Green Stormwater Infrastructure: Enhanced Stormwater Basins – UF Stormwater Ecological Enhancement Project

[00:07] Eban Bean: Hi, I'm Eban Bean.

Mark Clark: And I'm Mark Clark.

[00:10] Eban Bean: We're here at the Stormwater Ecological Enhancement Project. Mark, we've seen that there are solutions to managing stormwater, on the quantity and quality side. It often ends up in a least cost solution of wet pond or a dry infiltration basin. Tell us what's different about this site that sort of also achieves those objectives.

[00:31] Mark Clark: Okay, yeah, this is an interesting project that started back in the mid-'90s. What we did is, we took a conventional stormwater basin that met all those requirements of quantity and quality improvement, but we wanted to see what we could add to the landscape, what else could we get out of that footprint in the landscape. And so, we redesigned the basin in a way that it wasn't a single cell.

[00:50] We actually have two different cells, a forebay area and then a receiving basin that essentially really won't receive a lot of that water until an extreme event. We also tried to maximize the topographic differences, which means hydrologically we've got wetter areas and drier areas in the same stormwater retention basin. And what that does is set up an ecological opportunity to have a lot more diversity in our vegetation. And so, what you can see behind us here, this is basically very diverse. We have upwards of 160 different plant species in here, and each one of those areas also has different biogeochemical processes, so each one of those hydrologic differences has an opportunity for different biogeochemistry.

[01:28] So, we have different treatment areas as well. So, in addition to just storing the water, we can actually improve the water quality by taking it up in plants, storing it in peat, and we actually get an improved water quality out of this sort of a design. We're also trying to achieve an opportunity as an amenity in the landscape.

[01:47] So, a community, we've got a boardwalk out here that basically, you can literally walk through the stormwater retention basin, but really observe the natural ecosystem in the process. So, we've tried to figure out, how do we merge both the regulatory requirements with an ecological wetland opportunity?

[02:03] Eban Bean: Yeah, with the amenity it seems like you could walk through here but not know that it's a stormwater feature, you know, a wet pond or a dry infiltration basin, that may not be very attractive for going for a hike.

[02:15] Mark Clark: Right. And so, one of the real objectives here was to try to manipulate the foundation or essentially the topography, so that what we call self-organization can happen. So, we have hydrology that starts selecting for plants, and at this point the system is developed enough, it's really on its own trajectory ecologically. And as long as it's still meeting our quantity and quality objectives, we essentially don't do much maintenance out here at all. It's a natural wetland, and like you said, unless you told somebody that this was a stormwater retention basin, most people would assume it's just a natural wetland and a low spot in the landscape.

[02:49] Eban Bean: When I see a lot of wet ponds or a lot of wetlands, cattails are often a problem. You said there wasn't much maintenance. Have you seen cattails be a problem here?

[02:59] Mark Clark: Yeah, this is a really great story to tell. When this basin was originally designed, it was recruited by cattails, and so when we started in 1995, the original basin being built in 1989, the original basin was dominated by cattails. 95% of what you'd be seeing right now was all cattails. When we changed the hydrologic regime and brought in new vegetation to potentially compete with the cattail, we did not spray, or we did not physically remove any cattail, but by changing the ecological drivers, we have less than 5% cattail now. And now the majority of the landscape, I mean, you really can't even see any cattail, and yet we didn't do any management to essentially kill it. We modified the hydrologic conditions and provided some competition, and that's how we got rid of the cattails, or at least reduced their numbers.

[03:48] Eban Bean: You talked a little bit about, there was a redesign that happened here, or a reconstruction that happened. What was the design originally here at this site?

[03:56] Mark Clark: Okay, it was really a conventional design, like I mentioned, a single cell, flat bottom, so hydrologically during a storm the water levels would rise and fall equally throughout the basin. When we redesigned it, instead of thinking about the hundred-year, 24-hour event, which was really the design criteria, we thought about smaller events, and so we created a partition in the basin, and so now we have two cells.

[04:18] That first cell is really designed around the two-year storm event. So, we have most of our particulate settling and most of our initial treatment in the forebay. We have a weir in the forebay that lets the water bleed into then the rest of the basin. So, we have most of our treatment for smaller storms occurring in one-third of the basin, cleaner water moves into the rest of the basin, where really now we're into a polishing system.

