

London Assembly Environment Committee – Thursday 30 September 2021

Transcript of Agenda Item 6 - Climate Adaptation and Climate Risks in London

Zack Polanski AM (Chair): Please can I welcome our first panel of guests here in the Chamber: we are joined by Alex Nickson, Wastewater Systems Strategy Manager, Thames Water; Charlotte Wood, London Area Director, Environment Agency; Lilli Matson, Chief Safety, Health and Environment Officer, Transport for London (TfL); and welcome back to Peter Daw, Assistant Director, Environment and Energy & Head of Climate Change at the Greater London Authority (GLA). Joining us virtually is Professor Jason Lowe OBE, Head of Climate Services at the Met Office. Welcome to you all and thank you very much for joining us.

My first question is for Charlotte from the Environment Agency. Charlotte, what impacts from extreme weather, particularly flooding and rising temperatures, are foreseen for London based on current predictions for the short, medium and long term?

Charlotte Wood (London Area Director, Environment Agency): We are already seeing impacts now and they will just continue to increase. We are seeing more flooding and more extreme weather. We will see dry weather events and more heat.

The main thing that you can see demonstrating this, with the sea level rise, is the number of times we have closed the Thames Barrier. Over the first 17 years we closed the Thames Barrier 24 times and then in the following two years we closed it 21 times and 50 times, which indicates the increase in sea level rise that we are seeing and also the increase in river flows. We are seeing already increasing impacts and it will just continue over time.

Zack Polanski AM (Chair): Can I clarify the difference between the intense rainfall and the Thames Barrier? They are slightly different topics. What is the danger from intense rainfall?

Charlotte Wood (London Area Director, Environment Agency): With the intense rainfall, we will see more surface water events like those we have seen in July [2021]. I am sure we will come on to some of the complications of the roles and responsibilities of who oversees that because the Environment Agency has an oversight for surface water flooding. Yes, the impact will be more surface water flooding from those intense rainfall events.

Zack Polanski AM (Chair): Jumping to our virtual guest, Professor Jason Lowe [OBE] from the Met Office, can I ask you the same question? What impacts from extreme weather, particularly flooding and rising temperatures, are foreseen for London based on current predictions in the short, medium and long term?

Professor Jason Lowe OBE (Head of Climate Services, Met Office): I can answer that from the perspective of the climate hazard that we see. We have already seen a significant amount of climate change. If we look, for instance, at the number of days London experiences over 28°C, it has doubled over the last 30 years or so. Sea level was mentioned previously. Sea level has been going up through the 20th century by around 1.5 millimetres per year around the United Kingdom (UK) and over the last couple of decades that has gone higher. It has gone up to around 3 millimetres per year.

When we turn to the future, the size of the climate hazard depends on the emissions that we as a global community put into the atmosphere and so we need to look at a range of scenarios. Those scenarios in terms of the climate response diverge as we go through the century but, just to put some numbers on that, by the middle of the century - and these are specifically for London - we could see a warming in the summer of the order of 1.9°C to 4.1°C. In the summer, we could expect reductions in seasonal average rainfall somewhere between about 17% and 47%. In terms of extremes and the sorts of events we have seen that have caused flooding, we expect an event that has a return period today of two years to increase in magnitude by about 30%. We also expect increases in sea level rise, with sea level increasing by up to around a metre by the end of the century.

In terms of the impacts that go with those, for temperature we can expect impacts on infrastructure including energy supply and transport. We expect impacts on people: mortality is linked to high temperatures but also at lower temperatures there is an effect, for instance, on people's ability to work or take part in leisure activities. On flooding, we would expect there to be reduced amounts of water overall over the summer season, and so there could be drought conditions, but at the same time, when it does rain, the rainfall could be more intense and so we would also have to deal with the surface water flooding. One thing that often does not come up at these events is thinking about the imported impacts. London is, clearly, connected and there are potential impacts on supply chains and food supply from around the world.

Zack Polanski AM (Chair): The effects of flooding are clearly really stark, Professor. Recently, I went on an LBC interview and the presenter said to me, "But London has always had flash floods". What would you say to those cynics or sceptics who say that this is a consistent problem and is not getting worse?

Professor Jason Lowe OBE (Head of Climate Services, Met Office): Firstly, there is a lot of variability in the weather. We all see that from day to day. If we do look at the trend of rainfall anomalies specifically for London, at the moment we cannot pick out that trend for London because the variability is likely obscuring the trend signal. If we look on a larger basis over the UK as a whole, then we can see increases in rainfall in the period from about 1975 to now that are quite significant in both winter and summer. Also, our basic physical understanding of the atmosphere and the way the climate system works gives us confidence that we do expect more of these flooding events in the summer.

Zack Polanski AM (Chair): Moving to Peter Daw from the GLA, what lessons can be learnt from recent extreme weather events in London such as the flash flooding in July and what actions are being taken in response?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Thank you, Chair. It is good to join you today. Following the incidents on 12 and 25 July [2021], the Mayor convened an urgent roundtable with key partners. That included the Chief Executive Officer (CEO) of Thames Water, the London Fire Brigade (LFB), the London Resilience Partnership, leaders of affected boroughs and the Environment Agency as well.

The purpose really was twofold: to explore the incidents themselves and the response to that and ways in which it was effective and whether it could be improved, and to think about the longer-term challenges of events like this and how we could be more effectively prepared going forward.

The group has now met three times and the principal focus to date has been on the initial response, which has been led by the London Resilience Group. I am sure they would be happy to give you more details on their assessment of the response itself, but the sorts of issues that they have flagged for immediate follow-up

include things like streamlining flood communications, making sure that Londoners can reach a single point of contact when they experience flooding, and actions to improve partnership response, communications, access and sharing of data.

We also have written to the Government to: stress the need for more adequate levels of funding for surface water flooding, which is an area that is challenging at the moment to access funding for due to its distributed nature; to encourage it to support us in rolling out the Drain London Programme and the Sustainable Urban Drainage Systems (SuDS) Programme further from the six boroughs we currently have; and to support the development of an early weather detection warning system for Londoners as well.

The group is now transitioning more to think about the longer-term adaptation impacts and how we can be more effectively coordinated. There is a task and finish group, which meets next week for the first time. It is going to be led by the Environment Agency, and so Charlotte [Wood] is co-chairing it with Philip Glanville, Mayor of Hackney [and Chair of London Councils' Transport and Environment Committee], and it will be a group of relevant partners, stakeholders and politicians meeting to look at how we improve that strategic coordination of surface water flooding in London, what needs to be done, how we improve the communication, how we help Londoners be more resilient, and how we access greater levels of funding. The terms of reference are being finalised with London Councils at the moment but, as I say, that meeting is next week on 8 October [2021]. That is our avenue for looking at how we take those longer-term measures to improve things.

Zack Polanski AM (Chair): The same question to Lilli: from a TfL point of view, what lessons can be learned and what actions are being taken in response?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Looking at those flooding events of July, which were really significant and did have a major impact on the transport network, there are two levels: the operational learnings and then the more strategic learnings for how we prepare for the future.

In terms of operational response, we have done both localised reviews on London transport and on the road network, and we are doing a complete pan-organisational review to learn some of those lessons. If we just look at the London Underground and rail side, there were a number of station closures and quite severe disruptions to the transport network on both events. The kinds of lessons we have immediately taken from those are perhaps more practical in nature. Some of our staff were having to clean stations without the best personal protective equipment (PPE) that could protect them. There are some very practical lessons about operationally how we manage those but then also more strategically in terms of ensuring, for example, that we have the right surveillance of any vulnerable assets that might be susceptible to landslips. The overall lessons are being pulled together and they will feed into our main strategic planning.

Looking forward, if we look at those events, the transport network was impacted quite severely at the time but was quite resilient. It was fully back up and running the next day. That lesson informs what I want to say today, which is that in terms of resilience and operational response, the transport network copes with the kinds of events that have been thrown at it to date. I do acknowledge that we have not seen the kind of shock rain that New York or Belgium or Germany saw and for that I feel we are very lucky, but we did cope and were very resilient in the July events.

There is further work to do in adapting a 150-year-old transport system to the ongoing changes that we have heard about and the fact that this will be increasingly frequent. That feeds much more into the long-term

planning in terms of modelling our asset resilience and ensuring that we have the right investment to ensure that it is truly adapted to the changing climate and not just resilient to ongoing events, which are going to happen more and more often.

Finally, we are part of these collaborative groups that are being set up. We are part of the post-event summits. We work very closely with colleagues such as the Environment Agency in the London boroughs. That will be a key part of any response moving forward.

