Field Findings

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Subject: Pollution Detection & Elimination in Salisbury, MD

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Section 1. Introduction and Project Goals

Introduction

The Center for Watershed Protection (CWP) and other researchers have found illicit discharge detection and elimination (IDDE) to be an important best management practice (BMP) for eliminating systemic sources of contamination in water resources. IDDE has been shown to provide quantifiable pollutant load reduction benefits for water quality and IDDE can be listed alongside other BMPs (e.g., bioretention) in a jurisdiction's watershed planning tool box. For example, during field work in the City of Baltimore, CWP found that the pollutant reductions associated with the removal of one of the illicit discharges discovered would be equivalent to building over 140 bioretention facilities (each treating a 1/2 acre of impervious cover) at a conservative cost of over $1.7 million dollars.

Despite significant quantifiable pollution reduction benefits, IDDE is an under-utilized practice by local jurisdictions for meeting their water quality goals. To this end, CWP has been holding trainings and workshops in communities throughout the United States promoting and advancing IDDE programs. The methods used in the CWP's IDDE program have been research-tested to effectively isolate pollution sources and particularly useful for detecting sources of wastewater contamination, which carry large amounts of nutrients as well as bacteria containing potentially harmful pathogens (Brown et al, 2004). Adoption of the comprehensive methods presented in the CWP's IDDE program will be especially important as local jurisdictions begin developing Watershed Implementation Plans for meeting local and the Chesapeake Bay Total Maximum Daily Loads (TMDLs).

Funding for this project from the National Fish & Wildlife Foundation's Chesapeake Small Watershed Grant Program was used by the CWP to meet the following goals.

Primary goals:

- Work with three communities in Maryland to use IDDE as a BMP for nutrient and bacteria reduction;
- Train staff of local jurisdictions and watershed groups in IDDE techniques using CWP guidance materials;
- Find and fix illicit discharges;
- Determine practices for reducing wastewater contamination in a community with combined sewer overflows (City of Cumberland);

Secondary goals:

- Calculate pollutant loadings associated with detected illicit discharges;
- Refine methods for coastal plain communities; and
- Determine extent of illicit discharge problems in areas of Maryland outside of Baltimore, including a Phase I MS4 (Montgomery County), Phase II MS4 (City of Salisbury) and an unregulated municipal separate storm sewer system (MS4) communities (City of Cambridge).

One of the four communities that CWP worked with on this project was the City of Salisbury, MD (the City) in the Wicomico River watershed (Figure 1). The City's current IDDE program, regulated through a Phase II municipal separate storm sewer system permit (MS4) with the State of Maryland, consisted of visual surveys, but did not include any water quality testing. As part of

this project, CWP trained Salisbury Public Works (SPW) staff in both the classroom and the field to use a specific set of water quality parameters to detect illicit discharges. The classroom training also provided the City with training in pollution prevention, stormwater, watersheds, and more detail on illicit discharge program development. See Attachment A for the 3-day training and field work agenda.

This project also enabled CWP to refine methodologies developed in Brown et al (2004) for application in a Coastal Plain community. The City is at the head of tide in the Wicomico River watershed. Though the water is tidal, it is still freshwater and contains no salt. The City is the state of Maryland's second largest port so the river is heavily navigated and bulkheads are prevalent along the shoreline. For this reason, it was necessary to conduct the majority of the work by boat.

Results of this study continue to reinforce conclusions that illicit discharges are an overlooked source of nutrient and bacteria pollution to local streams and the Chesapeake Bay. By promoting effective IDDE programs as a BMP to jurisdictions throughout the Bay, the potential exists to make significant strides toward meeting local and Bay TMDLs. Communities like Salisbury that have a Phase II permit with the State have the flexibility to structure their IDDE program such that it is effective and meets the needs of the local watershed. As such, the following recommendations are made to the City for future implementation of the IDDE Minimum Control Measure in their Phase II MS4 permit:

- Continue to integrate water quality monitoring testing as part of the outfall screening program. Suggested parameters for inclusion in this testing include ammonia, detergents, potassium, fluoride and bacteria.
- Begin storm drain investigations and isolate pollution sources for outfalls that exceeded illicit discharge thresholds.
- Continue the storm drain investigations as suggested in Section 4.
- Complete outfall screening for outfalls missed during this study. When submerged or partially submerged outfalls are encountered, dry weather flow can be assessed from upstream manholes and inlets.
- Continue to update the storm sewer map data and accurately locate the outfalls. We were unable to locate many of the outfalls using the City's GIS layer. Pipes on the North Prong were particularly difficult to locate (XA27, X2C3 & X2C2); surveying from a boat in this location is advisable.
- Determine baseline concentrations of illicit discharge screening parameters, esp. fluoride, potassium and detergents, for groundwater (or well water) and surface water in various locations. This will help determine locally-based threshold levels for the screening parameters.
- Continue to conduct outfall screening by boat, preferably a small skiff or duck boat.
- Transitory discharges such as dumping of grease, as discovered at the hospital, or dumping of other materials such as trash are a problem in the City. The City should consider investing in a targeted education and outreach program to potential generating sites and conducting a hotspot assessment within the City's boundaries.
- Develop standard operating procedures for the detection and elimination of illicit discharges, including coordination with other departments. Example coordination

efforts include utilizing the City's sewer camera, training other department staff to identify illicit discharges in the field and maximizing use of lab facilities at the wastewater treatment plant.

Section 2. Field and Lab Methods

Field Preparation
The City provided CWP with the following GIS layers that were used in the field:

- Water lines
- Watershed boundary
- Roads
- Stormwater infrastructure including pipes and outfalls
- Combined sewer outfalls and drainage area
- Sanitary infrastructure
- Jurisdiction boundaries
- Aerial imagery

CWP used this information to develop detailed maps for conducting outfall surveys (Figure 1 & 2).

Field Sampling
Three field teams conducted outfall screening along approximately 5.4 miles of stream in the Wicomico River (includes both banks). A total of 55 outfalls were assessed during the initial screening. Each team was composed of one CWP staff person and one SPW staff person. The sampling took place over three days from 4/18/11- 4/20/11 and follow-up investigations took place 6/7/2011-6/8/2011 & 6/29/2011-6/30/2011. Stream segments were either walked or surveyed by a boat provided by the City. All outfalls with dry weather flow were sampled. Outfalls with no flow were assessed for physical indicators such as pipe benthic growth, corrosion, algae, and so on. All outfalls were marked in the field with a "CWP ID" that conformed to the following label scheme: [Grid ID][Team Letter][Sequential numbers]. When outfalls were encountered that were partially or fully submerged, these were assessed for dry weather flow from an upstream manhole or storm drain inlet.

Outfalls observed to have flow were investigated using the outfall reconnaissance inventory (ORI) technique described in Brown et al (2004) and screened for a number of illicit discharge indicators including flow, physical indicators and ammonia. Ammonia was measured in the field and the remaining parameters were analyzed in the City's wastewater treatment plant lab (Figure 3). A threshold greater than 0.1 mg/L for ammonia was used as an action level for a storm drain network investigation. The investigations are presented in Section 4. A Google map of potentially problematic outfalls was also created and can be found here: http://maps.google.com/maps/ms?msid=205262845524963937112.0004a171da7b183087855&msa=0&ll=38.36455,-75.598458&spn=0.003504,0.006968.

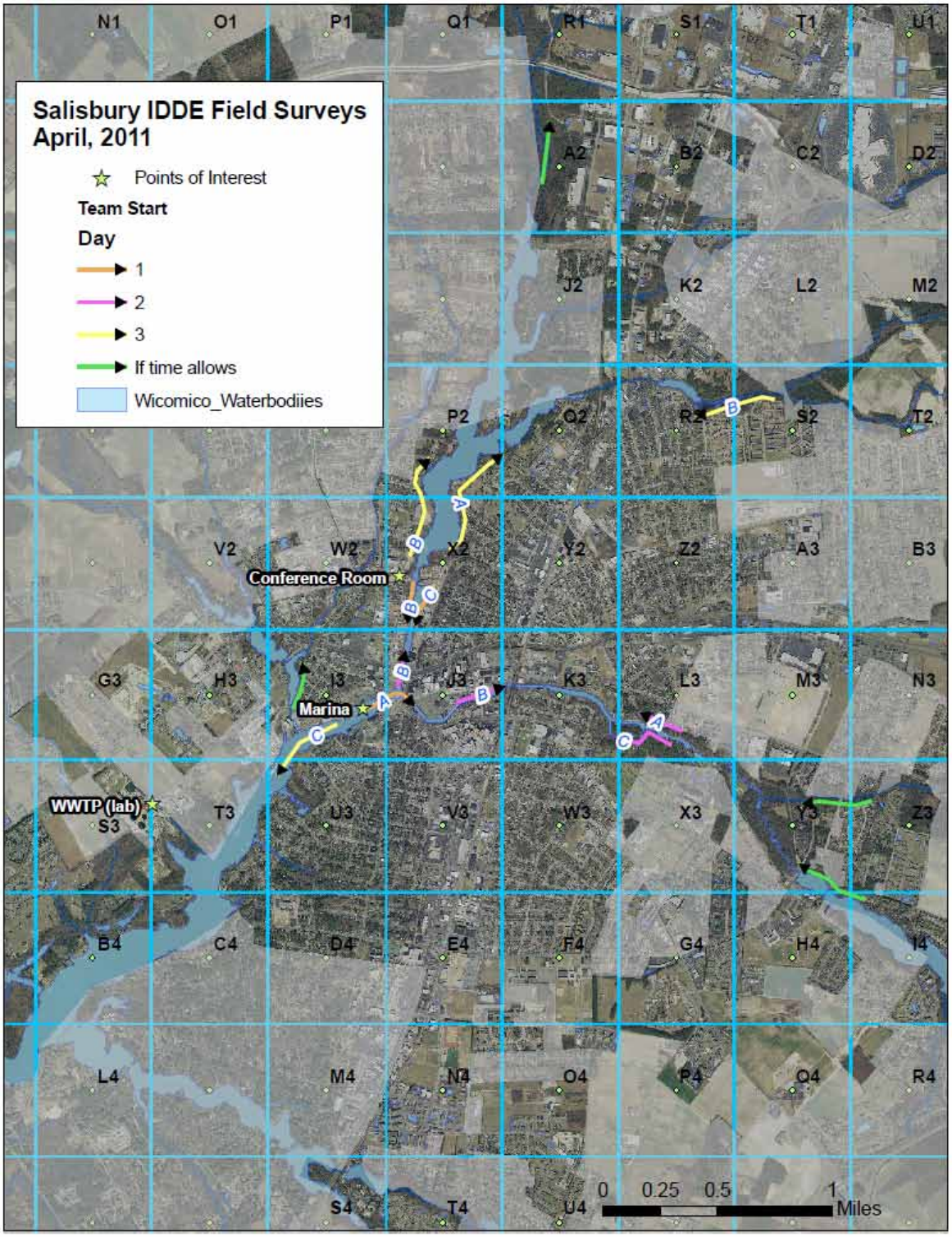

Figure 1. Locator map used for IDDE outfall surveys in Salisbury, MD.

