



**Maryland**  
Department of  
the Environment

# **How Nutrient TMDLs are implemented in Maryland NPDES permits**

November 6, 2018

ACWA Gulfport, Mississippi



# **Situations when Nutrient Limits are Required in MD NPDES Permits**

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1. Localized Impairments (next to dischargers)
  - a) Estuary, pond/lake, receiving stream
2. Tributary TMDL
3. Bay TMDL
  - a) Individual or Aggregate Waste Load Allocation
  - b) Bay Restoration Funding and Floating Caps
4. Offset Credits (through nutrient trading)
  - a) New or expanding facilities



# La Plata WWTP Receiving Stream Port Tobacco River

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**1993**



**2005**





# What is TMDL?

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- Total Maximum Daily Load
- Required under Federal Clean Water Act
- Establishes maximum amount of impairing substance or stressor a water body can assimilate and still meet water quality standards
- Allocates a load among pollution contributors, Point and nonpoint sources
- After EPA approval, limits implemented through NPDES Permit



# TMDL Components

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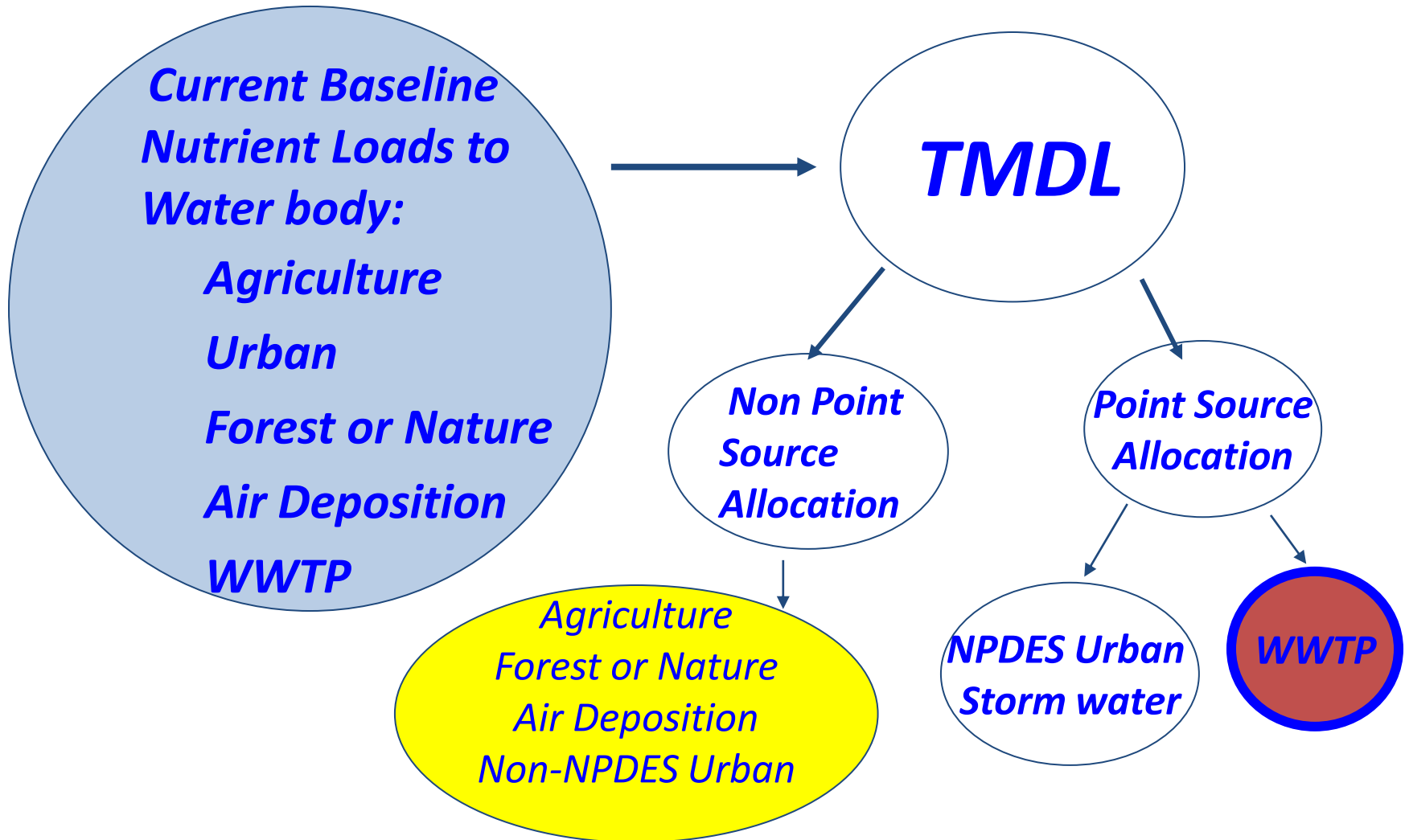
$$\text{TMDL} = \text{WLA} + \text{LA} + \text{MOS} (+\text{FA})$$

