Walnut Creek Storm Sewer Hydrant Flush Study

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Frequent rainfall occurred in the fall of 2007, washing the storm sewers leading to Walnut Creek of possible debris that might contribute to the high coliform counts and stream chemical contamination following rainfall. However, there finally came a three week period where no rainfall occurred, allowing this hydrant flush study to be conducted.

A storm sewer located at 63rd Street and Grand Avenue, Des Moines, was selected for study.

Method:
A water diffuser was attached to a fire hydrant one-half block from the storm sewer mouth, and the valve was opened to allow a vigorous amount of water to flow into the street and down the storm sewer. A sample of the street runoff was collected as it entered the storm sewer. Additional samples were collected at the mouth of the storm sewer prior to entering Walnut Creek, following zero, five and ten minutes of flow. The hydrant valve was then closed.

A second fire hydrant located on the same storm sewer three blocks from the storm sewer mouth, was opened and allowed to flow into the storm sewer. Additional samples were collected at the mouth of the storm sewer at zero, five and ten minute intervals. An up stream sample of Walnut Creek was also collected.

Quanti-tray 2000 trays were inoculated using Colilert medium, to assess the total coliform and *E. coli* levels. An anion battery and TOC levels (Total Organic Carbon) was performed to determine basic chemical content of the flush water.

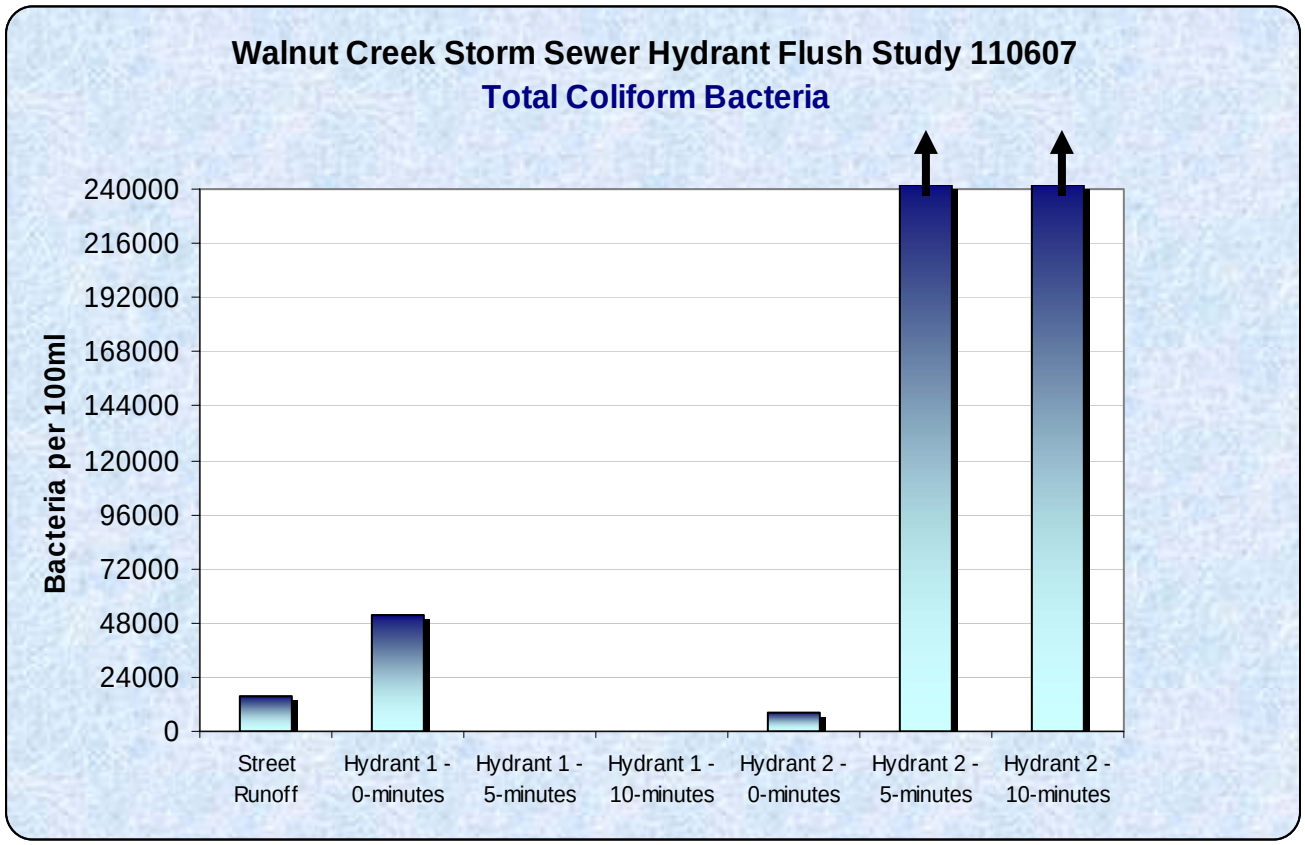
Bacteriological Results:
The Walnut Creek flow was low to moderate and the water was visually very clear. A definitive total coliform value was not attained; however, the *E. coli* count was 285/100ml.