Zack Polanski AM (Chair): You identified that the difference between us and what has happened in Europe and New York is that we did not have that same intensity of shock rainfall. How confident are you that if we did have that sort of shock rain the transport system would continue to be resilient, or do you think there is specific work we need to do for that very sudden rainfall?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): We do need to continue to look at our resilience to extreme weather events and we have been doing so. For example, last summer in 2020 there was a tragedy at Stonehaven in Scotland with a landslip and loss of life on that rail network. We immediately reviewed our heavy rain and flooding resilience plan in the wake of that and we have done so in the wake of the July flooding here. We continue to look at our operational response. Out of the last summer event, one of the recommendations is that when any new trains start running the next day they run at very low speed, at caution speed, just to ensure that there is nothing left on the tracks. Some of the changes will be quite minor but we are continually trying to learn lessons from how to respond to those events.

Those were very extreme events, particularly in Germany where you saw a very developed country's assets and infrastructure being torn away by climate change. That is a warning to us all that we need to take this seriously and focus minds on it.

Zack Polanski AM (Chair): May that warning be heard loud and clear. If I can move to Alex Nickson from Thames Water and the same question finally, what lessons can be learned and what actions are being taken to avoid things in the future?

Alex Nickson (Wastewater Systems Strategy Manager, Thames Water): I would like to start by saying that we are very sorry for the impact caused by any failure of our systems that may have had an impact on our customers and to express our deepest sympathies to anyone affected by the flooding. Our initial assessment is that our sewers did not fail. We believe they were overwhelmed by events greater than their capacity to manage, but we recognise there may be some distrust in us saying that and we want an open, honest and transparent assessment of what happened that Londoners can have faith in. Therefore, we have commissioned an independent review to get to the bottom of what really happened on those days, what the rainfall was, how our assets performed and the potential solutions.

We are a long way off. We have had 70 yellow weather warning forecasts this year. Only two of those have led to any big impact. I am very pleased to say that but, clearly, predicting things like convective storm cells is a very difficult thing to do. If we had stood up an emergency response for every one of those 70, we would be exhausted and we would have cried a lot of wolves there. What we need is a system that is resilient to these very extreme events.

I believe that trying to get all of that water underground is not the solution of the future. We have tried that. We have dug bigger and bigger tunnels and getting that intensity of water underground is simply going to get incredibly more expensive and incredibly more difficult to deliver. I believe we need to try to manage that

water on the surface through a varied range of solutions such as green infrastructure, careful flood routing, and, importantly, helping Londoners become more resilient themselves with individual property level defences. However, we have commissioned this independent review to actually look at international examples around the world and what other cities are doing and to learn from the very best because there is a lot out there that we can learn from them.

There are clearly things in the interim that we as Thames Water can be doing. We can be improving our incident response, making sure we work better with everyone else who comes to the support of Londoners when these things happen, to be creating a smart wastewater network and more telemetry in our system so that we are aware when our systems are becoming overwhelmed and potentially are able to use that very large drainage system to move water around, and also to work collaboratively with all the partners that need to be part of this solution. I would flag that London's drainage system is not just Thames Water's assets. We are just at the bottom of the hill where the water wants to run to. It is a combination of lost rivers, main rivers, ephemeral rivers, the highway agency, local authority drainage, private drains, etc, and everyone needs to work collaboratively together to find a long-term solution to this challenge.

Joanne McCartney AM: You said you are looking at a review. In my area, there were some areas that flooded that had never flooded before, for example, Crouch End. People do put it down to the lack of drainage. Will you be reviewing and feeding back to each local authority on particular areas?

Alex Nickson (Wastewater Systems Strategy Manager, Thames Water): I have two responses to that. Firstly, we are working with the boroughs to help them with their Section 19 responsibilities. Under the Flood and Water Management Act (2010), local authorities are required to undertake a study into any significant flooding, and we are required to support them. We held a workshop last week to help them with compiling that information.

Secondly, as an independent review, we will not be directing them what to do. They will look at and receive evidence from all the different partners and they will undertake what they believe is the right assessment to do. I would strongly encourage them to look at all areas that flooded but it is not something that we as Thames Water can direct to.

Léonie Cooper AM: Given the context that Charlotte was just mentioning, we know that the use of the Thames Barrier has massively increased and that is a response to the changing climate, but, that deals with fluvial and sea and tide matters. We have also seen these increasing very sharp rainfall events happening as well. It is great that this roundtable has taken place and that you are now talking about collaboration.

Do you think perhaps we should have done this a bit earlier? I am slightly conscious that we are listening to people talking about responses to something that we have seen changing now for the last 20 years. People have been talking about the increasing use of the Thames Barrier for some time. If you take that as an indicator of change, it is not like it just changed in July of this year. We have the London Resilience Forum and the London Resilience Partnership. I have looked at the risk register and it seems to be, if it happens, it will be high impact, but I have we been treating this with the urgency that it needs? Perhaps then we would be further ahead in knowing which one of the weather warnings of the 70 that we have received this year might then result in something that we need to respond to.

Charlotte Wood (London Area Director, Environment Agency): Surface water flooding is something that we have known is a massive risk for London for a long time. In 2007 we experienced some really serious flooding and as a result of that Sir Michael Pitt carried out a review [*The Pitt Review: Lessons Learned from the*

2007 Floods, 2008] of what happened. This was across the whole of the country but there were impacts in London. One of the recommendations from that was to bring forward the Flood and Water Management Act, which came into force and gave us a strategic overview of flooding and identified the boroughs as the Lead Local Flood Authorities.

Following that, in 2016, after a review of the risk register in London, there was an Extreme Rainfall Summit that took place, which identified a number of recommendations. More recently, last year one of the Regional Flood and Coastal Committee (RFCC) chairs was asked by the Department for Environment, Food & Rural Affairs (Defra) to review all the roles and responsibilities, the governance, the funding, etc, around surface water flooding. In 2020, David Jenkins [Chair, Wessex RFCC] carried out that review [*Report of a Review of the Arrangements for Determining Responsibility for Surface Water and Drainage Assets, 2020*]. The recommendations that came out of all of those various reviews are very similar to what we have experienced now around whose responsibility it is, where the funding is coming from and how we can work together better. Operationally, we are clear who should be responsible. It is just how it works in practice because it is a complicated remit.

Hopefully, that explains a little bit of it. It does not necessarily resolve the issues and move us forward in us being able to deal with these really extreme events, but there is clarity over who should be responsible in such events. Does that help explain some of the history of some of the recommendations? We have looked at it. Raising the profile again with the Government is a good thing and making sure that the money and the resources are in the right place to move forward some of these recommendations.

Léonie Cooper AM: That would be particularly helpful because we have discussed flooding here and Alex has come in and spoken about flooding more than once over the last five years to the Assembly and moving forward on getting that good collaboration because it is a complex picture. What was really disappointing this time was seeing some people on the news saying, "It was not our fault that this happened. It was somebody else's fault". I really do not want to hear anybody from any department in London saying that sort of thing.

I wondered if I could raise one thing with Lilli about the issue of the bounce back and the response. That might have been true of certain parts of the TfL network but it was not completely true of all of the roads, in particular Raynes Park and Queenstown Road. I am going to pick on those two. These are places where the road goes down under a railway bridge. Quite deep flooding occurred, which was extremely inconvenient for pedestrians and cyclists. A lot of people did not feel that it bounced back quickly because they were still being inconvenienced and there are bus routes that certainly run along Queenstown Road.

Is there more that can be done in terms of seeing the network as holistic because, for pedestrians and cyclists, flooding is as difficult as it is for train passengers or bus passengers?

Charlotte Wood (London Area Director, Environment Agency): It is really important to recognise the impacts on the surface network because the road network is where so many people in London travel, particularly pedestrians and cyclists. I know that dip in the road very well and I can really envision how that flooding happened.

When we see a yellow weather warning, we have an operational response plan in place which works on by - three, two, one - counting down in days to the event. As far as possible, what we can do is direct our engineers towards any asset faults where we know there are some pumps that are inadequate and then try to be as ready as possible. That does not cover all incidences such as those locations you mentioned. In many

incidences, we can get pumping to those sites. On the two events in July that we mentioned, basically the conditions overwhelmed what was available.

What we try to do in our operational response is, first of all, prioritise human safety - if there is any risk that we think people will be at risk of going into those locations, we prioritise protecting them from that, whether it is closing off the area or whatever is required - and protecting public transport services and people walking and cycling. There is a clear hierarchy in terms of how our operational response targets those efforts.

It does not mean that all problems go away and, back to your previous point, clearly, there has been a lot of work underway over many years. In preparing for this briefing, I have been looking back and just realising how long people have been looking at this issue. It does not mean that these incidents do not happen. What we are trying to do is improve our operational response to it. Part of that post-incident review I mentioned is exactly to look at the road network and see what more we could do.

