CSO Control Technologies

Event ID: 114278

Jim Collins: Good afternoon, and welcome to today's webcast on Combined Sewer Overflow Technologies Part One. This webcast is sponsored by EPA's Office of Wastewater Management. My name is Jim Collins. I'm with Tetra Tech and I'll be moderating today's session. Thank you for joining us today. We'll begin in a few moments.

While we wait for others to join I'd like to cover a few housekeeping items. The materials in this webcast have been reviewed by EPA staff for technical accuracy. However, the views of the speakers and the speakers' organizations are their own and do not necessarily reflect those of EPA. Mention of any commercial enterprise, product or publication does not mean that EPA endorses them. We have posted the speakers contact information in case you would like to contact them directly following today's webcast.

There is also a list of relevant CSO resources available by pressing the "Resources" button on your screen. You will need Adobe Acrobat Reader to view this document. You can also access archives of the two previous CSO webcasts for more information on the CSO policy and about long-term control plans.

For those of you new to the EPA webcasts I'd like to briefly summarize some of the webcast features. First, if you have any technical difficulties you can call 1-800-833-2812 or click the "Help" button to receive technical support from ON24. You may also use the "Ask a Question" area to post any technical issues that you are experiencing. Please include your telephone number where you can be reached and we will help you troubleshoot your problem.

There will be several question and answer sessions during this webcast. To ask a question simply type your question into the box located at the lower left-hand corner of the screen then click on the "Submit" button -- excuse me; "Submit Question" button. You don't need to wait until the question and answer periods to submit your questions. In fact, we encourage you to submit your questions early throughout the program. We will try to answer as many questions as possible, but due to the number of participants all questions may not be answered.

However, today's speakers’contact information is provided on your screen should you have questions directly for them following the webcast. There will also be several occasions when our presenters will ask you questions. The presenter will post questions in the slide window. Please submit your answers in that same slide window, not in the "Ask A Question" box. To see closed captioning, click on the "Closed Captioning" button on the lower left corner of your screen.

At the end of the webcast, you will be asked to complete an evaluation survey. This survey will appear in a pop-up window, so please turn off your pop-up blocker at this time. As a reminder this webcast will be archived indefinitely so that you can access it after today's live presentation. The archived webcast will be posted within a couple of weeks on this same website. Please note that Part Two of the CSO Technologies webcast is scheduled to take place on September 24th,

2008. We will post a comprehensive resource document for both parts of the CSO Technology webcasts at that time.

Finally, please don't forget to download our certificate of participation in today's webcast. Just click on the "Certificate" button to print the certificate after the webcast concludes. It will not be mailed to you. If there are multiple people in the room with you, you can click on this link, the link that shows at the end of the webcast, to customize your certificate and print a copy for everyone attending. We are now ready to begin this session.

Today's speakers are Mohammed Billah and Nikos Singelis of U.S. EPA, Carol Hufnagel of Tetra Tech and Mark Boner of Wet Weather Engineering and Technology Company. Mohammed Billah works as an environmental engineer with U.S. EPA. His responsibilities include coordinating CSO and SSO issues. Previously, Mohammed worked with the New York State Department of Environmental Conservation as a public engineer -- as an environmental engineer and with the State of Maryland Department of Environment as a public health engineer.

Nikos Singelis is a senior program analyst with EPA's NPDES Stormwater Program. Nikos has been with EPA's Stormwater Program for the past seven years and works on many projects aimed at helping communities implement the Stormwater Program.

Carol Hufnagel is a professional engineer with 24 years of technical and regulatory experience. As a wet weather specialist she serves as Tetra Tech's National Practice Leader for CSOs. Her wet weather project experience has focused on the areas of flow metering, hydraulic modeling, alternative evaluation, long-term control plan development and CSO program planning and implementation including conceptual design, hydraulic design and post-construction performance and operational evaluation. Carol has been involved in rehabilitation, sewer separation and wet weather facility projects and has participated in wet weather studies.

Mark Boner is an environmental engineer with 35 years' professional experience in the water and wastewater industry with an emphasis on planning, design, construction and operations of wet weather treatment systems. He has served as the principle investigator of demonstration projects focusing on various physical separation and disinfection technologies. Mark's experience include CSO and stormwater best management practice operations, performance testing, in-stream monitoring and modeling to demonstrate compliance with CSO regulations, TMDLs and water quality standards.

Mohammed Billah will now set the stage for today's presentation.

Mohammed Billah: Thank you, Jim. I'll be doing a brief CSO background discussion. What is a CSS - Combined Sewer System? When you are combining the sewer that fits your sanitary, domestic commercial and industrial wastewater and stormwater through a single pipe system to a Publicly Owned Treatment Works that situation is combined sewer and system is called combined sewer system. Two things here you need to remember. One is owned by a state municipality that the CSO program control the system that is owned by the municipality or the state and it should go to the Publicly Owned Treatment Works.

Now, what is CSO? Like I told you before when we're combining the overflow and creating a situation the wastewater treatment plant cannot handle those sewer anymore. So, at some point you need to discharge those sewer untreated before the POTW. The CSO consists of the domestic sewers and industrial and commercial wastewater. CSOs are point sources subject to NPDES permit requirements. It is technology-based and water quality-based requirements of the Clean Water Act; that means it meets the nine minimum controls which is a technology-based control of the CSO and LTCP, which is a water quality-based control of the CSO.
And the main thing to remember - CSOs are not subject to secondary treatment requirements applicable to the Publicly-Owned Treatment Works.

And now the recent history of the CSO control. A little background: 1989 National CSO Control Strategy that is 54 FR 37370. Next one is CSO Control Policy that we are discussing today with the technology issue of the CSO Control of 1994. That is 59 FR 18688. The next and the most important one is Consolidated Appropriations Act for the Fiscal Year 2001, which the CSO policy becomes part of the Clean Water Act.

Now, key principles of the CSO Control Policy. What the policy is trying to achieve is provide clear level of controls for the CSO. It also provides flexibility so you can do the control in a flexible way depending on your financial capability and your priorities and what you need to do. Allow a phased approach to do a different phase and give importancy of the phase that you try to have maximum impact for the CSO Control. And also it allows a state to review and revise the water quality standards if appropriate. That means you can either have the control that meets the water quality standard or you can change the water quality standards if appropriate for your state or for your community.

Now, nine minimum controls. As I told you before nine minimum controls are technology-based controls. That is a Phase One NPDES permit requirement for CSO community that you do minimum to control the CSOs. And next one is a long-term control plan. This is the water quality-based control for the CSO and you need to do like the analyze of water quality to find out whether you are meeting the water quality requirement or you need to do the changing water quality standards. And permittees are responsible for developing and implementing these long-term control plans.

I'm done with my brief one. Now, I'll hand over my mic to Nikos Singelis.

Nikos Singelis: Thank you, Mo. This is Nikos Singelis with EPA's Office of Wastewater Management and we want to welcome everybody here to our webcast today covering CSO Technologies. Thank you, Mo, for that opening. We have a poll question for you right now. We just want to get a better sense from our audience about who is out there. So, we give you a number of choices here. The way these poll questions work, if you haven't been with us before, is that you select the small circle or radio button to the left of the answer that best represents the company or organization that you are with. So, we have a variety of choices here: a small CSO community, a large CSO community, state/federal government, consulting groups, industry and those that don't fit into any category the "Other" category there. So, you select again the radio button and then hit the "Submit Answer" button right in that window and we'll show you the answers to that in just a second.

While we're waiting for you to do that -- and by the way, if you're in a big group out there just pick the answer that best represents the entire group so we get a sense. I've got a question for Mo here. As we mentioned before we've done a couple CSO webcasts that have covered the basics of the CSO Policy and requirements and things like that and the long-term control plans. And for our audience who may not know we're not going to be covering any of those sort of basics today, but you can go back and get those archived webcasts on our system and listen to them or train new staff in your office using those different resources. But Mo, just a little bit of background for folks. How many CSO communities are out there now?

Mohammed Billah: Right now, we have 853 CSO communities out there, mostly in the northeast part of the country, like Chicago, Milwaukee. EPA Region 5, Region 3 are the two biggest regions almost like more than 70% of CSO communities are there.