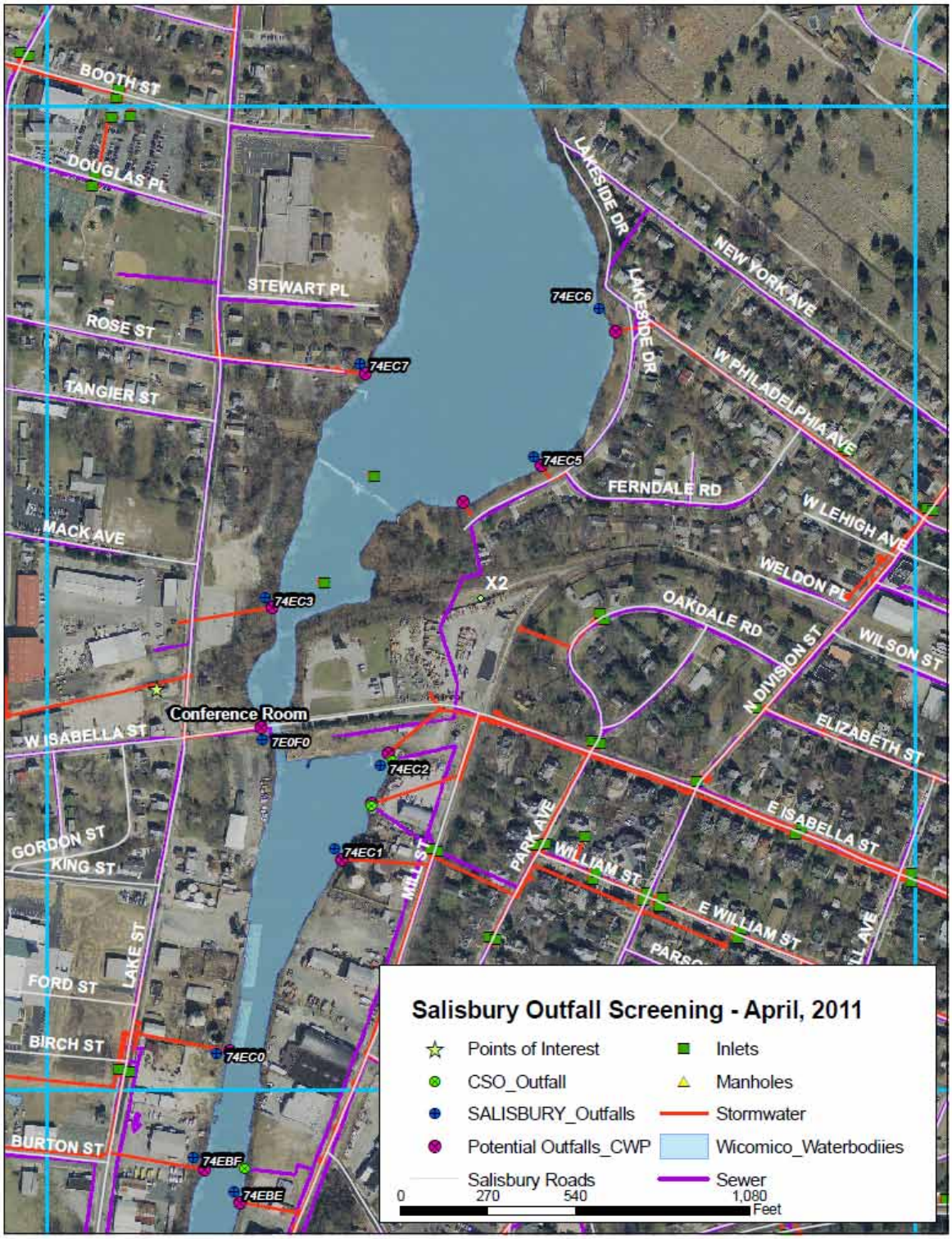

Figure 2. Detailed map used for IDDE surveys in Salisbury, MD.

Figure 3. Water quality analysis of field samples in the City's Wastewater Treatment Plant lab

Background on Water Quality Parameters

A variation of the Flow Chart Method (Brown et al, 2004, Figure 4) was used to distinguish between three major types of illicit discharges: wastewater, washwater, and tap water discharges. Groundwater, the fourth type of discharge, is not considered to be an illicit discharge.

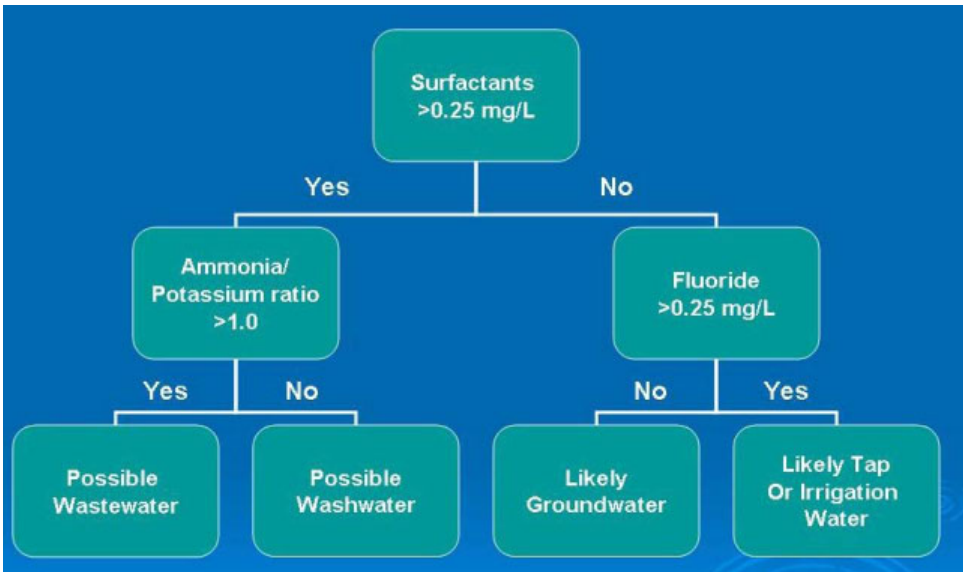

Figure 4. Flow chart method used to distinguish potential illicit discharges (Brown et al, 2004).

Additional detail regarding the particular parameters utilized is provided below.

Ammonia

Ammonia is a good indicator of sewage (typical value > 1.0 mg/L) since it has a significantly higher concentration compared to groundwater (~0.0 mg/L) or tap water (~0.0 mg/L). High ammonia concentrations may also indicate liquid wastes from some industrial sites. Ammonia is relatively simple and safe to analyze. Some challenges include the tendency for ammonia to volatilize (i.e., turn into a gas and become non-conservative) and its potential generation from non-human sources, such as pets or wildlife. Ammonia was measured in the field for this study using a Milwaukee Instruments field photometer with a range of 0-9.99 mg/l and accuracy of ± 0.1 mg/L. Ammonia concentrations were quality controlled for samples with "hits" (>0.1 mg/l) at the lab using a Hach DR 2010 spectrophotometer.

Fluoride

Fluoride is a good indicator of tap water in communities where potable water is treated with fluoride. Generally, a concentration > 0.25 mg/l indicates a potable water source. Fluoride was measured in this study using a Hannah photometer with a range of 0-2.00 mg/L, resolution of 0.01 mg/L and precision of ± 0.03 mg/L at 1.00 mg/L.

Chlorine is often used as an indicator in IDDE programs nationally because of its widespread use to disinfect tap water. Unfortunately, chlorine is extremely volatile, and even moderate levels of organic materials can cause chlorine levels to drop below detection levels. Chlorine is non-conservative and as such it is not a reliable indicator. Therefore, fluoride is a preferred indicator over chlorine where it is being used in the jurisdiction's drinking water treatment system. However, if very high chlorine levels are measured (e.g. > 1.0 mg/l), there is a strong indication of a water line break, swimming pool discharge, or industrial discharge from a chlorine bleaching process.

Potassium

Potassium is found at relatively high concentrations in sewage (≥7 mg/L based on data collection efforts by CWP in Baltimore), and extremely high concentrations in many industrial process waters (≥ 20 mg/L). Consequently, potassium can act as a good first screen for industrial wastes, and can also be used in combination with ammonia to distinguish washwaters from sanitary wastes in freshwater.

Potassium was measured immediately after field work in the lab in this study using a compact ion meter with a range of 0 – 99 x 100 ppm and a resolution of 1.0 ppm (0 – 99 ppm), 100 ppm (10 – 99 x 10 ppm), and 100 ppm (10 – 99 x 100 ppm). A two-point calibration was conducted before each set of sample readings where the meter was standardized first to 20 x 100 ppm and then to 15 x 10 ppm. Afterwards, the sample water is placed on the optical sensor of the meter to determine concentration.

Anionic Surfactants/Detergents

Most illicit discharges have elevated concentration of detergents. Sewage and washwater discharges contain detergents used to clean clothes or dishes, whereas liquid wastes contain detergents from industrial or commercial cleansers. The nearly universal presence of detergents in illicit discharges, combined with their absence in natural waters or tap water, makes them an excellent indicator.

Anionic surfactants were measured in this study for freshwater samples using Chemterics test kits. The procedure uses a 3-minute extraction technique to measure anionic detergents in the 0-3 ppm (mg/L) range.

E. coli

E. coli, and other bacteria such as fecal coliform and enterococcus, are found at very high concentrations in sewage compared to other flow types such as tap water and groundwater, and is a good indicator of sewage or septage discharges, unless pet or wildlife sources exist in the subwatershed that may confound illicit discharge detection. Overall, bacteria are good supplemental indicators and can be used to find "problem" streams or outfalls that exceed public health standards.

In this study, 100 mL of sample was collected in a sterile bottle and a 1- mL of subsample was used and plated onto an inoculant that grows E. coli as "blue" colonies and other coliforms as "red" colonies. The colonies of each are counted, multiplied by 100 and reported as colony forming units, or CFUs, per 100 mL. When blue and red colonies are summed, a total coliform count is obtained.