One of the actions we are doing is not directly related to the situation you referred to but there were a lot of stranded vehicles and, as the water receded, those became a safety hazard because people reopen the roads. We are working with the LFB, for example, to work on a protocol of how to retrieve stranded vehicles and how to get people safely from stranded vehicles.

It is perhaps frustrating that we are not perfect in our knowledge and exactly where we need to be, but there is a learning process going on. Certainly, those locations will be recognised as problem points now and for the future.

Léonie Cooper AM: Thank you. I would imagine, Chair, that we would probably be happy to receive a copy of your post-incident review when that is ready and I know the same with your independent review, Alex [Nickson]. That would be very helpful for us going forward.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): To reassure you, the work has not just started today or over the summer. It has been in play for a long time. I look over to Alex, whom I used to work with many years ago, ploughing a very lonely furrow as the Climate Adaptation Manager at the time, trying to get people interested in a topic which felt very far away at that time. People are now beginning to realise the impacts of it.

I wanted to illustrate some ways in which we have practically been working. We have the Thames Estuary 2100 Plan, which the Environment Agency leads. We are actively involved with that and a number of other stakeholders. We have helped secure and make sure that land is available for a new Thames Barrier when it is needed going forward and that plan is constantly under review. It is under review at the moment. In terms of SuDS, we have produced a surface water flood risk map for London, which shows you, firstly, where the risks are from surface water flooding and where the opportunities are for SuDS. I mentioned already the SuDS pilot, which we have worked with six London boroughs on to demonstrate the impact that those small interventions can have in terms of helping support the drainage system that Alex referred to.

Also, the London Plan has in play very strong policies on adaptation and flooding and overheating. For example, the current Plan is reducing water runoff into systems by about 87% on new developments. There are a number of things already underway and we will no doubt get on to more of those quite soon.

Zack Polanski AM (Chair): Thank you. We are coming on to the Mayor strategies and initiatives shortly. Assembly Member Bokhari.

Hina Bokhari AM: I am coming from the perspective of residents, Alex. I am sure you are aware that there has been great talk about communication and working better with boroughs and councils but there is a tension still - I would like you to be honest about this - between Thames Water and councils and how the communication works.

Would you say that, with the fact that there have been problems in London for 20 years now, Thames Water did have a responsibility, particularly with things like culverts, which have not been looked at? There are some culverts that have been neglected for some decades. Where does the council and the Thames Water relationship work there? What has gone wrong with the communication? With 20 years for a culvert not to be looked at, how come the council did not refer that to you? Why did not it come back to Thames Water? Is the onus on residents to do this? A lot of residents find it so frustrating when they keep on hearing it is Thames Water that is supposed to be doing it and the council is not responding to it.

Alex Nickson (Wastewater Systems Strategy Manager, Thames Water): That is a good question. First of all, there are a number of factors in this. Number one: not necessarily every asset has a clear ownership as to who actually owns and has responsibility for it. There are large numbers of drainage networks in London where the drainage system passes through a number of different ownerships and not all of them are agreed.

There are also areas where we have assets that are maintained according to a risk matrix that we have. We look at the actual likelihood of them causing a probability of an event. Perhaps we need to go back and look at that. Also, we have 110,000 kilometres of sewers. That is two and a half times around the circumference of the world. We have to identify which of those are the highest priority. There may be assets that we have not prioritised in the past because, when we have run that risk modelling, they have not shown to have had a major impact. Then, when you experience these kinds of extreme events, then they really do show that there is an impact that we were not previously aware of.

This is something that we are working increasingly well with the boroughs to determine. Part of what local authorities have produced in their local flood risk management strategies is a list of all flood risk management assets. We will be collaborating, and are collaborating, with them to produce that list and to ensure that then drives that clarity of ownership, maintenance and risk so that we can arrive at a much more concerted position.

Tony Devenish AM (Deputy Chairman): Before I start my questions, I wanted to ask Thames Water if they could send us the terms of reference for the independent review, please.

My question is for each of the panellists but perhaps starting with Peter. How is the London Environment Strategy so far making a positive impact on enabling London to adapt to the extreme weather impacts of climate change we are now seeing?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): I started to touch on a few of these areas already, but there are a number of things we have we have put in place since the London Environment Strategy was published.

I mentioned the London Strategic SuDS Pilot, which is a pilot with six London boroughs, Camden, Enfield, Hillingdon, Kingston, Southwark and Westminster. What that project is doing is showcasing the importance of local distributed systems, which typically are difficult to fund through routes of funding like through the RFCCs. Typically, they are looking for some quite big impact projects and it is hard to demonstrate that with relatively small interventions of about £20,000 to £50,000 of investment. We have worked with those

boroughs to look at the impact and where we could locate those interventions and what the impact would be in terms of benefits.

To give you an example, in the work to date we have identified that £20 million of investment brings about £280 million of benefits in terms of flood protection and also natural capital benefits. That has been important in terms of not only helping boroughs, highways agencies and other authorities to understand the opportunity more, but also unlocking £1 million of funding from the RFCC specifically to fund those sorts of interventions. We want to see that rolled out across the rest of London and so that is why we have written to the Secretary of State for the Environment looking for support to allow us to do that across the whole of London to help unlock more of those interventions.

We have invested directly through the Mayor's own programmes. There are clear connections between surface water drainage, biodiversity and greening. We have talked about this a few times: the Grow Back Greener Programme, for example, has invested about £1.8 million directly into surface water flooding projects and about £13 million into greening projects in total, which have benefits for adaptation too. We have introduced heat alerts, which we have had to use five times since we introduced them. That gives guidance to Londoners which gets triggered in line with Public Health England guidance and includes alerts on some major public places..

Last year we launched climate vulnerability risk maps. Again, with our limited resources we are thinking about where we can make the biggest impact. We have assessed the climate vulnerability and environmental impact of things like heat risk, flooding, access to green space and air quality and we have also mapped that against social vulnerabilities like age of population, unemployment, deprivation, etc, so that we can really identify where in London we should be investing our efforts. That map is now helping us to target our interventions in the second term. The Future Neighbourhoods Programme, our Resilient Spaces Fund and our Grow Back Greener Programme are now being targeted more in those areas. We are asking boroughs and others to demonstrate how they fit with that approach.

We have produced six separate SuDS guidance publications across schools, social housing, hospitals, parks, green spaces, commercial buildings, offices and retail, which are helping to make the case and showing how these interventions can be made in practice.

I mentioned the London Plan already, which is bringing in very robust planning policies around overheating and around flood management. For example, we are asking in developments that they think about how they manage out overheating in the design of a building. The Crystal, the new City Hall, is a very good example of that. The building, the orientation and the façade are all thinking about where the sun is in the day and trying to keep out that solar gain. Also, it is a glass building, but the opacity of the glass is different depending on where you are. There is a range of ways in which you can manage this through the planning system.

We are also working through our retrofit programmes to make sure that homes are properly ventilated and to deal with overheating as well. I have mentioned the Thames Estuary 2100 work. We have also produced a road surface runoff map for the outer London borough areas to understand those challenges with contaminated water entering rivers and where they are. Again, we can map that with our SuDS interventions.

In the second term we have just announced, with the support of Thames Water, an extended Grow Back Greener Programme. That is £1.8 million of interventions around adaptation plus £4 million multi-year programme - Green and Resilient Spaces Fund, which is closing today. We are hoping to get some very good applications. That is funding slightly bigger interventions around urban greening but also contributing to

improving adaptation with around about £250,000 to £750,000 worth of investment. I also mentioned the Future Neighbourhoods Programme, which is a £7.5 million programme supporting the boroughs to showcase how they can connect up a number of environmental issues from the circular economy, air quality, greening, adaptation and energy in a local area, whilst engaging their local communities with a view to developing models that can become best practice and exemplars and are showcases for other boroughs. I will stop there.

Tony Devenish AM (Deputy Chairman): TfL?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): To come at it from the point of view of a functional body and think about the importance of these strategies for organisations like TfL, I would say they are very important. The London Environment Strategy and the Mayor's Transport Strategy really shape the context in which the organisation thinks and directs its efforts. Having been very closely involved in the strategy and direction of the organisation as we have taken forward those plans, I would say, it has a big impact.. It means that the organisation thinks about these things.

What that translates to across both the Mayor's Transport Strategy and the London Environment Strategy is absolutely a focus on seeking to reduce our carbon emissions overall with a very clear commitment to a zero-carbon railway by 2030 and to modal shift towards more sustainable modes. At the heart of that is the whole Healthy Streets approach that we set out within the Mayor's Transport Strategy, which is integral to a resilient and adapted future in terms of ensuring our streets have shade and ensuring that the way that people travel on those streets is not worsening the climate crisis.

