Appendix 1

Draft 2017 MS4 Stormwater Annual Report

Water Testing

Memo to EPA dated 8/28/17

ENGINEERING DEPARTMENT

City of New Haven
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Toni N. Harp
Mayor

MEMORANDUM

TO: Jack Melcher, EPA
FROM: Ian Juden, City of New Haven
DATE: August 28th, 2017
Subject: Inlet Testing – MS4 and PPCP

Hi Jack,

This memo and the attached documentation forms my report on the supplemental water testing we discussed when you visited earlier in the month. The main objective of this testing was to try to verify my suspicions that run-off entering the MS4 is heavily polluted with bacteria from animal life. The Quinnipiac estuary is a migratory gathering ground for waterfowl, and also a significant breeding area for them. Approximately 26% of the city's area has an impervious area of less than 11%, and much of this is undeveloped woodland with abundant wildlife. Out of curiosity PPCP tests were done in addition to the MS4 spectrum to determine if they were present to any extent in run-off. All samples were taken from gutter flow into the catch basins just below their gratings, as indicated in the attached RFP. They were taken on three separate occasions in November 2016 and the spring of 2017.

The spreadsheet 'Inlet Test Results MS4 & PPCP' is similar to the one given to you earlier this month, with the exception that an estimate has been made as to how long rain had been falling prior to the sampling. This was to ensure that the results were not elevated by being in the first flush immediately after the start of the storm. Unfortunately NOAA information has only been published on their web site up until 2014. The attached data from the Wunderground website was used. There are some anomalies in it indicating no rainfall when the samples were taken, but I put these down to the weather station at Tweed New Haven airport being several miles from the sampling locations. As can be seen, all samples were taken well after the start of rainfall.

The test results are in the attached spreadsheet 'Inlet Test Results MS4 & PPCP'. Those marked yellow are in networks above the outlets routinely sampled as part of the MS4 monitoring programme.. Each of the six outlets has at least one catch basin sampled. The reason for the lack of consistency in numbers is the scope had to be cut back due to budget constraints. CB.831 on Whalley Avenue and CB.9278 on Orange Street were chosen due to their close proximity to West and East Rock parks respectively, both of which are heavily wooded areas rich in wildlife. As you will note both E-coli and enterococcus were more elevated at these locations. CB.9278 was also sampled by you on November 25th, 2014.

CB.2021 on Donna Drive was a substitute for Gando Drive which you also sampled on November 25th, 2014. Gando Drive was un-accessible at the time of sampling, and Donna Drive is a similar location.

The results highlighted in orange exceed the limits prescribed in the current MS4 permit. The results are variable from location to location, but they do indicate the stormwater entering the MS4 to be dirty. The only other observation I have is that CBs 5674, 5679, and 5142 probably have high levels of E-coli and enterococci as they are within 200 yards of both a dense wooded area and a privately owned solid waste transfer station which attracts seagulls.

Turning now to the PPCP testing, it must be noted that the laboratory (ALS) undertaking the testing was not able to achieve the low detection limits that usually apply to these tests for all analytes. I have discussed this with Bert Grauer of ACT, the primary laboratory for this work. He has advised that this was due to small quantities of fine grit in the samples preventing full extraction of the analytes during the concentration process. This sounds reasonable as New Haven has a very fine sandy soil which must get washed into the gutter flow that was collected. He also expressed skepticism that the low reporting limits indicated in EPA Method 1694 could be achieved in anything other than potable water. In the report ACT have indicated the detection limit achieved, whilst ALS have indicated non-detectable. In the spreadsheet I have used a zero for all non-detectable results. This is not an area that I have any great expertise in, so I've taken the results at face value. If your experts at the EPA want to take this further let me know, as I will need to get ACT to issue a release to ALS to allow them to talk about the results. ALS consider they have a duty of confidentiality to ACT, of foodstuffs containing cacao who they consider their client for this work.

Going to the spreadsheet, the first section is highlighted with shades of blue where ALS have issued qualifiers for the result. In the second section all results that exceed the limits indicated in your 9/19/14 spreadsheet have been highlighted in light brown where unqualified, and a darker brown where qualified by ALS.

My comments on the results, based on a read up on the analytes in Wikipedia are as follows :-

1,7-dimethylxanthine.

This is a metabolite of caffeine consumed by humans. It is also a metabolite of theobromine produced by animals, theobromine being present in chocolate and other foods. It is therefore possible that it is present in the environment from animal consumption as it was present in 45% of the samples.

Acetaminophen

This was present in 70% of the samples. As a cheap, commonly used over the counter pharmaceutical this is probably due to it being readily disgarded, and it would appear to be

present in the environment generally. Interestingly, CB.8422, which had by far the highest concentration of 1,300 ng/l is just 200 yards from Yale New Haven Hospital.