Total Nitrogen and Total Phosphorus

Total nitrogen and total phosphorus concentrations will be higher in sewage compared to other flow types. Monitoring for nutrients can help to determine "hotspots" in a watershed. Nutrient monitoring along with bacteria monitoring can assist in prioritizing actions as well as quantifying the benefit of eliminating a problem. For this study, 50 mL of sample was collected at each site and analyzed by the Horns Point lab (HPL) for total nitrogen and total phosphorus. Twice a year, the lab participates in two different blind audits. Reference materials prepared by two different laboratories (one funded by USGS and one funded by the Chesapeake Bay Program) are analyzed. The average percent difference of HPL analysis compared to the prepared reference concentration is between 5% and 10% difference for TN and TP.

Three samples were collected at each flowing outfall and analyzed as indicated in Table 1. Threshold levels for illicit discharge screening parameters are defined in Table 2.

Table 1. IDDE Analysis

	Parameters Analyzed	Equipment	Method	Location	Notes
Field Measurement	Ammonia	Hannah HI 93715 or Milwaukee Mi405	Nessler method	Field	Ammonia >0.1 mg/L action level for immediate investigation

Table 1. IDDE Analysis					
	Parameters Analyzed	**Equipment**	**Method**	**Location**	**Notes**
	Fluoride	Hannah HI 93729 Low Range Photometer	Adaptation of the SPADNS method		
	Anionic Surfactants	Chemetrics Detergent Kit	USEPA Methods for Chemical Analysis of Water and Wastes, Method 425.1 (1983)		
	Potassium	Horiba Cardy Compact Ion Meter C-131	Nitrate ion electrode method		
Sample 2	Total Nitrogen	--	Alkaline Persulfate Digestion of Nitrogen to Nitrate and Measured Using Enzyme Catalyzed Reduction[i]	Contracted to Horns Point lab for analysis	Samples frozen at end of field day
	Total Phosphorus	--	Alkaline Persulfate Digestion of Phosphorus to Orthophosphate[ii]		
Sample 3	E. coli and Total coliform	3M Petrifilm plates	Incubated at 35° C[iii] for 24 h ± 1 h; red and blue colonies with gas enumerated manually or with a 3M Plate Reader	Salisbury Wastewater Treatment Plant by CWP and SPW staff	Samples plated no more than 6 hours after collection

[i] USEPA. 1979. Method No. 353.2 *in* Methods for chemical analysis of water and wastes. United States Environmental Protection Agency, Office of Research and Development. Cincinnati, Ohio. Report No. EPA-600/4-79-020 March 1979. 460pp.

[ii] USEPA. 1979. Method No. 353.2 *in* Methods for chemical analysis of water and wastes. United States Environmental Protection Agency, Office of Research and Development. Cincinnati, Ohio. Report No. EPA-600/4-79-020 March 1979. 460pp.

[iii] Temperature on 12/6 was closer to 32ºC.

Table 2. Threshold levels for screening parameters used in Salisbury illicit discharge surveys		
Parameter	**Threshold**	**Source**
Ammonia	>0.1 mg/L	Brown et al (2004)
E. coli	235 CFU/100 ml (grab sample)	EPA (2006)
Total coliform	10,000 CFU/100 ml (grab sample)	California state standard (Dorfman and Rosselot, 2011)
Fluoride	0.25 mg/L	Brown et al (2004)
Detergents	0.25 mg/L	Brown et al (2004)
Potassium	5 ppm	Guidance extrapolated from Lilly and Sturm (2010)

Flow Measurements and Load Estimates

Outfall flow was measured in one of three ways. These are listed in priority of collection below.

1. Volume-based – a 1-liter container jug is filled and the time taken to fill it is recorded with a stopwatch. Flow is obtained by converting liters to cubic feet and then dividing volume by time;
2. Weir equation – average depth of flow and wetted width are collected at the outfall and the results are plugged into the weir equation: 3.1 * wetted width (feet) * depth (feet) ^1.5. Note that this method should only be used with a free-flowing outfall (i.e. water drops out of the pipe and falls to the streambed) and when the depth of flow is relatively uniform; and
3. Rate and cross-sectional area – the cross-sectional area of the water is obtained by collecting the wetted width and average depth of water and multiplying the results. Velocity is obtained by using a stopwatch to measure the time it takes for a ping pong ball to flow over a known distance. The velocity measurement is repeated 3-5 times and the results averaged. Flow is obtained multiplying cross-sectional area by velocity.

Load estimates were made from grab samples and assumed to remain constant over an entire day. The estimates were also made using a conservative approach whereby a "background level" was subtracted from the original concentration. Background nutrient concentrations in surface waters were determined as 0.02 mg/L for total phosphorus (TP) and 1.0 mg/L for total nitrogen (TN). This background level was determined from nutrient data collected by the USGS National Water-Quality Assessment (NAWQA) program for nutrients in "natural watersheds[iv]" as well as data collected by CWP from "clean" outfalls in Baltimore, MD, that is, those outfalls that did not exceed any of the identified parameters. A range of values reported from 50-150% to reflect the diurnal nature that is often observed with these flows.

[iv] http://water.usgs.gov/nawqa/nutrients/pubs/awra_v36_no4/

Section 3. Illicit Discharge Survey Results and Summary

A field site summary of the illicit discharge survey conducted in Salisbury is presented in Table 3 and the raw data can be found in Attachment B. A large map showing outfall locations can be found in Attachment C. It was found that 40% of the outfalls assessed had dry weather flow. The percentage of flowing outfalls may be an over-estimate because 1) all dry outfalls encountered in the field were not marked and located because of difficulties associated with use of the boat and the potential to get stuck behind a drawbridge and 2) some outfalls were partially submerged. When dry weather flows were encountered that exceeded illicit discharge screening parameters, a storm drain investigation was conducted to determine the source of the potentially polluted flow. A summary of samples that exceeded the thresholds defined above can be found in Table 4.

Table 3. Field Site Summary

	No.
Total outfalls assessed	55
Outfalls with dry weather flow	22 (40%)
Storm drain investigations	8

Table 4. Illicit Discharge Summary for Flowing Outfalls (n=22)

No. of discharges with potential wastewater or other discharge of unknown origin (ammonia >0.1 mg/L)	13 (59%)
No. of potential tap water discharges (Fl >0.25 mg/L)	7 (32%)
No. of potential washwater discharges (anionic surfactants >0.25 mg/L)	13 (59%)
No. of discharges exceeding ammonia, fluoride or detergent thresholds	19 (86%)
Outfalls with E. coli above EPA threshold for contact recreation (>235 CFU/100 ml)[v]	5 (28%)

Nutrient concentrations from outfalls with dry weather flow ranged from 0.002 mg/L to 0.437 mg/l for total phosphorus and 0.708 mg/l and 6.594 mg/l for total nitrogen (Figure 5 & 6). The total nitrogen load from outfalls with illicit discharge components based on water sampling was 9.82 lbs/day and the total phosphorus load was 0.31 lb/day. However, we were unable to obtain flow measurements from seven of the illicit discharge outfalls because they were partially submerged, the flow was too small to accurately measure or because the sample was taken from an inlet upstream from the actual outfall.

[v] N=18 for bacteria samples. 14 samples (77%) had total coliform concentrations greater than 235 CFU/100 ml; 11(61%) of these samples had concentrations > 1,000 CFU/100 ml.

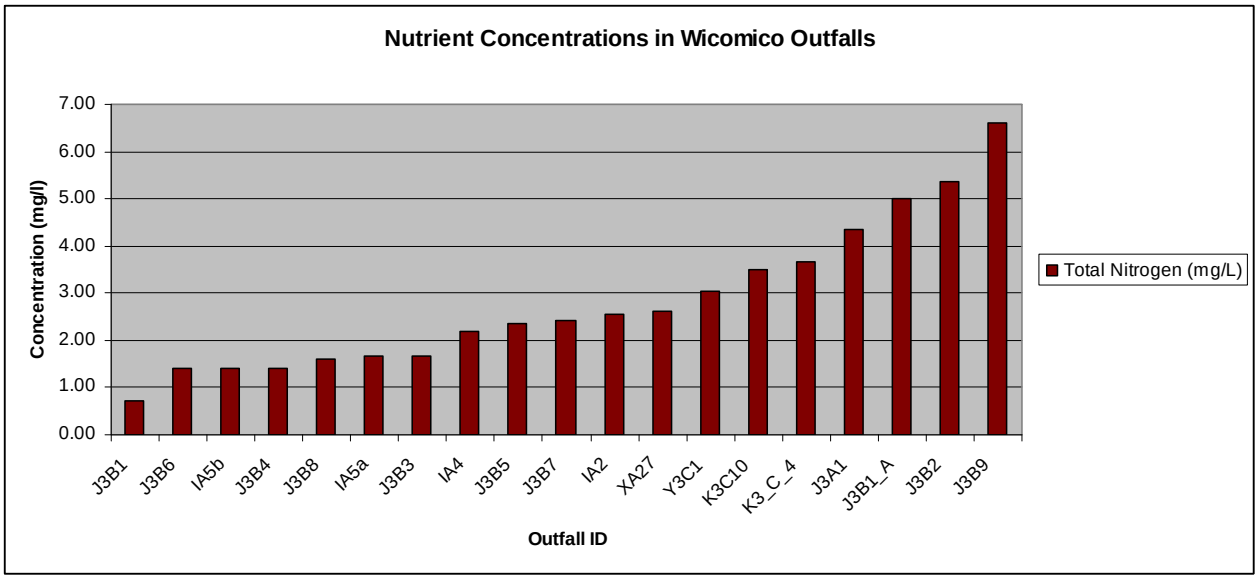

Figure 5. Total nitrogen concentrations in Wicomico outfalls with dry weather flow.