Nikos Singelis: So generally, the older communities and the sort of coastal communities and Great Lakes Communities?

Mohammed Billah: Yes. You're absolutely right because CSO situation was created by default. It was a design for carrying the combined sewer together. We had a stormwater then we start adding the domestic and industrial sewer in that single pipe to discharge it to the POTW. It was by default. And most of the big, old cities are right now with the CSO situation.

Nikos Singelis: Okay. So, we do have a wide variety of people with us today. Let's take a look at the results from this poll question. We've got about 14% in small communities, and those are probably the communities that are struggling the most with this question and need the most technical assistance. We hope that our speakers will provide some insights from some of the things that have been happening in the larger communities. We've also got about 11% here from our larger communities; quite a few, actually. A little bit surprising to me, we have quite a few regulators on the line, about 32% there. And also quite a bit of consultants, 32%, which makes sense. A lot of communities rely on consultants for expertise in designing solutions to these problems. And then you can see some of the other results there. So, thank you very much. We'll have one more poll question for you as we go along.

But now we're going to get into the meat of our discussion today to talk about some of the control technologies that Jim mentioned. This will probably be at least a two-part series on this. We'll see how it goes, but we do want to get into some of those technologies particularly the ones -- we're going to start with the ones that are little easier to implement. So, I'm going to turn it over to Carol to get started on those. Carol, welcome.

Carol Hufnagel: Thank you. And we'll get started today with some of the early action type projects that would be associated with a long-term control plan or even pre-long-term control plan work. The agenda that we're looking at is really addressing those first and then to just begin to get into more of the long-term control measures that communities look at in their long-term control plan. But that will be primarily the subject of the next webcast.

So, in the implementation of CSO control one of the first things that we can look at is flow reduction because the basic issue being addressed is to control the amount of flow that is generated in the collection system. In a flow reduction project that helps us to reduce both the peaks and the volumes associated with wet weather and the flow reduction can focus primarily on a base flow component or an infiltration component or an in-flow component, but very successful projects in flow reduction look at identifying locations where surface water sources either from a river system or a surface water or runoff are entering the system. And by doing that much more wet weather flow can reach treatment plants.

Key issues in implementing flow reduction projects involve understanding the collection system. If there's excess flow getting into the system we need to know where that flow is originating. Again, how does the collection system interface with the local receiving streams, the surface water sources? How is it related from an elevation perspective to those surface water sources? Is it subject to river intrusion and so forth? So, a detailed understanding of the collection system is critical to success of these projects. Sources of in-flow can be hard to determine and can require persistence and investigation. So, it may not be something that's immediately obvious, but there are great advantages in implementing these projects in terms of the amount of benefit that's achieved for the number of dollars expended and it may help reduce overall flow conditions both during dry weather and wet weather which would reduce normal operating costs.

One aspect of flow reduction that may not make them the primary focus of a long-term control plan is that in and of themselves they may not provide a final level of control. They focus more on shaving the peaks and reducing the annual volume, but may not reach that total extent of control that's required for a long-term plan. Nevertheless, in conjunction with long-term technologies they can enhance the performance of those types of facilities.

We have a number of different flow reduction project examples that we wanted to share. Oftentimes the best way to get an idea for your own system is to look at what others have done. So, we'll be doing that today with this list of projects. There are certainly a lot more out there, but a number of these focus really on using the existing infrastructure to the maximum potential. We have a lot of investment in our existing collection systems and those collection systems can be put to the maximum use for controlling wet weather flow.

The first project I want to highlight is one that was done actually in the mid '80s and this was not done in conjunction with any sort of a long-term control plan, but was performed as part of a project where the city was seeing excess flow coming into their system and causing high cost for their discharge of their wastewater. The city of Dearborn is adjacent to the city of Detroit, a community of about 93,000 people and on the west side of the city is the West Side Interceptor. That interceptor discharges to Detroit's system where the wastewater disposal costs were paid for on a per gallon basis essentially. So, this project was looking at ways to save the City of Dearborn expense for wastewater disposal and also they had a number of old flow and gate-type overflow regulators that were causing them a lot of operational concern and would stick open or not operate properly.

So, the project addressed two items. One was the leakage into the system. The interceptor was located in a flood plain area adjacent to the Rouge River and it had quite a bit of open joint construction and manholes that were subject to inflow. As such, during high river stage it would get quite a bit of water entering the system. In order to address that, the interceptor was lined with high density polyethylene pipe and in some sections the interceptor was replaced with direct bury HDPE. The regulators were rehabilitated with vortex values and updated backwater prevention was added to the various charges.

The cost of the project is presented there in 1987 dollars. As an O&M perspective the city saved significantly on their O&M costs primarily because of a change in the regulator valve, but their wastewater disposal costs were reduced so significantly that the project paid for itself in a very short period of time.

These are some photos from this project. You can see the existing sewer with the inflow entering it from a river source. The lining of the pipe was done through insertion tips and new manholes were constructed at those insertion tips. And then the replacement backwater valves that were used on the outfall, which in some cases necessitated construction of new outfall chambers because the size of the pipe required it be split into two valves as its shown in that photo.

The location of the interceptor is in a golf course, so that made construction interesting. But it happened in the winter, so it was able to be completed before the next playing season.

King County, Washington, has done extensive work on looking at rehabilitation technologies for control of I/I in separate sewer systems, often referred to as rainfall dependent I/I or RDII, which I may use throughout this. King County serves 32 local component agencies and they performed a series of pilot projects to address the sources and control of RDII. As part of this project they worked through using a number of different technologies both on the mainline system and on the house lateral and house systems. It included lining of pipes or addressing issues with manholes, both raising the manhole lids and working with crowding of manholes or lining of manholes so that they limited leakage. Also used for main lines and laterals pipe bursting technologies in some places and then cast-in-place pipes in other locations.

So, with these variety of technologies that were used they had 10 different study areas that were evaluated to determine how well the system worked. This slide shows two locations that were monitored prior to the pilot project and you can see that the response is pretty consistent between those two pilots' areas.

Subsequent to the rehabilitation there was a significant drop in the RDII. This was at one of the study areas called the Skyway Pilot Project and in this location was the best performing of all locations, had the most extensive rehabilitation work performed. So, overall results varied from no reduction in I/I up to a 90% reduction based on the mix of technologies and what portions of the system were addressed. King County found that the greatest success was when work included rehabilitation on private properties and was more extensive than just trying to address system components such as a manholes.

The amount of reduction, of course, partially depends on how wet the system was prior to the project and I/I rates prior to these rehabilitations were on the range of 8,000 to 58,000 gallons per acre per day, and regardless of where the system began or depending on the mix of I/I all the system plus post-evaluation results on the order of 4,000 to 8,000 gallons per acre per day.

Another project we'd like to highlight is the project that's being done by ALCOSAN. ALCOSAN is the Allegheny County Sanitary Authority which serves the Pittsburgh, Pennsylvania, region. One of the issues that ALCOSAN has identified with their collection system is the connection of streams into the overall sewer system. And you can imagine as systems were developed and combined sewers were originally constructed to move the flow further away from where people lived these connections of open streams became part of the way the system developed over time.

So, ALCOSAN has identified a number of these locations which they're working to address. This one is for Sheraden Park Stream Removal Project and it will involve constructing a new combined sewer for domestic and local stormwater collection while providing a new outlet for the stormwater associated with the creek. The program will go beyond that and will involve stream restoration and wetlands creation for the surface water.

This project is currently under development. The anticipated cost of the project is around $2 million. ALCOSAN anticipates a significant impact on their operations and maintenance because these existing stream connections result in gravel and debris getting into the sewer system. So, that will be a benefit for operation and maintenance. This project will improve the esthetics locally with the stream daylighting. And a significant tributary area will be removed from the sewer system.

You can see from this aerial map that the area in question, which is bordered in pink is primarily a park area, but it has the opportunity to bring in much inflow into the system.

