1272:41, 1294:2, 1304:39, 1304:40, 1305:6, 1305:7, 1306:31, 1306:32, 1306:34, 1306:35, 1307:44, 1308:5, 1308:18, 1309:16, 1309:23, 1309:26, 1309:40, 1309:46, 1314:30, 1314:36, 1314:44, 1314:45, 1314:46, 1317:31, 1318:27, 1320:14, 1322:47, 1324:23,</p>
--	--	--	---	--

<p>1333:17, 1333:31, 1339:28, 1341:39</p> <p>differential [1] - 1297:46</p> <p>differentiate [1] - 1308:7</p> <p>difficult [5] - 1175:27, 1272:1, 1331:45, 1335:16, 1349:5</p> <p>difficulty [2] - 1171:33, 1300:8</p> <p>digits [1] - 1175:37</p> <p>digs [1] - 1174:34</p> <p>dilated [2] - 1183:16</p> <p>dilates [1] - 1183:18</p> <p>diluted [3] - 1312:4, 1330:27, 1335:34</p> <p>dilutes [1] - 1324:20</p> <p>dimensions [1] - 1211:20</p> <p>direct [11] - 1220:30, 1225:26, 1227:27, 1245:26, 1246:37, 1251:43, 1252:1, 1253:12, 1264:17, 1297:23, 1349:22</p> <p>directing [1] - 1259:32</p> <p>direction [6] - 1177:10, 1177:12, 1178:4, 1221:14, 1250:39, 1274:21</p> <p>directly [5] - 1177:35, 1234:4, 1246:30, 1276:29, 1348:1</p> <p>director [1] - 1285:46</p> <p>directs [1] - 1210:36</p> <p>disagree [4] - 1281:46, 1307:21, 1314:15, 1314:18</p> <p>disagreement [4] - 1174:8, 1174:14, 1207:26, 1210:35</p> <p>disagreements [1] - 1207:30</p> <p>discern [1] - 1331:28</p> <p>discerned [1] - 1328:19</p> <p>discharge [2] - 1279:7, 1279:10</p> <p>disciplines [1] - 1317:21</p> <p>disconnect [2] - 1259:1, 1259:5</p> <p>disconnected [1] - 1337:23</p> <p>discuss [2] - 1275:13, 1321:31</p> <p>discussed [6] - 1171:7, 1222:4, 1245:19, 1275:4,</p>	<p>1275:19, 1275:21</p> <p>discussing [4] - 1197:3, 1216:47, 1257:32, 1341:35</p> <p>discussion [7] - 1175:3, 1206:4, 1245:39, 1246:2, 1267:10, 1274:33, 1347:5</p> <p>dispersing [1] - 1330:31</p> <p>displaced [3] - 1192:2, 1193:12, 1266:30</p> <p>displacement [9] - 1188:34, 1189:19, 1191:11, 1191:13, 1266:30, 1266:41, 1267:23, 1267:28, 1267:31</p> <p>disprove [1] - 1284:5</p> <p>dispute [3] - 1211:32, 1272:28, 1277:15</p> <p>disputed [1] - 1293:6</p> <p>disputing [2] - 1177:30, 1177:32</p> <p>disrespectful [1] - 1220:11</p> <p>dissimilar [1] - 1317:45</p> <p>dissipates [1] - 1324:10</p> <p>dissolution [3] - 1306:41, 1308:17, 1309:35</p> <p>dissolve [1] - 1306:9</p> <p>dissolved [4] - 1304:36, 1306:12, 1306:23, 1344:46</p> <p>dissolves [1] - 1324:20</p> <p>distance [11] - 1176:21, 1182:40, 1183:6, 1185:8, 1186:36, 1189:7, 1239:37, 1247:12, 1257:44, 1258:21, 1259:47</p> <p>distinct [1] - 1274:24</p> <p>distinction [1] - 1206:4</p> <p>distorted [1] - 1176:3</p> <p>distortion [1] - 1194:36</p> <p>distribute [2] - 1181:38, 1182:7</p> <p>distributed [1] - 1182:10</p> <p>distributing [2] - 1188:32, 1203:15</p>	<p>distribution [1] - 1189:9</p> <p>disturbance [1] - 1179:31</p> <p>diversion [1] - 1186:24</p> <p>divide [2] - 1252:32, 1253:2</p> <p>divvied [1] - 1259:22</p> <p>document [19] - 1175:36, 1180:21, 1183:27, 1185:12, 1185:17, 1185:25, 1186:15, 1210:25, 1211:34, 1214:20, 1266:23, 1270:4, 1270:26, 1290:22, 1290:24, 1290:28, 1290:33, 1290:34, 1340:1</p> <p>document's [1] - 1180:20</p> <p>documents [2] - 1339:28, 1346:32</p> <p>domestic [5] - 1210:26, 1271:20, 1337:33, 1338:1, 1346:33</p> <p>dominating [1] - 1204:43</p> <p>done [68] - 1177:2, 1184:14, 1184:27, 1198:20, 1200:9, 1200:18, 1202:44, 1209:28, 1215:37, 1217:23, 1217:24, 1217:34, 1218:32, 1218:42, 1219:15, 1219:29, 1231:8, 1231:12, 1240:17, 1240:22, 1240:32, 1241:3, 1241:40, 1242:26, 1242:28, 1243:31, 1252:24, 1252:25, 1255:39, 1256:27, 1256:28, 1256:34, 1261:29, 1261:30, 1261:43, 1267:4, 1267:5, 1287:41, 1290:17, 1296:38, 1299:20, 1307:1, 1307:4, 1307:32, 1313:10, 1313:16, 1313:29, 1315:19, 1315:30, 1317:21, 1321:13, 1323:36, 1323:47, 1331:26, 1331:27, 1332:21, 1334:39, 1339:13, 1341:45,</p>	<p>1347:24, 1348:8, 1348:39, 1348:40, 1349:26, 1351:15, 1351:16</p> <p>door [1] - 1313:8</p> <p>dot [4] - 1173:23, 1215:36, 1215:38, 1257:40</p> <p>double [1] - 1203:5</p> <p>doubt [5] - 1173:25, 1190:18, 1224:33, 1298:36, 1302:11</p> <p>DOUGLAS [1] - 1168:29</p> <p>down [92] - 1171:38, 1175:29, 1176:21, 1176:22, 1176:33, 1179:19, 1181:24, 1181:25, 1181:37, 1181:38, 1182:4, 1182:7, 1183:11, 1187:18, 1191:3, 1191:8, 1191:24, 1192:16, 1203:14, 1203:43, 1209:39, 1209:41, 1209:42, 1212:18, 1212:25, 1212:29, 1212:31, 1212:43, 1215:19, 1216:35, 1218:1, 1218:13, 1218:16, 1219:31, 1221:20, 1222:32, 1222:33, 1222:45, 1223:30, 1224:47, 1225:14, 1225:17, 1232:11, 1236:21, 1243:27, 1244:36, 1245:22, 1246:40, 1247:19, 1247:43, 1248:22, 1248:24, 1249:47, 1250:4, 1251:14, 1252:9, 1257:13, 1257:18, 1257:43, 1258:18, 1264:36, 1265:31, 1267:19, 1270:41, 1270:43, 1270:44, 1271:17, 1278:33, 1279:18, 1280:43, 1287:4, 1288:31, 1289:33, 1298:28, 1310:44, 1323:31, 1326:15, 1330:30, 1332:16, 1332:23, 1335:22, 1336:10, 1337:18, 1345:3, 1345:4, 1348:31</p> <p>downhill [7] - 1187:2, 1188:41, 1248:4,</p>	<p>1274:7, 1281:8, 1287:13, 1295:12</p> <p>downslope [1] - 1249:17</p> <p>downstream [2] - 1237:4, 1309:35</p> <p>downward [1] - 1337:5</p> <p>downwards [1] - 1251:10</p> <p>DPA [1] - 1196:45</p> <p>DPA.0004.0001.0001 [6] - 1211:3, 1213:23, 1247:3, 1253:43, 1268:5, 1340:1</p> <p>DPA.0004.0001.0001 _0106 [1] - 1308:26</p> <p>Dr [30] - 1216:27, 1300:35, 1303:12, 1306:15, 1306:30, 1306:45, 1307:3, 1308:26, 1308:30, 1310:34, 1312:43, 1313:34, 1314:15, 1316:3, 1317:6, 1317:46, 1318:30, 1319:10, 1319:39, 1320:25, 1320:30, 1321:3, 1321:27, 1321:46, 1323:26, 1325:30, 1328:13, 1332:4, 1333:16, 1333:22</p> <p>DR [78] - 1303:17, 1303:23, 1303:27, 1303:40, 1303:46, 1306:20, 1306:38, 1307:7, 1307:11, 1307:21, 1307:43, 1308:4, 1308:32, 1308:37, 1309:4, 1309:9, 1309:15, 1309:37, 1309:44, 1310:7, 1310:12, 1311:7, 1311:18, 1312:34, 1312:46, 1313:4, 1314:17, 1315:9, 1316:13, 1316:23, 1316:38, 1316:45, 1317:9, 1317:18, 1317:24, 1317:30, 1317:39, 1319:12, 1319:21, 1319:25, 1319:31, 1319:42, 1319:47, 1320:5, 1320:9, 1320:13, 1320:23, 1320:28, 1320:33, 1320:38, 1320:44, 1321:1, 1321:5,</p>
---	--	--	---	---

<p>1321:10, 1321:17, 1321:21, 1321:31, 1321:43, 1322:1, 1322:5, 1322:9, 1322:24, 1322:33, 1323:16, 1324:16, 1324:45, 1325:3, 1331:13, 1331:24, 1331:30, 1331:34, 1343:28, 1344:6, 1344:19, 1344:24, 1344:28, 1344:34, 1344:39</p> <p>drafted [2] - 1199:1, 1259:37</p> <p>drain [16] - 1213:18, 1225:21, 1237:13, 1239:36, 1241:12, 1244:36, 1245:31, 1257:20, 1265:16, 1265:18, 1269:45, 1271:20, 1280:43, 1317:1</p> <p>drainage [3] - 1195:1, 1278:16, 1325:8</p> <p>drains [8] - 1208:21, 1213:6, 1220:3, 1250:30, 1264:30, 1264:34, 1288:30, 1297:27</p> <p>draw [8] - 1176:46, 1221:29, 1264:5, 1315:7, 1315:31, 1328:21, 1342:46</p> <p>DRAWING [1] - 1227:13</p> <p>drawing [5] - 1185:24, 1227:11, 1268:23, 1271:25, 1295:24</p> <p>drawings [5] - 1184:21, 1184:25, 1184:29, 1184:31, 1215:17</p> <p>drawn [6] - 1195:26, 1195:27, 1195:32, 1244:11, 1249:10, 1311:35</p> <p>drilling [2] - 1220:21, 1302:2</p> <p>driven [2] - 1196:18, 1196:21</p> <p>driving [4] - 1191:46, 1238:21, 1239:7, 1239:16</p> <p>Dromana [1] - 1271:8</p> <p>Dromana-Portsea [1] - 1271:8</p> <p>drone [1] - 1178:33</p> <p>drop [10] - 1191:42, 1222:35, 1292:6,</p>	<p>1292:12, 1292:13, 1292:21, 1292:26, 1323:46, 1332:23, 1335:35</p> <p>drop-off [1] - 1292:21</p> <p>dropped [2] - 1291:20, 1291:27</p> <p>drove [1] - 1220:22</p> <p>dry [2] - 1222:39, 1325:3</p> <p>due [4] - 1280:19, 1315:40, 1337:3, 1346:28</p> <p>dug [1] - 1256:37</p> <p>dump [1] - 1179:16</p> <p>during [20] - 1172:19, 1193:25, 1194:46, 1195:3, 1195:4, 1195:9, 1195:17, 1219:24, 1220:21, 1237:25, 1237:30, 1269:47, 1275:9, 1275:34, 1279:15, 1292:37, 1302:2, 1306:39, 1324:37, 1328:45</p> <p>Durov [3] - 1334:40, 1335:30, 1343:12</p> <p>dye [34] - 1215:29, 1215:33, 1215:36, 1215:43, 1216:4, 1220:28, 1220:32, 1220:33, 1220:38, 1221:30, 1221:38, 1221:43, 1222:1, 1222:9, 1222:11, 1222:18, 1222:24, 1222:28, 1222:45, 1282:4, 1282:11, 1283:3, 1283:5, 1283:14, 1283:15, 1283:22, 1283:29, 1284:10, 1284:14, 1285:36, 1285:40, 1286:7, 1309:25</p> <p>dye's [1] - 1222:45</p> <p>dyed [1] - 1260:44</p> <p>dyes [1] - 1215:32</p> <p>dynamics [1] - 1296:43</p>	<p>easier [3] - 1232:20, 1252:19, 1339:27</p> <p>easily [1] - 1248:7</p> <p>east [3] - 1217:35, 1247:28, 1342:19</p> <p>East [28] - 1167:41, 1210:42, 1215:7, 1215:17, 1216:15, 1216:25, 1227:26, 1256:38, 1257:24, 1277:19, 1282:30, 1282:39, 1283:23, 1283:29, 1285:4, 1301:31, 1302:11, 1302:15, 1307:5, 1307:32, 1313:19, 1313:23, 1317:32, 1346:8, 1346:18, 1346:23, 1348:41</p> <p>easterly [2] - 1178:4</p> <p>eastern [1] - 1218:11</p> <p>EC [30] - 1281:39, 1308:6, 1308:13, 1308:44, 1323:34, 1323:46, 1328:20, 1329:20, 1329:31, 1330:10, 1330:15, 1330:19, 1331:16, 1332:15, 1339:5, 1339:31, 1340:6, 1340:28, 1341:13, 1341:19, 1341:20, 1342:8, 1342:13, 1342:20, 1342:26, 1342:40, 1343:10, 1343:13, 1344:43, 1345:13</p> <p>edge [5] - 1177:31, 1179:17, 1179:22, 1230:12, 1294:28</p> <p>effect [15] - 1181:28, 1192:10, 1195:22, 1196:21, 1235:9, 1241:29, 1252:35, 1259:9, 1279:24, 1279:31, 1304:23, 1304:35, 1333:24, 1347:15, 1349:21</p> <p>effective [2] - 1181:31</p> <p>effectively [12] - 1230:17, 1230:23, 1230:31, 1232:27, 1232:35, 1233:32, 1233:46, 1240:41, 1241:4, 1243:28, 1261:26, 1274:21</p> <p>efficient [1] - 1204:21</p> <p>effort [1] - 1351:17</p> <p>either [16] - 1177:23, 1184:18, 1207:25,</p>	<p>1209:21, 1223:6, 1224:19, 1232:30, 1235:36, 1247:38, 1256:22, 1259:30, 1272:13, 1274:23, 1278:23, 1315:40, 1319:16</p> <p>elaborate [2] - 1307:45, 1321:33</p> <p>electric [2] - 1304:37, 1324:16</p> <p>electrical [6] - 1303:15, 1304:34, 1310:13, 1320:15, 1322:44, 1324:21</p> <p>electroconductivity [13] - 1304:30, 1304:31, 1304:46, 1306:46, 1307:1, 1307:37, 1307:38, 1307:40, 1328:18, 1330:24, 1332:27, 1332:42</p> <p>element [2] - 1183:15, 1189:11</p> <p>elementary [1] - 1211:31</p> <p>elevated [1] - 1283:19</p> <p>elevation [8] - 1214:31, 1284:7, 1284:8, 1284:25, 1284:32, 1284:35, 1285:10, 1285:34</p> <p>eleven [1] - 1241:24</p> <p>elsewhere [1] - 1251:37</p> <p>emanates [1] - 1213:11</p> <p>embankment [1] - 1250:33</p> <p>embedded [1] - 1289:35</p> <p>embedment [39] - 1225:4, 1225:10, 1225:12, 1231:9, 1231:13, 1231:21, 1231:30, 1231:44, 1232:9, 1232:11, 1233:33, 1234:20, 1234:27, 1236:42, 1246:5, 1246:31, 1246:32, 1246:35, 1246:38, 1246:40, 1247:38, 1248:5, 1248:27, 1248:38, 1249:5, 1249:6, 1249:34, 1251:32, 1251:38, 1273:5, 1281:31, 1287:1, 1289:12, 1323:29,</p>	<p>1323:31, 1324:9, 1330:30, 1344:47</p> <p>emerge [1] - 1286:7</p> <p>emerged [6] - 1215:34, 1215:43, 1215:45, 1220:38, 1284:27, 1318:47</p> <p>emergency [1] - 1217:33</p> <p>emerging [3] - 1216:16, 1222:11, 1222:12</p> <p>employed [3] - 1195:14, 1301:14, 1301:18</p> <p>Enbom [1] - 1167:11</p> <p>encompassed [1] - 1253:35</p> <p>encountering [1] - 1256:37</p> <p>end [20] - 1186:26, 1215:46, 1229:11, 1238:16, 1252:28, 1252:29, 1252:42, 1262:13, 1263:9, 1263:17, 1287:34, 1287:43, 1291:12, 1291:15, 1291:16, 1307:2, 1313:21, 1313:25, 1331:1, 1347:5</p> <p>ending [1] - 1257:25</p> <p>engaged [3] - 1168:13, 1227:26, 1302:30</p> <p>engagement [2] - 1241:27, 1302:36</p> <p>engineer [1] - 1346:14</p> <p>engineering [4] - 1171:35, 1183:13, 1184:35, 1197:16</p> <p>engineers [1] - 1294:2</p> <p>enlarged [1] - 1318:7</p> <p>enormous [1] - 1297:35</p> <p>enrich [1] - 1311:9</p> <p>enriched [2] - 1308:47, 1313:38</p> <p>enrichment [1] - 1309:32</p> <p>ensure [1] - 1290:22</p> <p>enter [1] - 1253:7</p> <p>entered [3] - 1227:18, 1229:17, 1323:30</p> <p>entering [3] - 1236:42, 1246:4, 1257:47</p> <p>entire [7] - 1173:45, 1174:4, 1262:4, 1280:8, 1280:12, 1288:22, 1293:10</p>
---	--	--	---	--

<p>entirely [4] - 1191:25, 1286:38, 1286:40, 1318:44</p> <p>entitled [2] - 1192:19, 1192:27</p> <p>environment [1] - 1315:36</p> <p>EO [1] - 1217:33</p> <p>equal [2] - 1310:35, 1336:2</p> <p>equates [1] - 1237:6</p> <p>equation [4] - 1253:27, 1294:8, 1306:42, 1311:21</p> <p>equilibrium [6] - 1192:5, 1306:11, 1306:25, 1308:17, 1312:8, 1345:16</p> <p>equipment [1] - 1307:28</p> <p>equivalent [1] - 1182:4</p> <p>eroded [3] - 1305:35, 1305:36, 1305:38</p> <p>eroding [1] - 1187:29</p> <p>erosion [9] - 1198:46, 1199:1, 1199:3, 1200:2, 1200:18, 1200:46, 1268:38, 1268:42, 1306:7</p> <p>error [4] - 1187:13, 1255:41, 1261:29, 1350:12</p> <p>erupted [1] - 1230:31</p> <p>escaped [1] - 1269:30</p> <p>escarpment [42] - 1171:30, 1173:42, 1175:28, 1176:19, 1176:23, 1177:36, 1178:3, 1178:24, 1181:43, 1197:7, 1197:44, 1200:47, 1211:41, 1225:15, 1226:32, 1253:24, 1265:15, 1276:6, 1277:21, 1279:28, 1279:31, 1283:4, 1283:30, 1284:9, 1284:10, 1284:34, 1285:11, 1285:15, 1285:20, 1285:26, 1285:28, 1291:7, 1317:28, 1337:47, 1338:3, 1339:7, 1339:13, 1340:23, 1341:20, 1341:30, 1343:10</p> <p>especially [2] - 1177:3, 1181:23</p> <p>essence [1] - 1236:12</p>	<p>essential [1] - 1242:35</p> <p>essentially [8] - 1170:33, 1170:42, 1171:29, 1171:36, 1173:45, 1217:41, 1267:26, 1313:16</p> <p>establish [2] - 1185:5, 1225:30</p> <p>established [3] - 1170:16, 1306:30, 1337:41</p> <p>estimate [12] - 1179:16, 1216:25, 1228:10, 1229:20, 1230:14, 1238:22, 1241:10, 1242:24, 1246:37, 1262:10, 1309:21, 1324:30</p> <p>estimated [8] - 1228:47, 1229:34, 1231:37, 1231:39, 1236:23, 1246:30, 1251:29, 1260:8</p> <p>estimates [7] - 1228:45, 1229:11, 1231:36, 1231:40, 1237:2, 1241:30</p> <p>et [1] - 1241:28</p> <p>evacuated [3] - 1170:41, 1176:37, 1183:5</p> <p>evaluate [1] - 1309:28</p> <p>Evans [1] - 1167:35</p> <p>evapotranspiration [1] - 1295:24</p> <p>event [10] - 1215:45, 1270:1, 1276:15, 1291:19, 1292:32, 1295:37, 1295:38, 1299:22, 1324:41, 1337:23</p> <p>events [2] - 1294:10, 1337:24</p> <p>eventually [3] - 1239:32, 1248:21, 1248:26</p> <p>evidence [88] - 1170:17, 1172:33, 1173:35, 1173:39, 1173:41, 1173:44, 1173:46, 1174:2, 1174:4, 1175:7, 1175:8, 1175:20, 1178:10, 1178:25, 1179:14, 1179:26, 1187:26, 1188:46, 1189:47, 1191:1, 1191:7, 1192:12, 1196:8, 1201:22, 1203:30, 1205:2,</p>	<p>1209:5, 1212:4, 1213:9, 1215:6, 1216:30, 1218:42, 1220:7, 1222:36, 1226:6, 1230:14, 1230:27, 1242:43, 1243:19, 1243:20, 1244:6, 1244:9, 1244:23, 1244:35, 1244:40, 1247:24, 1248:36, 1248:37, 1255:23, 1255:29, 1256:43, 1262:9, 1262:35, 1269:18, 1269:23, 1272:21, 1275:47, 1276:5, 1276:20, 1276:25, 1276:26, 1278:45, 1279:44, 1285:25, 1290:25, 1296:33, 1301:29, 1304:30, 1306:46, 1316:30, 1316:31, 1316:32, 1317:33, 1328:26, 1328:41, 1333:23, 1333:24, 1336:5, 1338:19, 1343:23, 1346:6, 1346:7, 1346:26, 1346:40, 1347:31, 1347:41, 1350:25</p> <p>evident [1] - 1220:38</p> <p>evolution [1] - 1314:25</p> <p>evolves [1] - 1279:3</p> <p>exact [4] - 1222:43, 1254:26, 1272:18, 1314:27</p> <p>exactly [8] - 1215:33, 1245:18, 1260:5, 1276:25, 1278:20, 1278:22, 1278:27, 1314:26</p> <p>examination [1] - 1204:22</p> <p>EXAMINATION [12] - 1168:41, 1196:41, 1201:28, 1227:4, 1259:28, 1264:11, 1272:10, 1275:40, 1294:43, 1338:33, 1342:3, 1346:2</p> <p>examine [2] - 1259:24, 1316:47</p> <p>example [25] - 1173:37, 1197:35, 1198:12, 1198:36, 1199:22, 1200:1, 1208:15, 1211:26, 1217:39, 1219:41,</p>	<p>1239:35, 1245:32, 1253:5, 1253:6, 1273:43, 1274:1, 1276:46, 1280:2, 1296:12, 1303:43, 1314:18, 1323:3, 1331:15, 1348:16</p> <p>excavated [2] - 1289:23, 1289:27</p> <p>excavating [1] - 1214:32</p> <p>excavation [3] - 1270:9, 1270:11, 1289:20</p> <p>excavations [1] - 1231:8</p> <p>except [1] - 1300:32</p> <p>exception [2] - 1252:5, 1281:17</p> <p>excess [5] - 1205:2, 1256:44, 1264:16, 1264:26, 1299:30</p> <p>exchanges [1] - 1305:8</p> <p>excluded [2] - 1311:21, 1316:36</p> <p>excluding [1] - 1344:2</p> <p>exclusively [1] - 1218:33</p> <p>excused [1] - 1345:39</p> <p>execute [1] - 1285:1</p> <p>exempt [1] - 1199:2</p> <p>exercise [1] - 1195:43</p> <p>exhibit [5] - 1186:19, 1227:11, 1290:46, 1350:46, 1350:47</p> <p>EXHIBIT [2] - 1186:21, 1227:13</p> <p>exist [2] - 1274:12, 1324:35</p> <p>existing [4] - 1170:6, 1171:30, 1198:22, 1345:7</p> <p>exit [2] - 1273:42, 1313:25</p> <p>exited [1] - 1269:13</p> <p>exiting [4] - 1239:20, 1272:13, 1334:1, 1335:18</p> <p>exits [1] - 1177:42</p> <p>expanded [5] - 1206:34, 1211:5, 1212:13, 1213:2, 1214:20</p> <p>expect [21] - 1174:19, 1202:25, 1219:40, 1233:15, 1234:22, 1239:19, 1245:18, 1247:32, 1249:42, 1250:7, 1255:25,</p>	<p>1262:32, 1280:45, 1284:9, 1287:12, 1292:11, 1292:13, 1292:26, 1306:25, 1314:26, 1314:43</p> <p>expectation [2] - 1258:15, 1280:39</p> <p>expected [4] - 1241:35, 1256:47, 1286:47, 1287:11</p> <p>expecting [2] - 1295:17, 1315:2</p> <p>experience [4] - 1227:34, 1307:30, 1327:32, 1338:5</p> <p>experienced [1] - 1349:46</p> <p>expert [9] - 1168:18, 1197:28, 1197:30, 1220:12, 1255:46, 1299:8, 1321:43, 1323:23</p> <p>expertise [8] - 1197:21, 1227:24, 1227:43, 1227:45, 1234:23, 1244:23, 1244:43, 1301:23</p> <p>experts [16] - 1168:10, 1175:7, 1177:7, 1233:7, 1238:39, 1244:16, 1249:40, 1256:15, 1256:19, 1263:20, 1264:3, 1264:5, 1317:40, 1319:15, 1319:31, 1351:13</p> <p>explain [21] - 1171:25, 1172:31, 1175:10, 1183:7, 1190:28, 1211:6, 1211:14, 1213:5, 1221:3, 1230:1, 1235:47, 1237:19, 1239:2, 1252:10, 1252:19, 1253:22, 1311:34, 1333:4, 1334:40, 1335:42, 1336:24</p> <p>explained [5] - 1192:43, 1257:33, 1267:40, 1306:20, 1321:25</p> <p>explaining [1] - 1181:6</p> <p>explains [1] - 1177:37</p> <p>explanation [8] - 1177:17, 1212:45, 1230:46, 1236:27, 1241:8, 1285:42, 1313:12, 1323:29</p> <p>explorations [1] -</p>
--	---	---	--	---

<p>1217:29 explore [2] - 1189:47, 1212:4 exponential [1] - 1237:27 exposed [6] - 1173:27, 1179:32, 1196:27, 1196:29, 1196:32, 1306:27 exposing [1] - 1195:2 express [5] - 1192:19, 1197:2, 1197:32, 1318:27, 1347:32 expressed [8] - 1198:2, 1200:27, 1259:45, 1261:17, 1264:23, 1272:21, 1275:27, 1335:5 expression [1] - 1232:37 extended [1] - 1222:42 extending [1] - 1177:28 extension [1] - 1184:19 extent [20] - 1182:17, 1182:20, 1195:2, 1197:23, 1198:33, 1201:1, 1201:3, 1217:37, 1223:13, 1234:2, 1236:23, 1280:14, 1304:26, 1304:40, 1306:23, 1314:17, 1315:29, 1318:26, 1318:46 extra [1] - 1193:21 extreme [1] - 1193:16 extremely [1] - 1250:14 eye [1] - 1221:47 Eyrie [5] - 1177:5, 1180:2, 1279:35, 1279:37, 1280:10</p>	<p>1285:24, 1285:43, 1289:7, 1294:17, 1297:26, 1299:30, 1299:43, 1305:14, 1309:41, 1311:5, 1311:14, 1311:45, 1318:33, 1330:26, 1335:32, 1335:35, 1336:24, 1337:37, 1342:47, 1348:28 factor [33] - 1169:41, 1169:42, 1170:1, 1171:21, 1171:27, 1172:1, 1172:7, 1172:25, 1174:47, 1175:1, 1180:15, 1180:26, 1180:38, 1181:8, 1190:6, 1190:9, 1190:12, 1190:17, 1190:23, 1202:37, 1209:18, 1210:27, 1210:34, 1210:36, 1264:24, 1265:6, 1296:29, 1298:41, 1303:28, 1303:37, 1336:31 factors [3] - 1168:45, 1296:34, 1333:25 factory [1] - 1286:21 facts [7] - 1176:18, 1177:14, 1198:7, 1318:33, 1348:42, 1349:1, 1349:4 factual [5] - 1201:2, 1260:43, 1260:44, 1282:10, 1342:18 factually [1] - 1282:47 faded [1] - 1222:7 fail [1] - 1297:12 failed [6] - 1178:40, 1178:41, 1183:23, 1188:41, 1285:6, 1298:44 failing [2] - 1189:18, 1192:5 failure [15] - 1178:39, 1217:40, 1217:46, 1226:18, 1229:24, 1251:30, 1293:9, 1296:40, 1297:6, 1297:33, 1298:9, 1298:10, 1298:21, 1348:14 fair [17] - 1170:2, 1195:27, 1203:33, 1204:28, 1207:8, 1210:30, 1213:7, 1220:21, 1235:13, 1246:28, 1253:16, 1278:21, 1297:19,</p>	<p>1304:24, 1316:4, 1317:14, 1348:5 fairly [7] - 1177:31, 1229:25, 1237:27, 1300:3, 1303:8, 1315:39, 1331:43 fairness [3] - 1246:23, 1259:4, 1334:29 fall [3] - 1234:21, 1256:35, 1273:1 fallen [1] - 1182:37 falls [1] - 1234:20 false [1] - 1178:11 familiar [5] - 1211:7, 1221:37, 1308:30, 1346:12, 1346:37 familiarise [1] - 1219:28 fan [7] - 1213:10, 1236:2, 1240:28, 1247:18, 1247:21, 1248:18, 1289:36 fanned [1] - 1245:34 fans [1] - 1247:43 far [11] - 1191:15, 1193:46, 1196:17, 1203:14, 1211:26, 1226:9, 1245:9, 1245:30, 1261:26, 1299:29, 1337:32 fast [2] - 1203:40, 1259:47 faster [3] - 1253:6, 1253:37, 1253:40 feasible [2] - 1219:30, 1347:38 feature [2] - 1176:14, 1206:18 features [2] - 1305:30, 1336:39 February [5] - 1195:14, 1218:4, 1282:11, 1292:45, 1335:33 fed [1] - 1290:7 Federal [1] - 1167:17 feed [1] - 1265:17 feeding [1] - 1313:18 felt [1] - 1179:10 few [18] - 1173:18, 1187:32, 1205:45, 1208:24, 1209:33, 1221:13, 1254:27, 1264:3, 1279:29, 1286:27, 1291:23, 1314:39, 1320:13, 1320:35, 1324:25, 1342:6, 1348:9, 1348:30 field [11] - 1197:28,</p>	<p>1244:22, 1307:3, 1307:15, 1307:22, 1307:24, 1307:26, 1307:30, 1308:44, 1308:45, 1314:26 figure [25] - 1202:42, 1211:4, 1211:37, 1213:2, 1214:30, 1228:34, 1230:44, 1232:4, 1259:6, 1260:21, 1260:35, 1260:38, 1261:43, 1262:10, 1263:26, 1273:9, 1273:13, 1273:17, 1273:30, 1291:13, 1293:14, 1339:38, 1340:6, 1340:7, 1346:40 figures [7] - 1240:34, 1245:8, 1339:5, 1339:42, 1340:12, 1340:28, 1341:13 files [1] - 1170:40 fill [77] - 1168:46, 1169:5, 1169:11, 1169:24, 1169:43, 1170:17, 1170:18, 1170:24, 1170:28, 1170:34, 1170:36, 1170:43, 1170:47, 1171:4, 1171:19, 1171:20, 1171:26, 1171:29, 1171:31, 1171:32, 1171:36, 1171:38, 1172:15, 1172:17, 1172:23, 1172:24, 1172:34, 1172:36, 1173:24, 1173:25, 1173:30, 1173:43, 1173:44, 1173:45, 1174:4, 1174:11, 1174:20, 1174:23, 1174:26, 1174:38, 1174:40, 1174:42, 1175:25, 1175:28, 1176:17, 1176:22, 1176:38, 1176:42, 1177:16, 1177:30, 1177:31, 1177:32, 1178:45, 1179:14, 1179:15, 1179:27, 1179:43, 1180:11, 1180:14, 1181:30, 1181:35, 1183:16, 1189:36, 1190:38, 1195:22, 1198:30, 1233:47, 1250:25, 1250:32, 1250:46, 1278:39, 1282:45, 1314:44, 1336:30, 1336:39</p>	<p>filled [2] - 1173:45, 1212:18 filling [1] - 1330:33 fills [5] - 1170:5, 1170:6, 1173:26, 1198:13, 1251:14 film [1] - 1222:32 final [4] - 1195:12, 1240:41, 1306:35, 1316:15 fine [9] - 1181:18, 1185:28, 1200:31, 1254:27, 1254:39, 1292:3, 1311:46, 1315:40, 1336:44 finer [2] - 1253:36, 1287:1 finish [4] - 1188:1, 1306:29, 1327:40 finite [2] - 1189:11, 1348:15 firm [1] - 1285:46 firmer [1] - 1190:46 first [37] - 1168:45, 1173:18, 1175:46, 1182:45, 1183:13, 1189:33, 1189:35, 1189:41, 1209:34, 1212:12, 1221:30, 1227:16, 1235:3, 1242:41, 1244:41, 1245:15, 1245:16, 1246:15, 1247:27, 1256:24, 1263:25, 1263:32, 1264:2, 1274:27, 1275:46, 1276:16, 1286:23, 1289:5, 1290:39, 1315:37, 1315:42, 1315:43, 1317:44, 1324:25, 1335:43, 1339:29, 1350:42 firstly [2] - 1253:26, 1264:19 fit [2] - 1190:1, 1242:30 fitness [1] - 1217:23 fits [2] - 1211:19 Five [1] - 1258:24 five [16] - 1239:18, 1240:23, 1240:38, 1241:10, 1241:42, 1247:30, 1249:41, 1258:22, 1271:41, 1292:24, 1292:25, 1300:17, 1300:20, 1313:24, 1349:25 fixed [1] - 1269:34 fixing [1] - 1170:7 flagged [1] - 1172:19</p>
F				
<p>fabric [2] - 1173:17, 1173:20 face [3] - 1234:34, 1290:14, 1297:16 facing [1] - 1295:23 fact [37] - 1185:15, 1195:21, 1195:32, 1198:8, 1199:34, 1200:8, 1223:30, 1230:29, 1256:45, 1272:29, 1274:15, 1280:19, 1281:17, 1283:35, 1283:44,</p>				