[04:40] And we really like to think about it more as a natural wetland that's helping us treat that water before it discharges out of the system. And within the other part of the basin we've dug a deeper depressional area, so that acts more like an open water pond.

[04:53] We took some of that fill, created a diversion berm, so where we have a direct pipe discharge into the basin, it has to go through a treatment marsh before it gets into the open water. So, we tried to create a lot more complexity within the system that will facilitate improved water quality and diversity, and really just think about a more complex design than what we would have had originally with a flat bottom, single-celled approach.

[05:17] Eban Bean: It sounds like the design here that you have is basically achieving sort of that water quality with the smaller storm designs being the upper parts of the location here, and then the more flood control, volume control is on the downstream side here. Is that accurate?

[05:37] Mark Clark: Yeah, that's right, and you know, we think about the concept of a treatment train, and we're trying to establish that from the sources up in the watershed all the way down to the stormwater retention basin. In some areas you may not be able to do things outside the basin, so we're trying to build that treatment train internal.

[05:53] We've got the forebay, that's essentially an initial treatment cell, and then the rest of the basin is for that extreme event, or at least the bigger design event. You can see water levels are actually quite high right now, and they've overtopped the berm that typically partitions the forebay from the rest of the basin, but that's okay. Our extreme events essentially let the whole system be integrated, whereas the smaller events, which is really carrying the majority of our contaminant load, can be dealt with in just a third of the basin, but then they overtop and essentially fill the rest of the basin.

[06:23] Eban Bean: You know, we're standing here, we've got open water behind us, it's been a wet period, but I don't have any mosquitoes. I haven't had to knock one away the entire time we've been here.

Mark Clark: Right.

Eban Bean: Do you think that's attributed to the increased biodiversity here, the more ecological function that's going on?

[06:40] Mark Clark: Well, one of the things we really were concerned about is having a mosquito problem, because oftentimes people think wetlands, they think mosquitoes and snakes. And, however, a lot of times what we have is essentially biological controls.

[06:52] We have mosquitofish. We also have dragonflies, both of which are voracious predators on mosquito larvae in the water, and then the dragonflies of course are also going after the adults. And although we don't have zero mosquitoes, the population of mosquitoes is much lower, and it has a lot to do with creating refugia, a little lower depressional areas that retain water throughout much of the season.

[07:11] And that's where the fish can congregate, and then as the basin swells during the rainy season, those fish move out and start just eating away at the mosquitoes. So, it is much more of a biologically driven management of lots of things, the ecological community, but also some of these nuisance species like mosquitoes.

[07:28] Eban Bean: What we see behind us, we've got a ponded area. Is this what the system looks like all the time, or does it fluctuate gradually, or dynamically? Is it a dynamic system? Do you have the same vegetation in the same places? Or, talk about how this changes over time.

[07:47] Mark Clark: Yeah, the original planting essentially had forested areas within the system as well as herbaceous areas. The herbaceous areas helped us more for water quality, the wooded vegetation just provides structure, but the hydrology is very dynamic.

[08:00] Basically, we've had significant rain lately, so the water levels are up. Typically, during the wet season we'll have flooding upwards of 60 to 90 days, but during the dry part of the season, there you can walk across this and not get your feet wet. And so, it's very similar to a lot of stormwater retention basins that are in that transition between a wet basin and a dry basin.

[08:18] But, I would say it holds water much longer than the 72 hours that a dry basin is required to recharge, but less than a wet basin, which essentially is flooded year-round. So, it really is trying to mimic, and does mimic, a natural ephemeral cycle that wetlands have between wet season and dry season.

[08:36] Eban Bean: Well, it seems like there's a lot of options for enhancing how we do stormwater management above sort of the minimum wet pond or dry basin design that we often see, based on sort of what we see here, adding boardwalk as amenity, diversity of vegetation, and wildlife. It seems like we could be doing a lot more with those spaces.

[08:55] Mark Clark: Yeah, exactly. And that's the idea. What else can we get out of the footprint? We have to commit to stormwater management, but what other amenities, what other benefits can we get?