Nikos Singelis: Carol, I've got a question for you. You mentioned in two of your examples now, one you said specifically there were differences between dealing with parts of the system that were on private land as opposed to public land and the complexity here. This one I noticed that its in park land; the targeted area. Can you say a little bit more about some of those difficulties or the differences when you're working on private land and the kinds of things that a community would have to do to deal with that as opposed to public land?

Carol Hufnagel: Yes. There's basically two issues there because both in King County and in ALCOSAN those are systems which have multiple ownership. There's a local municipality owns the local collection system and then the agency owns the interceptors and the treatment plant. So there is a tremendous amount of need to work together between both the local municipality and the regional and collection system in order to make the system as a whole function well. So, that's one phase of coordination.

The other phase of coordination has to do with private property work. About half of the footage of our sewer systems is actually on private property and private leads and in private sewers that connect in the sewer system. If we ignore that part of the system then we just can't get a complete grasp on being able to control the potential for excess flow. So, there's obviously a lot of educational components. There's issues with how are things going to be paid for. There's concerns with even if the local agencies or wastewater authority is paying for the work that's being done on private property, how do they accomplish that from a legal perspective? And who's responsible for that contractor because if the contractor digs up the rose bushes while they're doing something else, then that might have been grandma's rosebush and it can be a problem from public happiness with the project perspective.

Nikos Singelis: I can certainly understand that. I'm just curious. Do you know is there a trend in whether the cities are ending up paying for the rehabilitation that's on private land? Is that more common or is it more common that that would be paid for by the private landowner or is it a mix? Do you see any sort of trends there?

Carol Hufnagel: I think the trend nationally is to have more public dollars spent because when you go through and you evaluate the total cost of the program the most cost-effective way to control the excess flow involves work on private property. Basically, if you don't address that source of excess flow then you're forced to go with large transport and trees and storage type work.

There are several projects that have become much more significant. The collection system committee for WEF has put work into a virtual library that's accessible through the WEF web-site for various programs around the country that have begun implementing private property work. So, that's a good resource.

Nikos Singelis: Okay. And for those who might not know, that's the Water Environment Federation and I believe their website is www.wef.org. Or you can Google them easily. And I just wanted to take a second to remind our audience to submit questions because we will have a couple question and answer breaks coming up and so you can do that in the "Submit Questions" box. We will try to answer your questions in just a few minutes. Carol, I'll give it back to you to continue on with Toledo now.

Carol Hufnagel: Thanks, Nikos. Our next project that we wanted to take a look at was done in Toledo, Ohio, and it was partial separation of an area tributary to the Columbus CSO, not to be confused with Columbus, Ohio. It's just a street named Columbus. What was the situation in this example was that this area already had a two-pipe system in a portion of the area tributary to the regulator. With that two-pipe system the city was able strip off some of the stormwater flow that was tributary to the regulator and thus reduced the frequency and volume of discharge. So, this photo here is a pond that was used for stormwater detention from a portion of the area.

And the collection system had several components to it. The green shaded area in this exhibit shows the original combined sewer area. The area with the black border is that portion of the area that had a partially separated system prior to the project. And a piece of that, a partially separated area, was able to be diverted to a stormwater basin.

The lesson here is that because they understood how the system was laid out they didn't just assume that it was a combined area. They were able to take advantage of the existing infrastructure with the two-pipe system that was in the ground.

Nikos Singelis: Now, we are up to our second poll question here. I just want to remind our audience who are being slow with submitting questions today that, yes, you are indeed encouraged to ask questions. So, while we're doing this poll question if you've got a question that you want to ask here or really anybody here in this room, please feel free to submit it.

Now we're going to do this poll question. This will just help us get a better sense of how many people are attending today because we know we do have groups of folks out there. So, same routine as last time. Select the answer with the radio button to the left of the answer and hit "Submit Answer". So, Answer A there if you are stuck in cube land like many of us at the Environmental Protection Agency and you're sitting there by yourself watching this, that's your answer. But if you are in a conference room or something like that give us your best estimate of the number of people that are attending with you and that will help us compile a better estimate of who's with us today.

And before I turn it over to questions, another thing maybe that I'll ask Carol is a lot of the things that you're talking about in some ways kind of ring bells for me in the stormwater arena where we're talking about kind of prevention kinds of approaches out there in the landscape. And some of the costs that you've mentioned compared to some of the other big projects that I've seen have seemed relatively low-key. So, it seems like some of these -- would you say that some of these sort of preventative kinds of projects are sort of a first tier thing that you would go to and the less costly kinds of things?

Carol Hufnagel: Yes, we would characterize them probably as early action items. Sometimes we'll use the term "low hanging fruit" to pull these off. Again, it's taking advantage of the infrastructure that's in the ground and understanding it to the point that these kind of opportunities can be identified and implemented.

Nikos Singelis: I think those were some good examples. Jim, how are we doing with the questions? Is the audience waking up a little bit out there?

Jim Collins: They are starting to stir, Nikos.

Nikos Singelis: That's good to know.

Jim Collins: Actually, there is a question for Carol; sort of a follow up to the discussion or to the question that you asked, Nikos, about private property. That is Roger asked: What type of private property projects were undertaken? I actually had one to maybe piggyback on that and that is the long-term maintenance aspects of projects on private property. How are those typically handled?

Carol Hufnagel: Well, there are certainly different types of private property projects that are part of work in CSO and the wet weather community. We have long had projects where issues such as disappearing downspouts that were directly connected to service leads have been addressed and looking at disconnecting those. There are other projects that have focused much more recently on the private lateral and the condition of the private lateral as a source of I/I. In some parts of the country we have foundation drains or footing drains which were intentionally constructed to drain the water that collects around the foundation of a home in the basement area away from the house and to the sewer system.

There are a number of locations I know of in Michigan and Ohio where those footing drain connections are being removed requires fairly extensive construction on the private property. The cost of some of the private property work can range from $6,000 to $12,000 per home. It's a significant investment and then if the foundation drains, for example, are disconnected and put into a sump pump there's a question of who's responsibility is it to maintain that sump pump.

I think those are questions that are addressed on a community by community basis, but they definitely need to be considered if programs are implemented.

Jim Collins: Thank you. By the way, Roger also had provided more details on the website for the WEF virtual private property library; that's www.wef.org/private property. So, thank you Roger. Ray asks: In separation projects is stormwater treatment required?

Carol Hufnagel: Actually, we'll talk a little bit more about separation projects a little bit later in this webcast, so some of those questions may be addressed. But it's certainly been a question with respect to sewer separation of what happens to the stormwater and how much are we benefiting the environment by separating the single pipe system into one.

I think that as municipalities have stormwater NPDES requirements that the active water quality impacts of stormwater are being more directly addressed and that is a concern in CSO control planning. I think in terms of water quality impacts we need to look at whether the water quality impacts from stormwater are event-based or total load base, which would be more depending on the river system or lake system or ocean system that it's being discharged to.

But certainly, I think in the engineering and the wet weather community we all understand that stormwater is not clean water and needs to be dealt with.

Jim Collins: Carol, you have -- I'll create this and turn this into a two-part question. Somebody's asking for clarification on what RDII is. And then once you respond to that there's a specific question about it, RDII removal. It has been fairly well established that ceiling pipes in the absence of proactive groundwater interception is ineffective in reducing separate system RDII. What is your experience with full-scale programs that utilize the existing leaking pipe system, as effective groundwater collectors to affect RDII reduction? For example, converting the sewer to a neighborhood French drain with installation of the new sewage-only collection system?

Carol Hufnagel: Okay. Let me tackle the first part first, which was what is the definition again, review on RDII. That is, again, RDII stands for Rainfall Dependent Inflow and Infiltration. It's primarily used in evaluating flow metering data and hydraulic modeling because we see this excess flow in the collection system during periods of wet weather. We're not necessarily able to specifically say which part is in-flow and which part is infiltration. So, that component of the flow is referred to as RDII.

The second question in terms of impact of groundwater on collection systems and effectiveness and removal of RDII I think is a good statement on why there's this recognition that if you only address the public sewer you're going to have issues with reducing RDII to a significant extent and obviously, a lot of flow travels through the ground and enters the sewer system.