<p>flank [3] - 1174:29, 1175:25, 1177:13</p> <p>flat [4] - 1176:23, 1203:41, 1273:23, 1273:32</p> <p>flight [4] - 1300:33, 1326:26, 1328:7, 1345:45</p> <p>float [1] - 1314:9</p> <p>flood [2] - 1252:24, 1263:44</p> <p>flooded [1] - 1245:20</p> <p>flour [1] - 1295:16</p> <p>flow [108] - 1174:27, 1174:28, 1183:22, 1205:35, 1208:23, 1210:12, 1211:38, 1212:8, 1212:14, 1213:6, 1214:47, 1217:47, 1222:46, 1223:4, 1224:4, 1224:40, 1225:26, 1225:40, 1225:47, 1227:44, 1228:35, 1229:1, 1229:18, 1229:28, 1229:32, 1229:33, 1230:20, 1231:5, 1231:29, 1231:37, 1233:35, 1235:18, 1235:28, 1236:9, 1236:19, 1237:3, 1237:46, 1240:24, 1240:26, 1240:34, 1241:9, 1241:37, 1242:22, 1243:29, 1243:40, 1244:19, 1244:24, 1247:39, 1247:47, 1248:14, 1248:36, 1248:44, 1249:42, 1249:43, 1250:25, 1251:9, 1251:43, 1251:47, 1252:15, 1253:31, 1253:46, 1254:34, 1255:30, 1256:26, 1257:45, 1258:2, 1259:8, 1259:45, 1264:17, 1264:18, 1265:14, 1267:5, 1271:1, 1272:18, 1272:20, 1272:29, 1272:32, 1273:1, 1273:43, 1276:17, 1278:8, 1279:31, 1280:42, 1281:19, 1284:1, 1284:5, 1286:1, 1291:3, 1291:19, 1292:6, 1292:11, 1295:18, 1295:29,</p>	<p>1295:32, 1297:32, 1299:34, 1309:16, 1316:20, 1337:40, 1343:22, 1345:3, 1345:5, 1348:6, 1349:41</p> <p>flowed [12] - 1210:17, 1212:31, 1244:8, 1246:17, 1257:34, 1264:36, 1265:30, 1269:12, 1276:29, 1295:19, 1315:23</p> <p>flowing [19] - 1217:44, 1218:17, 1220:2, 1222:44, 1224:45, 1225:12, 1229:34, 1229:40, 1236:34, 1244:36, 1281:7, 1285:26, 1285:33, 1287:13, 1290:21, 1290:27, 1306:10, 1338:3, 1342:19</p> <p>flows [10] - 1239:30, 1251:2, 1257:12, 1269:44, 1269:46, 1292:28, 1295:11, 1295:12, 1295:13, 1335:35</p> <p>fluoride [25] - 1310:35, 1310:38, 1310:41, 1310:46, 1311:1, 1311:4, 1311:9, 1311:10, 1311:14, 1311:20, 1311:23, 1311:26, 1311:28, 1311:34, 1311:36, 1311:47, 1312:1, 1312:6, 1312:7, 1312:12, 1312:18, 1312:34, 1312:38, 1313:36</p> <p>fluoride's [2] - 1311:1, 1311:38</p> <p>fly [1] - 1234:9</p> <p>flying [2] - 1326:31, 1326:33</p> <p>focused [1] - 1189:35</p> <p>focusing [1] - 1258:2</p> <p>fold [1] - 1176:47</p> <p>FOLEY [130] - 1196:41, 1196:43, 1197:12, 1197:16, 1197:20, 1197:26, 1197:32, 1197:42, 1198:1, 1198:6, 1198:18, 1198:36, 1198:42, 1199:6, 1199:11, 1199:20, 1199:34, 1199:39, 1199:43, 1200:7,</p>	<p>1200:16, 1200:25, 1200:33, 1200:41, 1201:8, 1201:13, 1201:21, 1201:26, 1259:28, 1259:30, 1259:41, 1260:5, 1260:13, 1260:18, 1260:29, 1260:34, 1261:1, 1261:6, 1261:11, 1261:22, 1261:34, 1261:42, 1262:1, 1262:7, 1262:16, 1262:24, 1262:31, 1262:41, 1263:1, 1263:6, 1263:11, 1263:20, 1263:41, 1263:47, 1271:41, 1272:10, 1272:12, 1272:26, 1272:35, 1272:41, 1272:47, 1273:9, 1273:17, 1273:22, 1273:28, 1273:36, 1273:42, 1274:1, 1274:9, 1274:15, 1274:27, 1274:39, 1274:45, 1275:4, 1275:13, 1275:18, 1275:26, 1275:31, 1275:37, 1300:16, 1325:47, 1327:18, 1338:19, 1338:25, 1338:29, 1338:33, 1338:35, 1338:40, 1338:46, 1339:5, 1339:12, 1339:20, 1339:27, 1339:38, 1339:42, 1339:47, 1340:11, 1340:16, 1340:21, 1340:28, 1340:32, 1340:42, 1341:1, 1341:8, 1341:13, 1341:18, 1341:25, 1341:37, 1341:43, 1345:26, 1346:2, 1346:4, 1346:17, 1346:46, 1347:15, 1347:24, 1347:31, 1347:40, 1347:47, 1348:36, 1349:1, 1349:7, 1349:17, 1349:30, 1349:36, 1350:3, 1350:14, 1350:19, 1350:24, 1350:33</p> <p>Foley [8] - 1167:38, 1271:39, 1281:21, 1325:44, 1327:16, 1338:17, 1345:23, 1350:35</p> <p>follow [6] - 1221:12,</p>	<p>1225:17, 1250:5, 1257:43, 1309:22, 1341:40</p> <p>followed [1] - 1344:15</p> <p>following [3] - 1219:32, 1225:1, 1253:20</p> <p>follows [1] - 1221:10</p> <p>foot [1] - 1252:17</p> <p>footage [2] - 1178:33, 1266:24</p> <p>footpath [1] - 1280:13</p> <p>footprint [3] - 1281:33, 1281:34, 1349:42</p> <p>force [9] - 1182:1, 1190:41, 1190:42, 1191:10, 1191:24, 1191:26, 1206:23, 1238:21, 1239:15</p> <p>forcefully [1] - 1333:43</p> <p>forces [1] - 1293:5</p> <p>forever [1] - 1294:21</p> <p>forget [1] - 1299:43</p> <p>forgive [1] - 1286:36</p> <p>form [7] - 1170:41, 1193:47, 1225:40, 1242:14, 1277:5, 1306:6, 1306:18</p> <p>form's [1] - 1278:15</p> <p>formal [1] - 1302:20</p> <p>formed [1] - 1230:18</p> <p>forming [1] - 1230:32</p> <p>forms [1] - 1341:39</p> <p>formula [1] - 1193:1</p> <p>fortunately [1] - 1217:10</p> <p>forum [2] - 1261:14, 1333:18</p> <p>forward [3] - 1214:19, 1320:42, 1349:11</p> <p>foundation [1] - 1208:20</p> <p>foundations [1] - 1193:12</p> <p>four [9] - 1175:37, 1239:17, 1240:23, 1240:38, 1241:10, 1241:42, 1247:30, 1249:41, 1292:24</p> <p>fourth [2] - 1210:25, 1316:16</p> <p>foxed [1] - 1349:40</p> <p>fractures [1] - 1306:11</p> <p>frame [4] - 1176:10, 1181:11, 1217:40, 1257:30</p> <p>framed [1] - 1347:20</p> <p>frames [1] - 1258:46</p>	<p>free [2] - 1259:43, 1325:15</p> <p>freeway [2] - 1180:1, 1250:37</p> <p>freeway's [1] - 1250:24</p> <p>frequent [1] - 1277:6</p> <p>fresh [2] - 1286:43, 1286:46</p> <p>friend [3] - 1259:20, 1263:23, 1289:3</p> <p>front [16] - 1181:4, 1191:19, 1191:31, 1195:18, 1203:39, 1203:41, 1214:40, 1215:9, 1256:10, 1265:45, 1282:16, 1283:4, 1285:18, 1328:28, 1329:22, 1339:32</p> <p>full [5] - 1239:27, 1267:4, 1277:21, 1293:4, 1293:14</p> <p>full-scale [1] - 1277:21</p> <p>fully [1] - 1245:33</p> <p>function [4] - 1237:37, 1237:38, 1296:42, 1304:32</p> <p>fundamentally [3] - 1171:33, 1277:9, 1297:18</p>
G				
<p>gain [1] - 1345:16</p> <p>gallery [1] - 1168:16</p> <p>galvanised [1] - 1171:15</p> <p>game [1] - 1210:31</p> <p>gap [4] - 1174:45, 1278:39, 1286:2, 1286:3</p> <p>garden [3] - 1188:46, 1336:3, 1336:16</p> <p>gardening [1] - 1174:37</p> <p>gathered [1] - 1276:25</p> <p>Gazette [1] - 1293:9</p> <p>gear [1] - 1286:3</p> <p>general [20] - 1179:8, 1195:23, 1198:12, 1198:27, 1203:27, 1207:34, 1213:14, 1219:47, 1220:8, 1220:24, 1248:3, 1264:30, 1264:34, 1271:6, 1288:16, 1305:41, 1306:1, 1306:30, 1311:33,</p>				

<p>1313:12 generalised [1] - 1212:45 generalising [1] - 1180:1 generally [9] - 1170:17, 1170:19, 1179:46, 1203:23, 1237:45, 1272:47, 1292:7, 1305:38, 1307:13 generate [1] - 1296:23 generous [1] - 1328:2 gentlemen [2] - 1254:19, 1333:32 genuinely [2] - 1261:30, 1298:3 geo [2] - 1277:26, 1303:3 geochem [1] - 1274:43 geochemical [6] - 1226:5, 1302:40, 1309:46, 1313:29, 1317:9, 1334:39 geochemist [5] - 1303:30, 1306:24, 1309:25, 1314:23, 1335:17 geochemistry [7] - 1257:16, 1281:29, 1301:26, 1302:39, 1308:16, 1341:44, 1349:40 geological [11] - 1207:36, 1278:35, 1278:38, 1305:7, 1305:14, 1306:22, 1306:31, 1316:26, 1349:23, 1349:24 geologist [2] - 1197:16, 1306:24 geology [3] - 1175:9, 1211:20, 1305:42 geometry [1] - 1177:38 geophys [4] - 1280:8, 1280:14, 1280:15, 1280:17 geophysical [3] - 1277:25, 1280:1, 1280:5 geophysics [2] - 1277:28, 1277:35 geotech [3] - 1323:22, 1337:2, 1337:12 geotechnical [5] - 1229:25, 1299:8, 1316:25, 1317:11, 1318:33</p>	<p>Gerry [1] - 1187:13 get-go [1] - 1287:14 geyser [4] - 1230:32, 1232:37, 1232:38, 1234:35 given [24] - 1175:20, 1185:12, 1203:29, 1203:30, 1210:29, 1245:10, 1260:21, 1262:18, 1262:35, 1262:42, 1263:24, 1265:8, 1267:10, 1269:7, 1272:27, 1272:44, 1285:24, 1288:7, 1294:46, 1301:29, 1317:44, 1338:19, 1338:20, 1345:39 global [1] - 1195:23 gloves [1] - 1174:37 God's [1] - 1350:10 golly [1] - 1258:16 GoPros [1] - 1222:32 gosh [9] - 1193:7, 1194:2, 1219:43, 1223:18, 1239:27, 1286:40, 1294:1, 1296:13, 1296:16 government [1] - 1204:1 GPS [1] - 1217:15 gradient [4] - 1252:30, 1254:10, 1273:5, 1314:39 grading [1] - 1287:30 grain [3] - 1253:37, 1289:43, 1290:2 grand [1] - 1294:14 granite [37] - 1171:37, 1181:25, 1181:26, 1181:38, 1182:11, 1182:17, 1193:16, 1193:21, 1196:21, 1202:6, 1202:31, 1203:3, 1203:12, 1206:12, 1206:16, 1206:17, 1206:21, 1206:25, 1211:22, 1250:14, 1305:38, 1305:40, 1305:43, 1306:2, 1306:5, 1306:9, 1306:15, 1306:16, 1306:20, 1306:27, 1311:8, 1311:19, 1312:7, 1335:8, 1335:9, 1335:10, 1335:31 granites [2] - 1171:34, 1306:6 granitic [2] - 1344:47,</p>	<p>1345:1 granular [3] - 1287:2, 1290:4, 1314:8 graph [14] - 1228:34, 1228:36, 1228:37, 1263:35, 1263:36, 1320:14, 1320:23, 1321:6, 1322:33, 1331:13, 1331:14, 1331:16, 1331:17, 1331:27 graphically [1] - 1216:40 graphs [4] - 1321:28, 1328:16, 1331:21, 1333:18 grass [2] - 1176:12, 1217:45 grate [2] - 1243:28 gravel [8] - 1215:4, 1234:37, 1253:37, 1253:39, 1254:11, 1268:39, 1285:14 gravity [3] - 1181:34, 1239:15, 1249:10 great [5] - 1173:14, 1234:2, 1234:23, 1235:45, 1292:40 greater [5] - 1170:2, 1193:20, 1226:28, 1238:32, 1238:35 green [13] - 1182:4, 1194:38, 1194:40, 1211:21, 1213:34, 1213:36, 1214:10, 1217:45, 1222:1, 1222:7, 1222:11, 1230:10 greener [1] - 1221:7 grey [1] - 1181:11 grid [1] - 1221:17 gritty [1] - 1287:2 ground [42] - 1170:6, 1173:21, 1174:14, 1182:35, 1196:18, 1199:12, 1202:30, 1203:6, 1203:41, 1206:41, 1219:41, 1220:34, 1230:10, 1233:47, 1235:8, 1239:37, 1240:40, 1241:11, 1241:32, 1242:7, 1242:18, 1245:2, 1245:3, 1247:32, 1248:18, 1248:22, 1249:35, 1250:24, 1251:13, 1252:8, 1252:9, 1253:35, 1255:24, 1259:7, 1259:8,</p>	<p>1259:9, 1276:40, 1278:37, 1281:40, 1292:43, 1292:45, 1298:7 groundwater [50] - 1193:1, 1205:1, 1206:36, 1206:40, 1206:44, 1206:45, 1207:2, 1207:5, 1207:7, 1207:20, 1208:29, 1209:20, 1209:26, 1209:36, 1209:38, 1210:5, 1212:40, 1222:47, 1225:1, 1250:8, 1252:31, 1254:34, 1269:40, 1269:42, 1283:19, 1284:1, 1301:26, 1308:4, 1310:36, 1312:5, 1315:24, 1316:8, 1317:46, 1318:2, 1318:14, 1318:17, 1318:36, 1318:40, 1318:46, 1324:1, 1330:26, 1333:45, 1334:41, 1337:36, 1345:7, 1347:16 grow [1] - 1222:7 growing [1] - 1222:1 guess [21] - 1208:28, 1230:32, 1233:4, 1238:19, 1242:29, 1248:5, 1248:7, 1248:17, 1261:9, 1262:17, 1288:1, 1289:30, 1292:9, 1292:11, 1330:33, 1331:43, 1333:9, 1335:17, 1335:29, 1341:33 guide [1] - 1311:23 gullies [7] - 1177:2, 1179:43, 1180:3, 1218:9, 1249:34, 1277:6, 1277:8 gully [28] - 1175:10, 1176:32, 1176:45, 1177:8, 1177:34, 1178:2, 1178:35, 1178:37, 1178:40, 1179:1, 1179:46, 1180:2, 1211:40, 1212:15, 1212:18, 1218:12, 1249:16, 1249:30, 1250:4, 1250:5, 1271:15, 1271:19, 1279:18, 1279:22, 1286:1 gum [3] - 1187:4,</p>	<p>1187:9 gun [1] - 1312:9</p>
				<p>H</p>
				<p>half [7] - 1187:18, 1237:30, 1287:46, 1289:32, 1289:33, 1326:28, 1332:47 hammered [1] - 1295:41 hand [20] - 1174:30, 1176:35, 1176:36, 1178:40, 1179:1, 1183:4, 1185:6, 1187:11, 1187:25, 1194:8, 1196:38, 1211:37, 1212:13, 1215:23, 1216:18, 1244:1, 1274:6, 1298:17, 1298:19, 1334:28 handheld [1] - 1307:2 hands [2] - 1327:12, 1327:23 hanging [1] - 1312:1 happy [3] - 1200:30, 1326:38, 1326:44 hard [11] - 1172:33, 1182:34, 1212:12, 1215:38, 1285:4, 1297:21, 1297:29, 1297:32, 1325:26, 1327:40, 1328:3 hardstanding [1] - 1297:26 HARTLEY [238] - 1168:31, 1175:6, 1177:47, 1178:30, 1178:47, 1192:21, 1192:25, 1192:29, 1192:35, 1193:7, 1193:29, 1193:35, 1193:39, 1193:43, 1194:2, 1194:7, 1194:13, 1194:17, 1194:21, 1194:34, 1195:29, 1195:35, 1195:40, 1196:1, 1196:10, 1208:7, 1210:46, 1213:9, 1213:20, 1218:44, 1219:4, 1219:10, 1219:15, 1219:21, 1219:27, 1219:43, 1220:10, 1223:11, 1223:18, 1223:25, 1223:38, 1223:42, 1223:47, 1225:23, 1225:29, 1225:37,</p>

1225:43, 1226:17, 1227:20, 1227:26, 1227:31, 1227:36, 1228:2, 1228:15, 1228:19, 1228:23, 1228:41, 1229:5, 1229:14, 1229:23, 1229:37, 1229:44, 1230:7, 1230:23, 1230:34, 1230:40, 1231:1, 1231:7, 1231:33, 1231:47, 1233:43, 1234:9, 1234:18, 1235:15, 1235:26, 1235:34, 1235:39, 1236:17, 1236:33, 1236:47, 1237:8, 1237:16, 1237:22, 1237:41, 1238:8, 1238:15, 1239:26, 1239:40, 1239:44, 1240:3, 1240:14, 1240:26, 1240:32, 1240:44, 1241:3, 1241:14, 1241:22, 1241:35, 1242:1, 1242:9, 1242:20, 1242:45, 1243:2, 1243:11, 1243:16, 1243:26, 1243:39, 1243:45, 1244:13, 1246:8, 1246:15, 1246:23, 1246:34, 1246:42, 1246:47, 1247:9, 1247:15, 1247:24, 1247:35, 1247:41, 1249:19, 1249:26, 1249:37, 1251:34, 1251:43, 1252:3, 1252:15, 1253:12, 1256:24, 1257:5, 1257:7, 1257:10, 1257:40, 1258:6, 1258:10, 1258:15, 1258:26, 1259:39, 1260:3, 1260:11, 1260:16, 1260:24, 1260:43, 1261:4, 1261:20, 1261:29, 1261:39, 1261:46, 1262:4, 1262:37, 1262:46, 1263:4, 1264:9, 1270:7, 1270:17, 1272:24, 1272:32, 1272:39, 1272:44, 1273:3, 1273:15, 1273:20, 1273:26, 1273:34, 1273:39, 1273:46, 1274:6, 1274:12,	1274:21, 1274:37, 1274:42, 1275:1, 1275:8, 1275:16, 1275:23, 1275:29, 1275:34, 1280:8, 1280:24, 1280:33, 1280:39, 1281:16, 1281:29, 1281:43, 1282:1, 1286:40, 1287:9, 1288:12, 1288:19, 1288:38, 1289:10, 1289:46, 1290:4, 1290:41, 1292:36, 1293:4, 1293:17, 1293:44, 1294:1, 1294:14, 1294:34, 1296:4, 1296:11, 1296:26, 1296:38, 1296:46, 1297:5, 1297:10, 1297:21, 1297:38, 1297:43, 1298:3, 1298:17, 1298:33, 1298:38, 1298:44, 1299:2, 1299:20, 1299:26, 1299:32, 1299:39, 1346:14, 1346:44, 1347:13, 1347:22, 1347:29, 1347:34, 1347:43, 1348:5, 1348:46, 1349:4, 1349:15, 1349:19, 1349:38, 1350:10, 1350:17, 1350:22, 1350:30 Hartley [48] - 1174:17, 1174:45, 1175:15, 1176:31, 1177:44, 1178:28, 1179:8, 1180:12, 1192:18, 1192:42, 1193:5, 1195:26, 1204:26, 1210:27, 1210:43, 1213:4, 1218:41, 1223:9, 1223:45, 1225:19, 1226:8, 1227:17, 1233:41, 1236:15, 1246:3, 1251:19, 1256:22, 1259:5, 1259:30, 1259:41, 1271:34, 1272:13, 1279:44, 1281:21, 1286:29, 1286:30, 1288:6, 1290:20, 1290:26, 1290:37, 1292:30, 1295:47, 1299:15, 1300:37, 1301:30, 1338:41, 1345:29, 1346:5 Hartley's [3] -	1178:10, 1281:4, 1291:1 hatching [1] - 1183:4 hazard [1] - 1170:7 HCO3 [1] - 1309:2 head [17] - 1176:18, 1202:12, 1222:43, 1237:42, 1238:3, 1239:5, 1239:7, 1240:5, 1251:14, 1256:40, 1258:34, 1273:4, 1282:47, 1296:17, 1297:28, 1298:20, 1298:25 heading [1] - 1270:43 heads [1] - 1345:43 headscarp [30] - 1172:44, 1173:14, 1173:16, 1173:27, 1174:9, 1174:10, 1176:17, 1176:20, 1182:28, 1182:36, 1186:45, 1187:3, 1187:19, 1187:28, 1187:40, 1188:2, 1188:22, 1188:38, 1221:13, 1222:37, 1253:10, 1264:17, 1278:26, 1284:21, 1308:46, 1311:22, 1313:37, 1316:6, 1316:28 hear [4] - 1168:18, 1178:10, 1325:26, 1338:25 heard [14] - 1191:36, 1260:6, 1262:35, 1263:24, 1272:27, 1279:44, 1295:3, 1299:6, 1333:30, 1335:12, 1335:26, 1350:6, 1350:25 HEARING [1] - 1351:24 hearing [14] - 1168:16, 1187:27, 1191:21, 1207:26, 1263:12, 1269:39, 1290:31, 1290:32, 1290:35, 1299:9, 1304:30, 1327:10, 1335:26, 1344:8 hearings [3] - 1302:44, 1306:47, 1318:42 heavier [1] - 1295:9 heavily [1] - 1338:11 hedgerow [2] - 1194:38, 1194:40 height [7] - 1198:47,	1199:2, 1202:27, 1202:28, 1202:46, 1239:12, 1252:7 held [1] - 1226:2 help [6] - 1181:14, 1217:42, 1246:24, 1260:19, 1313:29, 1335:10 helped [1] - 1174:22 helpful [1] - 1283:26 hence [2] - 1221:21, 1345:9 Henry [2] - 1250:28, 1250:31 high [25] - 1172:2, 1172:7, 1174:25, 1180:12, 1181:39, 1195:38, 1202:25, 1205:34, 1210:39, 1210:40, 1214:33, 1222:9, 1224:3, 1230:30, 1233:10, 1257:15, 1264:31, 1308:5, 1311:19, 1317:12, 1317:27, 1318:35, 1333:26, 1334:13, 1334:15 high-pressure [1] - 1230:30 higher [13] - 1263:9, 1309:33, 1324:18, 1324:19, 1332:24, 1332:25, 1332:32, 1332:36, 1332:39, 1342:13, 1343:32, 1343:33, 1347:18 highest [2] - 1291:11, 1291:15 highlighted [2] - 1176:9, 1181:11 highly [4] - 1257:33, 1280:15, 1294:16, 1344:11 highway [1] - 1250:46 Hill [21] - 1208:16, 1208:17, 1208:18, 1208:22, 1212:37, 1251:38, 1257:8, 1257:21, 1258:18, 1270:8, 1284:15, 1284:27, 1286:3, 1287:4, 1288:29, 1288:30, 1328:44, 1329:18, 1329:47, 1335:33, 1349:45 hill [15] - 1171:38, 1175:29, 1176:21, 1181:38, 1182:7, 1187:19, 1187:28, 1205:3, 1218:1,	1251:15, 1332:25, 1332:26, 1332:32, 1332:36, 1332:39 hills [1] - 1306:7 historic [2] - 1249:15, 1279:18 historical [1] - 1173:35 history [2] - 1180:3, 1220:24 hit [2] - 1174:35, 1202:5 Hitchcock [28] - 1206:6, 1206:29, 1206:34, 1207:24, 1207:42, 1210:41, 1224:39, 1226:46, 1234:32, 1245:13, 1245:35, 1249:44, 1254:17, 1256:20, 1263:25, 1272:17, 1299:4, 1300:32, 1308:10, 1310:18, 1310:47, 1311:31, 1313:34, 1315:5, 1317:44, 1325:11, 1325:20, 1333:30 HITCHCOCK [59] - 1168:39, 1206:10, 1206:38, 1206:47, 1207:10, 1207:18, 1207:45, 1208:46, 1209:3, 1209:10, 1224:44, 1225:6, 1225:12, 1226:22, 1226:26, 1226:32, 1226:36, 1226:41, 1234:34, 1238:42, 1238:47, 1239:12, 1245:37, 1245:45, 1249:47, 1250:4, 1250:10, 1250:17, 1250:37, 1254:21, 1254:46, 1255:7, 1255:13, 1263:28, 1299:8, 1308:13, 1308:22, 1310:22, 1310:26, 1311:38, 1311:43, 1312:16, 1312:22, 1312:32, 1312:40, 1313:41, 1313:46, 1315:13, 1315:17, 1318:1, 1318:9, 1318:14, 1318:20, 1318:30, 1319:3, 1319:7, 1325:22, 1325:29, 1326:44 Hitchcock's [1] - 1250:47
--	---	---	---	--

<p>hits [3] - 1248:23, 1248:24, 1257:14</p> <p>hitting [4] - 1268:40, 1297:47, 1331:6</p> <p>hold [5] - 1197:12, 1197:20, 1203:39, 1261:32, 1327:1</p> <p>holding [2] - 1336:30, 1336:40</p> <p>hole [6] - 1173:45, 1221:1, 1222:32, 1256:37, 1283:22, 1298:29</p> <p>Homestead [1] - 1218:14</p> <p>honest [3] - 1168:12, 1168:14, 1350:11</p> <p>HONG [1] - 1168:25</p> <p>honourable [1] - 1252:4</p> <p>honourably [2] - 1293:6, 1293:29</p> <p>Hooke's [1] - 1191:9</p> <p>hooked [1] - 1217:14</p> <p>hoped [1] - 1223:21</p> <p>hopefully [2] - 1220:31, 1322:13</p> <p>hoping [2] - 1186:25, 1270:7</p> <p>horizontal [5] - 1182:4, 1182:6, 1188:33, 1202:24, 1296:18</p> <p>hose [3] - 1230:30, 1336:3, 1336:16</p> <p>hour [4] - 1236:25, 1326:7, 1326:11, 1327:11</p> <p>hours [4] - 1280:44, 1281:4, 1299:22, 1336:17</p> <p>house [2] - 1179:18, 1179:22</p> <p>houses [5] - 1198:32, 1208:18, 1208:26, 1257:36, 1288:28</p> <p>huge [2] - 1323:22, 1343:44</p> <p>Hugo [9] - 1231:9, 1235:39, 1242:24, 1247:41, 1252:16, 1256:4, 1275:8, 1280:45, 1288:25</p> <p>HUGO [1] - 1168:29</p> <p>Hugo's [3] - 1240:14, 1240:44, 1288:20</p> <p>human [2] - 1261:29, 1350:12</p> <p>hundred [8] - 1239:18, 1240:23, 1240:38,</p>	<p>1241:10, 1241:42, 1247:31, 1249:41</p> <p>hurdles [1] - 1275:46</p> <p>hydraulic [6] - 1236:3, 1236:8, 1252:27, 1252:29, 1254:10, 1287:30</p> <p>hydrochemistry [1] - 1303:3</p> <p>hydrogeological [2] - 1317:11, 1318:33</p> <p>hydrogeologist [7] - 1208:3, 1227:43, 1301:25, 1303:31, 1306:24, 1309:25, 1323:22</p> <p>hydroxide [1] - 1311:28</p> <p>hydroxides [1] - 1310:43</p> <p>hypothesis [9] - 1189:35, 1189:46, 1190:1, 1212:1, 1212:21, 1212:28, 1212:32, 1212:39, 1276:21</p>	<p>1175:30, 1176:4, 1176:25, 1178:15, 1182:24, 1182:39, 1182:43, 1182:45, 1183:1, 1183:7, 1183:28, 1185:7, 1196:33, 1211:29, 1211:30, 1211:46, 1215:8, 1235:47, 1247:20, 1257:27, 1266:13, 1266:31, 1266:32, 1267:19, 1271:18</p> <p>images [6] - 1173:7, 1175:29, 1190:39, 1191:44, 1212:1, 1295:14</p> <p>imagine [2] - 1294:23, 1325:41</p> <p>immediate [1] - 1183:1</p> <p>immediately [3] - 1189:1, 1195:1, 1276:6</p> <p>impact [4] - 1196:36, 1199:15, 1223:32, 1292:39</p> <p>impacted [2] - 1197:33, 1260:14</p> <p>impacting [1] - 1347:16</p> <p>impacts [1] - 1206:15</p> <p>impediment [1] - 1248:25</p> <p>impermeability [1] - 1256:39</p> <p>impermeable [4] - 1234:14, 1256:34, 1289:30, 1289:34</p> <p>implied [1] - 1244:37</p> <p>implying [1] - 1198:34</p> <p>importance [1] - 1260:22</p> <p>important [2] [1] - 1168:12, 1168:17, 1190:17, 1220:25, 1260:34, 1261:15, 1261:17, 1261:24, 1261:25, 1269:33, 1295:12, 1295:19, 1303:21, 1303:32, 1304:1, 1304:3, 1304:5, 1304:7, 1311:1, 1311:3, 1311:23</p> <p>impossible [4] - 1233:3, 1262:38, 1270:10, 1288:8</p> <p>imprecise [3] - 1263:8, 1263:16,</p>	<p>1263:30</p> <p>improbable [2] - 1179:20, 1179:23</p> <p>impromptu [1] - 1219:15</p> <p>inaccurate [1] - 1295:44</p> <p>inadvert [1] - 1294:25</p> <p>incline [1] - 1237:30</p> <p>include [1] - 1292:42</p> <p>included [10] - 1233:34, 1252:12, 1261:23, 1261:27, 1280:8, 1280:11, 1281:12, 1316:19, 1334:40, 1343:20</p> <p>includes [5] - 1195:18, 1216:14, 1216:15, 1228:8, 1305:43</p> <p>including [9] - 1219:18, 1232:16, 1272:20, 1288:29, 1304:23, 1308:29, 1309:1, 1317:21, 1335:44</p> <p>incoming [1] - 1266:41</p> <p>incompatibility [3] - 1171:35, 1191:46, 1192:4</p> <p>incompatible [1] - 1191:25</p> <p>incomplete [1] - 1263:4</p> <p>inconclusive [2] - 1311:47, 1312:20</p> <p>inconsistent [1] - 1196:8</p> <p>inconstant [4] - 1207:7, 1207:37, 1208:36, 1208:38</p> <p>incorrect [2] - 1169:13, 1351:7</p> <p>increase [17] - 1181:41, 1182:5, 1197:6, 1197:43, 1198:2, 1198:9, 1198:15, 1199:24, 1244:36, 1295:31, 1314:12, 1315:40, 1324:16, 1328:20, 1345:3, 1345:4, 1345:17</p> <p>increased [6] - 1188:34, 1200:37, 1204:27, 1230:16, 1244:24, 1316:28</p> <p>increases [6] - 1239:9, 1239:16, 1239:20,</p>	<p>1239:22, 1239:23, 1293:21</p> <p>increasing [4] - 1200:35, 1204:45, 1205:1, 1295:10</p> <p>indebted [1] - 1289:3</p> <p>indeed [3] - 1191:10, 1191:45, 1238:2</p> <p>independent [6] - 1172:18, 1184:23, 1190:22, 1229:25, 1235:29, 1253:15</p> <p>independently [6] - 1188:37, 1231:29, 1235:10, 1235:15, 1235:22, 1263:45</p> <p>indicate [7] - 1178:34, 1196:3, 1196:4, 1259:21, 1292:7, 1292:39, 1323:44</p> <p>indicated [2] - 1208:29, 1242:16</p> <p>indicates [5] - 1179:27, 1292:21, 1316:16, 1316:17, 1343:19</p> <p>indication [5] - 1277:6, 1304:38, 1308:14, 1315:1, 1335:20</p> <p>indicative [4] - 1195:32, 1311:15, 1330:25, 1343:6</p> <p>indicator [3] - 1173:32, 1314:24, 1324:39</p> <p>indicators [1] - 1308:7</p> <p>indirectly [1] - 1218:38</p> <p>indistinct [27] - 1177:42, 1193:1, 1220:24, 1225:43, 1245:19, 1259:24, 1263:34, 1263:37, 1263:45, 1267:11, 1268:17, 1270:8, 1295:30, 1296:27, 1301:12, 1306:26, 1306:41, 1307:23, 1309:21, 1314:29, 1314:45, 1315:39, 1321:21, 1324:37, 1333:39, 1335:9, 1341:39</p> <p>indistinct [12] - 1204:17, 1207:40, 1231:18, 1256:40, 1259:24, 1266:36, 1302:23, 1307:47, 1314:40, 1325:18,</p>
--	---	--	--	--

1326:42, 1330:34 individual [1] - 1265:32 induce [1] - 1292:32 inert [3] - 1294:25, 1304:2, 1343:41 inevitable [2] - 1223:36, 1223:42 infer [7] - 1228:9, 1236:44, 1240:37, 1247:11, 1249:22, 1257:1, 1290:1 inference [3] - 1243:22, 1244:11, 1244:42 inferences [2] - 1195:27, 1195:32 inferred [5] - 1205:39, 1216:18, 1250:14, 1309:40, 1310:4 inferring [4] - 1233:32, 1236:6, 1241:43, 1317:20 infilled [1] - 1212:18 infiltrate [2] - 1237:12, 1347:11 infiltrated [4] - 1236:30, 1241:11, 1248:17, 1250:23 infiltrating [3] - 1241:32, 1274:18, 1347:27 infiltration [29] - 1204:28, 1205:32, 1235:41, 1236:24, 1236:25, 1237:5, 1237:36, 1237:43, 1237:44, 1238:23, 1239:7, 1239:10, 1240:3, 1240:11, 1240:15, 1240:45, 1245:20, 1245:26, 1246:39, 1260:8, 1267:10, 1267:12, 1272:44, 1273:3, 1273:39, 1274:24, 1297:24, 1297:25, 1347:25 infiltrations [1] - 1281:18 influence [11] - 1181:35, 1183:14, 1187:22, 1187:25, 1189:5, 1189:14, 1189:20, 1190:35, 1196:36, 1197:35, 1197:38 influenced [1] - 1191:2 influencing [1] -	1347:17 influx [1] - 1337:3 inform [1] - 1313:29 informal [2] - 1200:17, 1200:21 informally [1] - 1250:26 information [10] - 1195:46, 1214:36, 1214:39, 1216:14, 1261:27, 1270:17, 1290:10, 1314:6, 1315:1, 1319:33 infrastructure [2] - 1213:25, 1337:46 initial [7] - 1174:20, 1178:30, 1206:15, 1222:5, 1229:27, 1315:39, 1322:7 initials [1] - 1217:11 inlet [2] - 1268:37, 1268:38 inlets [1] - 1265:29 inquiry [2] - 1243:19, 1256:14 Inquiry [1] - 1167:4 inset [1] - 1337:10 inside [1] - 1265:18 insignificant [7] - 1191:38, 1209:22, 1211:2, 1223:11, 1223:14, 1296:1, 1335:22 insoluble [1] - 1306:21 insomuch [1] - 1223:27 instability [1] - 1170:2 instance [4] - 1253:12, 1263:25, 1279:18, 1309:35 instead [3] - 1181:33, 1241:32, 1348:36 instructor [1] - 1204:16 insufficient [1] - 1296:36 intact [1] - 1189:3 integer [2] - 1226:10, 1242:35 intend [1] - 1209:23 intended [1] - 1206:31 intenses [1] - 1208:15 intent [3] - 1207:13, 1207:16, 1207:18 intentionally [1] - 1233:13 interact [5] - 1304:2, 1305:11, 1306:27, 1309:15, 1324:19	interacting [1] - 1309:19 interaction [1] - 1306:1 interactions [1] - 1306:3 interest [1] - 1301:26 interested [2] - 1251:20, 1261:2 interesting [1] - 1349:44 interface [7] - 1173:33, 1206:25, 1250:11, 1250:13, 1312:5, 1335:9, 1335:31 internal [1] - 1322:17 interpret [1] - 1294:3 interpretation [3] - 1231:45, 1231:47, 1280:16 interpretations [2] - 1292:44, 1292:46 interpreting [2] - 1340:33, 1341:26 interrupt [2] - 1256:24, 1349:30 interrupted [1] - 1349:33 intersection [4] - 1257:30, 1266:28, 1267:22, 1331:6 intertwined [1] - 1237:41 intervening [1] - 1255:33 introduced [1] - 1292:32 introduction [1] - 1211:14 inundation [1] - 1236:23 invert [9] - 1214:22, 1215:5, 1271:25, 1273:18, 1273:23, 1273:32, 1285:3, 1285:7, 1289:29 investigate [2] - 1211:18, 1333:17 investigation [3] - 1214:32, 1292:45, 1325:5 investigations [1] - 1348:39 invitation [1] - 1179:8 involved [12] - 1173:43, 1189:37, 1210:11, 1214:32, 1236:4, 1245:11, 1264:4, 1301:1,	1301:32, 1301:38, 1311:16, 1317:28 involvement [4] - 1235:36, 1235:40, 1300:41, 1300:42 involving [1] - 1334:23 ion [4] - 1305:8, 1310:42, 1316:13, 1324:26 ionic [1] - 1304:42 ions [14] - 1304:35, 1304:39, 1304:40, 1305:4, 1305:11, 1306:17, 1309:34, 1313:35, 1313:38, 1316:21, 1343:22, 1343:34 irrelevant [2] - 1312:19, 1312:22 irrigation [8] - 1210:26, 1294:10, 1337:1, 1337:11, 1337:34, 1338:1, 1346:41, 1347:6 irritation [1] - 1217:13 island [2] - 1208:18, 1257:29 isolate [1] - 1303:12 issue [16] - 1172:13, 1179:11, 1199:11, 1199:43, 1208:11, 1208:28, 1209:10, 1223:4, 1261:17, 1263:21, 1275:13, 1285:34, 1290:19, 1325:12, 1328:13, 1342:6 issued [4] - 1308:46, 1313:37, 1316:42, 1334:43 issues [7] - 1168:12, 1168:17, 1199:35, 1250:47, 1284:25, 1325:47, 1348:37 issuing [2] - 1316:18, 1343:19 itself [10] - 1176:45, 1221:10, 1231:43, 1236:31, 1250:25, 1250:37, 1285:7, 1296:19, 1307:40, 1336:35	1171:47, 1172:6, 1175:11, 1178:33, 1178:39, 1182:24, 1183:6, 1191:1, 1191:3, 1191:36, 1191:40, 1191:45, 1196:4, 1196:28, 1196:36, 1209:35, 1209:38, 1223:7, 1223:8, 1223:25, 1223:26, 1223:32, 1223:35, 1223:36, 1224:27, 1226:18, 1251:30, 1259:1, 1262:34, 1268:44, 1275:35, 1279:15, 1281:35, 1284:14, 1286:35, 1288:7, 1288:14, 1291:5, 1291:26, 1291:34, 1291:35, 1293:9, 1293:10, 1293:33, 1294:15, 1294:16, 1294:27, 1294:31, 1294:34, 1294:35, 1297:10, 1298:9, 1299:36, 1299:40, 1299:42, 1308:47, 1313:37, 1316:6, 1322:37, 1329:31, 1330:10, 1330:25, 1330:36, 1332:10, 1332:11, 1334:5, 1339:20, 1342:8, 1342:17, 1348:7 January [1] - 1218:31 jargon [1] - 1303:11 Jewell [29] - 1300:36, 1300:41, 1301:20, 1302:29, 1304:11, 1306:38, 1310:28, 1312:24, 1315:11, 1315:28, 1317:42, 1318:39, 1326:24, 1327:25, 1328:4, 1328:11, 1328:15, 1333:20, 1334:19, 1335:12, 1335:13, 1338:11, 1340:37, 1341:35, 1344:41, 1345:28, 1345:39, 1345:43, 1345:44 JEWELL [42] - 1168:27, 1300:46, 1301:4, 1301:8, 1301:12, 1301:16, 1301:20, 1301:25, 1301:35, 1302:32, 1302:38, 1302:46, 1303:5, 1304:17, 1304:26, 1304:34,
---	---	--	--	---

