Transcript Recording

Quarterly Resilience Forum

November 2, 2022

Marisa Gleason: -what I said earlier, in case you couldn't hear me very well. But we just wanted to address some housekeeping items. The meeting today will be recorded. We kindly ask that you make sure not to share your screen and to remain muted until we reach the open discussion portion following each presentation. We encourage you to use the chat feature for any questions or information relevant to our discussion today. And the recording and a transcript of today's forum will be available for reference on our website under the coastal resilience forum tab. Grace will drop that link in the chat.

Alright! Thank you everyone for joining us for the fourth and final Quarterly Resilience Forum of 2022. My name is Marisa Gleason and Grace Altenburg, and I will be hosting todays webinar. Our contact information can be found in the chat, feel free to reach out to us with any questions you might have about the Program and Forum!

And the agenda today, we will have three presentations each followed by a Q and A session. After, we will end the forum with RF program updates and open the floor for any open discussion or forum member announcements.

Grace Altenburg: Great! Thanks Marisa. I would like to now introduce our speakers who have joined us today. Please welcome Dr. Angela Schedel, joining us from Taylor Engineering. Dr. Schedel will be discussing the lessons learned in using the SLIP webtool and reporting. Please also welcome Ryan Wiedenman, joining us from Atkins Global. Ryan will be sharing with us the recovery and resiliency efforts taking place in Mexico Beach, Florida. And for our last speaker of the day, please welcome Nick Muzia with Martin County. Nick will be sharing the County's work on finding natural solutions for stormwater challenges.
And a big thank you to our presenters for being available to share with us their topics of discussion and to our attendees for tuning in. I'd like to now turn it over to our first presentation, Angela would you like to share your screen?

Angela Schedel: Yes, thank you so much Grace. Alright, y'all seeing that?

Grace Altenburg: Looks great!

Angela Schedel: Okay! Well good morning and thanks for being here on this cold November morning. Hopefully it's not as cold where you are but it feels like fall to me. I am sure most of you are familiar with the SLIP tool that DEP launched last year but I thought I would just take the time to provide an overview and then some lessons learned since we have now had some people using it. Since it has been required to be used since July of this year. And we also have some enhancements that we will talk about. And if you have any questions feel free to put them in the chat and I will try to answer them as I go along. So, this is what will talk about. We've had some questions on when a SLIP study is required, so I will go over the terms that are in the statute and rule to make sure we define those. We will talk about what goes into a slip study, do an overview of all the different tabs and layers on the website. And then I will review what a SLIP Report looks like. Kind of what reviewers are looking at DEP when they review a Slip Report. And then I will talk about some website enhancements.

So, let's talk about when a SLIP Study is required. This is probably the biggest question that I think I get from people. And it's obviously- you know we created the SLIP tool, at Taylor engineering in concert with DEP. So, this wasn't something that we did. It was actually something that was a part of the state statute 161.551. So, I've highlighted in green what I think are kind of the key terms that need to be defined. And I will define them on the next few slides. So, a SLIP Study, a sea level impact projection study, is required before you have any major structure or non-habitable major structure that is built in the coastal building zone by a state finance constructor. And then you can see that the statute requires that it is published on the DEP website before construction starts. And DEP have to maintain copies for ten years after the receipt of the report. Another thing to note, you don't have to use the SLIP Tool website. DEP just wanted to make it more user friendly so they didn't have to hire a consultant to do an expensive study that would have the bare minimum as required by statute. So, let's talk about these terms. Once again, I'm not a lawyer, I am a coastal engineer, so I am just reading what's here. Not going to interpret it, I just want to make sure that everyone has these in their mind.

So, within the statute 161.551 it defines a state financed constructor as a public entity that is using funds appropriated from the state. To either commission or manage a construction project. So, a lot of you on this call are probably these public entities. Right? You can see the definition of a public entity. So, it's you know a municipality, a county, a state agency, a special taxation district, an authority, or a public body, that performs a public function to serve a governmental purpose. Some examples on the bottom, and these are examples that I took from some other slides, so I did not make these up, but I think these are really good to understand. Is that examples that would fall under state finance constructors, on the left, are things that come directly out of you know like a line-item appropriation, and a state budget, legislative funded projects, new construction from FDOT, any state park facilities coming through DEP and port facilities- public port facilities. Things that don't fall under that state financed constructors are federal funds administered by the state and state revolving funds. Once again, I didn't- I didn't use these terms- make up these terms. These are just terms that were interpreted by a DEP slide that I used from rulemaking.

Well, let's define a coastal structure. Because I think this is another area of confusion that I have seen. This definition of a coastal structure was defined in statute- the SLIP statute as a major structure or non-habitual major structure within the coastal building zone. And what DEP did in interpreting this is they pointed back to previous statute. So, we pointed to 161.54 section 6. I'm going to cover what is in A and C. And on the next slide will show you what's in B and D, which seem to be exclusions for when a SLIP study is required. So, you can see these major structures are major structures- things like houses, mobile homes, apartment buildings, condos, motels, hotels, restaurants. None of those to me are usually things that are state financed. Very rarely most of those are but that last one there, public buildings, or other construction having the potential for substantial impact on a coastal zone is. So public buildings is where I focus when I look at major structure and non-habitual major structure are things like you know you see there swimming pools, parking garages, pipelines, piers, canals, lakes, ditches, drainage structures, water retention. I will let you guys read those. I don't have to read them but once again this is coming from 161.54(6)(a). So when- I'm going to show you on the next slide what's on B and D of 161.54.

So, these are the ones that are not defined as coastal structures as per the SLIP statute. So, a minor structure. So, it's a pile-supported, you know something like a dune walkover, or a beach access ramp or walkway, a viewing platform, a public bathhouse, a park, sidewalks, or parking areas, sand fences, earth retaining walls. So, I think that's kind of interesting. I think I underlined there at the end because I thought that was a key thing to remember as a coastal engineer. Thinking about this- really a minor structure is something that is considered to be- I hate to say, expendable. But expendable under design

wind, wave, and storm forces, consider that when you are thinking about a SLIP study. And then also coastal or shore protection structures, so these big shore hardening things, like revetments, or groins, breakwaters, you know things that are using something other than beach sand for shoreline stabilization or protection or preventing erosion. So those are not defined as a coastal structure as per the statute.

Alright, so now we've gotten through the legal mumbo jumbo. Now I want to talk about coastal building zone. And some of the graphics that are in the SLIP tool. So, the coastal building zone is where a SLIP study is required currently. This was the coastal building zone was previously defined in statute also in 161.54 and 55. And you can see in the graphics here, this is a GIS layer that the DEP put together just for SLIP- to help define this. There's kind of four definitions, of what the coastal building zone is. And you actually see them in the pictures there. Yellow being the barrier island definition. Pink, the right graphic, being the area of the Florida Keys in Monroe County. Blue being kind of the standard- standard definition of what we call the mainland. And then orange is the VE. So, I'll show you what these mean.

So, the coastal building zone is defined in previous statute. Was that, that area from the seasonal high-water line landward to 1,500 feet landward of the CCCL (Coastal construction control line). But as we know there is not places with CCCL that are coastal construction line everywhere in the state of Florida. Because it's you know, I think about- I can go back to this chart here, you can see down there in the everglades that- that orange area or that's a park in the Jacksonville area that you're seeing that's up on the top left. So those orange areas don't have a VE zone because no one is living there so FEMA didn't do flood insurance rate maps for them. Typically tends to be a- a natural area without a lot of residents. So, in areas that don't have a CCCL and are fronting the Gulf of Mexico, or Atlantic, the Florida bay or the straits. We then defined it as everything, all the land that is seaward of the most landward velocity zone, like we said the VE zone as shown on FEMA flood insurance rate maps. And that's where we are getting that orange.

Then we are talking about the barrier islands. This is another definition. This is definition number three. Is that its- once again this is when it's a barrier island it's from the seasonal highwater line to 5,000 foot landward of the CCCL. So that is a lot- a lot more inland than the previous one that was the mainland. And then if- once again we got that coastline without a CCCL that does apply to barrier islands also. It's the once again the land area seaward of the most landward velocity zone of the boundary line where that V zone stops. And that last one definition number four, which is all land area of the Florida Keys.

So, these layers can be seen- can be viewed on the SLIP tool map. You can see my cursor here. The coastal building zone is this black dotted line area that you see every time you pull out the SLIP tool. If you click on the i button to the right of any layer, but specifically this one, it will give you those definitions that I just defined and a link to that map service, to that GIS layer.

Alright, so now we've gotten through all the policy that comes out of statute that is defined in the Florida statute. So, I want to talk about what goes into a SLIP study. I highlighted in green once again, these are words directly from the statute. That it's supposed to be systematic, interdisciplinary, in a scientifically accepted approach. Looking at, you know natural sciences and construction design. It's supposed to assess flooding, inundation, and wave action damage risks for a coastal structure over its expected life or 50 years, whichever is less. And then provide alternatives for the coastal structures design and siting, and how those alternatives would impact certain public safety and environmental risks.

Alright, so the data sources when we were looking at using SLIP tool, we wanted something that was creditable and authoritative. And if you go to the DATA.GOV website just as an example, and plug in sea-level rise, not knowing anything, you see it comes up with 26-thousand datasets. This was actually a search I ran when we were developing SLIP- so about 2 years ago. So, I'm sure it's more than 26 thousand now. So, we had focus groups and round tables with some experts from academics and engineering fields, talked to people in insurance, talked to local governments and state agencies to have an idea of what were the most credible and authoritative sources. So, what you're seeing here is mostly from federal or state agencies so we're using some data sources that come from NOAA and I will show you those in the following slides. Some from FEMA, some from national fish and wildlife, the Florida building codes for the maximum winds, and the Army Corp Depth Damage Function, and some NOAA/EPA adaptation measures.