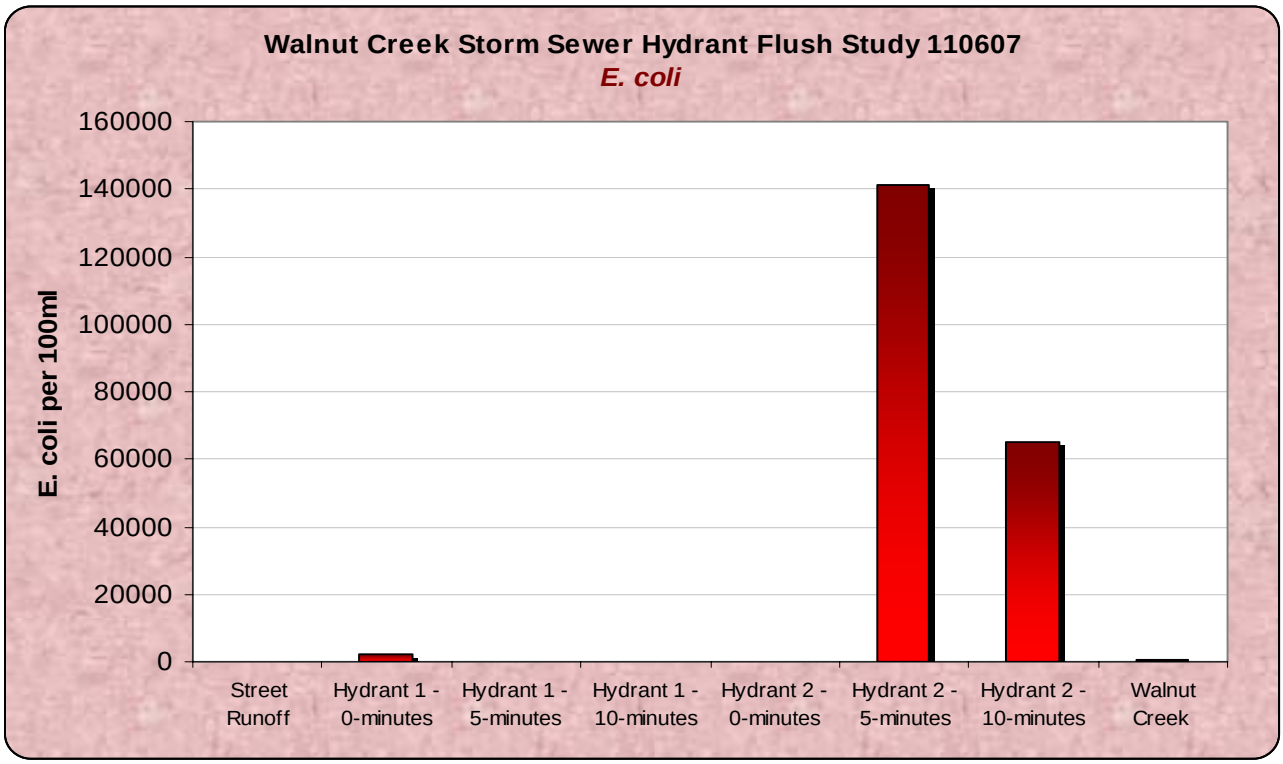
A moderate amount of total coliforms and a low amount of *E. coli* were recovered from the street run-off. Its contribution to the total coliform numbers was moderate, likely due to soil from the street. Its contribution of *E. coli* to the storm sewer numbers was small.

The initial flush water from the first hydrant caused the bacterial counts to momentarily increase to reach moderate numbers, relative to post rain counts recovered in the previous Walnut Creek watershed studies. Within five minutes, the bacterial counts dropped dramatically and remained low after ten minutes of flushing.

The initial flush water from the second hydrant produced moderate bacterial numbers. Within five minutes, the counts surged to reach high bacterial numbers relative to post rain counts recovered in the previous Walnut Creek watershed studies. After ten minutes, the numbers began to subside to half the five-minute value.