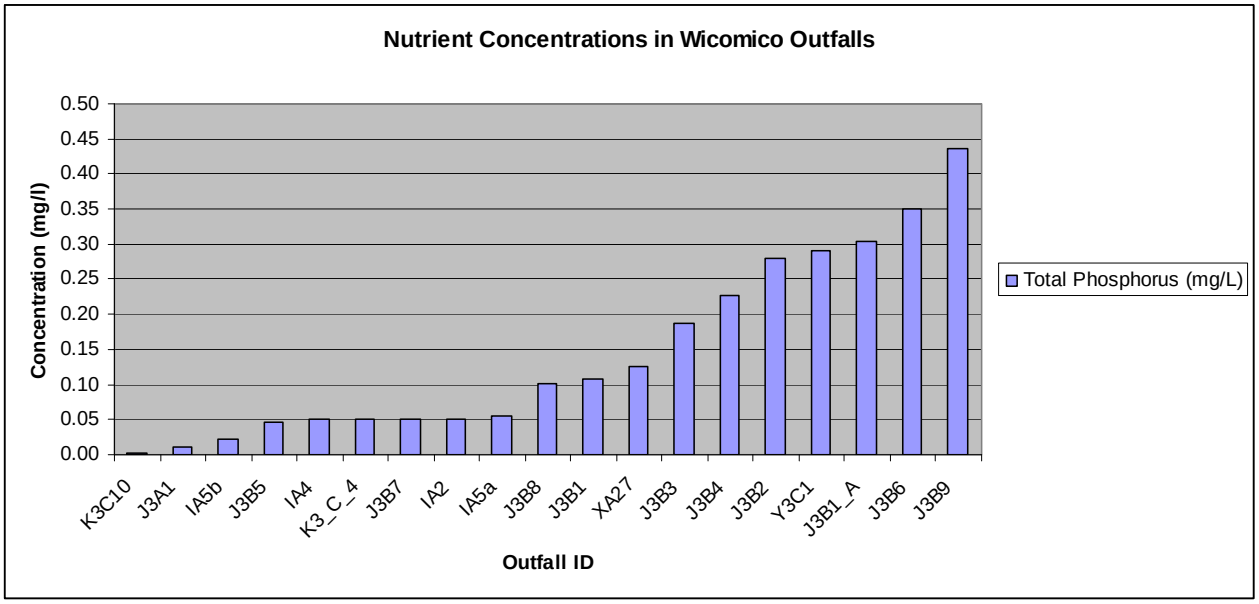

Figure 6. Total phosphorus concentrations in Wicomico outfalls with dry weather flow.

EPA water quality standards for E. coli were exceeded in 23% of the outfalls with dry weather flow. Very high concentrations of total coliform were measured in additional outfalls as well. (Figure 7). These samples had an average total coliform concentration of 13,000 CFU/100 ml[vi] and their high concentration indicates the presence of other types of coliform bacteria (e.g. fecal coliform) in the water column other than E. coli. The presence of coliform bacteria is an indicator that other pathogenic organisms of fecal origin may be present.

[vi] 18 samples of bacteria were taken. Two samples had concentrations of TNTC or too numerous to count. For these samples, an arbitrary value of 56,000 was given so that numeric analysis could be performed. 56,000 was the highest value that was measured in any of the outfalls.

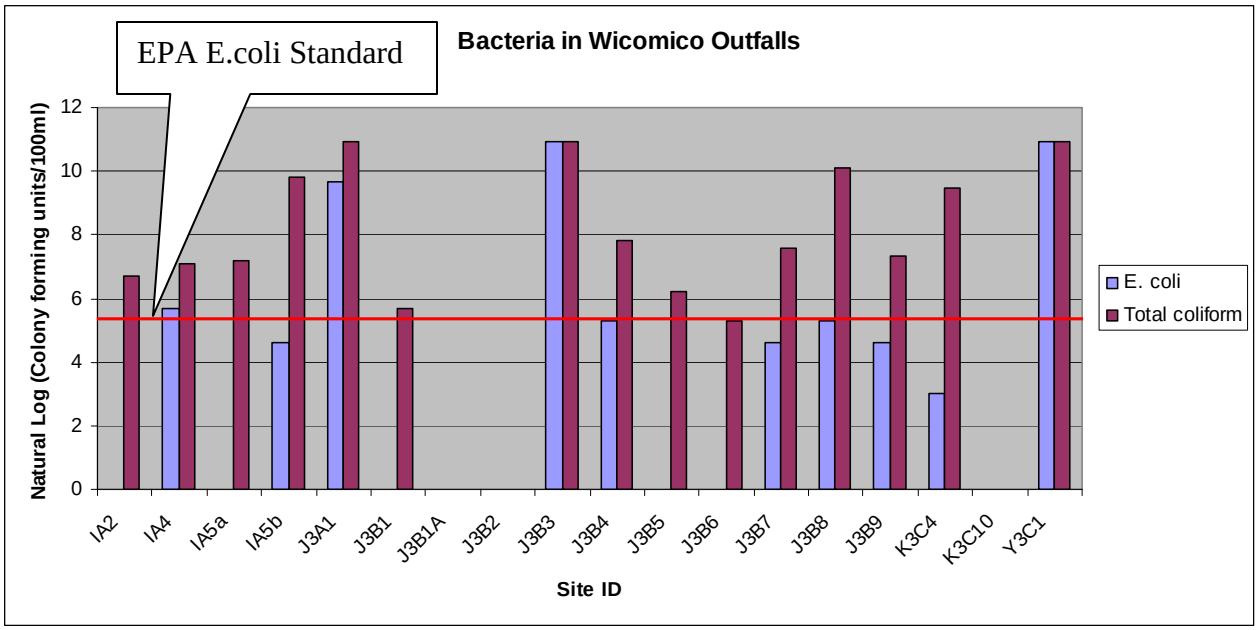

Figure 7. E.coli and total coliform concentrations in Salisbury outfalls.

The majority of problem outfalls were found on the East Prong and North Prong of the River in the downtown area, particularly on the East Prong between the hospital and just east of the Rt. 13 bridge (Figure 8). Along this same section, several outfalls were not assessed because of time constraints related to the tide and use of a boat as well as because many were partially submerged, even during low tide. This section should be re-screened in more detail, with outfall locations accurately identified, and dry weather flow from partially submerged outfalls assessed from the street.

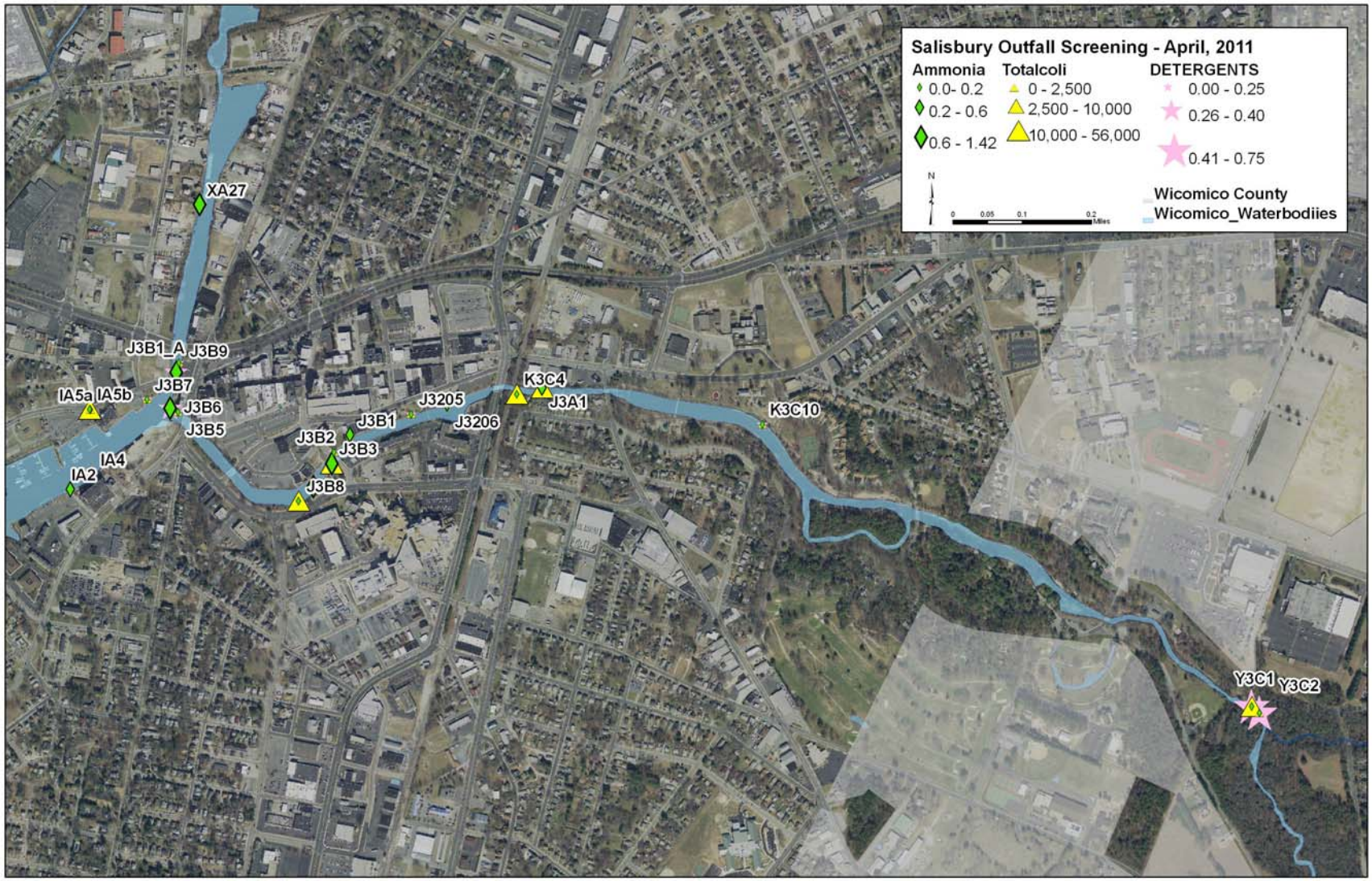

Figure 8. Illicit discharge screening in Salisbury outfalls.

Section 4. Storm Drain Investigations

CWP and Salisbury Public Works staff conducted drainage area investigations of outfalls with potential illicit discharges identified during the outfall surveys. The primary goal of the investigations was to isolate the source of the contaminated discharges as much as possible using indicator monitoring, primarily with ammonia, and physical characteristics such as flow or odor. Investigations are described in detail below and include overall conclusions and potential next steps that Salisbury should take to confirm the source or follow-up.

4/18/2011-4/20/2011; 6/7/2011-6/8/2011; 6/29/2011-6/30/2011 Investigations

Outfall J3B8
Investigators: Lori Lilly (CWP), Dallas Baker (SPW), Bill Sterling (SPW) and Dale Pusey (SPW)
Location: Carroll Street, near hospital
Initial screening results: Oily discharge reported at outfall; Ammonia – over range; Detergents – 0.25 mg/l; Total coliforms – 24,200 CFU/100 ml

- Team noted hospital parking garage had recently been washed and water was draining into a storm drain inlet in the garage, along with grease and oil from the lot surface (Figure 9a & b);
- Flow tracked to inlets on north and south side of Carroll St. and then to junction box at the northwest corner of the hospital parking garage that had substantial grease build-up (Figure 5c); and
- Becker & Morgan engineering firm for the hospital sent a representative to the field to investigate further though nothing definitive was established from the visit with regards to the illicit discharge.