So, when we first started on SLIP tool, I think in my mind what I envisioned when we met with DEP for the first time was looking at the statute. And it was to create a SLIP report. But secretary Valestein was very firm that he wanted it to be user-friendly and be available to the general public. To be able to show them the coastal hazards that are there. So, we were able to make kind of two sides of the SLIP tool. One that is the public mapping-viewing tool to show you know the coastal hazard risk of Florida. And then one that is for signed in users that generates a SLIP report.

This is the webpage, if you haven't been there. Hopefully you all have, you can link to it from the Florida DEP resilient coastlines website. Or you can just type in www.floridadep-slip.org. and it looks like this when you land on the page. The bottom three are information- informational pages. The one on the left shows the SLIP studies, I will give a little bit more on that at the end of the presentation. The one in the center expands a little bit on section 161 in statue. And the one on the end talks about adaptation strategies and the matrix that we used to develop those. It has some great examples and even ones that were funded within the state of Florida through the resilient coastlines program.

But really the key to it is when you click on the SLIP Map up here on the right, if you click this button, it takes you to the mapping platform. And as I said with creditable data, we are not producing any data here. We're actually just repackaging it so that it is available in a kind of one-stop-shop for the public and people who are doing a sea-level study. So, when you click on the first layer here on the left, I'm just going to go down- you know from the coastal layers starting at the top and going down. The sea level rise layer is just a repetitive of the NOAA digital coast layer. So, if you're familiar with NOAA digital coast, this is what we're repeating here. And what it's doing is actually taking the terrain layers- the topography layers, the digital elevation that is within NOAA and it's feeding back a water depth of flooding. So, from the slider on the left goes from 1 to 10, and you can move the slider up to look at depth of flood. And in the bottom left here you can change and look at aerial mapping. You can also zoom in, using either the plus or minus button, use your mouse to zoom in, or you can search by an address if you want to look at a specific area. Once again, if you click i on any one of these, it will give you the information that is- where its coming from and the map service that its rendering from. So, this is another way we repackage the NOAA data. This is using the NOAA 2017 regional SLR scenario. We're using 2017 because it was baked into our rulemaking, we tried to make it the most recent. But we were told by the lawyers that it had to be very much spelled out. So that's something to discuss probably in the QA, but it is using the NOAA 2017 regional SLR scenarios. It defaults to intermediate high. And what it is asking you to do when you go here is you click on any location within that coastal building zone, once again that's the dashed area there. In this case I clicked in this area, you know right here in the

green. And when I clicked on it, what it does it has a distance weighted interpellation between the NOAA tide gauges because sea level rise as we know is regionalized depending on a variety of factors such as vertical land movement and ocean circulation. And it's using the historic data from the nearest tide gauges. So, we've interpellated here, you can see on the left between Trident Pier and Daytona Beach, those are the two in blue. And it's giving a- in the future- it starts at 2020, so we do have 2 years passed, so don't be befuddled by that. Some people are. But its giving what every 20 years the future sea level rise will be. The reason that its negative here in 2020 is because we've used the vertical datum, the NOAA v datum, to actually translate all these to 1988 datum. And the reason we did that was if you are doing a construction project, you're going to build it in 1988. You're not going to say hey what sea level rise is it now and what is it going to be in the future. So, we used the projections that were in 2000, we brought them up to 2020, and from there we translated them to 1988. We presented this to NOAA, and they really thought this was kind of a cool tool. So, it's just one way of looking at it.

So, then we go to the FEMA flood hazard layer this is pulling direct from the FEMA special flood hazard zones. This shouldn't be a surprise to anyone one. This one is probably the slowest to draw. That's why you see I left this box here. Sometimes you have to zoom in to see this layer.

It will give you an error here on the left in red and say need to zoom in to get to it. So, you zoom in and it will show you different the VE, AE, AO zones and it will have the base flood zone elevation if there is one for the flood depth. And you can see the graphics here tell you what those are. That's present for the whole state of Florida, it's not just in the coastal building zone for this one. The NOAA high tide flooding does also come from the NOAA digital coast. Essentially its rendering areas that are of low topography that tend to have a- essentially annual occurrence of tidal flooding at a higher rate than other places. And that's kind of what that red area is. And you can see that as you zoom all over. So, think of nuisance flooding, king tide, sunny day flooding, that's where those areas are most reoccurring. The terrain elevation is an interesting one. We're actually feeding it from NOAA. We wanted to feed from the Florida GIS, but the new Lidar isn't 100 available all the way in the coastal counties. But as that is QA by its actually uploaded to NOAA. So, we're pulling this live from the NOAA site. So, if you click anywhere on the map, it will actually give you the terrain elevation in the 1988 datum so its really helpful. Especially if you're doing a SLIP tool to figure out what is the lowest- if you're doing a SLIP report what is the lowest area that I'm looking at here.

Alright, so we talked about the public mapping functions, and now I want to talk about a signed in user. Because most of you on here- I mean if you're a local government, if you haven't used it yet, you are going to be asked to use it eventually in the future. So, when you sign in up here, you just click on the little bit up here, that's the account user. When you open your account, it gives you some information about your profile, the project you have stored, the reports that you have already submitted or have in progress, any notifications that the system has sent you, and you the ability to change your password. If you're an admin user in your organization, let's say you're the grants manager, you will have the ability here to create new accounts or view accounts within your organization. So that's a good feature to have. If you don't know if you have this, you will want to talk to DEP. DEP is the one who is issuing the accounts. Once you are signed in, if you want to add a project, you want to click on the projects here, click the button add project, you can see I got a whole bunch of test projects that I put in. and I got, the organization obviously is Taylor has put them in, usually your organization will be your county, municipality, the district, that you are with. And when you click add a project it's going to come up with all these inputs. We tried to make these inputs very user friendly. It doesn't require a lot of information.

Typically, the people that are inputting this information are the grants manager or the public works officer at you know a county or municipality. So, we wanted to make it fairly simple. So, you can see what is required is the name of the project, the county where it is located, the category- is it a vertical structure like a building or more horizontal structure such as a road, parking area or maybe it's an underground utility, the risk category goes along with the vertical building. So that's risk categories 1-4, if you're not familiar with those it is an engineering term used to define the design loading. The critical elevation, this one is kind of a tricky one. The critical elevation should be the lowest first floor elevation.

So, if I think about if I'm building a structure for example its usually you know supposed to be your base flood elevation plus at least one foot as per the Florida building code. So that critical elevation would be your BFE plus that one foot. It could also be the lowest opening or if you got a utility that is low. Or if its a roadway and you got drainage it might be the bottom of that. That stormwater outfall because that tends to be the area that is most susceptible. So, we labeled that critical elevation, its defined by- in here but we leave that open to the person who is putting in the information. And then we ask for the construction start year, the expected design life, and then the estimated construction costs. So not a heavy load, once you hit save the project there, the project will show up in your projects. And you click here under SLIP study tool for create a SLIP study report. You will get a popup that asks you to click on the location. Right now, the location is the centroid of the project. So, if you're doing a roadway and its many miles long then that is going to be once again the centroid of the project. I hate- this is something that we- we'd like to enhance in the future to make it a polygon. We just haven't gotten there yet. so, you click on an area, and you click ok, and as you do that it will ask you to create a report. So, this is an area in Duval County, and I happened to pick in Jacksonville beach you notice I put an arrow and I can actually zoom in to see where I'm clicking. I find the location, I click create report, and then it will ask me what project do you want to use. So, I go under project name, and click the project that I just typed in, or you can add a project here, click create report one more time. You will get this circle- this circle while you're waiting. It will tell you where it's getting the information from.

Once again, it's pulling it live from all of the places we talked about. All that data. Once you get there of course it looks like this. It actually one page that you scroll down, I just put two pages here. On the top left you can save the report, you can export or print to a pdf, print it and save a copy of it for yourself. What it's showing in generally, this is your inputs, this is what you put in, and the date of when you put it in. You can see here then this is the results. This is kind of a summary of what we're- what was presented. So, we've got the average annual chance of substantial flood damage, the FEMA flood hazard zone, the base flood elevation, the terrain elevation, that sea-level rise or scenario and the wind zones. And the reason that this doesn't have an average annual chance of potential flood damage is because when we did those, we did them in areas where it had BFE, and you notice this one is in a FEMA flood zone hazard zone X. So, it's in the 500-year flood or the 0.2% annual chance, though it doesn't have a base flood elevation. So that's why this is unable to be calculated. And if you read down here it explains what that calculation is. I'll talk about it in a little bit. And then this even talks about sometimes why its N/A. Another thing I will say is the average annual change calculation can only be done for vertical buildings right now because we don't have the depth damage functions required to define substantial flood damage for horizontal structures such as roads, parking lots and utilities.

So, after you've looked at the summary it has the potential adaptation strategies that are suggested with some very general timelines along the scale of it. If its green, grey, or hybrid, adaptation, what type of protection it provides and then a general relative cost from low, medium or high. And going forward

you also see some public safety or environmental impacts that will give you some flood risks, it will say you know low, medium- low, moderate or high here. Wind risk it will talk about if its low, moderate or high. And then explain the risk and that is related to the wind risk and the potential down powerlines. Then it summarizes all the data we just talked about so here is the FEMA flood hazard zone risks at the area that we selected. Once again, it's that 0.2% for the 500-year flood without a BFE. Here's the NOAA regional scenarios for that location where the project was. Once again, in 1988 and it's doing it in future years for the project. Then the intermediate high the one that's in black, the default is – is has confidence bounds on it here in the yellow. So, you got a graphic that you can look at. See what the different scenarios looks like.

You can also look at the NOAA hightide flooding information, we just use the low and intermediate high and we put a graphic here with high tide flood days for year. Once again, this data is coming directly from NOAA in the table. The wind zones are summarized. What the maximum wind speed is, and that is dependent on the risk category of the building. So, it's category 1-4, think of risk category 4 as a building you wouldn't ever want to fail like a hospital or a power generating station utility. So those have higher wind speeds if you design to than to something that's a risk category 1. Then the terrain pops up here and then kind of a disclaimer talking about design alternatives.

