

Sharing Experience with Young Civil Engineers and a Review of MDE Guidelines for Use of Class IV Reclaimed Water

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Outline

1. MDE Introduction
2. Social Responsibility of a Civil Engineer (CE)
3. Special Advice for Young Professionals (YPs)
in Civil Engineering
4. Career Choice and Development
5. Review of MDE Guidelines for Use of Class IV
Reclaimed Water – A recent office project of
the presenter

MDE Overview

- Established in 1987, former agency- Environmental Program within DHMH.
- In FY 2015, there are a total of 964 MDE employees with an allocated total fund of \$238,766,072*.
- MDE Mission: To protect and restore the environment for the health and well-being of all Marylanders. **
- MDE Vision: Healthy, vibrant and sustainable communities and ecosystems in Maryland.**

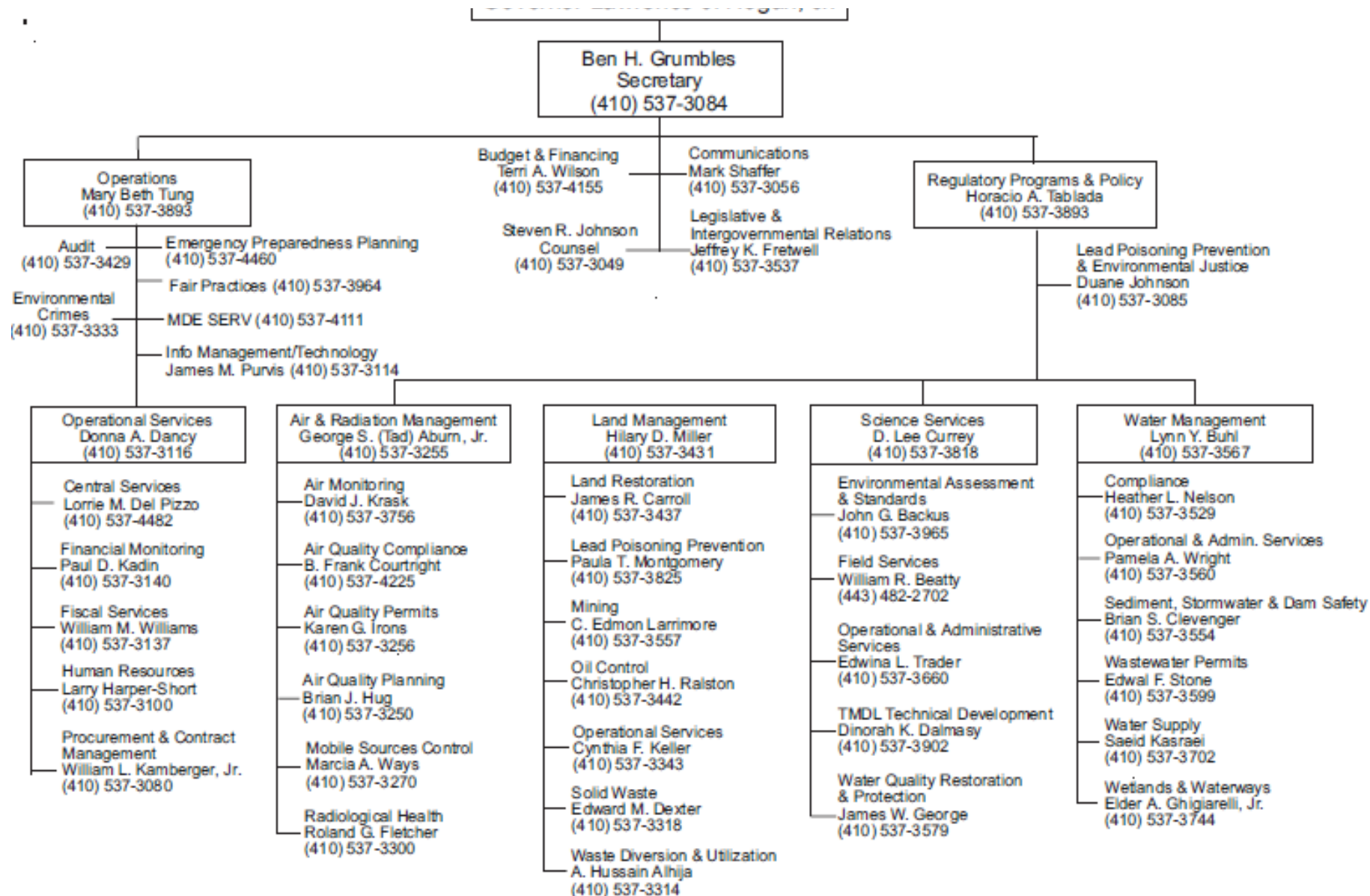
*Source: Maryland Manual On-Line at <http://msa.maryland.gov/msa/mdmanual/14doe/html/doeb.html>

