Bureau of Water and Wastewater

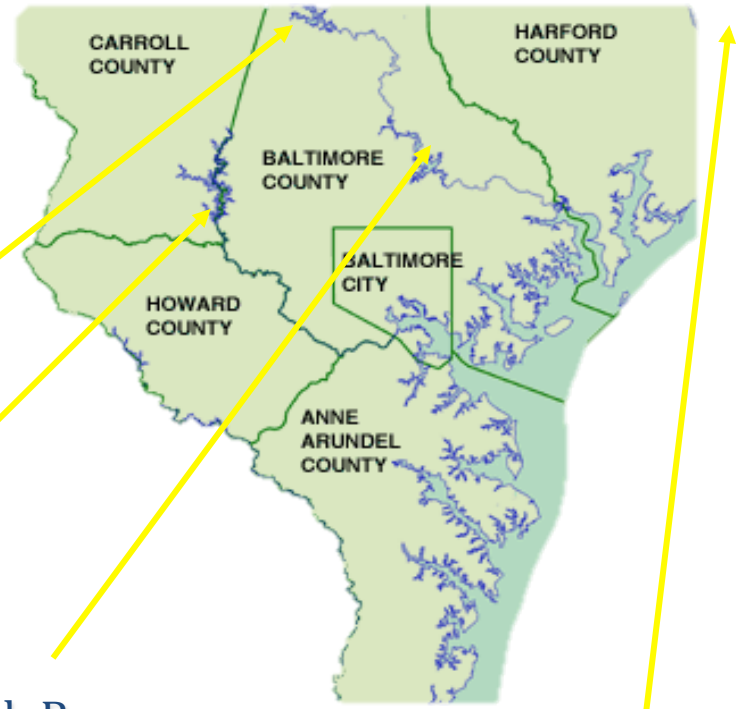
Rudolph S. Chow, P.E.
BUREAU HEAD

Bureau Overview: Water

Water service:

1.8 million people in Baltimore City and 5 counties.

4,000 miles of mains



Prettyboy Reservoir

Liberty Reservoir

Loch Raven Reservoir

Susquehanna River

Bureau Overview: Surface Water

Baltimore City maintains a separate storm drain system:

- **1,146 miles of storm drain pipes**
- **27,561 storm drain manholes**
- **52,438 storm drain inlets**
- **1,709 outfalls**