Conclusions:

- Build-up of grease at the junction box suggests some intermittent dumping of grease but potential generating sites are limited except for the hospital day-care facility;
- Flow and oily sheen detected at the outfall may have been drainage from the junction box that has been inundated during high tide and was draining with the ebbing tide as well as oil from the recent wash-down in the parking garage;
- Water that is held in the junction box is contaminated based on water quality analysis and options should be explored to treat this water before it mixes with tidal water and discharges to the river. Another option is to install a check valve on the outfall pipe to prevent tidal flow from mixing with water in the junction box; and
- Install an oil absorbent filter in the storm drain inlet in the parking garage that will catch sediment and oil before it is discharged to the river. Some example products include: http://www.absorbentsonline.com/passive_skimmer.htm and http://www.erosionpollution.com/catchbasinfilter.html.

(a) **(b)** **(c)**

Figure 9. (a) Oil from outfall J3B8; (b) oil and grease build up in hospital parking garage, recently washed into a floor drain that discharges from outfall J3B8; and (c) substantial amount of grease in junction box outside of hospital parking garage.

Outfall IA5b

Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP), Dallas Baker (SPW) and Bill Sterling (SPW)

Location: Fitzwater St, near Brew River and marina

Initial screening results: Ammonia – 1.48 mg/l; Detergents – 0.25 mg/l; Total coliforms – 18,100 CFU/100 ml

- Actual outfall at the marina was partially submerged so sample was taken from an inlet on Fitzwater St that had dry weather flow coming from both the west and the east; and
- Flow from the west was contaminated as indicated above, concentrations are indicative of sewage.
- The next junction upstream to the west was dry.

Conclusions:

- Potential inflow and infiltration (I/I) into the storm sewer or cross connection;
- I/I or connection may occur below the inlet and tide is pushing contaminated water up through the system during incoming tide; and
- Dye testing into adjacent sewer and/or nearby residences and business, potentially below the point of contamination, will be necessary to confirm a source.

Outfall XA27

Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP), Dallas Baker (SPW) and Weston Young (SPW)

Location: Lake St, near fire station

Initial screening results: Ammonia – 1.42 mg/l; Detergents – 0.25 mg/l; Fluoride – 0.5 mg/l

- Actual outfall was partially submerged so sample was taken from an inlet on Lake St that had dry weather flow coming from the south; and
- Flow was contaminated as indicated above, concentrations are indicative of sewage.
- Re-sampling on 6/7 showed an ammonia concentration of 2.07 mg/l as well as elevated fluoride (0.41 mg/l) and potassium (18 ppm).
- The next junction upstream was dry.

Conclusions:

- Initial determination was potential inflow and infiltration (I/I) into the storm sewer or cross connection; and
- This inlet receives tidal influence. Re-sampling was conducted at low tide from the pool in the inlet – only a small trickle of flow was visible from the east side of Lake Street, which may have been tidal water continuing to drain from the stormwater system. As in IA5b, the I/I or cross connection may occur below the point of contamination such that the incoming tide is bringing in contaminated water. To verify or refute, the City can try putting dye into the sanitary system, potentially below the point of contamination as well, and seeing if it dye is observed in the storm sewer system during an incoming tide.

Outfall J3B4
Investigators: Lori Lilly (CWP), Dallas Baker (SPW) and Weston Young (SPW)
Location: Carroll St, near floating dock
Initial screening results: Ammonia – 1.14 mg/l; Detergents – 0.25 mg/l; Total coliforms – 2500 CFU/100ml

- The outfall and inlet were partially submerged when the team went to investigate.

Conclusions:

- Re-visit and re-sample at low tide.

Outfall J3B6
Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP), Dallas Baker (SPW) and Weston Young (SPW)
Location: Port Exchange building
Initial screening results: Ammonia – 1.09 mg/l; Detergents – 0.35 mg/l; and Potassium – 10ppm

- Intermittent discharge reported lasting a couple minutes and then stops; recurred several times with high velocity (Figure 10).
- The outfall was re-sampled on 6/7 and had elevated concentrations of ammonia (1.52 mg/l), fluoride (0.83 mg/l) and potassium (14 ppm).
- City staff and CWP accessed the building of the basement for an inspection. It was determined that the outfall pipe was connected to two sump pumps. No internal connections to the sump pump system were noted. Several inches of water was found on the basement floor, some of it flowing across the floor or via channels into the sump pumps.
- One water sample was taken from each sump pump and each showed similar values for ammonia, fluoride and potassium. There appeared to be some interference with the detergent test and the sample was unreadable.
- Samples were also taken from the river for comparison (Table 5). River 1 was taken from the North Prong from the Main St. bridge and River 2 was taken from the East Prong from the Port Exchange building.
- The building was visited again the next day. The water in the basement was much lower and with much less flow. The variation in the water level was attributed to the tide. All of the first floor toilets were dyed to see if there was a sanitary break within the piping of the building itself that had created elevated concentrations of pollutants in the basement. No dye was observed on the floor of the basement.

Conclusions:

- There may be a sanitary break or I/I near the sanitary outlet of the building whereby sewage is being pushed back into the basement via backflow by an incoming tide, potentially through the old combined sewer outfall near the Main St. bridge. Since pipe schematics for the building are not available, the City can try video inspection of the CSO outfall pipe to determine if there is some kind of failure within the pipe or plug that was used to originally eliminate the combined sewer overflows.
- The City could consider connecting the sump pumps to the sanitary system for treatment since the water appears to be polluted.
- The City may also consider discussing the issue with the building owner and requesting – or requiring if an illicit discharge ordinance is in place – that he/she address the problem.

Figure 10. Outfall from Port Exchange building.

Table 5. Wicomico River samples		
Parameter	**River 1**	**River 2**
Ammonia (mg/l)	0.1	0.0
Fluoride (mg/l)	0.32	0.5
Potassium (ppm)	8	9
Detergents (mg/l)	0.1	0.25

Outfall J3B3

Investigators: Lori Lilly (CWP), Dallas Baker (SPW), Bill Sterling (SPW) and Dale Pusey (SPW)
Location: Division Street bridge
Initial screening results: Ammonia – 0.82 mg/l; Detergents – 0.25 mg/l; and Total coliforms and E. coli – too numerous to count (TNTC)

- Tracked to a trickle of flow observed in a manhole on Carroll St but incoming tide precluded further investigation.

Conclusions:

- Re-visit and re-sample at low tide.

Outfall J3A1

Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP), Dallas Baker (SPW), Bill Sterling (SPW) and Dale Pusey (SPW)

Location: Between Burnett-White and the Neighbor Care Pharmacy on main St

Initial screening results: Ammonia – 0.27 mg/l and E. coli – 13,000 CFU/100ml

- Continuous discharge with petroleum smell reported at the outfall.
- Tracked to Sharp Energy on the north side of Rt 50 but storm network was unclear after that point.
- The investigation continued on 6/7 after more detailed storm network drawings were obtained.
- On 6/7, a sample was taken from a manhole at Railroad and Rt 50 and this read very high for ammonia (3.57 mg/l), very high potassium (100 ppm), high fluoride (0.52 mg/l) and high detergents (0.35 mg/l).
- The discharge was tracked to a manhole at Railroad and Wailes where two different discharges were observed – a continuous flow from Railroad and a discharge from Wailes that was mostly discharging from under the pipe itself. Both had high ammonia and the discharge from Railroad was above the detection limit of the ammonia photometer (>9.99 mg/l), had very high fluoride (1.87 mg/l), potassium (22 ppm) and detergents (>3.0 mg/l).
- The following day, no flow was observed coming from Wailes. The pipe was inspected with a video camera and cracks were noted.
- A video camera was placed in the pipe from Railroad and flow tracked to Isabella St. (Figure 11a & b)
- Flow was tracked to Isabella and Church St. Pooled water with no flow was observed in a manhole at Church and Record. Pooled water with no flow, suds and a sewer smell were observed at Church and Anne. A manhole at Barclay and Church had a bottom that was covered in a sludgy-type sediment. The next manhole east of this point was dry. A clogged sewer manhole was found on Barclay St[vii].
- The investigation continued on 6/29 and 6/30. A camera was placed into the storm drain at Isabella and Church and run to the east. Due to accumulation of trash, the camera could not move forward more than ~200 ft. The crew tried to put the camera back into the storm drain at Church and Record St but again there were too many obstructions and accumulations of material for the camera to move forward. The crew tried to clear the obstructions with a vactor truck but was unsuccessful (Figure 11c).

Conclusions:

- This is an obvious sewage discharge that should be fixed immediately.
- The pipe should be cleared of all material and thoroughly inspected with the video camera to determine where the leak is occurring. A number of plugged laterals indicate that this pipe was an old combined sewer; there is potential that one of the combined laterals was missed when the others were being plugged.
- The manhole at Railroad and Wailes should be inspected periodically for the intermittent flow detected coming from Wailes. There is potentially a floor drain connected to the storm sewer as evidence by industrial discharge indicators present in the flow (petroleum smell, very high potassium).

[vii] The City cleared this on 6/30.

(a) **(b)** **(c)**

Figure 11. (a) Lowering the video camera into a manhole for a storm drain inspection; (b) City employee inspecting the storm drain from a camera; and (c) Clearing obstructions with a vactor truck.

Outfall J3B1A

Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP) and Dallas Baker (SPW)
Location: parking lot north of Main St and the Port Exchange building
Initial screening results: Ammonia – 0.29 mg/l and total coliform – 300 CFU/100ml

- The outfall had very high concentrations of total nitrogen (5.00 mg/l) and total phosphorus (0.3 mg/l) resulting in some of the highest nutrient loadings from any of the outfalls sampled.
- Continuous discharge with elevated fluoride (0.29 mg/l) and detergents (0.25 mg/l) reported at the outfall.
- Outfall was re-sampled on 6/7 and showed very high fluoride (1.48 mg/l) with a small amount of detergents (0.1 mg/l).
- Flow was tracked to the intersection of Main and Division St – flow present west of the intersection but not to the east.
- Flow was observed from this outfall during low tide on 6/29, suds were also present in the flow on this occasion.

Conclusions:

- This may be a blend of two or more illicit discharges, including a water main break due to the high fluoride concentrations detected at the outfall.
- No stormwater mapping for this network was available because it is drainage for state highway 50.
- The City should obtain the appropriate mapping layers from state highway and continue tracking the flow to the source.

Outfalls Y3C1 & Y3C2

Investigators: Lori Lilly (CWP), Lisa Fraley-McNeal (CWP), Dallas Baker (SPW) & Dale Pusey (SPW)
Location: Adjacent outfalls on the East Prong, near Civic Center
Initial screening results: Y3C1: Fluoride – 1.06 mg/l; detergents – 0.75 mg/l and total coliform – TNTC; Y3C2: Potassium – 29 ppm; fluoride – 0.38 mg/l; detergents – 06. mg/l

- Drainage for these outfalls comes from the Civic Center and area of the old mall;

- The team investigated the area after the initial screening but saw no unusual activity; the team noted a large pile of concrete rubble that may have been the cause of the high potassium concentration if it was slowly leaching rainwater into the storm drain system; and
- The site was re-visited on 6/7 but no flow was present in either outfall.