** Source MDE web site at : <http://www.mde.state.md.us/aboutmde/Pages/aboutmde/home/index.aspx>.

MDE Values

1. Service. Providing value to citizens, customers, colleagues, and communities by being responsive, inclusive respectful, and resourceful and transparent in how we operate programs and invest the public's money.
2. Science and Technology. Using science-driven regulation and policy to protect the environment more effectively and information technology to serve customers more efficiently.
3. Innovation. Embracing creativity to achieve better results, while encouraging the use of market-based and partnership-driven tools and strategies for improvements in environmental technologies, regulation, and finance.
4. Integration. Integration of air, water, land, and science programs for more effective and efficient results, and better use of ecosystem-based permitting to increase efficiency, offer better consistency and improve environmental protection.
5. Partnership. Increasing outreach and openness to broaden the range of public and private sector participants and strategies that foster better solutions through broader stakeholder involvement in environmental challenges.
6. Performance. Focusing on results and tracking outcomes to accelerate progress in how to manage for cleaner air, water, and land and to reduce risks from pollution, climate change, environmental emergencies, and other threats.
7. Employees. Cultivating and fostering a talented and diverse workforce and providing opportunities for development of professionalism, innovation, productivity, teamwork and leadership.

Source: MDE web site at <http://www.mde.state.md.us/aboutmde/Pages/aboutmde/home/index.aspx>



Social Responsibilities of a Civil Engineer (CE)

1. A Civil Engineering project should consider the health, safety and welfare aspects of the community and surrounding environment and comply with applicable laws and regulations.
2. A CE shall abide with a strict code of ethics to avoid conflict of interest (COI) and has the courage to disclose the COI, if encountered.
3. A CE shall be honest and realistic in their engineering design, construction and cost estimate. A CE shall not compromise public health, safety and welfare for a low cost civil engineering project.
4. A CE shall continue to maintain and improve his/her technical competence and give the best possible effort.
5. A CE shall have the capacity to accept constructive criticism of your engineering work and willingness to improve technical quality. Don't be afraid of “losing face (丢面子)”
6. A CE shall assist and work well with co-workers. Be humble.

Special Advice for Young Professionals (YPs) in Civil Engineering

1. Not to commit to a specific discipline too early in your career.
2. Never jump fully into something without evaluating all of the other options.
3. Obtain the Professional Engineer Certification as soon as possible.
4. To gain respect from your supervisor or coworkers, demonstrate your exceptional civil engineering knowledge in your projects, if possible. Go beyond what is expected.
5. Try to improve yourself by continued education to gain modern and advanced civil engineering technology/knowledge.

Career Choice and Development

1. Private vs Public Service
2. Salary and responsibility
3. Technical staff vs Management staff
4. Continued Education
5. Read technical journals to enrich yourself
6. Professional connections thru Technical Societies –
ASCE ? WEF ? CWEA locally??

Review of MDE Guidelines for Use of Class IV
Reclaimed Water – A recent office project of the
presenter

Another set of Power Point Slides will be
presented

Thanks and Questions



Department of the Environment

Water Reuse in Maryland and MDE Guidelines for Use of Class IV Reclaimed Water

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Outline

- **Water Reuse in Maryland**
- **MDE Guidelines for Use of Class IV Reclaimed Water**
- **Update of Use of Class IV Reclaimed Water in Maryland**



"**Reclaimed water**^{*}" means domestic, municipal or industrial wastewater that is treated to remove impurity and is suitable for beneficial reuse.

"**Reuse**" or "**Water reuse**^{*}" means the use of reclaimed water for a direct beneficial use, an indirect potable reuse^{**}, or a controlled use in accordance with these Guidelines.

* Excerpted from "MDE Guidelines for Use of Reclaimed Water

** **Example:** Groundwater recharging

Use of Reclaimed Water in Maryland (1)

Land treatment systems regulated by MDE **groundwater discharge permits**:

- 35 spray irrigation systems including 9 golf courses. Total design flow (Q) : 5.4 mgd
- 4 rapid infiltration (RI) systems, Q= 1 mgd
- 3 drip irrigation systems, Q=0.11mgd



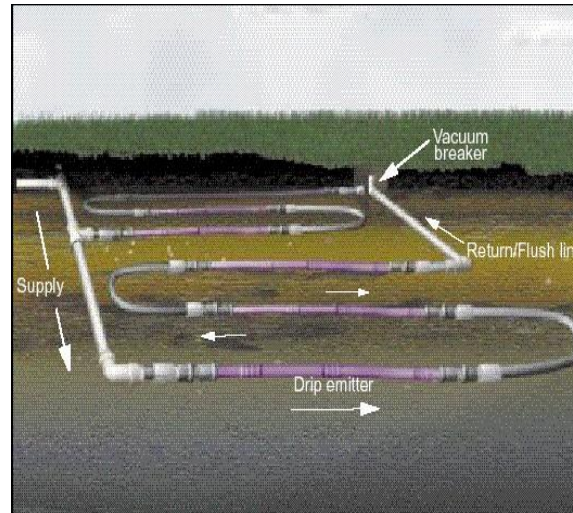
Ridgely spray field



Golf Course irrigation



Solomons Island RI Basins



Schematic of Drip irrigation



Use of Reclaimed Water in Maryland (2)

Surface discharge facilities regulated by MDE NPDES permits:

1. **Back River WWTP- RG Steel LLC(formerly Severstal Steel LLC)**

2011 average water reuse rate:38.4 mgd* (plant shut down 12/2011)

2. **Cox Creek WWTP- Constellation Brandon Power Plant**

2011 average water reuse rate:1.87 mgd*

3. **Mattawoman WWTP- Panda Brandywine, LP Power Plant**

2011 average water reuse rate:0.45 mgd**

* From 2011 Discharge Monitoring Report (DMR)

** From Panda Brandywine, LP Plant Engineer



Water Reuse in Maryland (2A)

- Back River WWTP Effluent to Sparrows Point Steel Plant (Severstal) reused for Processing water – 38.4 mgd (**plant shut down 12/2011**)



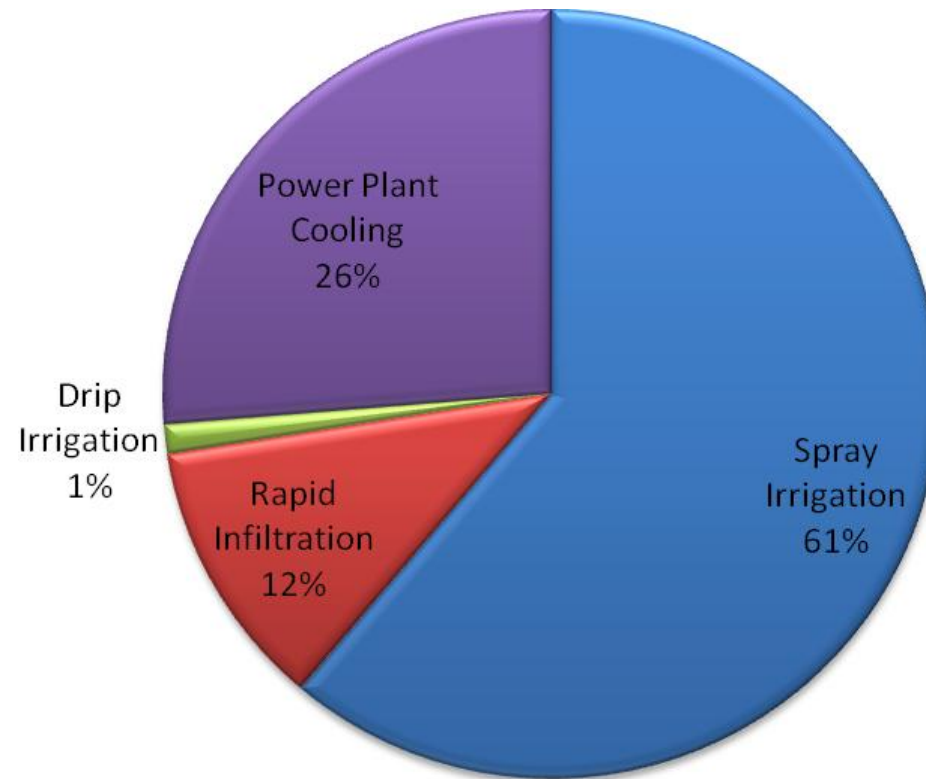
- Mattawoman WWTP Effluent to Panda-Brandywine, L.P. reused for power plant cooling – 0.45 mgd



Mattawoman WWTP

Panda-Brandywine Power Plant

Types of Water Reuse in Maryland



Source : Maryland Department of Environment (MDE) - Zero Waste Plan (Draft, 2014)



Maryland's Zero Waste Goals

	2015	2020	2025	2030	2040
Overall Waste Diversion Goal	54%	65%	70%	75%	85%
Overall Recycling Goal	50%	60%	65%	70%	80%
Recycling Goal, Food Scraps	15%	35%	60%	70%	90%
Recycling Goal, Yard Trimmings	73%	76%	80%	83%	90%
Water Reuse	2% *	3%	5%	7%	10%

* A round-it-up number based on 8.8 million gallons per day (mgd) reuse water and 578 mgd treated wastewater in Maryland. In comparison, Florida, the leading state for water reuse, used 725 mgd of reclaimed water in 2012. The total WWTP flow for that year was 1,599 mgd, making Florida's reuse rate 45%.





Current Use of Reclaimed Water in Maryland

	Water Reuse Facility in Maryland	Water Reuse Rate (mgd)
1	Land Treatment Systems	6.5
2	Cox Creek-Constellation	1.87
3	Mattawoman- Panda Brandywine	0.45
Total		8.82*

*Excluding the 5 mgd effluent reuse proposal from Little Patuxent WWTP to NSA buildings in Fort Meade.





Water Reuse Rate in Top Four States of USA

State	Water Reuse Rate* (Million gallons per day, mgd)
Florida	584
California	525
Texas	230
Arizona	220

*Water reuse rate in 2002

Source: 2004 US EPA Guidelines for Water Reuse





MDE Guidelines for Use of Class IV Reclaimed Water



MARYLAND DEPARTMENT OF THE ENVIRONMENT

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MARYLAND DEPARTMENT OF THE ENVIRONMENT

GUIDELINES FOR USE OF CLASS IV RECLAIMED WATER:

High Potential for Human Contact

MDE-WMA-002-07/15



Purpose and Scope of the Guidelines

- To provide additional approved uses for reclaimed water to promote water reuse.
- To apply only to use of Class IV reclaimed water generated from a centralized wastewater treatment plant.
- Not intended to address other non-potable water reuses such as graywater and rainwater which are addressed under applicable local plumbing codes.
- To guide the facility owner or operator of a water reclamation facility to produce or distribute Class IV reclaimed water for proper use without compromising public health and environmental quality protections.

Classes of Reclaimed Water In Maryland

- Categorized into four water quality Classes (I-IV).
- Use of each class is based on the level of treatment (or quality) attained.



Reclaimed Water Quality Standards

<u>Parameter</u>	Slow Rate Irrigation For Restricted Public Access		Slow Rate Irrigation for Urban Reuse- Unrestricted Public Access	Unrestricted Water Reuse (High Potential for Human Contact)
	Class I	Class II	Class III	Class IV
Biochemical Oxygen Demand (5 day) (monthly average)	70 mg/l	10 mg/l	10 mg/l	10 mg/l
Suspended Solids (monthly average for Classes I & II) or Turbidity (NTU)	90 mg/l	10 mg/l	2 NTU (daily average) Not to exceed 5 NTU at any time	2 NTU (daily average) Not to exceed 5 NTU at any time
E. coli (MPN per 100 mL) (monthly median) Or meet the Fecal Coliform limit below	N/A	N/A	N/A	1 Monthly max not to exceed 23 MPN/100ml
Fecal Coliform (MPN per 100 mL) (monthly geometric mean)	200 3 (golf course)	3	2.2	2.2 (monthly median) Monthly max not to exceed 23 MPN/100ml
pH	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Total Nitrogen (monthly average)	Case by case	Case by case	Case by case	10 mg/l
Total residual chlorine at outlet of the wastewater treatment plant, wwtp)	Case by case	Case by case	Case by case	1.5-4 mg/l at outlet of WWTP 0.5-4.0 mg/l at monitoring locations in the distribution system nearby point of use



Class IV Reclaimed Water Acceptable Types of Reuse

Reuse Category	Type of Reuse	Related Classes
Commercial, Industrial, and Government owned Facilities	Aesthetic Fountains, Ponds and Lagoons; Car Washing; Closed Loop Cooling; Equipment Operation; Fire Protection; Laundering; Parts Cleaning; Pressure Cleaning; Snow Making; Toilet and Urinal Flushing; and Window Washing.	None
Other Industrial	Aggregate Washing; Concrete Mixing; Cooling Water Systems; Dust Control and Soil Compaction; and Manufacturing Processes.	None
Residential Outdoor Irrigation	Lawns and Non-edible vegetation.	None
Non-residential Irrigation	Cemeteries; Golf Courses; Highway Landscaping; Lawns; Parks; Play Grounds; School Yards; and other Green Open Spaces.	Class III
Irrigation with Restricted Access and Applicable Buffer Zone	Fiber and Seed Crops; Food Crops Commercially Processed ; Forested Land; Golf Courses; Non-Food Crops; Pasture For Foraging Livestock; Silviculture; Sod Farms, Ornamental Nurseries, and Turf (including Fodder);	Classes I, II, and III



MDE Guidelines for Use of Class IV Reclaimed Water

The guidelines include 14 chapters:

- (1) Purpose and Scope;
- (2) General Conditions;
- (3) Types of Reuse vs Classes of Reclaimed Water;
- (4) Water Quality Treatment Standards;
- (5) Monitoring Requirements for Reuse of Class IV Reclaimed Water;
- (6) Applying for a Permit;
- (7) Design Criteria;
- (8) Construction Requirements;
- (9) Operations and Maintenance;
- (10) Requirements for the End-Use Location;
- (11) Access Control and Advisory Signs;
- (12) Recordkeeping;
- (13) Reporting; and
- (14) Definitions





Some Highlights of MDE Guidelines for Use of Class IV Reclaimed Water

1. **A new discharge permit (or a modified NPDES permit for adding a reclaimed water outfall) and reclaimed system construction permit must be obtained from MDE. (Chapters 2&6)**
2. **Use of Class IV reclaimed water must comply with the applicable County Water and Sewerage Plan. (Chapter 2)**
3. **Use of Class IV effluent for fire protection (including sprinkler system), toilet and urinal flushing are permitted only for commercial buildings and condominiums managed by a property management company or other similar corporate entity acceptable to MDE.(Chapter 3)**
4. **Class IV applicable to commercial and industrial uses of reclaimed water involving high potential for human contact or other public health risks. The Department may allow lower quality water to be used on a case by case basis. (Chapter 3)**
5. **Monitoring the reclaimed water quality including parameters shown in the Class IV water quality standard table. On-line turbidity monitoring must be performed between filtration and disinfection process. Total residual chlorine must be monitored at treatment works and distribution system. (Chapter 5)**



Some Highlights of MDE Guidelines for Use of Reclaimed Water (2)

6. A Reclaimed Water Management Plan (RWMP) must be submitted to MDE with the permit application. The RWMP must include service area map, cross-connection control, monitoring plan, service agreement with end users, etc. (Chapter 6)
7. All force mains for transmitting Class IV effluent must be purple color (or affixing purple adhesive tape) and provide adequate separation from water mains. (Chapter 7)
8. A “Reclaimed Water, Do Not Drink” sign shall be posted in the impoundment and irrigation area to inform the public about use of reclaimed water. (Chapter 10 & 11)



Courtesy of US EPA 2012 Guidelines for Water Reuse,

Examples of Class IV Projects in Maryland

- 1. Little Patuxent Water Reclamation Plant – Fort Meade Federal System Reclaimed Water Project.**
- 2. Assateague Island National Seashore WWTP effluent reuse for toilet flushing.**

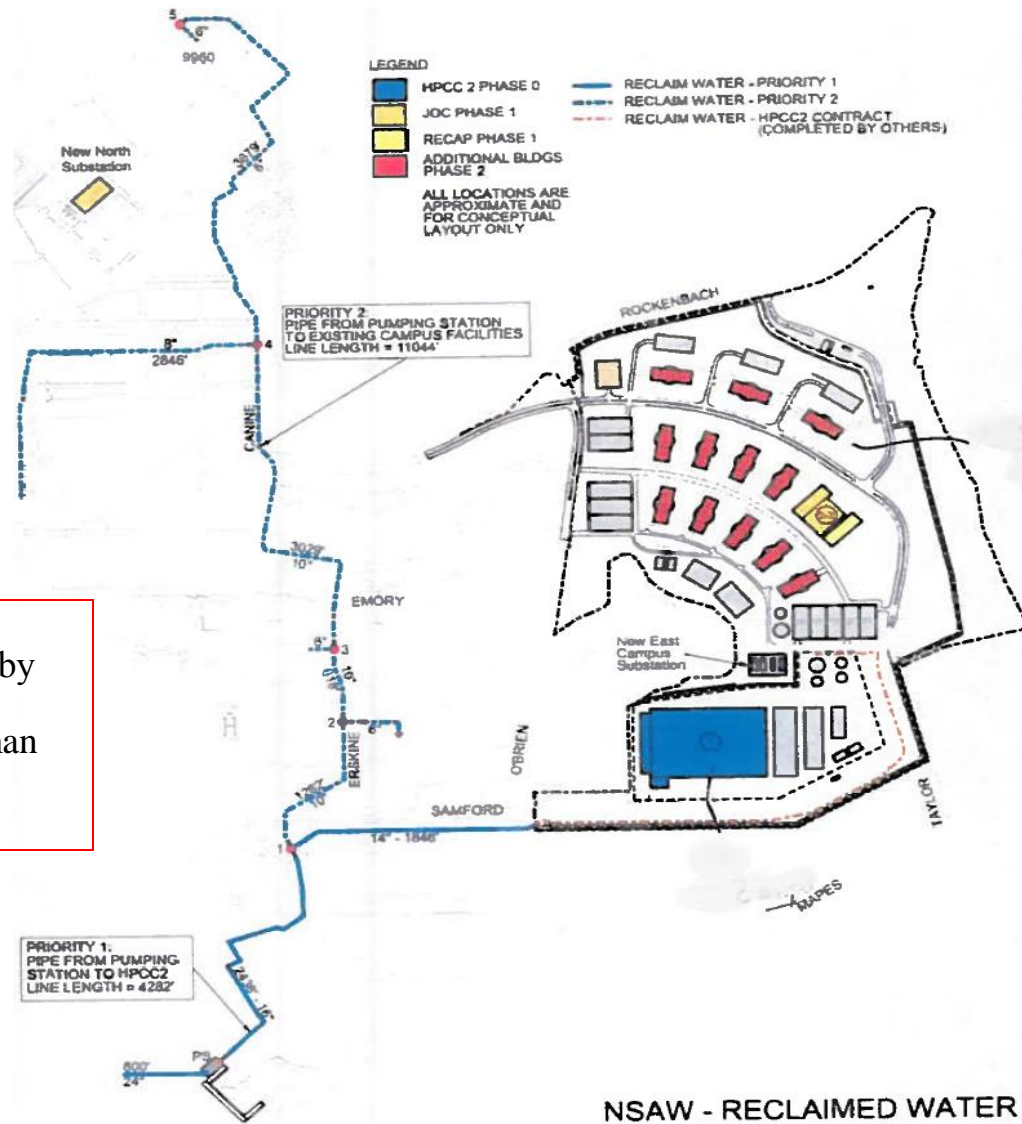


Little Patuxent – Fort Meade Reclaimed Water Project.

1. Use a total of 5 mgd reclaimed water from Little Patuxent WWTP for building and equipment cooling at the Fort Meade Federal Facility.
2. The NPDES permit (13-DP-1421, effective 10/1/2014) of Little Patuxent WWTP was modified to include Outfall 102 (Reclaimed Water Pumping Station) for delivery of reclaimed water.
3. The permit requires: (1) effluent must be chlorinated and maintain adequate level of free chlorine residual. Re-chlorination must be provided at reclaimed water tank of Federal facility; (2) use an alternate water source if the turbidity of the reclaimed water is greater than 5 NTU.



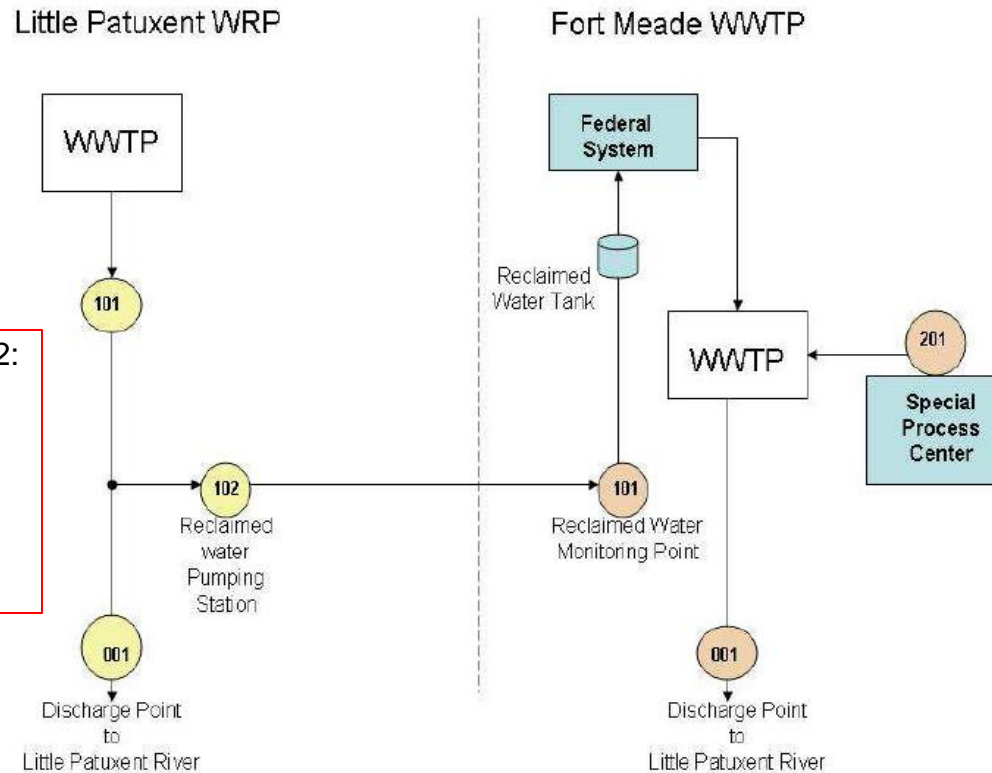
Conceptual Layout – NSA Reclaimed Water Distribution



Source: “Fort Meade Reclaimed Water Project” by Whitman Requardt & Associates, LLP and Ulliman Schutte Construction (11/28/2012)

Effluent Monitoring Diagram

FLOW DIAGRAM



Parameters Monitored at 102:

- (1) Total Residual Chlorine
- (2) Turbidity
- (3) Flow
- (4) Total Suspended Solids
- (5) Total Nitrogen
- (6) Total Phosphorus

Source: NPDES permit MD 0055174



Assateague Island National Seashore WWTP

Use of Reclaimed Water.

1. Use reclaimed water from Assateague Island National Seashore WWTP for toilet flushing in the visitor center.
2. The NPDES permit (MD0021091, effective 10/1/2011) of Assateague Island National Seashore WWTP was modified to include Outfall 002 for effluent reuse.
3. The permit requires: (1) effluent must meet Class IV reclaimed water quality standards; (2) permittee is obligated to meet local applicable plumbing code for indoor plumbing installation; and (3) use of reclaimed water for toilet flushing shall be terminated if the water quality limitation is violated. Use of reclaimed water can be resumed once the water quality limitation can be steady met.





Water Quality Limitations for Effluent Reuse at Assateague Island National Seashore WWTP

Parameters	Class IV Water Quality Limitation	Sampling Frequency	Sample Type
Biochemical Oxygen Demand (5 day) (monthly average)	10 mg/l	Weekly	8hr Composite
Turbidity (NTU)	2 NTU (daily average) Not to exceed 5 NTU at any time	Continuous	Recorded
E. Coli (MPN per ml, Monthly Geometric Mean) or meet the Fecal Coliform limit below	1.0	Weekly	Grab
Fecal Coliform (all samples) (MPN per 100 ml)	2.2	Weekly	Grab
pH	6.5-8.5	Daily	Grab
Total residual chlorine (all samples)	0.5-4.0 mg/l	Daily	Grab



1. Mattawoman WWTP - Panda- Brandywine L.P. and CPV Maryland, LLC Power Plant (reclaimed water used for cooling system). Proposed reclaimed water flow about 2 mgd.
2. Piscataway WWTP – Mattawoman Power Plant (reclaimed water used for cooling system) Proposed reclaimed water flow about 5 mgd.
3. Smithsonian Environmental Research Center (13-DP-3562) project - use of reclaimed water for toilet flushing (100-200 gpd), lawn irrigation (15,000 gal/mo for 6 months) and fire protection (20,000 gpd storage volume).

Thank You!

&

Questions (?)