Sample	**Total Coliforms / 100ml**	***E. coli* / 100ml**
Walnut Creek upstream	>2,419	285
Street Runoff	15,290	96
Hydrant 1 – 0-minutes	51,720	2,160
Hydrant 1 – 5-minutes	67	0
Hydrant 1 – 10-minutes	93	1
Hydrant 2 – 0-minutes	8,010	249
Hydrant 2 – 5-minutes	>241,920	141,360
Hydrant 2 – 10-minutes	>241,920	64,880


Walnut Creek Storm Sewer Hydrant Flush Study 110607
Total Coliform Bacteria
Bacteria per 100ml
240000
216000
192000
168000
144000
120000
96000
72000
48000
24000
0
Street Runoff
Hydrant 1 - 0-minutes
Hydrant 1 - 5-minutes
Hydrant 1 - 10-minutes
Hydrant 2 - 0-minutes
Hydrant 2 - 5-minutes
Hydrant 2 - 10-minutes

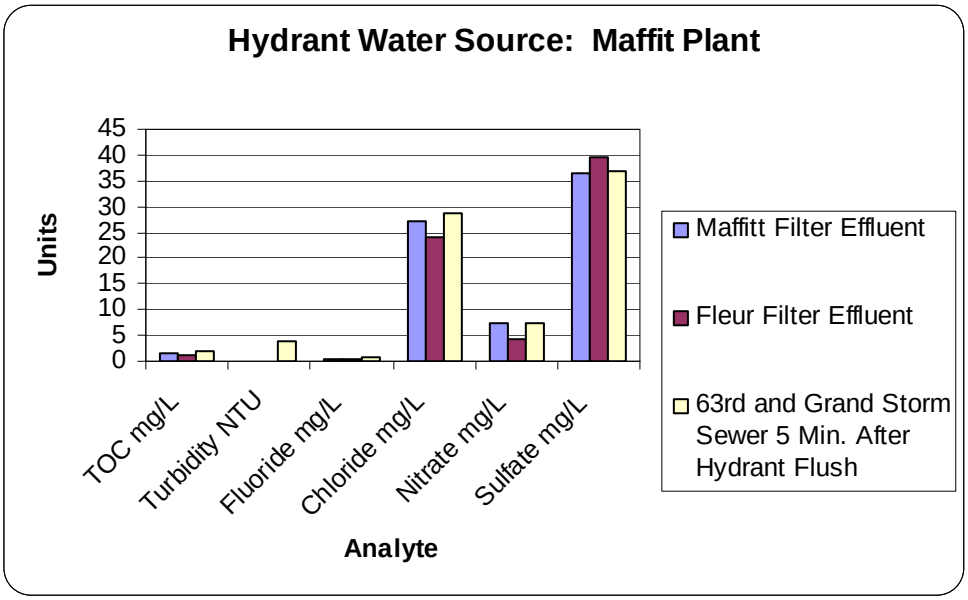

Walnut Creek Storm Sewer Hydrant Flush Study 110607
E. coli
E. coli per 100ml
160000
140000
120000
100000
80000
60000
40000
20000
0
Street Runoff
Hydrant 1 - 0-minutes
Hydrant 1 - 5-minutes
Hydrant 1 - 10-minutes
Hydrant 2 - 0-minutes
Hydrant 2 - 5-minutes
Hydrant 2 - 10-minutes
Walnut Creek

Chemistry Method:
A water diffuser was attached to a fire hydrant one-half block from the storm sewer mouth, and the valve was opened to allow a vigorous amount of water to flow into the street and down the storm sewer. A sample of the street runoff was collected as it entered the storm sewer. Additional samples were collected at the mouth of the storm sewer prior to entering Walnut Creek, and after 5 minutes of flow. The hydrant valve was then closed.

Samples were not collected from a second fire hydrant located three blocks from the storm sewer mouth.