Conclusions:

- These could be intermittent or transitory discharges and should be periodically re-checked for flow, and sampled if flow is present.

Section 5. Recommendations

The following recommendations are made to the City of Salisbury in order to provide a more effective and efficient IDDE program to meet their MS4 permit requirements:

Regulatory

- Continue illicit discharge monitoring program using recommended methods used here.
- Ensure repair of known illicit discharge sources.
- Follow-up with identified actions described in the storm drain investigation section above.
- Isolate sources for remaining outfalls exceeding parameters in Attachment A.

Programmatic

- Enact an illicit discharge ordinance, if one is not already in place, in order to provide the proper enforcement authority for illicit discharges and illicit connections. See Attachment D for model illicit discharge ordinance language. An illicit discharge ordinance is a requirement of the Phase II MS4 permit.
- For transitory discharges detected at outfalls such as sediment or suds, particularly at outfalls with a history of problems, keep a list of potential generating sites in the drainage area and visit those sites when a problem is detected.
- Develop standard operating procedures for the detection and elimination of illicit discharges, including coordination with other departments. Example coordination efforts include utilizing the City's sewer camera, train other department staff to identify illicit discharges in the field, maximizing use of lab facilities at the wastewater treatment plant.
- Future monitoring:
  - Resurvey confirmed polluted outfalls four times per year until clean for 1 year;
  - Resurvey remaining suspect and potentially polluted outfalls at least one time per year;
  - Engage/encourage citizen water monitoring efforts to expand the City's capacity to address water pollution issues
  - Continue monitoring, or have citizens continue to monitor, for bacteria and assure that standards improve after elimination of the identified problems.

Education

- Conduct education and outreach to potential generating sites such as potential washwater dischargers, esp. in drainage areas where a history of problems exist.
- Conduct targeted outreach to each type of business, e.g. restaurants should be targeted for grease barrels and provided materials on proper storage and containment; concrete companies should be provided with education materials regarding slurry and its proper disposal.

Program Support

- Provide staff with additional training and tools regarding water quality monitoring and tracking procedures, such as use of dye, smoke and video to isolate sources.
- Develop standard operating procedures for tracking illicit discharges and following up with illicit discharge repairs.

- Keep abreast of the Chesapeake Bay TMDL and the potential impacts that it may have for nutrient reduction and regulations for local Bay communities. Information on the overall TMDL can be found on EPA's TMDL website, and information on Maryland's' strategy to meet the new regulations can be found on MDE's TMDL Implementation Plan webpage.

Section 6. References

Brown, E., D. Caraco and R. Pitt. 2004. *Illicit Discharge Detection and Elimination: a guidance manual for program development and technical assessments*. Center for Watershed Protection and University of Alabama. EPA X-82907801-0.U.S. EPA Office of Wastewater Management, Washington, D.C.

Environmental Protection Agency. 1983. Methods for Chemical Analysis of Water and Wastes, USEPA *6004-79-030.*

Environmental Protection Agency. 1986. Ambient Water Quality Criteria for Bacteria. EPA440/5-84-002.

Lilly, Lori and Paul Sturm. 2010. *Technical Memorandum: Illicit Discharge Monitoring in Baltimore Watersheds*. Center for Watershed Protection. Ellicott City, MD.

Dorfman, Mark & Kirsten Sinclair Rosselot. 2011. Testing the Waters: A Guide to Water Quality at Vacation Beaches. Natural Resources Defense Council. http://www.nrdc.org/water/oceans/ttw/titinx.asp

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Attachment A. City of Salisbury Training Agenda

AGENDA

City of Salisbury IDDE Workshop & Field Training

Monday, April 18, 2011
Meeting Location: City of Salisbury Public Works Department
508 Lake St., Salisbury, MD
Low Tide 10:17 AM (-0.6 ft)

8:30 – 8:45 Set up in conference room
8:45 – 9:45 **CWP introduction / IDDE overview / Outfall surveys** (LAL)
10:00 – 12:00 Field (one team in boat, two teams on land)
12:00 – 1:00 Lunch
1:00 – 2:15 Lab analysis of samples at WWTP
2:15 – 2:30 Travel back to conference room
2:30 – 3:00 **Why Watersheds** (LW)
- Review of impervious cover and effects on stream water quality
- The eight tools of watershed protection

3:00 – 3:30 **Pollution Prevention** (BTS)
- Assessment and source control practices at "pollution generating sites"

3:30 – 4:30 **Finding Illicit Discharges and What to Do Now That You Found Them** (LAL)
- Indicator monitoring
- Isolating and fixing illicit discharges

Tuesday, April 19, 2011
Meeting Location: TBD
Low Tide 11:09 AM (-0.5 ft)
8:30 – 12:00 Field (one team in boat, two teams on land)
12:00 – 1:00 Lunch
1:00 – 3:00 Field (all teams on land)
3:00 – 4:00 Lab analysis of samples at WWTP; Read bacteria samples from previous day
4:00 – 4:30 Field/lab de-brief

Wednesday, April 20, 2011
Meeting Location: TBD
Low Tide 12:01 PM (-0.4 ft)

8:30 – 9:15 **Urban Watershed Restoration** (BTS)
- Review of various types of restoration practices such as retrofitting, stream restoration and urban forestry

9:15 – 10:00 **Stormwater Retrofitting** (LW)
- Why we do it, identifying sites, prioritizing sites, involving the public, and so on.

10:00 – 12:00 Field (one team in boat, two teams on land)
12:00 – 1:00 Lunch
1:00 – 3:00 Field (all teams on land)
3:00 – 4:00 Lab analysis of samples at WWTP; Read bacteria samples from previous day
4:00 – 4:30 **Wrap up** (LAL)

ATTACHMENT B.
Table 1. Raw Data

Salisbury Illicit Discharge Survey - April 2011

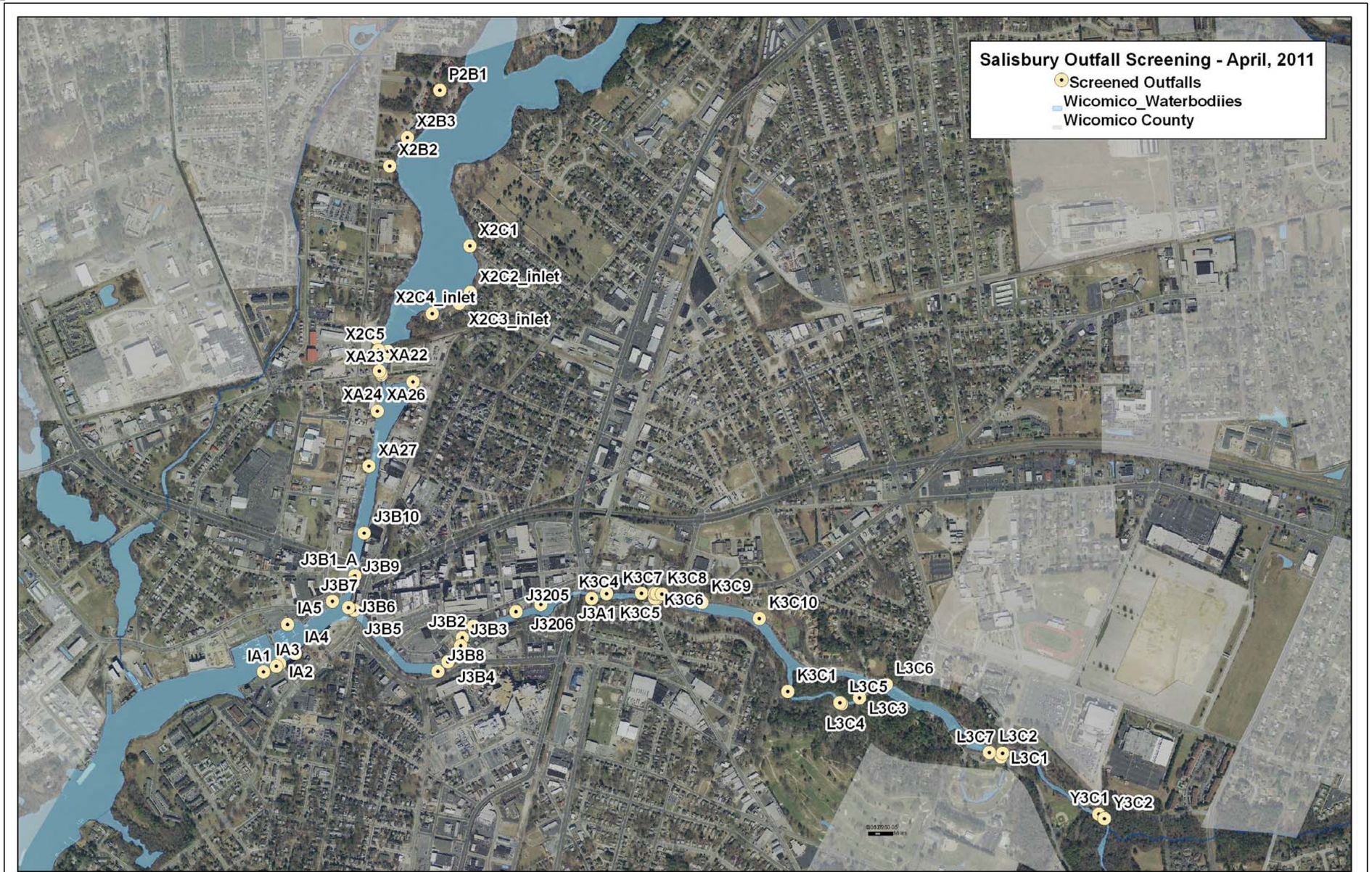
										Exploratory Calculations				
											High		Low	
Outfall ID	Pipe dia-meter (in)	NH3 (mg/L)	K (ppm)	Fl (mg/L)	Deter-gents (ppm)	Total coliforms (cfu/100 ml)	E. coli (cfu/100 ml)	TP (mg/L)	TN (mg/L)	Gallons / day	TN (lb/year)	TP (lb/year)	TN (lb/year)	TP (lb/year)
IA2	24	0.4	2	0.19	0.25	800	0	0.051	2.548	1,313	9.30	0.17	3.10	0.06
IA4	12	0	2	0	0.1	1200	300	0.050	2.198	N/a	N/a	N/a	N/a	N/a
IA5a	18	0	5	0	0.25	1300	0	0.055	1.666	N/a	N/a	N/a	N/a	N/a
IA5b	18	1.48	9	0	0.25	18100	100	0.022	1.399	N/a	N/a	N/a	N/a	N/a
J3205	24	0.05	0	0.01	0	0	0	0.000	0.000	0	0.00	0.00	0.00	0.00
J3206	24	0.44	0	0.19	0	0	0	0.000	0.000	0	0.00	0.00	0.00	0.00
J3A1	36	0.27	7	0	0.13	56000	16000	0.011	4.354	181,756	2787.49	0.00	929.16	0.00
J3B1	10	0.29	2	0.12	0.13	300	0	0.107	0.708	630	0.00	0.23	0.00	0.08
J3B1A	30	0	0	0.29	0.25	0	0	0.303	5.012	139,595	2560.89	167.97	853.63	55.99
J3B2	24	0.16	4	0	0.13	0	0	0.279	5.362	0	0.00	0.00	0.00	0.00
J3B3	36	0.82	5	0	0.25	TNTC	TNTC	0.187	1.680	2,676	8.32	1.90	2.77	0.63
J3B4	18	1.14	6	0.13	0.25	2500	200	0.226	1.414	147	0.28	0.13	0.09	0.04
J3B5	24	0	2	0	0.25	500	0	0.047	2.352	21	0.13	0.00	0.04	0.00
J3B6	8	1.09	10	0	0.35	200	0	0.350	1.393	2,594	4.66	3.64	1.55	1.21
J3B7	18	0	3	0	0.13	2000	100	0.051	2.422	8,453	54.96	1.11	18.32	0.37
J3B8	18	N/A	6	0.25	0.25	24200	200	0.102	1.596	67	0.18	0.02	0.06	0.01
J3B9	18	0.74	3	0.49	0.4	1500	100	0.437	6.594	N/a	N/a	N/a	N/a	N/a
K3C4	70	0.22	3.5	0.09	0.13	13000	1000	0.050	3.668	992	12.11	0.13	4.04	0.04
K3C10	N/A	0	2.5	0.49	0.13	0	0	0.002	3.486	N/a	N/a	N/a	N/a	N/a
XA27	36	1.42	4.5	0.5	0.25	N/A	N/A	0.125	2.632	N/a	N/a	N/a	N/a	N/a
Y3C1	24	N/A	6.5	1.06	0.75	TNTC	TNTC	0.290	3.038	25	0.24	0.03	0.08	0.01
Y3C2	48	N/A	29	0.38	0.6	N/A	N/A	N/a	N/a	N/a	N/a	N/a	N/a	N/a