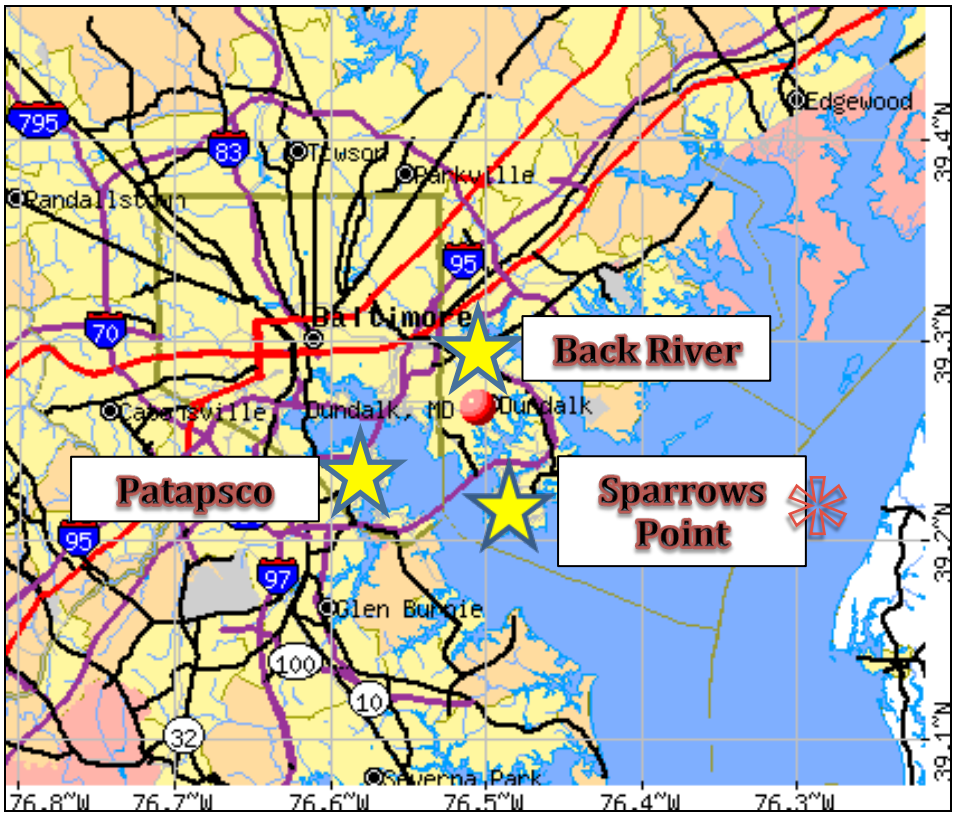
Bureau Overview: Wastewater

- **Two Wastewater Treatment Plants: Back River and Patapsco**
- **Collects and treats up to 250 million gallons wastewater daily (Back River: 180 MGD/Patapsco: 63 MGD)**
- **3,100 miles of sanitary mains; 1,400 miles in Baltimore City.**
- **Operates 8 major pumping stations and 10 minor installations…**

…and 39,000 manholes.

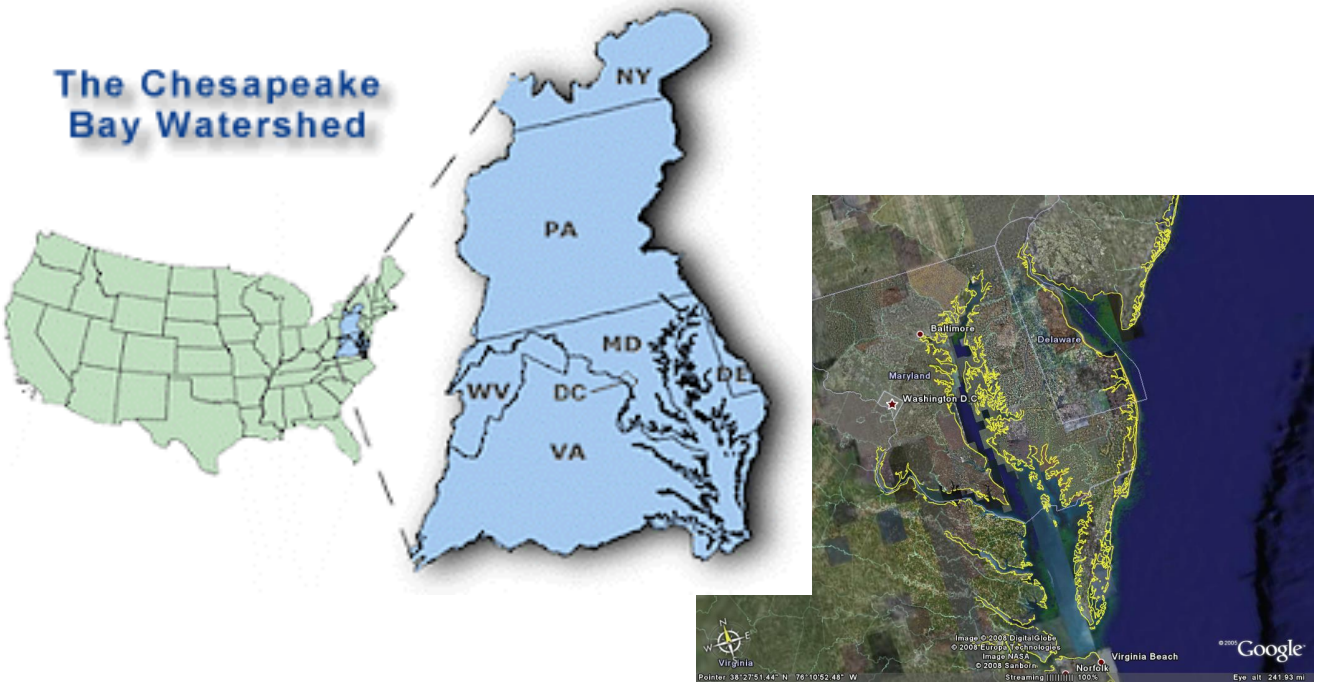
Bureau Overview: Wastewater

Treatment and release



Wastewater Treatment

Chesapeake Bay Protection



- **Chesapeake Bay: largest of 130 estuaries in the US**
- **64,000 square miles watershed; over 15 million people**

Wastewater Treatment

Chesapeake Bay Restoration

- **Water Quality**
  - Improve dissolved oxygen (DO) levels
  - Reduce dead zones
  - Increase submerged aquatic vegetation (SAV)
  - Improve marine habitat
- **Factors affecting Chesapeake Bay Water Quality**
  - Sediment loading
  - Nutrients → Nitrogen and Phosphorus (N and P) loading
- **Wastewater Treatment Plants (point-sources)**
  - Reduce levels of N and P through best available technology

Back River Wastewater Treatment Facility

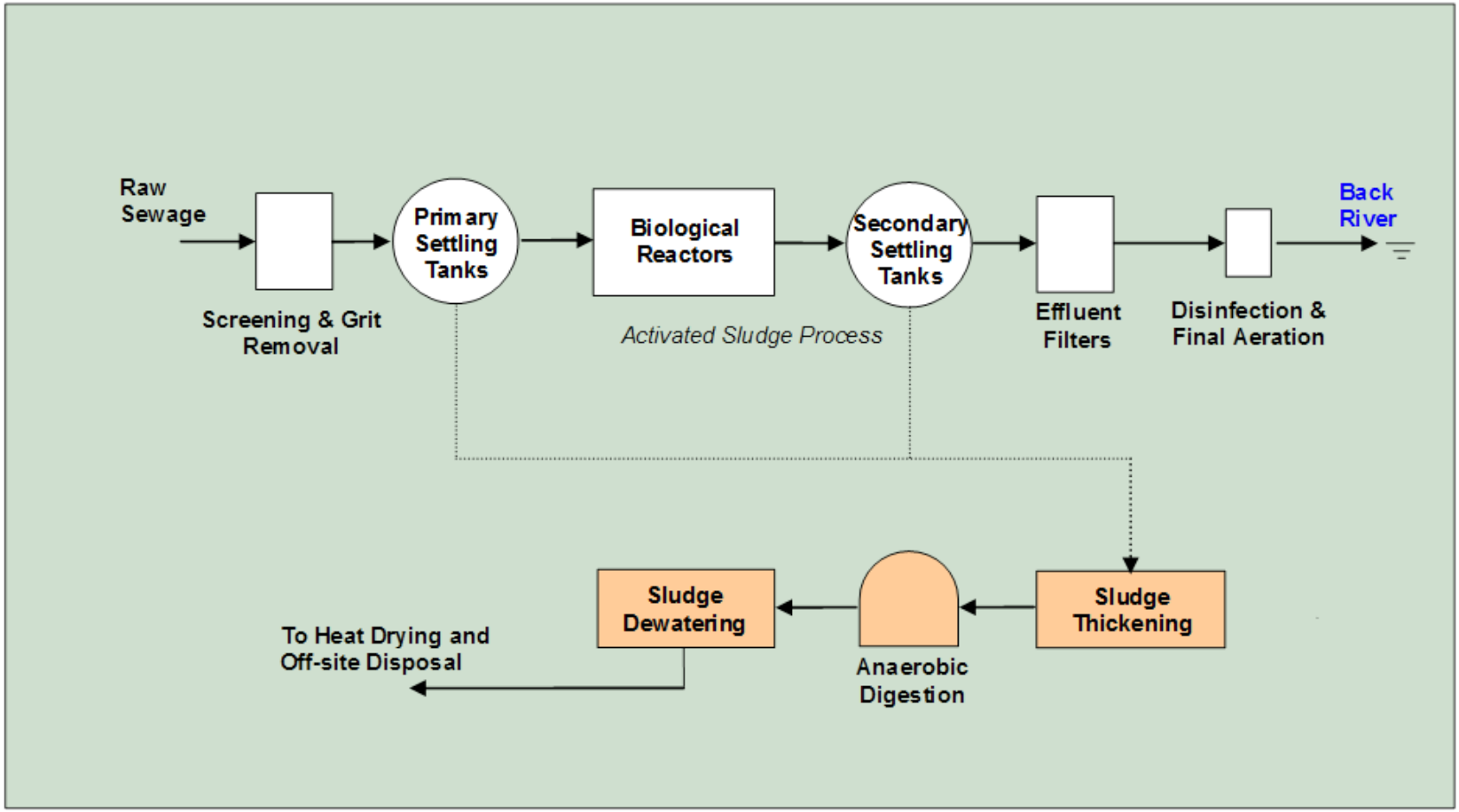
Back River Wastewater Treatment Facility

- Original facilities constructed in 1907; operational 1912
- Today the plant occupies 466-acres and serves 1.3 million people.
- Among the largest wastewater treatment plants in the mid-Atlantic region.
- Physical, chemical and biological treatment processes – 24-hour operation.
- Can process flows over 400 million gallons per day and handle peak flows up to 600 MGD w/flow equalization after head works upgrade.