Alright, so now going to talk about potential pitfalls because people are asking us like "what are you looking for?" when someone's reviewing this. And once again I'm not reviewing it, its DEP so you'd have to ask them the questions. But some things that they are paying special attention to when they are looking at SLIP reports are the risk categories of the building as I explained. Risk category 1, you know is something that does not have a high potential for loss of life at all, which category 4 does. And so, they are looking at that to make sure its applicable to what it is. They are also looking at the critical elevation that was typed in. You know if this said 30 feet, they're probably thinking- I don't know if that's true or not- they're just doing that to say I need to check on these. And then also looking at the FEMA special flood hazard zone and base flood elevation and I think- I can't speak for the reviewers but I think they're wondering does this pass the sniff test. They're not going to reject these. But you know these are going to be in the public eye. So, I think as you do a SLIP report you should wonder huh is a critical facility a hospital or you know a public utility that's in- it should probably not have a critical elevation that's below the base flood elevation, should probably not be in a BFE zone. So, just you know some common sense, what would this look like if it was published, and the public was seeing it. Another thing to pay attention to are the construction start year. Does that seem reasonable. Not a past year because obviously that- it won't work correctly in the expected life. Says its only supposed to last for 10 years, is that reasonable. And then looking at that average annual chance of substantial flood damage and does this make sense? Does it seem appropriate. So, I want to just really quickly cover this annual chance of substantial flood damage, I'm not going to get in to all the algorithm that's there. There is an example calculation so if you're really science-y or math brainy and want to see what it looks like you can go under the SLIP study page on the home page you can download a four- or five-page sample calculation. You can go through all the arrays and all the graphics and understand what has been done. Substantial flood damage as defined by the statute was damages of greater than 25% of market value of the structure. You will note that that's very different from what FEMA definition is. That just happens to be what the Florida legislator set within the SLIP tool. I said before that we only do this average annual chance for vertical construction so not for any horizontal and it uses the following data. It's looking at you know the critical elevation that was input, the existing terrain elevation where the button was

clicked and then using- it uses the FEMA data of base flood, storm surge flooding, annual exceeding probability from the 10% or the ten-year, up to the 0.2% for the 500-year and that's using sea level rise at the design life of that project.

So, what this looks like if you can consider it graphically, is that if you can imagine in this yellow here is the structure that you're building. This is a FEMA diagram not one for the state of Florida. And what the algorithm is doing in the calculator is calculating the total water levels. Which is really sea level rise at that point in the future. Plus, the storm surge Stillwater elevation those are the ones I talked about. The annual exceedance probability for- that are in the system that are coming directly from FEMA. And then we're adding the wave height on to that. We've done a wave ratio method and we've also done you know making sure that you know looking at the depth limited wave based on the terrain elevation to make sure that it will have waves or will not and if the wave is breaking or not.

So, then its's comparing with total water levels, that's what this is- total water levels from the terrain with the sea level rise with the storm surge with the wave height to some depth of flooding in the building. And that depth of flooding is figured out by over here on the right. We've got a graphic that comes from the Army Corp depth damage function of damage percentage of structure values so that go in that 25% most likely here happens to be at 1.5 feet. Right now, we're just using the NACCS study depth damage function. They're the most recent ones the Corp has done and we're using a commercially engineered structure because that tends to be public buildings in the state of Florida. And then once it does that it is interpolates it backwards into calculating that annual exceedance probability associated with this depth of flood, so that's how that's figured out.

Alright, so in closing I wanted to show you some recent website enhancements. You know, we heard you. I've had people tell me like oh my gosh there are so many. You know it's just a list of SLIP reports. Since people have been using it since July there's a lot more SLIP reports on there. Recent updates that have actually rolled out yesterday morning at 7am, added a map to help users to view the SLIP study reports. So, when you're in the SLIP studies section that's once again under learn SLIP studies or the bottom left from the homepage. If you click on that, usually it just looks like a list, it used to look like this. We kept the list, so the list you can go down, and you can look there. They were done when they were published so from the newest to the oldest. You can scroll the list and view the report. But we thought it'd be a lot easier if we created a map. So, you can toggle over the map and what you see on the map, its also a new layer, so you can see that it's a layer right up here on the top, under coastal building zone this says SLIP study reports. Now what you're seeing here is these little green reports. Green checkbox means it's a published report. Only the public can see those, published reports.

But within your organization you can actually, if you're a signed in user, you can view anything that has been- not submitted but saved. Anything that has been submitted to DEP that you're waiting for an answer on and any published reports. And on the right, we tried to make it a little bit easier, we put a keyword search in. So, if you know what you're looking for- you can type in oh I was looking for that living shoreline in this area. Or I was looking for this park. And it'll- it'll filter by the ones that are there and you can select your county. And you can hit update or resubmit filter. Trying to make things user-friendly. Once again, we are listening, and we do appreciate your feedback. When you click on a report, what you get is a real quick summary of what's there, when it was published, saved, or submitted, if you happen to be signed in. And just the inputs that were put in and then kind of the summary of the average annual chance of substantial flood, if you click view project. It will give you that project page, if

you click up here- view report, it takes you to the report. So, we are trying to make it just user-friendly. So, if you're doing a SLIP report you can look around you and see which ones have already been published or some of the organizations said they would do one and you're not sure- you can at least go in there and see.

Alright, we also added a reCAPTCHA. Down here at the bottom, I am not a robot, to reduce the email spam because DEP was getting all kinds of interesting things down there. So, in summary and in closing, you know the SLIP tool isn't perfect. You know it was a- something that we created together and spent a lot of time designing with focus groups and with DEP in a very quick 6-month period to be able to meet the standard for rulemaking and what was in the statute. It does require minimum inputs, it is user-friendly, it does give you a minimum standard SLIP study report and those reports are then available to the public. I will say it has room for growth. I mean there are- I'm sure many of you on here can tell me what you think is wrong with it and I- no tool is ever perfect and there are definitely enhancements that we're currently making. So, if you have feedback, you can tell Grace and Marisa, you can respond to resilience@FloridaDEP.gov, and we would appreciate your feedback. I think more refined analysis you know is available in the future. And I think SLIP tool is going to be integrated into with Florida state-wide vulnerability assessment. But I will let Eddy or Grace speak to that. I will hand it off to you guys.

Any questions in the chat?

Grace Altenburg: Awesome, Thanks!

Angela Schedel: Thanks Grace.

Grace Altenburg: Thanks- yea, thanks so much Angela for sharing on the SLIP tool! And those enhancements are really awesome. So, I'm going to turn it over to Marisa to start calling on raised hands. Again, you may use the raise hand feature located in the top tool bar to ask your question or you can drop it in the chat. So, pass it on to Marisa for any questions for Angela on the SLIP tool.

Marisa Gleason: Thank you. And I don't see- oh. Someone just raised their hand. Christina if you would like to come off of mute and ask your question.

Christina Lingvay: Hi, thanks so much for that presentation. I just had a quick question about who can make an account to kind of use the extra features. Is it just public entities that are allowed to make accounts or if you know- if we're a private firm that's hired by a public entity, can we also make an account? Is it kind of like open for everybody to do?

Angela Schedel: I'll let DEP answer that. I'll hand that over to Grace or Eddy.

Eddy Bouza: Hey, so we can definitely make accounts or like test accounts. We prefer that the reports that are actually submitted to publish are only actual you know projects that require the SLIP study. So, we have a couple options for that. We can either give you access to just like a play account or we can like create you a real one with sort of a disclaimer like "hey please don't actually submit these if you're just kind of exploring the tool". If you're not actually a state financed constructor, we prefer that you don't actually submit those for publishing.

Christina Lingvay: Okay great, thank you.

Marisa Gleason: And I don't believe we have any other questions at the moment. But we will have time at the end if any more questions do come up.

Angela Schedel: Great! Thank you all so much for your time.

Grace Altenburg: Thanks Angela and thanks for joining us today. I'm going to now move on to our next presentation. Ryan, would you like to share your screen? We can start.

Ryan Wiedenman: Yup! Will do.

Grace Altenburg: Sharing, awesome. Great, thank you.

Ryan Wiedenman: Cool, thanks for giving me the opportunity to present today guys. Going to talk a little about our resilience and recovery efforts in Mexico Beach. I am with Atkins, and we are the- basically the disaster services recovery manager for the city. We're their consultant who's working with them. Trying to get all their grants done and help the with the whole recovery process from my goal which we'll talk about here in a minute. But today is kind of just- I think of it as, for me this presentation is really just about how we've tried to integrate resilience into those recovery efforts. Which is not something that happens. Often, I think the best time to try to start talking about resiliency when you know you got a storm comes through and you know rips up a lot of your infrastructure. This is a great sort of opportunity to try to do the build back better mentality.

So, you know before the storm I always kind of pitched that Mexico Beach was this quiet, authentic, family-friendly little beach town. That was never expecting to be at the heart of a major storm. And you can see basically the entirety of the city here in this aerial. You know it's a small town. What less than 2,000 you know full time residents. They're obviously a beach town so they got a lot of folks coming in as tourist season comes around.

But you know overall, you know they don't have a huge area. I think it's like 3 square miles, is what makes up Mexico beach. Something like that but you can see this canal system that runs through here. That's the sort of the main economic drivers of the city and they do a lot of boating and fishing out of there. You can see the pier out there as well. Mentioned this already, you know just to kind of give you a reference point of where Mexico Beach is, up in the panhandle. Just a couple of fun facts for you there. Again, they're kind of build themselves as the dubarry on the water- not dubarry, the mayberry on the water. Sorry, got my words mixed up there. And they- really again they are really big on- sort of small fishing boating activities town they're just inside the central time zone. So, if you ever wonder where the central time zone in Florida starts it's over there, right at Mexico beach.