*Illicit discharge loads for total nitrogen (TN) and total phosphorus (TP) were estimated; assumptions and caveats were made to generate these estimates. They are listed below.

- Estimates were made from grab samples and assumed to remain constant over an entire year;
- To account for background nutrient concentrations in surface waters, 0.02 mg/L was subtracted from the value obtained from each outfall for total phosphorus (TP) and 1.0 mg/L was subtracted from the value of each total nitrogen (TN) sample. In-stream load calculations were made without this more conservative approach. This background level was determined from nutrient data collected by the USGS National Water-Quality Assessment (NAWQA) program for nutrients in "natural watersheds[viii]" as well as data collected from "clean" outfalls in Baltimore, MD, that is, those that did not exceed any of the identified parameters.
- A range of 50-150% of the calculated value is also displayed to account for the diurnal flow associated with some outfalls.

[viii] http://water.usgs.gov/nawqa/nutrients/pubs/awra_v36_no4/

ATTACHMENT C.
Outfall Map



Attachment D. Model Illicit Discharge Ordinance

Introduction to the Model Illicit Discharge and Connection Ordinance

The model ordinance provided in this Appendix is intended to be a tool for communities who are responsible for meeting the illicit discharge detection and correction requirements of the National Pollutant Discharge Elimination System (NPDES) regulations. This model ordinance is provided to assist communities in creating their own illicit discharge ordinances. In designing this model, an attempt was made to avoid creating too complex an ordinance, and instead to provide standard language and concepts that a good illicit discharge ordinance might contain. The language was borrowed from a number of ordinances.

Feel free to use and alter any and all portions of this document to meet the needs of the local community. Throughout the ordinance, there are sections in which the name of the agency to which regulatory power over illicit discharges has been given should be filled in to customize it. These sections are denoted by text placed in brackets – [authorized enforcement agency].

Italicized text with this symbol should be interpreted as comments, instructions, or information to assist local governments in tailoring the ordinance. This text would not appear in a final adopted ordinance.
This ordinance should not be construed as an exhaustive listing of all the language needed for a local ordinance, but represents a good base that communities can build upon and customize to be consistent with the staff resources available in their locality. It is recommended that this document be used in conjunction with other sources, such as existing ordinances created by other IDDE programs in the same geographic region and with similar objectives. In addition, several state agencies, councils of governments, and other regional groups have developed model ordinances. Two very comprehensive yet different examples of ordinances are:

- Model Storm Water Ordinance
  Source: North Central Texas Council of Governments
  (www.dfwstormwater.com/illicits)

- Model Illicit Discharge and Illegal Connection Ordinance
  Source: Metropolitan North Georgia Water Planning District
  (www.northgeorgiawater.com)

For those areas where septic systems are commonly used for wastewater treatment, language requiring inspection of these systems should also be added. The Washtenaw County (MI) *Regulation for the Inspection of Residential On-site Water and Sewage Disposal Systems at Time of Property Transfer* is an example of an ordinance that specifies requirements for inspection and maintenance of septic systems.

MODEL ILLICIT DISCHARGE AND CONNECTION ORDINANCE

ORDINANCE NO. _____

SECTION 1. PURPOSE/INTENT.

The purpose of this ordinance is to provide for the health, safety, and general welfare of the citizens of **[jurisdiction]** through the regulation of non-storm water discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

(1) To regulate the contribution of pollutants to the MS4 by storm water discharges by any user.

(2) To prohibit illicit connections and discharges to the MS4.

(3) To establish legal authority to carry out all inspection, surveillance, monitoring, and enforcement procedures necessary to ensure compliance with this ordinance.

SECTION 2. DEFINITIONS.

For the purposes of this ordinance, the following shall mean:

Authorized Enforcement Agency. Employees or designees of the director of the municipal agency designated to enforce this ordinance.

Best Management Practices (BMPs). Schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to storm water, receiving waters, or storm water conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage.

Clean Water Act. The federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.), and any subsequent amendments thereto.

Construction Activity. Activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

Hazardous Materials. Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Illegal Discharge. Any direct or indirect non-storm water discharge to the storm drain system, except as exempted in Section 8 of this ordinance.

Illicit Connections. An illicit connection is defined as either of the following:

- Any drain or conveyance, whether on the surface or subsurface that allows an illegal discharge to enter the storm drain system including but not limited to any conveyances that allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or,
- Any drain or conveyance connected from a commercial or industrial land use to the storm drain system that has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

Industrial Activity. Activities subject to NPDES Industrial Storm Water Permits as defined in 40 CFR, Section 122.26 (b)(14).

Municipal Separate Storm Sewer System (MS4). The system of conveyances (including sidewalks, roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned and operated by the **[jurisdiction]** and designed or used for collecting or conveying storm water, and that is not used for collecting or conveying sewage.

National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit. means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC § 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

Non-Storm Water Discharge. Any discharge to the storm drain system that is not composed entirely of storm water.

Person. Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

Premises. Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

Storm Drainage System. Publicly-owned facilities by which storm water is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures.

Storm Water. Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

Storm Water Management Plan. A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Storm Water, Storm Water Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

Wastewater. Any water or other liquid, other than uncontaminated storm water, discharged from a facility.

SECTION 3. APPLICABILITY.

This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by the **[authorized enforcement agency]**.

SECTION 4. RESPONSIBILITY FOR ADMINISTRATION.

The **[authorized enforcement agency]** shall administer, implement, and enforce the provisions of this ordinance. Any powers granted or duties imposed upon the **[authorized enforcement agency]** may be delegated in writing by the Director of the **[authorized enforcement agency]** to persons or entities acting in the beneficial interest of or in the employ of the agency.

SECTION 5. COMPATIBILITY WITH OTHER REGULATIONS.

This ordinance is not intended to modify or repeal any other ordinance, rule, regulation, or other provision of law. The requirements of this ordinance are in addition to the requirements of any other ordinance, rule, regulation, or other provision of law, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule, regulation, or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human health or the environment shall control.

SECTION 6. SEVERABILITY.

The provisions of this ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this ordinance or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this ordinance.

SECTION 7. ULTIMATE RESPONSIBILITY.

The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend or imply that compliance by any person will ensure that there will be no contamination, pollution, or unauthorized discharge of pollutants.

SECTION 8. DISCHARGE PROHIBITIONS.

8.1. Prohibition of Illegal Discharges.

No person shall throw, drain, or otherwise discharge, cause, or allow others under its control to throw, drain, or otherwise discharge into the MS4 any pollutants or waters containing any pollutants, other than storm water.

The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

(1) The following discharges are exempt from discharge prohibitions established by this ordinance: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering,

individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water.

(2) Discharges or flow from firefighting, and other discharges specified in writing by the **[authorized enforcement agency]** as being necessary to protect public health and safety.

(3) Discharges associated with dye testing, however this activity requires a verbal notification to the **[authorized enforcement agency]** prior to the time of the test.

(4) The prohibition shall not apply to any non-storm water discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the United States Environmental Protection Agency (EPA), provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

The local government may evaluate and remove any of the above exemptions if it is determined that they are causing an adverse impact.

8.2. Prohibition of Illicit Connections.

(1) The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.

(2) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(3) A person is considered to be in violation of this ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.

(4) Improper connections in violation of this ordinance must be disconnected and redirected, if necessary, to an approved onsite wastewater management system or the sanitary sewer system upon approval of the **[authorized enforcement agency]**.

(5) Any drain or conveyance that has not been documented in plans, maps or equivalent, and which may be connected to the storm sewer system, shall be located by the owner or occupant of that property upon receipt of written notice of violation from the **[authorized enforcement agency]** requiring that such locating be completed. Such notice will specify a reasonable time period within which the location of the drain or conveyance is to be determined, that the drain or conveyance be identified as storm sewer, sanitary sewer or other, and that the outfall location or point of connection to the storm sewer system, sanitary sewer system or other discharge point be identified. Results of these investigations are to be documented and provided to the **[authorized enforcement agency]**.

SECTION 9. WATERCOURSE PROTECTION.

Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.

SECTION 10. INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES.

10.1. Submission of NOI to [jurisdiction].

(1) Any person subject to an industrial or construction activity NPDES storm water discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the **[authorized enforcement agency]** prior to the allowing of discharges to the MS4.

