OUTFALL STABILIZATION

Mike Clar has not encountered any specific references for the traditional outfall stabilization measures using riprap, however given all the failing and eroding outfall that are being inventoried by the local jurisdictions it would not be too difficult to develop estimates of the volume of sediment that is eroded and this could then be tied to the drainage area to yield a sediment volume in tons or lbs/acre. The nutrient load can then be tied to the sediment load.

Below are the responses that we have received. Mike Clar has met with Matt Meyers of Fairfax County and will have one final piece of input. As seen from the responses, outfall stabilization is a topic of significant concern for many local jurisdictions for the reasons that they identify. It is also an area that is undergoing a substantial amount of transition at this time. Some jurisdictions, like Carroll County, still use traditional stabilization measures, which consist primarily of riprap aprons and channels. However, a growing number of jurisdictions are now using RSC's as the preferred method of outfall stabilization. Anne Arundel County is the leader in this area and all the outfall stabilizations are done with RSC.

Radu Zamfirache, Baltimore County

From: Radu Zamfirache <rzamfirache@baltimorecountymd.gov>
Sent: Tuesday, February 3, 2015 5:03 PM
To: Clar, Michael
Subject: RE: Otfall Stabilization

Mike,

We, at Baltimore County, are in a somewhat similar situation as far as outfalls condition is concerned. Countywide, we have a total of approx. 7000 outfalls. I say "approximate" since we have not yet finished compiling all the data in our newly acquired storm drains layer. We also know (from the older compilation done by our DEPS) that there are 4409 ponds in the County.

The problems with the outfalls were and still are one of the hardest to tackle. We've been working on them since ever. We've addressed many but there are much more out there that were and still are problematic. the County does not have - at this time - a systematic approach to dealing with them. Rather, they're addressed on a first-encountered-first-fixed basis. Up until now, we simply did not have the core logistics needed to go for a systematic approach. We do believe (and it doesn't take much science to figure out) that failed outfalls play a central role in transporting sediment (nutrient laden, for that matter) into receiving waterways. While statistics and observations are hard to come by, we hold a firm belief that the outfalls do a lot more damage to streams/bay/wetlands than they're credited for, at least from the perspective of the amount of funds that goes into addressing them. I underline that while many outfalls may be problematic, they're primarily addressed on an emergency basis (i.e. another piece of infrastructure is either in peril or already failed due to the failure of an outfall). That makes

outfall work somewhat contingent to other work, even when the outfall gets the lion's share of the cost of any particular project.

Some progress was made since DEPS started monitoring water quality at outfalls. This allowed them to identify a number of outfalls that are clearly in trouble and provided us (DPW) with a preliminary inventory of issues to address.

Let me just outline the key points of the conversation over outfalls,in the way we see them:

1. What is an outfall, in our understanding?

Obviously, any conversation should start with defining its own scope. In our view, and as far as our jurisdiction (SDDS) is concerned, an outfall is any point where a man made runoff conveyance system discharges into a surface waterway. For the scope of runoff drainage (which makes the object of storm drainage infrastructure), we do not regard in-stream, on-line structures as being outfalls. Similarly, we do not deal with sanitary outfalls.

2. Why do outfalls fail?

In the overwhelming majority of cases, when a fault can be assigned to error, the answer to this question is pretty straight forward: inadequate energy dissipation. When it comes to what causes outfalls to fail, there are many culprits, so I'll enumerate just the ones that readily come to mind (no intent for the list to be exhaustive or provide any rankings):

a) faulty execution: the outfall was simply designed without due consideration to the conditions in the field (whether the nature of the soils, flow rates, velocity or any combination of these) or the construction was executed poorly.

b) improperly identified "suitable outfall point": again, improper documentation of soils, grades, improper computation of flow rates, velocities, poor standards or poor implementation of existing standards; expedient (and convenient) design practices that attempt to apply boilerplate solutions, ignoring the legwork needed to verify and adjust practices to what's really happening in the field, etc.

c) in-fill "upgrades": new storm drain systems are introduced (as a result of in-fill development or of redevelopment) or existing storm drain systems are upgraded but nobody checks/upgrades suitability of the existing/old outfall to accept modified hydraulics. In the same category one should consider the introduction of a base-flow into a system initially intended to function only under storm events.

d) failure of pipe systems in the immediate vicinity of the outfalls.

e) obstruction of the outfall channels: improper placement of extraneous materials (either refuse or even plantings) in the waterway, obstructing the intended and/or otherwise stabilized outfall channel.

f) failure of other utilities passing by in the immediate vicinity of an outfall: sanitary sewers, water lines.

g) weather events: many an outfall finds it demise with a tree uprooted by a wind storm, in a landslide or by other similar "act of God" type of events.

h) failure of land retaining structures: retaining walls, road embankments, pond embankments, etc.

i) natural evolution of streams: in its naturally occurring course, (perhaps increased meandering, greater flows, etc.), a stream undermines and ultimately dislodges an outfall structure.

j) anthropic events: traffic accidents; construction incidents, lack of minimal maintenance, etc.

These are just a few of the causes I can think of, at a first glance. As said before, the list is not exhaustive.