Caffeine

Present in significant quantities in all samples. It would appear that people spill a lot as they walk around. CB.8327, which has the highest concentration of 5,800 ng/l, is in a shopping precinct in the heart of the Yale campus which has numerous small restaurants, convenience stores, and coffee shops. Another readily available consumable that appears to be in the environment generally.

Cotinine

This is a metabolite of nicotine that has a half-life of approximately 20 hours. Saliva from regular smokers typically contains 100 ng/l. The most probable way this analyte gets into storm water is through disgarded cigarette ends. The attached photograph shows a catch basin that drains to Outlet 109 which contains somewhere between 30 and 50 cigarette ends. There are similar ones in the downtown area, where smokers dispose of their cigarette ends outside clubs and restaurants. Contine would appear to be another analyte that is generally present in the environment due to disgarded cigarette ends. It was present in 45% of samples.

Primidone

This is an anticonvulsant used to treat seizures and epilepsy, and its use appears to be decreasing. It was detected in just one sample, and there is no obvious reason for this.

Urobilin

A urine related chemical that results from the degradation of heme. It was detected at only one location, which as mentioned above is close to dense wood land and a privately operated solid waste transfer station. It's most likely origins are wildlife.

Atenolol, Azithromycin, and Carbamazepine

These were non-detected, but at much higher detection limits than EPA Method 1694 indicates are achievable. Obviously, they could have been present, but not detected. The same can be said for Primidone and Urobilin.

Based on these test results my conclusions are that 1,7-dimethylxanthine, caffeine, acetaminophen, and cotinine should not be used as PPCP analytes in densely developed urban areas. These chemicals appear to be present in the environment generally. It would be better to use other pharmaceuticals, preferably ones that are easily detectable, widely prescribed, and expensive, so they don't get disgarded.

The spreadsheet "Inlet and outlet comparison' is based on your 9/19/2014 spreadsheet, with all subsequent outlet testing added in, together with the inlet testing for comparison. The brown highlighting shows whether a particular pollutant is more prevalent at the inlet or the outlet. Generally no particular pattern can be observed, except that E-coli are in all instances at higher levels at the outlet. This does suggest that there are illicit discharges into all the networks sampled. Surfactants and enterococci were not considered as there was so little data for them.

The high levels of enterococci in the inlet tests piqued my interest, and I surfed the web for information for relationships between enterococci and E-coli level, but could find none.
It appears that historically E-coli were used as the gauge of sewage presence in salt water as late as the 1990s, when it was superseded by enterococci, this being based on extensive research in California. It would appear that brackish water with varying degrees of salinity has not been considered. As this is what New Haven has, there is the conundrum as to which of these bacterial samples should be given the most weight. The inlet samples suggest that there will be occasions when E-coli levels are satisfactory, but enterococci are not. Going forward the City's routine testing at outlets will include both enterococci and salinity.

As always, your comments and feedback will be most welcome.

Attachments:-

Supplemental Water Testing RFP
Catch Basin Location Plans
ACT Report Part 1
ACT Report Part 2
ACT Report Part 3
Weather Data
Inlet Test Results MS4 & PPCP
Outlet & Inlet Comparison

Cc Chrons
File 16-146-01


CANADA

watershed exceeds 12%. Stormwater pollution from IC is a likely cause of impairment for these waterbodies.

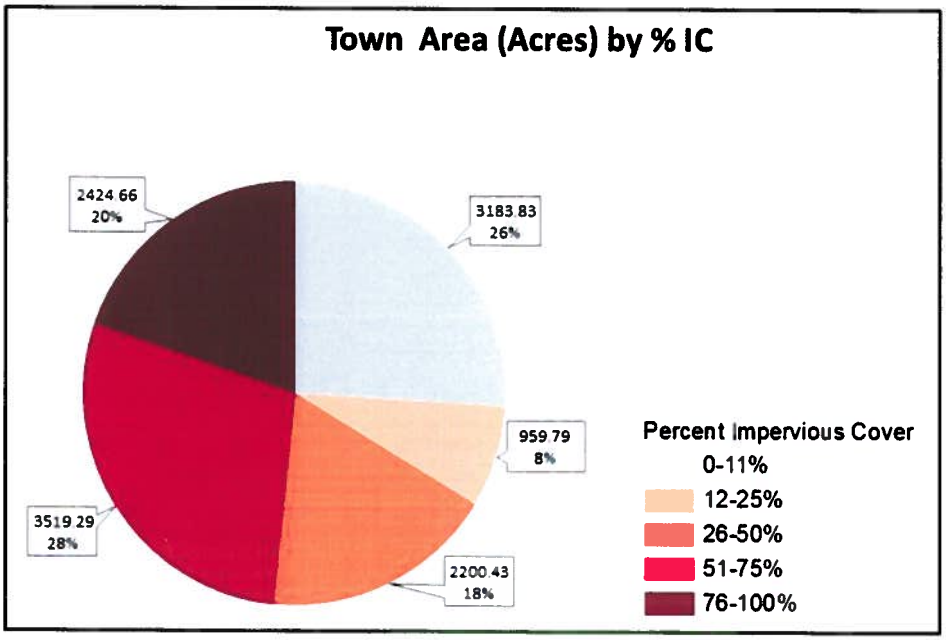
City of New Haven: Impervious Cover Data

This chart shows the amount of area within your town that contains IC. Data is grouped by acres and percent IC. While all levels of IC can contribute stormwater to streams, it is important to note that land with IC greater than 12% in town is likely to be contributing enough stormwater to streams to have a negative impact on water quality.

Towns should aim to make stormwater improvements in areas with IC greater than 12% in an effort to reduce the amount of stormwater pollution reaching surface waters which will protect and improve water quality.

For more information on areas of impervious cover within your town, please see the maps at the back of this factsheet.

Amounts of Impervious Cover within the City of New Haven



Pollution Reduction

Waterbodies often can handle a certain amount of pollutants and still maintain good water quality. However, impaired waterbodies have too much pollution impacting their water quality and therefore the streams do not support all uses for the waterbody. Total Maximum Daily Loads (TMDLs) are pollution reduction budgets developed for impaired waterbodies in order to meet water quality. If the pollution budget is achieved through the recommended pollution reduction

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Your Town: Land Cover

Back

Basic Landcover Information Showing Changes to the CT Landscape

Select your town by clicking on the map or with the pull-down menu. Then press **Go**.

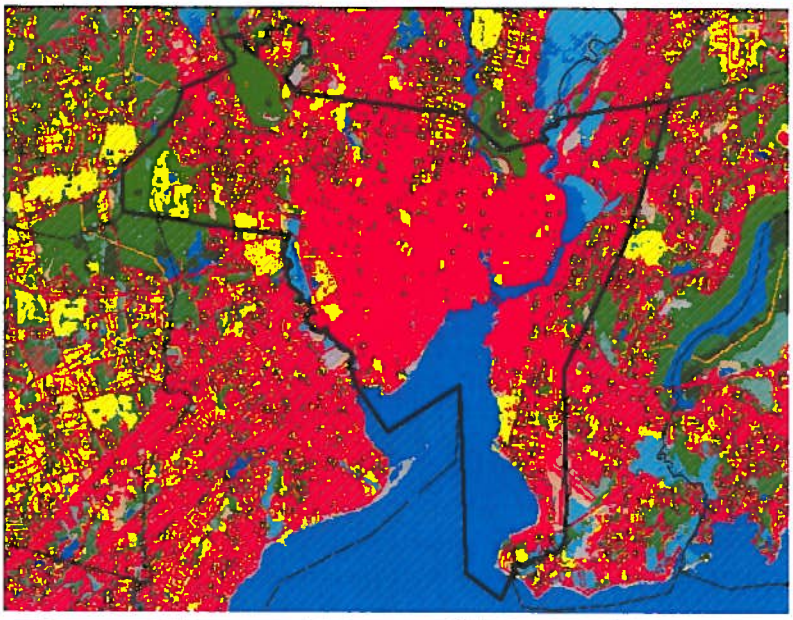
This page contains static maps and area statistics (scroll down) for all five dates of land cover and for all 169 municipalities in Connecticut.

The 1985 and 2006 land cover maps, as well as both change maps, have pdfs for viewing, saving and printing.

New Haven Go

New Haven, Connecticut

1985 Land Cover | 1990 Land Cover | 1995 Land Cover | 2002 Land Cover | 2006 Land Cover | Change To Developed | Change From



2006 Land Cover

Printable PDF

LAND COVER
- Developed
- Turf & Grass
- Other Grass
- Agricultural Field
- Deciduous Forest
- Coniferous Forest
- Water
- Non-forested Wetland
- Forested Wetland
- Tidal Wetland
- Barren
- Utility (Forest)

New Haven Land Cover and Land Cover Change

	1985		1990		1995		2002		2006		Change	
	acres	% of town	acres	% of town	acres	% of town	acres	% of town	acres	% of town	acres	% change
Developed	8234	%67	8341	67.9%	8402	68.4%	8422	68.5%	8465	68.9%	231.3	2.8%
Turf & Grass	1092	8.9%	1067	8.7%	1063	8.7%	1056	8.6%	1057	8.6%	-35.3	-3.2%
Other Grasses	129	1%	124	1%	119	1%	118	1%	124	1%	-4.9	-3.8%