- WLA = Point Source Load Allocation  
(NPDES permit)/ Urban Non Point Source
- LA = Non-Point Source Load Allocation
- MOS = Margin of Safety
- FA = Future Allocation (included when applicable)

Expressed as “mass per unit time, toxicity or other appropriate measure”



# Graphic Representation of TMDL





# Chesapeake Bay Overview

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# Chesapeake Bay TMDL

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- Established by EPA on December 29, 2010
- It is a "pollution diet" to restore clean water in Chesapeake Bay and the region's streams, creeks, and rivers
- Combination of 92 smaller TMDLs
- Sets limits of: 185.9 million lbs nitrogen, 12.5 million lbs phosphorus and 64.5 billion lbs sediment
- Allows states to set load caps for point and non-point sources for Nitrogen, Phosphorous and Sediment
- Tributary Strategy is predecessor of Bay TMDL





# Factors for Developing the Bay TMDL and the Latest Model

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- Extensive Knowledge in:
  - Watershed
  - Source of pollution
  - Land uses
  - Precipitation data
  - BMP
  - Other factors.
- Uses series of Models that simulate data to replicate system
- Models calibrated to decades of water quality and other data
- Phase 6 is latest version called Chesapeake Bay Suite of modeling tools



# Determinants of MD WWTP WLA in Bay TMDL

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- WWTP design capacity  $\geq 0.5$  mgd
  - given individual WLA based on **ENR level treatment \***
- WWTP design capacity  $< 0.5$  mgd
  - Given aggregate WLA based on **Secondary level treatment \*\***

Please note going to refer to:

\* 4 mg/l TN and 0.3 mg/l TP values as

**ENR level treatment** and

\*\* 18 mg/l TN and 3 mg/l TP values as

**Secondary level treatment**



# Example of Individual WLA limit at Major ENR WWTP

WLA for major facilities use ENR level treatment and design capacity to calculate load limit in current WWTP

Current 1.5 MGD WWTP	Expansion to 2 MGD
TN allocation: 18,265 lbs/yr and 4 mg/l	Effluent TN Limit: 18,265 lb/yr and 3.0 mg/l*
TP allocation: 1,370 lbs/yr and 0.3 mg/l	Effluent TP Limit: 1,370 lb/yr and 0.2 mg/l*
	*annual average concentration

ENR limit vs TMDL limit: more stringent limit applied to permit.



# Example of Aggregate WLA at Minor WWTP

## Secondary level treatment annual average

- If original allocations less than 6,100 lbs/yr TN and 457 lb/yr TP and WWTP expands then load will remain the same.
- If original allocation larger than 6,100 lbs/yr TN and 457 lb/yr TP then depends on funding source

<b>Current design flow or 2020 flow of 0.12 MGD</b>	<b>Expansion to 0.24 MGD</b>
TN allocation: 6,575 lbs/yr and 18 mg/L  TP allocation: 1,096 lbs/yr and 3.0 mg/L	Depends on funding source:  a) If private source  b) If state or federal source



# Example of Aggregate WLA at Minor WWTP Continued

<b>Expansion to 0.24 MGD</b> <b>a) if private funding apply</b> <b>6,100 lb/yr TN and 457</b> <b>lb/yr TP</b> per state policy	<b>Expansion to 0.24 MGD</b> <b>b) if state or federal</b> <b>funding apply ENR Level</b> <b>treatment to get load</b>
Effluent TN Limit: 6,100 lbs/yr and 8.3 mg/l*	Effluent TN Limit: 2,922 lbs/yr and 4 mg/l*
Effluent TP Limit: 457 lbs/yr and 0.6 mg/l*	Effluent TP Limit : 219 lbs/yr and 0.3 mg/l*