So, I think the RDII removal projects where all components of the pipe system, private and public, have been addressed with an attempt to seal them have been relatively successful, but I have also seen projects where all that was tried and it was recognized that there was just a very poor stormwater drainage system in place. There was too much water ponding above the sanitary sewers and the presumption was that because of that sustained ponding of stormwater over the sanitary sewers there's a lot of infiltration through the ground coming into the sewer pipe.

So, ideally the system is looked at holistically. We have learned over time that we can't just pick off one piece and be successful. So, the specific example of using the existing sewer for groundwater collection, I don't know of a specific example of that, but that's an intriguing thought.

Jim Collins: Thank you, Carol. Nikos, do you have a question or comment?

Nikos Singelis: No, but I think we're ready to move on. Let me show folks the results from our poll question just so you know. As expected, 64% or so out there in their cubes by themselves and then we've got a range of folks in different groups. So, thank you very much. This will help us to assess how many people are actually with us.

Carol, let's move on with the next section of our presentation and we'll have time for more questions later on. So, I will get you to the proper slide here and you can pick it up. There we go.

Carol Hufnagel: Great. We just had a question about stormwater and stormwater quality. In conjunction with wet weather programs a number of communities have gone green and seen that, again, we need to look at the entirety of the flow generation, and where is the water going and so forth. So, we have a couple examples here.

We're not one to dwell on these types of technologies in this webcast because there may be a future webcast on this type of approach, but in Seattle there is a project that was in conjunction with local street work. This is called the Pinehurst Green Grid Drainage System where the street was improved, landscaped biofiltration swales were constructed. The benefit was not only to improve water quality, but it also helped reduce local flooding. And because the streets were narrow the traffic was calm. Here's some photos of some of the completed project.

The city of Lansing did a project with a stormwater bioretention system and this was an area where they actually had gone through and separated the combined system into a two-pipe system, sanitary and stormwater, but they were very cognizant of the concerns of stormwater quality. So, this was in an urban core. I think it was described in the latest edition of Water Environment and Technology, which is WEF's monthly magazine.

It involved creating biofiltration trenches in an urban area, highly developed and attractive landscaping and streetscaping. This system has the ability to control because between one-half inch and four inches of stormwater. It really depended on the specific location in terms of how much space there was for the trench relative to the amount of area tributary to it that volume was maximized, but it was site specific and how much was able to be developed. As part of the program there were a number of informational activities that were included and public information programs associated with the project.

With that, one more project and then Mark's going to give us a break. Detroit, Michigan, did a project with in-system storage devices that again maximized the use of the existing infrastructure. This system involved 13 in-system storage devices or dams. These were inflatable rubber dams put into existing large diameter or box sewers in the combined sewer system upstream of the regulator. These are large pipes, generally over 10 feet in diameter, and they were designed for a ten-year storm event. So, during the smaller storm events they have a lot of excess volume and capacity.

The project cost approximately $24 million and provided about 54 million gallons of storage. For those of us that have worked with constructing storage in either basements or tunnels, we know that's a very economical rate for accomplishing that such storage volume. Some of the issues that were addressed in the project involved the condition of the existing sewers in the inflatable rubber dams and it became -- the condition of the sewers was important for connection of the inflatable dams.

The system profile allowed for extensive storage and in some cases these dams were put in series, which enables additional volume to be created.

With that, I'm going to turn it over to Mark.

Mark Boner: Thank you, Carol. I'm going to talk about another type of flow control that's a new device. It's also made out of a bladder material like the inflatable dam, but it uses static water pressure on top of that bladder to control the flow. It can be used with storage basins like stormwater ponds as you were talking about earlier to reduce the rate of flow or store the flow before it goes into a combined sewer system.

It's a passive device. There are no mechanical parts on it. It opens from the bottom going up, so that trash and debris does not get stuck in it. It can be used to allow a base flow, so it can be used in in-line sewer systems to allow a base flow to go underneath or even in a stream where you have a regular stream flow and then only store or tenuate flows during wet weather.

The device can be put in in the bottom of a combined sewer system like you see in this graph that would divert treatment -- divert the flow to treatment and then when it rains the device would store that water level until it reaches the maximum storage level in the pipe system itself. And one device could actually block the flow completely, like the one on the left-hand side, and one device could actually allow base flow underneath as you see on the right-hand side.

And when it rains that storage if it's already exceeded or you maximize the storage, the bladder actually lifts up. It only takes a couple of inches of differential pressure to lift up the bladder and allow the excess to go by. Therefore, you're reducing the rate to your treatment and that the same time you're maximizing storage. And it will fully invert so that the pipe capacity has full capacity through it, so you don't really reduce your piping system capacity at all. So, it's very passive, allowing the maximizing of storage system to divert flow to a treatment system or to just maintain that maximum storage.

This is a project that was built in Columbus, Georgia, under a 319 grant where the flow control device is used to divert stormwater runoff from a vehicle maintenance yard to a BMP for treatment. The flow control device was actually placed on an existing 30-inch outfall and the water on top of that bladder was the maximum level, almost at the paving level of that site, that 7 acre site. It caused the pipe to seal and thus when it rained that flow was diverted to pretreatment and then to a compressed media filter.

And as solids were removed from that filter the water level would rise until it equaled the water level inside that flow control device, that static water level on top of that bladder. The bladder would lift up based upon the differential pressure and let the excess flow go by. So, in this application it was always maintaining the flow to the treatment system to the BMP. When you reach peak flow that bladder would lift all the way up and all the flow would go by, but it would maintain the flow to your BMP.

This is another project where that technology was placed. It's on an existing stormwater pond. The pond actually would not store -- it would not use its available storage until you got to the 100 year flood and that particular pond served about 300 acres of impervious area. It went to a tributary into the water supply in Columbus, Georgia. When we reconstructed that pond effluent it looked like this picture. The low flow was blocked off and all the flow was diverted to those two openings you see on the right-hand side. That's where the flow control devices were.

During the low flow, the flow went underneath the bladder. There was a small area where the base flow would go through it at all times, but then when it rained there was that space between the bladder and the pipe itself that acted like an orifice and it immediately stored the water in the pond. So, what we're doing here is storing water initially every time it rains and not until you get to the 100 year flood or the 50 year flood, that kind of thing. So, we're using the storage all the time and that reduces downstream velocity and downstream erosion to help protect the aquatic biology. It also improves the removal capacity of the pond itself. When the pond starts to rise up to that water level that's on the top of the bladder, the bladder then will open up and the excess flow as you can see in this picture is going by that flow control device.

This is the back side of that bladder. You can see during dry weather this is the base flow going underneath the flow control device. I ought to say that this device was developed through a Small Business Innovation Research Grant by EPA that was commercialized through that process. And then there's peak flow in this particular installation where it's going through the flow control and over a high weir level for the large event.

The effect of putting this device in is basically it reduced the peak flow as seen in this plot. The blue line represents the flow without the bladder or the flow through of the system and it reduced it down to the green line. There was about a sevenfold decrease in the peak flow downstream. So, it's very effective in controlling the flow, stormwater flow in maximizing use of this basin before it really reaches the design conditions of that basin. These kind of things can be used to reduce stormwater flows into combined sewer systems.

Nikos Singelis: Mark, that a pretty nifty technique there and actually that's one of the things in the stormwater world that we've been talking about is we do have a lot of ponds out there on the landscapes that are not using their capacities very well. And so the example that you just gave were other ways of changing the outlet devices so that we can expand the retention capacity and utilize more of that basin capacity to slow water down or even retain it ultimately. It seems like a pretty important thing to do both for stormwater and CSOs. Let’s see, Jim, do we have questions now again?

Jim Collins: Yes, we do have some questions and the first one for Mark would be: Are the inflatable dams still available? Somebody has the idea that Bridgestone may have discontinued production.

Mark Boner: Well, that's a good question. I recently noticed on their website that you can't go to that. It's still listed on their homepage, but you can't go to that. We actually put in an inflatable dam in Columbus, Georgia, as a failsafe device and it was through a Japanese company that I believe is no longer building those. Do you know any more, Carol?

Carol Hufnagel: We have looked recently at the available facility of inflatable dams and that is an issue right now. I guess it's not their highest market item, so they are difficult to find. I think there may be a new manufacturer out there of those dams. I think the concept, though, of the in-system storage doesn't go away regardless of where the market is or the availability of the inflatable dams is because you can accomplish similar flow control with other types of devices.

In Detroit, there was a whole series -- types of technologies that were evaluated. Inflatable dams were selected because they were the lowest cost and had the best characteristics, but there are other technologies out there that can be used for similar concepts.

Mark Boner: I might also point out that South Bend, Indiana, is looking at a number of devices in a similar fashion to control the stormwater entering into their combined sewer system.

Jim Collins: Thank you. There's a question posed to Carol about if she knows of data available on the effectiveness of landscaped swales or biofiltration, et cetera, based on that Seattle project slide.

Carol Hufnagel: I don't know the answer to that. There's data in the literature about bio infiltration facilities in terms of some of their effectiveness on that particular project. I'm not sure if there's data available.

Jim Collins: Nikos, would you like to add something?

Nikos Singelis: In general, I don't know about this particular project, whether they're monitoring that or not, but we do have on the EPA website a new tool that the CSO community could use. It's called the Urban BMP Performance Tool and it is a collection of about 275 different studies of BMP performance and swales is one of the categories that's listed there. So, you can go to the NPDES website and find that. It's actually right on the front there and search and sort and look at some of the performance information for different kinds of BMPs that we share across the spectrum in CSO and stormwater. Also, another source would be the International BMP database, which we borrow most of their data as well.

Jim Collins: Thanks. I guess we have time for one more. I guess I'd throw it to Carol, but I guess either of you could take this on. The question is: How do you calculate the benefit of CSO reduction in terms of money since it does not help any wastewater load reduction at the treatment plant? That's the question. In other words, the benefits happening -- the water quality at the treatment plant itself is still just being treated. How do you calculate a CSO reduction benefit?

Carol Hufnagel: That's a good question. Obviously, we have legal requirements and in our profession we're usually in this because we care about the environment. So, there's certainly -- the greater good of the environmental benefit which has an economic benefit associated with it. I think in a number of the case studies of what we've shown so far, like with flow control, that can have a long-term benefit in terms of financial cost of wastewater treatment. That one community, the project in Dearborn where they work on the interceptor and the stopped treating the river so much. They saved on their wastewater costs.

Sometimes these projects can be very beneficial for the type of service that you give to your customers when they're not getting basement back up any more or reduced impacts of that type that don't usually make people happy. So, there are other benefits beyond direct dollars.

Mark Boner: The benefits of improving the stream biology in case of CSOs that go to tributaries, but when you reduce those loads and reduce those velocities your aquatic biology is going to improve and that is a benefit. You can calculate per rise in indices from increased improvement of aquatics biology, like macroinvertebrates or fish. Those are benefits, so you can measure them that way or per pound removed.

In a TMDL analysis where the CSOs have a part of the problem, the wastewater treatment plant has a part of the problem. You can calculate the dollar per load reduction for each of those components and compare those to see where you're getting the best benefit and what measure you look at to meet the target.

Jim Collins: Great. Okay. Back to Carol.

Carol Hufnagel: Okay. We'll move on to another concept in early action projects. This is one of pollutant reduction. In most long-term control plans we end up with some type of end-of-pipe solution or that may involve storage or treatment that's a satellite from the plant, but even in those cases we have a benefit if we can get the flow entering those facilities to be more dilute rather than more concentrated.

So, pollutant reduction is a concept of taking the more concentrated portions of the wastewater flow generation and getting those portions to the plant. It maximizes how much pounds of overall pollution reduction will occur during those wet weather events that may exceed the design criteria of the long-term control. And because the long-term control plans are implemented over a period of years these are things that can have a more immediate benefit to the collection system and to the receiving stream.

The key on using this type of project is you need to be able to isolate those portions of the system that have more concentrated sewage. And with doing that it prioritizes the wastewater's treatment plant treatment capacities for the more concentrated waste water. While it may not provide the final level of control it will help the final level of control and it will help in the near term.

A case study for this type of approach is a project that Omaha, Nebraska, is implementing as part of their long-term control plan early action project. In Omaha they have a portion of the community that has a lot of meat packing industry and other industries with high levels of high strength flows, BOD and TSS. Full characteristics are as much as 2,000 milligrams per liter of BOD from some of these industries and that's not the kind of flow that is desirable to go into a CSO discharge.

So, as part of the project they're focusing on separating out that industrial flow and making sure that it gets to the treatment plant. They're doing some other sewer separation work in the area in order to reduce localized flooding and get their system operating as a two-pipe system.

So, in the area they had a packinghouse line that was connected into a large combined sewer and as part of this project they're looking at redirecting that particular sewer so that it can get immediately or directly to wastewater treatment.

Another type of approach that can be used is taking advantage of opportunities that occur. CSO control is very expensive and to the extent that we can find opportunities where something else is going on that the CSO control can piggyback on is an excellent way of reducing the overall cost. It can be either a short-term or a long-term measure, but in most cases if we orchestrate these well they can be a great benefit to the overall cost effectiveness of the program.

The key in making these types of projects work is that they usually -- because they're involving different agencies with different objectives -- they can have longer time frames. So, you need to be alert to what's going on elsewhere. And because a lot of work that happens in the sewer systems involves work on private property or as property redevelops, ordinances need to be in place in order to address what's going on on those sites. And this involves not just working within the sewer authority, but it involves working with the communities as a whole in terms of ordinance development and so forth to facilitate this type of approach.

One example of this type of project was done in Cincinnati, Ohio. Cincinnati had a very large redevelopment project along their riverfront. There were new stadiums that were constructed for football and baseball. So, in this photo the area to the east - that road that you see in the middle - is the stadium area along the riverfront that was redeveloped. And Cincinnati sits at the south end of the state of Ohio and just north of Kentucky. This is a major transportation corridor going through here. So, this project was a transportation project. It wasn't a sewer project in the beginning.

But because the project involved lowering this major transportation corridor, Ft. Washington Way, that impacted the sewers that were going across it in and into the Ohio River. So, Cincinnati MSD was very proactive in looking at how could we make a benefit to this project for the sewer system. And there were a number of different discharge points from the sewer system that were intercepted by new consolidation conduit and that consolidation conduit is the yellow highlighted sewer on this slide. And that consolidation conduit provides for not only the transport of the flows, but it also was oversized for storage.

So, the total cost of this project, which was on the prior slide of $10.7 million, was the cost of the system, but there was a lot of the system that needed to be constructed just to allow the transportation project to go ahead. And in this case because it was a moment of opportunity for the system to be oversized and provides storage in addition to providing the transport sewer.

Not sure how we're doing with accumulation of questions.

Jim Collins: We do have some more questions. Actually, several questions for Mark about the hydraulic control valves and the bladders. Is maintenance necessary? Is more information available? Could you provide any sources of more information on those, Mark?

Mark Boner: The flow control device that was developed through the FDIR program is actually pretty much maintenance-free because it lifts up from the bottom. If there is debris that starts to accumulate the differential head will increase and it will actually lift up and let that material go by. The application that I showed on the presentation was for a stormwater basin and one of the pictures showed during wet weather when the water was full that there's quite a bit of trash there and we've never really cleaned it. It cleans itself. So, it does let material go by and they collect material there, but it lets it go by.

In terms of availability you can go to www.wwetco.com and there's also an EPA SBIR website you can look up that project. I don't know that particular website name right, but now we can provide that.

Jim Collins: We'll try to get that up on the resource document for the next. Okay. Thanks. Question also for Mark. What is the application of the membrane to SSOs if any?

Mark Boner: It can be used in the same way. It can be used to provide a base flow and then if there's storage available, it can store, whether that storage is in line or offline in the containment vessel. It would just attenuate the peak flow to the downstream source. If it's a treatment plant and if its SSO it could actually cause it to go into an EQ basin and the EQ basin drain back into the sewer system. So, it's all passive control to use a wide spot in the line so to speak.

Jim Collins: Thanks. And then the last question is actually held over from the earlier discussion, but I'll go ahead and ask it for Carol. Can you recommend any information sources for benchmarking RDII rates?

Carol Hufnagel: That's a good question. I know that the Water Environment Research Foundation has done some studies related to RDII and how effective various projects were in reducing RDII. That would be the first place that I would look. Mark, do you have any sources that come to mind immediately?

Mark Boner: No, I don't other than the individual projects that you have to go to. There's work in Birmingham. They have a lot of RDII and they built a huge system for treating -- storing and treating. They may have some data on operation of that. It's been in operation quite a while now. I think you'd have to go to individual projects to possibly find that out. I don't know any other EPA resources; I'm not sure.

Carol Hufnagel: Yeah, I think that one thing that will continue to be a challenge with RDII is it's going to be different in Seattle than in Georgia and different in Georgia than in Pennsylvania and so forth. So, it's hard to come up with what the number is because of the difference in rainfall.

Jim Collins: Thanks. Okay. I think we're ready to begin the last session.

Carol Hufnagel: This portion of the presentation is going to focus on more of the long-term types of projects, the long-term capital that would lead you to a long-term control plan level of control. We have taken most of what would have been in this and have deferred it to the next session, which will be on September 24th. So, we do have information on sewer separation and partial sewer separation.

Sewer separation has been around for a long time. It's probably the most widely used methodology for CSO control when you consider all the small communities that have relatively small areas that have been implementing this. It's beneficial in that it removes the stormwater from the collection and treatment system.

The other thing that sewer separation can do that is not always recognized is the benefits that it provides in terms of infrastructure conditions. There's a whole host of issues to consider as you go into a sewer separation project. There's a lot of these projects that have not worked because they were done without thorough understanding of what was going on in the system or it was easy to pick up nine catch basins, but the 10th one was difficult to get to. You can't really approach these projects this way.

In order to be successful the first time through, a detailed understanding of the sewer system is required. Because sewer separation happens on streets, it involves working on with what other infrastructure is out there. Some of our communities we have one decision point where that individual or that department manages the sewers and the water main and the streets and maybe even other infrastructure components, but in others of our communities we have different departments or even different agencies that are handling those different components of infrastructure. So, certainly, coordination between the different infrastructure needs is critical.

We've talked about private property issues today. You can't have a successful sewer separation program if you don't consider what's going to happen with private property and flow.

Advantages of sewer separation are really in terms of a reinvestment in infrastructure. When you go through sewer separation you can often piggyback a number of other activities onto that. You don't have to site facilities. Many communities have learned that siting of a CSO retention basin is not the easiest thing to do and that can be a challenge.

One thing that we found is correction of unsuspected illicit discharges. I'll touch on an example of that in a minute. Of course, there are disadvantages. One of the key things is to recognize that just because you're separating the sewer system afterwards it's not necessarily going to be a dry system. You may still have a wet sanitary system and you need to be prepared to deal with that.

We talked about the need to consider stormwater quality already because we want to make sure that the project is beneficial to the receiving waters. The time frames of sewer separation because of the level of localized work may be extended from other types of projects. And then there's always a concern about the amount of disruption associated with sewer separation. I'll come back to that a little bit later.

The concept of unknown illicit discharges is -- I haven't heard this talked about a lot, but in every community that I've worked in where there's been a combined sewer system; when we've gone in and understood the collection system we find that there are portions of the community, maybe a single building, maybe a large area, that are connected to what everyone thought was a combined sewer, but it was really a storm sewer. It didn't go through a regulator. It just went straight to the river. In those cases there is a portion of the community that is 365 days a year discharging all the wastewater directly to the river.

The city of Port Huron had a project where going through and separating an area and found that a sewer that on all the maps was thought to be a combined sewer was going straight to the river. It did not connect through a regulator. When they found it, they had it corrected within less than 24 hours, but it's one of those situations that when we talk about what is the net reduction in load or the net change in load to the river these kind of situations are ones that provide an opportunity to really benefit the water quality of the receiving stream.

And while I'm bringing this up in conjunction with the sewer separation project these kind of situations can occur in areas that are intended for control with other methodologies as well.

Nikos Singelis: Carol, since we're on the topic which is near and dear to the stormwater folks' heart, illicit discharge stuff, I would mention to folks out there who are working on CSOs that we actually do have an excellent guidance document that the Center for Watershed Protection developed for us a couple years ago on illicit discharge detection and elimination. And it has a lot of good information there about how to go and track these things down and find them because as you're mentioning a lot of communities aren't really aware. Sometimes things can get very complicated when you have a lot pipes in the ground, exactly where things are going and mistakes are often made.

But the manual particularly is, I think, well suited towards smaller sized communities and emphasizes some of those investigatory techniques to find out what's happening in the system and where it's coming from and that sort of stuff. So, again, you can find that on the NPDES stormwater web page.

Carol Hufnagel: There's two different ways to approach sewer separation projects. One way is to approach it from the aspect of we want to get enough water out of the system to reduce the frequency of overflow. And the second one is we want to separate the system as the permanent control and it will just strictly be a separated system. I have two project examples here. One's from Boston, Massachusetts, and the other is Lansing, Michigan.

Boston's approach was really from a perspective of reducing the amount of volume going into the system so that the overflow frequency and volume were significantly reduced. And a key aspect of this project had to do with the work on private property. Again, we've talked about private property today and this will give us another perspective on it.

This project has been what's known as the Reserved Channel. It's old Boston. It's very densely populated. There are buildings that are very congested. The streets have a lot of parking on them. There's a lot of utilities below the ground. There's not only water and sewer. We have electric. We have cable. We have all sorts of utility conflicts to deal with in this program.

One aspect of this project was in order to accomplish the amount of tributary area reduction that would be necessary for accomplishing the overflow frequency objective was that private property had to be dealt with. Internal piping in buildings we have a tendency to make assumptions about the way that buildings have been constructed. And even though this area of Boston was an older area, over time plumbing evolved in different ways within buildings. And so, in this area there was an investigation done to determine just how easy would it be to separate the internal piping within the buildings.

And buildings were classified into different types, but the internal piping took on different characteristics where it might be fully separated; it might be separated within the building, but then joined together into one pipe for discharge; or it might be totally combined within the building. And so, accomplishment of removing private property drainage was identified based on a color coding. Basically, think of a traffic light as red, yellow and green where red is difficult and green is easy. Even though this was an older area there were a number of homes and buildings that were already disconnected as far as their stormwater was concerned. And then there were other homes that were very easy to disconnect.

And really, only a few properties were classified as an extremely difficult to disconnect. So, even though the public system may be combined, it doesn't necessarily mean that the private property is combined and there can be opportunities there to pick up the private stormwater components separately from their wastewater components.

The sewer separation program in Lansing, Michigan, is a very significant program. They embarked on construction in 1992 and they have a total of about 7,200 acres that they're looking to separate. They're building new sanitary sewers. This is not necessarily the easiest way to do this in the short term, but in the long term they will have a new sanitary sewer system infrastructure.

When we think about combined sewer systems being constructed as early as 100 or more years ago we know that the physical condition of the pipes in the ground is not always good and so the asset value of the sewer system that we get at the completion of a project that's done this way is beneficial to the long term capital investment of a city.

Lansing has done an excellent job with private property in-flow removal programs. They investigate every property and have found about 20% of the properties have in-flow sources at the beginning of the program and most of those have been corrected. This has not been -- these corrections are of surface water sources and does not include any foundation drain type of connection, but all the private property work in this program has been done at the property owner's expense.

The city has accomplished that through a lot of up-front communication and willingness to enforce their requirements. They put a lot of infrastructure in, but when you look at the infrastructure that's been constructed you see that sewers are only a piece of it. Most communities have water mains that need to be replaced and roadways that need to be replaced because it's just at the end of its useful life. That's one of the things that Lansing has incorporated into their program. It's more cost effective to do these things in conjunction with each other than as independent projects.

The green on this map is the portion of the city that has been separated. The gray is further out in the future and the other colors are coming up in the near term. So, it's taken them time to implement it. They started earlier than a lot of communities, beginning in 1992, but they do have a 30-year implementation schedule to get through those.

So, as they have implemented this program there have been a number of benefits that have been experienced. One of the things that's been accomplished is basement flooding in the areas that have been separated has essentially been eliminated. It's only been in a couple pretty extreme events where basement flooding has occurred in isolated areas. Operation and maintenance of the system has been reduced. There aren't the CSO regulators in the system. The per acre costs are presented there. One thing to note on those costs is that's an aggregate over a period of time, so I can't tell you what the ENR value associated with it is.

Essentially, it's about $58,000 an acre is what they have been spending for the total project and then the portion of the cost that is not directly attributed to sewer separation has been about 25%. So, things like water main, additional street construction that weren't part of the initial project were about 25% of the total cost.

We have some photos of construction; a number of putting pipes in the ground. It's a lot of detailed work house-to-house. Got to make sure all the house leads are connected properly when you're done and everything's suitably connected.

These photos here are actually from the city of Port Huron which has a very similar program to the city of Lansing. Having worked with communities that have gone through sewer separation projects successfully, one of the issues that I hear from people that are considering sewer separation has been, "Well, we can't possibly do that because it's so disruptive and our community just won't stand for it." The articles that we see in the newspaper, at least in the city of Port Huron, the articles that we've seen in the newspaper said, "Gee, that construction was disruptive, but boy, I got a nice street now." So, they don't even necessarily recognize that it's a sewer project.

A lot of other issues have been addressed because a number of these homes would have jointly shared leads and that was able to be corrected as part of the project. And some of the water main condition was extremely poor and so because that was part of the project they're seeing real benefits on a house-by-house basis.

Nikos Singelis: Carol, I can't help but notice in those pictures that it looks like the street got vastly wider.

Carol Hufnagel: It does, doesn't it?

Nikos Singelis: It's prettier. Maybe not something that we would recommend for stormwater issues ultimately.

Carol Hufnagel: Right. That's interesting because I think that AASHTO has street standards for street widths and when you have allowed parking and when you have two-way traffic. I think part of that that you saw in the picture there was a bit of an optical illusion, but nevertheless there is that need to get all coordinated with AASHTO on how we design streets.

Nikos Singelis: That's a good point to make, too. We've been doing some work, too, with stormwater communities about narrowing, particularly in residential streets. Narrowing the width of those to decrease the amount of total impervious surface that we have and to use techniques like swales and things like that on the sides rather than the curb so that we have more of a sheet flow effect than a channelized flow.

So, I think we made a kind of general point, but one of the disadvantages of sewer separation is that you launch yourself into this whole realm of stormwater issues. I think, make sure that we're really looking at this holistically and making sure that the kinds of things we do aren't going to create new kinds of problems for us that then will need to be corrected down the road, too. So, I think some of your points are really good.

Carol Hufnagel: We have a small bit here on our last couple slides on CSO basins. This is just a little bit of an appetizer for part two of this series. CSO basins have been used in a number of programs to accomplish primarily storage of excess flow until it can be sent to treatment. But also, some treatment of the flow including screening and settling and disinfection.

The benefits of basins are that they are a great long-term control measure particularly when you have a large tributary area coming to that point in the system and it allows for complete capture of small storms and for large storms that allows for a decrease in the pollutant load.

There are a whole host of implementation issues that need to be evaluated for CSO basins. This would be true for most storage related facilities or storage treatment related facilities. There's always economies of scale that we can look at so consolidation of outfalls and bringing multiple discharges to one point is usually beneficial. Citing has been one of those issues that has been most likely to disrail a CSO infrastructure project or delay it. It can result in a lot of additional costs in terms of acquisition of property and so forth.

Of course, we have to understand the hydrological and hydraulic conditions. Then there's a series of issues related to the process components of a basin and how are we going to structure it. Basins can include things like first flush tanks and then coupled with flow-through compartments they can be a single cell. Most basins that are broken up into compartments whether it's a first flush or a smaller compartment that contains smaller events help to reduce the operation and maintenance cost because you only have to clean that portion of the basin and you're able to reduce the amount of work after a small event.

Basins that include screening, you have to consider screen location, type and opening size. Screening technology has advanced and we have smaller screens. They have considerations that need to be evaluated, especially with a number of different types of flushing systems. There's a need to dewater these facilities and then a final thing would be maximizing use of the facilities after construction.

One of the things that we've seen with constructed facilities is that because they essentially act as a “fat” spot in the line, is one way to think of them, is that they can accomplish more than their sizes. I've seen facilities where it may be a 4 million-gallon facility, but you have an event that generates 6 million gallons of flow into that facility and you have no discharge because you've been able to use it as the point where you can lead flow back into the interceptor system as capacity is available.

CSO basins do provide a volumetric control and single point. You don't have to go on every street for a sewer separation. The challenges that CSO basins may have is that they don't operate every day and with various types of equipment that needs to turn on and work perfectly during a wet weather event that can be a challenge because some of this equipment was really designed for sustained wastewater treatment plant functionality and it doesn't operate as well when it sits in an idle period.

Rouge River National Wet Weather Demonstration Project involved constructing a number of CSO facilities and collecting a tremendous amount of data at those facilities. There were three in the city of Detroit, three in Wayne County, Michigan, and three in Oakland County, Michigan, and they have been online since 1997 was about the earliest that these basins came online. There's intensive period of flow data -- of monitoring data collection for two years for each of the facilities after they were constructed, so the number of events that are monitored there are noted.

Most of the basins are compartmentalized. Some have the functionality of having a first-flush compartment that capture that first part of the event and then subsequent compartments to handle the latter part of the storm.

And this is just some of the facilities what they look like above ground. People are always -- if you work with a long-term control plan and working with the public they want to know what things are going to look like. They usually cannot be completely hidden, but they don't have to look bad. They can look very nice.

We have just a little bit of data to again whet your appetite for future webcasts. What was found in these facilities is that the influent characteristics of wastewater were stronger than the effluent. So, we know we removed a lot of the more concentrated portions of the flow and provided some settling to go along with that and improve the characteristics.

One of the things is that in a lot of events the influent flow had become relatively dilute for much of the volume and the effluent qualities of BOD in particular were in the range that we would like to see.

The concentrations of ammonia and phosphorus were also less coming out than going in. And just going back to what we talked about before about the characteristics of getting the more concentrated flow from directly into the interceptor. It made a difference here. If the basin tributary area had more sanitary components than stormwater components, the concentrations were higher and vice versa if it was more stormwater dominated.

So, it does speak to getting the more concentrated flow to treatment as opposed to a basin when you couldn't find those opportunities.

Jim Collins: Thank you, Carol. Well, that concludes the slide presentation. We do have a number of questions that have been asked that we have time for addressing those. So, a couple folks asked about when you actually do sewer separation how do you get the private property owners to separate within their own premises. Are the costs of private homes paid for by the projects? Sort of combining that question with another. Have any private property sewer separation projects been combined with water efficiency programs, such as installation of low flush toilets or low flow showers, et cetera. And then what types of -- or any other types of incentives that may have been offered to homeowners or building owners?

Carol Hufnagel: In some of these it's a mix in terms of how payment is done. The programs that I'm most directly familiar with are the ones in Lansing and Port Huron, Michigan what they're doing there. In those, the property owner pays for the work on private property, but there's two things that the community provides and one is a long lead time and technical assistance. That's item one; to help them figure out how to do this and make sure they have the opportunity to plan their budget. We're not talking just homes. We're talking about downtown multiple story buildings. We're talking about industrial property. Some of the work can be quite significant.

The other thing that the communities provide is access to a storm sewer lead where it's needed. So, potentially a municipality could say you've got access to a storm sewer at this corner of your property. That's all I'm going to do for you. But in the spirit of working with the private property owners that leads are made accessible where the property owners need it.

There are programs where again with the concept we talked about before with wet weather flow control and paying for work on private property where if that's the most cost-effective means to implement it that it can be -- that the community would consider cost. I think some communities are doing a number of programs where they have partial payment. So, they'll pay 50% of the cost. There's communities in Ohio that operate that way. So, there's differences.

Mohammed Billah: Carol, I want to add something with your answer. Recently I viewed a small community in Region 5 area for the Clean Water Act for Commissioner Ward. The approach they took for the sewer separation is they give a time frame to the property owner. If you let us do your part of the sewer separation within that time period we'll do it free for you. But after that period if we need do a sewer separation we'll charge you a certain amount.

At the same time they put a deadline that if you do not finish your part of sewer separation by that deadline your sewer connection will be disconnected. That was the approach that they took like a characteristic kind of approach; we'll do it free for you and then if you do not let us do it we will totally ignore your service. Your service will be disconnected; something like that.

Carol Hufnagel: That's an interesting approach. I know the city of Ann Arbor has -- they have a footing drain disconnection program. That's for the purposes of sanitary sewer overflow control and basin backup control. But the way they had it structured originally - and I can't speak to whether it's still this way - is that they would pay for the work on private property. And if the property owner did not cooperate after a period of time they would have a surcharge on their sewer bill that was pretty significant. The number that sticks in my mind and I don't know if this is correct is something on the order of $100 a month. So, that was another carrot and stick approach.

Of course all these things require political support which can be a challenge at times. I guess one of the things that I've seen in private property programs is that if the agency or the individual that's in charge of the sewer system operation if they're proactive and confident that, yes, we can do this, the politicians will generally follow along. There's a lot of concern about most public works officials report to that political body and they don't want to get on their bad side. So, there needs to be a lot of communication, but there needs to be some assertiveness to make them work.

Mohammed Billah: But Carol, you asked for the participation process that can be involved in politics to make the decision which is right for the community, like the one I gave an example. They did lots of public participation meetings on the website and those things before they come up with that kind of decision that they come up with that approach of disconnecting the sewer line.

Jim Collins: Thank you, Mo. Well, we do have time for some additional questions, but first I'd like to remind you that this webcast will be archived so that you can access it after today's live presentation. The archived webcast will be posted within several weeks and you can revisit EPAs NPDES training website to view this and other archived presentations.

Also, we've posted -- as I mentioned earlier -- posted the speakers' contact information in case you would like to have contact with them directly after today. You can find a comprehensive resource list by pressing the "Resources" button on your screen. And finally, the webcast evaluation survey should soon appear on the screen. Please consider completing this survey and let us know your thoughts. We do appreciate your feedback as we work to improve our webcasts. If you do not see the evaluation survey on your screen please turn off your pop-up blocker.

Now, we do have time for a few additional questions. Carol, in the Boston project how were the private property issues dealt with during the planning stage? How was percent capture estimated relating to hydrologic modeling? Were the most difficult, i.e., the red buildings, left alone or left as is and were the green buildings required to disconnect at their own expense? The Boston project seemed to give a good example of an analytical tool, but the question is: What was actually implemented there if you know?

Carol Hufnagel: Well, that project is in a design phase and the approach was there was an overflow control target. There was a frequency target and a volumetric target. And so, as the buildings were classified, the analytical tool of a hydraulic model was used to assess how many buildings needed to come off the system in order to accomplish the performance target. The right of way area was included in the partial sewer separation, but then the question was how much of the building area would be incorporated into the sewer separation?

And it was as the question raised -- the approach was to see how deep in the list did they need to go in order to reach the performance target. So, whether it was the green plus the yellow plus the orange and not the red, I'm not sure where the final line got drawn.

I do not know the answer to the question about how the payment structure was going to go; what the private property owner responsibilities are. We can certainly find that out for the resource document that will be posted.

Jim Collins: Great. Thanks. This question could be applicable to Carol or Mark. The question is: Are there real world comparisons that you're aware of the effectiveness of sewer separation versus CSO treatment on water quality?

Mark Boner: I think in Atlanta, I know when before the storm sewers or the combined sewers were capturing about 18% of the overflows in the treatment plant itself, and so there was an 18% removal of the sanitary part of that combined sewage plus the stormwater part. That's typically the first part of it.

And then once you separate -- they're separating some of those systems -- once you separate those you're losing that 18% of the storm sewer part. It's now going into the tributaries. And you're looking at stormwater controls there. All of Atlanta is looking at stormwater as it is actually contributing 80% of the water quality issues in the river system itself.

If they're looking for specific numbers, I couldn't tell you any more than that. But there are numbers that you can go back and look at the pollutant loads for that 18% of volume. Those were done in some of the earlier studies.

Jim Collins: So, you're suggesting that the treatment of the combined system might be a better approach than separation, at least in that case?

Mark Boner: Yes, exactly. When you have stormwater issues in a community to the water body then you really need to be looking at the bigger picture when you're looking at your combined sewer controls.

Carol Hufnagel: I guess the question is everything becomes site-specific at the end of the day. In cases where there is a major waterbody that flows the discharge into, the impact of the different combined sewage or reduced volumes of combined sewage or stormwater they have different impacts. Our pollutant discharges have either cumulative impacts or they have time-dependent impacts. I think we need to consider on a case by case basis what the most significant impact is and assess that as part of the selection of a control methodology.

I think if you look at it on an annual basis, if you have a high level of CSO control and a system that remains combined versus separating the system, there is -- you usually increase your number of pounds of various pollutants.

Mohammed Billah: I support you 100%. You need to see the bigger picture of what is going on. I think it is very case sensitive to that particular region. You need to be like watershed approach nd you need to find out the bigger picture of the pollutants loading coming into the particular waterbody for the CSO discharge.

At the same time separating the sewer they have been that you're increasing the flow of the stormwater. In that scenario the pollutant load may go up. If the TMDL Level may be going up in that situation. So, it's a very case sensitive thing that whether separation is good for you or it is not good for you. You need to see the total picture, the bigger window that looking at that total waterbody, watershed approach, and what loading you're getting for that particular water-body at that particular situation.

Carol Hufnagel: Then the question is even more broader than that in that beyond the water quality issues you have the potential public health issues if you have basin backup. You need to address those. You need to have an infrastructure that's viable and long-term benefit to the community.

So, you really need to look at the whole picture holistically to determine what the best way to go is. My experience has been to recommend multiple types of approaches. So, I think there's much to be said about it's very case specific.

Jim Collins: Well, we have time for one more question. The question that I'd like to select here is the following: There are often cold weather-related limitations to solutions in terms of pollution control success. Can you speak about some of the implications of cold climates for CSO control and identify sources for case study performance by climate?

Carol Hufnagel: Well, I'm from Michigan so it snows there. I think the main thing that we see with cold climates is not so much a cold climate issue as it is what we've talked about and where I come from as dormant versus growing season. Hydrology of an area is very different when there's active vegetation growth. You get tremendous additional run off during the winter versus the summer.

On the other hand in the winter your protection of the waterbody for swimming type of recreation isn't in place. The impacts on dissolved oxygen in waterbodies are significantly different. So, we'll see a lot higher volume of discharge in the winter, the impacts are not as significant. I'm guessing that the question might be more related to --

Jim Collins: In terms of technologies. Can you identify things that clearly have been shown to be not effective in cold climates compared to warm climates? Again, Mark can jump in.

Mark Boner: In terms of disinfection it's a lot easier to disinfect cold water than it is during the warmer season. In terms of operating equipment you have to consider how things are going to operate and be maintained. So, you're dealing with buildings and things like that in terms of the CSO treatment. It might be underground and it's somewhat tempered, but you have to consider all those factors and things freezing. So, any pertinent parts of technologies have to be protected from freezing.

Carol Hufnagel: I think it's one thing that applies to stormwater control as well. As we look at green technologies to be part of the solution for CSO control the impact of climate differences between winter and summer and how well those controls work under the different seasonality conditions is a question, too. I think there's a lot more that can be learned on it at this point in time.

Jim Collins: Great. Well, thank you. Well, at this time I'd like to conclude today's webcast and thank Mohammed, Nikos, Carol and Mark for presenting today and I'd thank everyone for joining us today.

Remember to check the NPDES training courses and workshops web page for the latest information on upcoming CSO webcasts. The site is www.epa.gov/npdes/training. An announcement will also be sent out through NPDES News. So, sign up for this e-mail newsletter if you've not already done so.

That ends our webcast for today. Thank you for joining us.