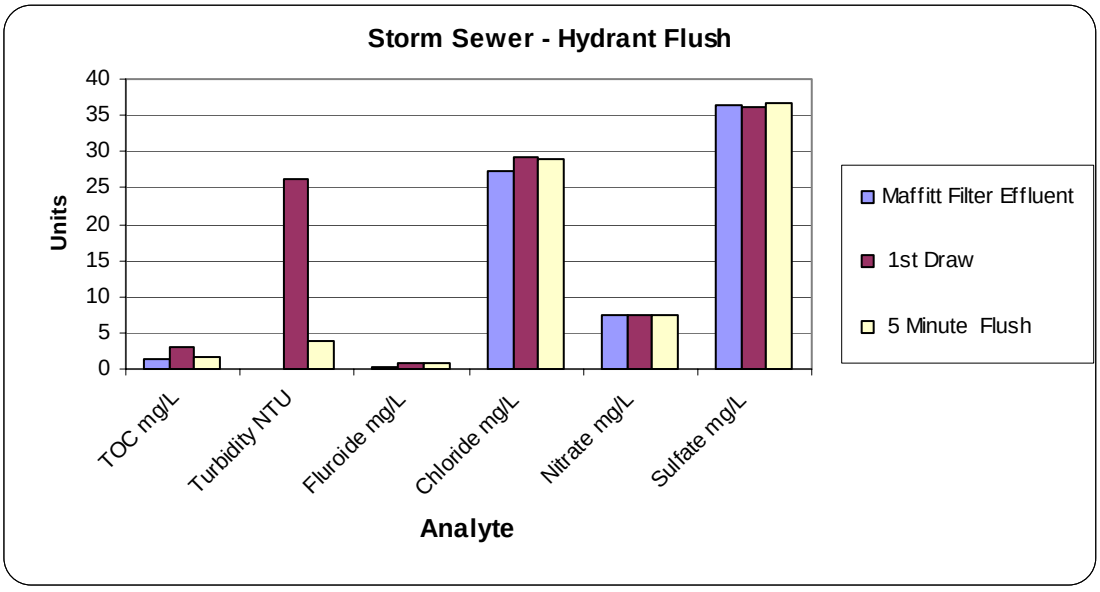
Chemistry Results:
An anion scan comparing the Fleur and Maffitt finished water to the hydrant water after a 5 minute flush determined the source of the hydrant water to be that of the Maffitt water treatment plant.

Sample Site	Sample Date	Fluoride mg/L	Chloride mg/L	Nitrate-N mg/L	Phosphate-P mg/L	Sulfate mg/L
Fleur Filter Effluent Water	11/05/07	0.3	24.03	4.37	<0.1	39.59
Maffitt Filter Effluent Water 63 &Grand Storm Sewer after 5 min. flush	11/05/07	0.27	27.24	7.4	<0.1	36.48
	11/05/07	.86	28.90	7.42	<0.1	36.66



Organic compounds increased 100% and turbidity increased 25000% after the initial flush water passed through the storm sewer. In addition, the chloride increased 8% while nitrate-N and sulfate remained unchanged. These increases are similar to post rain turbidity and chloride results observed in previous studies. Within five minutes, the organic and turbidity concentrations dropped dramatically.

		Analyte							
Sample Site	**Sample Date**	**TOC** mg/L	**Turbidity** NTU	**Total Chlorine** mg/L	**Fluoride** mg/L	**Chloride** mg/L	**Nitrate-N** mg/L	**Phosphate-P** mg/L	**Sulfate** mg/L
Maffitt Filter Effluent	11/06/07	1.47	0.103	NA	0.27	27.24	7.4	<0.1	36.48
Storm Sewer 1st Draw	11/06/07	3.10	26.10	0.31	0.87	29.33	7.43	<0.1	36.27
Storm Sewer 5 Min.	11/06/07	1.77	3.97	0.53	0.86	28.90	7.42	<0.1	36.66



The chemistry studies revealed:

1. Turbidity appears to be the greatest contributor of urban contamination to Walnut Creek at the time of this study.
2. It is speculated that the organic matter contribution may be due to either wild or domestic animal waste or degraded plant materials.
3. As noted in previous studies, the chloride concentration will most likely surpass turbidity as the analyte causing the greatest increase to Walnut Creek concentrations once public works crews apply road deicer.
4. The nitrate contribution from urban runoff, at the time of this study, was not a contributing source water contaminant as it is in agricultural field runoff. The

amount of nitrate could potentially increase in early summer following fertilizer application.

Summary:

The first hydrant flushed only one-half block of the storm sewer, which yielded a moderate number of bacteria that soon dwindled to very few. Once the second hydrant was used to flush three blocks of storm sewer, a large number of bacteria were recovered, yet this number also began to decrease after an additional five minutes of flushing.

In our previous Walnut Creek studies, we recovered high numbers of bacteria after the rain had fallen for a few hours. This might be accounted for because a far greater amount of the storm sewer system was flushed by the rain. The material could be waste from wild animals or from pet waste as it is washed off of lawns or discarded down storm sewers by pet owners. The high numbers might also be sustained due to sewage infiltration of the soil originating from leaky home sewer pipes.

This study shows that storm sewers harbor material that may adversely affect stream water quality.

Whereas agriculture contributes much fecal contamination to Iowa streams, it must be acknowledged that urban communities also contribute to the bacterial and chemical contamination of the waterways.