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Paul Thies: According to a report published by National Geographic earlier this year, sea levels are expected to rise one foot by 2050 due to the effects of ocean heating, climate change and carbon emissions. This is especially problematic for coastal areas which simultaneously are seeing an increase in their population densities. Add in the difficulty of aging infrastructure in many geographies and you have a real recipe for disruption.

Hello, I'm your host, Paul Thies. On this episode of *If Win* I discussed the topic of sea-level rise with Abby Crisostomo, Thames Estuary 2100 Project Director in London area and FFDM incident support officer and Natalie McIlldowie, Jacob's environment agency client account manager. We talked about the efforts that London is undertaking via Thames Estuary 2100 plan to address sea level rise and what actions that industry and coastal cities might consider adopting to counter this burgeoning environmental challenge.

Abby and Natalie, thank you both so much for joining me today to talk about high tides and sea level rising, fascinating topic and seems something that we should be concerned about. It'd be interesting to see especially as your experience there in the United Kingdom, particularly with London, what we can learn about this challenge and what's being done. Start us off Abby, I'd like to ask when London realized it was going to be at increasing risk of flooding through this century, what was the response?

Abby Crisostomo: Thanks, Paul. I think I have to hand it to my predecessors I think because they flagged this really as an issue almost 20 years ago. Took the decision to tackle it using what was at the time, an innovative approach and is still innovative and now's being taken more broadly around the world, but really, I think it wasn't just about increasing flood risk. We've got climate change. It was just going to go up over time. We also have population growth in London and outside London where there's quite a lot of growth even out in the outer edges of London and the estuary.

We are lucky to have a system in place already. We have the Thames Barrier that was built, off start operating in 1983 and a massive system of walls and embankments and defenses. We had all that, but it's all aging now as well. You've got that triple threat of the climate change, aging infrastructure and population growth had to deal with.

If we didn't manage that risk then we were going to get into trouble and given the scale of what we're talking about, we need to think about it at that scale. I think even with climate change if we did everything perfectly right now, tomorrow, if we did everything we could do to mitigate climate change and stop making it worse, we've already got the impacts of what's happened so far. We know that sea level's already rising, so we have to plan for this.

It took eight years to develop the Thames Estuary 2100 plan. What it does is that it takes an adaptation pathways approach to thinking about this long-term change that's needed in the estuary, but also in light of the uncertainty we have with climate

change. We know climate change is happening. We know sea level rise is happening, but we don't necessarily know how quickly it's going to happen.

The scale of investment that needs to happen to manage that risk is so big that we both need to take the time to plan for it properly, but we also don't want to invest in the wrong thing or too big or too small of a solution. What the adaptation pathways approach lets us do is it sets out multiple different options that we have for that future, and that we can spend the current period planning towards those different options.

At the same time, we're monitoring sea-level rise, climate change, as well as a number of other metrics in terms of population growth and other things to understand when's the point at which we need to make a change. While we're monitoring that same time, we can make the best decision at the right time. We have all the information gathered to make that decision.

Yes, the plan it took eight years to develop. It was published in 2012, it was led by the Environment Agency, but alongside partners and it set out three phases of activity. Up to 2035 we're doing that research, we're gathering information, we're maintaining the system we already have, and we're leading ourselves up to a decision, but then it's in that next phase from 2035 to 2050 where we start investing in different solutions to help us manage that sea level rise. Then we're even planning even beyond that from 2050 to 2100 and beyond in terms of what those solutions could look like.

Paul: That's fascinating. I can't help but think that London is probably if not the most perfect testing ground for this definitely one of the global testing grounds. London is by some measures. I think it's the, quote-unquote, smartest city on earth in terms of AI and emerging technology and how far along it is compared to most geographies coupled with the fact that it's a megacity by the UN metrics. It's a destination city.

The population is growing by leaps and bounds. Then there's all kinds of resource. It's obviously also maybe not the financial capital of the world, but definitely one of the financial capitals of the world, so it's this beautiful nexus of technology and people and resources to be able to tackle a problem like this. Natalie when you see cities like London setting out long-term adaptation plans what are the opportunities that this can create to deliver projects and programs differently?