And one of the things about them that made this whole recovery process difficult is you know they're really separated kind of out on the edge of a county and away from the major population centers there in Panama City and Panama City beach. I think they're about 45 minutes from Panama City and probably another 30 on the other side away from Port St. Joe. So, that's where Mexico Beach is and that really sets the stage for Hurricane Michael in October of 2018. And basically, you remember back then it made landfall as a cat 5 hurricane. You know I think - you know, hopefully no one is getting the sort of PTSD feeling from Hurricane Ian recently, but it was you know very similar in my mind. I remember thinking as the end was coming through. Like oh man this can come up through Mexico Beach and hit us again up here which would be really difficult and devastating. But that said it was really a huge storm with a big impact. You can see here over on the right, again I mentioned Panama City is about 40 minutes to the

west, northwest. And Port St. Joes is about 30 to the southeast and both of those places were recording storm surge levels of around 11 and 12 feet. And Mexico Beach we were getting about 19 feet. So just in that small differential of the area just the way that the storm came in and the way the surge hit.

We really took the brunt of it in Mexico Beach. And it put the city on the map. National news, you can see all of the clippings and stuff I pulled here. You know it was just really a bad place to be in. And I'll- you know we saw the devastation basically across the city. I will show you kind of an aerial pre and post in just a second here. But basically, in a lot of ways the entirety of the city was kind of wiped off the face of the earth. And lost you know tons and tons of homes. I think almost all their city infrastructure was incapacitated to some degree, they didn't have utilities, and a lot of key landmarks like the governor and here on the left were destroyed and there was just storm debris everywhere.

So, again pre-storm you can see the aerial here. Sorry that its black and white partly. But it's just the way I pulled it from google earth. But you can see all the homes and the pier out here serves as a landmark. And when I flip the slide here, you can just see the overall devastation post storm. Things like the pier were washed away, water treatment and water storage tank were destroyed. MX-1, their primary lift station was knocked out, canal parkway bridge was washed away. Marina and boat ramp were basically filled with debris and sediment after the storm from the storm surge pushing it in. We had 15 feet of water in the police and fire stations. The dune system was flattened. Without basically didn't have any protection. We lost all our dunes, dune walkovers. The Getty was washed out and basically wasn't functioning to stop more debris from moving into the canal system, which was an issue. 15th street bridge which is kind of the main truckline road was- and the culvert was blown out so there were two places where that street was basically out of commission. And then throughout the whole city we had things like storm debris, non-functioning lift stations, water, sewer, stormwater- all broken or destroyed. Road and sidewalks were damaged, and a lot of park facilities were lost.

So, you know now I want to kind of shift just after that set up. To you know "what do we do in the aftermath?". And you know, "how do we again integrate resilience into that?". And normally I'd do a couple slides when I'm giving this presentation on you know the immediate aftermath, sort of you know the short-term recovery. Getting all the debris picked up, the emergency protective measures. All that kind of stuff, skip that for you guys and jump in kind of right into the medium term. Which I think is what we really started thinking about resilience and we moved from you know sort of that response mode of emergency management to sort of the more recovery oriented and resilience-oriented mode. So one of the biggest things that I think really helped us kind of set the stage for building resilience into recovery was that we got an FDEP grant to help us to fund resilient redevelopment plan and that really helped. We did public meetings and all that kind of stuff. With the small town that's integral because citizens want to know what's going on and they expect you to kind of give face to face contact to work through these ideas and how are we going to do recovery in a resilient way. So, that was really helpful. And really kind of set the tone for how we were going to do recovery. And in this medium term you know we were working on things that were like rebuilding the water facilities, getting the storage- new water storage tank built, building in those lines.

Working on really those critical, essential things you have to have to keep a community running. But while we were doing that we were even trying to do things like elevate the control panels on our lift stations. And as we were rebuilding roads and bridges we really worked hard to try to integrate mitigation dollars through the FEMA public assistance 406 program. Which I think, you know I would

recommend to anybody. It's one of those things that if you worked in recovery, it's hard because there's a lot of pressure to get things rebuilt back quickly. And the 406 add-ons to your rebuilds, do take some additional time to try to meet out. But in the end, you know they really made I think the city better, and they are in a better place now in the long term. So, I'm going to talk about this example of the canal parkway bridge in a second, but you know just remember this 406 program if you're ever you know in the recovery realm, I can't recommend it enough. So here's just a couple of the things we did resilience wise. Again we- here's our resilient redevelopment plan and this was in, kind of ran- the process ran in like 2019 to 2020. We on- places like 8th street bridge, places where the bridge was ok, but we had the utilities got wiped out, so we hardened there to try to protect those going forward. Our next one, our main lift station- we used 406 mitigation there to elevate it. It had been sitting at grade prior to the storm. And that was a big part of the reason that it was damaged and incapacitated. So we were trying to do these kind of things as we rebuild throughout all of our projects. So here is just the case study that I wanted to walk through with you guys. I'm just going to show you some pictures and stuff. This canal parkway bridge as you can kind of see here, the canal runs out to the gulf, down to the south here. You can kind of see how the water is set up. And so then there's a lot of infrastructure down here. Like the city has a pavilion down this direction south, they have parking and stuff all along here, there's homes down here as well.

Basically this salt creek from the west runs in here and drains into the canal system which then drains out south to the gulf. And so when the- when surge came through we had a lot of water coming through. Basically this- you might call it a culvert, a lot of people call it a pipe in the ground, got washed out and the road got washed out as well. So then there was no access over to these homes. And you know, facilities that the city owned. So it was imperative that we got this repaired quickly but we also again wanted to take the time to try to implement 406 mitigation into it. And this is just after the storm you can see the pipe there, the culvert. Whatever you want to call- It's not a culvert, it's a pipe, that ran under the ground. And right here you can see it as well. Everything was just washed out so there was no access down this direction looking south on this right picture.

So when we rebuilt, we did some really cool things. One was that we just created a permanent hardened structure that wasn't just a pipe in the ground. We additionally increased the capacity of the structure to allow a greater volume to pass through and designed it to withstand that and so that was great. And of course we protected utilities along the top as well as we had done on 8th street bridge and I'm really proud of it. Took some good pictures there that obviously you can see how nice it is. And how we've- you know, this project actually got done pretty quickly, I think it was just two years after the storm we had this one completed. Which you know I don't say that with tongue and cheek. I mean it takes a while to get some of this stuff rolling and to get approvals from FEMA and all that kind of stuff to get these kinds of projects funded. So this was real success story for us. I think we are again in the context of trying to make our city more resilient. This was a really good example of how to go about doing that.

So that kind of shifted us from medium term- after we finished those projects sort of the water, sewer, bridges, those things you have to have to keep the city going. Then we really started really shifting towards the long-term recovery projects. These are like sort of the bear big projects that take even more effort to get the funding squared away on and you know I don't want to say that they're not critical because they obviously are critical. But a lot of these are more oriented towards sort of resilience in the economic sense or the long-term sense. And so we kind of saved these purposefully for- towards the end of our recovery because you have- you got to get the debris picked up, you got to get you know

utilities and stuff restored Then you can kind of focus back on the structures that are really doing- you know they're doing their work for the economic health of the community. And a lot of these projects are funded by public assistance dollars. But there's also a lot of cases that we work hard to try to supplement them. With things FEMA, HMPG, CDGB-DR program, the national fish and wildlife foundation funds, and the national resource conservation service funds. And so here is one example of one in the longer-term where we had sunset park. Where we basically had a facility that was you know located in a V-zone and was at- had been at a grade zone, it had been grandfathered in essentially. When we rebuilt, you can see I'll show you on the next picture here, but we've basically elevated it you can see here that it's up and its looking great. This one just got finished maybe two to three months ago and we also used piles in there to prevent surge damage. The restroom facility here that's on the left picture is now elevated up as well. And it looks, I just think it looks great- it's a good looking facility right overlooking the beach for the city.

We also spent a lot of time repairing the marina you can see these photos of just after the storm just debris everywhere. Everything was kind of a wreck, and first step was obviously cleaning that up. Did a lot of dredging over time to get sediment out but we also again as we rebuilt the marina and boat ramp area, we did a lot of things to try to integrate resilience as well. Where we floodproofed and elevated pavilions. We worked with FEMA to fund a mobile restroom. One of those units that can be moved so that we can place it down. Down near the beach and canal head where people were using it or wanting to use it. But also be able to pop it on a hitch quickly and pull it out of there when major storms are on the way. And then we did some embankment protection through armoring that I will show you some photos as well. This is the pavilion up at the boat ramp. You can see it's a little far away. But it's elevated up there I think about two or so feet which is where it needed to be for the floodplain that it was in. It's also looking good; this is our armoring right along the canal- marina area there so this had all gotten kind of washed eroded away during the storm when surge was coming through and now we put in these armoring stones to try to protect that and reduce erosion.

Another project we did was the Getty's. This one well I should say- another project we're doing is the Getty's. This one on the left was the Gettys just after the storm, you can see the city had some- stone basically coming down to here on the left picture and on the left- yea the west side of the canal you can see there's still some bits of it- remains of the Getty, the rocks. There but a lot of it had gotten washed away and there was already kind of an erosion issue down on the edge. So as we were working to get this project funded. And are still working to get this project funded. The new conceptual design is pushing to stabilize and protect that shoreline and also I mentioned dredging here a couple times. The city had been constantly dredging even you know prior to Michael just because they didn't have a Getty system that was allowing for sand bypassing. So you know through the 406 program again we worked with FEMA to allow for some extra mitigation measures. So that we could sand tighten the Gettys. And allow for 100% sand bypassing. So that- this is one I think is what I'll say is going to be a real success story. We haven't built it yet, its in the mist of permitting and FEMA environmental review right now, but we've gotten the scope at least approved which is exciting.