Then within that, particularly looking at the subject of this inquiry around adaptation and resilience, those Strategies give us a reason to report to our panels and to report to our boards in terms of how we are doing and holding ourselves to account. We have had regular reports to our Safety and Sustainability Panel on our adaptation readiness and we will indeed be bringing a further report this winter. Being required to hold that mirror to ourselves enables us to identify where we do have further work to do and in terms of understanding fully our risks. We have adaptation to climate change as our number one strategic risk alongside major events. Without the strategic framework of the London Environment Strategy and the Mayor's Transport Strategy we would not have so much leverage to focus attention on this.

If you think back to the case we are currently making to the Government around our need for future funding and the Financial Sustainability Plan, it is based on the direction of a decarbonised transport network by 2030 and one that is resilient and adapted to climate change. I would say these threads run through all of the work and direction that we are taking now as an organisation.

Charlotte Wood (London Area Director, Environment Agency): I suppose Peter [Daw] has covered off a huge number of initiatives which we are heavily involved in as well and so I will not repeat any of those. Just to echo Lilli's comments, the London Plan and the Environment Strategy have incredibly strong environmental policies to help London adapt and be resilient to climate change.

I suppose the big thing for me is to see that that actually happens in practice on the ground, especially given an increasing population and more development. Are we seeing those policies play out? We will not know that for quite a long time to come but these initiatives that we are working on will help that.

One of the things that Peter did not mention, that we are also working on, with the Thames Estuary 2100 plan looking at the future flood risk around the Thames Estuary, is the riverside strategies approach. A lot of the flood walls will need to be heightened over time. How does London as a city interact with the river and how

do we maintain that adaptation from the flood risk that is going to come from the river? The City of London has published the first consultation on the riverside strategies, and we are seeing some others coming forward. We are working closely with everybody around the table to make sure that those consider far into the future. I am looking at the Tower of London there and taking into account those really historic parts of the city as well.

Lilli [Matson] touched on future funding as another really big thing. Funding is really stretched for all of us and so one of the things that I am doing is I am also a London Sustainable Development Commissioner. I sit on the green finance subgroup to look at new funding initiatives. We cannot just rely on the Government to fund a lot of these schemes going forward. What are the other ways that we can do that? I will finish there because Peter covered most of the things I would say.

Tony Devenish AM (Deputy Chairman): You were very complimentary about the GLA and TfL strategies overall but is there anything that needs to be improved? There is lots to do and the United Nations Climate Change Conference (COP26) is in a month's time.

Charlotte Wood (London Area Director, Environment Agency): We were. Part of that is because we do work in close partnership. I have had staff spending most of their time sitting with both Lilli's and Peter's officers to write the policies that we would want to see and, at the time of them being written, they were more progressive than some of the Government policies and so I would say they are very strong. The issue is seeing it playing out on the ground.

Tony Devenish AM (Deputy Chairman): Thank you. Thames Water, please?

Alex Nickson (Wastewater Systems Strategy Manager, Thames Water): It is always difficult when you are the last in the line there. I also probably have to declare an interest. As a former employee of the GLA, I had quite a hand in writing earlier versions of the Environment Strategy and so I might be inadvertently criticising myself and I might need to play the Fifth Amendment.

As Charlotte said, we have worked closely with the GLA to help shape and influence those policies. I have sat across a number of similar scrutiny sessions, sometimes agreeing with Peter, sometimes pushing for more, but the combined weight of mayoral strategies is pushing in the right direction. Events like this are things that we had not necessarily planned for. One of the things I am hoping that the independent review will come out with is to say what is the right level of resilience that we should be planning for because London's drainage system is pretty old now. It would be in a museum if it was in America but it is something that we rely on here every day.

We need to be looking at that next generation of drainage that we need. Does it all need to be subterranean? We need to understand the level of protection that is acceptable to Londoners and how we best deliver that. Is Thames Water the only partner in doing it or is it a composite of all the local authorities, other emergency responders, developers, etc, to do it? That perhaps has to be the next focus. My anticipation is that the independent review will point us in that direction and perhaps raise a national-level discussion about what is an acceptable level of resilience and how we achieve it. If we say we move to a one-in-50-year level of resilience - Copenhagen is aiming for a one-in-100-year resilience plus an allowance for climate change - that is a fundamental change in the makeup of your city and the attitude of its citizens. For me, the challenge is how big we want to think and how urgently we need to deliver it.

Tony Devenish AM (Deputy Chairman): Thank you. My next question is to Peter. It is probably the most important question, in my opinion. Ultimately, who is responsible? Is it the boroughs? Is it Thames Water? Is

it the Environment Agency? How much of the power to adapt London to extreme weather is within the Mayor's control and how would that change with new powers for the Mayor? Do you believe the Mayor should ultimately be responsible rather than those bodies?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): That is a good question. It is a complicated and complex ecosystem. We are spending a lot of time on flooding today, for example.

It is probably just worth setting out very quickly what the Mayor's role in this is. The Mayor is required to produce a London Environment Strategy, which has policies and proposals related to climate adaptation in the capital. What the Mayor does not have or what he is not is a strategic flood authority. That is the Environment Agency's responsibility. He is not a highways agency with responsibility for drainage across the networks. He is not responsible for the drainage network. That is Thames Water. The London boroughs are the Lead Local Flood Authorities. There is a range of complexities there.

If we take the other issues around adaptation, the other challenges really facing London are potentially around drought. Again, the responsibility is with Thames Water and we do not have a formal responsibility there. Equally, there is no authority with responsibility for overheating risk in London or in fact anywhere.

The answer to your question is that certainly in the short term that is not going to change. We are not going --

Tony Devenish AM (Deputy Chairman): Are you asking for new powers?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): No. What we need is more effective coordination across all of the authorities involved. The recent surface water flooding incident is a great example. What is clear is there is a need for a more integrated, effective plan for London. The lead flood authorities are required to cooperate, but can that be strengthened? Does that really take account of the whole of London? There is a whole number of stakeholders involved in that who will continue to have a role.

It is not quite as easy as giving the Mayor the responsibility because the levers for this do not and will not sit with the Mayor going forward. That coordination is important and driving a collective approach to setting out the challenge and how we solve it and making that case for greater funding are the other key things, as well as continuing to develop that evidence base, which we have worked hard with others including the boroughs to do. It is by driving that evidence base that we make the case for greater interventions here and we unlock more money. The focus must be on that rather than chasing powers, which would require very significant changes to Government legislation. Where we have the power, we are intervening with the Transport Strategy and the London Plan. Where we do not have the power, we see our role very much as convening, collaborating and working with others to support delivery.

Tony Devenish AM (Deputy Chairman): Do you think you should be communicating - or rather the Mayor should be communicating - more of the earlier, very impressive list of all the things you talked about, like the SuDS pilot? People like us vaguely know about it; Londoners do not know. When you go on the Tube, it would be a good opportunity to have a poster saying all the things that you are doing. Do you think the Mayor could do more in terms of the communication side at least?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Certainly, there is more to be done around awareness raising of Londoners and London's businesses, not just of what we are doing but a number of really good and impactful things which are happening. It is challenging getting that message across and that is certainly an area we are looking at through the new group set up to look at adaptation going forward with the Environment Agency and the boroughs. Absolutely, an important thing is how we effectively get the message out there that this is important, that Londoners need to take action too and that these are the things we are doing to make London more resilient, yes, absolutely.

Emma Best AM: Peter has done a good job of answering most of my questions and, with an eye on time, I will try to be concise. Peter, I just wanted to know if you have been able to be involved with the London Plan at all, with planning officers, and how closely you have a say in that?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): We review all strategic plans that come to the Mayor and we will make assessments of the development against the policies of the Plan. That is not just adaptation. That is energy and climate change. That is greening. A whole range of policies are assessed. We would we feed that into planning colleagues. Where there are issues, we will be raising them and then working with planning colleagues to make sure those are raised through the planning process.

I gave the good example earlier of where that planning policy is really starting to bite and have an impact, essentially reducing the runoff from new development into the hard infrastructure we have. About 87% of water now is not draining off into those systems through new development. That is a really good example. We are putting together a checklist now so that we can get better data back on the performance of the Plan in the development phase.

Emma Best AM: What concerns, if any, do you have around urban warming and tall buildings being built in close proximity?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Do you mean in terms of urban heat island effects?

Emma Best AM: Yes.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): That is clearly an issue and we have a number of things in play already. The Cool Spaces Programme is helping. It does not solve the challenge, but it helps Londoners if they are out on hot days to find areas of respite, both indoors and outside.

In terms of new development, that is factored in. We are looking at how a new development can reduce its contribution to the overheating of the city. We are about to commission some work to look at the potential for a Cool Roofs Programme as well. We are looking at the evidence for doing that, where other cities have taken action, how that could work and what the costs would be. That is certainly on our minds.

The buses are a really good example of a very practical action of something that can be done to help with overheating, simply painting the roofs of the buses a different colour to reflect the heat. There is a range of things underway to help with that.

Emma Best AM: Peter, those are the right words. Hopefully it is put into practice more this term. Thank you.

Léonie Cooper AM: An estimated 25% of Londoners do not have flood insurance. I wondered, is there anything that the GLA can do to address this in terms of the Mayor's strategies and initiatives? We often talk about adverts being placed on the Tube, is there any kind of awareness raising campaign that the GLA could undertake? It is devastating being flooded in any case in your home, but it would make quite a significant difference for people's recovery from the flood if they did have insurance.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): That is a really good point. It links to Assembly Member Devenish's point. It is something we need to look at and explore around the resilience of people and property. Again, it is in the play of the group we are starting next week. Yes, there is something there, I am sure, around how we get that message across about the importance of this. It is a growing risk to Londoners. We will certainly factor that in.

Léonie Cooper AM: We have a panel later where we are talking to people from local authorities and it is pretty much the same question for them, but maybe it is something, Chair, we could write to the Mayor to see in what way the GLA could help with getting that message out there because it does make a significant difference to people.

Zack Polanski AM (Chair): Thank you. On that same question, Charlotte, there is an interesting report from JBA Trust, which is a retrospective look at London surface water flash floods. It talks about Assembly Member Cooper's point of insurance, particularly for people living in basements, for instance, where often high-value goods are kept.

How do you balance that alongside the needs and costs of warnings and things like that? How can we make sure that Londoners are protected?

Charlotte Wood (London Area Director, Environment Agency): That is a really good point. I was just going to add to the point before that we do run a flood awareness campaign each year. We do that nationally. Recently we have been doing it in London with the GLA. It escapes my mind but it was two years ago we did a focus on surface water flooding. Maybe your point about insurance is a good one and we could think about how we could talk specifically about insurance.

We must be realistic about the population of London. I have mentioned this before on some of the roundtables. It is a transient population. It is difficult to raise awareness. We see it across the country but London as a national city is even harder. When English is not the first language, we need to find different ways of sharing that message and making it something that people need to understand and need to take action on. Some of our national messages do not apply to surface water flooding, like have a 'grab bag' and those kind of things, but raising up your important belongings is also something that is relevant regardless of where you are or what kind of flooding comes in.

That was on the previous point. Sorry, your second point, it was around protecting people?

Zack Polanski AM (Chair): Yes, it was particularly this balance between the cost of warnings and making sure that we are adapting for Londoners.

Charlotte Wood (London Area Director, Environment Agency): Something that we are doing is we are releasing new flood maps. The quality of our flood maps and who is at risk is constantly being updated. The next version will have better information around surface water risk.

Warning and forecasting for surface water flooding is complicated and so it is something that we are working closely on with the Met Office in our flood forecasting centre. Also, there are lots of private organisations that are looking at that as well and creating a competitive market on it. It is a tricky thing to give that prior warning and then for people to take action.

There are some initiatives coming forward like the cell broadcasting, which is where a message gets forced to your phone. You can do that within a postcode area. How will that work in London? How do you not scare people? Mass panic and things like that are issues that we need to work through. There is also the point that Alex made about standing people up too often so that they will not listen in the future. How do you target specific locations and know that an impact will happen and therefore they will take action? It is a big issue. Yes, it is balancing all of those things and making sure that we target in the right places.

Planning is also a big issue. Peter touched on the implementation of the planning policies in the London Plan. We have recently published, and regularly publish, planning applications that have gone against our recommendations. We are a statutory consultee and there are quite a few in London that go against our flood advice. That still happens. We try to get into understanding why those decisions have been taken against our advice. It is something that I know I have asked my team to pick up with Peter's team to make sure that we talk with the local authorities and really understand why those decisions have been taken.

Zack Polanski AM (Chair): Thank you. I am really pleased to hear that point about the maps. I spoke to the Mayor about this at our last [Mayor's] Question Time and he responded positively. Previously the maps have not necessarily said what the flood risk is, whether it is surface water, whether it is tidal or whether it is fluvial. It is really good for people to know their specific risk. Also, this report talks about the fact that sometimes these maps do not indicate where there has been basement flooding, for instance. That has not been tracked on a risk map or where there has been previous flooding and so it is good to hear you will look at that.

I want to turn to our scientist Professor Lowe from the Met Office to finish this section off because forecasting is hard. We have these warnings and very often they are quite broad warnings, but London needs local specific warnings. How do you measure that and how do you adapt to that?

Professor Jason Lowe OBE (Head of Climate Services, Met Office): There are really two timescales here we probably want to talk through. One of them is thinking about the climate information. We have moved to a much more detailed spatial model. Now we use the type of model that previously was used for weather forecasting with a grid scale of a couple of kilometres. We can use that for climate. Our climate projections are coming down to a much finer scale than they did before and there is further research on detailed modelling for London.

When it comes to the nearer-term warnings, we have seen improvements over the last three decades in the accuracy of the high-resolution forecasts and that will continue with techniques, for instance, around nowcasting. The key is then translating that information. For instance, we heard earlier discussion of the yellow warnings. Those very much are probability-based warnings and that means they can show, for instance, a high likelihood of a low-impact event or a low likelihood of what could happen in terms of a high-impact event.

Getting the understanding of what that means locally is really helped by two things. It is helped by the network of civil contingency advisers. For instance, one of those works with the London Resilience Forum to translate the message. Once a weather warning is triggered, there is a much more intense dialogue and techniques like the hazard mapping portal. There is also the relationship with the Environment Agency. We work very closely through the Flood Forecasting Centre to provide as localised information as is credible from the projections.

Zack Polanski AM (Chair): Thank you very much.

Joanne McCartney AM: My questions are for TfL. On the concentrations of heavy rainfall we have had recently, is there anything else that you want to see in the Mayor's strategies and plans to deal with that heavy rainfall and increased risk of flooding?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Thank you for raising that because it relates directly to the subject we were just talking about. It is not so much that we need new things in terms of strategies but quite often the data, the modelling or the very information that we were just hearing about is often in formats that are very difficult for transport planners or designers to easily translate into very localised design solutions. We have been talking a lot about surface water flooding because it is very top of mind, but it is very granular and very localised in nature. For us to have enough granular information and data and to know exactly what the risk is to this Tube station or this railway line, if I am honest, although we are all talking we do not readily have that information available in its most up-to-date format ie containing absolutely everything we need to know about the most up-to-date climate projections.

For me, the priority is more about better data, ensuring that we can lucidly and easily understand what the Met Office is saying and understand what it means in terms of us being able to design a response to that effectively. We have talked a lot about collaboration and all of us need to go at that with some urgency and real commitment to making things happen now on the ground. We have that now on the back of the July events, but after the Mayor's Transport Strategy we set up the Transport Adaptation Steering Group, which we chair, and it includes all of these representatives and the boroughs. It is a very good forum but it should become a real nexus for actually saying, "We commit to doing this kind of change".

Then, ultimately, I cannot get away without talking about funding. We really need to make not only the kind of emergency but this part of the climate emergency, adapting and being a resilient city, a city where 8.5 million people live, an absolute priority for funding from the Government. We are doing all we can to translate to net zero and we will get there as best we can with the funding we have available but, if we have not adapted to the changes that have already happened, we will still not be a liveable city. We need to raise the profile of this in terms of its priority for funding.

Joanne McCartney AM: Can I take up that point about the data. You wanted it more granular and localised to a particular Tube station. Does that data actually exist? Is it available? Who holds the data? We heard from Professor Lowe at the Met Office that there is someone in the Resilience Forum whose job is to translate that information that the Met Office is giving, but who should hold that?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): The issue is that it does not exist at the Tube level, but we have our own flood risk models and we need to inform them as best we can with the latest information on heightened flood risk coming from what the Environment Agency or the Met Office understands about climate projections. What we are finding difficulty in is translating what some of

those latest projections and modelling of that means to our localised models. That would be a practical example of where we could better join up and have that information flow.

Joanne McCartney AM: Thank you.

Professor Jason Lowe OBE (Head of Climate Services, Met Office): If I could respond to that, we are talking about risk there and bringing together the hazard information on weather with local vulnerability information and the exposure information, for instance, on a local Tube station. For the very high-resolution climate data, we have the United Kingdom Climate Projections (UKCP) set with more than 5,000 users picking that up and it is available in a number of formats. We are always very keen to hear from users as to how we could make that more accessible. I am aware there is now a piece of work going on specifically with TfL to provide an additional format for that data so that it is easier to import it into geographic information systems (GIS).

Joanne McCartney AM: That is helpful. One of the things that the two flooding events this year showed us was that there are some sites that are particularly vulnerable. If I take in my constituency Turnpike Lane, for example, it is one of those stations where we had pictures of water rushing in at a tremendous rate. What can you do in terms of preventative measures once you know there are specific sites that are particularly vulnerable? Are you working on plans for such sites?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Yes, I referred to a few things. One is our heavy rain and flood resilience plan, which tells us how to prepare and react in the moment, but we also have a London Underground comprehensive risk framework for flooding as well, which is exactly looking at the vulnerability of different assets across the network. We do know which stations and which parts of the network are more vulnerable than others. That then would include several responses to understand the level of that risk, to understand if that is a whole asset risk like an embankment, for example, or more to do with localised risk around a station. That will feed into different actions. Do we need to reinforce a structure or an embankment, for example? What are the tactical local responses needed in a station, for example? A few stations have floodgates but at others where we know that it might be an ongoing risk there will be a programme where we know we can go and direct our emergency response unit with extra pumps and flood boards and other ways to help protect it. A lot of that knowledge is held and we know where we are vulnerable. Because we do this three-two-one operational response model I talked about, we can try to direct, as much as possible, people to be ready in advance.

One of the real dangers and one we are very alert to after the July flooding is back to that granular understanding. It could be already at Turnpike Lane Station and then a rogue event could happen somewhere else. What we are vulnerable to are the changes to the surrounding environment. There is the continued paving over of London and that is changing the local hydrology. You can have surface water changes in terms of flooding in a way that you might not have three or five years ago. It is about how we stay on top of those events. That is very flashy, if you like, in terms of the flooding and it is very difficult to pre-empt. In that respect, it is all about making sure all of our staff know what to do in terms of those responses.

We also use our London Underground control centre and the network management control centre, which have real-time visibility of the entire transport network to be able to respond in the moment and send the emergency response unit to those locations if something should happen.

Joanne McCartney AM: Thank you.

Hina Bokhari AM: My question is also for Lilli, for TfL. My specific area is surface water flooding on the road network that I would like to ask you about and all the properties alongside it but specifically also about the drains and the gullies along the Red Routes. What is the plan there, how are you reviewing it and what are the timescales?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): It is very important that we keep the strategic routes safe and moving for all users. In the run-up to an event that would be indicated as a yellow weather warning, we would ensure that gullies are cleared. We can deploy in advance gully suckers and other things to try to, as far as possible, ensure that we are ready to fix faults. Both the events that we are talking about were between one-in-30-year or one-in-60-year events. They were overwhelmed by the level of water --

Hina Bokhari AM: Are you not doing this regularly anyway?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Yes, we are, but what I am saying is that when you get a very high-intensity rainfall event like that, the drainage system is overwhelmed and so you are getting surface water literally running on the surface. We recognise that and it is how we respond to that safely rather than in terms of whether we are closing roads or diverting traffic away from it.

There are two things in a way. One is, as our colleague from Thames Water mentioned, the assets are incredibly complicated and what is under London streets. There is a risk assessment going on of the surface road network to basically inspect and try to understand fully what the asset risks are, but also it is about looking ahead and trying to see where we need to improve or enhance drainage.

What I was also saying is there is an acceptance or a recognition that in the moment of some of those extreme events, even with good drainage, even with pump stations working at capacity, the level of water that flowed did overwhelm it. You would never be able to plan for the level of --

Hina Bokhari AM: What you are saying is that despite the strategy that you have for clearing drains and gullies, the drainage system is still not good enough to deal with the situation?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): No, by and large it is good enough. What we have seen with these extreme events is that we get very intense issues happening, which is why Thames Water, for example, was talking about its drainage system being overwhelmed.

What we can do, and what at the strategic level we are working towards, is the whole SuDS approach. That is about not relying on just endpoint drainage but trying to make London more of a sponge city. We play a part in that through our own tree planting along our network and we are working hard to achieve the targets that we have for that --

Hina Bokhari AM: Do you have a timescale, as I asked before?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): For what in particular?

Hina Bokhari AM: For achievable targets to make sure that there are systems in place to help with the drainage, for example.

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): We have clear plans to ensure that the network is safe. I guess what I am trying to explain is that, with the level of crisis that we are facing, I could never guarantee you hand on heart that there would not be flooding on a certain part of the road network. Thames Water could not do that, and neither could the Environment Agency. What we need to do is ensure that as far as possible we are working collaboratively to improve the drainage overall of London.

Hina Bokhari AM: Is there a plan perhaps then to do something that is proactive? You are responsible for paving. Could that be made more porous? Are you looking into tree planting along the Red Routes? What are you doing that is actually going to help this situation?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): On all of those, yes, we do have targets and we are moving forward. In terms of tree planting, the Mayor's Transport Strategy set a target to increase the overall tree coverage by 1% a year and we are on track with that. Even though last year it was hard to get out and about, the levels of trees were planted.

In terms of that SuDS I mentioned, there is a target again within the Transport Strategy to increase that by 50,000 square metres a year in capacity and, again, we are working with the boroughs and others to work towards that. In all of those elements, as well as ensuring our asset resilience, which is back to your original point, in our current discussions with the Government and in the Financial Sustainability Plan what we have prioritised above all else is asset resilience to make sure that we have the money and the funding to keep London safe. That is the road network as well as the rest of the public transport network. That is based on an uplift in spend on our assets and that will include the drainage because that is the basic level that is needed.

Hina Bokhari AM: Would you also look into cycle routes as well using porous materials and is that happening at the moment?

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Yes, we would. In terms of porous paving, we are trialling that and we have looked at that. On some of the main carriageways and the most heavily trafficked roads, it has not proved that durable. On cycle routes, as you said, where there is less weight from the vehicles, there is potential for using. It is very much one of the mixes that our asset engineers are looking at and trying to use as much as possible alongside the green infrastructure, which has a key role to play.

Hina Bokhari AM: Thank you. I am going to move on to Peter. How is the Sustainable Drainage Action Plan progressing and what impact is it having now on water surface water flooding?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Can I just have one point before I answer that one?

Hina Bokhari AM: Yes, of course you can.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Colleagues here at City Hall in the London Infrastructure Group are also doing some really good work with utility companies in their works on roads where they need to dig up parts of London. In essence, as part of that planning consent and planning that work, they are working to identify where they can implement local SuDS or permeable pavements, for example, as part of that programme. There is some really interesting

work going on with Cadent up in Enfield, which they are looking to roll out much more effectively with other utility providers. That is just an example. Some of the answers to this are opportunistic. We can plan for certain things and some of the bigger opportunities but there will be opportunistic ways to turn London into more of a sponge, to use Lilli's turn of phrase.

In terms of the Sustainable Drainage Action Plan, there is the London Sustainable Drainage Action Plan progress report, which covers 2017 to 2021, on the website. One of the key elements of that which I would highlight first is the publication of the SuDS opportunity map for London. That is showcasing where we see the potential locations for SuDS interventions across the whole of Greater London. We have, as I mentioned a couple of times already, funded a number of interventions through the Grow Back Greener Programme, which is ongoing this year and is increasingly being targeted in areas which are most vulnerable. We have updated the London Plan and so there is now a drainage hierarchy and a much stronger stance on impermeable surfacing. We have introduced a SuDS planning pro forma so that we are able to gather the information much more effectively on what the planning system is actually delivering. We have published a series of sector-based guidance so there are six of those in total and we work with our networks across the National Health Service (NHS) and education and business to get that out and promoted and with the London boroughs.

We have also been working to train highways officers. Part of this is not just about educating Londoners but is also about educating highways engineers and others who work in this industry who would not naturally think in this way because they have never really had to. We have trained 300 highways officers to date and that work continues as well.

Then finally, I will just mention the London infrastructure planning work, which again is really important, and using that reinstatement of planned road closures to introduce new SuDS measures, too.

Hina Bokhari AM: The creation of SuDS is to provide an alternative to drains and sewers. Many of the proposed schemes are fairly low cost. Section 106 [of the Town and Country Planning Act 1990] agreements are there to compensate for the impact of housing and development. Do you think that the creation of SuDS should be part of the routine planning conditions for most of these developments and a planning condition through funding by Section 106 agreements?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Certainly, we push that through strategic developments. That is a really interesting question. Yes, I see it as a really good opportunity for the boroughs then in terms of their own plans and implementation to certainly think about that.

I would just stress though with SuDS that there is no magic bullet to any of this stuff. For the very extreme events we have been talking about, SuDS intervention will not deal with one-in-200-year extreme events.

Hina Bokhari AM: There are cases probably coming up and there are planning applications coming through where there should be more consideration of the old Victorian pipes that are being used and the need for them to be replaced, would you say, rather than using SuDS?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Again, one of the things we have worked very hard on and put a lot of pressure on Thames Water and the Water Services Regulation Authority (Ofwat) for is to improve London's ageing network,. We have worked to make sure that Londoners do not just pay the bill for that. There is a £300 million offer via Ofwat to

improve London's assets and that has recently been matched by Thames Water's stakeholders. It is something the Mayor has pushed very hard for over the last two years.

Hina Bokhari AM: I am just raising this because there might be a concern that there is a cheap alternative here using SuDS rather than replacing old Victorian pipes that need to be replaced.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Yes, that has to happen, too. SuDS will play a role, but it is not, as I say, the silver bullet.

Charlotte Wood (London Area Director, Environment Agency): Funding for surface water flooding solutions is a complicated one because, as you say, they are quite small schemes in very specific locations. At the moment, to bring forward a flood scheme through the RFCC, you have to bring in a certain amount of partnership funding and you have to show that it is cost beneficial to bring forward the scheme. That was always created on the basis of big schemes that would protect lots of people or infrastructure. For the schemes that we are seeing now, it is definitely harder to bring forward those schemes, to do the modelling, to prove that it is going to work.

The RFCC - there are loads of them around the country but the one that is important here is the Thames - because of the size of London and the amount of levy that it brings in through the boroughs, has quite a big pot of money to play with and has been incredibly innovative in the solutions that it has been looking at and this is one of them. It has been looking at these strategic SuDS pilots and at a catchment level and saying, "How can we fund X, Y and Z to bring forward benefits, not only for flood risk but for multiple benefits, for biodiversity, for health, for social, etc?" They are doing that now to put forward a package to say to the Government, "This is how we need to look in the future".

Part of that is that the big schemes have been done because they are easier and because you can model them. The money is going to come and you can find the partnership funding from others to bring forward the scheme. Now the harder stuff is in play. The RFCC is also looking at natural flood management, like planting up trees higher in the catchment to absorb the water. I suppose the sponge analogy is about slowing the flow and trying to prevent it entering the sewerage system at all.

I hope that explains it a little bit better. We are aware it does not work for these smaller schemes and we are working closely with that Committee, which is independent of all of us and represents everybody here, to find a solution and put that to the Government.

Hina Bokhari AM: Thank you very much.

Zack Polanski AM (Chair): I am aware that we are well over time and so, Peter, could I ask you to write to the Committee about hospitals? I am aware that Newham and Whipps Cross [Hospitals] were both affected and so it would be great if you could write to the Committee about SuDS and hospitals and the plan around that. Can I just remind everyone to be brief and succinct, just so we can get through the business?
Assembly Member Best.

Emma Best AM: Charlotte, how is the Environment Agency working with the Mayor and boroughs to support their efforts to halt climate change?

Charlotte Wood (London Area Director, Environment Agency): We have heard here today that we cannot halt climate change. It is already here, and we all need to work to adapt and create a resilient city. We

have spoken a lot about how we are working together. That is not necessarily the issue, but a sharper focus on some of those collaborative approaches and partnership working is what we need to move forward on now and to try and find those real solutions to some of the problems. As Peter said, I will be co-chairing this task and finish group. The important thing is to not duplicate what other existing groups are doing and to be clear who is taking forward what and how we can find solutions that are going to make a difference.

Emma Best AM: Thank you. Would you be able to comment in some more detail about that round table event with London Councils, the Mayor and the Environment Agency that happened after the flash flooding recently?

Charlotte Wood (London Area Director, Environment Agency): Yes, we were all present at that. It was a good event to look at the moment in time. At first it was very operationally focused: what did we all do? Should we have done more? Could we have worked together better? There were absolutely some immediate lessons that we all could have learned from. One that jumps to mind is there was a suggestion to have had a partnership call earlier on and bring together all of our partners to talk about the fact that we knew thunderstorms were coming. Also, to share the fact that thunderstorms are really tricky to know exactly where that water will fall, because you do not know where the thunderstorm will happen, but you know that it will happen over a certain area, so having those conversations.

We proactively worked with the boroughs and Thames Water, talking to them about the fact that this weather system was coming and that now is the time to get out and clear drains and trash screens, which is what we did for the main rivers. We took that forward. We had a meeting a week later and then two weeks after that, so we kept the momentum going in moving from the immediate to, "Right, what next?" It became apparent that the reviews I mentioned previously had taken place and, "Let us quickly look back at the recommendations from those", specifically the summit that happened in 2016 around London and, "Are there immediate things that we can do that we have not done together?" They have helped with the momentum and bringing us together to be as collaborative as we can. The next phase will be looking further to the future.

Emma Best AM: Thanks. One question on that, I was really interested when you were talking about how we know thunderstorms are coming, for example, and better communicating when this is happening. Were there any key outcomes from that? That is one element where there is a poor breakdown and linkup between councils and Thames Water of taking preventative actions before we end up with reactive measures?

Charlotte Wood (London Area Director, Environment Agency): Yes. Thunderstorms are very tricky for that specific location. We spend a lot of time with the Met Office to work out the best way to communicate that information, the risk and the potential impact and explain that. We get out and clear those gullies and streams for the main rivers, because obviously the impact can be pretty significant if we do not do that. We work really closely with the boroughs and Thames Water. The issue for us is around resources because there are so many boroughs in London, and making sure that that communication happens with every single one of them. Out of hours as well, making sure that there is a single point of contact, 24/7, 365 days a year. We have an instant management system that allows us to ensure that we have somebody on duty all that time to be able to explain what we are seeing and what action they could take.

All of this is set out in the multiagency flood plan that the London Resilience Forum wrote a while ago. It has been reviewed recently and we are constantly inputting. All of the actions, the trigger points, the multiple issues that go on are set out in that document.

Joanne McCartney AM: I want to pick up, Charlotte, if I can, about something you said about other waterways. Obviously poorly maintained waterways can have an impact as well. I am not just talking about major rivers, but, for example in my constituency, the Pymmes Brook and Salmons Brook have caused flooding to properties before. Are our waterways sufficiently maintained at the moment? What does the Environment Agency do about working with local boroughs to identify where existing waterways could be a potential flood risk? Then what remedial action can be taken? Is it just a question of funding?

Charlotte Wood (London Area Director, Environment Agency): That is a really good question, because, as Alex pointed out, being clear who is responsible for what is essential. When you get into the main river and then the tributaries, ensuring that we are clear who is responsible for that maintenance on those systems is incredibly important. Just as others have said, all of the rivers are mapped. We are clear where the pinch points are in those rivers. We will regularly go out and check the rivers. There is a clear maintenance programme. We have as much money as we are given from Government to go and do that and so do the boroughs. We talk to them regularly. Where we know that we have particular hot spots or pinch points, we will work with them to ensure that they are cleared. If we know that a particular weather system is coming in and we know that those particular areas are difficult, we will assist the boroughs to help with that localised issue where we can.

Joanne McCartney AM: Thank you.

Léonie Cooper AM: I would like to come to Professor Lowe. Thank you very much for joining via the internet. In this section we wanted to ask some questions about rising temperatures and heatwaves that you thought you might be able to help us with. If you could describe how London experiences the urban heat island effect currently and what more can be done to alleviate the impact of the urban heat island effect on London, particularly going forward?

Professor Jason Lowe OBE (Head of Climate Services, Met Office): Firstly, just thinking about temperature more generally, how we project temperature in our climate models, they include a representation of the urban area. They build in the urban heat island to the high-resolution climate projections. The numbers I talked about in the start, in terms of warming for London, for instance, between 1.9°C and 4.1°C by the 2050s, that factors in the urban heat island in the first instance. We can also look to see how high temperature events from the past might change in the future. The type of summer we had in 2018, that in present day climate you would expect to have probably, in any given year, between about 10% and 25% of the time. By the middle of the century, you would expect that probability to rise to 50%. On average, every other year could be like 2018. The urban heat island, we have seen trends in the difference between the urban area and the surrounding rural area that have been changing over time. It is especially noticeable in the night-time minimum temperatures. In terms of the magnitude of the urban heat island effect, if you look at the average over the city as a whole, then it is typically of the order of 1.5°C up to 3°C, but there will be times when there are parts of the city that are even warmer. You may have seen heat maps where this goes up to 7°C or 8°C, but the average is a bit lower.

The future trend, extracted from our regional model, is that during the day we are not expecting to see a big increase in the urban heat component. During the night we could see a trend of the order of 0.05°C per decade. Just to comment, that is already in the projections.

Léonie Cooper AM: That is a huge difference for people who are living in London. I am particularly struck because I have seen a lot of buildings going up that -- in continental Europe and the United States, where they do have higher heats, because there is the continental landmass, and the same in the States, a lot of people

avoid the use of air conditioning, which has its own impacts of energy use, by having very good external shuttering, which is also helpful for cold in the winter, but also shading. We seem to have moved away from that. I am quite concerned that some of the buildings that have been going up do not have adequate protection to the levels of heat that we have now due to the urban heat island, but you seem to be saying it could be even worse. If it gets much worse at night, particularly, then the ambient temperature during the day, in some of those flats, particularly if they have large windows, could have serious impacts.