(2) The operator of a facility, including construction sites, required to have an NPDES permit to discharge storm water associated with industrial activity shall submit a copy of the Notice of Intent (NOI) to the **[authorized enforcement agency]** at the same time the operator submits the original Notice of Intent to the EPA as applicable.

(3) The copy of the Notice of Intent may be delivered to the **[authorized enforcement agency]** either in person or by mailing it to:

Notice of Intent to Discharge Storm Water

[authorized enforcement agency]

[street address]

[city, state, zip code]

(4) A person commits an offense if the person operates a facility that is discharging storm water associated with industrial activity without having submitted a copy of the Notice of Intent to do so to the **[authorized enforcement agency]**.

SECTION 11. COMPLIANCE MONITORING

11.1. Right of Entry: Inspection and Sampling.

The **[authorized enforcement agency]** shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to determine compliance with this ordinance.

(1) If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the **[authorized enforcement agency]**.

(2) Facility operators shall allow the **[authorized enforcement agency]** ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge storm water, and the performance of any additional duties as defined by state and federal law.

(3) The **[authorized enforcement agency]** shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the **[authorized enforcement agency]** to conduct monitoring and/or sampling of the facility's storm water discharge.

(4) The **[authorized enforcement agency]** has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure storm water flow and quality shall be calibrated to ensure their accuracy.

(5) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the **[authorized enforcement agency]** and shall not be replaced. The costs of clearing such access shall be borne by the operator.

(6) Unreasonable delays in allowing the **[authorized enforcement agency]** access to a permitted facility is a violation of a storm water discharge permit and of this ordinance. A person who is the operator of a facility with an NPDES permit to discharge storm water associated with industrial activity commits an offense if the person denies the **[authorized enforcement agency]** reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this ordinance.

11.2. Search Warrants.

If the **[authorized enforcement agency]** has been refused access to any part of the premises from which storm water is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the **[authorized enforcement agency]** may seek issuance of a search warrant from any court of competent jurisdiction.

SECTION 12. REQUIREMENT TO PREVENT, CONTROL, AND REDUCE STORM WATER POLLUTANTS BY THE USE OF BEST MANAGEMENT PRACTICES.

[Authorized enforcement agency] will adopt requirements identifying Best Management Practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the United States. The owner or operator of such activity, operation, or facility shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premise that is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the MS4. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a storm water management plan (SWMP) as necessary for compliance with requirements of the NPDES permit.

SECTION 13. NOTIFICATION OF SPILLS.

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into storm water, the storm drain system, or waters of the United States, said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, said person shall notify the **[authorized enforcement agency]** in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed

and mailed to the **[authorized enforcement agency]** within **[___]** business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least **[___]** years.

Failure to provide notification of a release as provided above is a violation of this ordinance.

SECTION 14. VIOLATIONS, ENFORCEMENT, AND PENALTIES.

14.1. Violations.

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of this ordinance. Any person who has violated or continues to violate the provisions of this ordinance, may be subject to the enforcement actions outlined in this section or may be restrained by injunction or otherwise abated in a manner provided by law.

In the event the violation constitutes an immediate danger to public health or public safety, the **[authorized enforcement agency]** is authorized to enter upon the subject private property, without giving prior notice, to take any and all measures necessary to abate the violation and/or restore the property. The **[authorized enforcement agency]** is authorized to seek costs of the abatement as outlined in Section 17.

14.2. Warning Notice.

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, the **[authorized enforcement agency]** may serve upon that person a written Warning Notice, specifying the particular violation believed to have occurred and requesting the discharger to immediately investigate the matter and to seek a resolution whereby any offending discharge will cease. Investigation and/or resolution of the matter in response to the Warning Notice in no way relieves the alleged violator of liability for any violations occurring before or after receipt of the Warning Notice. Nothing in this subsection shall limit the authority of the **[authorized enforcement agency]** to take any action, including emergency action or any other enforcement action, without first issuing a Warning Notice.

14.3. Notice of Violation.

Whenever the **[authorized enforcement agency]** finds that a person has violated a prohibition or failed to meet a requirement of this ordinance, the **[authorized enforcement agency]** may order compliance by written notice of violation to the responsible person.

The Notice of Violation shall contain:

(1) The name and address of the alleged violator;

(2) The address when available or a description of the building, structure or land upon which the violation is occurring, or has occurred;

(3) A statement specifying the nature of the violation;

(4) A description of the remedial measures necessary to restore compliance with this ordinance and a time schedule for the completion of such remedial action;

(5) A statement of the penalty or penalties that shall or may be assessed against the person to whom the notice of violation is directed;

(6) A statement that the determination of violation may be appealed to the **[authorized enforcement agency]** by filing a written notice of appeal within **[___]** days of service of notice of violation; and

(7) A statement specifying that, should the violator fail to restore compliance within the established time schedule, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator.

Such notice may require without limitation:

(1) The performance of monitoring, analyses, and reporting;

(2) The elimination of illicit connections or discharges;

(3) That violating discharges, practices, or operations shall cease and desist;

(4) The abatement or remediation of storm water pollution or contamination hazards and the restoration of any affected property

(5) Payment of a fine to cover administrative and remediation costs; and

(6) The implementation of source control or treatment BMPs.

14.5. Compensatory Action.
In lieu of enforcement proceedings, penalties, and remedies authorized by this ordinance, the **[authorized enforcement agency]** may impose upon a violator alternative compensatory actions, such as storm drain stenciling, attendance at compliance workshops, creek cleanup, etc.

14.6. Suspension Of MS4 Access.

14.6.1. Emergency Cease and Desist Orders

When the **[authorized enforcement agency]** finds that any person has violated, or continues to violate, any provision of this ordinance, or any order issued hereunder, or that the person's past violations are likely to recur, and that the person's violation(s) has (have) caused or contributed to an actual or threatened discharge to the MS4 or waters of the United States which reasonably appears to present an imminent or substantial endangerment to the health or welfare of persons or to the environment, the **[authorized enforcement agency]** may issue an order to the violator directing it immediately to cease and desist all such violations and directing the violator to:

(1) Immediately comply with all ordinance requirements; and

(2) Take such appropriate preventive action as may be needed to properly address a continuing or threatened violation, including immediately halting operations and/or terminating the discharge.

Any person notified of an emergency order directed to it under this Subsection shall immediately comply and stop or eliminate its endangering discharge. In the event of a discharger's failure to immediately comply voluntarily with the emergency order, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize harm to the MS4 or waters of the United States, and/or endangerment to persons or to the environment, including immediate termination of a facility's water supply, sewer connection, or other municipal utility services. The **[authorized enforcement agency]** may allow the person to recommence its discharge when it has demonstrated to the satisfaction of the **[authorized enforcement agency]** that the period of endangerment has passed, unless further termination proceedings are initiated against the discharger under this ordinance. A person that is responsible, in whole or in part, for any discharge presenting imminent endangerment shall submit a detailed written statement, describing the causes of the harmful discharge and the measures taken to prevent any future occurrence, to the **[authorized enforcement agency]** within **[___]** days of receipt of the emergency order. Issuance of an emergency cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the violator.

14.6.2. Suspension due to Illicit Discharges in Emergency Situations
The **[authorized enforcement agency]** may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the United States. If the violator fails to

comply with a suspension order issued in an emergency, the **[authorized enforcement agency]** may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the United States, or to minimize danger to persons.

14.6.3. Suspension due to the Detection of Illicit Discharge
Any person discharging to the MS4 in violation of this ordinance may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The **[authorized enforcement agency]** will notify a violator of the proposed termination of its MS4 access. The violator may petition the **[authorized enforcement agency]** for a reconsideration and hearing.

A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the **[authorized enforcement agency]**.

14.7. Civil Penalties.

In the event the alleged violator fails to take the remedial measures set forth in the notice of violation or otherwise fails to cure the violations described therein within **[___]** days, or such greater period as the **[authorized enforcement agency]** shall deem appropriate, after the **[authorized enforcement agency]** has taken one or more of the actions described above, the **[authorized enforcement agency]** may impose a penalty not to exceed $**[___]** (depending on the severity of the violation) for each day the violation remains unremedied after receipt of the notice of violation.

14.8. Criminal Prosecution.

Any person that has violated or continues to violate this ordinance shall be liable to criminal prosecution to the fullest extent of the law, and shall be subject to a criminal penalty of $**[___]** per violation per day and/or imprisonment for a period of time not to exceed **[___]** days. Each act of violation and each day upon which any violation shall occur shall constitute a separate offense.

SECTION 15. APPEAL OF NOTICE OF VIOLATION.

Any person receiving a Notice of Violation may appeal the determination of the **[authorized enforcement agency]**. The notice of appeal must be received within **[___]** days from the date of the Notice of Violation. Hearing on the appeal before the appropriate authority or his/her designee shall take place within **[___]** days from the date of receipt of the notice of appeal. The decision of the municipal authority or their designee shall be final.

SECTION 16. ENFORCEMENT MEASURES AFTER APPEAL.

If the violation has not been corrected pursuant to the requirements set forth in the Notice of Violation, or, in the event of an appeal, within **[___]** days of the decision of the municipal authority upholding the decision of the **[authorized enforcement agency]**, then representatives of the **[authorized enforcement agency]** shall enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation and/or restore the property. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the government agency or designated contractor to enter upon the premises for the purposes set forth above.

SECTION 17. COST OF ABATEMENT OF THE VIOLATION.

Within **[___]** days after abatement of the violation, the owner of the property will be notified of the cost of abatement, including administrative costs. The property owner may file a written protest objecting to the amount of the assessment within **[___]** days. If the amount due is not paid within a timely manner as determined by the decision of the municipal authority or by the expiration of the time in which to file an appeal, the charges shall become a special assessment against the property and shall constitute a lien on the property for the amount of the assessment.

Any person violating any of the provisions of this article shall become liable to the **[jurisdiction]** by reason of such violation. The liability shall be paid in not more than **[___]** equal payments. Interest at the rate of **[___]** percent per annum shall be assessed on the balance beginning on the **[___]** day following discovery of the violation.

SECTION 18. VIOLATIONS DEEMED A PUBLIC NUISANCE.

In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this ordinance is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken.

SECTION 19. REMEDIES NOT EXCLUSIVE.

The remedies listed in this ordinance are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the **[authorized enforcement agency]** to seek cumulative remedies.

The **[authorized enforcement agency]** may recover all attorney's fees court costs and other expenses associated with enforcement of this ordinance, including sampling and monitoring expenses.

SECTION 20. ADOPTION OF ORDINANCE.

This ordinance shall be in full force and effect **[___]** days after its final passage and adoption. All prior ordinances and parts of ordinances in conflict with this ordinance are hereby repealed.

PASSED AND ADOPTED this ____ day of _____, 20__, by the following vote: