Charles County Phase II WIP Strategy

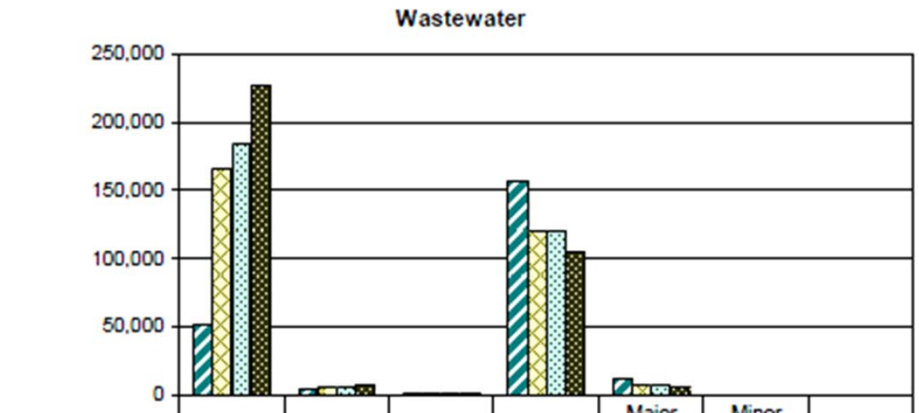
LimnoTech
February 28, 2013

Introduction

- Evaluated 3 sectors
  - Wastewater
  - Urban stormwater
  - Septic systems
- Evaluated 3 scenarios for urban stormwater and septic systems (wastewater sector has available growth capacity)
  - Maryland Phase II WIP
  - Two additional scenarios
    - "Low hanging fruit"
    - Cost efficiency

Wastewater

- Does not require load reduction
  - There is room to grow
  - Retaining some capacity may be able to "offset" loads in other sectors
- Mattawoman WWTP has most potential available capacity



	Major Municipal	Minor Municipal	Major Industrial	Minor Industrial	Major Federal Municipal	Minor Federal Municipal	CSO
2009	51,469	3,718	730	156,855	11,736	0	0
2017 Projected	165,527	5,120	1,777	120,611	7,169	0	0
2020 Projected	183,626	5,657	1,777	120,611	7,921	0	0
2020 Target	226,590	7,440	1,777	105,078	6,091	0	0

Table 3-1
Total Nitrogen Loads from Major Municipal WWTPs in Charles County

Facility Name	2009 Flow (MGD)	2009 TN concentration (mg/L)	2009 TN Load (lbs/yr)	2025 Design Flow (MGD)	2025 Permit Limit for TN concentra-tion (mg/L)	2025 Permit Cap on TN Load (lbs/yr)	Available TN Load (lbs/year)
Mattawoman WWTP	8.2	2.0[1]	49,712	20.0	4.0	194,916	145,204
Swan Point WWTP[2]	0.1	10.0	3,264	0.6	4.0	7,309	4,045
La Plata WWTP	1.1	3.26	11,397	1.5	4.0	18,273	6,877
Indian Head WWTP	0.3	4.63	4,547	0.5	4.0	5,540	1,544

[1]Conservative estimate of current TN effluent concentration.

[2] When the Swan Point WWTP is expanded to 0.6 MGD the permit limit for TN concentration will be reduced to 5.0 mg/L from current permit limit of 10 mg/L

Table 3-2
Total Phosphorus Loads from Major Municipal WWTPs in Charles County

Facility Name	2009 Flow (MGD)	2009 TP concen-tration (mg/L)	2009 TP Load (lbs/yr)	2025 Design Flow (MGD)	2025 Permit Limit for TP concen-tration (mg/L)	2025 Permit Cap on TP Load (lbs/yr)	Available TP Load (lbs/year)
Mattawoman WWTP	8.2	0.08[1]	1,989	20.0	0.18	8,771	6,782
Swan Point WWTP	0.1	0.5	71	0.6	0.3	548	477
La Plata WWTP	1.1	0.24	834	1.5	0.3	1,371	536
Indian Head WWTP	0.3	0.47	459	0.5	0.3	457	-2

[1]Conservative estimate of current TP effluent concentration.

Mattawoman WWTP Excess Load Capacity

- Projected 2025 loads based on expected growth per 2012 draft of Water Resource Element
- Included expected water re-use (Panda Brandywine and CPV) and water conservation
  - These reduce flows and free up capacity
- Load capacity available which could be used as credits towards other sectors

Table 3-5
Project 2025 Excess Loading at the Mattawoman WWTP

	TN lbs (delivered)/year	TP lbs (delivered)/year
a). 2025 Permit Loading Cap	194,916	8,771
b). 2012 Loads	70,029	2,801
c). 2012-2025 Loads for Growth	24,492	998
d). Projected 2025 Loads (b + c)	94,971	3,799
e). Wastewater Re-use (Industrial)	6,732	362
f). Wastewater Re-use (Other types)	Future projects to be included here	Future projects to be included here
g). Water Conservation (reduction in volume to WWTP)	5,138	277
h). Total Savings from Projected 2025 Baseline Loads (e + f + g)	11,870	639
i). Total Loads Projected in 2025 (d - h)	83,101	3,160
2025 Excess Loading Capacity (a – i)	111,860	5,611

Potential Cost Savings

- Calculated how much of targets could be achieved by using excess load capacity
  - Capacity available to meet all of nitrogen targets for urban stormwater or septics
  - Capacity not available to meet phosphorus targets for urban stormwater
  - Potential to use some capacity to help offset loads in scenarios

Table 3-6
Potential Cost Savings by Crediting Mattawoman WWTP Excess Nutrient Loading Capacity

Load	Target Load Reduction (lbs/yr)	Excess Loading Capacity (lbs/yr)	Percent of Excess Loading Capacity Required to Offset Target Load Reduction	Cost of Scenario	Cost of Scenario per lb of Pollutant Removed
Urban Stormwater					
Nitrogen	32,119	111,860	28.71	$132,690,750	$4,131.22
Phosphorus	7,866	5,611	140.02	$132,690,750	$16,868.90
Septic Systems					
Nitrogen	51,759	111,860	46.27	$90,807,690	$1,754.43

Urban Stormwater Scenarios

- Multiple Best Management Practice (BMP) scenarios
- Evaluated different combinations of BMP types
  - Stream restoration
  - Wet and dry pond retrofit (submerged gravel wetlands)
  - Environmental Site Design (ESD) on parcels with no existing stormwater BMPs
  - Shoreline stabilization projects
  - Urban nutrient management
  - Urban forest buffer restoration
- Different land owners
  - County
  - State
  - Private

Urban Best Management Practice (BMP) Factors

- Cost efficiency
  - Evaluated BMPs that provided most "bang for the buck" – cost per pound of pollutant removed
- Available land
  - Use GIS to identify parcels that met criteria for the BMP
  - Identified maximum feasible amount of BMP based on criteria
  - Adjusted amount down from maximum feasible to achieve targets
- "Low hanging fruit"
  - County-owned land
  - Unmanaged areas

Table 3-25 Urban Stormwater Scenario 3							
Strategy	**Quantity**	**Units**	**Description**	**Treatment Drainage Acres**	**Treatment Impervious Acres**	**Pollutant Reduction**	
						TN (lbs/ year)	**TP (lbs/ year)**
Stream Restoration (TOTAL)	117,037	Feet	Stream restoration of degraded or potentially degraded stream channels. Potential restoration streams identified from "Poor" rated streams from MBSS and analysis of impervious cover within 1,000 feet of stream.	NA	NA	16,695	6,749
Streams on County Land	14,782	Feet		NA	NA	2,222	902
Streams on State Land	39,761	Feet		NA	NA	6,531	2,394
Streams on Select Private Land	62,494	Feet		NA	NA	7,942	3,453
BMP Pond Retrofits (TOTAL)	258	# of Ponds	Retrofit low-efficiency SWM ponds with submerged gravel wetlands, SPSCs, or similar approach.	3,498	774	5,853	671
County Wet Ponds	79	# of Ponds		443	104	618	43
County Dry Ponds	23	# of Ponds		580	137	1,758	191
Select Private Wet Ponds	82	# of Ponds		1,481	309	1,327	117
Select Private Dry Ponds	74	# of Ponds		994	223	2,150	320
ESD Retrofits (TOTAL)	1,314	Acres	Retrofit areas without SWM with ESD practices (100% of County parcels, 0% of private parcels)	1,314	276	2,491	437
County Parcels	1,314	Acres		1,314	276	2,491	437
Private Parcels	0	Acres		0	0	0	0
Shoreline Stabilization	25,506	Feet	Shoreline stabilization based on projections of future implementation levels identified by Charles County	NA	NA	510	64
Urban Nutrient Management	9,544	Acres	Implementation of existing urban nutrient management laws and regulations at level implemented by MDE in WIP	9,544	NA	6,571	252
					TOTALS	**32,120**	**8,173**

Urban Stormwater Scenario Costs

- Lowest cost scenario for urban stormwater
- Includes work on private land
  - Stream restoration
  - Pond retrofits

Table 4-8
Total Costs For Stormwater Scenario 3

BMP Type	Amt	Unit	Unit Capital Cost[1]	Total Capital Cost	Annual O&M Costs	Total O&M Costs[2]	Total Costs
Stream Restoration (County Land)	14,782	Feet	$285[3]	$4,212,870	$8.91[4]	$856,100	$5,068,970
Stream Restoration (State Land)	39,761	Feet	$285[3]	$11,331,885	$8.91[4]	$2,302,758	$13,634,643
Stream Restoration (Private Land)	62,494	Feet	$285[3]	$17,810,790	$8.91[4]	$3,619,340	$21,430,130
BMP Wet Pond Retrofits (County Land)	104	Acres	$65,998	$6,863,792	$763	$515,788	$7,379,580
BMP Wet Pond Retrofits (Private Land)	309	Acres	$65,998	$20,393,382	$763	$1,532,486	$21,925,868
BMP Dry Pond Retrofits (County Land)	137	Acres	$72,500	$9,932,500	$1,231	$1,096,206	$11,028,706
BMP Dry Pond Retrofits (Private Land)	223	Acres	$72,500	$16,167,500	$1,231	$1,784,335	$17,951,835
ESD Retrofits (County Land)	276	Acres	$60,000[5]	$16,560,000	$1,531	$2,746,614	$19,306,614
ESD Retrofits (Private Land)	0	Acres	$60,000[5]	$0	$1,531	$0	$0
Shoreline Stabilization (Private Land)	25,506	Feet	$310[3]	$7,906,860	$0	$0	$7,906,860
Urban Nutrient Management	9,544	Acres	$3.10	$29,586	$0	$0	$29,586
Totals							**$125,662,791**

[1]Unit capital costs are from King and Hagan unless otherwise noted.

[2]Assuming a constant rate of implementation of BMPs over the 13 year period from 2013 to 2025, the average BMP will be in place for 6.5 years. Therefore, the annual O&M costs should be multiplied by 6.5 to calculate the total O&M cost until 2025.

[3]Unit costs from Maryland Phase II WIP.

[4]Unit cost for O&M from King and Hagan. Assuming a conversion of 100 feet = 1 acre.

[5]Estimated based on average costs of ESD installations from literature review.

County Costs

- County will not pay all costs for this scenario
- Assumed County would pay
  - 100% of costs for stream restoration on private land
  - 50% of costs for pond retrofits on private land

Table 4-9
County Costs For Stormwater Scenario 3

BMP Type	Amt	Unit	Unit Capital Cost[1]	Total Capital Cost	Annual O&M Costs	Total O&M Costs[2]	Total Costs
Stream Restoration (County Land)	14,782	Feet	$285[3]	$4,212,870	$8.91[4]	$856,100	$5,068,970
Stream Restoration (State Land)	39,761	Feet	$285[3]	$11,331,885	$8.91[4]	$2,302,758	$13,634,643
Stream Restoration (Private Land)	62,494	Feet	$285[3]	$17,810,790	$8.91[4]	$3,619,340	$21,430,130
BMP Wet Pond Retrofits (County Land)	104	Acres	$65,998	$6,863,792	$763	$515,788	$7,379,580
BMP Wet Pond Retrofits (Private Land)	154.5	Acres	$65,998	$10,196,691	$763	$766,243	$10,962,934
BMP Dry Pond Retrofits (County Land)	137	Acres	$72,500	$9,932,500	$1,231	$1,096,206	$11,208,706
BMP Dry Pond Retrofits (Private Land)	111.5	Acres	$72,500	$8,083,750	$1,231	$892,167	$8,975,917
ESD Retrofits (County Land)	276	Acres	$60,000[5]	$16,560,000	$1,531	$2,746,614	$19,306,614
Urban Nutrient Management	9,544	Acres	$3.10[3]	$29,586	$0	$0	$29,586
Totals							**$97,817,080**

[1]Unit capital costs are from King and Hagan unless otherwise noted.

[2]Assuming a constant rate of implementation of BMPs over the 13 year period from 2013 to 2025, the average BMP will be in place for 6.5 years. Therefore, the annual O&M costs should be multiplied by 6.5 to calculate the total O&M cost until 2025.

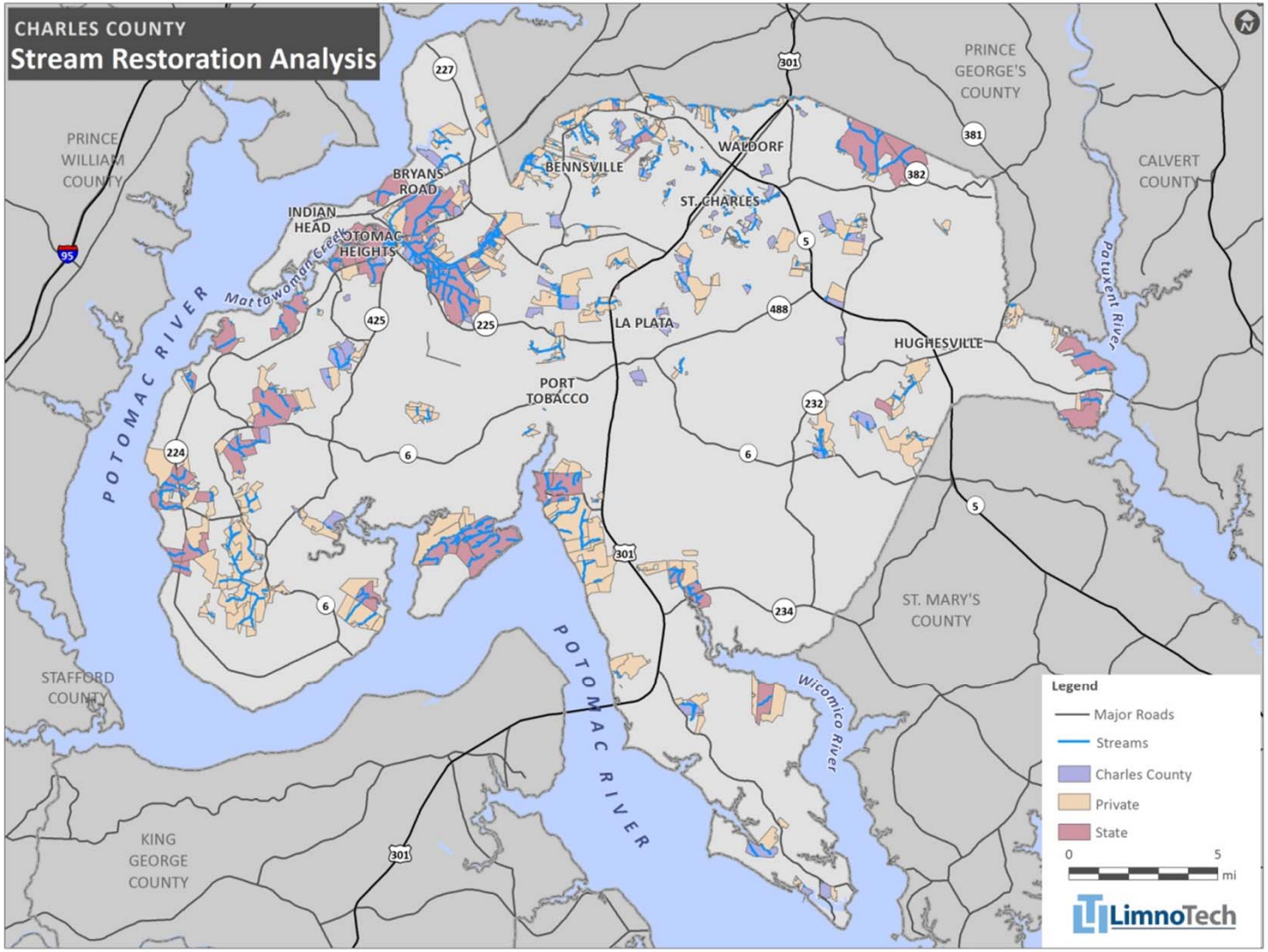
[3]Unit costs from Maryland Phase II WIP.

[4]Unit cost for O&M from King and Hagan. Assuming a conversion of 100 feet = 1 acre.

[5]Estimated based on average costs of ESD installations from literature review.

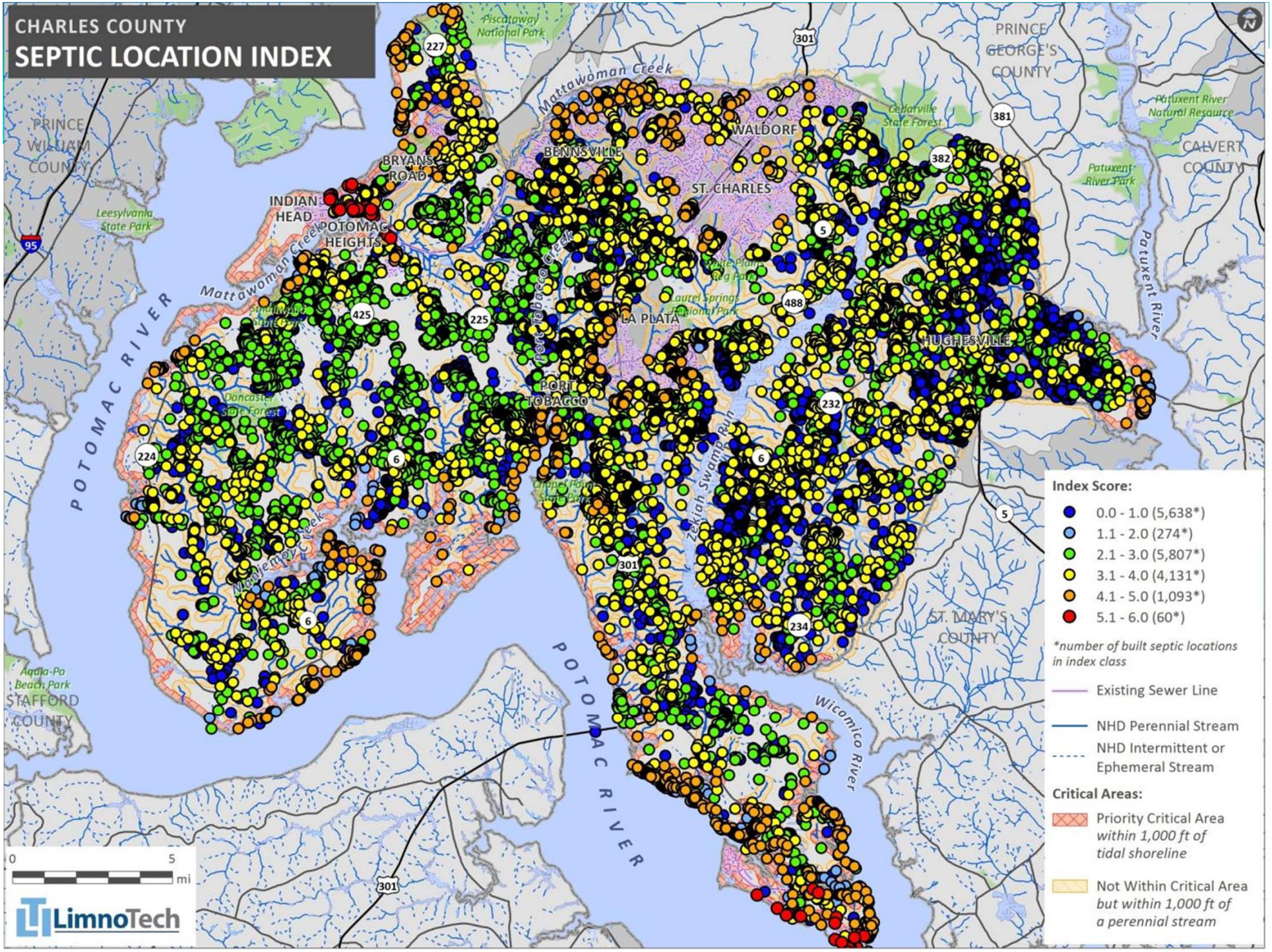
[6]It is estimated that the County would pay half of the total cost of this BMP, because it is unlikely that 100 percent of this BMP would be funded by private landowners.

[7]Thiswork is done by private landowners, so there is no cost to the County for this BMP.


CHARLES COUNTY
Stream Restoration Analysis
PRINCE WILLIAM COUNTY
PRINCE GEORGE'S COUNTY
CALVERT COUNTY
ST. MARY'S COUNTY
STAFFORD COUNTY
KING GEORGE COUNTY
POTOMAC RIVER
Mattawoman Creek
Patuxent River
Wicomico River
BRYANS ROAD
INDIAN HEAD
POTOMAC HEIGHTS
BENNSVILLE
WALDORF
ST. CHARLES
LA PLATA
HUGHESVILLE
PORT TOBACCO
95
227
301
381
382
5
488
425
225
232
6
224
234
Legend
Major Roads
Streams
Charles County
Private
State
0
5
mi
LimnoTech

Septic System Sector

- Developed "prioritization index" to assist with identifying BMPs
  - Location relative to critical area
  - Septics built before 1990
  - Location relative to existing sewers
    - Within 500 ft. of existing sewers – connect to sewers
    - Not within 500 ft. of existing sewers – upgrade to Best Available Technology


CHARLES COUNTY
SEPTIC LOCATION INDEX
Index Score:
0.0 - 1.0 (5,638*)
1.1 - 2.0 (274*)
2.1 - 3.0 (5,807*)
3.1 - 4.0 (4,131*)
4.1 - 5.0 (1,093*)
5.1 - 6.0 (60*)
*number of built septic locations in index class
Existing Sewer Line
NHD Perennial Stream
NHD Intermittent or Ephemeral Stream
Critical Areas:
Priority Critical Area within 1,000 ft of tidal shoreline
Not Within Critical Area but within 1,000 ft of a perennial stream
0
5
mi
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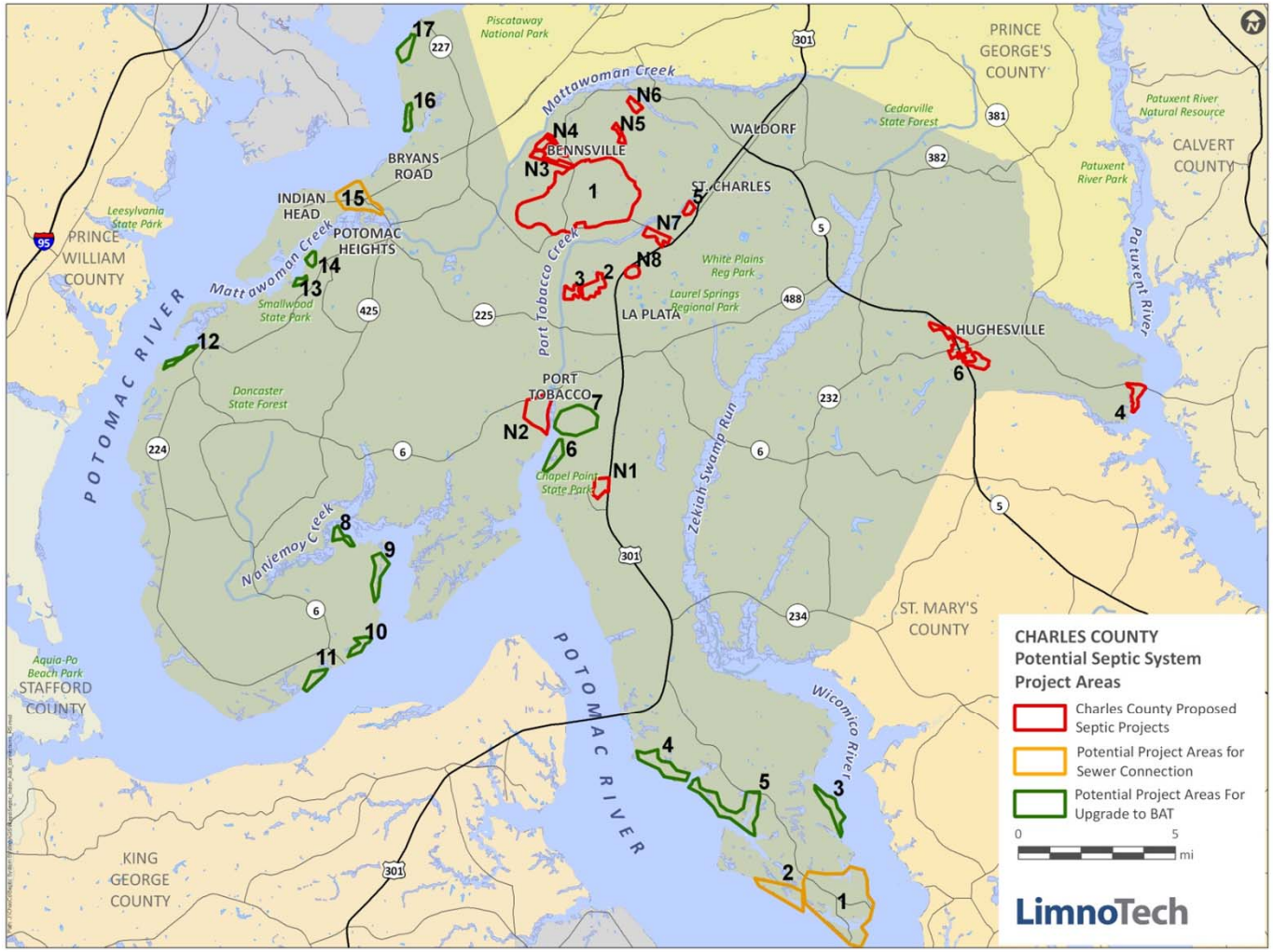
POTOMAC RIVER
Mattawoman Creek
Piscataway National Park
PRINCE GEORGE'S COUNTY
PRINCE WILLIAM COUNTY
CALVERT COUNTY
ST. MARY'S COUNTY
STAFFORD COUNTY
Cedarville State Forest
Patuxent River Natural Resource
Patuxent River Park
Patuxent River
Leesylvania State Park
Aquia-Po Beach Park
Doncaster State Forest
Chapel Point State Park
Laurel Springs Regional Park
White Plains Reg Park
Wicomico River
Zekiah Swamp Run
Port Tobacco Creek
Mattawoman Creek
Nanjemoy Creek
WALDORF
BENNSVILLE
ST. CHARLES
BRYANS ROAD
INDIAN HEAD
POTOMAC HEIGHTS
LA PLATA
HUGHESVILLE
PORT TOBACCO
227
301
381
382
5
488
425
225
232
224
6
234
95

Septic System Scenario

- Includes:
  - Regular pump-outs
  - County-identified projects (e.g., Hughesville, Benedict, Old Woman's Interceptor)
  - Connection and BAT from prioritization analysis
  - Use of TN capacity at Mattawoman WWTP

Table 3-42
Load Reduction Scenario 3

Project Type	Load Reduction Achieved, lbs TN (delivered)/year
Septic Pump-out Program	1,998
Septic Connections for County identified projects	16,785
Septic BMPS from Prioritization Analysis	8,669
WWTP Credit (22% of remaining capacity)	25,107
Totals	**51,759**


CHARLES COUNTY
Potential Septic System
Project Areas
Charles County Proposed Septic Projects
Potential Project Areas for Sewer Connection
Potential Project Areas For Upgrade to BAT
0
5
mi
LimnoTech
PRINCE GEORGE'S COUNTY
CALVERT COUNTY
ST. MARY'S COUNTY
KING GEORGE COUNTY
STAFFORD COUNTY
PRINCE WILLIAM COUNTY
POTOMAC RIVER
Mattawoman Creek
Port Tobacco Creek
Nanjemoy Creek
Zekiah Swamp Run
Wicomico River
Patuxent River
BENNSVILLE
WALDORF
ST. CHARLES
LA PLATA
PORT TOBACCO
HUGHESVILLE
BRYANS ROAD
INDIAN HEAD
POTOMAC HEIGHTS
Piscataway National Park
Cedarville State Forest
Patuxent River Natural Resource
Patuxent River Park
White Plains Reg Park
Laurel Springs Regional Park
Chapel Point State Park
Doncaster State Forest
Smallwood State Park
Leesylvania State Park
Aquia-Po Beach Park
N1
N2
N3
N4
N5
N6
N7
N8

Costs for Septic System Scenario, Focus on Priority Areas

Table 4-18 Total Costs for Septic System Scenario 3	
Project Type	**Total Cost**
Septic Pump-Out Program	$6,892,600
County Staff Costs for Pump-Out Program Administration	$650,000
Septic Connections	$73,992,840
Septic Upgrade to BAT	$7,540,000
Septic BAT O&M	$1,732,250
WWTP Credit (22% of remaining TN capacity)	$0
Totals	**$90,807,690**
County's costs for Scenario 3	**$74,642,840**

Total Costs for Most Cost-Efficient Scenarios

Table ES-1 Total Costs for Load Reduction Strategies, Urban Stormwater Sector Scenario 3 and Septic System Sector Scenario 3		
Scenario Name	**Total Cost**	**Cost to County**
Stormwater Sector Scenario 3 - Focus on Stream Restoration	$125,662,791	$97,817,080
Septic System Sector Scenario 3 – Focus on Priority Project Areas	$90,807,690	$74,642,840
Totals	**$216,470,481**	**$174,459,920**

Two Year Milestones (July 2013 – June 2015)

Milestone	Assignment
Wastewater	
• Coordinate capacity crediting	Staff
• Sewer capacity analysis	Staff
• Explore water re-use and conservation	Staff or Consultant
Urban Stormwater	
• Complete GIS data updates	Underway under MS4 program
• Conduct pilot/demonstration projects	MS4 program
• Begin project implementation	Underway under MS4 program
• Integrate with MS4 requirements	Underway under MS4 program
• Stormwater utility	Staff
Septic Systems	
• Explore pump-out ordinance	Staff
• Take next steps with County-identified sewer connection projects	CIP
• Enhanced outreach for septic upgrades to BAT targeting critical/priority areas	Consultant for program
General	
• Resolve data discrepancies with MDE	Staff

Consequences

- TMDL and load targets not directly enforceable
  - Only NPDES permits are enforceable
  - Continue to comply with permit requirements
- Potential consequences of non-compliance
  - Fines
  - Re-issuance of the permit with more stringent permit requirements
  - Rejection of requests for increased loads or permits for new source loads