Natalie McIlldowie: Thanks, Paul. While we're extolling the virtues of London, I have to start with the fact that I have a really strong personal relationship with London. I first came to London when I was 18 years old and spent the summer staying with family. That experience changed my life for all the reasons that you've just described. This is nothing like Fort Wayne, Indiana, where I was a big thinker in a small place.

Paul: With all due respect to Fort Wayne Indiana, of course.

Natalie: Indeed. Yes. Now I go there on holiday.

[laughter]

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I ended up coming back here for a couple of summers while I was getting my engineering degree in university. I met the Englishman that I called my husband for the last 24 years. It's because of that I've lived here in England for 18 years. Now what I do for a living, working for Jacobs serving infrastructure clients and I have particular focus on serving the environment agency. The long-term adaptation plans that we have for example, in the Thames Estuary, provides the opportunity for the long-term contracting mechanisms, which foster collaboration, deeper relationships between people across businesses and areas of expertise.

This opens up more innovative ways of working. There's a lot going on in the UK in terms of transforming that the way that the public and the private sector work together. We have the National Infrastructure Strategy that came out in 2020, and this is about leveling up. Creating much better social equality in this country and working towards achieving net-zero carbon emissions by 2050 and underpinning that is the construction playbook.

I can say with all honesty having done this work for a living for quite a long time, I'm hearing more references to a government release document than ever before in the construction playbook, which really articulately lays out a transformational change in the way that we work. In these long-term contracts, they enable us to really focus on developing the skills that we need now in the future to do what is required to deliver the outcomes.

When you have longer-term ambitions, you can spend more time front planning, what you're going to do. The more time you spend planning the more likely you are to succeed. You can also deliver in a much safer way where you have time to plan and it gives you more space to, quote-unquote, build back greener. Developing those net-zero solutions and considering the whole life of the assets, and also enables businesses to invest in technologies.

When you can see a long-term relationship over an opportunity that you're going to be involved in over a period of time, businesses will invest in technologies and solutions that they know that they're going to get a return on that investment, because they have that opportunity to apply it. This brings us on to things like the modern methods of construction where we're focused on when you look at long-term asset management, asset planning, how can we think about developing our solutions in a much more sustainable way?

In modern methods of construction, you've got opportunities for offsite manufacturing and different ways of implementing them on-site. In that controlled environment, you can be more efficient, you produce less waste, you're much better at delivering an optimal solution. All of this is in service to providing value for money for the taxpayer.

Paul: That's fascinating. Companies like Jacobs, it could be said in a certain way, they invest in the communities in which they do the work, because so much time and energy and effort, particular time too goes into working toward that development. Abby, this next question is really anchored in that idea of a time investment, given that you're already 10 years into the Thames Estuary 2100 plan. What are the main challenges that lie ahead and how do your adaptation pathways help to manage these?

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Abby: It's so interesting with a hundred-year plan, 10 years into it. It feels both like it's been quite a long time and that it's been no time but I think there's quite a lot of challenges. We're in the process of doing our first full review of the plan, we call the tenure review where we're looking at what we've done so far, how it's worked? How far we've come against the original intentions of the plan and also how the world in the estuary is changing?

I think what has come out of that are probably four main challenges, some challenges. We'll see. One of them is keeping up to date with the science and the engineering that they need to. From our monitoring research, we've found that sea level is rising in line with the most likely scenario in the IPCC scenarios but it is rising.

We need to make sure that we are understanding this climate forecast and how climate science is changing. Then we also have to translate that into our day-to-day operation and how we can make decisions in the medium to long-term? How we do modeling? How we consider tide cycles? How do we think about the way weather forecasts will change? It's not the first one.

I think the second main challenge is it's a really big area to manage that we're looking after the Thames Estuary tidal defense network is made up of 330 kilometers of flood walls and embankments. We have nine major barriers and we have more than 400 other structures, flood gates, pumping stations, outfalls.

As I said before, these assets are aging. You have to think about part of what the plan sets out for us is to take a strategic asset management approach. That means trying to invest more and optimize maintenance so that we can invest less now and prevent more expensive investment later when it comes to failures, which is not something that is always easy to do with the way that funding works for the type of investment we can do. Then obviously with sea level rise the plan sets out a number of intervention deadlines for upgrading defenses for sea level rise.

In most cases, that means raising the line of the defense, but sometimes it means managed retreat or realignment, or coming up with other solutions where it's not worth investing in that additional upgrade. We have quite a large scale of geography and number of assets to deal with. The third challenge is really linked to that, because actually, only 12% of that network is, that's 12% by number about 30% by length is owned and operated by the environment agency.

Third challenge is really about working with others to actually deliver the plan and so that's working with local authorities sometimes who either own the land or own the assets themselves or run the planning system that dictates how development can happen along the riverfront. Then the other part of it is the riparian owners themselves. Here in London, it's the riparian owners. The landowner on which the flood defense sits is actually responsible for maintaining that and improving it over time.

In some parts of London, you've got literally individual landowners and especially in West London. It's a little different in East London where you've got probably wider estates and housing developments. Then it's even different further out in the outer

estuary where you've got more industrial areas, but across the whole estuary you've got a really different mix of who owns or is responsible for the riverfronts. Trying to raise the level of defense across that whole estuary by a certain point in time is really complicated in terms of how we work with our partners and with landowners.

Then I think the kind of force challenge, which I think I'm sure everybody is challenged in a sense, it's how do we fund all of this with such a different set of people who reap the benefits of this flood defense system versus who's got the ability to pay. It's how do you match up those beneficiaries and the investment needed. Because the Environment Agency has a certain amount that we invest in quite a lot at the moment that we can invest into flood defense systems, but it's not going to be enough for the level investment we're going to need.

If in the future we need either an improved Thames Barrier or a new Thames Barrier that's going to be a massive investment, both in terms of funding, but also political will. Really big stuff that we have coming up, but I think what the adaptation pathways approach gives us is the ability to think about those long-term challenges now and start planning for them and start actually building the relationships with partners, setting up the systems, setting up the partnerships.

For example, what we have right now with Thames 2100 and Jacobs **[unintelligible 00:16:26]** in terms of how we then invest in the near term. We can learn in that process about how to keep improving that over time.

Paul: Natalie, Abby mentioned working with partners. When you look at the prospects of sea level rise and you couple that with the demographic changes where I want to say, I'm going to quote, "I think the UN said like 60% of the world's population are moving toward megacities within this century." You're looking at cities like Tokyo, Los Angeles, New York City, Shanghai where these are huge cities, immense populations, and they're coastal, which I'm not a scientist, but I suspect that puts them at more risk for something like sea level rise.

Coming back to that idea of partnerships and collaboration that Abby touched on and what can the industry or what can industry do to support cities like those, I mentioned like London and working smart to manage the impact of sea level rise?

Natalie: Thanks, Paul. You're absolutely right. You look at these major cities and they became what they are because of their proximity to this international highway, which is the ocean. Again, I've got a personal experience. I don't actually live in London, but several years ago, my husband and I took his mother and our baby at the time to their childhood home. This is just up the Thames and we were walking along the strand on the green in Chiswick and went and saw how the house looked.

We went to a local pub, sat upstairs, had a nice meal, chatting away, came down and the tide was up. I did not even realize this was happening. We couldn't go out the door we came in. The water in that really short space of time had risen by feet. I looked around and people seemed pretty casual about it. They were used to it. People were standing on picnic tables.

I suddenly noticed that the pub itself had all this property level resilience attached to it so that the water wasn't actually coming into the building, but I thought, "Wow, here I am just a civilian and this has happened without my even noticing." This is just stressing the contextual importance of what we're talking about here. This affects people's daily lives now, in terms of what can we in industry do.

We're working across so many different infrastructure developers, particularly in this country where we're working for all the public sector developers. Those relationships that we have gives us an opportunity to be the integrators, to look at solutions across the system. I think, up to now, we really in infrastructure delivered individual projects. Yes, you imagine that somewhere along the way, somebody made a master plan and these things hang together.

As we continue to develop and make our places suitable for a growing and aging population, where we need to be doing things very differently to protect the natural environment and deliver outcomes in a net-zero carbon way. We have an opportunity to look across all those projects and all those programs and leverage the relationships that we have with our clients with the industry forums.

I believe, in my experience of working for the Environment Agency as my main client for the last few years, they're very mature in this space around collaboration, and innovation. Really, really understand that we're all human beings trying to do good things for human beings and with that you need to be collaborative, and develop collaborative behaviors and think about your purpose.

I think there's a lot going on here. I would encourage anybody who's listening to this to Google Infrastructure Planning Authority Roadmap to 2030, there's a brilliant graphic that really shows what this system's thinking approach could look like. It sets the United Nations Sustainable Development Goals, right at the top of the tree of decision makings. What are the societal outcomes that we're looking to achieve? What value can be delivered? Then how do we work together? Most importantly, how do we integrate all the data that we have across these different systems so that we're able to make smarter decisions?

We know that Jacobs is really pushing itself as a business in that direction of being at the forefront of addressing the climate experience, the climate response. As well as really investing in digital transformation so that we're able to be in that position to make better decisions.

Paul: Now, Abby they say every cloud has a silver lining. What are the opportunities socially and environmentally that creating a long-term adaptation plan like the Thames Estuary 2100, can create for global cities like London?

Abby: I think part of how we set it up is to try to take advantage of those wider benefits. Obviously, first and foremost, it's climate adaptation or flood risk protection. There's more than 1.4 million people, and £321 billion worth of residential property that benefit from the title defense system in the Thames Estuary.

Then within that, there's loads, there's 56,000 commercial industrial properties, more than 700 healthcare centers, 116 train and tube stations, more than 27 square

kilometers of open space. All this stuff that's getting protected by having the Thames Estuary defense system in place and continuing to make sure that that system adapts with sea level rise and climate change.

You're talking before, Natalie, about personal impact. Personally, I live in central London. I also live in castle, which was right in the middle of the area of North Suffolk, that is very much impacted if the defenses did not exist, where I live would be underwater, so is very personally something that matters to me. I think the other thing, so in addition to that flood risk protection that we get out of having this plan.

The other thing that having the long-term vision and adaptation pathways approach that we have is to have that strategic 100-year time horizon and vision that gives us all something to plan to and translate to on a local level, and integrate into our local plans. We have what we call the Riverside strategies approach, which is part of how we implement the plan. Really what it asks is, what is the vision for our riversides?

There's an easy answer where we have sea levels rising, and a lot of the Thames Estuary we've got walls and embankments. In certain parts of the estuary, after a certain number of years, we could see another half-meter to a meter of protection needed. You could just go around and tack on an extra half-meter to a meter on top of all your walls and embankments and that would be the easy way to do it.

If you think about, if you've been in Central London, if you've been near the riverfront, you think about what the relationship is with people in London to the actual river and the waterfront. If you stuck another meter on top of those walls, you'd be completely disconnected from the river, you'd be completely separate and inward-facing and it would no longer be part of what is basically cut through the center of the city.

What we try to ask for and work with others on with this Riverside Strategy Approach is that's the default position but how about we plan, how about we build into local plans what the vision is for your riverfront that incorporates adaptation into the flood defenses that gives us the protection that we need. Whether that's actually building in habitat, we've got this program called Estuary Edges where we think about how you build habitat and ecology into defense systems and waterfront. How do you improve access to waterfront?

Large parts of the Thames have the River Thames path. How do we make sure that we continue to have that and that we don't again, stick more flood defenses in front of it where you have no relationship with river? How could you also while investing in the path invest in a flood defense system also.

It's what we do with that approach and what the adaptation pathways approach gives us is that long-term view, so you can spend the time now thinking, what would I want the waterfront to look like with climate change happening? How can we make sure that we align the planning system and new developments and local investment in a way that then gives us something that benefits us in terms of access to the waterfront, or increased habitat, or just that wider amenity of having proximity to the blue space?

Paul: You're touching on this idea that in order to plan for the future, to plan long-term you need to have innovative ideas. You need to take a moment, to think creatively, and come at the problem in a different way, let's say. Rather than just, what seems might be the easy fix or the obvious fix, or just throw up some more brick walls and just break everything around. Obviously, that strikes at the heart of the culture of London and really strikes at the quality of living and all of that.

Natalie, getting in that context. What are some of the bold ideas you think that industry and global cities might need to consider in order to adapt to increasing sea levels later on here in the 21st century?

Natalie: As Abby's already mentioned setting back the coastline, perhaps not suitable for the center of London, but in other coastal areas or outer estuaries making space for water. That sounds obvious but it's actually really bold because it requires you to change the way people are living their daily lives. One of the things that is becoming of increasing importance is the creation of salt marsh habitat because it has a big potential for carbon sequestration.