\*annual average concentration



# Bay Restoration Fund (BRF)

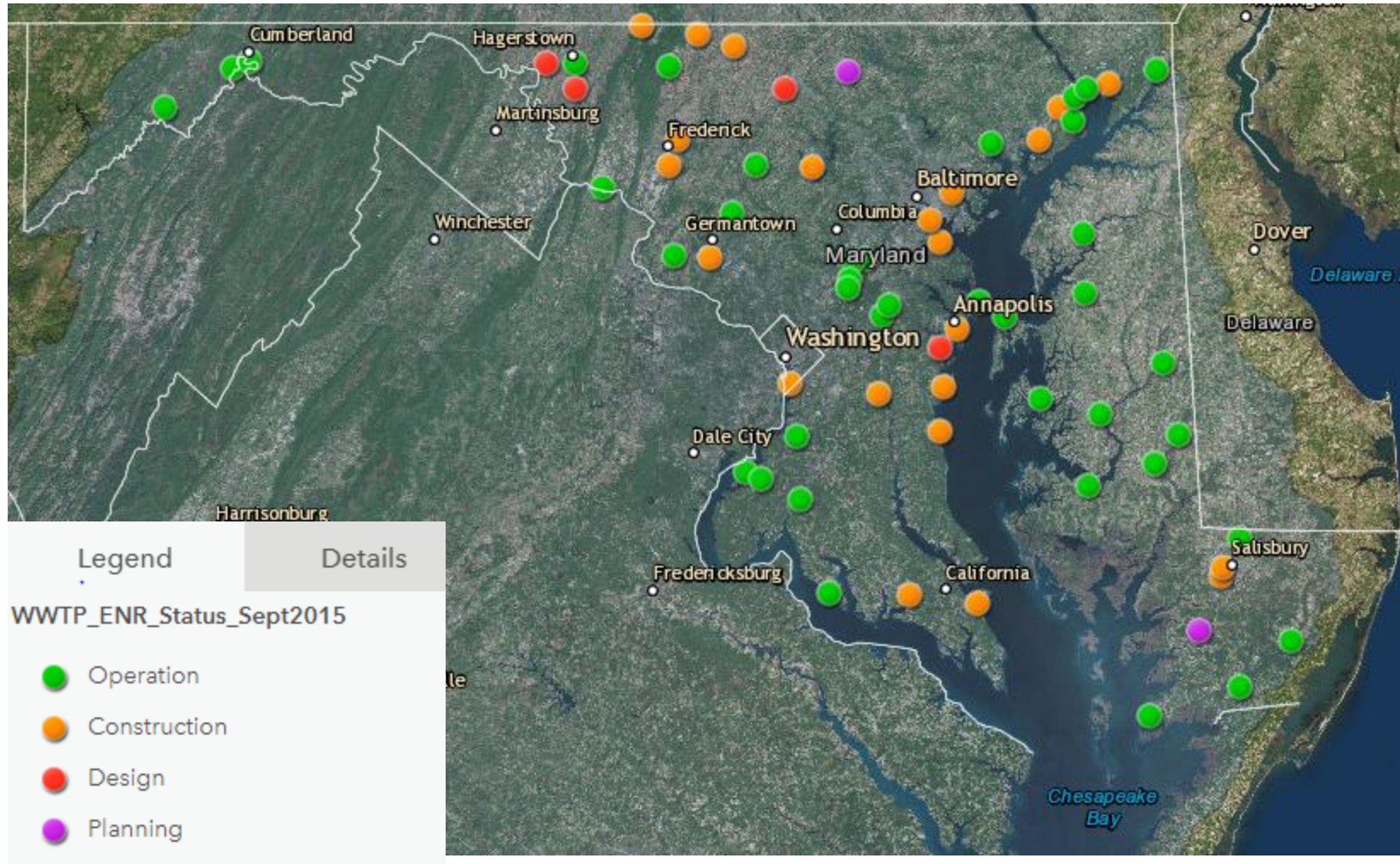
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- Signed into law May 26, 2004
- Provide financing for Chesapeake Bay clean up.
- Funds to upgrade WWTP with ENR technology.
- Fee placed on all WWTP users and similar fee on septic system users
- 67 major POTW discharging to Chesapeake Bay received priority funding
- ENR WWTP can achieve 3 mg/l TN and 0.3 mg/l TP





# Location of ENR WWTP







# Chesapeake Bay TMDL Limits

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- Annual maximum effluent load limits (NPDES permit limit derived from Chesapeake Bay TMDL Individual WLA) for nutrients are calculated using:
  - Permitted Capacity (1.4 mgd) x 4 mg/l TN = 17,055 lbs/yr TN
  - Permitted Capacity (1.4 mgd) x 0.3 mg/l TP = 1,279 lbs/yr TP



# Floating Cap

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- Floating cap is a performance based nutrient limit.
- At the end of each year, WWTP permit requires permittee to comply with limits established in the permit (previous slide) or with the performance based limits for the actual flow, whichever value is lower.
  - Maximum Allowable Annual TN limit:  $4 \text{ mg/l} \times \text{total annual flow of } 182 \text{ MG} = 6,063 \text{ lbs/yr}$
  - Maximum Allowable Annual TP limit:  $0.3 \text{ mg/l} \times \text{total annual flow of } 182 \text{ MG} = 455 \text{ lbs/yr}$



# MDE Worksheet for Annual Load and flow and Floating Cap Calculation

Calculation TABLE for Reporting Annual Waste Load for Total Nitrogen, Total Phosphorus and Total Suspended Solids

Facility Name: Brunswick Wastewater Treatment Plant

State Permit Number: 14-DP-0106

NPDES Number: MD0020958

YEAR Reporting: 2015

Months	Total Monthly Effluent Flow (Million Gallons (MG))	Total Nitrogen (TN) as N			Total Phosphorus (TP) as P			Total Suspended Solids (TSS)		
		Monthly TN Average Concentration (mg/L)	Monthly TN Loading Rate <sup>(1)</sup> (Pounds/month)	Year-to-date Cumulative TN Loading <sup>(2)</sup> YTD (Pounds)	Monthly TP Average Concentration (mg/L)	Monthly TP Loading Rate <sup>(1)</sup> (Pounds/month)	Year-to-date Cumulative TP Loading <sup>(2)</sup> YTD (Pounds)	Monthly TSS Average Concentration (mg/L)	Monthly TSS Loading Rate <sup>(1)</sup> (Pounds/month)	Year-to-date Cumulative TSS Loading <sup>(2)</sup> YTD (Pounds)
January	16.347	2.3	314	314	0.23	31	31	0.2	27	27
February	11.828	2.13	207	521	0.10	10	41	6.6	640	667
March	21.486	2.1	376	897	0.20	36	77	0.7	125	793
April	14.126	1.99	231	1128	0.30	35	112	0.2	24	816
May	19.904	2	232	1360	0.31	36	148	0.2	23	840
June	18.139	2.3	348	1708	0.40	61	208	0.3	45	885
July	19.711	2.68	306	2014	0.20	23	231	0.2	23	908
August	12.962	2.02	208	2222	0.20	21	252	0.4	41	949
September	11.837	2.21	214	2437	0.20	19	271	0.2	19	968
October	16.006	2.99	399	2836	0.10	13	285	0.2	27	995
November	13.694	2.64	288	3124	0.10	11	296	0.4	45	1040
December	18.8	2.24	351	3475	0.10	15	311	0.4	63	1103

Effluent Total Annual Flow

(MG/Year) <sup>(3)</sup>

181.748

Annual average TN, TP and TSS concentrations, (mg/L) = Total Annual Load / (Total Annual Flow x 8.34)

2.3

<—Meets TN Floating Cap Limit

0.2

<—Meets TP Floating Cap Limit

0.7

WASTE LOADING	POLLUTANT					
	TN		TP		TSS	
Pollutant's Total Annual Load in Effluent discharged from Facility (Pounds) <sup>(4)</sup>	3475		311		1103	
Maximum Allowable Annual Loading Rate (Pounds/Year) <sup>(5)</sup>	6063		455		127914	
TMDL/Tributary Strategy Based Annual Maximum Waste Load Allocation (Pounds/Year)	GOAL =	LIMIT =	GOAL =	LIMIT =	LIMIT =	
		17055		1279	127914	
Concentration-Based Annual Maximum Loading Rate Limit (Pounds/Year)	C <sub>N</sub> (mg/L) =	L <sub>N</sub> (Pounds/Year) <sup>(6)</sup> =	C <sub>P</sub> (mg/L) =	L <sub>P</sub> (Pounds/Year) <sup>(6)</sup> =	TSS (mg/L) =	Load Limit (Pounds/Year) =
	4.0	6063	0.30	455	N/A	N/A

<sup>(1)</sup> Monthly Loading Rate (Pounds/Month) = Total Monthly Flow (MG) x Monthly Average Concentration (mg/L) x 8.34

<sup>(2)</sup> Year-to-date Cumulative Load (Pounds) = Sum of Total Monthly Loadings from January to the reporting month

<sup>(3)</sup> Total Yearly Effluent Flow = Sum of total monthly flows from January through December

<sup>(4)</sup> Total Annual Load (in Pounds) = Year-to-date cumulative load for month of December

<sup>(5)</sup> Maximum allowable annual loading rate is equal to the lower of the TMDL/Tributary Strategy-based or Concentration-based annual maximum loading rate limits.

<sup>(6)</sup> Concentration based Annual Maximum Load Limit:

- FOR TN, L<sub>N</sub> = C<sub>N</sub> x Total Yearly Effluent Flow x 8.34 (Where C<sub>N</sub> is Tributary Strategy based TN concentration of 4.0 mg/l or as specified in the permit. If not applicable, set C<sub>N</sub> = 0.0 & L<sub>N</sub> = N/A)

- FOR TP, L<sub>P</sub> = C<sub>P</sub> x Total Yearly Effluent Flow x 8.34 (Where C<sub>P</sub> is Tributary Strategy based TP concentration of 0.3 mg/l or as specified in the permit. If not applicable, set C<sub>P</sub> = 0.0 & L<sub>P</sub> = N/A)



# Annual Concentration, Load and Flow and Floating Cap

<b>Effluent Total Annual Flow (MG/year)</b>	<b>181.748</b>	<b>or 0.49 MGD</b>	<b>Design Capacity 1.4 MGD</b>	
<b>Annual Average TN and TP concentration, (mg/L)</b>	<b>2.3</b>	<b>&lt;---- Meets TN Floating Cap Limit</b>	<b>0.2</b>	<b>&lt;---- Meets TP Floating Cap Limit</b>
<b>Waste Loading</b>	<b>TN</b>		<b>TP</b>	
<b>Total Annual Load in Effluent discharged form Facility (pounds)</b>	<b>3475</b>		<b>311</b>	
<b>Maximum Allowable Annual Loading Rate (Pounds/ Year)</b>	<b>6063</b>		<b>455</b>	
<b>TMDL or Tributary Strategy Based Annual Maximum Waste Load Allocation or Permit Limit (Pounds/year)</b>	<b>17055</b>		<b>1279</b>	



# Offset Credit

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- If a facility is operating at better than ENR level treatment, surplus nutrients can be provided to new or expanding facilities which may not have an individual WLA.
- Surplus nutrient can be eligible for purchase or trade.
- WWTP can generate TN credits by connecting OSDs, this causes a reduction to nutrient load discharged (green row previous slide).



# How can Credit be used in the Permit

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- If  $\text{Annual Load} - \text{Credit} \leq \text{WLA}$  then the permit is in compliance
- Floating cap compliance assessment is done separately so credits don't affect floating cap.
- Even if surplus of credit still need to operate at ENR level.



# Contact Information

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## **Elita Castleberry, Project Manager**

Municipal Surface Discharge Permits Division

Wastewater Permits Program

Water and Science Administration

Maryland Department of the Environment

Email: ***Elita.Castleberry@maryland.gov***

Voice: 410-537-4113

Fax: 410-537-3163





# Questions?

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