3. What are the hurdles we encounter when attempting to deal with failed outfalls?

The outfalls are notoriously difficult to address. There are financial, technical and ownership hurdles to overcome in order to successfully restore a failed outfall. I'll enumerate, again, the ones that most often occur and therefore easily come to mind:

a) Access: many times (indeed an overwhelming majority of cases) failed outfalls are simply very difficult to reach. Part of it may be due to them being usually landlocked among private properties and served by insufficient easements. another part of this story is that in their failure, outfalls trigger severe erosion, which translates in unstable slopes, deep cuts, slope collapse and other such catastrophic failures that result in the need of very extensive construction just to reach the location of the failure.

b) Cost: the high cost of addressing outfalls largely derives from access issues. A distinctive component here is the ability to reach the location, unimpeded. Even when easements are acquired and suffice in terms of width, they may traverse multiple private properties and often require removing and resetting or replacing of numerous private structures.

c) Utilities: it is not unusual to encounter utility conflicts and - many times - utilities that have themselves been damaged in the process of an outfall's failing. Temporary or permanent relocation of such utilities routinely introduce extreme costs in the equation.

d) lack of crediting mechanism: despite the obvious benefit of stabilizing an outfall, there currently are no easily available and handy mechanisms to credit the work against restauration efforts. In the last year an evaluation of 29 failed outfalls yielded only 5 projects (17.24%) that were found to be creditable for reductions under the existing mechanisms. This is an extremely low return, considering that the sole evaluation criterion was exactly the outfalls' ability to contribute to MS4 implementation, with deliberate disregard towards all the other restrictions and considerations.

4. When we DO pursue an outfall repair, what are the core tenets we follow and what do we usually do?

a) Evaluate the outfalls suitability: is the outfall where it should be, given its hydraulics?

b) Stabilize the outfall channel: make it so that erosion is arrested, under the hydraulic conditions.

c) Install adequate energy dissipation.

d) Reconstruct the outfall structure.

5. When the outfall restauration proves unfeasible and the outfall is otherwise nearing its point of self equilibrium, we would explore the possibility to install detention within the tributary area, in a way and to an extent that would re-adjust the outfall's hydraulics, hopefully dialing back its erosional (and contamination) potential to the minimum feasible.

These would be the outlines / synopsis of what outfalls mean and how we pursue them. In the coming weeks/months I will try to prepare a comprehensive list of representative projects with brief descriptions of how they came to be and how we pursued them. It is true that there's a dearth of information on actual / measured environmental impact of this work. And this is exactly why we feel that this matter actually DOES NEED further evaluation and a more methodical approach. Financing could be available, the results can be astonishing but - we believe - they cannot be made into a feasible pursuit unless proper crediting can be assigned to this work.

Let me know if this track is something that you would be interested in and/or if you think of any other approaches that may be of use.

Thanks,

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Derek Winegradoff, Prince Geoerge's County

Hi Mike:

It was good speaking to you the other day about outfall stabilization. As you know, the County has performed many outfall stabilization projects over the years. In the past, DPWT and DER (DOE) could repair outfalls under maintenance and operation purview as long as we did not perform work within the stream proper. For a period of time, we also had a blanket maintenance agreement to do maintenance and repair work for outfalls of SWM facilities, regular SD outfalls, and roadside ditches and channels. We no longer have the blanket agreement and now have to apply for a permit for each location separately.

Beth Schrayshuen of our office has several projects involving outfall stabilization. Because of the typical lowlands location of the outfall work and the quantity of disturbance, what began as a simple emergency outfall repair project has snowballed into an arduous permitting endeavor. Concept approval is required, necessitating sediment and erosion control review, which requires an NRI, which in turn identifies work being performed in the floodplain, WUS, and possible wetland delineation and mitigation if there are project impacts.

Suggest that you talk to Beth directly about her recent experience with outfall stabilization.

On a related note, when I met with MDE (Ray Bahr and Debbie Cappisetti) about our Water Quality Analysis of Existing Roadway Imperviousness protocol, they suggested that we evaluate outfall stabilization for WIP credits. I expressed to them our desire to do so, but the permitting requirements make derived benefits impractical.

Derek

Martin Covington, Carroll County

Dear Mike,
Please refer to pages 42a and 42b of the CC Supplement. Page 42a shows our modification of the plunge pool (stilling basin) outfall and page 42b shows our level pipe outfall. Both work. 42b is more substantial. We use a combination of both when discharging onto a sand filter. See page 73.
Best wishes,
Sincerely Yours,

MBCIII PE
Martin B. Covington III,PE,CFM,DWRE
C.C. SWM Program Engineer
410-386-2205

Peter Hill, DC

From: Hill, Peter (DDOE) <peter.hill@dc.gov>
Sent: Monday, February 2, 2015 6:02 PM
To: Clar, Michael
Subject: RE: Outfall Stabilization as an Urban BMP.

Hi mike – for the ones the DDOE funds, we install RSCs – ranging from 200 ft to 1000 ft.

DC Water may also put in rip rap aprons as well –

Hope all is well
Best,
Pete

From: Hill, Peter (DDOE) <peter.hill@dc.gov>
Sent: Tuesday, February 3, 2015 3:58 PM
To: Clar, Michael
Subject: RE: Outfall Stabilization as an Urban BMP.

Hi mike – sure thing – ddot may in a couple of cases – however it's not standard. One project – Oregon Avenue reconstruction is one where they may put in some RSCs. I'm not aware of any other DDOT projects where they are specifically looking to address outfall issues.

Wayne Wilson is the PM for DDOT. Wayne.wilson@dc.gov

The contact for DC Water is will elridge see attached.. he is very involved in the outfall work. DCWater and DDOE collaboratively developed an assessment of all outfalls.

Best,
Pete