We've had a couple of projects, where we've successfully delivered outcomes around salt marsh habitat creation. As Abby talks about these ends up becoming sources of pride and joy and community wellbeing. Because that connection that you have with nature, and the connection that people have with water just it increases your quality of life. In Jacobs, we're doing a lot of work in the space of blue carbon, and it's a really exciting place to be.

The other thing to consider is tidal energy, water, especially from the sea presents a great opportunity for renewable energy. In the last couple of decades, it fell foul to not being the chosen solution because of the impact on marine life, the types of solutions that generated tidal energy presented. They just became quite unpopular in favor of other sources of renewable energy, but now here we are, in the middle of this climate crisis, and this real push to net-zero, we probably need to open that backup. I understand that the UK Government is getting back behind that.

When you get leadership, an impetus behind something, it can give rise to better innovation, more creative thinking. How do we make this work so that it doesn't have negative environmental impacts that it achieves those outcomes that we're all aiming for? On the point of outcomes, if I dwell on that-- in this industry, we often say that we're outcome focused, and we like to think that we're outcome focused, but are we really? I don't think so. I think we all have a tendency to default back to what we know which is being quite prescriptive.

To achieve all those great things that Abby's just described, I think it's going to take a different way of working where we're really asking industry in the marketplace to deliver outcomes. That's where you will unlock innovation and drive continuous improvement.

When you've got a clear vision and aren't overly prescriptive about how to solve the problem, I think that's going to give rise to achieving these bolder outcomes that Abby has described. One of the most effective ways is to create sustainable contracting environments that promote collaboration but are set up in such a way

that we're not doing unnecessary work. Why produce that output just because you've done it that way before if it doesn't need to be done to achieve the outcome?

Paul: No, that's fascinating because it really comes down to a focus on the problem, not a prescribed solution, like, "This is what I know. Let me produce this." That may not actually solve the problem you're trying to solve. It's really being more fundamental in terms of what it is you're hoping to accomplish and working from that. [crosstalk]

Natalie: I can add to that just a little bit. It's also about the client and the delivery partner taking risks that they're not used to taking, and you can see this happening more and more. Abby talked about where is the funding source going to come from? I think we'll increasingly see private investment. You're funding it because that it's going to achieve outcome a monetized benefit and that feels like a space that we're moving into and navigating our way through at the moment. I don't think anybody has the perfect answers, but it's a really exciting time to be having really open creative conversations.

Paul: We're finding ourselves at a time where change is upon us, and so now it's how are we going to respond to it? Abby, you touched on people are impacting how they live. Natalie, you did too in terms of the coastal lines, the coastal squeeze and that kind of thing. We're really having to change how we approach the environment and how we approach our living conditions.

Abby, you've articulated a bold and ambitious adaptation plan for the Thames, which is presumably going to result in a lot of change to the current set of assets and associated landscape. How do you go about getting people to support that change? Beyond just the government mandate real change has to start, like everybody has to embrace that. How do you get there?

Abby: That's a good question.

[laughter]

We're actually really in the thick of starting some of these conversations now. By starting, we've been having them for years, but literally this week, we've kicked off a series of collaborative workshops with some of our partners to think about this and to create more co-ownership of the plan and the outcomes that it needs to deliver, but really the actions and activities that need to happen to deliver it.

One of the contacts we have to think about in terms of the change that's going to be needed because of climate change, but we also have change happening because of growth. I think in London, or just outside of London, the outer Thames Estuary has been recognized as a prime government growth opportunity area. 2019 Thames Estuary Growth Commission reports stated that we need 1 million new homes by 2050 to meet the housing need.

A lot of that growth is happening on the waterfront and not only is there residential growth and development happening but there's also infrastructure plans. You've got the lower Thames crossing being planned, and a lot of other activity happening. The

change that's going to come from climate change and flood risk is a change that we are putting in because of growth and development.

I think you're right, it's just how do we think about making sure that we're bold about how we integrate those things? They're not competing against one another, but that actually Natalie was talking before about making space for water and development. Whether we're making space for water and green infrastructure and that nature-based solution part, which is part of the solution, but also making space for new infrastructure, new hard infrastructure that we might need.

I think we need to work together to be able to make those things work on the ground, and take into account both things because you can't really have one without the other. You need the growth, you need houses and infrastructure. You need that to support people, but you need to protect the area from flood risk as well. We've talked a lot about partnership working collaboration and I think that's where a lot of our energy goes into.