<p>1305:2, 1305:10, 1305:18, 1305:26, 1305:34, 1305:45, 1306:5, 1310:31, 1312:27, 1315:34, 1326:26, 1326:33, 1327:27, 1327:32, 1328:7, 1333:34, 1334:3, 1334:7, 1334:13, 1334:17, 1334:26, 1344:45, 1345:16, 1345:31, 1345:35, 1345:47</p> <p>join [1] - 1272:26</p> <p>joined [1] - 1281:26</p> <p>Joint [1] - 1266:30</p> <p>joint [18] - 1169:6, 1169:7, 1169:34, 1169:37, 1182:15, 1190:21, 1209:14, 1209:25, 1209:32, 1226:2, 1226:9, 1264:20, 1264:21, 1267:20, 1272:16, 1272:21, 1293:39, 1308:27</p> <p>July [8] - 1196:44, 1324:38, 1325:4, 1325:6, 1334:44, 1342:29, 1342:38, 1350:38</p> <p>jump [4] - 1258:41, 1259:17, 1277:34, 1286:42</p> <p>jumping [1] - 1259:8</p> <p>jumps [3] - 1323:43, 1329:46</p> <p>junction [4] - 1258:17, 1274:13, 1274:19, 1340:5</p> <p>juncture [1] - 1323:38</p> <p>June [11] - 1174:29, 1219:7, 1219:28, 1219:43, 1302:32, 1302:33, 1325:3, 1325:6</p> <p>justify [1] - 1281:34</p> <p>juxtaposition [1] - 1281:43</p>	<p>1339:42</p> <p>keeping [1] - 1292:27</p> <p>keeps [1] - 1295:10</p> <p>kept [1] - 1302:21</p> <p>key [2] - 1170:42, 1303:12</p> <p>kids [1] - 1300:11</p> <p>kilogram [1] - 1333:40</p> <p>kilometres [1] - 1279:29</p> <p>kind [29] - 1178:41, 1194:38, 1200:25, 1219:32, 1230:32, 1234:9, 1237:41, 1237:42, 1239:31, 1240:34, 1240:45, 1249:15, 1256:25, 1256:26, 1258:19, 1261:42, 1262:10, 1262:18, 1267:41, 1270:36, 1292:38, 1306:26, 1309:24, 1310:12, 1312:35, 1319:31, 1348:20, 1348:34, 1348:43</p> <p>kinds [1] - 1210:6</p> <p>Kings [2] - 1249:20, 1249:23</p> <p>kitchen [1] - 1221:19</p> <p>knife [1] - 1294:28</p> <p>knowledge [1] - 1278:38</p> <p>known [2] - 1249:34, 1311:9</p> <p>knows [1] - 1335:17</p>	<p>1186:21</p> <p>landslide [109] - 1167:4, 1169:6, 1169:8, 1169:9, 1169:43, 1170:41, 1171:1, 1171:47, 1172:6, 1173:15, 1173:43, 1176:37, 1178:23, 1179:33, 1181:1, 1181:22, 1181:45, 1182:24, 1183:10, 1186:14, 1187:20, 1189:33, 1191:1, 1191:2, 1191:3, 1196:27, 1196:28, 1196:36, 1197:7, 1197:33, 1197:39, 1197:40, 1197:44, 1198:26, 1200:36, 1200:37, 1204:25, 1204:43, 1205:25, 1212:3, 1214:28, 1217:34, 1219:33, 1251:45, 1253:1, 1260:14, 1264:27, 1269:9, 1269:20, 1269:27, 1269:40, 1270:1, 1272:19, 1272:30, 1272:33, 1275:47, 1276:7, 1277:43, 1278:2, 1278:19, 1279:15, 1280:30, 1280:34, 1281:14, 1283:15, 1283:36, 1283:45, 1284:28, 1286:35, 1288:6, 1288:14, 1291:4, 1291:7, 1292:32, 1294:6, 1294:11, 1295:5, 1295:41, 1295:42, 1296:8, 1296:9, 1296:11, 1296:12, 1296:47, 1308:47, 1310:40, 1313:37, 1317:3, 1317:35, 1334:5, 1335:43, 1335:45, 1336:26, 1336:31, 1338:4, 1339:33, 1339:34, 1339:43, 1342:8, 1342:46, 1346:25, 1347:17, 1347:45, 1348:40, 1349:5, 1349:25</p> <p>landslides [12] - 1177:12, 1181:2, 1187:28, 1212:32, 1223:16, 1224:23, 1224:24, 1268:29, 1275:45, 1338:2,</p>	<p>1347:8, 1347:44</p> <p>Lane [8] - 1176:34, 1179:18, 1280:12, 1342:19, 1342:26, 1342:31, 1342:33, 1342:35</p> <p>language [4] - 1190:17, 1205:47, 1264:20, 1281:24</p> <p>laptop [1] - 1256:17</p> <p>large [7] - 1189:14, 1225:32, 1267:35, 1285:47, 1321:38, 1321:39</p> <p>largely [4] - 1242:26, 1245:6, 1290:13, 1300:27</p> <p>larger [2] - 1183:10, 1308:29</p> <p>last [15] - 1175:37, 1226:9, 1246:23, 1251:27, 1253:33, 1256:30, 1264:13, 1269:38, 1270:4, 1270:25, 1302:44, 1316:16, 1347:7, 1349:33, 1351:18</p> <p>late [4] - 1256:29, 1256:30, 1302:32, 1345:45</p> <p>lateral [2] - 1193:19, 1260:44</p> <p>laterally [1] - 1225:14</p> <p>latest [1] - 1275:21</p> <p>latter [1] - 1237:30</p> <p>law [4] - 1191:8, 1191:9, 1191:12, 1253:27</p> <p>lawful [1] - 1200:14</p> <p>lay [3] - 1316:29, 1317:45, 1346:9</p> <p>layer [8] - 1170:36, 1177:27, 1202:26, 1238:11, 1248:25, 1347:9, 1347:10, 1347:26</p> <p>layers [2] - 1182:5, 1248:23</p> <p>leach [7] - 1232:15, 1312:44, 1313:7, 1313:13, 1313:47, 1315:5, 1315:28</p> <p>leached [1] - 1232:6</p> <p>leaching [1] - 1314:24</p> <p>lead [4] - 1198:2, 1230:44, 1279:6, 1279:24</p> <p>leader [1] - 1181:17</p> <p>leading [1] - 1229:2</p> <p>leads [2] - 1170:1,</p>	<p>1177:16</p> <p>LEAF [5] - 1313:15, 1314:1, 1314:6, 1314:19</p> <p>leak [55] - 1210:37, 1211:18, 1211:26, 1216:19, 1216:30, 1223:5, 1223:28, 1224:30, 1228:9, 1228:36, 1230:24, 1234:10, 1235:7, 1235:17, 1240:27, 1251:14, 1251:26, 1251:28, 1251:30, 1251:44, 1255:30, 1259:46, 1259:47, 1265:15, 1265:28, 1266:47, 1272:19, 1272:30, 1272:32, 1274:35, 1275:20, 1275:32, 1280:28, 1280:33, 1288:13, 1292:14, 1292:19, 1314:42, 1317:3, 1317:34, 1324:13, 1339:1, 1340:33, 1341:9, 1341:27, 1343:3, 1343:4, 1343:39, 1344:28, 1346:8, 1346:25, 1348:16, 1349:5, 1349:45, 1350:4</p> <p>leakage [16] - 1210:34, 1216:18, 1216:20, 1216:25, 1228:37, 1228:46, 1229:2, 1229:10, 1241:30, 1241:41, 1259:17, 1264:19, 1264:22, 1264:25, 1265:5, 1314:40</p> <p>leakages [1] - 1264:14</p> <p>leaked [4] - 1228:12, 1246:17, 1289:13, 1344:24</p> <p>leaking [3] - 1216:31, 1244:38, 1264:30</p> <p>leaks [1] - 1294:10</p> <p>learned [1] - 1263:23</p> <p>learnt [1] - 1318:41</p> <p>least [33] - 1172:22, 1186:45, 1202:29, 1205:11, 1206:32, 1213:15, 1217:2, 1219:6, 1220:6, 1226:9, 1232:24, 1234:18, 1236:38, 1242:6, 1247:33, 1248:13, 1248:15, 1248:44, 1275:46,</p>
<p>KC [3] - 1167:11, 1167:32, 1167:35</p> <p>keen [1] - 1333:1</p> <p>keep [10] - 1189:2, 1194:35, 1242:23, 1252:16, 1320:28, 1320:30, 1320:41, 1331:42, 1331:43,</p>	<p>L</p> <p>lab [3] - 1289:43, 1307:16, 1307:31</p> <p>lab-tested [1] - 1289:43</p> <p>label [1] - 1214:29</p> <p>labelled [3] - 1211:22, 1214:28, 1247:20</p> <p>laboratory [6] - 1307:17, 1307:36, 1308:42, 1311:35, 1311:44, 1321:12</p> <p>laid [1] - 1260:31</p> <p>lake [1] - 1279:32</p> <p>land [3] - 1170:41, 1277:5, 1278:15</p> <p>landowner [1] - 1195:16</p> <p>landowners' [1] - 1219:32</p> <p>landscape [2] - 1194:9, 1279:3</p> <p>LANDSLIDE [1] -</p>	<p>K</p>	<p>leak [55] - 1210:37, 1211:18, 1211:26, 1216:19, 1216:30, 1223:5, 1223:28, 1224:30, 1228:9, 1228:36, 1230:24, 1234:10, 1235:7, 1235:17, 1240:27, 1251:14, 1251:26, 1251:28, 1251:30, 1251:44, 1255:30, 1259:46, 1259:47, 1265:15, 1265:28, 1266:47, 1272:19, 1272:30, 1272:32, 1274:35, 1275:20, 1275:32, 1280:28, 1280:33, 1288:13, 1292:14, 1292:19, 1314:42, 1317:3, 1317:34, 1324:13, 1339:1, 1340:33, 1341:9, 1341:27, 1343:3, 1343:4, 1343:39, 1344:28, 1346:8, 1346:25, 1348:16, 1349:5, 1349:45, 1350:4</p>	<p>leak [55] - 1210:37, 1211:18, 1211:26, 1216:19, 1216:30, 1223:5, 1223:28, 1224:30, 1228:9, 1228:36, 1230:24, 1234:10, 1235:7, 1235:17, 1240:27, 1251:14, 1251:26, 1251:28, 1251:30, 1251:44, 1255:30, 1259:46, 1259:47, 1265:15, 1265:28, 1266:47, 1272:19, 1272:30, 1272:32, 1274:35, 1275:20, 1275:32, 1280:28, 1280:33, 1288:13, 1292:14, 1292:19, 1314:42, 1317:3, 1317:34, 1324:13, 1339:1, 1340:33, 1341:9, 1341:27, 1343:3, 1343:4, 1343:39, 1344:28, 1346:8, 1346:25, 1348:16, 1349:5, 1349:45, 1350:4</p>

Transcript produced by Epig

<p>Madam ^[14] - 1168:3, 1168:23, 1204:4, 1204:13, 1204:16, 1227:6, 1233:1, 1235:1, 1259:20, 1271:36, 1319:31, 1327:6, 1327:36, 1350:37</p> <p>magnesium ^[4] - 1304:4, 1306:18, 1309:2, 1309:44</p> <p>magnet ^[1] - 1249:9</p> <p>magnitude ^[4] - 1233:15, 1254:28, 1254:36, 1296:2</p> <p>main ^[43] - 1175:25, 1190:2, 1190:5, 1210:31, 1211:24, 1213:46, 1214:2, 1218:11, 1218:12, 1219:46, 1230:4, 1230:5, 1230:11, 1231:21, 1247:13, 1257:34, 1257:38, 1264:35, 1267:14, 1267:27, 1267:35, 1270:29, 1270:42, 1271:2, 1271:8, 1282:12, 1282:39, 1283:35, 1312:37, 1315:20, 1316:27, 1317:34, 1318:36, 1322:45, 1323:4, 1323:6, 1323:17, 1323:19, 1343:30, 1343:39, 1343:47, 1344:11, 1344:28</p> <p>mains ^[48] - 1233:44, 1233:46, 1234:4, 1234:19, 1236:43, 1241:22, 1246:5, 1259:10, 1270:36, 1270:41, 1271:20, 1274:40, 1274:46, 1276:11, 1286:44, 1287:1, 1289:12, 1303:43, 1309:32, 1310:5, 1310:39, 1310:41, 1311:4, 1311:5, 1311:15, 1312:3, 1312:14, 1316:7, 1317:27, 1318:36, 1318:47, 1333:35, 1333:36, 1333:37, 1333:44, 1334:24, 1335:21, 1335:34, 1342:13, 1343:24, 1343:25, 1344:3, 1344:32, 1344:41, 1344:45,</p>	<p>1345:12, 1349:44</p> <p>maintain ^[1] - 1278:47</p> <p>maintaining ^[1] - 1304:24</p> <p>maintenance ^[1] - 1268:16</p> <p>major ^[10] - 1171:2, 1172:1, 1172:7, 1174:47, 1180:11, 1210:40, 1304:15, 1304:17, 1308:47, 1315:18</p> <p>majority ^[8] - 1225:20, 1235:17, 1242:14, 1243:14, 1243:20, 1244:11, 1256:36, 1297:27</p> <p>make-up ^[2] - 1179:3, 1350:1</p> <p>MAKIN ^[16] - 1168:35, 1207:34, 1245:18, 1245:26, 1251:8, 1253:18, 1253:26, 1254:2, 1254:7, 1254:14, 1255:18, 1255:29, 1263:44, 1270:23, 1325:18, 1326:42</p> <p>Makin ^[18] - 1207:32, 1208:2, 1245:13, 1245:16, 1251:5, 1253:15, 1253:45, 1255:15, 1255:22, 1262:8, 1263:41, 1270:5, 1270:21, 1271:34, 1272:16, 1325:11, 1325:15, 1326:40</p> <p>Makin's ^[1] - 1328:37</p> <p>managed ^[1] - 1280:16</p> <p>management ^[6] - 1198:46, 1199:1, 1199:3, 1200:2, 1200:19, 1200:46</p> <p>manhole ^[1] - 1273:46</p> <p>manipulated ^[1] - 1292:42</p> <p>manmade ^[1] - 1288:23</p> <p>map ^[9] - 1213:25, 1217:1, 1217:14, 1218:26, 1220:10, 1266:27, 1274:3, 1274:4, 1279:19</p> <p>mapped ^[1] - 1269:41</p> <p>mapping ^[8] - 1177:2, 1217:36, 1217:42, 1218:32, 1218:39, 1285:45, 1285:46,</p>	<p>1285:47</p> <p>maps ^[2] - 1175:8, 1218:15</p> <p>March ^[8] - 1219:7, 1219:10, 1219:13, 1219:29, 1268:32, 1285:17, 1285:20</p> <p>Margaret ^[4] - 1180:2, 1264:37, 1279:39, 1279:41</p> <p>marginally ^[1] - 1292:42</p> <p>mark ^[2] - 1176:11, 1247:13</p> <p>mark-up ^[1] - 1176:11</p> <p>married ^[1] - 1293:28</p> <p>marry ^[1] - 1293:36</p> <p>MARTIN ^[1] - 1168:27</p> <p>mass ^[4] - 1182:19, 1183:5, 1239:16, 1336:25</p> <p>massive ^[1] - 1226:42</p> <p>match ^[2] - 1196:10, 1216:31</p> <p>mate ^[1] - 1193:31</p> <p>material ^[98] - 1173:17, 1173:24, 1174:30, 1179:20, 1179:21, 1181:26, 1181:29, 1192:45, 1192:46, 1193:19, 1195:33, 1225:4, 1225:10, 1225:12, 1230:12, 1231:5, 1231:9, 1231:14, 1231:21, 1231:26, 1231:31, 1231:38, 1231:39, 1231:41, 1231:44, 1231:45, 1232:7, 1232:9, 1232:10, 1232:11, 1232:24, 1233:34, 1233:46, 1234:3, 1234:20, 1234:28, 1238:26, 1246:5, 1248:5, 1248:19, 1248:20, 1248:38, 1248:44, 1249:5, 1249:6, 1250:15, 1251:44, 1252:1, 1252:3, 1253:37, 1253:39, 1253:46, 1254:10, 1254:14, 1256:35, 1256:36, 1257:19, 1258:17, 1260:3, 1260:8, 1262:31, 1272:37, 1273:5, 1273:7, 1281:31, 1287:1, 1288:19, 1288:20,</p>	<p>1288:28, 1289:12, 1289:38, 1290:11, 1293:8, 1293:21, 1297:11, 1305:27, 1309:16, 1311:25, 1311:46, 1314:38, 1315:30, 1315:41, 1323:30, 1323:31, 1324:9, 1330:31, 1336:30, 1336:32, 1344:47, 1345:1, 1347:11, 1347:27, 1347:35, 1347:37</p> <p>materially ^[1] - 1269:46</p> <p>materials ^[26] - 1171:16, 1172:37, 1173:28, 1174:19, 1174:21, 1207:36, 1224:47, 1227:47, 1229:1, 1229:41, 1232:15, 1241:26, 1245:5, 1246:31, 1246:32, 1246:35, 1246:39, 1246:40, 1247:38, 1249:34, 1251:19, 1251:32, 1251:38, 1260:5, 1305:21, 1314:8</p> <p>math ^[1] - 1258:34</p> <p>mathematical ^[1] - 1186:8</p> <p>maths ^[2] - 1242:36, 1252:11</p> <p>matrix ^[1] - 1174:35</p> <p>matter ^[10] - 1196:23, 1199:45, 1212:45, 1244:42, 1275:9, 1287:5, 1299:6, 1327:7, 1334:29, 1337:43</p> <p>matters ^[11] - 1189:30, 1195:25, 1195:26, 1195:31, 1196:19, 1205:24, 1205:25, 1205:45, 1205:47, 1224:34, 1328:14</p> <p>MATTHEW ^[1] - 1168:31</p> <p>maximum ^[7] - 1240:23, 1242:40, 1262:22, 1262:24, 1295:24, 1298:25</p> <p>MAY ^[1] - 1186:21</p> <p>MBS ^[2] - 1284:17</p> <p>McCrae ^[10] - 1167:4, 1168:15, 1177:2, 1177:8, 1197:7, 1218:14, 1336:27, 1337:24, 1337:44,</p>	<p>1347:17</p> <p>mean ^[41] - 1170:5, 1172:17, 1174:7, 1174:25, 1176:41, 1178:41, 1187:18, 1187:29, 1187:32, 1198:29, 1206:35, 1216:23, 1217:32, 1217:44, 1218:21, 1229:8, 1234:14, 1238:18, 1242:26, 1247:47, 1254:31, 1262:12, 1263:8, 1287:9, 1288:36, 1290:14, 1298:20, 1299:40, 1303:35, 1304:45, 1309:13, 1324:13, 1328:29, 1335:16, 1336:16, 1337:21, 1343:13, 1345:35, 1349:7</p> <p>meaning ^[1] - 1335:34</p> <p>meaningfully ^[1] - 1293:41</p> <p>means ^[15] - 1171:27, 1181:35, 1182:6, 1182:9, 1191:20, 1210:29, 1220:18, 1264:29, 1286:34, 1305:2, 1305:13, 1306:33, 1310:4, 1315:21, 1329:2</p> <p>meant ^[5] - 1188:26, 1222:40, 1233:36, 1303:36, 1314:1</p> <p>measure ^[8] - 1181:23, 1187:11, 1191:43, 1206:32, 1286:4, 1307:23, 1307:25, 1346:11</p> <p>measured ^[8] - 1189:7, 1196:28, 1226:36, 1293:41, 1299:11, 1313:23, 1332:43, 1336:1</p> <p>measurement ^[8] - 1196:33, 1291:29, 1291:30, 1291:38, 1292:2, 1299:20, 1307:25, 1336:6</p> <p>measurements ^[5] - 1187:14, 1291:5, 1291:9, 1308:44, 1308:45</p> <p>measuring ^[3] - 1227:43, 1227:44, 1227:46</p> <p>mechanics ^[2] - 1211:13, 1336:38</p> <p>mechanism ^[3] -</p>
--	---	---	---	---

<p>1181:31, 1191:30 mechanisms [1] - 1218:1 medium [7] - 1175:1, 1180:12, 1180:15, 1210:27, 1210:29, 1210:34, 1210:35 meeting [2] - 1217:38, 1301:42 meetings [6] - 1301:30, 1301:33, 1301:38, 1302:6, 1302:20, 1302:25 meets [1] - 1170:24 megalitre [7] - 1316:46, 1324:31, 1346:10, 1346:20 megalitres [18] - 1237:6, 1237:12, 1237:31, 1237:36, 1246:17, 1246:45, 1323:10, 1323:11, 1323:12, 1343:45, 1343:46, 1344:17, 1344:19, 1344:21, 1344:24, 1344:35, 1344:37, 1346:12 Melbourne [1] - 1167:18 members [1] - 1284:17 memorandum [5] - 1319:19, 1334:30, 1334:36, 1334:46, 1335:3 memory [2] - 1266:34, 1289:33 mention [13] - 1172:14, 1174:18, 1179:10, 1191:40, 1193:4, 1214:44, 1215:4, 1311:18, 1314:20, 1314:22, 1314:32, 1323:18, 1334:30 mentioned [14] - 1205:26, 1212:17, 1220:33, 1284:32, 1287:29, 1293:38, 1303:47, 1306:45, 1312:44, 1314:18, 1314:21, 1343:38, 1343:40, 1343:44 merit [1] - 1294:4 mesh [1] - 1173:20 messy [1] - 1191:41 metal [2] - 1309:19, 1311:28 metals [3] - 1304:2, 1304:3, 1343:33</p>	<p>meter [1] - 1308:13 method [1] - 1179:4 method's [1] - 1254:39 metre [13] - 1187:18, 1187:21, 1196:32, 1202:24, 1202:27, 1238:26, 1260:21, 1263:26, 1277:1, 1285:38, 1289:38, 1290:12, 1295:39 metre's [1] - 1237:43 metres [80] - 1173:18, 1174:26, 1176:16, 1176:19, 1179:15, 1183:8, 1183:11, 1183:13, 1191:44, 1191:46, 1191:47, 1192:3, 1202:24, 1202:25, 1202:28, 1202:29, 1202:32, 1202:47, 1203:11, 1214:47, 1221:13, 1222:42, 1230:11, 1230:13, 1236:24, 1238:22, 1239:19, 1240:7, 1242:5, 1243:41, 1247:28, 1249:4, 1249:5, 1252:26, 1252:28, 1252:31, 1252:45, 1253:1, 1254:22, 1254:32, 1258:2, 1258:4, 1258:21, 1258:22, 1260:9, 1260:36, 1261:24, 1262:12, 1264:6, 1276:1, 1277:2, 1278:21, 1278:23, 1280:3, 1280:4, 1280:41, 1281:8, 1282:16, 1282:46, 1287:18, 1287:23, 1287:25, 1287:29, 1287:31, 1287:34, 1289:32, 1289:33, 1290:13, 1293:10, 1293:25, 1295:15, 1296:4, 1298:22, 1298:28, 1314:39, 1349:22 mid [2] - 1244:34, 1257:28 mid-70s [2] - 1171:9, 1179:36 mid-left [1] - 1257:28 mid-week [1] - 1244:34 middle [5] - 1185:6, 1257:26, 1257:30,</p>	<p>1266:2, 1302:32 might [80] - 1169:23, 1170:30, 1172:35, 1174:19, 1180:6, 1180:19, 1180:23, 1180:24, 1185:15, 1186:3, 1197:35, 1198:29, 1199:31, 1200:18, 1201:17, 1202:1, 1202:37, 1204:5, 1204:36, 1205:9, 1206:1, 1206:7, 1206:28, 1206:31, 1207:27, 1207:39, 1210:16, 1210:30, 1211:13, 1211:36, 1212:8, 1212:11, 1216:3, 1221:28, 1221:35, 1221:47, 1224:19, 1230:1, 1233:6, 1238:12, 1240:18, 1247:39, 1248:45, 1256:4, 1263:20, 1266:15, 1273:22, 1273:23, 1273:24, 1273:37, 1274:9, 1274:17, 1275:43, 1276:14, 1279:18, 1279:34, 1279:39, 1281:39, 1284:3, 1284:37, 1286:15, 1289:5, 1298:36, 1298:41, 1304:5, 1307:17, 1307:37, 1314:30, 1314:36, 1317:5, 1324:35, 1325:14, 1325:15, 1327:1, 1327:10, 1337:27, 1340:3, 1341:45, 1346:32, 1346:34 migrated [2] - 1191:36, 1212:40 milligram [2] - 1323:5, 1323:6 milligrams [2] - 1310:36, 1333:40 millilitres [1] - 1348:29 millimetres [10] - 1236:25, 1237:46, 1238:27, 1238:28, 1296:6, 1297:6, 1297:30, 1297:35, 1298:18, 1299:21 million [6] - 1228:38, 1229:11, 1240:40, 1244:7, 1244:8, 1346:10</p>	<p>million-odd [1] - 1240:40 mills [1] - 1242:6 mind [11] - 1171:20, 1180:30, 1187:13, 1188:18, 1247:17, 1299:40, 1313:1, 1327:36, 1336:47, 1339:42, 1344:10 mine [3] - 1244:43, 1278:39, 1290:16 mineral [5] - 1306:12, 1306:41, 1309:35, 1312:7 minerals [5] - 1305:31, 1306:9, 1306:13, 1310:43, 1311:29 minimum [2] - 1202:30, 1202:47 minor [17] - 1172:25, 1174:47, 1180:15, 1190:17, 1192:8, 1209:17, 1209:22, 1210:27, 1210:34, 1211:2, 1223:11, 1223:14, 1335:22, 1335:23, 1335:38 minus [4] - 1229:10, 1255:10, 1255:11, 1256:40 minute [5] - 1291:27, 1291:35, 1327:37, 1333:1, 1348:32 minutes [12] - 1222:36, 1271:41, 1272:2, 1300:17, 1300:21, 1302:21, 1325:41, 1326:1, 1326:5, 1326:34, 1327:34, 1348:9 missing [2] - 1315:21, 1324:30 misspoke [1] - 1293:13 misstated [1] - 1241:24 mistake [2] - 1286:25 misunderstanding [1] - 1237:35 misunderstood [1] - 1188:25 mix [5] - 1276:10, 1309:18, 1325:24, 1343:31, 1343:47 mixed [2] - 1316:20, 1343:21 mixing [15] - 1309:32, 1309:40, 1310:14, 1316:11, 1318:35,</p>	<p>1321:31, 1322:44, 1323:3, 1323:7, 1323:8, 1325:30, 1333:41, 1343:41, 1345:6, 1349:47 mixture [6] - 1330:37, 1333:35, 1333:37, 1333:44, 1334:23, 1343:24 ml [1] - 1314:21 moat [1] - 1239:30 mobilise [1] - 1191:20 mobilising [1] - 1190:47 Model [1] - 1181:22 model [34] - 1172:17, 1172:18, 1176:7, 1177:25, 1177:26, 1177:29, 1177:35, 1189:11, 1204:37, 1211:17, 1211:21, 1214:26, 1224:26, 1240:32, 1240:33, 1241:36, 1269:42, 1292:43, 1293:40, 1295:5, 1295:21, 1297:1, 1297:10, 1297:15, 1297:18, 1298:7, 1298:15, 1298:36, 1298:41, 1298:47, 1299:28, 1316:18, 1316:42, 1343:19 model's [1] - 1244:6 modelled [3] - 1211:20, 1228:46, 1237:24 modelling [9] - 1236:8, 1240:17, 1241:4, 1241:39, 1242:12, 1244:2, 1286:31, 1302:40, 1313:30 models [2] - 1176:6, 1278:35 moderate [10] - 1172:26, 1175:2, 1197:5, 1210:28, 1317:10, 1317:16, 1318:31, 1318:32, 1333:28, 1337:18 moderately [1] - 1237:33 modifications [3] - 1296:19, 1296:21, 1296:22 modified [1] - 1314:6 moister [1] - 1217:43 moisture [8] - 1218:22, 1218:27,</p>
--	---	---	--	---

1264:16, 1264:26, 1264:31, 1293:21, 1293:22, 1347:10 moment ^[11] - 1192:43, 1196:13, 1253:45, 1261:11, 1263:39, 1267:40, 1270:29, 1304:10, 1330:5, 1332:5 MONDAY ^[1] - 1351:24 months ^[6] - 1208:24, 1342:45, 1342:46, 1342:47, 1343:3, 1351:17 mop ^[3] - 1325:47, 1341:44, 1345:23 mop-up ^[3] - 1325:47, 1341:44, 1345:23 morning ^[5] - 1168:3, 1168:10, 1297:31, 1322:5, 1350:44 Mornington ^[3] - 1167:39, 1180:1, 1268:16 moss ^[2] - 1222:1, 1222:6 most ^[23] - 1189:11, 1205:33, 1206:6, 1213:16, 1216:17, 1224:40, 1224:41, 1228:8, 1237:25, 1268:44, 1275:5, 1275:14, 1285:42, 1296:14, 1297:26, 1298:22, 1303:47, 1310:34, 1321:39, 1322:35, 1345:5, 1348:18, 1348:39 motorway ^[3] - 1218:17, 1250:27, 1250:44 mountains ^[1] - 1306:6 mouth ^[1] - 1223:45 mouthful ^[1] - 1310:44 move ^[31] - 1171:36, 1171:40, 1171:44, 1176:11, 1179:8, 1180:7, 1204:4, 1204:13, 1204:24, 1207:27, 1211:29, 1212:34, 1213:42, 1214:19, 1215:20, 1223:3, 1230:14, 1235:2, 1251:19, 1294:45, 1299:46, 1303:8, 1303:9, 1310:17, 1310:33, 1317:35, 1320:13,	1331:2, 1331:10, 1333:16, 1345:3 moved ^[3] - 1182:19, 1189:18, 1253:30 movement ^[7] - 1195:1, 1195:4, 1195:9, 1195:19, 1217:19, 1287:23, 1306:39 moving ^[11] - 1187:28, 1187:40, 1188:2, 1188:22, 1188:38, 1191:29, 1191:31, 1191:34, 1194:39, 1251:32, 1259:16 MPSC ^[1] - 1218:31 MR ^[1573] - 1168:3, 1168:7, 1168:23, 1168:41, 1168:43, 1169:1, 1169:3, 1169:13, 1169:16, 1169:19, 1169:21, 1169:23, 1169:26, 1169:28, 1169:30, 1169:32, 1169:34, 1169:39, 1169:41, 1169:46, 1170:1, 1170:5, 1170:10, 1170:13, 1170:16, 1170:22, 1170:24, 1170:26, 1170:28, 1170:33, 1170:45, 1170:47, 1171:4, 1171:7, 1171:12, 1171:14, 1171:19, 1171:23, 1171:25, 1171:29, 1171:46, 1172:4, 1172:6, 1172:10, 1172:12, 1172:17, 1172:22, 1172:29, 1172:31, 1172:33, 1172:41, 1172:43, 1172:46, 1173:1, 1173:3, 1173:7, 1173:10, 1173:13, 1173:20, 1173:23, 1174:7, 1174:13, 1174:17, 1174:25, 1174:40, 1174:42, 1174:45, 1175:6, 1175:14, 1175:18, 1175:20, 1175:25, 1175:32, 1175:34, 1175:36, 1175:39, 1175:41, 1175:43, 1175:46, 1176:1, 1176:3, 1176:6, 1176:25, 1176:27, 1176:29, 1176:31, 1176:41,	1176:44, 1177:16, 1177:19, 1177:21, 1177:25, 1177:40, 1177:42, 1177:44, 1177:47, 1178:8, 1178:13, 1178:28, 1178:30, 1178:44, 1178:47, 1179:7, 1179:13, 1179:25, 1179:30, 1179:39, 1179:41, 1179:46, 1180:1, 1180:6, 1180:28, 1180:30, 1180:33, 1180:36, 1180:40, 1180:42, 1180:45, 1180:47, 1181:4, 1181:6, 1181:10, 1181:14, 1181:17, 1181:47, 1182:3, 1182:9, 1182:13, 1182:15, 1182:17, 1182:22, 1182:26, 1182:28, 1182:32, 1182:34, 1182:39, 1182:43, 1182:45, 1182:47, 1183:4, 1183:26, 1183:31, 1183:35, 1183:37, 1183:40, 1183:42, 1183:45, 1183:47, 1184:2, 1184:5, 1184:8, 1184:11, 1184:13, 1184:16, 1184:18, 1184:21, 1184:25, 1184:29, 1184:34, 1184:38, 1184:41, 1184:43, 1184:45, 1185:1, 1185:3, 1185:22, 1185:27, 1185:31, 1185:33, 1185:40, 1185:45, 1186:1, 1186:3, 1186:6, 1186:8, 1186:10, 1186:12, 1186:17, 1186:24, 1186:29, 1186:31, 1186:33, 1186:35, 1186:38, 1186:40, 1186:42, 1186:44, 1186:47, 1187:7, 1187:9, 1187:16, 1187:18, 1187:24, 1187:32, 1187:36, 1187:38, 1187:40, 1187:43, 1187:47, 1188:5, 1188:7, 1188:11, 1188:13, 1188:15, 1188:17, 1188:20, 1188:22, 1188:25, 1188:28,	1188:30, 1188:36, 1188:40, 1189:5, 1189:9, 1189:13, 1189:17, 1189:23, 1189:25, 1189:27, 1189:33, 1189:39, 1189:41, 1189:44, 1189:46, 1190:4, 1190:9, 1190:11, 1190:14, 1190:16, 1190:25, 1190:27, 1190:31, 1190:33, 1190:35, 1192:14, 1192:16, 1192:18, 1192:21, 1192:23, 1192:25, 1192:27, 1192:29, 1192:31, 1192:35, 1192:42, 1193:1, 1193:3, 1193:7, 1193:27, 1193:29, 1193:31, 1193:33, 1193:35, 1193:37, 1193:39, 1193:41, 1193:43, 1193:45, 1194:2, 1194:4, 1194:7, 1194:11, 1194:13, 1194:15, 1194:17, 1194:19, 1194:21, 1194:24, 1194:26, 1194:28, 1194:31, 1194:34, 1195:25, 1195:29, 1195:31, 1195:35, 1195:37, 1195:40, 1195:45, 1196:1, 1196:7, 1196:10, 1196:12, 1196:26, 1196:38, 1197:10, 1197:14, 1197:18, 1197:23, 1197:30, 1197:38, 1197:46, 1198:4, 1198:11, 1198:24, 1198:40, 1198:45, 1199:9, 1199:18, 1199:29, 1199:37, 1199:41, 1200:1, 1200:13, 1200:21, 1200:30, 1200:39, 1200:44, 1201:11, 1201:15, 1201:24, 1201:28, 1201:30, 1201:36, 1201:38, 1201:41, 1201:45, 1202:1, 1202:4, 1202:8, 1202:10, 1202:12, 1202:16, 1202:18, 1202:20, 1202:22, 1202:34, 1202:40, 1202:42, 1202:46, 1203:5,	1203:8, 1203:14, 1203:18, 1203:20, 1203:23, 1203:26, 1203:33, 1203:36, 1203:38, 1204:4, 1204:13, 1204:21, 1204:31, 1204:33, 1204:36, 1204:40, 1204:42, 1204:45, 1205:1, 1205:5, 1205:7, 1205:9, 1205:13, 1205:15, 1205:17, 1205:21, 1205:23, 1205:28, 1205:30, 1206:10, 1206:28, 1206:38, 1206:40, 1206:47, 1207:4, 1207:10, 1207:15, 1207:18, 1207:22, 1207:30, 1207:32, 1207:34, 1207:42, 1207:45, 1207:47, 1208:2, 1208:5, 1208:7, 1208:9, 1208:11, 1208:35, 1208:38, 1208:40, 1208:42, 1208:44, 1208:46, 1209:1, 1209:3, 1209:8, 1209:10, 1209:12, 1209:30, 1209:32, 1209:46, 1210:1, 1210:9, 1210:14, 1210:16, 1210:19, 1210:22, 1210:24, 1210:46, 1211:1, 1211:10, 1211:12, 1211:17, 1211:29, 1211:43, 1211:45, 1212:1, 1212:6, 1212:8, 1212:11, 1212:17, 1212:21, 1212:23, 1212:25, 1212:28, 1212:34, 1212:39, 1212:43, 1213:9, 1213:14, 1213:20, 1213:22, 1213:28, 1213:30, 1213:32, 1213:34, 1213:36, 1213:38, 1213:40, 1213:42, 1213:44, 1214:1, 1214:4, 1214:6, 1214:8, 1214:10, 1214:12, 1214:14, 1214:17, 1214:19, 1214:25, 1214:38, 1214:42, 1214:44, 1215:2, 1215:4, 1215:11, 1215:13, 1215:15,
--	--	---	--	--

1215:19, 1215:25, 1215:27, 1215:32, 1215:36, 1215:41, 1215:43, 1216:1, 1216:3, 1216:11, 1216:23, 1216:25, 1216:27, 1216:29, 1216:35, 1216:40, 1216:43, 1217:6, 1217:8, 1217:10, 1217:13, 1217:17, 1217:19, 1217:21, 1217:23, 1217:27, 1217:29, 1217:32, 1218:20, 1218:24, 1218:26, 1218:30, 1218:36, 1218:38, 1218:41, 1218:44, 1218:46, 1219:4, 1219:6, 1219:10, 1219:13, 1219:15, 1219:18, 1219:21, 1219:23, 1219:27, 1219:38, 1219:43, 1220:5, 1220:10, 1220:16, 1220:20, 1220:28, 1220:36, 1220:38, 1220:42, 1220:44, 1220:47, 1221:3, 1221:6, 1221:24, 1221:26, 1221:28, 1221:32, 1221:34, 1221:40, 1221:42, 1221:45, 1221:47, 1222:4, 1222:11, 1222:14, 1222:16, 1222:20, 1222:24, 1222:26, 1222:28, 1222:30, 1223:2, 1223:11, 1223:13, 1223:18, 1223:21, 1223:25, 1223:35, 1223:38, 1223:40, 1223:42, 1223:44, 1223:47, 1224:2, 1224:8, 1224:10, 1224:13, 1224:15, 1224:18, 1224:22, 1224:26, 1224:32, 1224:37, 1224:39, 1224:44, 1225:3, 1225:6, 1225:8, 1225:12, 1225:19, 1225:23, 1225:25, 1225:29, 1225:32, 1225:37, 1225:39, 1225:43, 1225:45, 1226:5, 1226:8, 1226:17, 1226:20, 1226:22, 1226:24, 1226:26,	1226:30, 1226:32, 1226:34, 1226:36, 1226:39, 1226:41, 1226:46, 1227:4, 1227:6, 1227:13, 1227:15, 1227:20, 1227:23, 1227:26, 1227:29, 1227:31, 1227:33, 1227:36, 1227:38, 1227:40, 1227:42, 1228:2, 1228:4, 1228:6, 1228:8, 1228:15, 1228:17, 1228:19, 1228:21, 1228:23, 1228:25, 1228:28, 1228:31, 1228:41, 1228:43, 1229:5, 1229:7, 1229:14, 1229:16, 1229:23, 1229:31, 1229:37, 1229:39, 1229:44, 1229:46, 1230:7, 1230:9, 1230:23, 1230:27, 1230:34, 1230:37, 1230:40, 1230:42, 1231:1, 1231:3, 1231:7, 1231:12, 1231:16, 1231:18, 1231:20, 1231:24, 1231:28, 1231:33, 1231:35, 1231:47, 1232:2, 1232:9, 1232:14, 1232:18, 1232:22, 1232:30, 1232:33, 1232:40, 1232:43, 1232:46, 1233:1, 1233:3, 1233:6, 1233:10, 1233:18, 1233:21, 1233:23, 1233:25, 1233:27, 1233:29, 1233:31, 1233:38, 1233:40, 1233:43, 1234:7, 1234:9, 1234:13, 1234:18, 1234:30, 1234:34, 1235:1, 1235:15, 1235:20, 1235:26, 1235:31, 1235:34, 1235:36, 1235:39, 1235:43, 1236:2, 1236:6, 1236:11, 1236:14, 1236:17, 1236:21, 1236:33, 1236:37, 1236:47, 1237:2, 1237:8, 1237:10, 1237:16, 1237:19, 1237:22, 1237:35, 1237:41, 1238:5,	1238:8, 1238:10, 1238:15, 1238:18, 1238:25, 1238:32, 1238:34, 1238:37, 1238:39, 1238:42, 1238:45, 1238:47, 1239:2, 1239:5, 1239:9, 1239:12, 1239:15, 1239:26, 1239:35, 1239:40, 1239:42, 1239:44, 1240:1, 1240:3, 1240:10, 1240:14, 1240:17, 1240:21, 1240:26, 1240:30, 1240:32, 1240:37, 1240:44, 1241:1, 1241:3, 1241:8, 1241:14, 1241:16, 1241:22, 1241:24, 1241:35, 1241:39, 1242:1, 1242:4, 1242:9, 1242:12, 1242:20, 1242:26, 1242:33, 1242:45, 1242:47, 1243:2, 1243:4, 1243:11, 1243:13, 1243:16, 1243:18, 1243:26, 1243:36, 1243:39, 1243:43, 1243:45, 1244:5, 1244:13, 1244:15, 1244:22, 1244:26, 1244:28, 1244:31, 1244:33, 1244:40, 1244:47, 1245:13, 1245:18, 1245:24, 1245:26, 1245:29, 1245:37, 1245:42, 1245:45, 1245:47, 1246:8, 1246:13, 1246:15, 1246:21, 1246:23, 1246:28, 1246:34, 1246:37, 1246:42, 1246:44, 1246:47, 1247:3, 1247:9, 1247:11, 1247:15, 1247:17, 1247:24, 1247:30, 1247:35, 1247:37, 1247:41, 1247:47, 1248:13, 1248:17, 1248:30, 1248:32, 1248:35, 1248:41, 1248:43, 1249:1, 1249:3, 1249:9, 1249:13, 1249:19, 1249:22, 1249:26, 1249:28, 1249:37, 1249:39, 1249:47, 1250:2,	1250:4, 1250:7, 1250:10, 1250:13, 1250:17, 1250:19, 1250:22, 1250:35, 1250:37, 1250:41, 1251:4, 1251:8, 1251:17, 1251:34, 1251:36, 1251:43, 1251:47, 1252:3, 1252:7, 1252:15, 1252:19, 1252:21, 1252:23, 1252:35, 1252:38, 1252:40, 1252:42, 1252:44, 1252:47, 1253:4, 1253:12, 1253:15, 1253:18, 1253:20, 1253:26, 1253:42, 1254:2, 1254:4, 1254:7, 1254:9, 1254:14, 1254:17, 1254:21, 1254:44, 1254:46, 1255:3, 1255:7, 1255:9, 1255:13, 1255:15, 1255:18, 1255:21, 1255:29, 1255:35, 1255:38, 1255:45, 1256:1, 1256:7, 1256:10, 1256:13, 1256:17, 1256:19, 1256:24, 1256:42, 1257:5, 1257:7, 1257:10, 1257:23, 1257:40, 1257:42, 1258:6, 1258:8, 1258:10, 1258:13, 1258:15, 1258:24, 1258:26, 1258:28, 1258:30, 1258:32, 1258:34, 1258:37, 1258:39, 1258:41, 1258:43, 1258:45, 1259:4, 1259:14, 1259:16, 1259:39, 1260:3, 1260:11, 1260:16, 1260:24, 1260:26, 1260:31, 1260:40, 1260:43, 1261:4, 1261:8, 1261:20, 1261:29, 1261:37, 1261:39, 1261:46, 1262:4, 1262:12, 1262:22, 1262:27, 1262:37, 1262:46, 1263:4, 1263:8, 1263:14, 1263:28, 1263:44, 1264:9, 1264:11, 1264:13, 1264:29, 1264:33, 1264:40,	1264:42, 1264:44, 1264:47, 1265:2, 1265:4, 1265:11, 1265:13, 1265:21, 1265:23, 1265:35, 1265:37, 1265:40, 1265:42, 1266:1, 1266:5, 1266:8, 1266:10, 1266:15, 1266:17, 1266:20, 1266:22, 1266:36, 1266:39, 1266:44, 1266:46, 1267:3, 1267:8, 1267:10, 1267:18, 1267:26, 1267:30, 1267:33, 1267:37, 1267:44, 1267:46, 1268:2, 1268:4, 1268:9, 1268:11, 1268:15, 1268:20, 1268:23, 1268:27, 1268:31, 1268:46, 1269:2, 1269:4, 1269:7, 1269:11, 1269:16, 1269:18, 1269:22, 1269:29, 1269:33, 1269:36, 1269:38, 1270:3, 1270:7, 1270:13, 1270:17, 1270:21, 1270:23, 1270:25, 1270:33, 1270:35, 1270:39, 1270:41, 1270:46, 1271:1, 1271:6, 1271:10, 1271:12, 1271:23, 1271:25, 1271:28, 1271:31, 1271:33, 1272:24, 1272:32, 1272:39, 1272:44, 1273:3, 1273:15, 1273:20, 1273:26, 1273:34, 1273:39, 1273:46, 1274:6, 1274:12, 1274:21, 1274:37, 1274:42, 1275:1, 1275:8, 1275:16, 1275:23, 1275:29, 1275:34, 1276:3, 1276:9, 1276:24, 1276:35, 1276:40, 1277:5, 1277:18, 1277:28, 1277:34, 1277:40, 1278:1, 1278:10, 1278:15, 1278:25, 1278:33, 1279:2, 1279:10, 1279:15, 1279:21, 1279:27, 1279:37, 1279:41, 1280:8,
---	---	---	---	--

1280:24, 1280:33, 1280:39, 1280:47, 1281:7, 1281:16, 1281:29, 1281:43, 1282:1, 1282:8, 1282:14, 1282:19, 1282:23, 1282:27, 1282:32, 1282:36, 1282:41, 1282:45, 1283:7, 1283:12, 1283:18, 1283:25, 1283:32, 1283:38, 1283:42, 1283:47, 1284:12, 1284:17, 1284:23, 1284:30, 1284:37, 1284:43, 1284:47, 1285:13, 1285:22, 1285:30, 1285:36, 1285:45, 1286:10, 1286:15, 1286:23, 1286:40, 1287:9, 1287:20, 1287:25, 1287:37, 1287:41, 1287:46, 1288:12, 1288:19, 1288:38, 1289:10, 1289:23, 1289:29, 1289:46, 1290:4, 1290:10, 1290:41, 1291:9, 1291:15, 1291:23, 1291:29, 1291:37, 1291:40, 1291:42, 1291:44, 1292:1, 1292:9, 1292:21, 1292:36, 1293:4, 1293:17, 1293:44, 1294:1, 1294:14, 1294:34, 1294:43, 1294:45, 1295:5, 1295:34, 1295:36, 1295:46, 1296:4, 1296:6, 1296:11, 1296:21, 1296:26, 1296:31, 1296:38, 1296:42, 1296:46, 1297:3, 1297:5, 1297:8, 1297:10, 1297:15, 1297:21, 1297:35, 1297:38, 1297:40, 1297:43, 1297:45, 1298:3, 1298:13, 1298:17, 1298:31, 1298:33, 1298:35, 1298:38, 1298:40, 1298:44, 1298:46, 1299:2, 1299:4, 1299:8, 1299:15, 1299:20, 1299:24, 1299:26, 1299:28, 1299:32, 1299:34,	1299:39, 1299:46, 1300:7, 1300:11, 1300:14, 1300:27, 1300:32, 1300:46, 1301:1, 1301:4, 1301:6, 1301:8, 1301:10, 1301:12, 1301:14, 1301:16, 1301:18, 1301:20, 1301:22, 1301:25, 1301:29, 1301:35, 1301:37, 1301:40, 1301:42, 1301:45, 1301:47, 1302:2, 1302:5, 1302:8, 1302:11, 1302:13, 1302:20, 1302:23, 1302:25, 1302:27, 1302:29, 1302:32, 1302:35, 1302:38, 1302:42, 1302:46, 1303:1, 1303:5, 1303:7, 1303:19, 1303:25, 1303:35, 1303:42, 1304:9, 1304:17, 1304:21, 1304:26, 1304:29, 1304:34, 1304:44, 1305:2, 1305:6, 1305:10, 1305:13, 1305:18, 1305:20, 1305:26, 1305:30, 1305:34, 1305:40, 1305:45, 1305:47, 1306:5, 1306:15, 1306:29, 1306:45, 1307:9, 1307:13, 1307:35, 1308:2, 1308:10, 1308:13, 1308:20, 1308:22, 1308:25, 1308:34, 1308:39, 1309:6, 1309:11, 1309:31, 1309:39, 1310:3, 1310:9, 1310:17, 1310:22, 1310:24, 1310:26, 1310:28, 1310:31, 1310:33, 1311:13, 1311:31, 1311:38, 1311:41, 1311:43, 1312:11, 1312:16, 1312:18, 1312:22, 1312:24, 1312:27, 1312:29, 1312:32, 1312:40, 1312:42, 1313:1, 1313:6, 1313:10, 1313:12, 1313:15, 1313:27, 1313:29, 1313:34, 1313:41, 1313:44, 1313:46,	1314:15, 1315:4, 1315:11, 1315:13, 1315:15, 1315:17, 1315:28, 1315:34, 1316:2, 1316:15, 1316:34, 1316:40, 1317:5, 1317:14, 1317:20, 1317:26, 1317:37, 1317:42, 1318:1, 1318:4, 1318:9, 1318:12, 1318:14, 1318:17, 1318:20, 1318:25, 1318:30, 1318:39, 1319:3, 1319:5, 1319:7, 1319:10, 1319:19, 1319:23, 1319:27, 1319:38, 1319:45, 1320:3, 1320:7, 1320:11, 1320:21, 1320:25, 1320:30, 1320:35, 1320:40, 1320:46, 1321:3, 1321:8, 1321:12, 1321:19, 1321:23, 1321:27, 1321:36, 1321:38, 1321:45, 1322:3, 1322:7, 1322:11, 1322:13, 1322:15, 1322:17, 1322:19, 1322:22, 1322:26, 1322:29, 1322:31, 1323:14, 1323:26, 1323:29, 1324:7, 1324:43, 1325:1, 1325:11, 1325:18, 1325:20, 1325:22, 1325:26, 1325:29, 1325:36, 1325:41, 1326:9, 1326:15, 1326:18, 1326:21, 1326:26, 1326:33, 1326:38, 1326:42, 1326:44, 1327:1, 1327:6, 1327:27, 1327:32, 1328:1, 1328:7, 1328:9, 1328:13, 1328:23, 1328:26, 1328:31, 1328:33, 1328:39, 1328:43, 1329:2, 1329:4, 1329:7, 1329:10, 1329:14, 1329:17, 1329:22, 1329:24, 1329:26, 1329:30, 1329:36, 1329:38, 1329:42, 1329:44, 1330:4, 1330:8, 1330:10, 1330:13, 1330:15,	1330:17, 1330:19, 1330:21, 1330:23, 1330:29, 1330:36, 1330:40, 1330:43, 1330:45, 1330:47, 1331:4, 1331:20, 1331:26, 1331:32, 1331:37, 1331:42, 1332:2, 1332:4, 1332:8, 1332:10, 1332:13, 1332:15, 1332:19, 1332:21, 1332:29, 1332:32, 1332:34, 1332:36, 1332:39, 1332:42, 1332:45, 1332:47, 1333:4, 1333:7, 1333:9, 1333:11, 1333:14, 1333:16, 1333:34, 1333:47, 1334:3, 1334:5, 1334:7, 1334:9, 1334:13, 1334:15, 1334:17, 1334:19, 1334:26, 1334:28, 1334:33, 1334:35, 1334:38, 1334:43, 1334:46, 1335:2, 1335:7, 1335:12, 1335:16, 1335:25, 1335:29, 1335:40, 1335:47, 1336:5, 1336:9, 1336:12, 1336:14, 1336:16, 1336:20, 1336:22, 1336:29, 1336:37, 1336:47, 1337:8, 1337:10, 1337:15, 1337:18, 1337:21, 1337:30, 1337:32, 1337:36, 1337:39, 1338:9, 1338:15, 1338:38, 1338:44, 1339:3, 1339:9, 1339:16, 1339:25, 1339:36, 1339:40, 1339:45, 1340:9, 1340:14, 1340:18, 1340:26, 1340:30, 1340:37, 1340:46, 1341:6, 1341:11, 1341:16, 1341:23, 1341:32, 1341:39, 1342:10, 1342:15, 1342:22, 1342:26, 1342:31, 1342:35, 1342:42, 1343:2, 1343:12, 1344:45, 1345:16, 1345:28, 1345:31, 1345:33, 1345:35, 1345:38,	1345:47, 1346:14, 1346:44, 1347:13, 1347:22, 1347:29, 1347:34, 1347:43, 1348:5, 1348:46, 1349:4, 1349:15, 1349:19, 1349:38, 1350:10, 1350:17, 1350:22, 1350:30, 1350:44, 1351:2, 1351:6, 1351:11 MS [259] - 1196:41, 1196:43, 1197:12, 1197:16, 1197:20, 1197:26, 1197:32, 1197:42, 1198:1, 1198:6, 1198:18, 1198:36, 1198:42, 1199:6, 1199:11, 1199:20, 1199:34, 1199:39, 1199:43, 1200:7, 1200:16, 1200:25, 1200:33, 1200:41, 1201:8, 1201:13, 1201:21, 1201:26, 1204:16, 1259:20, 1259:28, 1259:30, 1259:41, 1260:5, 1260:13, 1260:18, 1260:29, 1260:34, 1261:1, 1261:6, 1261:11, 1261:22, 1261:34, 1261:42, 1262:1, 1262:7, 1262:16, 1262:24, 1262:31, 1262:41, 1263:1, 1263:6, 1263:11, 1263:20, 1263:41, 1263:47, 1271:41, 1272:1, 1272:10, 1272:12, 1272:26, 1272:35, 1272:41, 1272:47, 1273:9, 1273:17, 1273:22, 1273:28, 1273:36, 1273:42, 1274:1, 1274:9, 1274:15, 1274:27, 1274:39, 1274:45, 1275:4, 1275:13, 1275:18, 1275:26, 1275:31, 1275:37, 1275:40, 1275:42, 1276:5, 1276:14, 1276:28, 1276:38, 1276:43, 1277:12, 1277:24, 1277:31, 1277:37, 1277:42, 1278:5, 1278:12, 1278:18, 1278:30, 1278:44,
--	---	---	---	--

1279:5, 1279:13, 1279:17, 1279:24, 1279:34, 1279:39, 1279:44, 1280:22, 1280:26, 1280:36, 1281:3, 1281:11, 1281:21, 1281:37, 1281:46, 1282:3, 1282:10, 1282:16, 1282:21, 1282:25, 1282:29, 1282:34, 1282:39, 1282:43, 1283:3, 1283:9, 1283:14, 1283:21, 1283:28, 1283:34, 1283:40, 1283:44, 1284:7, 1284:14, 1284:20, 1284:25, 1284:32, 1284:40, 1284:45, 1285:10, 1285:17, 1285:24, 1285:32, 1285:42, 1286:6, 1286:12, 1286:18, 1286:27, 1287:7, 1287:17, 1287:22, 1287:33, 1287:39, 1287:43, 1288:5, 1288:16, 1288:36, 1288:46, 1289:19, 1289:26, 1289:40, 1290:1, 1290:6, 1290:19, 1290:37, 1290:43, 1291:1, 1291:11, 1291:19, 1291:26, 1291:32, 1291:46, 1292:5, 1292:17, 1292:30, 1293:1, 1293:13, 1293:38, 1293:46, 1294:6, 1294:30, 1294:38, 1300:16, 1325:47, 1326:5, 1327:18, 1327:23, 1327:36, 1338:19, 1338:25, 1338:29, 1338:33, 1338:35, 1338:40, 1338:46, 1339:5, 1339:12, 1339:20, 1339:27, 1339:38, 1339:42, 1339:47, 1340:11, 1340:16, 1340:21, 1340:28, 1340:32, 1340:42, 1341:1, 1341:8, 1341:13, 1341:18, 1341:25, 1341:37, 1341:43, 1342:3, 1342:5, 1342:12, 1342:17, 1342:24, 1342:28, 1342:33,	1342:37, 1342:44, 1343:9, 1343:15, 1344:2, 1344:14, 1344:21, 1344:26, 1344:31, 1344:37, 1344:41, 1345:12, 1345:20, 1345:26, 1346:2, 1346:4, 1346:17, 1346:46, 1347:15, 1347:24, 1347:31, 1347:40, 1347:47, 1348:36, 1349:1, 1349:7, 1349:17, 1349:30, 1349:33, 1349:36, 1350:3, 1350:14, 1350:19, 1350:24, 1350:33, 1350:37, 1350:42, 1351:4 MSC [1] - 1249:29 MSC.5056.0001.0003 [1] - 1182:23 MSC.5087.0001.0001 [2] - 1206:30, 1318:5 MSC.5087.0001.0157 [5] - 1183:27, 1193:45, 1216:45, 1220:29, 1265:24 mSC.5087.0001.0405 [1] - 1172:43 mud [1] - 1220:10 multiple [3] - 1178:24, 1276:24, 1316:32 multiply [1] - 1287:47 municipal [1] - 1195:14 must [12] - 1171:34, 1173:42, 1182:7, 1191:11, 1191:31, 1244:8, 1245:1, 1295:14, 1297:18, 1333:5, 1338:15 mysterious [1] - 1300:42	1272:36, 1274:18, 1279:47, 1286:33, 1288:19, 1288:20, 1288:28, 1290:2, 1292:11, 1312:3, 1314:43, 1315:35, 1316:8, 1324:1, 1324:10, 1324:41, 1325:8, 1333:44 naturally [2] - 1188:5, 1312:6 nature [7] - 1175:9, 1175:11, 1208:14, 1208:30, 1269:8, 1290:5, 1346:5 NDT01 [3] - 1215:34, 1215:37, 1222:20 NDT02 [1] - 1284:43 NDT04 [1] - 1283:38 NDT1 [6] - 1282:12, 1282:43, 1283:3, 1283:10, 1283:15 NDT13 [1] - 1233:12 NDT2 [7] - 1283:22, 1283:40, 1283:45, 1284:9, 1284:33, 1285:13, 1285:18 NDT2's [1] - 1285:10 NDT4 [1] - 1285:19 NDTO1 [2] - 1220:33, 1221:3 near [9] - 1176:34, 1181:11, 1181:43, 1218:14, 1218:16, 1257:37, 1274:4, 1274:15, 1290:27 nearby [1] - 1247:44 Nearmap's [1] - 1176:6 neat [1] - 1176:23 necessarily [6] - 1208:14, 1208:36, 1276:9, 1276:35, 1306:33, 1343:2 necessary [3] - 1179:10, 1249:15, 1261:34 need [46] - 1174:33, 1184:21, 1185:17, 1185:34, 1199:13, 1199:25, 1202:5, 1202:26, 1203:14, 1203:23, 1203:42, 1208:14, 1237:42, 1241:28, 1262:2, 1274:30, 1275:46, 1276:3, 1276:5, 1277:44, 1278:7, 1278:13, 1279:21, 1295:30, 1300:8,	1300:11, 1300:12, 1300:28, 1303:28, 1311:45, 1320:18, 1325:45, 1326:26, 1326:34, 1327:8, 1327:9, 1327:29, 1327:33, 1333:19, 1340:3, 1344:9, 1345:13, 1347:8, 1347:36, 1349:27 needed [14] - 1202:8, 1229:24, 1229:27, 1283:1, 1293:22, 1293:33, 1294:7, 1299:26, 1299:29, 1299:30, 1343:42, 1343:45, 1346:36, 1346:39 needless [1] - 1346:40 needs [7] - 1193:3, 1201:33, 1207:11, 1274:22, 1286:42, 1293:23, 1345:39 negates [1] - 1254:33 negligible [7] - 1231:41, 1231:42, 1232:3, 1232:4, 1232:6, 1234:14, 1234:38 network [4] - 1258:19, 1265:31, 1270:36, 1288:40 neutral [1] - 1230:37 never [4] - 1241:29, 1276:26, 1284:37, 1328:1 new [4] - 1184:18, 1187:1, 1187:18, 1324:25 newer [1] - 1171:20 news [1] - 1189:34 next [21] - 1194:22, 1200:34, 1210:38, 1212:26, 1216:43, 1222:37, 1222:38, 1230:15, 1231:35, 1232:28, 1241:41, 1248:14, 1248:44, 1267:21, 1267:37, 1294:45, 1313:2, 1316:34, 1332:16, 1332:23 nicely [2] - 1235:28, 1293:36 nine [1] - 1349:26 no-one [2] - 1187:10, 1345:42 nodes [1] - 1247:19 non [6] - 1172:38, 1185:20, 1257:45,	1285:34, 1307:17, 1307:36 non-issue [1] - 1285:34 non-laboratory [2] - 1307:17, 1307:36 non-natural [1] - 1172:38 non-publication [1] - 1185:20 non-trench [1] - 1257:45 none [1] - 1192:32 normal [4] - 1177:31, 1295:22, 1295:26, 1330:26 normally [8] - 1304:18, 1305:36, 1307:25, 1307:26, 1307:30, 1309:15, 1314:24, 1316:30 north [5] - 1176:16, 1176:20, 1183:11, 1217:35, 1295:23 north-east [1] - 1217:35 note [2] - 1227:6, 1255:21 noted [2] - 1244:34, 1256:20 notes [7] - 1169:37, 1209:40, 1219:39, 1251:6, 1297:12, 1302:25, 1302:27 nothing [3] - 1206:21, 1263:23, 1279:5 notice [4] - 1204:14, 1220:2, 1290:24, 1290:29 noticeable [2] - 1267:27, 1337:45 noticed [1] - 1168:15 noting [3] - 1233:6, 1346:25, 1346:33 November [6] - 1169:7, 1243:47, 1270:42, 1288:42, 1295:41 nowhere [1] - 1260:36 number [62] - 1170:30, 1189:6, 1192:29, 1193:33, 1194:11, 1196:45, 1205:33, 1208:22, 1209:14, 1209:35, 1209:36, 1209:37, 1209:43, 1209:44, 1216:38, 1219:45, 1219:46, 1229:19, 1229:21, 1235:9,
--	---	---	---	---

<p>1236:37, 1236:41, 1242:13, 1243:14, 1246:45, 1248:10, 1249:29, 1251:21, 1252:11, 1252:12, 1253:4, 1254:24, 1254:29, 1254:33, 1254:42, 1255:26, 1256:7, 1256:45, 1257:8, 1259:2, 1259:33, 1265:5, 1265:43, 1265:44, 1266:13, 1267:12, 1267:38, 1280:10, 1288:29, 1289:3, 1304:22, 1313:22, 1313:46, 1314:3, 1319:42, 1319:47, 1320:25, 1322:15, 1322:20, 1329:39, 1344:34</p> <p>numbers [13] - 1209:16, 1222:43, 1233:34, 1235:21, 1240:15, 1243:6, 1264:21, 1265:32, 1265:42, 1295:39, 1295:43, 1346:18, 1350:11</p> <p>numerous [2] - 1278:46, 1348:24</p>	<p>observed [16] - 1174:21, 1178:25, 1188:7, 1188:34, 1191:19, 1216:16, 1218:27, 1244:24, 1255:23, 1275:1, 1310:40, 1325:24, 1336:25, 1337:24</p> <p>obvious [6] - 1189:46, 1213:16, 1222:17, 1250:47, 1258:46, 1266:40</p> <p>obviously [17] - 1179:44, 1181:2, 1196:20, 1202:43, 1203:29, 1217:32, 1238:19, 1238:20, 1254:38, 1256:33, 1262:28, 1297:22, 1311:10, 1312:37, 1347:44, 1348:8, 1349:43</p> <p>occasion [2] - 1302:13, 1302:15</p> <p>occur [7] - 1205:25, 1272:47, 1273:22, 1273:23, 1273:24, 1294:16, 1298:18</p> <p>occurred [15] - 1175:4, 1180:37, 1236:27, 1268:29, 1268:44, 1272:41, 1294:15, 1297:16, 1336:32, 1343:3, 1343:4, 1347:25, 1347:44, 1348:14, 1349:25</p> <p>occurrences [1] - 1256:43</p> <p>occurring [3] - 1169:43, 1188:2, 1312:6</p> <p>occurs [2] - 1274:25, 1348:14</p> <p>October [3] - 1229:7, 1288:41, 1348:18</p> <p>odd [1] - 1240:40</p> <p>OF [1] - 1227:13</p> <p>offer [1] - 1262:20</p> <p>offset [2] - 1187:2, 1221:11</p> <p>often [4] - 1307:40, 1309:20, 1309:25, 1318:42</p> <p>old [18] - 1168:45, 1169:5, 1169:11, 1170:36, 1170:47, 1171:4, 1171:15, 1172:17, 1172:23, 1172:24, 1172:34,</p>	<p>1173:36, 1176:38, 1176:42, 1180:11, 1203:33, 1218:15, 1268:33</p> <p>older [2] - 1171:9, 1269:7</p> <p>once [15] - 1180:25, 1185:16, 1187:47, 1232:14, 1234:18, 1239:23, 1242:4, 1242:21, 1245:21, 1248:38, 1251:13, 1280:47, 1281:7, 1294:15, 1323:46</p> <p>one [179] - 1173:7, 1173:8, 1173:13, 1173:28, 1174:19, 1175:30, 1177:10, 1177:25, 1178:17, 1178:19, 1178:22, 1180:14, 1184:41, 1185:4, 1185:22, 1185:27, 1187:10, 1188:1, 1189:41, 1190:39, 1191:40, 1193:23, 1194:32, 1194:34, 1194:35, 1196:3, 1196:13, 1197:34, 1198:36, 1199:32, 1199:35, 1201:31, 1202:22, 1202:28, 1203:29, 1205:34, 1208:20, 1212:8, 1212:11, 1212:13, 1212:25, 1212:26, 1213:15, 1214:29, 1214:35, 1214:42, 1215:11, 1215:13, 1215:20, 1215:21, 1216:29, 1217:38, 1217:39, 1218:20, 1218:47, 1221:37, 1223:27, 1224:19, 1225:16, 1226:6, 1228:34, 1231:25, 1234:22, 1238:32, 1243:8, 1244:17, 1247:17, 1247:27, 1248:9, 1248:19, 1248:20, 1249:19, 1249:22, 1253:9, 1253:33, 1254:29, 1257:25, 1259:31, 1259:34, 1259:37, 1260:45, 1262:8, 1262:9, 1267:33, 1267:46, 1268:31, 1270:4, 1270:25, 1270:28, 1270:43, 1273:11, 1273:36, 1274:1,</p>	<p>1274:9, 1276:14, 1276:24, 1279:2, 1279:8, 1283:15, 1283:38, 1284:8, 1286:12, 1286:23, 1288:7, 1289:32, 1289:38, 1290:19, 1294:15, 1297:40, 1298:5, 1298:17, 1303:30, 1303:37, 1305:30, 1305:42, 1306:7, 1307:29, 1308:4, 1308:6, 1311:2, 1311:11, 1314:4, 1314:11, 1314:37, 1315:1, 1315:20, 1315:45, 1316:31, 1318:28, 1318:41, 1319:16, 1319:17, 1319:43, 1320:7, 1320:33, 1320:35, 1320:44, 1321:1, 1322:38, 1323:38, 1324:17, 1328:17, 1328:34, 1329:11, 1329:17, 1329:18, 1329:24, 1329:26, 1329:27, 1329:30, 1329:32, 1329:33, 1329:44, 1329:45, 1329:47, 1331:1, 1332:16, 1336:41, 1336:47, 1338:1, 1339:17, 1339:20, 1340:22, 1340:23, 1340:32, 1341:26, 1342:5, 1342:26, 1343:41, 1345:42, 1346:10, 1348:13, 1349:9, 1350:5</p> <p>one's [1] - 1247:17</p> <p>one-off [1] - 1314:4</p> <p>one-third [2] - 1243:8, 1244:17</p> <p>ones [15] - 1177:3, 1181:23, 1196:31, 1196:35, 1212:3, 1268:7, 1269:5, 1271:7, 1277:9, 1290:14, 1303:12, 1304:17, 1339:9, 1343:6</p> <p>onsite [1] - 1193:11</p> <p>onwards [1] - 1195:15</p> <p>open [5] - 1183:18, 1183:20, 1191:25, 1244:15, 1281:17</p> <p>opened [2] - 1182:45, 1191:22</p>	<p>operation [1] - 1264:30</p> <p>operator [2] - 1218:4, 1289:4</p> <p>opinion [38] - 1168:14, 1172:26, 1174:46, 1181:7, 1192:19, 1197:2, 1197:32, 1198:1, 1198:6, 1199:14, 1199:23, 1199:26, 1200:27, 1210:41, 1210:42, 1210:44, 1223:31, 1239:3, 1244:20, 1247:12, 1255:10, 1261:25, 1262:33, 1264:23, 1272:21, 1272:27, 1296:32, 1317:44, 1321:33, 1323:23, 1324:16, 1331:34, 1333:30, 1333:31, 1346:24, 1347:19, 1350:3</p> <p>opinions [5] - 1168:12, 1168:18, 1262:41, 1340:44</p> <p>opportunistic [1] - 1219:31</p> <p>opportunity [14] - 1179:26, 1189:27, 1196:14, 1201:32, 1203:27, 1219:34, 1294:46, 1299:5, 1308:40, 1317:43, 1318:26, 1325:12, 1328:15, 1333:19</p> <p>opposed [8] - 1174:10, 1210:14, 1210:16, 1231:43, 1246:26, 1246:39, 1264:34, 1293:10</p> <p>opposite [2] - 1332:24, 1332:29</p> <p>options [3] - 1193:11, 1288:7, 1324:17</p> <p>orange [3] - 1182:3, 1183:12, 1218:32</p> <p>order [10] - 1185:20, 1202:31, 1211:17, 1217:33, 1249:45, 1254:28, 1254:36, 1287:28, 1333:38, 1346:19</p> <p>ordered [1] - 1216:12</p> <p>orderly [1] - 1313:1</p> <p>orders [1] - 1233:14</p> <p>ordinarily [2] - 1262:9, 1262:18</p> <p>ordinary [1] - 1302:5</p>
<p style="text-align: center;">O</p>				
<p>o'clock [5] - 1178:35, 1178:36, 1234:42, 1326:29, 1327:40</p> <p>objective [1] - 1219:27</p> <p>objectives [1] - 1197:4</p> <p>obliged [1] - 1192:32</p> <p>oblique [2] - 1175:43, 1194:21</p> <p>observation [7] - 1216:32, 1278:26, 1278:27, 1309:47, 1310:4, 1311:27, 1325:9</p> <p>observational [1] - 1244:35</p> <p>observations [18] - 1175:21, 1216:8, 1216:13, 1216:14, 1218:21, 1218:31, 1219:2, 1219:39, 1219:45, 1219:47, 1253:28, 1253:29, 1255:32, 1258:47, 1269:40, 1278:28, 1289:26</p> <p>observe [1] - 1324:22</p>				

<p>organised [2] - 1313:10, 1321:13</p> <p>orientate [1] - 1169:5</p> <p>orientation [1] - 1177:34</p> <p>origin [1] - 1174:36</p> <p>original [7] - 1182:39, 1188:44, 1194:37, 1296:13, 1319:16, 1319:43, 1324:24</p> <p>otherwise [17] - 1191:29, 1198:8, 1233:8, 1242:43, 1248:43, 1249:35, 1250:20, 1255:24, 1256:44, 1256:46, 1270:14, 1292:23, 1294:21, 1297:17, 1326:19, 1326:21, 1338:12</p> <p>ought [1] - 1327:13</p> <p>ourselves [1] - 1219:28</p> <p>outcome [2] - 1283:28, 1285:2</p> <p>outflowing [1] - 1348:27</p> <p>outgoing [1] - 1266:42</p> <p>outlier [1] - 1252:5</p> <p>outline [1] - 1204:37</p> <p>outputs [2] - 1236:3, 1236:8</p> <p>outside [5] - 1178:6, 1191:4, 1234:23, 1257:36, 1333:18</p> <p>overall [4] - 1255:26, 1304:38, 1305:4, 1316:29</p> <p>overlaid [1] - 1247:6</p> <p>overland [1] - 1319:8</p> <p>overlap [1] - 1205:34</p> <p>overlay [5] - 1198:46, 1199:4, 1200:3, 1200:19, 1200:46</p> <p>overlays [1] - 1199:1</p> <p>oversight [5] - 1261:35, 1261:39, 1262:28, 1264:5, 1268:23</p> <p>Oversight [1] - 1261:37</p> <p>overwhelmingly [1] - 1192:10</p> <p>own [5] - 1204:38, 1228:2, 1256:1, 1295:1, 1301:20</p> <p>owner's [1] - 1282:29</p> <p>oxides [1] - 1310:43</p>	<p>P</p> <p>page [75] - 1173:4, 1173:7, 1176:12, 1184:38, 1193:24, 1193:33, 1194:11, 1196:47, 1200:35, 1202:18, 1202:20, 1206:30, 1209:34, 1209:37, 1209:41, 1210:25, 1211:34, 1213:1, 1213:23, 1215:20, 1215:21, 1216:5, 1216:36, 1216:44, 1218:26, 1220:31, 1221:12, 1221:35, 1228:33, 1228:44, 1230:2, 1230:15, 1230:43, 1231:35, 1235:45, 1236:39, 1241:17, 1245:47, 1247:4, 1251:24, 1253:44, 1257:26, 1259:34, 1264:40, 1265:4, 1265:24, 1265:25, 1266:22, 1266:26, 1267:21, 1267:38, 1268:6, 1270:27, 1273:11, 1274:30, 1274:31, 1274:32, 1289:5, 1289:41, 1290:39, 1291:32, 1291:34, 1312:43, 1318:6, 1319:47, 1320:13, 1320:16, 1320:46, 1321:17, 1322:11, 1322:17, 1337:10, 1340:2, 1347:3</p> <p>pages [6] - 1209:33, 1214:19, 1216:38, 1264:3, 1320:35, 1320:40</p> <p>pagination [1] - 1193:46</p> <p>paid [1] - 1303:2</p> <p>paleochannel [4] - 1177:35, 1178:14, 1276:47, 1280:3</p> <p>paleochannels [9] - 1276:44, 1276:45, 1277:14, 1277:26, 1278:46, 1279:6, 1279:17, 1279:21, 1279:34</p> <p>paragraph [24] - 1195:16, 1197:3, 1200:27, 1200:34, 1201:22, 1214:45,</p>	<p>1236:22, 1236:41, 1236:43, 1237:11, 1262:42, 1268:5, 1308:28, 1310:20, 1310:29, 1312:42, 1313:2, 1316:5, 1316:35, 1316:41, 1320:25, 1320:38, 1343:17, 1347:6</p> <p>paragraphs [5] - 1206:33, 1207:5, 1308:40, 1311:32, 1318:6</p> <p>parallel [1] - 1279:29</p> <p>parameters [3] - 1253:27, 1292:40, 1311:11</p> <p>pardon [10] - 1194:13, 1195:29, 1223:18, 1241:22, 1243:33, 1258:26, 1274:24, 1286:44, 1338:19, 1348:10</p> <p>part [32] - 1181:4, 1199:20, 1225:32, 1229:29, 1231:21, 1243:30, 1246:15, 1251:25, 1255:22, 1255:40, 1259:5, 1259:44, 1260:22, 1260:29, 1260:35, 1264:29, 1265:14, 1290:24, 1290:29, 1291:46, 1292:1, 1296:43, 1297:27, 1300:3, 1304:32, 1308:32, 1308:35, 1320:40, 1321:38, 1327:18, 1347:32</p> <p>participating [1] - 1220:6</p> <p>particle [3] - 1253:9, 1253:32, 1314:36</p> <p>particular [26] - 1170:18, 1175:30, 1185:24, 1194:42, 1221:22, 1223:3, 1224:40, 1231:20, 1232:24, 1232:25, 1235:21, 1238:26, 1248:10, 1263:21, 1264:35, 1268:31, 1273:29, 1298:40, 1303:2, 1307:43, 1309:41, 1310:5, 1311:32, 1312:29, 1337:24, 1338:46</p> <p>particularly [7] - 1176:14, 1203:40, 1251:20, 1256:37,</p>	<p>1299:42, 1303:42, 1345:39</p> <p>particulate [1] - 1315:40</p> <p>parties [1] - 1220:13</p> <p>partly [1] - 1344:43</p> <p>parts [5] - 1189:2, 1219:29, 1221:8, 1275:34, 1302:2</p> <p>pass [5] - 1226:3, 1247:41, 1259:43, 1263:20, 1318:39</p> <p>passage [1] - 1206:28</p> <p>passages [1] - 1255:21</p> <p>passing [1] - 1335:42</p> <p>passive [10] - 1189:17, 1190:40, 1190:41, 1190:43, 1191:2, 1191:4, 1191:21, 1191:33, 1192:35, 1196:35</p> <p>past [5] - 1175:43, 1183:1, 1326:28, 1327:32, 1346:19</p> <p>path [42] - 1183:22, 1212:14, 1212:21, 1214:47, 1224:40, 1225:1, 1225:9, 1225:26, 1225:40, 1225:47, 1229:18, 1229:28, 1229:32, 1229:33, 1232:23, 1232:28, 1234:18, 1237:29, 1247:33, 1248:13, 1248:14, 1249:1, 1254:34, 1255:30, 1265:14, 1272:18, 1276:20, 1277:45, 1278:28, 1278:30, 1284:5, 1284:9, 1284:26, 1284:30, 1286:1, 1305:8, 1306:33, 1324:9, 1337:26, 1337:40, 1345:3, 1345:5</p> <p>paths [19] - 1205:35, 1211:38, 1212:46, 1213:6, 1218:1, 1223:4, 1224:5, 1224:10, 1224:16, 1224:19, 1227:2, 1256:26, 1271:1, 1272:20, 1272:29, 1272:32, 1276:17, 1299:34, 1314:9</p> <p>pathway [29] - 1206:22, 1207:2, 1207:45, 1224:42,</p>	<p>1232:18, 1232:31, 1248:45, 1253:38, 1254:15, 1275:47, 1276:3, 1282:5, 1285:43, 1286:8, 1288:23, 1304:6, 1304:7, 1304:10, 1310:14, 1316:13, 1316:19, 1316:21, 1316:47, 1324:23, 1324:24, 1324:25, 1343:20, 1343:23, 1343:31</p> <p>pathways [11] - 1205:45, 1248:8, 1259:11, 1259:21, 1269:25, 1271:45, 1272:1, 1275:43, 1279:46, 1281:22, 1281:23</p> <p>PAUL [118] - 1168:33, 1172:29, 1172:33, 1172:43, 1173:1, 1173:7, 1173:13, 1173:23, 1174:13, 1177:25, 1177:42, 1178:13, 1179:13, 1189:33, 1189:41, 1189:46, 1190:9, 1190:14, 1190:25, 1190:31, 1190:35, 1192:16, 1196:26, 1197:10, 1197:14, 1197:18, 1197:23, 1197:30, 1197:38, 1197:46, 1198:4, 1198:11, 1198:24, 1198:40, 1198:45, 1199:9, 1199:18, 1199:29, 1199:37, 1199:41, 1200:1, 1200:13, 1200:21, 1200:30, 1200:39, 1200:44, 1201:11, 1201:15, 1201:24, 1205:15, 1208:2, 1210:9, 1210:16, 1211:10, 1211:17, 1211:43, 1212:1, 1212:8, 1212:17, 1212:23, 1212:28, 1212:39, 1213:28, 1213:32, 1213:36, 1213:40, 1213:44, 1214:4, 1214:8, 1214:12, 1214:17, 1214:25, 1215:25, 1215:32, 1215:41, 1216:1, 1216:11, 1216:25, 1216:29, 1216:40, 1224:8,</p>
--	---	---	--	---

<p>1224:13, 1224:18, 1224:26, 1244:22, 1244:28, 1244:33, 1244:47, 1264:29, 1266:15, 1268:9, 1268:15, 1268:31, 1269:22, 1276:3, 1276:9, 1276:24, 1276:35, 1276:40, 1278:25, 1278:33, 1279:2, 1279:10, 1279:15, 1279:21, 1279:27, 1279:37, 1279:41, 1291:9, 1291:15, 1291:23, 1291:29, 1291:37, 1291:42, 1292:1, 1295:5, 1300:11, 1326:38</p> <p>Paul [50] - 1169:16, 1172:13, 1172:22, 1174:7, 1174:18, 1174:46, 1175:2, 1175:15, 1177:21, 1178:1, 1178:8, 1179:7, 1180:15, 1189:29, 1192:14, 1196:13, 1196:43, 1196:47, 1201:26, 1204:26, 1207:47, 1210:38, 1211:6, 1211:37, 1213:24, 1214:21, 1215:22, 1216:6, 1216:47, 1224:2, 1224:34, 1244:19, 1266:10, 1268:6, 1269:18, 1270:14, 1271:34, 1272:16, 1275:43, 1277:12, 1278:18, 1291:3, 1291:46, 1293:6, 1293:17, 1294:1, 1295:2, 1300:8, 1326:36, 1339:22</p> <p>PAUL'S [1] - 1227:13</p> <p>Paul's [12] - 1220:7, 1227:7, 1227:10, 1253:21, 1253:43, 1268:4, 1293:14, 1293:32, 1293:35, 1293:40, 1294:9, 1340:1</p> <p>pay [1] - 1313:41</p> <p>PDF [18] - 1193:24, 1193:33, 1193:47, 1194:9, 1194:11, 1196:46, 1259:35, 1273:11, 1274:30, 1274:32, 1319:42,</p>	<p>1319:47, 1322:13, 1322:15, 1322:20, 1339:30, 1340:2, 1347:3</p> <p>peak [7] - 1240:38, 1241:9, 1244:19, 1245:15, 1247:31, 1249:42, 1258:46</p> <p>peaked [1] - 1258:47</p> <p>peaks [1] - 1228:38</p> <p>pedestrian [1] - 1280:13</p> <p>peer [2] - 1172:18, 1172:19</p> <p>pending [1] - 1276:14</p> <p>Peninsula [2] - 1167:39, 1268:16</p> <p>Penny [7] - 1176:34, 1179:18, 1342:19, 1342:26, 1342:31, 1342:33, 1342:35</p> <p>penultimate [1] - 1347:6</p> <p>people [7] - 1187:33, 1195:40, 1199:12, 1302:11, 1311:38, 1333:19, 1341:1</p> <p>people's [1] - 1231:8</p> <p>Peppler [1] - 1167:35</p> <p>per [79] - 1182:5, 1228:28, 1228:39, 1228:46, 1229:1, 1229:3, 1229:9, 1229:19, 1229:40, 1230:17, 1230:20, 1231:30, 1231:36, 1231:39, 1234:19, 1236:25, 1236:26, 1236:34, 1236:42, 1237:4, 1237:5, 1237:6, 1237:12, 1237:36, 1238:2, 1239:18, 1240:23, 1240:27, 1240:33, 1240:45, 1241:5, 1241:19, 1241:25, 1241:30, 1243:33, 1245:9, 1246:6, 1246:10, 1246:18, 1246:29, 1246:45, 1247:31, 1252:27, 1252:28, 1252:31, 1254:27, 1260:9, 1260:21, 1260:36, 1261:24, 1262:12, 1263:26, 1264:6, 1287:13, 1287:25, 1287:29, 1287:31, 1288:40, 1289:11, 1289:38, 1290:13,</p>	<p>1291:6, 1293:13, 1302:17, 1323:6, 1323:16, 1333:40, 1336:1, 1336:2, 1336:9, 1336:10, 1336:14, 1344:34, 1344:39, 1348:7, 1348:29</p> <p>perch [2] - 1312:35, 1312:36</p> <p>perched [40] - 1206:11, 1206:18, 1206:36, 1206:44, 1206:45, 1206:47, 1207:7, 1207:37, 1208:12, 1208:13, 1208:19, 1208:29, 1208:32, 1208:36, 1209:4, 1209:6, 1318:40, 1318:43, 1321:32, 1322:45, 1322:46, 1323:4, 1323:5, 1323:11, 1323:19, 1323:22, 1323:23, 1324:31, 1324:34, 1324:40, 1325:23, 1325:27, 1325:30, 1342:39, 1343:32, 1343:42, 1343:45, 1344:11</p> <p>percolate [1] - 1313:20</p> <p>perfect [2] - 1212:34, 1265:4</p> <p>perfectly [2] - 1215:44, 1242:33</p> <p>performance [2] - 1250:43, 1295:40</p> <p>performed [10] - 1220:40, 1220:44, 1220:45, 1240:10, 1240:22, 1242:16, 1243:23, 1253:15, 1265:17, 1266:46</p> <p>performing [1] - 1252:8</p> <p>perhaps [33] - 1172:38, 1173:10, 1182:22, 1185:6, 1189:29, 1190:27, 1201:9, 1205:10, 1224:5, 1225:47, 1226:1, 1235:46, 1244:31, 1245:16, 1249:23, 1251:22, 1254:17, 1255:36, 1266:5, 1270:3, 1286:29, 1295:31, 1303:13, 1304:11, 1308:6, 1311:33,</p>	<p>1312:2, 1313:6, 1318:4, 1318:31, 1319:8, 1321:17, 1326:15</p> <p>period [14] - 1245:29, 1251:27, 1251:31, 1286:28, 1295:6, 1297:36, 1314:30, 1328:27, 1329:7, 1330:25, 1335:43, 1336:26, 1336:43, 1338:4</p> <p>periods [3] - 1170:19, 1257:1, 1292:25</p> <p>peripheral [1] - 1210:29</p> <p>permanent [5] - 1206:18, 1207:1, 1207:11, 1207:19, 1208:15</p> <p>permeabilities [1] - 1256:26</p> <p>permeability [31] - 1183:21, 1231:4, 1232:4, 1232:25, 1232:35, 1232:40, 1233:3, 1233:11, 1233:18, 1233:31, 1233:36, 1245:3, 1245:4, 1250:10, 1252:25, 1252:27, 1252:36, 1254:24, 1254:28, 1256:28, 1256:33, 1260:26, 1273:6, 1281:30, 1287:26, 1287:28, 1288:47, 1290:1, 1290:8, 1290:10, 1293:30</p> <p>permeable [10] - 1232:9, 1232:15, 1247:39, 1247:42, 1250:38, 1256:35, 1259:11, 1289:36, 1323:30, 1324:24</p> <p>permeameter [2] - 1252:25, 1287:27</p> <p>permeate [1] - 1232:34</p> <p>permeating [1] - 1231:43</p> <p>permit [15] - 1198:37, 1199:3, 1199:6, 1199:22, 1199:31, 1199:34, 1199:37, 1199:39, 1199:41, 1199:44, 1200:4, 1200:10</p> <p>permits [2] - 1199:45, 1200:8</p>	<p>person [4] - 1196:16, 1308:34, 1317:45, 1346:9</p> <p>personal [1] - 1256:1</p> <p>perspective [1] - 1215:28</p> <p>pH [1] - 1308:43</p> <p>phase [1] - 1302:2</p> <p>phases [1] - 1306:12</p> <p>Phil [1] - 1307:45</p> <p>Phillip [1] - 1314:19</p> <p>PHILLIP [1] - 1168:39</p> <p>phone [2] - 1192:44, 1300:33</p> <p>photo [13] - 1172:43, 1174:31, 1176:17, 1184:6, 1187:3, 1194:15, 1194:21, 1221:30, 1221:36, 1233:13, 1236:7, 1247:5, 1267:19</p> <p>photograph [18] - 1182:23, 1185:27, 1186:26, 1193:24, 1194:7, 1194:36, 1194:45, 1195:7, 1227:7, 1227:8, 1227:10, 1243:27, 1244:5, 1280:26, 1290:20, 1290:23, 1290:27, 1290:38</p> <p>PHOTOGRAPH [1] - 1227:13</p> <p>photographic [1] - 1175:8</p> <p>photographs [5] - 1193:11, 1195:41, 1196:4, 1290:39, 1291:2</p> <p>photos [10] - 1171:8, 1173:36, 1179:13, 1179:30, 1179:34, 1179:35, 1187:19, 1221:42, 1222:38</p> <p>phrase [1] - 1170:3</p> <p>phrases [1] - 1303:11</p> <p>physical [5] - 1172:33, 1173:46, 1174:4, 1196:7, 1255:22</p> <p>physics [2] - 1191:9, 1191:12</p> <p>pick [6] - 1197:26, 1212:36, 1281:33, 1281:41, 1324:25, 1343:34</p> <p>picked [7] - 1197:24, 1280:4, 1300:11, 1304:6, 1304:10, 1318:1, 1341:33</p> <p>picking [3] - 1310:14,</p>
--	---	--	--	--

<p>1316:13, 1319:7 picks [1] - 1349:41 picture [8] - 1173:10, 1173:13, 1184:2, 1185:4, 1185:5, 1185:12, 1211:4, 1211:15 pictures [2] - 1173:4, 1177:23 piece [1] - 1191:7 pieces [3] - 1178:24, 1190:47, 1214:35 pier [3] - 1181:20, 1203:2 piers [12] - 1181:10, 1187:1, 1190:37, 1201:38, 1201:42, 1201:46, 1202:2, 1202:4, 1202:5, 1202:34, 1202:36, 1286:24 piesometer [2] - 1260:45, 1286:19 pile [8] - 1192:36, 1193:8, 1193:10, 1193:12, 1193:14, 1203:1, 1203:18 piled [1] - 1181:33 piles [8] - 1181:23, 1181:24, 1181:28, 1181:37, 1196:26, 1196:28, 1201:42, 1201:46 pink [2] - 1202:26, 1214:14 pipe [45] - 1171:14, 1171:15, 1212:2, 1212:31, 1216:32, 1229:1, 1229:41, 1230:13, 1230:28, 1231:38, 1231:40, 1231:44, 1232:5, 1233:33, 1235:8, 1241:25, 1243:30, 1244:7, 1247:12, 1250:45, 1260:45, 1266:33, 1266:40, 1266:41, 1266:42, 1267:26, 1267:39, 1268:13, 1268:36, 1268:37, 1269:23, 1269:26, 1271:12, 1281:19, 1289:20, 1289:24, 1316:18, 1316:43, 1328:21, 1338:4, 1343:20 pipes [5] - 1221:19, 1227:44, 1233:21, 1234:36 pipework [3] -</p>	<p>1282:29, 1282:30, 1282:36 pit [6] - 1247:25, 1266:12, 1268:11, 1268:12, 1284:15, 1284:27 pits [4] - 1247:20, 1247:21, 1309:12, 1310:14 pitting [2] - 1268:36, 1268:42 Place [20] - 1243:29, 1256:38, 1257:13, 1274:34, 1290:21, 1290:28, 1293:31, 1317:32, 1323:32, 1323:38, 1329:14, 1332:24, 1332:34, 1332:39, 1338:47, 1340:5, 1340:35, 1341:4, 1341:29, 1348:19 place [24] - 1170:19, 1171:37, 1177:9, 1198:21, 1198:43, 1198:46, 1199:31, 1200:3, 1200:17, 1200:22, 1200:45, 1200:46, 1201:4, 1201:16, 1201:18, 1201:19, 1248:10, 1251:23, 1300:36, 1323:45, 1332:19, 1348:25, 1349:42 Place" [1] - 1332:30 placed [11] - 1171:31, 1179:14, 1179:28, 1198:13, 1198:30, 1202:6, 1213:5, 1220:34, 1222:45, 1255:46, 1260:45 places [7] - 1248:11, 1255:24, 1256:46, 1273:24, 1274:9, 1317:31, 1348:24 placing [1] - 1313:18 plain [2] - 1180:25, 1336:42 plan [1] - 1175:10 planes [2] - 1181:42, 1181:44 planet [1] - 1249:10 plank [2] - 1350:14, 1350:19 planners [1] - 1197:23 planning [32] - 1197:1, 1197:4, 1197:6, 1197:21, 1197:30, 1197:33, 1197:35, 1197:38,</p>	<p>1197:40, 1197:43, 1198:8, 1198:13, 1198:25, 1198:28, 1198:47, 1199:13, 1199:23, 1199:30, 1199:37, 1199:41, 1199:44, 1200:4, 1200:10, 1200:28, 1200:36, 1200:45, 1201:4, 1201:15, 1201:18, 1259:16, 1338:20 plans [4] - 1184:34, 1211:23, 1214:30, 1214:31 plastic [1] - 1173:25 plausibility [1] - 1229:32 plausible [19] - 1177:17, 1224:4, 1224:10, 1224:16, 1232:2, 1271:1, 1277:42, 1278:6, 1278:12, 1280:18, 1281:26, 1289:7, 1316:17, 1316:42, 1336:44, 1336:47, 1337:41, 1338:6, 1343:19 played [1] - 1205:24 pleasing [2] - 1235:26 plenty [4] - 1183:19, 1222:34, 1298:38, 1340:43 plot [3] - 1315:19, 1334:40, 1335:30 plots [1] - 1315:22 plotted [1] - 1343:12 plucked [1] - 1350:11 plumbing [1] - 1309:24 plume [3] - 1217:37, 1242:5, 1247:18 plus [3] - 1255:9, 1255:11, 1328:43 point [36] - 1174:3, 1178:37, 1178:41, 1179:17, 1182:34, 1186:25, 1192:4, 1196:38, 1200:7, 1213:11, 1216:45, 1222:31, 1224:18, 1225:20, 1234:9, 1234:10, 1239:44, 1239:45, 1240:6, 1248:19, 1253:34, 1253:42, 1257:38, 1259:41, 1276:16, 1279:22, 1286:2, 1295:11, 1296:9,</p>	<p>1307:18, 1313:25, 1314:38, 1332:22, 1341:23 Point [23] - 1170:35, 1173:15, 1176:34, 1176:35, 1182:19, 1213:30, 1214:22, 1214:46, 1215:8, 1219:46, 1221:8, 1267:5, 1270:43, 1271:4, 1279:6, 1282:17, 1282:19, 1282:23, 1282:25, 1285:37, 1286:16, 1288:43 pointed [4] - 1174:20, 1195:31, 1296:34, 1332:10 Pointerra [2] - 1181:22, 1269:41 pointing [3] - 1181:19, 1297:16 points [8] - 1168:45, 1178:33, 1178:38, 1255:29, 1272:42, 1273:32, 1273:36, 1273:43 pop [1] - 1289:1 POPE [232] - 1168:37, 1169:1, 1169:13, 1169:19, 1169:23, 1169:28, 1169:32, 1169:39, 1169:46, 1170:5, 1170:13, 1170:22, 1170:26, 1170:33, 1170:47, 1171:7, 1171:14, 1171:23, 1171:29, 1172:4, 1172:10, 1172:17, 1174:25, 1174:42, 1175:18, 1175:25, 1175:34, 1175:39, 1175:43, 1176:1, 1176:6, 1176:27, 1176:31, 1176:44, 1177:19, 1179:30, 1179:41, 1180:1, 1180:28, 1180:33, 1180:40, 1180:45, 1181:4, 1181:10, 1181:17, 1182:3, 1182:13, 1182:17, 1182:26, 1182:32, 1182:39, 1182:45, 1183:4, 1183:31, 1183:37, 1183:42, 1183:47, 1184:5, 1184:11, 1184:16, 1184:21, 1184:29, 1184:38,</p>	<p>1184:43, 1185:1, 1185:31, 1186:1, 1186:6, 1186:10, 1186:29, 1186:33, 1186:38, 1186:42, 1186:47, 1187:9, 1187:18, 1187:32, 1187:38, 1187:43, 1188:5, 1188:11, 1188:15, 1188:20, 1188:25, 1188:30, 1188:40, 1189:9, 1189:17, 1189:25, 1192:23, 1193:31, 1194:15, 1194:24, 1194:28, 1201:36, 1201:41, 1202:1, 1202:8, 1202:12, 1202:18, 1202:22, 1202:40, 1202:46, 1203:8, 1203:18, 1203:23, 1203:33, 1203:38, 1204:31, 1204:36, 1204:42, 1205:1, 1205:7, 1205:13, 1205:21, 1205:28, 1207:30, 1209:30, 1209:46, 1210:22, 1214:42, 1215:2, 1215:11, 1215:15, 1217:6, 1217:10, 1217:17, 1217:21, 1217:27, 1217:32, 1218:24, 1218:30, 1218:38, 1220:36, 1220:42, 1220:47, 1221:6, 1221:26, 1221:32, 1221:40, 1221:45, 1222:4, 1222:14, 1222:20, 1222:26, 1222:30, 1224:37, 1226:39, 1233:10, 1233:21, 1233:25, 1233:29, 1233:38, 1250:22, 1250:41, 1258:41, 1258:45, 1259:14, 1264:40, 1264:44, 1265:2, 1265:11, 1265:21, 1265:35, 1265:40, 1266:1, 1266:8, 1266:20, 1266:36, 1266:44, 1267:3, 1267:10, 1267:26, 1267:33, 1267:44, 1268:2, 1268:23, 1269:2, 1269:7, 1269:16, 1269:33, 1269:38, 1270:33, 1270:39, 1270:46,</p>
---	--	--	---	--

<p>1271:6, 1271:12, 1271:25, 1271:31, 1277:5, 1277:18, 1277:28, 1277:34, 1277:40, 1278:1, 1278:10, 1278:15, 1282:8, 1282:14, 1282:19, 1282:23, 1282:27, 1282:32, 1282:36, 1282:41, 1282:45, 1283:7, 1283:12, 1283:18, 1283:25, 1283:32, 1283:38, 1283:42, 1283:47, 1284:12, 1284:17, 1284:23, 1284:30, 1284:37, 1284:43, 1284:47, 1285:13, 1285:22, 1285:30, 1285:36, 1285:45, 1286:10, 1286:15, 1286:23, 1291:40, 1291:44, 1295:36</p> <p>Pope [62] - 1168:43, 1174:8, 1174:17, 1174:18, 1174:47, 1175:9, 1175:14, 1179:7, 1179:25, 1180:11, 1180:18, 1180:22, 1185:11, 1185:45, 1186:25, 1187:7, 1189:28, 1190:18, 1190:19, 1190:29, 1191:22, 1192:21, 1196:12, 1196:13, 1196:19, 1201:30, 1203:27, 1204:25, 1204:33, 1205:19, 1205:26, 1207:27, 1209:34, 1210:39, 1214:39, 1216:45, 1220:7, 1220:30, 1221:37, 1224:32, 1264:38, 1265:17, 1265:26, 1266:18, 1267:1, 1267:40, 1268:20, 1268:46, 1270:14, 1270:28, 1272:17, 1276:43, 1282:3, 1286:19, 1293:39, 1295:34, 1295:46, 1299:11, 1300:34, 1309:23, 1339:21</p> <p>Pope's [17] - 1189:31, 1192:38, 1193:15, 1193:23, 1193:29, 1193:41, 1195:20, 1196:1, 1196:33, 1220:10, 1249:14,</p>	<p>1249:28, 1265:23, 1280:2, 1292:36, 1294:8, 1336:5</p> <p>popped [1] - 1290:26</p> <p>pore [4] - 1204:27, 1204:45, 1205:2, 1295:31</p> <p>pores [1] - 1245:35</p> <p>porosity [3] - 1252:30, 1256:28, 1293:24</p> <p>portion [7] - 1235:46, 1239:22, 1239:24, 1242:17, 1247:20, 1269:13, 1269:19</p> <p>Portsea [1] - 1271:8</p> <p>position [12] - 1168:13, 1175:14, 1223:3, 1223:15, 1223:25, 1260:1, 1262:20, 1275:5, 1346:35, 1350:26, 1350:27</p> <p>positive [1] - 1255:4</p> <p>possibilities [1] - 1276:22</p> <p>possibility [10] - 1225:26, 1225:27, 1274:24, 1277:38, 1286:6, 1286:12, 1286:16, 1299:16, 1317:2, 1323:21</p> <p>possible [23] - 1176:33, 1205:31, 1219:36, 1225:41, 1232:46, 1233:4, 1262:33, 1262:34, 1262:37, 1262:38, 1272:18, 1272:33, 1272:35, 1276:44, 1277:12, 1277:13, 1281:23, 1288:8, 1316:26, 1341:41, 1344:10, 1348:3</p> <p>possibly [5] - 1193:18, 1302:39, 1315:40, 1315:43, 1348:28</p> <p>post [9] - 1170:41, 1181:21, 1191:34, 1194:43, 1328:20, 1328:27, 1329:2, 1329:7, 1329:11</p> <p>post-landslide [1] - 1170:41</p> <p>post-repair [5] - 1328:20, 1328:27, 1329:2, 1329:7, 1329:11</p> <p>potassium [4] - 1303:14, 1303:47, 1306:18, 1309:1</p>	<p>potential [17] - 1170:2, 1207:36, 1209:13, 1210:4, 1211:38, 1212:14, 1226:13, 1237:39, 1257:11, 1264:15, 1266:47, 1269:24, 1269:27, 1276:17, 1279:45, 1311:15, 1348:15</p> <p>potentially [4] - 1186:44, 1306:20, 1316:27, 1317:2</p> <p>pothole [6] - 1323:17, 1323:20, 1330:5, 1340:4, 1344:29, 1344:39</p> <p>potholes [4] - 1317:31, 1317:34, 1324:23, 1343:40</p> <p>poured [4] - 1282:11, 1282:34, 1282:43, 1284:14</p> <p>practical [3] - 1244:6, 1244:9, 1256:43</p> <p>practices [2] - 1200:17, 1200:21</p> <p>pre [3] - 1203:47, 1264:24, 1269:9</p> <p>pre-burst [1] - 1264:24</p> <p>pre-dates [1] - 1269:9</p> <p>pre-qualified [1] - 1203:47</p> <p>preceding [1] - 1178:10</p> <p>precise [8] - 1245:8, 1245:9, 1254:42, 1261:44, 1262:7, 1262:19, 1263:1, 1263:14</p> <p>precisely [1] - 1205:10</p> <p>predate [1] - 1170:40</p> <p>predict [1] - 1300:1</p> <p>predicts [1] - 1236:8</p> <p>prefer [3] - 1232:11, 1263:4, 1285:14</p> <p>preference [4] - 1249:35, 1259:23, 1326:13, 1327:16</p> <p>preferential [4] - 1177:12, 1183:22, 1248:45, 1259:8</p> <p>preferred [4] - 1288:24, 1288:25, 1292:40, 1314:9</p> <p>preliminary [1] - 1300:41</p> <p>premise [1] - 1223:28</p> <p>preparation [1] - 1235:37</p>	<p>preparatory [18] - 1168:44, 1169:42, 1171:21, 1171:27, 1180:26, 1180:38, 1181:8, 1190:6, 1190:9, 1190:12, 1190:17, 1190:23, 1202:37, 1210:34, 1264:22, 1265:6, 1336:31, 1337:1</p> <p>prepare [3] - 1331:39, 1331:40, 1344:8</p> <p>prepared [7] - 1235:31, 1241:29, 1298:47, 1319:14, 1331:42, 1331:47, 1337:36</p> <p>preparing [1] - 1220:5</p> <p>presence [8] - 1303:20, 1305:26, 1309:41, 1311:4, 1311:36, 1312:11, 1313:35, 1321:32</p> <p>present [4] - 1178:31, 1219:41, 1305:4, 1335:2</p> <p>presented [5] - 1331:20, 1333:44, 1340:43, 1343:37</p> <p>press [4] - 1326:13, 1327:21, 1327:25, 1327:27</p> <p>pressing [1] - 1327:18</p> <p>pressure [12] - 1203:39, 1204:28, 1204:46, 1205:3, 1206:14, 1206:22, 1206:23, 1230:28, 1230:30, 1232:27, 1295:31</p> <p>pressures [3] - 1203:43, 1203:44, 1206:12</p> <p>pressuring [1] - 1323:20</p> <p>pressurising [1] - 1232:36</p> <p>presumably [3] - 1245:29, 1331:2, 1333:42</p> <p>pretty [6] - 1170:14, 1178:32, 1218:18, 1221:14, 1222:9, 1240:4</p> <p>prevent [1] - 1198:13</p> <p>previous [2] - 1241:44, 1266:26</p> <p>previously [5] - 1194:36, 1199:30, 1220:33, 1322:34,</p>	<p>1343:38</p> <p>primary [2] - 1313:31, 1316:3</p> <p>principal [2] - 1304:13, 1334:31</p> <p>principally [4] - 1189:30, 1308:34, 1321:13, 1321:24</p> <p>principles [1] - 1183:13</p> <p>private [4] - 1221:8, 1221:9, 1221:21, 1294:10</p> <p>probable [1] - 1224:40</p> <p>probe [1] - 1307:23</p> <p>problem [5] - 1171:27, 1172:19, 1281:29, 1300:8, 1300:14</p> <p>problems [1] - 1177:38</p> <p>process [3] - 1205:19, 1278:38, 1295:10</p> <p>processes [1] - 1306:39</p> <p>produce [2] - 1290:25, 1290:29</p> <p>produced [6] - 1184:30, 1228:44, 1255:46, 1256:14, 1290:29, 1298:8</p> <p>product [1] - 1188:31</p> <p>production [1] - 1301:1</p> <p>profess [1] - 1197:27</p> <p>profession [1] - 1298:4</p> <p>professional [3] - 1227:33, 1338:7, 1341:25</p> <p>Professor [29] - 1216:23, 1227:20, 1227:26, 1228:31, 1229:41, 1229:46, 1230:14, 1230:43, 1231:29, 1231:36, 1233:35, 1235:2, 1235:9, 1235:16, 1235:21, 1235:27, 1236:41, 1237:26, 1241:17, 1241:18, 1242:17, 1242:34, 1243:6, 1247:11, 1286:31, 1287:10, 1288:38, 1289:15, 1289:42</p> <p>profile [3] - 1314:41, 1316:5, 1343:34</p> <p>progress [2] - 1311:22, 1316:28</p> <p>progressed [1] -</p>
--	--	---	--	---

<p>1216:30</p> <p>prominent [1] - 1215:29</p> <p>prompt [1] - 1209:33</p> <p>promptly [1] - 1213:17</p> <p>prongs [1] - 1350:5</p> <p>properly [8] - 1179:11, 1250:42, 1285:5, 1307:33, 1307:35, 1314:10, 1316:34, 1335:42</p> <p>properties [4] - 1201:8, 1214:15, 1238:43, 1239:6</p> <p>property [7] - 1214:17, 1221:11, 1221:12, 1221:15, 1221:17, 1257:20, 1285:25</p> <p>proportion [3] - 1224:19, 1235:11, 1242:43</p> <p>proposed [3] - 1290:32, 1290:34, 1346:47</p> <p>proposition [4] - 1262:17, 1275:44, 1341:2, 1341:18</p> <p>propositions [1] - 1303:9</p> <p>Prospect [21] - 1208:16, 1208:17, 1208:18, 1208:22, 1212:37, 1251:38, 1257:7, 1257:21, 1258:18, 1270:8, 1284:15, 1284:27, 1286:2, 1287:4, 1288:29, 1288:30, 1328:44, 1329:18, 1329:47, 1335:33, 1349:45</p> <p>prove [3] - 1220:25, 1277:22, 1298:44</p> <p>proved [1] - 1217:13</p> <p>proven [1] - 1214:47</p> <p>provide [6] - 1168:11, 1168:14, 1245:10, 1302:38, 1317:39, 1340:38</p> <p>provided [7] - 1256:29, 1300:43, 1305:22, 1307:32, 1350:8, 1350:10, 1350:38</p> <p>provides [6] - 1206:43, 1228:10, 1236:22, 1244:6, 1264:31, 1314:47</p> <p>providing [2] - 1262:9, 1263:16</p>	<p>proximity [1] - 1182:41</p> <p>PSM [11] - 1172:17, 1173:1, 1214:31, 1291:5, 1291:9, 1291:12, 1291:37, 1324:36, 1324:37, 1328:45, 1342:18</p> <p>PSM's [4] - 1186:14, 1186:21, 1292:44, 1328:45</p> <p>public [2] - 1280:13, 1337:46</p> <p>publication [1] - 1185:20</p> <p>pull [1] - 1185:13</p> <p>pulled [2] - 1185:45, 1267:34</p> <p>pumps [1] - 1251:39</p> <p>punched [1] - 1222:21</p> <p>pure [1] - 1309:47</p> <p>purely [5] - 1253:35, 1259:7, 1261:29, 1293:8, 1293:32</p> <p>purpose [12] - 1206:3, 1207:25, 1211:25, 1211:45, 1217:29, 1218:21, 1220:6, 1242:34, 1311:2, 1313:31, 1313:32, 1334:35</p> <p>purposes [4] - 1217:24, 1218:20, 1229:17</p> <p>push [2] - 1190:42, 1290:15</p> <p>pushed [3] - 1176:18, 1176:21, 1177:31</p> <p>pushing [6] - 1190:41, 1191:24, 1192:3, 1226:44, 1239:12, 1274:17</p> <p>put [64] - 1171:2, 1174:29, 1180:19, 1181:36, 1181:44, 1189:36, 1191:30, 1193:24, 1202:35, 1203:45, 1203:47, 1205:10, 1209:15, 1211:23, 1214:26, 1214:30, 1214:33, 1215:34, 1215:37, 1216:8, 1216:19, 1217:47, 1219:30, 1221:1, 1221:30, 1222:24, 1222:32, 1223:45, 1224:35, 1228:32, 1233:13, 1251:12, 1257:45, 1260:6, 1261:34,</p>	<p>1262:28, 1263:8, 1264:24, 1267:41, 1276:14, 1283:1, 1284:2, 1285:36, 1286:24, 1288:16, 1294:47, 1304:11, 1313:8, 1314:3, 1314:8, 1314:10, 1314:20, 1316:29, 1324:37, 1324:45, 1330:32, 1331:34, 1334:47, 1335:22, 1337:18, 1348:2, 1348:42, 1349:11, 1350:14</p> <p>puts [1] - 1350:25</p> <p>putting [8] - 1180:22, 1181:43, 1186:27, 1262:17, 1284:8, 1295:16, 1341:25, 1349:11</p>	<p>1303:2, 1325:37, 1333:20, 1338:29, 1338:36, 1338:41, 1341:43, 1341:45, 1341:46, 1343:15, 1345:20, 1345:22, 1345:24, 1345:43, 1346:4, 1346:6, 1346:38, 1347:1, 1350:33, 1351:9</p> <p>quick [4] - 1203:41, 1281:1, 1281:3, 1327:39</p> <p>quicker [1] - 1258:10</p> <p>quickly [9] - 1209:15, 1222:35, 1258:41, 1281:40, 1292:39, 1300:3, 1303:8, 1334:11, 1335:36</p> <p>quite [44] - 1170:6, 1170:30, 1171:30, 1177:3, 1177:6, 1178:38, 1179:22, 1180:36, 1196:20, 1209:15, 1214:1, 1222:32, 1233:1, 1233:10, 1239:31, 1240:6, 1241:39, 1244:2, 1249:3, 1249:39, 1254:41, 1266:40, 1267:13, 1267:23, 1271:13, 1280:16, 1280:17, 1289:30, 1293:6, 1300:1, 1304:29, 1306:21, 1307:24, 1307:30, 1314:10, 1315:40, 1316:34, 1318:43, 1319:33, 1322:37, 1325:23, 1333:26, 1335:36, 1346:6</p> <p>quoted [2] - 1251:22, 1317:33</p> <p>quoting [2] - 1245:8, 1268:17</p>	<p>1297:23, 1297:41, 1324:41, 1325:7, 1336:43</p> <p>rainwater [6] - 1297:32, 1307:46, 1309:11, 1309:33, 1310:9, 1316:9</p> <p>raise [3] - 1186:26, 1205:46, 1333:38</p> <p>raised [4] - 1277:37, 1305:27, 1328:14</p> <p>raising [1] - 1347:10</p> <p>ran [1] - 1286:3</p> <p>range [29] - 1193:11, 1196:15, 1245:19, 1253:27, 1253:34, 1254:25, 1254:30, 1254:31, 1254:41, 1255:10, 1255:11, 1255:18, 1262:9, 1262:20, 1263:30, 1263:31, 1287:27, 1287:34, 1287:43, 1289:7, 1290:12, 1291:12, 1291:16, 1291:17, 1292:33, 1293:2, 1306:47, 1307:28</p> <p>ranged [1] - 1252:26</p> <p>Rankine [2] - 1203:38, 1203:43</p> <p>rapidly [1] - 1292:26</p> <p>rarity [1] - 1298:19</p> <p>rate [25] - 1174:28, 1174:29, 1228:35, 1228:37, 1231:29, 1233:35, 1235:18, 1236:24, 1237:29, 1238:29, 1238:35, 1239:18, 1239:20, 1240:11, 1240:24, 1240:26, 1241:9, 1241:37, 1242:39, 1244:19, 1253:4, 1258:4, 1291:3, 1291:20</p> <p>rates [12] - 1227:44, 1227:46, 1235:28, 1253:40, 1267:5, 1267:11, 1272:45, 1273:1, 1291:4, 1299:35, 1299:36, 1299:37</p> <p>rather [19] - 1178:10, 1201:42, 1219:10, 1222:46, 1223:7, 1223:21, 1225:16, 1226:44, 1228:45, 1239:5, 1247:21, 1259:23, 1262:10,</p>
Q				
<p>QAQC [1] - 1307:29</p> <p>qualification [1] - 1301:25</p> <p>qualifications [1] - 1346:26</p> <p>qualified [1] - 1203:47</p> <p>qualify [1] - 1200:41</p> <p>quality [3] - 1331:17, 1343:4, 1343:7</p> <p>quantity [1] - 1219:40</p> <p>quantums [1] - 1170:13</p> <p>quarters [1] - 1326:7</p> <p>questioning [1] - 1281:11</p> <p>questions [60] - 1169:4, 1180:6, 1180:8, 1196:15, 1196:43, 1197:2, 1198:19, 1201:26, 1205:31, 1205:38, 1205:40, 1205:44, 1206:1, 1206:2, 1206:33, 1209:23, 1209:24, 1216:4, 1227:2, 1259:18, 1259:30, 1259:35, 1263:22, 1263:47, 1264:13, 1271:35, 1271:42, 1272:12, 1273:12, 1275:37, 1275:42, 1276:15, 1282:3, 1286:27, 1288:46, 1291:3, 1294:38, 1294:40, 1294:47, 1300:39,</p>				
R				
<p>rabbit [1] - 1298:29</p> <p>racing [1] - 1178:5</p> <p>radial [3] - 1266:30, 1266:41, 1267:23</p> <p>radically [1] - 1204:5</p> <p>rain [7] - 1295:41, 1296:7, 1297:6, 1297:36, 1297:38, 1297:46, 1336:42</p> <p>rainfall [10] - 1209:17, 1295:37, 1297:22,</p>				

<p>1278:45, 1291:20, 1307:15, 1312:3, 1318:4, 1330:27 ratio [12] - 1242:20, 1243:22, 1244:16, 1245:14, 1245:15, 1314:27, 1314:28, 1323:7, 1323:8, 1333:41, 1334:23, 1343:42 ratios [1] - 1245:37 raw [2] - 1292:36, 1292:44 ray [1] - 1278:36 re [1] - 1257:47 re-entering [1] - 1257:47 reach [17] - 1235:12, 1235:23, 1235:24, 1240:39, 1240:41, 1241:43, 1243:8, 1245:30, 1245:31, 1251:28, 1284:20, 1288:6, 1316:41, 1340:34, 1341:28, 1350:7 reached [18] - 1232:12, 1241:45, 1241:46, 1242:5, 1242:15, 1242:36, 1243:21, 1244:7, 1244:41, 1245:34, 1248:6, 1251:38, 1262:33, 1265:30, 1286:35, 1303:10, 1306:11, 1335:4 reaches [14] - 1206:19, 1232:14, 1235:10, 1236:28, 1239:23, 1241:19, 1241:25, 1241:31, 1241:32, 1242:22, 1243:6, 1243:23, 1248:38, 1251:10 reaching [8] - 1229:2, 1229:9, 1229:12, 1241:30, 1241:41, 1244:17, 1244:18, 1334:20 reaction [3] - 1344:47, 1345:8, 1345:17 reactions [2] - 1306:32, 1306:34 read [16] - 1197:3, 1200:28, 1214:45, 1215:38, 1227:29, 1234:34, 1235:9, 1235:17, 1235:27, 1235:39, 1315:30, 1319:13, 1319:32,</p>	<p>1321:29, 1323:39, 1343:29 reader [1] - 1246:24 reading [7] - 1175:6, 1289:10, 1289:15, 1307:27, 1330:15, 1330:19, 1333:1 readings [2] - 1286:20, 1286:23 readouts [1] - 1314:30 ready [2] - 1202:43, 1203:41 real [5] - 1207:2, 1217:13, 1307:19, 1314:29, 1347:43 realise [1] - 1215:16 realistic [1] - 1337:44 Reality [1] - 1181:22 reality [3] - 1214:35, 1269:42, 1349:7 really [46] - 1185:4, 1195:26, 1195:37, 1196:3, 1196:5, 1196:30, 1198:18, 1200:28, 1201:31, 1210:36, 1211:18, 1212:44, 1219:35, 1222:35, 1240:6, 1243:18, 1244:2, 1244:22, 1245:10, 1245:38, 1246:9, 1248:33, 1250:28, 1254:22, 1255:9, 1257:12, 1260:34, 1277:44, 1285:13, 1287:9, 1295:18, 1295:25, 1295:26, 1297:28, 1309:46, 1311:21, 1312:38, 1331:14, 1334:29, 1335:3, 1338:13, 1345:4, 1346:9, 1348:1, 1349:40, 1350:3 realm [1] - 1337:2 reason [25] - 1177:33, 1179:36, 1183:9, 1188:42, 1201:33, 1208:13, 1225:47, 1233:14, 1261:13, 1261:22, 1262:8, 1275:18, 1284:33, 1284:37, 1284:41, 1285:11, 1286:7, 1286:13, 1296:22, 1296:42, 1300:34, 1303:19, 1333:24, 1350:1 reasonable [9] - 1229:44, 1237:45,</p>	<p>1242:20, 1242:22, 1278:41, 1294:15, 1294:22, 1304:37, 1349:23 reasonably [4] - 1205:34, 1281:1, 1281:3, 1294:24 reasons [3] - 1286:13, 1306:7, 1311:2 reassess [1] - 1344:9 receive [1] - 1248:39 received [2] - 1260:46, 1293:30 receives [1] - 1315:44 recent [6] - 1170:31, 1177:4, 1178:19, 1275:5, 1275:14, 1296:14 recently [2] - 1177:3, 1343:37 recharge [1] - 1318:42 recharged [1] - 1318:47 recognise [2] - 1254:26, 1266:12 recollection [2] - 1169:17, 1169:19 record [3] - 1268:17, 1306:22, 1319:17 recorded [1] - 1260:46 records [2] - 1170:39, 1216:15 red [7] - 1173:23, 1176:10, 1176:16, 1183:4, 1236:2, 1257:40, 1265:37 redirect [1] - 1249:7 reduce [4] - 1293:21, 1293:23, 1296:28, 1318:20 reduced [1] - 1221:35 reduces [5] - 1238:2, 1238:3, 1291:34, 1299:10 reducing [1] - 1336:12 reel [1] - 1176:22 refer [10] - 1206:35, 1207:36, 1207:39, 1208:18, 1236:44, 1266:11, 1321:25, 1337:13, 1339:17, 1340:37 reference [8] - 1185:12, 1187:5, 1187:9, 1189:30, 1201:46, 1225:3, 1288:47, 1292:2 references [1] - 1264:21 referred [5] - 1208:25,</p>	<p>1257:29, 1265:45, 1276:43, 1307:21 referring [8] - 1199:41, 1210:11, 1249:31, 1256:8, 1265:25, 1266:6, 1322:26, 1344:16 reflect [1] - 1298:13 reflected [2] - 1190:20, 1254:4 reflection [2] - 1196:24, 1331:21 reflects [2] - 1210:20, 1304:35 refusal [1] - 1193:18 regard [7] - 1192:46, 1294:9, 1302:39, 1302:42, 1303:1, 1303:38, 1305:20 regarding [3] - 1205:44, 1251:1, 1306:46 region [5] - 1219:29, 1256:27, 1258:21, 1288:32, 1293:34 regional [4] - 1206:16, 1207:20, 1208:32, 1208:33 registered [1] - 1170:37 regression [1] - 1188:5 regular [2] - 1294:25, 1345:4 rehearse [1] - 1241:28 reinforce [1] - 1192:38 relate [1] - 1251:31 related [9] - 1188:17, 1188:22, 1194:17, 1216:47, 1229:21, 1235:3, 1250:45, 1251:18, 1280:18 relates [2] - 1247:12, 1255:26 relation [10] - 1171:47, 1192:9, 1198:38, 1230:5, 1263:26, 1272:13, 1278:18, 1278:21, 1341:44, 1347:20 relationship [1] - 1214:27 relative [5] - 1183:10, 1234:18, 1240:11, 1248:15, 1308:14 relatively [9] - 1168:44, 1211:31, 1238:18, 1240:7, 1273:23, 1273:32, 1292:24, 1296:29,</p>	<p>1315:44 release [4] - 1306:17, 1336:35, 1348:25, 1348:27 released [5] - 1230:29, 1346:8, 1346:17, 1346:22, 1346:23 releases [1] - 1306:16 relevance [3] - 1213:14, 1305:22, 1315:4 relevant [4] - 1205:46, 1206:4, 1213:15, 1304:22 relevantly [2] - 1223:15, 1319:28 reliable [1] - 1315:31 relied [5] - 1255:4, 1259:42, 1329:5, 1347:31, 1350:7 relieved [1] - 1338:25 rely [8] - 1170:42, 1255:22, 1277:46, 1278:6, 1285:10, 1285:13, 1338:11, 1340:38 remain [3] - 1275:26, 1291:19, 1300:35 remainder [3] - 1179:5, 1218:33, 1236:3 remaining [1] - 1168:44 remember [13] - 1177:28, 1180:20, 1192:1, 1216:20, 1244:28, 1267:33, 1280:12, 1281:11, 1291:15, 1291:16, 1293:18, 1295:36, 1298:9 remembering [1] - 1279:28 remind [1] - 1168:10 removed [2] - 1198:14, 1292:10 Renée [1] - 1167:11 repacked [1] - 1315:36 repair [20] - 1265:45, 1266:1, 1266:6, 1322:35, 1322:36, 1322:38, 1322:41, 1323:36, 1323:46, 1324:13, 1324:29, 1328:20, 1328:27, 1329:2, 1329:7, 1329:11, 1330:41, 1331:35, 1349:26 repaired [5] - 1323:43,</p>
---	---	--	---	--

1324:7, 1328:40, 1330:30, 1338:4 repairing [1] - 1324:12 repairs [3] - 1266:2, 1266:11, 1269:43 rephrase [1] - 1286:10 replaced [1] - 1324:10 replacing [1] - 1330:33 report [201] - 1169:6, 1169:7, 1169:10, 1169:14, 1169:17, 1169:34, 1169:35, 1169:37, 1170:33, 1171:7, 1172:46, 1173:1, 1175:30, 1175:32, 1176:46, 1179:34, 1184:38, 1185:14, 1185:19, 1190:19, 1190:21, 1193:23, 1193:41, 1196:33, 1196:44, 1197:1, 1200:34, 1202:16, 1202:18, 1204:36, 1206:7, 1206:28, 1206:29, 1206:35, 1209:14, 1209:25, 1209:32, 1211:7, 1211:38, 1214:21, 1214:39, 1214:40, 1214:45, 1215:22, 1216:5, 1216:7, 1216:46, 1218:41, 1219:44, 1219:47, 1220:5, 1220:31, 1221:34, 1225:3, 1226:2, 1226:9, 1227:29, 1227:45, 1228:8, 1228:32, 1228:33, 1228:44, 1229:47, 1230:3, 1233:14, 1233:35, 1235:2, 1235:6, 1235:16, 1235:21, 1235:27, 1236:39, 1241:18, 1242:13, 1242:17, 1245:38, 1245:43, 1246:1, 1249:28, 1251:23, 1251:24, 1252:12, 1253:21, 1253:43, 1254:25, 1254:26, 1254:29, 1255:22, 1255:40, 1256:24, 1257:25, 1259:33, 1259:37, 1259:44, 1260:1, 1260:20, 1260:22, 1260:29, 1260:35, 1260:36, 1261:2,	1261:6, 1261:12, 1261:13, 1261:18, 1261:23, 1261:27, 1262:29, 1262:42, 1262:43, 1263:32, 1264:3, 1264:4, 1264:20, 1264:21, 1265:23, 1266:11, 1268:4, 1268:18, 1270:27, 1272:16, 1272:22, 1273:9, 1273:10, 1274:27, 1274:29, 1274:33, 1275:5, 1275:14, 1275:20, 1275:21, 1275:24, 1275:27, 1276:17, 1276:43, 1282:10, 1288:47, 1289:2, 1289:10, 1289:40, 1290:38, 1290:39, 1290:45, 1291:33, 1291:46, 1292:1, 1293:17, 1293:39, 1300:43, 1301:2, 1301:4, 1308:27, 1308:35, 1308:41, 1310:47, 1311:24, 1311:32, 1313:2, 1314:5, 1314:18, 1314:32, 1318:5, 1319:13, 1319:14, 1319:16, 1319:19, 1319:21, 1319:29, 1319:32, 1321:14, 1321:24, 1321:29, 1321:39, 1321:43, 1322:3, 1322:7, 1322:33, 1333:28, 1334:43, 1337:10, 1338:42, 1339:1, 1339:22, 1339:29, 1340:1, 1340:44, 1342:18, 1342:39, 1343:28, 1344:7, 1344:8, 1346:47, 1347:2, 1347:32, 1350:38 reported [4] - 1263:44, 1311:27, 1324:38, 1325:5 reporting [1] - 1310:37 reports [10] - 1209:4, 1220:12, 1224:45, 1237:26, 1302:43, 1303:2, 1303:10, 1318:21, 1319:15, 1343:29 repose [1] - 1176:22 represent [1] -	1315:35 representative [3] - 1262:4, 1314:41, 1328:19 represented [1] - 1244:40 represents [3] - 1183:5, 1312:8, 1331:14 require [2] - 1199:3, 1200:3 required [16] - 1199:9, 1199:31, 1199:32, 1199:34, 1199:46, 1200:8, 1200:11, 1205:37, 1226:12, 1237:3, 1237:47, 1242:36, 1251:28, 1257:2, 1292:31 research [1] - 1228:2 residence [1] - 1314:7 residential [1] - 1170:11 residents [5] - 1168:15, 1208:24, 1220:23, 1275:9, 1348:19 resides [1] - 1206:41 residual [2] - 1181:25, 1211:22 resistance [7] - 1191:23, 1191:35, 1232:24, 1234:18, 1247:33, 1248:13, 1248:15 resistant [1] - 1306:7 resisting [1] - 1248:45 resorption [1] - 1306:40 respect [14] - 1172:6, 1180:11, 1180:14, 1184:25, 1209:15, 1223:4, 1233:19, 1253:23, 1256:7, 1264:23, 1265:6, 1267:46, 1269:4, 1329:7 respectively [1] - 1310:37 respects [3] - 1210:28, 1211:12, 1316:3 respond [10] - 1179:26, 1189:28, 1192:21, 1192:23, 1196:14, 1234:32, 1295:47, 1317:43, 1323:27, 1328:16 response [2] - 1223:23, 1288:10	responses [1] - 1265:8 responsible [2] - 1308:34, 1313:7 rest [3] - 1175:12, 1218:8, 1285:6 restricted [1] - 1273:43 result [11] - 1244:6, 1255:5, 1275:10, 1283:34, 1307:32, 1311:26, 1318:35, 1322:39, 1322:44, 1336:33, 1346:8 results [18] - 1220:32, 1222:18, 1256:28, 1256:29, 1263:44, 1287:28, 1289:43, 1308:42, 1312:1, 1314:11, 1314:13, 1315:44, 1323:2, 1339:20, 1339:21, 1339:22, 1339:31, 1340:22 resumed [1] - 1250:29 RESUMING [1] - 1234:46 retain [1] - 1311:26 retained [4] - 1182:6, 1202:27, 1202:46, 1310:41 retaining [55] - 1169:3, 1170:35, 1170:40, 1179:9, 1180:7, 1180:9, 1181:1, 1181:7, 1181:19, 1181:33, 1181:34, 1181:47, 1182:11, 1182:18, 1182:29, 1182:36, 1183:5, 1183:12, 1183:31, 1184:29, 1187:34, 1188:9, 1188:15, 1188:40, 1188:41, 1188:43, 1188:45, 1189:3, 1189:34, 1189:36, 1190:23, 1190:37, 1190:39, 1190:42, 1191:38, 1192:11, 1193:9, 1194:40, 1195:19, 1195:21, 1195:22, 1196:2, 1196:17, 1198:31, 1198:38, 1198:47, 1199:2, 1199:22, 1200:2, 1203:44, 1203:45, 1292:43, 1295:42, 1296:14, 1296:15	retarding [1] - 1250:25 retention [1] - 1314:31 return [10] - 1204:9, 1234:41, 1245:47, 1257:23, 1264:14, 1272:5, 1285:25, 1300:20, 1326:13, 1328:23 returned [1] - 1343:5 returning [4] - 1168:10, 1217:37, 1226:47, 1330:26 rev [1] - 1186:6 reveal [3] - 1303:20, 1306:2, 1306:35 revealed [5] - 1262:43, 1283:3, 1306:3, 1306:17, 1311:14 reverse [1] - 1249:45 review [2] - 1172:18, 1172:20 reviewed [2] - 1301:4, 1301:6 revised [4] - 1185:34, 1319:17, 1319:45, 1319:47 revising [1] - 1246:9 revisit [1] - 1246:3 Rexicon [2] - 1184:30, 1192:40 Rhodes [2] - 1235:32, 1236:11 RICHARD [1] - 1168:37 right-hand [7] - 1176:36, 1178:40, 1179:1, 1183:4, 1194:8, 1215:23, 1216:18 ripped [1] - 1336:33 risk [5] - 1185:14, 1186:14, 1200:37, 1201:17, 1217:34 RISK [1] - 1186:21 river [3] - 1278:33, 1278:34, 1278:35 Road [46] - 1173:15, 1205:32, 1210:37, 1212:37, 1213:30, 1214:22, 1214:46, 1215:8, 1216:19, 1216:21, 1217:36, 1219:46, 1223:5, 1223:28, 1224:30, 1228:13, 1231:25, 1251:26, 1257:8, 1257:21, 1258:18, 1259:46, 1264:36, 1265:14, 1265:27, 1270:8, 1270:43,
--	--	--	--	--

1271:4, 1274:35, 1275:20, 1275:32, 1283:10, 1284:15, 1284:27, 1287:4, 1288:31, 1288:43, 1289:21, 1289:24, 1339:1, 1341:9, 1348:16, 1349:5, 1349:10, 1350:4 road [1] - 1337:25 roads [1] - 1170:7 Roads [1] - 1250:41 robust [1] - 1315:31 robustly [1] - 1349:39 rock [4] - 1181:32, 1305:11, 1305:37, 1345:1 rocks [2] - 1345:8, 1345:18 rode [1] - 1178:19 role [3] - 1190:22, 1191:38, 1205:24 Rome [1] - 1279:25 room [1] - 1327:10 root [1] - 1215:6 ROSS [1] - 1168:33 rough [4] - 1176:7, 1176:8, 1202:43, 1202:46 roughly [10] - 1177:5, 1182:5, 1187:1, 1221:18, 1222:42, 1243:46, 1301:45, 1323:8, 1329:20, 1337:26 route [4] - 1232:20, 1253:6, 1253:12, 1276:16 routinely [1] - 1170:7 row [1] - 1254:5 RU [1] - 1298:23 rubbish [1] - 1173:26 rule [7] - 1203:5, 1210:10, 1226:13, 1286:6, 1286:12, 1312:18, 1315:4 ruled [1] - 1335:22 run [4] - 1212:35, 1270:41, 1283:18, 1297:24 run-off [1] - 1297:24 running [1] - 1336:16 runoff [1] - 1247:27 runs [8] - 1211:40, 1217:39, 1221:10, 1231:22, 1249:16, 1257:38, 1270:30, 1279:28 rush [2] - 1302:17, 1336:38	S safe [1] - 1244:18 safety [1] - 1296:29 sake [1] - 1185:41 salinities [1] - 1345:3 salinity [13] - 1303:15, 1304:32, 1304:38, 1310:12, 1314:12, 1318:22, 1333:39, 1340:34, 1340:39, 1341:28, 1345:6, 1345:8, 1345:17 salt [2] - 1309:35, 1345:6 salt's [1] - 1318:1 salts [3] - 1319:7, 1324:21, 1341:33 salty [2] - 1308:14, 1308:22 sample [26] - 1174:27, 1174:28, 1230:45, 1281:35, 1307:15, 1307:27, 1310:5, 1313:36, 1313:47, 1314:20, 1317:31, 1322:36, 1322:38, 1324:29, 1328:45, 1328:47, 1329:8, 1329:12, 1329:18, 1329:27, 1329:28, 1329:40, 1330:1, 1342:7 sampled [2] - 1328:44 samples [15] - 1205:38, 1231:7, 1256:34, 1304:19, 1310:34, 1312:4, 1313:21, 1313:22, 1313:24, 1314:11, 1323:35, 1323:37, 1329:32, 1329:39, 1330:10 sampling [1] - 1342:18 sand [19] - 1174:35, 1213:10, 1217:37, 1233:13, 1234:37, 1236:2, 1237:3, 1237:47, 1239:28, 1239:36, 1240:28, 1245:31, 1247:18, 1248:18, 1254:10, 1287:1, 1289:36, 1305:34 sandcastle [2] - 1239:30, 1245:31 sands [5] - 1305:26, 1305:31, 1305:35, 1305:36, 1319:8	sandy [1] - 1206:25 sat [3] - 1193:17, 1194:40, 1235:28 saturate [1] - 1226:27 saturated [7] - 1219:41, 1225:13, 1245:35, 1251:12, 1251:13, 1277:2, 1336:40 saturates [1] - 1248:14 saturating [1] - 1234:36 saturation [4] - 1218:28, 1220:1, 1336:41, 1277:45 save [1] - 1204:36 saved [1] - 1295:46 saw [8] - 1190:39, 1247:18, 1280:24, 1285:47, 1312:1, 1331:16, 1340:34, 1344:7 SC [1] - 1167:38 scale [7] - 1202:23, 1218:8, 1257:47, 1258:1, 1277:21, 1291:12, 1347:18 scarp [23] - 1173:18, 1205:36, 1220:39, 1221:38, 1224:6, 1224:11, 1225:27, 1225:34, 1226:12, 1257:3, 1264:26, 1297:46, 1314:42, 1316:43, 1333:35, 1333:39, 1333:42, 1334:1, 1334:21, 1334:23, 1335:36, 1335:43, 1336:40 scenario [3] - 1246:19, 1246:25, 1247:1 scenarios [1] - 1253:30 scheme [1] - 1318:43 science [9] - 1254:27, 1261:44, 1262:7, 1262:19, 1263:1, 1263:14, 1263:16, 1263:30, 1267:11 sciences [1] - 1278:38 scientific [1] - 1349:39 scientist [2] - 1262:19, 1341:26 scientists [1] - 1348:38 scope [4] - 1187:12, 1187:13, 1241:5,	1302:35 scoria [2] - 1195:1, 1195:5 scoured [1] - 1261:6 screen [19] - 1180:19, 1183:26, 1186:27, 1209:30, 1211:3, 1211:35, 1212:47, 1213:22, 1228:32, 1228:33, 1235:44, 1266:24, 1268:5, 1290:27, 1308:26, 1321:46, 1328:29, 1328:37, 1329:26 screens [2] - 1328:33, 1328:39 screenshot [1] - 1176:6 screw [1] - 1195:13 scroll [1] - 1267:19 sea [5] - 1239:29, 1239:31, 1239:33, 1239:35, 1279:31 seal [1] - 1292:10 search [3] - 1205:10, 1277:25, 1277:26 Seat [1] - 1211:40 sec [1] - 1202:23 second [40] - 1169:3, 1193:9, 1193:23, 1195:12, 1196:2, 1228:28, 1228:46, 1236:18, 1236:22, 1236:26, 1236:35, 1236:38, 1236:43, 1237:4, 1237:5, 1238:2, 1238:3, 1239:45, 1240:27, 1240:33, 1240:34, 1240:46, 1241:6, 1241:29, 1241:40, 1243:33, 1243:45, 1260:46, 1267:30, 1276:5, 1291:6, 1299:21, 1335:44, 1336:1, 1336:10, 1336:14, 1336:26, 1342:31, 1348:29, 1350:19 secondly [1] - 1205:38 section [18] - 1176:29, 1178:32, 1179:1, 1182:40, 1183:38, 1196:47, 1202:13, 1237:23, 1259:36, 1259:37, 1260:6, 1265:37, 1268:13, 1274:32, 1296:47, 1297:22, 1347:4, 1347:7	sections [1] - 1183:7 sediment [1] - 1268:39 see [175] - 1170:10, 1171:12, 1173:15, 1173:16, 1173:17, 1173:41, 1173:42, 1173:43, 1173:46, 1174:17, 1174:19, 1176:8, 1176:12, 1176:17, 1177:26, 1177:40, 1178:15, 1178:28, 1178:32, 1179:7, 1179:39, 1182:22, 1183:9, 1183:42, 1184:21, 1185:3, 1187:19, 1189:13, 1189:23, 1189:34, 1189:39, 1190:4, 1191:11, 1191:12, 1191:30, 1192:14, 1194:31, 1194:37, 1194:41, 1197:8, 1203:20, 1204:40, 1204:45, 1205:2, 1205:5, 1206:12, 1206:32, 1207:4, 1207:10, 1207:42, 1208:20, 1209:8, 1209:35, 1209:42, 1211:7, 1212:12, 1216:12, 1216:17, 1218:31, 1218:46, 1219:18, 1219:38, 1220:32, 1221:24, 1221:38, 1222:33, 1223:2, 1223:44, 1224:2, 1228:37, 1230:9, 1231:36, 1236:40, 1247:19, 1257:27, 1257:30, 1257:34, 1257:37, 1261:6, 1261:15, 1261:16, 1263:20, 1264:2, 1265:26, 1265:28, 1265:32, 1265:42, 1265:43, 1266:29, 1266:39, 1267:21, 1267:38, 1268:12, 1268:35, 1268:36, 1268:41, 1270:35, 1273:13, 1273:31, 1273:37, 1273:39, 1274:3, 1274:10, 1274:15, 1275:6, 1275:43, 1278:1, 1278:40, 1281:37, 1282:10, 1284:9, 1291:33, 1294:3, 1299:44, 1300:5,
---	--	--	--	--

<p>1301:14, 1302:42, 1303:12, 1304:44, 1305:6, 1306:29, 1306:43, 1309:31, 1310:17, 1311:23, 1312:24, 1314:1, 1314:15, 1314:24, 1314:46, 1315:2, 1315:22, 1317:14, 1318:25, 1319:15, 1320:13, 1321:19, 1321:36, 1322:9, 1322:35, 1322:41, 1323:14, 1323:26, 1323:34, 1323:36, 1324:24, 1325:11, 1328:3, 1328:35, 1329:31, 1330:36, 1331:18, 1332:24, 1332:26, 1335:12, 1335:33, 1336:22, 1337:5, 1338:10, 1339:31, 1339:33, 1339:34, 1339:38, 1340:6, 1341:13, 1341:20, 1341:28, 1341:29, 1342:18, 1347:4, 1347:7, 1347:11</p> <p>See [1] - 1265:38</p> <p>seeing [2] - 1192:38, 1330:32</p> <p>seek [1] - 1227:8</p> <p>seeking [3] - 1216:11, 1303:42, 1328:15</p> <p>seem [6] - 1174:45, 1175:10, 1261:20, 1280:12, 1299:42, 1320:41</p> <p>seep [1] - 1272:36</p> <p>seepage [17] - 1178:25, 1178:34, 1178:38, 1272:47, 1273:22, 1273:37, 1308:46, 1310:36, 1310:38, 1310:40, 1316:6, 1316:19, 1339:33, 1339:34, 1339:43, 1340:23, 1343:21</p> <p>seeped [1] - 1249:41</p> <p>seeping [7] - 1249:4, 1249:35, 1276:6, 1285:20, 1285:27, 1295:6, 1295:7</p> <p>semantical [1] - 1180:42</p> <p>sending [1] - 1307:16</p> <p>senior [1] - 1220:42</p> <p>sense [16] - 1177:13,</p>	<p>1198:28, 1213:15, 1220:24, 1222:47, 1234:39, 1235:20, 1238:21, 1242:31, 1242:33, 1254:44, 1255:23, 1263:37, 1264:34, 1296:22</p> <p>senses [1] - 1304:22</p> <p>sentence [6] - 1246:16, 1246:23, 1251:27, 1316:15, 1343:18, 1347:7</p> <p>sentences [1] - 1348:2</p> <p>separate [3] - 1210:1, 1243:23, 1348:20</p> <p>separately [4] - 1188:37, 1190:21, 1231:3, 1241:4</p> <p>separating [1] - 1206:15</p> <p>series [8] - 1170:39, 1181:42, 1188:44, 1217:36, 1245:2, 1265:16, 1265:19, 1265:32</p> <p>seriously [1] - 1297:45</p> <p>service [13] - 1229:32, 1229:34, 1230:25, 1272:14, 1272:36, 1273:44, 1283:23, 1286:42, 1287:13, 1288:40, 1316:19, 1343:21, 1344:42</p> <p>services [5] - 1211:19, 1211:23, 1214:27, 1270:9, 1286:42</p> <p>session [1] - 1351:7</p> <p>set [4] - 1260:20, 1260:36, 1348:37, 1348:42</p> <p>sets [4] - 1216:7, 1318:21, 1318:23, 1340:11</p> <p>setting [1] - 1295:38</p> <p>settings [1] - 1286:21</p> <p>settlement [3] - 1195:8, 1250:44, 1250:47</p> <p>settling [1] - 1195:5</p> <p>seven [2] - 1264:3, 1264:4</p> <p>several [1] - 1276:45</p> <p>SEW [7] - 1214:30, 1214:46, 1259:33, 1270:4, 1321:13, 1324:12, 1328:44</p> <p>SEW.0001.0001.0500 [2] - 1290:23, 1290:28</p>	<p>SEW.0001.0001.0501 [1] - 1319:28</p> <p>SEW.0001.0002 [1] - 1246:1</p> <p>SEW.0001.0002.0001 [1] - 1274:28</p> <p>SEW.0001.0002.4187 [7] - 1213:1, 1218:47, 1235:44, 1270:26, 1273:10, 1339:30, 1347:2</p> <p>SEW.0001.0002.4191 [3] - 1228:32, 1241:17, 1289:4</p> <p>sewage [3] - 1236:43,</p> <p>sewer [85] - 1171:15, 1211:26, 1212:35, 1212:40, 1213:36, 1214:10, 1214:22, 1214:28, 1214:29, 1214:32, 1214:33, 1214:46, 1215:7, 1215:22, 1217:46, 1221:7, 1221:8, 1221:9, 1221:10, 1222:21, 1229:1, 1229:17, 1229:18, 1229:20, 1229:32, 1229:41, 1230:5, 1230:12, 1231:13, 1231:20, 1231:21, 1231:30, 1231:38, 1231:41, 1231:44, 1232:5, 1233:12, 1233:33, 1233:44, 1233:45, 1233:46, 1234:2, 1234:4, 1234:10, 1234:21, 1241:25, 1247:6, 1247:13, 1247:20, 1247:38, 1248:5, 1248:26, 1248:37, 1248:38, 1249:5, 1249:6, 1249:33, 1251:32, 1251:37, 1253:6, 1253:7, 1257:23, 1257:34, 1257:38, 1259:8, 1259:10, 1264:18, 1272:20, 1273:17, 1274:16, 1276:19, 1282:12, 1283:26, 1283:29, 1283:35, 1283:45, 1288:30, 1289:20, 1289:23, 1289:29, 1289:35, 1323:31</p> <p>sewerage [9] - 1213:25, 1224:46,</p>	<p>1257:12, 1257:18, 1258:19, 1279:47, 1286:46, 1287:2, 1289:14</p> <p>sewers [4] - 1211:24, 1214:34, 1217:41, 1286:15</p> <p>shaded [2] - 1236:7, 1265:37</p> <p>shake [1] - 1313:47</p> <p>shaking [1] - 1314:5</p> <p>shallow [32] - 1206:3, 1206:5, 1206:11, 1206:17, 1207:18, 1208:12, 1208:19, 1208:29, 1208:31, 1209:27, 1210:6, 1210:9, 1210:12, 1224:41, 1225:9, 1238:18, 1238:21, 1276:47, 1312:35, 1314:40, 1316:20, 1318:36, 1318:40, 1318:44, 1321:32, 1322:45, 1324:34, 1325:30, 1337:3, 1342:39, 1343:22, 1345:6</p> <p>shaped [1] - 1237:27</p> <p>sharp [2] - 1274:4, 1274:6</p> <p>sheer [2] - 1338:1, 1346:22</p> <p>shire [3] - 1195:15, 1196:39, 1200:17</p> <p>Shire [2] - 1167:39, 1268:16</p> <p>shoot [1] - 1202:22</p> <p>shoots [1] - 1258:26</p> <p>SHORT [4] - 1204:11, 1272:8, 1300:23, 1327:43</p> <p>short [4] - 1196:34, 1196:35, 1297:36, 1338:35</p> <p>shorter [2] - 1257:1, 1338:21</p> <p>shortly [2] - 1323:36, 1324:12</p> <p>shot [1] - 1175:41</p> <p>shoulder [2] - 1218:5, 1250:30</p> <p>shovel [2] - 1174:29, 1174:35</p> <p>show [10] - 1172:38, 1175:29, 1182:40, 1209:33, 1220:32, 1262:27, 1311:25, 1315:37, 1320:14, 1347:24</p>	<p>showed [6] - 1182:39, 1182:43, 1234:7, 1283:5, 1283:15, 1314:12</p> <p>showing [2] - 1212:40, 1213:6</p> <p>shown [11] - 1173:38, 1177:23, 1214:31, 1214:34, 1216:37, 1216:40, 1257:40, 1280:26, 1289:1, 1290:22, 1329:19</p> <p>shows [18] - 1174:14, 1177:27, 1194:36, 1194:47, 1212:35, 1214:21, 1226:43, 1228:35, 1228:36, 1228:37, 1273:17, 1277:7, 1289:7, 1335:31, 1337:11, 1340:33, 1341:27</p> <p>shrub [1] - 1174:31</p> <p>side [28] - 1170:5, 1173:5, 1174:30, 1176:35, 1176:36, 1178:40, 1178:47, 1179:1, 1183:4, 1185:6, 1188:41, 1190:40, 1193:15, 1194:8, 1215:23, 1232:38, 1250:46, 1257:35, 1267:30, 1267:39, 1268:40, 1274:23, 1276:14, 1280:10, 1284:8, 1342:19</p> <p>sideways [2] - 1171:34, 1234:37</p> <p>SIEMENSMA [129] - 1204:16, 1259:20, 1272:1, 1275:40, 1275:42, 1276:5, 1276:14, 1276:28, 1276:38, 1276:43, 1277:12, 1277:24, 1277:31, 1277:37, 1277:42, 1278:5, 1278:12, 1278:18, 1278:30, 1278:44, 1279:5, 1279:13, 1279:17, 1279:24, 1279:34, 1279:39, 1279:44, 1280:22, 1280:26, 1280:36, 1281:3, 1281:11, 1281:21, 1281:37, 1281:46, 1282:3, 1282:10, 1282:16, 1282:21, 1282:25, 1282:29, 1282:34,</p>
---	---	--	---	--

<p>1282:39, 1282:43, 1283:3, 1283:9, 1283:14, 1283:21, 1283:28, 1283:34, 1283:40, 1283:44, 1284:7, 1284:14, 1284:20, 1284:25, 1284:32, 1284:40, 1284:45, 1285:10, 1285:17, 1285:24, 1285:32, 1285:42, 1286:6, 1286:12, 1286:18, 1286:27, 1287:7, 1287:17, 1287:22, 1287:33, 1287:39, 1287:43, 1288:5, 1288:16, 1288:36, 1288:46, 1289:19, 1289:26, 1289:40, 1290:1, 1290:6, 1290:19, 1290:37, 1290:43, 1291:1, 1291:11, 1291:19, 1291:26, 1291:32, 1291:46, 1292:5, 1292:17, 1292:30, 1293:1, 1293:13, 1293:38, 1293:46, 1294:6, 1294:30, 1294:38, 1326:5, 1327:23, 1327:36, 1342:3, 1342:5, 1342:12, 1342:17, 1342:24, 1342:28, 1342:33, 1342:37, 1342:44, 1343:9, 1343:15, 1344:2, 1344:14, 1344:21, 1344:26, 1344:31, 1344:37, 1344:41, 1345:12, 1345:20, 1349:33, 1350:37, 1350:42, 1351:4</p> <p>Siemensma [6] - 1167:41, 1271:46, 1290:45, 1326:3, 1342:1, 1351:6</p> <p>sign [1] - 1195:4</p> <p>signature [1] - 1306:26</p> <p>signatures [2] - 1334:40, 1335:7</p> <p>significance [7] - 1170:47, 1171:21, 1171:39, 1175:22, 1192:6, 1308:41, 1311:34</p> <p>significant [17] - 1170:19, 1175:26,</p>	<p>1176:20, 1180:3, 1190:12, 1190:16, 1196:20, 1210:38, 1218:22, 1244:41, 1244:44, 1266:40, 1267:3, 1267:23, 1280:18, 1333:38</p> <p>significantly [4] - 1173:40, 1253:47, 1269:43, 1296:29</p> <p>similar [24] - 1196:31, 1196:34, 1202:25, 1231:25, 1253:16, 1253:26, 1253:38, 1255:15, 1256:25, 1257:18, 1267:1, 1269:23, 1281:19, 1300:16, 1304:42, 1305:3, 1312:5, 1313:38, 1314:10, 1340:14, 1340:16, 1340:24, 1341:19, 1343:13</p> <p>similarly [2] - 1200:16, 1329:38</p> <p>simple [11] - 1172:34, 1191:12, 1191:15, 1203:38, 1203:44, 1223:22, 1248:32, 1267:11, 1281:43, 1307:2, 1341:2</p> <p>simplest [4] - 1181:10, 1181:33, 1217:43, 1305:13</p> <p>simply [4] - 1190:28, 1198:24, 1200:1, 1345:17</p> <p>simulate [2] - 1314:2, 1314:4</p> <p>single [3] - 1262:10, 1304:45, 1329:8</p> <p>sit [8] - 1172:27, 1178:38, 1192:16, 1241:4, 1298:13, 1327:45, 1333:7, 1333:12</p> <p>site [78] - 1170:18, 1175:16, 1178:23, 1187:44, 1188:47, 1205:35, 1211:19, 1212:3, 1212:36, 1213:7, 1213:17, 1218:42, 1219:2, 1219:36, 1220:20, 1220:47, 1224:5, 1224:10, 1225:27, 1226:15, 1227:18, 1228:10, 1235:40, 1236:9, 1236:28, 1239:21, 1240:14,</p>	<p>1240:35, 1241:11, 1247:24, 1251:29, 1252:4, 1253:9, 1253:24, 1259:47, 1261:30, 1261:31, 1262:34, 1269:20, 1272:19, 1272:30, 1272:33, 1275:47, 1276:10, 1277:44, 1279:8, 1279:10, 1280:30, 1280:34, 1280:37, 1280:39, 1281:14, 1283:16, 1283:36, 1283:45, 1284:28, 1286:20, 1286:23, 1286:28, 1286:35, 1288:6, 1288:20, 1289:20, 1292:32, 1295:42, 1296:9, 1296:29, 1307:24, 1324:38, 1325:4, 1328:47, 1337:26, 1342:8, 1342:39, 1344:42, 1347:10</p> <p>sites [2] - 1219:33, 1287:26</p> <p>sits [3] - 1183:32, 1242:38, 1318:43</p> <p>sitting [5] - 1181:39, 1209:5, 1238:27, 1238:28, 1288:27</p> <p>situ [9] - 1240:15, 1240:44, 1241:3, 1253:28, 1260:8, 1314:31, 1314:33, 1314:37, 1315:2</p> <p>situation [8] - 1178:30, 1199:21, 1223:26, 1223:33, 1288:30, 1300:17, 1348:14, 1349:8</p> <p>size [6] - 1202:27, 1289:43, 1290:2, 1294:18, 1314:36, 1346:11</p> <p>sketch [1] - 1203:34</p> <p>sketches [1] - 1220:13</p> <p>skin [3] - 1336:30, 1348:25, 1348:28</p> <p>slice [1] - 1214:25</p> <p>slid [1] - 1224:29</p> <p>slide [15] - 1170:18, 1180:31, 1180:34, 1180:37, 1189:37, 1204:27, 1209:38, 1210:2, 1223:36, 1293:24, 1293:33, 1333:42, 1337:22, 1337:32</p>	<p>slides [4] - 1209:16, 1296:24, 1297:17</p> <p>slight [1] - 1194:36</p> <p>slightly [8] - 1180:14, 1196:32, 1219:27, 1250:37, 1250:38, 1300:42, 1318:32, 1347:18</p> <p>slip [3] - 1226:27, 1346:37, 1346:39</p> <p>slipped [1] - 1297:11</p> <p>slope [41] - 1170:2, 1176:11, 1176:19, 1177:36, 1177:42, 1180:31, 1181:24, 1183:17, 1189:36, 1190:36, 1191:10, 1191:37, 1195:23, 1198:14, 1198:25, 1203:43, 1229:26, 1229:27, 1277:7, 1292:36, 1292:41, 1293:5, 1295:6, 1295:22, 1295:27, 1295:38, 1295:40, 1296:19, 1296:34, 1296:40, 1296:44, 1297:24, 1297:30, 1297:47, 1335:18, 1335:32, 1337:3, 1337:5, 1337:37, 1347:9, 1347:34</p> <p>slopes [4] - 1171:32, 1176:15, 1179:32, 1203:40</p> <p>slow [1] - 1260:14</p> <p>slower [1] - 1253:36</p> <p>slug [1] - 1267:20</p> <p>small [13] - 1170:13, 1186:25, 1191:47, 1192:9, 1210:35, 1240:8, 1294:19, 1294:20, 1295:38, 1298:9, 1307:15, 1348:23</p> <p>smaller [2] - 1238:5, 1348:33</p> <p>SME.0001.0001.0501 [1] - 1319:38</p> <p>SMEC [34] - 1235:6, 1246:1, 1251:23, 1254:21, 1257:25, 1259:33, 1270:26, 1273:10, 1280:1, 1295:1, 1301:2, 1301:4, 1301:14, 1302:38, 1311:24, 1319:16, 1320:9, 1322:7, 1322:43, 1330:1, 1339:21,</p>	<p>1339:29, 1341:8, 1342:28, 1342:38, 1346:24, 1346:32, 1346:35, 1346:46, 1347:1, 1347:24, 1350:26, 1350:37</p> <p>SMEC's [3] - 1295:1, 1325:4, 1338:41</p> <p>smidgen [1] - 1240:4</p> <p>smoking [1] - 1312:9</p> <p>SO4 [1] - 1309:6</p> <p>socket [8] - 1181:37, 1182:15, 1182:17, 1182:20, 1202:30, 1203:2, 1203:12, 1203:23</p> <p>socketed [2] - 1193:16, 1193:21</p> <p>sodium [12] - 1303:14, 1303:47, 1306:18, 1309:1, 1309:12, 1309:15, 1309:17, 1309:20, 1309:28, 1309:33, 1309:41, 1313:35</p> <p>software [1] - 1189:11</p> <p>soil [81] - 1173:30, 1174:22, 1179:3, 1183:20, 1190:41, 1190:45, 1190:46, 1191:29, 1191:31, 1191:41, 1191:42, 1191:43, 1191:47, 1192:1, 1192:2, 1224:26, 1226:27, 1230:30, 1231:40, 1231:43, 1232:4, 1232:10, 1232:31, 1232:34, 1232:38, 1232:40, 1233:19, 1233:21, 1233:31, 1233:32, 1234:16, 1236:30, 1236:31, 1237:12, 1237:38, 1237:39, 1238:10, 1238:12, 1238:26, 1238:29, 1238:34, 1238:42, 1239:6, 1239:16, 1245:35, 1248:9, 1250:38, 1250:39, 1253:29, 1254:27, 1267:11, 1276:18, 1279:47, 1289:27, 1290:2, 1295:8, 1295:9, 1295:12, 1295:28, 1304:3, 1309:16, 1309:19, 1310:42, 1311:8, 1311:44, 1313:18, 1314:7,</p>
--	--	--	---	--

<p>1314:41, 1314:43, 1314:44, 1314:45, 1314:46, 1316:19, 1317:2, 1324:20, 1343:21, 1343:34, 1345:12, 1345:14</p> <p>soils [15] - 1173:32, 1206:26, 1211:21, 1217:43, 1225:13, 1227:46, 1232:16, 1234:36, 1252:24, 1261:32, 1262:5, 1274:18, 1289:30, 1305:22, 1305:31</p> <p>sole [1] - 1334:31</p> <p>solicitors [2] - 1301:32, 1351:21</p> <p>solid [5] - 1213:45, 1214:1, 1306:12, 1314:27, 1314:28</p> <p>solids [2] - 1344:46, 1345:6</p> <p>soluble [2] - 1306:5, 1306:8</p> <p>solution [4] - 1304:35, 1304:37, 1314:1, 1315:38</p> <p>someone [3] - 1298:4, 1302:15, 1331:40</p> <p>sometimes [5] - 1206:12, 1207:38, 1208:17, 1208:26</p> <p>somewhat [2] - 1174:46, 1216:46</p> <p>somewhere [9] - 1176:33, 1177:7, 1185:27, 1191:3, 1194:8, 1222:5, 1245:19, 1276:41, 1287:12</p> <p>Sorry [2] - 1258:32, 1315:15</p> <p>sorry [76] - 1169:7, 1169:16, 1169:32, 1172:24, 1174:28, 1174:42, 1176:16, 1176:44, 1180:36, 1184:2, 1184:8, 1184:35, 1185:10, 1185:11, 1188:25, 1191:42, 1192:43, 1192:45, 1193:1, 1193:5, 1193:7, 1196:12, 1199:18, 1199:41, 1202:20, 1204:14, 1209:41, 1213:45, 1216:6, 1216:29, 1219:13, 1220:44, 1221:17, 1221:36, 1222:30,</p>	<p>1232:3, 1233:27, 1234:39, 1243:7, 1243:36, 1245:42, 1250:43, 1251:5, 1254:44, 1256:24, 1268:11, 1270:4, 1274:2, 1274:3, 1274:30, 1277:26, 1281:23, 1281:46, 1282:21, 1282:36, 1287:33, 1294:9, 1308:27, 1312:13, 1318:9, 1318:12, 1318:17, 1320:15, 1321:3, 1325:26, 1328:33, 1330:24, 1336:37, 1339:29, 1339:32, 1344:2, 1349:33, 1349:36, 1349:38</p> <p>sort [41] - 1173:17, 1176:3, 1177:27, 1177:35, 1178:16, 1179:14, 1184:31, 1189:35, 1190:1, 1193:4, 1199:29, 1206:24, 1207:1, 1208:22, 1214:29, 1218:7, 1220:23, 1222:39, 1226:43, 1240:44, 1241:39, 1242:29, 1244:34, 1245:6, 1245:37, 1254:31, 1254:36, 1254:47, 1263:29, 1264:30, 1268:37, 1289:37, 1292:10, 1294:9, 1323:37, 1331:4, 1336:2, 1343:5, 1343:6, 1343:32, 1345:7</p> <p>sorted [2] - 1300:27, 1300:30</p> <p>sorts [1] - 1215:45</p> <p>sought [1] - 1231:28</p> <p>sound [1] - 1245:37</p> <p>source [52] - 1205:17, 1205:31, 1206:14, 1209:21, 1209:35, 1209:38, 1210:17, 1210:26, 1210:33, 1216:14, 1222:40, 1223:5, 1223:6, 1224:23, 1224:29, 1278:1, 1292:12, 1292:13, 1292:19, 1292:27, 1303:27, 1303:43, 1303:44, 1304:4, 1305:34, 1306:36, 1307:18,</p>	<p>1307:41, 1308:7, 1309:22, 1309:28, 1310:38, 1312:36, 1316:27, 1317:46, 1318:15, 1318:18, 1321:27, 1321:33, 1324:40, 1330:27, 1330:38, 1335:41, 1336:23, 1336:41, 1336:45, 1336:47, 1343:26, 1344:10, 1345:5, 1348:15</p> <p>source [1] - 1318:10</p> <p>sources [15] - 1209:13, 1226:13, 1278:3, 1294:25, 1299:37, 1303:21, 1303:46, 1316:11, 1316:35, 1318:37, 1319:8, 1344:3, 1347:19, 1347:37, 1348:31</p> <p>South [28] - 1167:41, 1210:42, 1215:7, 1215:17, 1216:15, 1216:25, 1227:26, 1256:38, 1257:24, 1277:19, 1282:30, 1282:39, 1283:23, 1283:29, 1285:3, 1301:31, 1302:11, 1302:15, 1307:5, 1307:32, 1313:19, 1313:23, 1317:32, 1346:8, 1346:18, 1346:23, 1348:41</p> <p>south [3] - 1178:4, 1247:28</p> <p>south-east [1] - 1247:28</p> <p>south-easterly [2] - 1178:4</p> <p>southbound [1] - 1247:26</p> <p>span [1] - 1260:45</p> <p>spatial [1] - 1214:27</p> <p>speaking [10] - 1170:17, 1190:5, 1190:6, 1210:5, 1215:7, 1293:19, 1303:46, 1308:42, 1308:43, 1317:30</p> <p>special [2] - 1279:5, 1299:41</p> <p>specific [3] - 1198:16, 1198:33, 1263:15</p> <p>specifically [2] - 1210:11, 1302:39</p> <p>specifics [1] - 1224:4</p> <p>spectacular [1] -</p>	<p>1230:34</p> <p>speculating [3] - 1284:41, 1285:1, 1297:5</p> <p>speculation [4] - 1348:2, 1349:17, 1349:19, 1349:21</p> <p>speculative [4] - 1284:40, 1293:41, 1337:16, 1337:22</p> <p>speed [4] - 1253:31, 1281:30, 1325:42, 1350:5</p> <p>spend [2] - 1281:31, 1281:32</p> <p>spent [2] - 1220:21, 1311:44</p> <p>spoken [3] - 1189:5, 1290:20, 1301:43</p> <p>spot [1] - 1329:33</p> <p>spots [1] - 1178:34</p> <p>spread [3] - 1230:21, 1235:7, 1245:21</p> <p>spreading [1] - 1239:21</p> <p>spreadsheet [3] - 1255:42, 1256:1, 1256:14</p> <p>spreadsheet's [1] - 1255:45</p> <p>spring [2] - 1292:9, 1318:47</p> <p>springs [4] - 1218:15, 1295:25, 1318:40, 1318:42</p> <p>springwater [1] - 1325:8</p> <p>spur [1] - 1258:19</p> <p>square [4] - 1238:22, 1240:7, 1243:41, 1295:38</p> <p>squared [4] - 1236:24, 1238:26, 1239:19, 1242:5</p> <p>stabilise [2] - 1315:38, 1315:39</p> <p>stability [6] - 1181:44, 1195:23, 1229:26, 1292:37, 1296:46, 1347:34</p> <p>stable [1] - 1294:21</p> <p>staff [3] - 1302:9, 1307:26, 1351:21</p> <p>stage [1] - 1309:47</p> <p>stages [2] - 1252:10, 1340:21</p> <p>stamp [1] - 1252:17</p> <p>stand [4] - 1203:36, 1296:13, 1338:7, 1350:31</p>	<p>standard [4] - 1201:16, 1307:27, 1307:28, 1313:46</p> <p>standards [2] - 1179:21, 1200:47</p> <p>standing [6] - 1176:33, 1186:27, 1222:31, 1328:4, 1337:42, 1338:5</p> <p>start [33] - 1168:9, 1168:43, 1180:18, 1180:24, 1180:47, 1181:6, 1181:10, 1189:29, 1196:44, 1202:47, 1203:8, 1207:27, 1211:36, 1215:38, 1222:36, 1227:6, 1249:44, 1251:23, 1251:29, 1264:19, 1275:43, 1287:11, 1300:3, 1300:5, 1303:8, 1303:13, 1308:43, 1311:33, 1313:6, 1316:5, 1325:16, 1335:25, 1348:17</p> <p>started [2] - 1255:30, 1282:46</p> <p>starting [6] - 1217:47, 1225:19, 1242:41, 1286:29, 1320:5, 1326:16</p> <p>starts [3] - 1316:16, 1319:28, 1319:39</p> <p>State [3] - 1167:36, 1179:42, 1204:1</p> <p>state [11] - 1183:35, 1184:3, 1185:7, 1207:16, 1223:2, 1234:1, 1295:28, 1306:25, 1307:39, 1317:7, 1328:46</p> <p>statement [7] - 1195:13, 1195:15, 1195:17, 1198:12, 1260:7, 1316:10, 1334:17</p> <p>statements [2] - 1195:41, 1216:15</p> <p>states [3] - 1237:11, 1251:27, 1313:34</p> <p>stay [2] - 1326:38, 1326:44</p> <p>staying [2] - 1191:32, 1345:45</p> <p>steady [1] - 1291:20</p> <p>steel [3] - 1181:21, 1201:41, 1267:27</p> <p>steep [10] - 1171:30, 1171:32, 1176:15,</p>
---	--	---	--	--

<p>1181:42, 1181:44, 1203:40, 1237:29, 1297:24, 1337:37 steeper [2] - 1170:6, 1190:46 Stefano [4] - 1167:32, 1205:44, 1227:1, 1327:1 STEFANO [201] - 1227:4, 1227:6, 1227:15, 1227:23, 1227:29, 1227:33, 1227:38, 1227:42, 1228:4, 1228:8, 1228:17, 1228:21, 1228:25, 1228:31, 1228:43, 1229:7, 1229:16, 1229:31, 1229:39, 1229:46, 1230:9, 1230:27, 1230:37, 1230:42, 1231:3, 1231:16, 1231:20, 1231:28, 1231:35, 1232:2, 1232:14, 1232:22, 1232:33, 1232:43, 1233:1, 1233:6, 1233:18, 1233:23, 1233:27, 1233:31, 1233:40, 1234:7, 1234:13, 1234:30, 1235:1, 1235:20, 1235:31, 1235:36, 1235:43, 1236:6, 1236:14, 1236:21, 1236:37, 1237:2, 1237:10, 1237:19, 1237:35, 1238:5, 1238:10, 1238:25, 1238:34, 1238:39, 1238:45, 1239:2, 1239:9, 1239:15, 1239:35, 1239:42, 1240:1, 1240:10, 1240:21, 1240:30, 1240:37, 1241:1, 1241:8, 1241:16, 1241:24, 1241:39, 1242:4, 1242:12, 1242:33, 1242:47, 1243:4, 1243:13, 1243:18, 1243:36, 1243:43, 1244:5, 1244:15, 1244:26, 1244:31, 1244:40, 1245:13, 1245:24, 1245:29, 1245:42, 1245:47, 1246:13, 1246:21, 1246:28, 1246:37, 1246:44, 1247:3, 1247:11,</p>	<p>1247:17, 1247:30, 1247:37, 1248:13, 1248:30, 1248:35, 1248:43, 1249:3, 1249:13, 1249:22, 1249:28, 1249:39, 1250:2, 1250:7, 1250:13, 1250:19, 1250:35, 1251:4, 1251:17, 1251:36, 1251:47, 1252:7, 1252:21, 1252:35, 1252:40, 1252:44, 1253:4, 1253:15, 1253:20, 1253:42, 1254:4, 1254:9, 1254:17, 1254:44, 1255:3, 1255:9, 1255:15, 1255:21, 1255:35, 1255:45, 1256:7, 1256:13, 1256:19, 1256:42, 1257:23, 1257:42, 1258:8, 1258:13, 1258:24, 1258:28, 1258:32, 1258:37, 1258:43, 1259:4, 1259:16, 1264:11, 1264:13, 1264:33, 1264:42, 1264:47, 1265:4, 1265:13, 1265:23, 1265:37, 1265:42, 1266:5, 1266:10, 1266:17, 1266:22, 1266:39, 1266:46, 1267:8, 1267:18, 1267:30, 1267:37, 1267:46, 1268:4, 1268:11, 1268:20, 1268:27, 1268:46, 1269:4, 1269:11, 1269:18, 1269:29, 1269:36, 1270:3, 1270:13, 1270:21, 1270:25, 1270:35, 1270:41, 1271:1, 1271:10, 1271:23, 1271:28, 1271:33 Stefano's [1] - 1327:12 step [7] - 1300:34, 1303:21, 1305:42, 1307:26, 1315:38, 1315:42, 1315:43 STEPHEN [1] - 1168:35 steps [1] - 1307:29 stick [3] - 1311:43, 1311:46, 1330:4</p>	<p>sticking [3] - 1306:15, 1332:16, 1332:21 stiffer [1] - 1190:46 still [23] - 1170:24, 1172:27, 1186:27, 1187:21, 1190:11, 1197:12, 1207:39, 1211:37, 1222:6, 1232:35, 1232:37, 1243:29, 1254:33, 1285:20, 1285:26, 1285:27, 1293:1, 1329:26, 1330:37, 1335:29, 1335:33, 1335:35, 1350:30 stonewall [1] - 1194:22 stop [8] - 1192:42, 1209:42, 1221:18, 1261:1, 1293:4, 1293:14, 1298:33, 1317:6 stopped [3] - 1218:3, 1285:3, 1331:1 storm [1] - 1310:14 stormi [1] - 1271:17 Stormi [1] - 1284:23 stormwater [100] - 1210:34, 1211:25, 1212:29, 1212:31, 1213:6, 1213:12, 1213:18, 1213:25, 1213:40, 1213:45, 1214:6, 1220:3, 1224:46, 1225:21, 1227:18, 1235:5, 1235:8, 1235:13, 1235:24, 1236:29, 1237:13, 1239:24, 1239:36, 1239:38, 1240:39, 1240:41, 1241:12, 1241:33, 1241:43, 1241:46, 1242:15, 1242:21, 1242:22, 1242:37, 1242:38, 1243:6, 1243:8, 1243:21, 1243:24, 1244:9, 1244:17, 1244:24, 1244:36, 1244:42, 1247:7, 1247:21, 1247:25, 1249:32, 1250:45, 1259:17, 1264:15, 1264:16, 1264:19, 1264:22, 1264:25, 1264:30, 1264:34, 1264:35, 1265:5, 1265:13, 1265:16, 1265:28, 1265:31, 1265:32,</p>	<p>1265:43, 1266:12, 1266:26, 1267:1, 1268:12, 1268:28, 1269:13, 1269:14, 1269:30, 1269:45, 1270:31, 1271:2, 1271:12, 1271:16, 1276:19, 1279:47, 1280:27, 1280:29, 1280:37, 1280:43, 1281:1, 1281:8, 1284:15, 1284:26, 1297:27, 1309:12, 1309:32, 1310:9, 1316:9, 1316:21, 1317:1, 1325:8, 1343:22 story [1] - 1322:47 straight [3] - 1215:44, 1221:11, 1252:47 straightforward [2] - 1229:25, 1331:43 strain [2] - 1171:35, 1191:10 strata [1] - 1206:42 street [4] - 1247:5, 1250:28, 1250:31, 1266:2 Street [28] - 1167:18, 1180:2, 1218:4, 1218:6, 1257:32, 1264:37, 1264:45, 1265:45, 1266:6, 1266:28, 1267:22, 1269:5, 1269:31, 1269:34, 1270:30, 1270:37, 1271:3, 1273:29, 1273:31, 1279:39, 1279:41, 1280:13, 1280:28, 1280:33, 1286:2, 1317:32, 1329:14, 1340:5 streets [1] - 1220:22 stress [12] - 1181:30, 1181:32, 1181:42, 1182:6, 1182:7, 1182:9, 1183:17, 1189:9, 1191:9, 1191:34, 1203:42, 1277:21 stresses [6] - 1171:43, 1181:38, 1182:4, 1188:31, 1188:33, 1188:40 strike [2] - 1328:34, 1337:43 strikes [2] - 1178:47, 1271:13 strong [2] - 1175:22,</p>	<p>1223:42 structures [3] - 1305:7, 1305:15, 1306:31 study [3] - 1195:43, 1309:24, 1314:38 stuff [8] - 1203:9, 1217:35, 1218:3, 1218:38, 1220:23, 1220:25, 1287:2, 1289:12 style [1] - 1307:14 subdivided [2] - 1201:1, 1201:3 subdivision [1] - 1200:45 subject [3] - 1185:19, 1212:45, 1296:47 subjected [1] - 1172:18 submission [2] - 1220:12, 1256:30 submissions [1] - 1346:27 submitted [1] - 1319:12 subparagraph [3] - 1308:29, 1310:18, 1310:33 subsequently [1] - 1169:35 subsoil [1] - 1236:26 substantial [4] - 1292:6, 1292:14, 1292:22, 1297:38 substantially [1] - 1291:20 subsurface [6] - 1225:40, 1225:46, 1245:27, 1279:46, 1316:20, 1343:22 subterranean [1] - 1207:8 subterraneanly [2] - 1246:38, 1247:33 succession [1] - 1188:3 suction [12] - 1204:27, 1204:37, 1204:43, 1293:20, 1293:21, 1293:23, 1293:38, 1293:40, 1295:21, 1295:31, 1299:10 sudden [1] - 1249:10 sufficiency [1] - 1195:45 sufficient [7] - 1224:24, 1225:35, 1245:32, 1285:32, 1296:23, 1296:35,</p>
---	---	---	---	---

1299:16 sufficiently [2] - 1307:37, 1315:31 suggest [11] - 1233:43, 1247:25, 1266:39, 1284:40, 1285:32, 1291:27, 1292:19, 1293:29, 1303:35, 1349:44, 1349:47 suggested [5] - 1180:25, 1180:26, 1195:5, 1299:21, 1322:34 suggesting [4] - 1232:43, 1234:13, 1249:31, 1348:26 suggestion [5] - 1169:42, 1195:3, 1244:43, 1299:17, 1338:6 suggestive [2] - 1311:5, 1312:12 suggests [4] - 1195:19, 1236:25, 1242:10, 1309:32 suits [1] - 1168:13 sulphate [1] - 1309:6 sulphide [1] - 1304:14 summarised [2] - 1237:23, 1321:19 summarises [1] - 1228:45 summary [1] - 1279:46 summation [1] - 1235:13 summations [1] - 1270:18 sump [1] - 1251:39 sun [1] - 1295:24 sunk [2] - 1182:11, 1202:5 superficial [1] - 1193:19 superimpose [1] - 1247:17 superimposed [1] - 1183:8 superlaid [1] - 1236:7 supersedes [1] - 1275:24 supplementary [6] - 1235:6, 1246:1, 1251:24, 1270:27, 1275:23, 1347:2 supplemented [1] - 1333:23 supplied [3] - 1175:8, 1193:10, 1220:13	supply [3] - 1206:43, 1207:6, 1222:6 support [5] - 1176:18, 1177:14, 1179:35, 1191:33, 1317:33 supporting [1] - 1255:29 supportive [2] - 1254:40, 1254:44 supports [3] - 1283:34, 1283:38, 1283:44 suppose [3] - 1242:30, 1330:31, 1342:45 surcharge [5] - 1191:8, 1191:45, 1191:47, 1192:1, 1192:9 surface [55] - 1173:38, 1173:39, 1174:14, 1174:15, 1178:18, 1206:41, 1216:16, 1220:7, 1229:3, 1229:9, 1229:12, 1230:9, 1230:18, 1230:20, 1230:21, 1230:25, 1230:32, 1232:19, 1232:31, 1232:41, 1235:10, 1235:12, 1235:18, 1235:23, 1236:23, 1236:28, 1236:29, 1241:19, 1241:30, 1241:31, 1241:41, 1241:45, 1242:23, 1242:41, 1244:19, 1244:38, 1245:21, 1245:30, 1246:17, 1246:34, 1246:39, 1250:32, 1258:47, 1265:30, 1280:42, 1280:47, 1281:7, 1289:36, 1297:23, 1306:10, 1323:34, 1335:9, 1347:9, 1347:27 surfaces [3] - 1170:42, 1305:7, 1337:25 surfacing [1] - 1287:7 surficial [1] - 1193:19 surge [1] - 1226:44 surprise [1] - 1183:23 surprised [1] - 1223:22 surprising [1] - 1268:41 surrounding [5] - 1232:10, 1234:25,	1272:36, 1273:6, 1289:30 surroundings [1] - 1273:40 surrounds [2] - 1234:26, 1342:40 survey [11] - 1170:39, 1173:36, 1173:37, 1173:40, 1173:41, 1174:13, 1176:14, 1187:10, 1296:39 surveyed [1] - 1170:42 surveyor [3] - 1170:37, 1170:39, 1195:14 susceptibility [9] - 1197:7, 1197:33, 1197:38, 1197:39, 1197:44, 1198:15, 1199:25, 1200:36, 1201:17 susceptible [4] - 1181:45, 1198:25, 1198:26, 1264:26 suspect [4] - 1189:30, 1296:16, 1326:9, 1345:38 suspicion [1] - 1193:17 SW02 [1] - 1329:47 SW2 [1] - 1328:45 swamp [1] - 1208:26 swap [1] - 1345:29 swings [1] - 1178:5 symmetrical [3] - 1177:3, 1177:5, 1177:6 symmetry [1] - 1177:1 system [13] - 1208:32, 1215:6, 1217:42, 1227:18, 1257:20, 1264:16, 1268:28, 1269:13, 1269:14, 1269:31, 1310:14, 1317:1 systems [1] - 1208:21	1248:1, 1253:44, 1263:45, 1266:34, 1289:7, 1318:7, 1321:14, 1321:40, 1322:9, 1322:22, 1322:26, 1322:35, 1327:8, 1328:28, 1328:41, 1328:43, 1329:11, 1329:22, 1329:28, 1330:4, 1331:13, 1331:22, 1333:18, 1340:3 talks [4] - 1195:16, 1219:47, 1244:23, 1293:17 tank [1] - 1256:38 TDS [2] - 1308:5, 1308:44 team [4] - 1218:32, 1284:17, 1285:45, 1322:43 team's [1] - 1170:7 technical [8] - 1171:42, 1205:24, 1303:11, 1319:19, 1334:30, 1334:35, 1334:46, 1335:3 telephone [3] - 1294:19, 1299:13 tend [6] - 1228:28, 1251:9, 1251:14, 1256:34, 1293:35, 1306:6 tendency [5] - 1193:18, 1242:22, 1248:23, 1248:24, 1293:20 tender [7] - 1185:17, 1185:28, 1185:35, 1185:37, 1185:40, 1186:12, 1227:8 tendered [5] - 1185:33, 1185:46, 1302:43, 1350:38, 1351:7 tends [2] - 1292:18 tensile [1] - 1188:43 tension [13] - 1181:18, 1187:33, 1187:44, 1188:8, 1188:23, 1188:30, 1188:42, 1188:46, 1188:47, 1191:18, 1191:23, 1191:28 term [3] - 1246:8, 1252:16, 1314:4 terminology [3] - 1206:33, 1207:24 terms [24] - 1178:20, 1181:33, 1189:7,	1190:6, 1191:15, 1192:35, 1209:13, 1242:30, 1252:7, 1253:31, 1259:21, 1262:14, 1264:18, 1265:13, 1278:16, 1288:16, 1304:12, 1304:23, 1305:41, 1307:36, 1343:10, 1343:12, 1346:21 terracing [1] - 1296:18 test [47] - 1231:13, 1252:25, 1255:4, 1256:28, 1259:31, 1261:14, 1261:16, 1262:16, 1262:25, 1263:11, 1263:35, 1266:34, 1277:13, 1277:22, 1282:5, 1283:3, 1283:9, 1283:22, 1283:34, 1284:12, 1284:47, 1285:5, 1285:6, 1285:18, 1298:46, 1304:46, 1307:1, 1307:2, 1308:42, 1313:16, 1313:47, 1314:1, 1314:6, 1314:19, 1314:23, 1314:24, 1314:33, 1314:37, 1314:47, 1315:19, 1315:44, 1332:27, 1339:20, 1339:21, 1342:17 tested [5] - 1233:31, 1252:38, 1267:4, 1277:16, 1289:43 testing [71] - 1215:30, 1215:37, 1216:4, 1220:28, 1220:39, 1221:21, 1222:18, 1225:47, 1226:5, 1236:3, 1240:44, 1242:10, 1251:39, 1251:40, 1252:23, 1252:24, 1252:26, 1253:28, 1255:1, 1260:20, 1261:42, 1262:43, 1263:1, 1263:44, 1277:44, 1278:3, 1280:2, 1280:6, 1280:8, 1282:4, 1285:6, 1287:26, 1287:27, 1287:41, 1289:37, 1290:16, 1304:31, 1306:3, 1306:46, 1307:14, 1307:17, 1307:22, 1307:30, 1307:31, 1307:37, 1311:2, 1311:14,
--	--	---	---	---

<p>1311:25, 1311:35, 1312:44, 1313:7, 1313:13, 1315:5, 1315:29, 1316:16, 1316:17, 1321:12, 1332:26, 1339:13, 1342:7, 1342:29, 1342:37, 1343:18, 1344:22, 1344:26, 1344:31, 1347:24, 1349:39, 1350:15</p> <p>tests [35] - 1220:32, 1221:30, 1231:8, 1231:12, 1235:41, 1240:15, 1240:45, 1241:3, 1254:23, 1254:37, 1256:27, 1256:33, 1260:8, 1260:9, 1260:44, 1261:30, 1261:32, 1262:4, 1262:18, 1263:34, 1263:35, 1277:25, 1283:14, 1286:20, 1290:12, 1290:14, 1293:30, 1306:47, 1307:2, 1307:4, 1313:41, 1332:10, 1342:6, 1342:44, 1350:7</p> <p>text [2] - 1211:5, 1323:17</p> <p>thalweg [1] - 1212:17</p> <p>THE [1] - 1351:24</p> <p>theirs [1] - 1277:22</p> <p>themselves [2] - 1257:20, 1306:35</p> <p>theoretical [5] - 1225:25, 1225:27, 1225:29, 1277:38, 1347:45</p> <p>theoretically [1] - 1225:41</p> <p>theories [3] - 1282:5, 1296:32, 1349:39</p> <p>theory [21] - 1221:20, 1277:43, 1278:6, 1279:7, 1293:20, 1293:38, 1296:8, 1333:12, 1337:16, 1337:22, 1337:27, 1346:31, 1346:46, 1347:20, 1348:44, 1349:2, 1349:8, 1349:11, 1349:12, 1349:23, 1349:24</p> <p>therefore [16] - 1178:5, 1193:17, 1193:18, 1200:9, 1223:27, 1233:44, 1234:3, 1237:31,</p>	<p>1246:16, 1255:41, 1289:15, 1294:24, 1294:26, 1295:9, 1335:19, 1345:2</p> <p>thereon [1] - 1257:17</p> <p>thesis [2] - 1181:47, 1182:10</p> <p>they've [7] - 1196:27, 1198:27, 1254:24, 1269:41, 1305:36, 1307:35, 1328:34</p> <p>thicker [1] - 1238:11</p> <p>thickness [3] - 1177:27, 1237:46, 1240:4</p> <p>thimble [1] - 1295:16</p> <p>thinking [3] - 1297:28, 1298:20, 1299:11</p> <p>thinks [1] - 1196:20</p> <p>thinned [1] - 1245:34</p> <p>third [6] - 1212:39, 1243:5, 1243:8, 1244:17, 1298:24, 1298:27</p> <p>thirds [2] - 1243:8, 1244:16</p> <p>thousand [9] - 1239:18, 1240:23, 1240:38, 1241:10, 1241:25, 1241:43, 1247:31, 1249:41, 1299:9</p> <p>thousands [1] - 1306:22</p> <p>three [8] - 1174:32, 1211:20, 1279:45, 1299:9, 1318:22, 1320:40, 1326:7, 1349:34</p> <p>three-quarters [1] - 1326:7</p> <p>throughout [8] - 1252:4, 1256:27, 1272:44, 1301:27, 1315:44, 1336:26, 1337:24, 1337:44</p> <p>thrust [1] - 1278:45</p> <p>thumb [1] - 1203:5</p> <p>tie [2] - 1176:23, 1195:2</p> <p>tieback [2] - 1188:44, 1203:24</p> <p>tiebacks [4] - 1189:1, 1203:9, 1203:15, 1203:21</p> <p>tiebreaker [1] - 1192:18</p> <p>tied [3] - 1274:35, 1275:19, 1339:1</p> <p>tight [4] - 1273:44,</p>	<p>1273:46, 1274:12, 1274:13</p> <p>Tim [3] - 1235:32, 1236:11, 1285:45</p> <p>timed [1] - 1260:45</p> <p>timeframe [1] - 1314:22</p> <p>tip [1] - 1176:18</p> <p>tipped [1] - 1179:22</p> <p>tippling [1] - 1295:11</p> <p>today [12] - 1183:42, 1197:12, 1269:46, 1272:28, 1280:26, 1305:22, 1333:44, 1346:24, 1346:26, 1346:34, 1350:7, 1350:25</p> <p>today's [2] - 1200:47, 1207:26</p> <p>toe [3] - 1183:16, 1183:17, 1189:17</p> <p>together [12] - 1180:8, 1211:5, 1211:19, 1211:35, 1214:26, 1216:9, 1216:19, 1217:47, 1293:28, 1331:13, 1348:43</p> <p>tomorrow [5] - 1326:21, 1326:27, 1327:9, 1327:10, 1327:11</p> <p>tonight [2] - 1326:31, 1326:33</p> <p>took [10] - 1173:37, 1174:27, 1219:34, 1222:17, 1222:34, 1235:17, 1272:18, 1276:20, 1330:1, 1330:2</p> <p>top [39] - 1173:16, 1173:18, 1173:44, 1175:26, 1177:33, 1189:34, 1189:36, 1202:12, 1211:4, 1211:36, 1212:8, 1212:13, 1228:37, 1230:10, 1231:37, 1235:45, 1236:7, 1236:41, 1238:12, 1238:27, 1238:28, 1238:34, 1239:15, 1246:4, 1247:4, 1247:19, 1251:25, 1253:44, 1256:39, 1257:28, 1266:32, 1271:14, 1274:3, 1274:4, 1296:17, 1297:28, 1298:20, 1298:25, 1347:45</p> <p>topic [27] - 1169:4,</p>	<p>1169:9, 1175:4, 1175:23, 1179:10, 1189:29, 1195:46, 1196:15, 1201:32, 1203:28, 1204:5, 1206:8, 1211:14, 1211:38, 1227:16, 1251:18, 1256:42, 1263:47, 1264:2, 1264:13, 1271:43, 1286:18, 1294:41, 1294:45, 1306:30, 1333:17, 1341:46</p> <p>topical [1] - 1205:35</p> <p>topics [2] - 1180:8, 1205:33</p> <p>topography [3] - 1249:44, 1292:41, 1298:7</p> <p>total [9] - 1228:9, 1228:29, 1229:10, 1229:20, 1246:4, 1246:9, 1246:31, 1308:6</p> <p>totality [1] - 1210:3</p> <p>touch [1] - 1220:28</p> <p>touched [2] - 1170:36, 1176:31</p> <p>touching [1] - 1227:15</p> <p>towards [18] - 1173:15, 1176:32, 1176:34, 1185:6, 1194:39, 1212:31, 1236:29, 1252:28, 1252:42, 1264:37, 1270:43, 1271:17, 1279:18, 1279:39, 1289:36, 1292:18, 1328:23, 1337:5</p> <p>town [1] - 1180:3</p> <p>trace [1] - 1269:25</p> <p>tracer [12] - 1231:12, 1231:13, 1303:31, 1309:20, 1309:21, 1309:23, 1309:24, 1309:26, 1309:28, 1311:39, 1311:41</p> <p>tracers [1] - 1343:41</p> <p>traces [1] - 1309:13</p> <p>track [2] - 1299:47, 1300:1</p> <p>tracked [1] - 1217:19</p> <p>tracking [1] - 1217:30</p> <p>train [1] - 1349:38</p> <p>training [1] - 1337:42</p> <p>transfer [2] - 1181:32, 1246:38</p> <p>transferred [1] - 1203:43</p> <p>transfers [1] - 1203:3</p>	<p>transient [2] - 1208:14, 1208:30</p> <p>transition [1] - 1267:35</p> <p>transitioned [1] - 1267:26</p> <p>translate [4] - 1171:38, 1171:39, 1175:28, 1274:22</p> <p>transmit [1] - 1304:37</p> <p>transport [1] - 1283:35</p> <p>transported [5] - 1211:21, 1241:26, 1262:5, 1305:27, 1314:45</p> <p>travel [18] - 1234:15, 1247:32, 1248:4, 1249:34, 1252:31, 1253:23, 1254:4, 1276:16, 1282:5, 1287:31, 1305:11, 1306:34, 1310:13, 1323:17, 1324:19, 1343:30, 1343:39, 1345:12</p> <p>travelled [17] - 1205:37, 1213:17, 1215:33, 1215:44, 1215:45, 1246:30, 1246:32, 1259:46, 1261:26, 1276:18, 1316:18, 1317:34, 1324:23, 1343:20, 1344:29, 1344:39, 1344:42</p> <p>travelling [4] - 1225:9, 1225:41, 1231:43, 1305:14</p> <p>travels [5] - 1236:28, 1305:6, 1305:16, 1306:31, 1324:14</p> <p>traverse [1] - 1245:30</p> <p>treated [1] - 1250:28</p> <p>tree [8] - 1185:5, 1186:27, 1186:36, 1187:4, 1187:9, 1187:20, 1215:6</p> <p>trees [1] - 1176:9</p> <p>trench [42] - 1194:47, 1214:33, 1215:5, 1221:9, 1221:10, 1221:21, 1222:21, 1222:22, 1222:28, 1225:17, 1230:12, 1231:9, 1233:45, 1234:21, 1234:26, 1234:38, 1247:44, 1247:45, 1253:7, 1253:39, 1257:13,</p>
---	---	--	--	--

<p>1257:45, 1257:47, 1258:2, 1259:9, 1264:18, 1273:6, 1273:39, 1273:40, 1274:16, 1282:37, 1283:23, 1283:26, 1283:29, 1283:45, 1285:8, 1286:46, 1288:30, 1289:14</p> <p>trench's [2] - 1229:32, 1229:33</p> <p>trenched [1] - 1288:23</p> <p>trenches [38] - 1212:41, 1217:46, 1221:7, 1225:40, 1225:46, 1229:17, 1229:18, 1229:20, 1229:34, 1230:25, 1234:25, 1246:35, 1250:30, 1258:6, 1258:11, 1271:6, 1272:14, 1272:20, 1272:36, 1272:42, 1273:3, 1273:42, 1273:44, 1276:19, 1279:47, 1281:32, 1281:39, 1284:2, 1286:37, 1286:38, 1286:40, 1286:41, 1286:42, 1287:13, 1288:26, 1316:20, 1343:21, 1344:42</p> <p>trenching [1] - 1271:2</p> <p>trend [1] - 1257:17</p> <p>triangles [1] - 1176:10</p> <p>tricky [2] - 1248:3, 1347:44</p> <p>tried [6] - 1179:13, 1216:31, 1331:42, 1348:42, 1349:27, 1349:34</p> <p>trigger [20] - 1169:43, 1180:26, 1180:33, 1180:37, 1190:7, 1204:14, 1204:24, 1204:26, 1204:42, 1205:11, 1210:4, 1223:7, 1223:9, 1223:11, 1223:14, 1226:11, 1251:39, 1294:20, 1296:7, 1299:17</p> <p>triggered [1] - 1333:42</p> <p>triggering [4] - 1209:21, 1209:39, 1210:26, 1337:22</p> <p>triggering" [1] - 1209:36</p> <p>trouble [2] - 1218:13, 1286:47</p>	<p>trucks [1] - 1179:17</p> <p>true [14] - 1194:41, 1194:43, 1195:41, 1218:24, 1227:40, 1261:9, 1276:1, 1276:7, 1282:30, 1283:16, 1284:15, 1285:36, 1286:8, 1332:40</p> <p>trunk [2] - 1214:46, 1215:7</p> <p>trust [2] - 1195:40, 1307:31</p> <p>truth [1] - 1350:11</p> <p>try [19] - 1185:9, 1185:15, 1185:16, 1194:31, 1211:18, 1214:26, 1216:32, 1242:27, 1259:23, 1303:7, 1316:31, 1328:39, 1331:27, 1331:43, 1331:44, 1332:4, 1334:40, 1335:8</p> <p>trying [20] - 1171:42, 1190:42, 1198:16, 1211:27, 1218:7, 1218:9, 1225:30, 1230:37, 1242:29, 1244:10, 1248:32, 1248:35, 1258:35, 1289:31, 1294:3, 1300:32, 1302:16, 1318:18, 1333:21, 1348:20</p> <p>tube [1] - 1256:36</p> <p>tubes [1] - 1290:15</p> <p>Tuesday [1] - 1167:24</p> <p>turbulent [2] - 1230:18, 1230:30</p> <p>turn [16] - 1178:5, 1230:2, 1231:35, 1235:43, 1236:39, 1251:4, 1251:17, 1273:44, 1273:46, 1274:4, 1274:6, 1274:12, 1274:13, 1289:4, 1295:17, 1300:39</p> <p>turned [1] - 1237:47</p> <p>turns [2] - 1178:2, 1351:6</p> <p>twice [1] - 1214:34</p> <p>two [57] - 1168:44, 1170:33, 1173:4, 1173:7, 1174:31, 1175:7, 1175:29, 1178:9, 1183:7, 1183:37, 1185:16, 1187:27, 1187:47,</p>	<p>1188:17, 1190:47, 1201:30, 1202:29, 1207:4, 1209:4, 1209:16, 1214:19, 1214:28, 1214:34, 1214:35, 1220:39, 1223:15, 1233:21, 1243:8, 1244:16, 1247:19, 1262:37, 1265:28, 1267:33, 1272:26, 1275:46, 1283:21, 1287:25, 1288:7, 1299:9, 1321:28, 1323:7, 1323:47, 1324:17, 1327:37, 1328:16, 1329:19, 1329:32, 1330:10, 1332:10, 1333:31, 1338:2, 1339:28, 1340:22, 1346:20, 1346:21, 1350:4, 1351:18</p> <p>two-thirds [2] - 1243:8, 1244:16</p> <p>type [21] - 1173:30, 1176:4, 1179:2, 1190:45, 1198:14, 1205:26, 1220:25, 1244:22, 1253:29, 1307:17, 1307:36, 1307:44, 1308:6, 1308:16, 1308:22, 1309:16, 1309:26, 1311:8, 1314:44, 1314:46, 1346:21</p> <p>types [5] - 1170:34, 1195:25, 1307:4, 1309:40, 1314:45</p> <p>typical [2] - 1316:7, 1342:13</p> <p>typo [1] - 1236:44</p>	<p>1189:21, 1199:3, 1249:14, 1270:30, 1292:10, 1337:27</p> <p>underestimate [2] - 1233:35, 1233:38</p> <p>underground [3] - 1249:4, 1277:14, 1278:7</p> <p>underlying [4] - 1171:34, 1260:37, 1347:11, 1347:27</p> <p>undermined [2] - 1191:37, 1191:41</p> <p>underneath [13] - 1176:39, 1176:42, 1187:36, 1206:13, 1233:44, 1250:39, 1257:13, 1257:20, 1257:36, 1271:12, 1271:15, 1286:44, 1288:28</p> <p>understandings [1] - 1228:12</p> <p>understood [2] - 1192:36, 1343:23</p> <p>undertake [3] - 1236:11, 1277:44, 1283:22</p> <p>undertaken [8] - 1200:25, 1236:4, 1263:34, 1277:25, 1280:1, 1304:12, 1313:30</p> <p>undertaking [1] - 1285:18</p> <p>undertook [2] - 1283:14, 1342:29</p> <p>undisturbed [1] - 1256:34</p> <p>unexplained [1] - 1256:44</p> <p>unfair [3] - 1313:8, 1317:5, 1348:46</p> <p>unfortunately [3] - 1217:10, 1289:2, 1312:8</p> <p>uniform [1] - 1177:27</p> <p>uniformly [1] - 1254:10</p> <p>unique [2] - 1299:43, 1299:44</p> <p>unit [1] - 1169:13</p> <p>units [1] - 1246:11</p> <p>unknown [4] - 1245:6, 1269:22, 1271:28, 1276:38</p> <p>unknowns [3] - 1262:1, 1276:36, 1278:36</p> <p>unless [9] - 1202:34,</p>	<p>1232:18, 1245:32, 1248:1, 1248:23, 1304:41, 1305:2, 1309:18, 1322:38</p> <p>unlikely [11] - 1193:15, 1211:31, 1225:16, 1225:32, 1249:6, 1268:44, 1307:18, 1317:46, 1318:9, 1318:15, 1318:17</p> <p>unsaturated [4] - 1247:47, 1248:2, 1248:22, 1251:9</p> <p>unsure [1] - 1193:14</p> <p>unsurprising [1] - 1189:44</p> <p>UNTIL [1] - 1351:24</p> <p>untrained [1] - 1221:47</p> <p>unusual [3] - 1171:17, 1177:6, 1312:2</p> <p>up [175] - 1170:11, 1171:36, 1174:28, 1175:26, 1176:11, 1176:32, 1177:25, 1178:35, 1179:3, 1179:17, 1180:9, 1180:20, 1180:22, 1181:14, 1181:39, 1182:22, 1182:29, 1183:18, 1183:20, 1185:13, 1185:45, 1186:26, 1187:28, 1187:40, 1188:2, 1188:22, 1188:38, 1191:22, 1191:25, 1191:30, 1191:36, 1193:25, 1193:27, 1194:15, 1194:24, 1195:3, 1195:13, 1195:20, 1196:1, 1196:10, 1196:28, 1196:45, 1197:24, 1197:26, 1202:13, 1202:42, 1203:36, 1204:1, 1206:13, 1206:23, 1209:30, 1209:33, 1209:42, 1212:11, 1212:36, 1213:24, 1214:44, 1217:1, 1217:14, 1217:38, 1218:14, 1218:16, 1218:47, 1220:31, 1221:11, 1221:16, 1221:18, 1221:30, 1228:9, 1230:16, 1230:24, 1230:25, 1234:22, 1234:24, 1234:26,</p>
---	--	--	--	--

1236:26, 1238:16, 1239:29, 1240:5, 1240:15, 1243:40, 1244:15, 1244:45, 1245:21, 1247:3, 1249:15, 1249:23, 1251:14, 1252:26, 1252:31, 1253:34, 1253:43, 1254:22, 1254:24, 1256:2, 1259:22, 1261:43, 1263:36, 1265:24, 1269:46, 1270:4, 1270:27, 1272:14, 1273:11, 1274:17, 1275:10, 1280:5, 1280:9, 1280:13, 1281:33, 1281:41, 1287:23, 1289:1, 1289:40, 1290:26, 1290:46, 1292:28, 1293:33, 1293:36, 1294:8, 1299:10, 1300:11, 1304:6, 1304:10, 1308:28, 1310:14, 1310:15, 1311:27, 1312:42, 1313:47, 1314:39, 1316:13, 1318:1, 1318:5, 1319:7, 1319:27, 1322:1, 1322:19, 1322:41, 1323:20, 1323:43, 1323:44, 1324:2, 1324:21, 1325:47, 1327:2, 1328:17, 1329:46, 1331:5, 1331:27, 1332:24, 1332:25, 1332:32, 1332:36, 1332:39, 1336:1, 1336:34, 1337:2, 1339:27, 1341:3, 1341:33, 1341:44, 1342:29, 1342:38, 1343:34, 1343:43, 1345:23, 1348:19, 1348:28, 1348:43, 1349:1, 1349:41, 1350:1 up-to-date [1] - 1228:9 updated [1] - 1319:29 uphill [1] - 1187:4 UPON [1] - 1234:46 upper [17] - 1187:20, 1189:2, 1206:19, 1247:20, 1252:28, 1252:29, 1252:38, 1252:42, 1257:30, 1262:13, 1263:17,	1287:27, 1287:34, 1291:33, 1293:30, 1294:17 upright [2] - 1181:21, 1201:41 uprising [1] - 1323:19 upstream [4] - 1214:47, 1217:40, 1217:46, 1297:26 upswelling [2] - 1274:10, 1274:15 uptick [1] - 1330:23 upwards [1] - 1187:29 upwell [1] - 1286:46 upwelling [23] - 1213:11, 1257:5, 1257:7, 1274:34, 1274:40, 1275:1, 1275:10, 1275:19, 1275:31, 1280:41, 1323:18, 1323:38, 1330:5, 1337:25, 1337:45, 1338:46, 1338:47, 1339:5, 1339:14, 1339:16, 1340:4, 1340:22, 1341:3 usage [2] - 1210:26, 1346:33 useful [8] - 1180:24, 1206:32, 1209:12, 1211:14, 1256:13, 1284:47, 1312:27, 1312:29 uses [2] - 1293:18, 1293:19 utility [2] - 1304:47, 1315:46	V	1235:21, 1235:27, 1236:41, 1237:26, 1241:17, 1241:18, 1242:17, 1242:34, 1243:6, 1247:11, 1286:31, 1287:10, 1288:38, 1288:47, 1289:2, 1289:15, 1289:40, 1289:42 variable [1] - 1244:2 variables [6] - 1245:5, 1245:11, 1262:2, 1263:30, 1276:32, 1276:38 variations [1] - 1293:40 varied [1] - 1219:27 variety [5] - 1248:46, 1254:23, 1307:4, 1308:5, 1314:47 various [8] - 1193:11, 1197:4, 1216:13, 1253:29, 1284:17, 1286:28, 1292:45, 1303:10 vary [4] - 1253:47, 1254:27, 1272:45, 1273:3 varying [1] - 1170:29 vast [1] - 1256:36 VC [1] - 1171:14 vegetable [1] - 1188:46 vegetation [4] - 1179:31, 1198:14, 1198:29, 1296:27 velocity [18] - 1225:33, 1237:3, 1251:18, 1252:16, 1258:3, 1260:7, 1260:9, 1260:14, 1268:40, 1274:21, 1286:32, 1286:34, 1287:29, 1288:27, 1299:34, 1299:36, 1299:37, 1331:1 veracity [1] - 1298:15 verbal [1] - 1318:4 verge [4] - 1270:10, 1332:24, 1332:29 verify [4] - 1231:29, 1244:6, 1254:22, 1319:34 version [6] - 1185:33, 1185:34, 1185:45, 1185:46, 1186:3, 1319:29 vertically [3] - 1176:47, 1249:4, 1251:10	via [5] - 1281:40, 1288:13, 1309:35, 1310:42, 1316:47 viability [2] - 1223:4, 1225:46 viable [5] - 1227:2, 1349:8, 1350:1, 1350:4, 1350:27 vibrating [1] - 1286:19 vicinity [1] - 1224:23 viciously [1] - 1178:39 Victoria [3] - 1167:17, 1167:18, 1167:36 Victorian [1] - 1293:9 video [1] - 1265:17 view [55] - 1170:28, 1171:4, 1172:23, 1172:27, 1174:3, 1175:43, 1176:8, 1180:15, 1181:26, 1189:13, 1189:17, 1190:11, 1190:18, 1195:20, 1196:1, 1197:12, 1210:19, 1210:38, 1210:39, 1211:1, 1224:15, 1224:40, 1226:1, 1229:7, 1231:42, 1233:34, 1245:9, 1247:5, 1255:15, 1257:33, 1268:43, 1269:29, 1275:26, 1276:22, 1281:4, 1281:13, 1281:27, 1292:31, 1294:11, 1299:15, 1318:28, 1333:47, 1334:21, 1334:26, 1335:17, 1335:25, 1335:27, 1335:37, 1337:33, 1337:47, 1340:42, 1341:23, 1341:39, 1347:32, 1350:8 View [23] - 1170:35, 1173:15, 1176:34, 1176:35, 1182:19, 1213:30, 1214:22, 1214:46, 1215:8, 1219:46, 1221:8, 1267:5, 1270:43, 1271:4, 1279:6, 1282:17, 1282:19, 1282:23, 1282:25, 1285:37, 1286:16, 1288:43 viewed [5] - 1171:47, 1172:7, 1183:6, 1187:3, 1209:21 views [7] - 1219:45, 1318:27, 1325:14,	1327:13, 1333:43, 1335:2, 1335:4 visible [1] - 1266:30 vision [1] - 1278:36 visit [3] - 1219:33, 1324:38, 1325:3 visits [1] - 1217:36 visual [1] - 1213:9 vitrified [1] - 1171:14 void [6] - 1266:30, 1267:39, 1268:41, 1280:29, 1281:12, 1281:19 voids [3] - 1269:24, 1281:12, 1281:16 volume [68] - 1177:30, 1177:32, 1179:20, 1179:21, 1183:10, 1191:43, 1224:24, 1226:11, 1226:18, 1227:17, 1228:9, 1228:12, 1228:29, 1228:46, 1229:2, 1229:16, 1229:20, 1229:23, 1229:27, 1229:28, 1230:16, 1230:24, 1232:25, 1235:18, 1237:28, 1241:30, 1241:31, 1241:41, 1241:45, 1242:36, 1242:40, 1242:41, 1245:15, 1245:32, 1246:4, 1246:8, 1246:10, 1246:16, 1281:18, 1287:15, 1293:7, 1293:24, 1294:18, 1294:19, 1294:23, 1294:24, 1295:9, 1297:11, 1298:14, 1299:41, 1316:45, 1323:9, 1324:30, 1335:42, 1335:47, 1336:2, 1343:42, 1343:44, 1346:7, 1346:22, 1346:44, 1347:35, 1347:36, 1348:15, 1348:23 volumes [3] - 1170:13, 1235:28, 1285:47 volumetric [1] - 1253:31 Vu [2] - 1325:30, 1328:37 VU [79] - 1168:25, 1303:17, 1303:23, 1303:27, 1303:40, 1303:46, 1306:20, 1306:38, 1307:7, 1307:11, 1307:21,
---	--	----------	--	---	---

1307:43, 1308:4, 1308:32, 1308:37, 1309:4, 1309:9, 1309:15, 1309:37, 1309:44, 1310:7, 1310:12, 1311:7, 1311:18, 1312:34, 1312:46, 1313:4, 1314:17, 1315:9, 1316:13, 1316:23, 1316:38, 1316:45, 1317:9, 1317:18, 1317:24, 1317:30, 1317:39, 1319:12, 1319:21, 1319:25, 1319:31, 1319:42, 1319:47, 1320:5, 1320:9, 1320:13, 1320:23, 1320:28, 1320:33, 1320:38, 1320:44, 1321:1, 1321:5, 1321:10, 1321:17, 1321:21, 1321:31, 1321:43, 1322:1, 1322:5, 1322:9, 1322:24, 1322:33, 1323:16, 1324:16, 1324:45, 1325:3, 1331:13, 1331:24, 1331:30, 1331:34, 1343:28, 1344:6, 1344:19, 1344:24, 1344:28, 1344:34, 1344:39 vu [29] - 1300:35, 1303:12, 1306:15, 1306:30, 1306:45, 1307:3, 1308:26, 1308:30, 1310:34, 1312:43, 1313:34, 1314:15, 1316:3, 1317:6, 1317:46, 1318:30, 1319:10, 1319:39, 1320:25, 1320:30, 1321:3, 1321:27, 1321:46, 1323:26, 1328:13, 1332:4, 1333:16, 1333:22, 1343:15 vu's [1] - 1324:4 VW [1] - 1286:23	1219:2, 1219:6, 1219:16, 1219:32 walks [6] - 1217:2, 1218:7, 1218:8, 1218:20, 1218:42, 1219:25 wall [101] - 1169:3, 1170:35, 1170:40, 1179:9, 1180:7, 1180:9, 1181:1, 1181:7, 1181:19, 1181:33, 1181:34, 1181:47, 1182:11, 1182:18, 1182:20, 1182:29, 1182:36, 1182:41, 1183:5, 1183:6, 1183:12, 1183:13, 1183:28, 1183:31, 1183:32, 1183:38, 1183:42, 1184:5, 1184:8, 1184:18, 1184:19, 1184:29, 1184:32, 1184:36, 1184:46, 1185:7, 1186:40, 1187:1, 1187:2, 1187:18, 1187:22, 1187:34, 1188:9, 1188:15, 1188:30, 1188:32, 1188:41, 1188:43, 1188:45, 1189:1, 1189:3, 1189:18, 1189:19, 1189:20, 1189:21, 1189:34, 1189:36, 1190:2, 1190:23, 1190:37, 1190:39, 1190:42, 1191:15, 1191:19, 1191:29, 1191:32, 1191:38, 1191:42, 1192:11, 1193:9, 1194:28, 1194:37, 1194:39, 1194:41, 1194:42, 1195:2, 1195:7, 1195:19, 1195:21, 1195:22, 1196:2, 1196:17, 1198:31, 1198:38, 1198:47, 1199:2, 1199:22, 1200:2, 1202:6, 1202:37, 1203:10, 1203:24, 1203:39, 1203:42, 1232:36, 1292:43, 1295:42, 1296:14, 1296:15 Waller [23] - 1243:28, 1256:38, 1257:13, 1274:34, 1280:12, 1290:21, 1290:28, 1293:31, 1317:32,	1323:32, 1323:38, 1329:14, 1329:38, 1332:24, 1332:29, 1332:34, 1332:39, 1338:47, 1340:5, 1340:35, 1341:4, 1341:28, 1348:19 walls [4] - 1183:37, 1202:25, 1203:44, 1203:45 wants [2] - 1171:38, 1259:17 warned [1] - 1292:38 warrant [1] - 1198:25 WAS [1] - 1351:24 washed [1] - 1315:42 watching [1] - 1168:16 Water [24] - 1167:41, 1210:42, 1215:7, 1216:15, 1216:25, 1227:27, 1256:38, 1257:24, 1277:19, 1282:39, 1283:23, 1283:29, 1285:4, 1301:31, 1302:11, 1302:15, 1307:5, 1307:32, 1313:19, 1313:23, 1317:32, 1346:8, 1346:18, 1346:24 water [542] - 1171:40, 1171:42, 1171:43, 1174:27, 1177:4, 1178:22, 1178:42, 1183:20, 1192:10, 1204:28, 1204:42, 1205:11, 1205:18, 1205:24, 1205:31, 1205:35, 1205:36, 1205:38, 1206:11, 1206:14, 1206:23, 1206:24, 1206:40, 1206:42, 1206:43, 1207:1, 1207:2, 1207:6, 1207:8, 1207:19, 1207:37, 1207:38, 1207:39, 1208:19, 1208:23, 1208:27, 1209:5, 1209:6, 1209:13, 1209:35, 1209:38, 1210:5, 1210:11, 1210:16, 1210:26, 1210:33, 1211:24, 1212:2, 1212:8, 1212:28, 1213:16, 1213:46, 1214:1, 1216:7, 1216:16, 1217:43, 1217:44,	1218:1, 1218:11, 1218:12, 1218:17, 1219:40, 1220:8, 1221:1, 1221:20, 1222:6, 1222:8, 1222:31, 1222:34, 1222:40, 1222:44, 1222:46, 1223:5, 1223:30, 1224:22, 1225:20, 1225:34, 1225:41, 1226:11, 1226:13, 1226:14, 1226:27, 1226:28, 1226:30, 1227:2, 1227:18, 1228:12, 1229:17, 1229:24, 1229:27, 1229:28, 1229:33, 1230:4, 1230:11, 1230:16, 1230:18, 1230:19, 1230:31, 1231:42, 1232:6, 1232:23, 1232:25, 1232:26, 1232:27, 1232:28, 1232:34, 1232:36, 1232:38, 1233:36, 1234:15, 1234:25, 1234:35, 1235:4, 1235:7, 1235:10, 1235:11, 1235:22, 1236:8, 1236:27, 1236:34, 1236:43, 1237:25, 1237:28, 1237:37, 1237:43, 1238:6, 1238:11, 1238:19, 1238:20, 1238:22, 1238:27, 1238:28, 1238:29, 1238:34, 1238:43, 1239:5, 1239:7, 1239:12, 1239:16, 1239:20, 1239:23, 1239:27, 1239:29, 1240:38, 1240:40, 1241:45, 1242:5, 1242:14, 1242:23, 1242:30, 1242:41, 1243:5, 1243:20, 1243:30, 1244:18, 1244:37, 1244:41, 1244:44, 1245:21, 1245:30, 1246:4, 1246:5, 1246:10, 1246:17, 1246:29, 1246:31, 1247:21, 1247:41, 1248:1, 1248:14, 1248:36, 1248:39, 1248:43, 1249:3, 1249:31, 1249:33, 1249:40, 1249:43, 1250:23,	1251:1, 1251:12, 1251:18, 1251:28, 1251:31, 1251:36, 1251:37, 1251:39, 1251:47, 1252:47, 1253:5, 1253:9, 1253:23, 1253:30, 1253:32, 1255:23, 1255:24, 1256:44, 1256:46, 1257:7, 1257:12, 1257:17, 1257:34, 1258:16, 1258:47, 1259:22, 1259:45, 1259:46, 1260:7, 1260:9, 1260:44, 1261:26, 1262:33, 1264:15, 1264:36, 1265:15, 1265:29, 1266:47, 1267:14, 1267:15, 1267:27, 1267:35, 1268:38, 1269:12, 1269:19, 1269:22, 1269:30, 1269:47, 1270:29, 1270:36, 1270:41, 1270:42, 1271:2, 1271:8, 1272:13, 1272:18, 1272:30, 1272:35, 1273:4, 1273:42, 1274:17, 1274:40, 1274:46, 1275:45, 1276:6, 1276:7, 1276:10, 1276:11, 1276:15, 1276:18, 1276:20, 1276:26, 1276:29, 1276:31, 1276:40, 1277:20, 1277:43, 1278:1, 1278:2, 1278:3, 1279:7, 1280:30, 1280:42, 1281:32, 1282:34, 1282:43, 1283:9, 1283:35, 1284:2, 1284:4, 1284:7, 1284:8, 1284:20, 1284:25, 1284:32, 1284:35, 1285:10, 1285:19, 1285:26, 1285:27, 1285:33, 1285:39, 1285:47, 1286:32, 1286:37, 1286:44, 1286:46, 1287:1, 1287:13, 1287:23, 1288:6, 1288:12, 1289:13, 1290:20, 1290:27, 1292:12, 1292:14, 1292:22, 1292:27, 1292:31, 1294:7, 1294:20,
W				
wait [1] - 1261:11 waiting [1] - 1294:11 walk [1] - 1218:16 walked [1] - 1220:22 walkover [1] - 1219:28 walkovers [4] -				

1295:5, 1295:7, 1295:13, 1295:14, 1295:16, 1295:18, 1295:25, 1295:27, 1295:29, 1295:30, 1296:1, 1296:23, 1298:14, 1298:18, 1298:23, 1298:26, 1299:9, 1299:37, 1300:39, 1303:15, 1303:20, 1303:21, 1303:28, 1303:29, 1303:43, 1303:44, 1304:6, 1304:38, 1305:6, 1305:14, 1305:16, 1305:24, 1306:2, 1306:5, 1306:9, 1306:10, 1306:11, 1306:13, 1306:17, 1306:21, 1306:31, 1306:35, 1306:39, 1306:43, 1307:1, 1307:18, 1307:23, 1307:40, 1307:41, 1307:44, 1308:6, 1308:8, 1308:16, 1308:22, 1309:11, 1309:18, 1309:22, 1309:29, 1309:32, 1309:33, 1309:40, 1310:1, 1310:5, 1310:13, 1310:34, 1310:40, 1310:41, 1311:4, 1311:5, 1311:15, 1312:12, 1312:14, 1312:35, 1312:37, 1313:19, 1313:23, 1313:36, 1313:47, 1314:3, 1314:22, 1314:29, 1316:7, 1316:11, 1316:18, 1316:27, 1316:35, 1316:42, 1316:45, 1317:27, 1317:28, 1317:30, 1317:34, 1318:34, 1318:36, 1318:40, 1318:43, 1319:1, 1321:32, 1322:45, 1322:46, 1323:3, 1323:4, 1323:5, 1323:6, 1323:9, 1323:11, 1323:19, 1323:20, 1323:22, 1323:23, 1323:24, 1323:30, 1323:45, 1324:8, 1324:11, 1324:22, 1324:32, 1324:34, 1324:39, 1324:40, 1324:41, 1325:5,	1325:24, 1325:27, 1325:30, 1330:30, 1330:32, 1330:38, 1330:47, 1331:7, 1333:34, 1333:36, 1333:37, 1333:38, 1333:41, 1333:42, 1333:44, 1333:47, 1334:22, 1334:24, 1335:8, 1335:9, 1335:18, 1335:19, 1335:21, 1335:31, 1335:33, 1335:34, 1335:41, 1335:42, 1335:47, 1336:25, 1336:31, 1336:33, 1336:40, 1336:45, 1337:3, 1337:23, 1337:25, 1337:45, 1338:2, 1339:6, 1339:12, 1340:33, 1340:39, 1341:3, 1341:14, 1341:27, 1342:7, 1342:13, 1342:19, 1343:4, 1343:7, 1343:9, 1343:19, 1343:24, 1343:25, 1343:30, 1343:32, 1343:39, 1343:42, 1343:43, 1343:45, 1343:47, 1344:3, 1344:11, 1344:22, 1344:32, 1344:41, 1344:45, 1345:10, 1345:12, 1346:7, 1346:9, 1346:17, 1346:22, 1346:23, 1346:33, 1346:36, 1347:7, 1347:37, 1347:38, 1348:6, 1348:15, 1348:16, 1348:27, 1348:42, 1349:22, 1349:41, 1349:44, 1349:47, 1350:27 water's [3] - 1206:21, 1268:35, 1314:7 Water's [4] - 1215:17, 1282:30, 1301:32, 1348:41 water-bearing [1] - 1206:42 watering [1] - 1208:21 waters [6] - 1236:42, 1304:41, 1305:3, 1310:15, 1315:22, 1318:36 ways [3] - 1294:3, 1294:4, 1346:10 weather [1] - 1294:10	weathered [3] - 1193:16, 1193:21, 1250:14 weathers [1] - 1306:16 website [1] - 1185:38 wedge [9] - 1189:18, 1190:41, 1190:43, 1191:3, 1191:4, 1191:21, 1192:36, 1196:36, 1203:39 week [4] - 1222:39, 1244:34, 1256:30, 1323:47 weekly [1] - 1301:42 weeks [4] - 1224:27, 1283:21, 1291:24, 1323:47 weighs [1] - 1299:40 weight [1] - 1313:41 welcome [1] - 1327:45 western [2] - 1178:47, 1218:13 wet [5] - 1224:29, 1295:10, 1295:26, 1314:20, 1337:4 wetter [7] - 1224:28, 1295:8 wetting [1] - 1337:2 whereas [3] - 1207:20, 1251:29, 1254:11 whereby [1] - 1260:44 whichever [1] - 1181:26 white [2] - 1213:45, 1214:6 whiteboard [4] - 1190:31, 1196:17, 1203:34, 1227:10 WHITEBOARD [1] - 1227:13 whole [7] - 1189:9, 1191:37, 1206:19, 1225:17, 1267:6, 1271:13, 1314:41 wholly [1] - 1344:43 why's [2] - 1222:8, 1313:44 wide [5] - 1181:43, 1183:13, 1249:19, 1276:46, 1280:3 wider [1] - 1181:36 WILLIAM [1] - 1168:39 William [1] - 1167:18 Willigenburg [1] - 1285:24 wind [1] - 1177:10 windblown [1] - 1177:9 winter [1] - 1342:45 wire [1] - 1286:19	wish [7] - 1169:4, 1192:33, 1206:5, 1308:10, 1310:19, 1311:32, 1323:27 withdraw [6] - 1243:7, 1249:32, 1257:35, 1265:14, 1266:25, 1268:11 witness [9] - 1192:45, 1195:12, 1195:15, 1207:23, 1216:15, 1244:28, 1300:33, 1300:35, 1351:14 witnesses [4] - 1207:23, 1212:44, 1294:46, 1295:1 wonder [2] - 1273:28, 1300:16 word [7] - 1189:14, 1201:39, 1219:18, 1223:42, 1223:44, 1281:34, 1288:25 words [1] - 1223:45 workings [3] - 1256:20, 1256:21, 1335:4 works [5] - 1190:39, 1270:8, 1270:9, 1270:11, 1288:21 world [1] - 1221:8 worms [1] - 1234:10 worried [1] - 1331:44 worry [1] - 1184:8 worse [2] - 1181:45, 1246:26 worser [1] - 1237:44 worst [12] - 1237:17, 1237:24, 1242:45, 1243:4, 1243:20, 1243:22, 1246:19, 1246:25, 1247:1, 1259:10, 1259:12, 1298:20 worth [2] - 1172:35, 1237:43 would've [3] - 1201:5, 1220:2, 1269:26 write [1] - 1344:7 written [6] - 1235:16, 1246:24, 1300:43, 1302:43, 1303:1, 1333:23 wrote [2] - 1209:3, 1343:28 WSP [2] - 1196:44, 1253:21	XW [1] - 1181:26 Y yard [2] - 1282:16, 1283:4 year [4] - 1268:25, 1269:36, 1269:38, 1302:9 years [5] - 1170:30, 1177:11, 1286:24, 1306:23, 1311:44 yellow [4] - 1177:26, 1182:5, 1211:39, 1247:12 yes" [1] - 1281:24 yesterday [20] - 1168:5, 1168:11, 1170:16, 1170:37, 1173:38, 1175:27, 1177:29, 1185:31, 1185:34, 1185:46, 1206:2, 1212:17, 1269:24, 1272:28, 1277:13, 1278:18, 1278:44, 1279:19, 1297:31, 1301:30 yourself [2] - 1197:20, 1331:47 yourselves [1] - 1348:37	Z zero [6] - 1192:8, 1232:35, 1232:41, 1233:4, 1234:24, 1274:22 zip [1] - 1288:27 zone [14] - 1176:13, 1181:35, 1182:3, 1183:14, 1187:21, 1187:24, 1189:5, 1189:14, 1189:20, 1190:35, 1190:43, 1190:47, 1191:4, 1230:31 zoom [13] - 1230:3, 1230:15, 1230:42, 1235:45, 1236:39, 1247:4, 1257:26, 1266:31, 1267:18, 1273:28, 1301:31, 1339:32, 1340:3 zoom-in [1] - 1247:4 zoomed [1] - 1253:44 Zyl [15] - 1216:23, 1227:20, 1227:23, 1227:26, 1231:36, 1235:2, 1241:18,
X					
x-ray [1] - 1278:36					

1286:31, 1287:10,
1288:47, 1289:2,
1289:15, 1289:40,
1289:42

Zyl's ^[20] - 1228:8,
1228:31, 1228:43,
1229:42, 1229:47,
1230:14, 1230:43,
1231:29, 1233:35,
1235:9, 1235:16,
1235:21, 1235:27,
1236:41, 1237:26,
1242:17, 1242:34,
1243:6, 1247:11,
1288:38