Professor Jason Lowe OBE (Head of Climate Services, Met Office): Yes. Just to be clear, in terms of peak temperatures, they will still occur during the day, but I was referring to the change in the urban heat island particularly manifesting at night. We do expect to see the changes in the daytime temperature. In terms of adaptations, there are a range of things that could be done. Some of them are behavioural, so making sure people do see the warnings and know what to do when there is a heat health warning. So, staying hydrated and seeking out cool spaces, for instance. In terms of more engineering-type solutions, there is a raft of measures. Some of those involve shading. Some of them involve changes to building design to improve ventilation. Some of them involve things we have already talked about for flooding, like green roofs that provide a sponge effect and allow for latent heat cooling at night. Creating more green spaces in cities is something that has been studied in a number of cases.

There are also some very useful examples that one can find from cities around the world that are already applying some of the measures to deal with high temperatures. Projects like the C40 Cities Network have a climate hub that does so and the Climate-ADAPT Programme. It is possible to compare the effectiveness of these different measures now that information is out there.

Léonie Cooper AM: Clearly there are a number of cities around the world where temperatures are much, much higher than London, so learning the lessons through the C40 Cooler Cities Group and those sorts of things is very helpful.

Peter, what further steps can the Mayor take to reduce the impact of heatwaves on London's citizens, businesses and services? He is very involved in the C40 Cities Group. Perhaps there are some messages that he and some of the team have been able to bring back from that that would be useful to us now.

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): Professor Lowe has helpfully covered a number of things that we are already working on. I would emphasise again the London Plan is really important here for new builds. We are encouraging developers, as part of our London Plan and new developments, to include robust overheating modelling, so against extreme weather scenarios. The London Plan has a cooling hierarchy, which is to ensure that overheating risk is managed. That hierarchy is trying to focus first and foremost on managing our heating risk, as I mentioned earlier, in the design of buildings, rather than relying on mechanical solutions, such as air conditioning, which can add to the problem.

The professor talked about shading. That is really important as part of that work. We are pushing that quite hard through the London Plan as well. We have looked at particular vulnerable groups. To mention a couple, one is education early years settings where we have produced a simple guidance for education authorities to implement measures in their schools and settings to help them adapt to warmer temperatures. We also undertook some work around care homes. I am sure you will appreciate that the risk of high temperatures is far greater to elderly people. That is work we did with University College London, Oxford Brookes University and with Public Health England, looking at simple measures that could be taken. We undertook that in five care homes and made recommendations on what they could do. We produced a checklist to help with making

care homes better prepared. The Care Quality Commission has now committed to including that assessment of risk of overheating in their own inspection assessments of care homes as well and using that simple checklist.

I have mentioned already the Cool Spaces Programme. While it does not solve the problem, it is helping with respite for Londoners when they are out and about. We have 313 outdoor spaces and 43 indoor spaces so far. We are continuing to work with faith groups, boroughs and others to identify and grow that network. Also, tied to the Zero Carbon Challenge, we have a lot of buildings that we need to retrofit in London, both commercial and homes. An important part of that is thinking about ventilation and not just making buildings airtight. Part of our approach to the Warmer Homes initiative is also thinking about how we make effective interventions to make those buildings cooler. We also have underway things like tree planting and other efforts through green roofs to cool the city as well.

Léonie Cooper AM: When the London Environment Strategy was first drafted and agreed in May 2018, subsequent to that the Assembly declared a Climate Emergency in December 2018. The London Plan had largely been written at that point. The Examination in Public then took place in early 2019. A lot of proposals were put forward, particularly by me, Caroline Russell [AM] and Nicky Gavron [former Assembly Member]. We spent a lot of time saying additional areas around this should be considered.

With the change from the Mayor saying Zero Carbon by 2050 to saying Zero Carbon by 2030, have you been looking again at the London Plan and the Environment Strategy in terms of what we need to do, not just in terms of flooding or in terms of energy use, but also in terms of addressing the heating situation in the city and overheating, particularly?

Peter Daw (Assistant Director, Environment and Energy & Head of Climate Change, Greater London Authority): There is work underway around the London Plan to address overheating. Longer-term thinking never seems to end right with the London Plan about what might be needed going forward. I expect that we will feed in, as part of that review, the growing challenges that we are facing. The Green New Deal Mission is a good example of where we are practically, then taking forward more measures which are trying to bring together a range of different things from creating economic opportunity and jobs through to making London better prepared for the recovery from the impact of the pandemic and better prepared to cope with climate. A number of the initiatives I have already mentioned have been borne out of that. There is an evolving programme of work.

I mentioned earlier, one of the areas we are currently looking at is around cool roofs initiatives as well. Is there more we could do effectively to make London's roofs reflective to reduce the urban heat island effect? There is a constant programme of work underway to respond to needs we have. Lilli might want to talk about some of the things that TfL is doing to mitigate heat on the transport network as well.

Léonie Cooper AM: That would be interesting. Following on from what Hina [Bokhari AM] was talking about, it would certainly be interesting to hear that TfL is not going to keep putting in impermeable road surfaces without having some mitigation in terms of adding in additional trees and shrubs. I am still seeing road schemes going in that look like that. All the recent street space included lots of floating bus stops, but not enough shrubs, in my view. There still seems to be a lot of ability to change London, but without really starting to address this -- because we know that it reflects the heat away. If you leave the surface there then it can also absorb the floods that we were talking about earlier, but it does also cool. Having people boiling at bus stops is not really something that we want to see.

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): In terms of the general approach to dealing with heat, it is clearly something that is really important to our customers. We get a lot of feedback on that already. When we look at reports looking at what that might mean in terms of climate change and the impacts on the Tube, we can see that there are going to be more and more days where it is going to be uncomfortably hot. If I start with the Tube and then move on to the road network, there has been quite a lot of work which has already been done and put in place from the softer end of behavioural measures, where we have a clear hot weather plan. That involves advising customers about the need to carry water, advising them about heat, and encouraging those who may be concerned about it to be aware.

We have also put in place physical improvements, with more fresh air vents into the Victoria line and the Northern Line. In addition, 40% of Tube trains now have air conditioning: the Circle line, District line, Metropolitan line and Hammersmith and City line. All the new Elizabeth line trains will have air conditioning. This is a modern network. It is trying to adapt. Clearly that is going to take time, in terms of the whole network being hotter climate ready. The connection then between the surface road network is really important. If we can reduce above-air temperatures, we can also help passengers who might be underground. I am worried about your feedback on these schemes. A lot of the new schemes under the Healthy Streets approach do include greening and climate mitigation measures. The Old Street scheme that is going in, for example, not so much the greening side, but has a lot of flood attenuation built into it.

If you have specific local examples, I always welcome feedback on that and will take it back to the designers. We are seeking to build our tree cover on the main road network because we have a target to increase that tree cover. I love trees, so I would absolutely like to see this roll forward. It is very much part of our policy to increase tree cover as part of street design. It may be that they were some of the more rapid street space schemes that came in quickly over the pandemic period. Many of them are now being made permanent, so there is an opportunity there to look at that.

Léonie Cooper AM: I know why you have not been able to put trees in. It is because the Northern line extension heading south to Morden essentially follows the A24. Just as I know some of Thames Water's assets are very close to the pipework that had to be fixed that goes over where the District line runs at Southfields. Sometimes there is more than one thing going on. However, we have very good examples close to here of some very large containers with trees around the more London Estate. At one point people were talking about the Balham Boulevard and they wanted trees planted down the middle of the road. Unfortunately, that would then impede the Northern line from running just underneath those trees, unless you can think of a way to get Tube trains to run through roots.

Perhaps that is something we can take offline because I am sure the Chair is keen to move on because we are running a bit late.

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): I would like to. We need to continue to challenge ourselves and see what more we can do on that. That feedback is really welcome.

Léonie Cooper AM: I did mention shrubs as well. Shrubs as well as trees are really important for that reason.

Zack Polanski AM (Chair): That concludes part one. Thank you very much to our guests for joining us. Thank you to our virtual guest, Professor Lowe.

Lilli Matson (Chief Safety, Health and Environment Officer, Transport for London): Chair, I should have mentioned at the beginning, but I did not really have time to introduce myself. I wanted to make clear I am a member of the Environment Agency Board, but all my comments today were from my role as Chief Officer for TfL. I wanted to make sure that that was noted.

Zack Polanski AM (Chair): Noted and you are, of course, free to leave the Chamber. Thank you very much.