At the moment, we are having those conversations with partners about coding the plan, and we're thinking about different ways to engage landowners and local people on this, which is not something that we've historically done that well. It is quite difficult and so working with other organizations and groups to try to do that differently and try to actually bring people along on almost a more personal and community-based level.

Then I think that's what we need to be doing now. In the not too distant future, we are going to have to make some really big decisions and big investments about the future of the estuary, whether that's major new infrastructure that will have an impact on the shape of the estuary or some of the smaller investments we need all the way along the estuary.

Natalie was talking before about how do we invest? We are trying to look at what are some of those innovative and green finance investment opportunities that we should be thinking about. Rather just only thinking about this from the public sector investment model, but how do we actually bring in that private investment as part of it. Because there's lots of private beneficiaries to the investors we make here.

I think that's the direction everyone is probably going to have to go with. We're thinking about how do we take advantage of that to make sure that we get the environmental and climate outcomes we need alongside kind of those social and community outcomes.

Paul: Then Natalie my last question for you is regards Jacobs and how it's responding to this issue. How is the company helping its clients present the need for change to a wide range of stakeholders?

Natalie: First and foremost, investing in developing our capability and capacity and stakeholder comes in engagement. I've seen that team grow exponentially over the past 15 years I'd say and now it used to be only on the major schemes. Would you have a stakeholder professional on your project team? Whereas now it's pretty much

integral to everything that we're doing because it is directly impacting on people in communities and in their daily lives.

Certainly, professionalizing that expertise and having those people embedded in your project teams, working alongside the designers and the relationship leaders to make sure that we are bringing people along that journey and actually engaging. In this particular industry we've taken a while to get round to understanding that you have to take people on the journey.

They don't want you to come to them with the foregone conclusion because at least they feel like they've been part of the decision making. You can't make everyone happy, of course, but at least everybody feels like they had their voice heard. They said what they thought a decision got made and that really changes the environment within which you're trying to get things done.

I also think that Jacobs invests heavily in the culture of the people that enables our designers, our engineers, our technologists to really think about who they're serving. We have a culture in Jacobs where we encourage people to be curious, ask why? Why am I even doing this? If you understand that, then when you are coming up with your solution, you're going to be thinking about who is going to be living with this? Who has to operate and maintain this asset that I've been asked to design?

That really changes the way that you think about what you're going to produce. Also, I'm seeing increasingly inclusive engagement practices. Coming back to professionalizing stakeholder comes in engagement, certainly during the change in ways of working, going virtual, which is new to a lot of us, it's not new to a lot of others. We're seeing an opportunity to engage with the younger generation who have to live with the legacy that we're creating and finding ways, but there's no one size fits all.

I think that there is more of an emphasis around making sure that you are reaching out to everyone understand your community. Who's your audience? Because yes, you want to engage with the people who in here at the legacy, the families and working people who interface with what you're doing day in and day out, but also the older generation not to exclude them. Because people who've lived through all the changes that have been going on for the last several decades, they have a lot to offer and they have a lot of experience.

My mother-in-law for example. Yes, she's super savvy, independent, clever woman, and she has an iPad. She knows how to email her friends, but I'm pretty sure she'd rather respond to a questionnaire that came through the post than try to fill out a form online.

It's those inclusive engagement practices that were increasingly applying on our projects and also engaging with small to medium enterprises. Because that then gives you the local flare to what you're doing if you're working with companies who really understand the place, we're making places better.

I went out for a cup of tea with someone who works for an SME that is a business partner on a couple of projects. She described herself riding around on her bicycle

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through all these neighborhoods around London, Thames side, and really getting to know the street names, how they interconnected. Observing the way people use the space so that when she was engaging with people, she had that credibility and you need credibility to get trust.

If people trust you, then you can get things done. At the end of the day where people doing good things for people and particularly in the case of working with the Environment Agency, we're working to enhance the natural environment that supports all life, making that personal.

Paul: Well said. Abby and Natalie, this has been a fascinating discussion about the challenge of sea level rise and what is being done and what we can learn from global leaders, like the City of London. I want to thank you both so much for joining me today.

Abby: Thanks, Paul. Thanks, Natalie.

Natalie: Thank you.

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