For the pier this is another one that hasn't started construction yet. We're going through permitting and environmental reviews. But one- a couple of the things we agreed on, this was a wooden pier prior to the storm and we're using FEMA PA funds once again to do- upgrade some resilience features including using concrete piles in place of the wood piles. And we're also elevating the dock elevation which had previously been at 18 feet and now to 26 feet which will allow- basically will really reduce any surge or

wave action that impacts the pier, it will reduce the impact from that. So we're excited about that one as well. Again these are sort of the tail-in projects that we've had a little bit more time to think about them and so we've had some real opportunities to integrate resilience in there.

And then the police and fire station, were- we've got a new municipal complex plan. This is just the- sort of a sketch layout. Again, its conceptual, we're still working on trying to get the funding for that. But the biggest thing we're doing here is the police fire station was located- I mentioned that it got about 15 feet of water. And it was located very close to- located first of all in the 500- year flood plain, which is bad news for a critical facility for a start. But then its very close to the gulf so it got some surge there as well. So our biggest idea there was we want to move that out of the flood plain. We're also going to harden it and create a community safe room that we're getting funded through the FEMA HMPG program so that first responders will be able to- to be able to shelter during the storm. So this is one of those examples where we're going to plan to use multiple sources of funding. To basically integrate resilience into our rebuild process. And this Is just showing where the police fire station was located prior to the storm. You can see we got water very close to it and there's not tons of area in Mexico Beach where there's not floodplain but there are some. And the city is working hard to try to rebuild their infrastructure there when possible. So we've got an area identified where ut's close to our existing city hall as well where we can potentially construct this police and fire station and again protect our first responders and that critical facility.

So I'll just whip through real quick of some of the major challenges. I'll do this one quickly because this is really more aimed at your kind of emergency management person. And you know a lot about the 428 process, but in general there is a program that FEMA has called the 428 program which is pretty new. Which though public assistance you can agree to a set dollar figure for a project, essentially. FEMA normally reimburses based on- actual based on reconstructing a project based on the scope that has been outlined. But the 428 process really- it's a good program in that it allows a lot more flexibility in terms of what you want to do. So that you don't just have to build something back the way it was. So it's aimed partly giving FEMA a little bit more stability in terms of their fiscal resources but also you know allows you to build in a little more I would say sort of those resilience features in your project because you have more flexibility in the scope of your project. So we had some problems with it though in that you know- as you can imagine during this recovery process from things like being away from major work forces, having a lot of construction work after hurricane Michael, having COVID-19 material shortages which are driving up prices, then hurricane sally came through and further increased construction work, really made it difficult because our projects where we had set costs; now as we're going to bid them out a year later after they've been obligated. The costs are going way up. And the original cost that we had kind of agreed to are no longer applicable. So it made it really- it has made it difficult for us in a lot of ways because we're short on funding for what the project should have cost you know years ago. Which you'll see I think across the board in many cases in their recovery process.

And then we also had challenges with managing cashflow in a small city. Mexico Beach only has about a four-million-dollar annual budget and there always a need to like try to rebuild back quickly and you know get projects moving and out the door. But if you're moving and doing them all at the same time, you're having to spend a lot of money. And contractors are going to want to come in and get paid and so when we're go through and trying to do the reimbursement process, you know with the state and FEMA to get that money back. That's not always quick and you know in short the city ended up with a lot of cash flow issues where there were, they didn't have funding on hand to pay contractors quickly as they

would like. I think we're past a lot of that now but that was a real issue early on the storm when you know millions and millions of dollars of work were getting done on all in a short period. Another problem was just with a small town, you know a lot of the city staff didn't have experience with you know managing the grants themselves. They had only ever done you know really small grants and here they were getting millions and millions of dollars' worth of grants. And just trying to document everything was a challenge. And they didn't necessarily have systems set up or workflow to track all of that. So we had to- on the Atkins side we were really trying to come in and help them with a lot of that. Just basic stuff of how a city would operate. And then finally, you know I mentioned that it's great that we're bringing numerous funding streams together to try to complete projects and make them more resilient. So it was needed in a lot of cases to try to do this the right way. But there was a lot of and still is ongoing conversation constantly with a lot the federal and state agencies about things like duplication of benefits and the city has done a really great job making sure we're not duplicating any benefits and not taking money to do the same thing twice.

But when you have overlapping fundings when you're doing a project like a police and fire station where you're both, you know building it back but then also trying to build it stronger on top of that with additional funds. You have to do a lot of splitting things up on invoices and it takes a lot of effort to try to track all of that. So that was a challenge and still remains a challenge for us just as we try to implement these projects. And delineate the funding to the right places. So in the end you know this is just where we stand today I showed you the initial amount where I was showing you all the issues. But here is the sort of successes that we're seeing already or will be seeing hopefully before too long in the future. The pier will be rebuilt with concrete piles at a higher elevation, we've restored the water supply system, repaired MX-1 the main lift station and elevated it, we fixed that canal parkway bridge and built it into a resilient bridge and culvert system, we did marina, armor flex armoring, and elevated pavilion at the new boat ramp, we got police and fire station which will be integrated into a municipal complex at a safe location and have wind protection, got a berm in place to provide temporary protection and then obviously opportunity for new vegetation to make that dune system more resilient and build the dune walk over into that, we'll extend the Getty and make it sand bypass at a 100% and we replaced the culvert and added some new wind walls so that's looking really good and then you know removed over 15 million dollars' worth of debris and got the lift station and wastewater restored, got stopper lids on all the man holes which is another 406 project that I didn't mention previously, roads and sidewalks had been repaired and extended in many places.

And we've better park facilities that I think are improved and under development now. So just looking forward you know our goal is to try to receive obligation on like our 3 out of more than 50 remaining PA projects. Get those marquees projects like the pier, Getty's, and municipal complex integrated using a lot of different funding sources. We're also working with the city again to try to do some of their economic take resilience efforts, where we're expanding the boat ramp to be able to include or to have another ramp so there will be more space to put in more boats. That's through a FWC grant, we'll harden the municipal complex, we're doing stormwater improvements which is part of a bigger park plan for the city to integrate you know park areas into those improvements. And one of the biggest things we've received is through the public assistance program we did get a waiver on the city's local share match, which has been great because the city is so small they don't have tons of funding. So now they're getting all their FEMA public assistance projects funded at a 100%, which is really incredible. On the right here, you see just our dune walk is on the lower slide and then our new welcome center on the

top. So that's all I've got. But hope you guys enjoyed and thanks for giving me an opportunity to talk through some of the resilience efforts we've gone through in Mexico Beach post-storm, and I'll be happy to take any questions. I guess I'll throw it back over to you Grace. If you want to moderate that.

Grace Altenburg: Awesome! Yes, thank you so much Ryan for sharing Mexico Beach's resilience initiative with us! I would like to turn it over to Marisa actually. She's going to handle any questions you might have. If you have questions for Ryan please use the raise hand button or drop it in the chat, Marisa.

Marisa Gleason: Thank you. And we do have one question in the chat. I'm curious whether strategic retreat was in consideration for certain areas in your recovery planning process?

Ryan Wiedenman: Yeah, I would say to some degree it was. I mean I think we talked about things like the new location for the police and fire station is much farther away from the gulf now. And so you know that was things that we had control over directly in the city. We tried to think about that. I will say there's not tons of room as I mentioned in the city to move completely out of the floodplain. I think we tried to get out of the storm surge areas and V-zones when we can. But it's been- that's been a battle and I think in any coastal community they're going to say that. But you know it's just people want to be by the water at the same time as we need to protect that so or protect our infrastructure so. It's kind of a mixed review on that I would say. In some cases we tried to do it, but we haven't done it in all cases, and I think we could've always done a better job.

Marisa Gleason: Thank you, and we have a couple more questions that came in. I see a lot of hardening of the shoreline but were any dunes and green infrastructure considered during the design?

Ryan Wiedenman: Yeah, when- you're right I mean I think it has been definitively much more sort of the hardening path maybe I guess you would say that we've taken. But we definitely have done, we've- I'll saw two things about dunes. One is that when we put the- we've done a lot of having to rebuild the dune system. So within that, you know we've definitely considered that and have been replanting vegetation and all of that. We've also gotten a lot of- well not a lot, we've gotten some grants to do that vegetation replanting. And to try to you know stabilize those dune systems. So we've definitely considered them, considered that, and I think I've done a good job on the dune side. On the green infrastructure side we haven't done as good of a job. And you know again part of it- it's just a constraint of space and that sort of thing- I think. And also just you know there's not always a mentality to be able to do that sort of thing post-storm. And we've tried to do it in the places that we can. In cases where we have sort of the political will to do it, but it hasn't been you know 100% political will. To go forward with those kinds of initiatives.

Marisa Gleason: Alright, thank you. And we do have one hand raised. And we'll take that question and then we can finish the rest of the questions at end of the forum, just to stay on our timeline. Janet if you'd like to come off mute.

Janet Bowman: Sure, I'm Janet Bowman with the nature conservancy. I'm interested in hearing you describe how you've chosen you know the elevation for the lift station, and you know what you look for in terms of elevation for the new public safety facility. You know just what some of the considerations are?

Ryan Wiedenman: Yeah, so mainly I guess maybe to start I'll say that a lot of the things, infrastructure, that was built in Mexico Beach had been older and grandfathered in- it was located in the floodplain in many cases and not up to the code, that it needed to be. So first and foremost a lot of what we did in terms of elevating those things- in terms of elevating those things was just you know convincing FEMA; like hey there's a code standard that exists that we need to come up to post-storm. So, when we did things like the lift station panel elevations it was really just things like saying hey this is what the new code is, and we have to elevate to that. So it wasn't anything super fancy, but it was a big step in the right direction for the city. In terms of things like the police and fire station, we're going to elevate those based, I'm trying to think- I think because they're still trying to figure out what and haven't constructed it- I think they're still trying to figure out how much we can elevate it with mitigation. They're certainly going to up to what the code allows there and that will be in a non-flood plain not even in the 500-year at the new location. So we'll have to- we won't have to go up very high according to code but will try to get sort of extra free board built in that through 406 is our plan there.

Janet Bowman: Yeah, well this is a follow up. Will that be adequate? If you know if hurricane Michael hit again would that, would the same facilities particularly the lift station.

Ryan Wiedenman: Yeah, and we did- it should be. I guess I will say straight up I'm not an engineer by trade, but I remember having a lot of conversations with the engineers who do the H&H around there that the height that we elevated it should protect against that level of storm surge.

Janet Bowman: Okay. Great, thanks and impressive work.

Ryan Wiedenman: Thanks, yeah it's been a journey.

Grace Altenburg: Thanks Ryan! And thank you Marisa too for facilitating that question-and-answer session. I going to now move on to our final presentation, Nick if you want to share your screen. And then at the end we can come back and revisit some more questions that you might have for Ryan. So Nick you can take it away. Thank you Ryan.

Nicholas Muzia: Alright, can you guys see my screen?

Grace Altenburg: Yup, looks great.

Nicholas Muzia: Alright, excellent! So, thank you very much. Again my name is Nick Muzia with Martin County Public Works. I'm an infrastructure manager and stormwater engineer here at the county. So what we're going to talk about today is something that I think is a really cool topic. And we're going to tell you a little about a pilot project that we did here in Martin County that proved that this concept really does work. And then I'm going to teach you a little about some of the engineering principles behind what we did and why it's such a great idea. So what we're going to talk about today first is natural solutions and an interesting concept of designing resiliency and seagrass into stormwater.

So first of all, what is a natural solution? So according to FEMA, nature-based solutions are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. So you might've seen one of these other names for it. This is an excerpt from FEMAs BRIC or Building Resilient Infrastructure and Communities grant package. Green/grey infrastructure, bioengineering, or engineering with nature. And today we are kind of going to be focusing more on the engineering with nature aspect. So an interesting

way to look at gray infrastructure would be gray infrastructure consumes materials and it's less sustainable. But at times its needed, but a true nature-based solution can actually create the very materials needed to serve a function. We use- so some examples of this would be a living shoreline or coral restoration that actually grows over time. It creates the materials needed to serve its purpose. Vegetated buffers or stabilized areas for erosion control. You know to help the roots continue to grow and provide that stabilization needed to serve a function. And also what we're going to talk about is beneficial submerged aquatic vegetation or SAV for stormwater. Has some pretty neat functions as well. So gray infrastructure, clearly not a natural solution, this is traditional means and methods, concrete its used in many instances, and this is the method used to solve some of our most challenging problems.

Natural solutions are not applicable in all cases but if we learn where they are and where they can be used, we can start folding them in and doing things a little bit smarter. So, smarter- smarter solutions. Evaluating resiliency, I'm sure I don't have to preach to everyone here- evaluating resiliency helps create a smarter solution for the future. We're looking at the future and seeing how can we design, build, and maintain things smarter. Engineering with nature is a cost-effective and adaptive option when it works as a solution. So this is a smarter way of doing things, especially when you can actually save money or build something that will adapt or grow over time. Often times though, smart solutions are not obvious and they're complex. So it hard, but with some of the right tools, some of the things we're going to talk about a little later today in this presentation, I am going to give you some of those bits of information to make it easy. And we're literally going to get into the weeds on submerged aquatic vegetation at the end.

So I found a quote as we were talking about this topic internally that I think is really applicable when looking at natural solutions. From Albert Einstein, we can't solve problems with the same kind of thinking we used when we created them. So just keep that in mind as we evaluate projects. And now that will kind of lead us to the stormwater aspect. So I want to start with the struggle is real, so stormwater managers and engineers have to balance many challenges here in Florida. And one of the most difficult challenges is the balance between flood control and water quality. Using traditional infrastructure, these become two opposite ends of the spectrum. And my job, this one of the most difficult aspects of managing a municipal stormwater system. The basis of the clean water, the basis of water quality in our state was established by the clean water act of 1972 and also the state of Florida has enacted many total maximum daily loads limit (TMDLs) on water bodies for nutrient reduction. New infrastructure projects are getting more and more expensive by the day. Especially here in Florida when you're trying to acquire real estate and other means. Can we find a more effective solution or implement a retrofit in our existing infrastructure that meets our needs. You know the pressure on municipal stormwater systems continues to grow as the population grows in Florida. It is not going to get any easier. One thing that is important to understand when looking at this, precipitation in Florida- it is important to understand that Florida is different than the rest of the United States. We get more intense storms and more yearly rainfall than most of the rest of the country. Really the gulf coast and Florida are alone in that and solutions that may work elsewhere may not be sufficient for Florida. And we need to be aware of those additional challenges. Erosion control- erosion control impacts water quality, has a negative impact on flood control, and can be costly to fix. But what we're going to talk about a little later and what we'll try to do was incorporate a natural solution to help us address erosion control.

So what tools has mother nature proved? You know mother nature solving problems using natural solution for far longer than any human has been around, and natural solutions evolve. To solve problems, some would say that mother nature had the best drainage system for Florida already figured out but unfortunately the Florida of the past is long gone. And we will probably never be able to get back to sprawling wetlands that allowed the water to accumulate for months and months, reducing suspended solids and the nutrient loads before it entered our rivers and lagoons. So we need to change the way we look at the problem. Cause it's not working all that well. Its not balancing flood control and water quality and as we try to do these projects, there's always a struggle between the two. Can we find- can we find the balance? Is there a tool that mother nature has developed that we might not know about. But I think there is one that was hiding just below the surface that I think many of you are already aware of. Seagrass! Or I'll use the term beneficial submerged aquatic vegetation or flexible submerged aquatic vegetation. And I'll just make it real quick but I am sure a lot of you are familiar- seagrass has a lot of environmental benefits from carbon sequestration, food, environmental restoration, water quality, climate resilience, the list goes on. In Martin County in 2020, we did a pilot project to determine if something like this beneficial submerged aquatic vegetation could work in our stormwater system. And what I'm going to share with you may seem too good to be true. But we're going to learn a little and understand how good of a solution it really can be.

So in 2020, like I said we initiated a test project in our coral garden's stormwater treatment area. I'm going to let you take a look at that list of objectives on the left side of the screen for just a minute. And if I told you we had to design a project that could do one or two of those it would be a pretty cool project, right? But what if I told you there was one single solution that can accomplish all of those. And we're going to get into the details and we're going to try to cover it really fast.

So how? what we did was plant Vallisneria Americana or American eelgrass which is actually not technically a seagrass but submerged aquatic vegetation for freshwater and Ruppia Maritima or widgeon grass, which is a seagrass that has an extremely wide range of salinity tolerance. We planted these in strategic locations within our municipal stormwater system. We planted over 5,000 plugs throughout the stormwater system, specially within the outflow canals. We monitored and changed our maintenance practices to help them establish. And we waited about 1 year. So some of the goals of this were to reduce erosion and sediment transport through our stormwater system into our coastal environment and then try to improve water quality, out compete invasive vegetation, and improve the natural habitat.

So what we learned. We learned the grasses established very well in moving water, between half a foot to 1.5 feet per second. Lots of animals eat it, we think that's one of the contributing factors of why it established in moving water. Because turtles and ducks were less likely to sit on it versus when the water was still. And in the areas where we were we don't really have manatee worries. Because we're far enough up stream where we don't get to these areas but in a coastal area you'll have to consider that. But anyways, snails', fish, mullet, a lot of different things were eating it. We also learned; it has a significant impact to creating an improvement to water quality. We did some control testing in March and April of 2022, so this previous late spring- you know this method theoretical treats every drop of water that flows through a canal. In this area, we had a just about 3,000-acre stormwater basin that all converges at one point. Our coral garden, stormwater treatment area and just downstream with that, we did some controlled testing. We did 2 water quality samples at the exit of our stormwater treatment center and then 2 additional samples- 200 feet downstream with a thick vegetated eelgrass bed. No

other water was coming in, no other water was coming out. We got upwards of 40% reductions in phosphate or phosphorus, TP. And 30 to 40% reductions in TN, total nitrogen. It also had significant reductions in suspended solids which contribute to poor water quality issues downstream. So we saw this and were pretty amazed at how low of a project cost this was. So this project including monitoring. Cost about $20,000 dollars for the first year. Which is about 1% of what a traditional stormwater infrastructure project will cost to get similar nutrient reductions. So we're pretty amazed with this.

So now we're going to get into the weeds a little bit. So how does flexible submerged aquatic vegetation impact your drainage system? So if you're interested in this topic, here is where you're going to want to get out a notebook and take some notes. And this is what's going to be a good learning opportunity. Here's just a couple of photos from a little photoshoot that we did with a camera finding you know various animals and seeing our sea- our Ruppia and American eelgrass established. So the first concept I'm going to go over is sediment transport. Now sediment transport is the relationship between sediment size and the velocity of the stream or the moving water. There are three mechanism of sediment transport: erosion, transport, or deposition or depositing. These can be represented in curves such as Hjulstrom curve or shields diagram and sediment impacts water quality. So I've chosen right here the Hjulstrom curve for a simplistic representation of sediment transport.

You've got three zones, one is erosion, transport and deposit. So we're going to start with a half-inch stone for example, a half inch stone will begin and then- sorry the vertical axis is flow speed, speed through a stormwater ditch or in a waterbody, and then the horizontal axis is grain size, which is the size of stone or sediment. So we're going to start with a half inch stone as an example, half inch stone will begin to erode at 3.5 fps. But it can stay in transport in about 1 fps and then below that it deposits and sits. Sand- sand is one of the most common substrates found in Florida. Sand can be picked up and begin erosion as little as 1 fps. Silt- so silt carries a lot of the nutrients that we're trying to keep out of our downstream water bodies. Silt can begin transport in as little as a tenth of a foot per second. Which is a low velocity in most common stormwater areas and silt impacts the TMDLs that we're trying to keep out or impacts the nutrients based on our TMDLs so we're trying to keep out of water quality so here we've just linked erosion and water quality have a significant connection.

The next topic is boundary layer theory. So boundary layer is a thin layer of fluid that's affected by the surface roughness so the bottom of a ditch and the fluid velocity, the velocity of the water in your stormwater ditch for example. This is where the speed changes from 0 on the surface to the speed of the moving water in the free channel. So the Vallisneria can stabilize the bottom- the Vallisneria can stabilize the bottom to create a boundary layer or improve it. So that's the eelgrass or submerged aquatic vegetation that will grow on there. It will actually increase the boundary layer and reduce the speeds immediately against a sandy or silty bottom. Thus, reducing erosion at a very small scale. But this fee can be reduced greatly and as a result reduces that sediment transport and improves water quality. Flood control, one of the most important considerations for stormwater design, the manning coefficient, manning's equation, so if you're a stormwater engineer out there you've probably seen this. If not the manning's equation is used to evaluate flow and open channels. This can be plugged and the manning coefficient and this can be plugged into most modeling software's and that what a lot of it is driven off of. The coefficient is generally pulled from the table, it's not defined based on the flow speed which can be inaccurate at times. We will go over that in a little more detail there with beneficial submerged aquatic vegetation. This changes things a little bit.

So, the concept that I think is important to grasp here is flexible vegetation, flexible vegetation- the vegetation height decreases with an increase in flow velocity. Or as the water speeds up the grass lays down. And thus, it lowers the flood resistance and impacts to capacity. So this is pretty neat, this is kind of natures way of saying when you need water to move faster, the vegetation lays down and lets water go. But as you're worried more about water quality, your base flow condition where you're not worried about flood control, it slows the water down and can improve water quality. So what I got here is a study that found where they proved this. They took various- I've got a citation there, but they took various grasses of different heights and they put them in a controlled tank and measured the manning coefficient as it relates to velocity. So you can see once the velocity increases, the drag or manning's coefficient reduces poor flexible vegetation. So it's evolved to do this.

Here's another study, similar thing where they did something similar in a natural environment. They showed that the- as the water increased, the water velocity increased, the drag reduced. So natures smart idea, here's another kind of visualization that shows in figure A, we've got a bare bottom to our stormwater ditch or canal, the boundary layer is very near the bottom. Which means the bottom is experiencing its highest velocity and sediment transport is at its highest. Flexible submerged aquatic vegetation or seagrass along the bottom can create a boundary layer; in example B, where we got water moving slowly, it's standing up and it's slowing things down as much as possible. In a flood scenario, figure C, the grass helps to stabilize that boundary layer and still protects the bottom, thus reducing sediment transport and helping us improve water quality and reduce erosion by this natural solution. And the seagrass will grow and spread on its own. In storm water, residence time is a term used for the amount of time water spends in a given area. And perhaps it's the most important term or the important- the most important factor for water quality performance according to a study by Harvey Harper done for DEP for the state stormwater design criteria. So when the speed of water is low under baseflow conditions the water will slow down further and this will increase its residence time and improve water quality. Going back to the reductions that we got out of just 200 feet of vegetated canal. The total nitrogen reductions typically peaked out at about 40%, we got 20% and 40% at one of the months testing just in 200 feet and $20,00 dollar project. To build a dry detention area that's going to keep water for longer than this and now a days with real estate, if it's a new one, it's going to cost you millions. So here we just stumbled upon a pretty cost-effective solution.

Another thing that we haven't really looked at, but I wanted to bring up because I've heard- talked about is blue carbon. You know studies suggest that coastal wetlands can annually sequester carbon at a rate greater than 10% of what a mature tropical rainforest can do. Planting seagrasses or submerged aquatic vegetation in our stormwater system in strategic areas could do the same to offset this as an additional benefit. So, in conclusion flexible submerged aquatic vegetation, what we learned is that its shown the ability to out compete nuisance vegetation that causes us to use other things like chemicals to maintain which we try not to do here in martin county. It also allows us to stabilize the bottom and reduce sediment transport and improves water quality, improves the natural ecosystem, provides coastal resilience by improving water quality and allowing natural features like our lagoons and coastlines to thrive. It can also act as a seeding source for downstream grass beds. There's also potential for blue carbon sequestration or credits with projects like this. Also here in the photo we have baby snook this is in our stormwater ditch. It'll be last place you will find somebody snorkeling, but we did a little but in our monitoring we found snook which I think is pretty beneficial even in from a game fish standpoint. So with that I tried to be pretty quick, hopefully not too fast. But I can go over anything else

if you need but will leave with this point back to Grace and Marisa. And thank you guys very much for listening.

Grace Altenburg: Alright, thank you so much Nick. I'm going to turn it over to Marisa for questions. So again, feel free to use the raise hand feature or the chat function.

Marisa Gleason: Okay thank you, we do have one hand raised right now. So Elaine if you'd like to come off mute and ask your question.

Elaine Franklin: Thank you, yes. This is Elaine Franklin, environmental sustainability coordinator in Hollywood. Nick it's nice to meet you on this meeting today. And thank you for this project you did. So I have two questions, one I'm not familiar with those seagrass species that you all used. Are both of those native to our region.

Nicholas Muzia: Yes, both of them are. Vallisneria, American eelgrass is common to pretty much the entire east coast and southeast of the US. And then Ruppia Maritima or widgeon grass is the same, it's also listed as one of the 7 inter lagoon species which is where most of our stormwater in Martin County discharges to.

Elaine Franklin: Okay great, my second question is now that you've done this pilot and it has shown to be so effective what are you all thinking about in terms of where else this can be done and what kind of recommendations would you have for folks in other areas.

Nicholas Muzia: So we did- after we did this project in May of this past year we did another planting. Made in another one of our outfalls so looking at it we kind of strategically picked areas like the outfalls or within a stormwater treatment area where a precede notation of flood control impact wasn't there. So we- dealing with stormwater from the environmental minded folks to the more flood control minded folks. There's a perception of stormwater that all vegetation is bad in a stormwater conveyance canal so what we tried to do here was to evaluate that. And it has turned into a little bit more of a research project, we've shown that may not be the case and it could be engineered into all systems by evaluating the manning number when the velocity of the water increases but generally in the outflow canals, I look at those as a last line of defense so when we're looking at our discharge into receiving waterbodies so we've strategically picked the outflow canals which are generally they're common owned property right away directly downstream of our last stormwater treatment area or in that general vicinity where everything is about to hit open water. And we picked areas there that we would plant and monitor and then changing the maintenance practice we did mechanical removal of invasive vegetation such a hydrilla and hyacinth to allow our eelgrass or ruppia to better establish. And once it became established then it's so thick on the bottom that it was able to start outcompeting those nuisance vegetation that are generally you know handled by expensive mechanical removal or chemical treatments.

Elaine Franklin: Thank you so much, that's great to hear.

Marisa Gleason: Alright, thank you. And we do have a couple questions in the chat. The first is any management or removal of the grass, just wondering where TP eventually goes?

Nicholas Muzia: Sorry, can you repeat that one?

Marisa Gleason: Yes, any management or removal of the grass, just wondering where TP eventually goes?

Nicholas Muzia: The nutrients- well so the grass in principle can you know talk into the science. Both so I am an engineer by trait, but we don't remove the grass to get those reductions but what as I understand that occurs is the grass itself can remove some nutrients from the water column where typical littoral vegetation that's commonly used really requires the water and the sediment and the nutrients in the water to be deposited and then the plants can uptake that. Some of these grasses can take that straight from the water column but the main engine inside that is the microbes that live on- you know the immense amount of surface area in the grass that are constantly churning to remove nitrogen and phosphorus. But from what I understand, nitrogen is the main thing that a lot of the microbes will remove but phosphorus as well. So a lot that is being consumed by those microbes that are then consumed by other entities and those nutrients are then worked through a food cycle and deposited as heavier form such as animal waste that then comes into you know the grasses themselves. So it's kind of doing a circle loop. But I heard an interesting thing, on how clams fit into this. Where they consume all those and then deposited something in a heavier form, so it takes that nutrients in a solution and then deposited- deposits it so the grass helps doing that from where the nutrient go.

Marisa Gleason: Okay, thank you again. And the next question is, what's the term again? Is it flexible?

Nicholas Muzia: Yea so the, with the seagrasses I've talked to some other people in like the environmental engineering side, they've used the term flexible aquatic vegetation. But I think we can kind of use that interchangeable with you know all seagrasses that is flexible vegetation, all flexible vegetation could be considered or should be beneficial submerged aquatic vegetation. But we're trying to use the term beneficial submerged aquatic vegetation in the stormwater world. So it kind of shows that there's a benefit to submerged aquatic, it's not just slowing down conveyance and causing flood control. Because that's the thing, from a stormwater aspect, it's a balancing act between flood control and water quality. And this solution seems to address both of those. Pray need, so we're really liking the idea here and trying to share it.

Marisa Gleason: Alright, and last question from the chat: how difficult was it to find the SAV and plant it?

Nicholas Muzia: So they- SAV itself was pretty easy, so there are a couple of nurseries that grow it locally in Florida. So getting it was easy and planting it was pretty easy too. I can- let's see try to jump back on the slides to some pictures. So in the picture you'll see here that they come in little plugs was what we did through a company, sea and shoreline restoration. And they have a nursey in Ruskin, Florida but I know there's a couple other people too. One of the reasons we did American eelgrass and ruppia was that it's a little easier to grow than seagrasses. So there it is easier to be these types of species to get some of the benefit with the goal of improving the water quality up stream. And then we can let the seagrasses naturally recruit and recover downstream as well. But what we did was planted these little plugs, literally stick your thumb in the ground and stick one of the plugs in there. And they spaced them out, 18 inch spacing. You know we do lose some throughout that but trying to find areas where the bottom has a relatively sandy substrate or something that's not completely silt. Will allow it to stay- so we planted them in some of our stormwater outfalls where the water velocity can go between 0 to as much as 3 feet per second. So it kind of changes, so we do lose some but generally found that about after a year to a year and a half, you know some of those established communities

started to grow and they were really starting to thrive. And that's what you know we did the project; I'll be honest the first year we were like it's doesn't- not really working as well as we thought. But after a year and a half it started- it became you know a sustainable level where it could sustain the predation and it just- it took off. And we had flourishing grass beds in our stormwater system with snook, mullet, blue crabs, all sorts of animals you know living in there. And then we did the water quality testing and found it really does have a pretty good impact.

Darryl Boudreau: Hey Nick, great- great presentation. I work in the northwest district, used to work for DEP. And they did a Ruppia propagation for our living shoreline projects and you're right that's pretty easy to do. We didn't have much luck with any other type of seagrasses. So, this is opening up a whole new use for that and I really appreciate you doing the presentation and just wanted to let you know I'll probably get in touch with you and other people. Cause this going to be very handy.

Nicholas Muzia: No problem, thank you.

Grace Altenburg: Alrighty, so thank you so much Nick. And a couple more questions in the chat that we can revisit later because of time. Or we can get you in contact with them. And thank you Marisa for facilitating the Q&A. Really quickly I want to go over some resilient Florida program updates. We can share our screen with those. Beautiful, so the Resilient Florida Program Budget and Disbursement team is hosting a discussion on completing reimbursement request via Exhibit C and the required supporting documentation needed. This event will take place tomorrow at 10 am eastern and will be virtual. So please tune in if you are an awarded or executed grantee for the program. You may reach out to Resilience@FloridaDEP.gov for more information as well as the registration link.

The program accepted applications for both planning and implementation projects from July 1st through September 1st and received 269 implementation projects that totaled almost $1.5 billion dollars. And 192 planning projects that totaled almost $50 million dollars.

The program is currently evaluating those applications and developing the Statewide Flooding and Sea Level Rise Resilience Plan which is due to the Governor, the President of the Senate, and the Speaker of the House of Representatives on December 1st. The plan will consist of ranked projects that address risks of flooding and sea level rise to coastal and inland communities in the state and will include all eligible projects submitted to the department pursuant to statute. Be sure to sign up to or update your subscriber preferences to get the most up to date information regarding the grant applications and program using the link in the chat. I think Eddy will add that. (https://public.govdelivery.com/accounts/FLDEP/subscriber/topics?qsp=FLDEP_2)

The next Quarterly Resilience Forum will be held in the new year on February 1st at 9 am eastern. Please join us to hear from Florida Department of Transportation on their Resilience Action Plan and more from our other speakers! Details for this forum will be sent out 30 days before and will include the registration link for attendance. If you would like to present at one of our 2023 Resilience Forums, please fill out a speaker request form, spots are filling up fast and we'd love to hear about your programs, success stories, or resilience efforts! And that form can be found on our Forum webpage which is linked in the chat. (Quarterly Resilience Forum: https://floridadep.gov/rcp/florida-resilient-coastlines-program/content/quarterly-resilience-forum)

I would like to say a special thank you to our presenters for joining us today and bringing insightful topics to our table for discussion. If you don't mind dropping your contact information in the chat just so

that we can relay some added questions just because of the time crunch. I would also like to thank all of you for tuning in to join our resilience webinar. And I also want to wish a very happy birthday to Marisa. I'll spare her the embarrassment by not singing happy birthday, but I did want to say, thank you to Marisa. You are such an important member of this team; you are a wonderful coworker and an even better friend. And I hope you have a great birthday. With that I will pass it on to her to close us out, and I hope you have a fantastic rest of the year and see you again!
Marisa Gleason: Thank you so much Grace, we do still have some time left so I would like to open the floor to our attendees. If you would like to give any updates on your resilience efforts, programs, initiatives, or outreach, you can come off of mute, use the raise hand feature or drop it in the chat. And if we don't have too many updates we can go back and finish out the questions for both Ryan and Nick.

Alright, so I don't see any hands raised or any new chat comments. So Ryan I'll start with a few questions for you that were left over. If you're ready for them.

Ryan Wiedenman: Yup, I'm still here.

Marisa Gleason: Alright, so the first question is: was the utility taken over by a regional entity afterwards?

Ryan Wiedenman: No- well, so Mexico Beach runs its own water, sewer, and they still own it. That's the answer. I'm trying to think if anything else is owned by regional- that they have. I don't think so, so I think the answer is no.

Marisa Gleason: Thank you. Next question, it appeared that the lift station control panel was not elevated. Is it a waterproof design?

Ryan Wiedenman: I think you're talking about the one on MX-1 and I'm pretty sure that it's a waterproof design on that one. I think most of the elevated of utility control panels was on other lift stations, not on the main one.

Marisa Gleason: Okay, and the last one: on the planning side, is there new zoning to control new development particularly in residential and high hazard areas.

Ryan Wiedenman: No new zoning. The city after the storm went in and basically revaluated their floodplain ordinance and did a lot of things like adding the 500-year in as a restrictor. Trying to think of the right way to say that, basically using the 500-year floodplain elevations where they could drive development in that sense. But they did not redo their zoning or anything like that. They mainly tried to promote that resilience through the floodplain ordinance revamp.

Marisa Gleason: Alright perfect! Thank you for answering those leftover questions. That's it for you for now unless someone else has another question.

So we will move back to Nick. There were two leftover questions for you.

Nicholas Muzia: Go ahead.

Marisa Gleason: If you're ready, the firs: I know that a challenge with SAV planting is retention and establishment success has that been a challenge with your project and how have you circumvented that?

Nicholas Muzia: Yea, so it definitely is a challenge that needs to be considered. What we kind of learned was that predation was a major factor and that was- you know that information was given to us by the environmental consultants that we worked with for the nursery and planting. But one thing that we found was that moving water helped to keep some of the larger predators such as turtles and ducks off of it. And then once we had a viable community of you know beds of grasses forming in the moving water then that helped downstream as well. But we did just literally waiting a while and kind of just watching our management practice of the area to make sure we weren't doing anything that would harm it. Then eventually in the- just happened to be in the late springtime or early spring we started to see significant grass beds form in our outflow canal. And we had planted really only a 100-foot area and the grass itself had moved several thousand feet downstream and we kind of contained it in a or we had just kind of for the sake of our pilot project set up a 200-foot area that we were going to maintain and monitor and watch. And that's what we did for the control water quality testing. Just arbitrability picked 200 feet. But how we managed early on the invasive vegetation, we would get hydrilla trying to grow up through it. And we went through a learning process in our inflow canal where we planted as well where the hydrilla and the eelgrass would bud up against each other.

They would both be doing you know thick, and we're like hey the eelgrass is establishing- that's great but then the hydrilla which is really the bane of submerged aquatic vegetation for stormwater will grow up and out in like 30-foot-long chains and the problem with stormwater is that it breaks up- breaks off, pulls everything out of the bottom and then can clog up structures. Or eelgrass when it breaks off it usually does it in just a small bit, the leaves will break off leaving the roots there or the root will uproot a couple at a time not in 30-foot-long clumps. But back to the hydrilla, it shaded out the eelgrass. We ended up losing some. So what we did then was started doing more mechanical maintenance. And just using literally a potato rake going out there and grabbing the hydrilla off the top of the eelgrass every couple of months. We would go out there and pull it off. It became really easy and we ended up hiring our stormwater treatment area/maintenance contractors to go out there quarterly and pull them out and it's to the order of 250 dollars' worth of labor or $300 quarterly. And then they pull out any of the hydrilla that are growing up through. Early on you may- I would recommend doing it more like monthly, just to evaluate your site to get it established. But once it's established after about a year to a year and a half, the maintenance requirements go down. Once you have it established. But then we also had some issues with floating vegetation such as water lettuce and Salvinia is another one. I learned a lot about floating vegetation in this project. But those we keep away with a boom, a turbidity boom or a containment boom. So those are some of the challenges that we had. There are challenges to consider but I think one of the keys to success is, you know we learned as we went along but it's you know planning out your first year- year and a half of maintenance and what you need to do based on your site to help it establish.

Marisa Gleason: Thank you for that. And the last question for you is, the health and water scenario has been challenged by nutrient rich water in the springs. Will this face the same challenge?

Nicholas Muzia: So, what I think the real challenge is not the nutrient rich water. It's the other competing plants that come from or thrive in the nutrient rich water. So they had, one of the main grasses was used in the crystal river restoration in kings bay over there but they had I think limbia or a lot of the carpet algae. That carpet algae can you know cause shade on the eelgrass as well take up the ground that the eelgrass can't. You know kind of crowd out the little plugs, so we haven't really have that- an issue with that type of vegetation. The water lettuce that comes from nutrient rich water, we

have had an issue with and that we used containment booms upstream of our kind of 200 feet project area to keep that at bay. Because that will shade out the grass and what we found is the eelgrass clusters like kind of the individual plant will break free after 4 or 5 days of complete shade. They will break free and move downstream to try to reestablish which downstream for us isn't very far because then it reaches the Indian river lagoon and the salinity there is too high for the eelgrass, but we hope that it just floats away and them some manatee finds it because it is one of the main food sources for the manatees as well.

Marisa Gleason: Okay and thank you again with that we'll conclude our fourth Quarterly Resilience Forum of 2022!

I would like to thank our presenters for sharing their resilience efforts and would like to thank everyone for joining us today.

Again, if you have any additional questions or joined us late, we will be circulating the event recording and a transcript, along with the presentation materials for you to reference. Please do not hesitate to reach out to either myself, Grace, or our general inbox at Resilience@FloridaDEP.gov.

Thank you again for your support and be on the lookout for the next Quarterly Resilience Forum. Have a wonderful week everyone!!