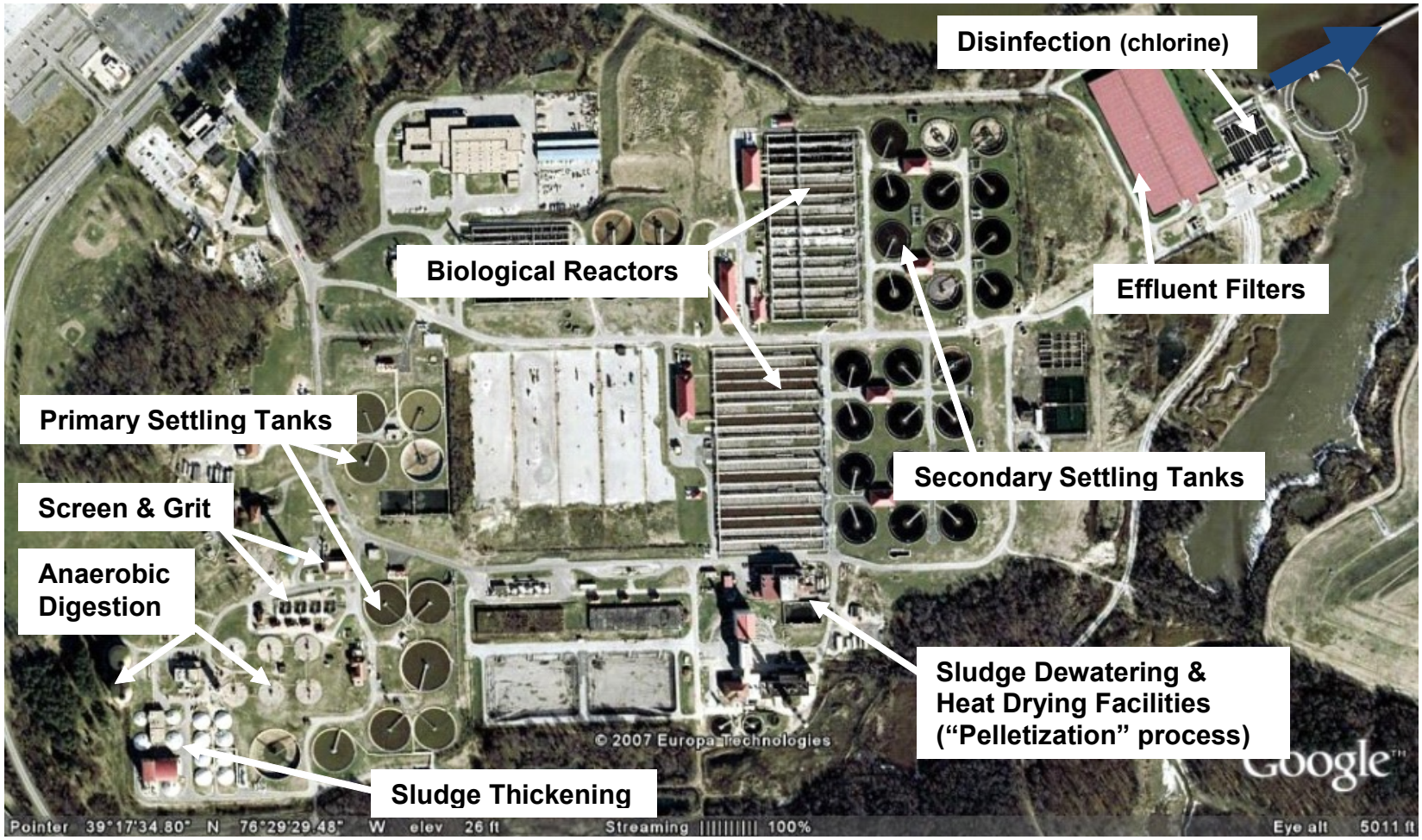
Back River Wastewater Treatment Facility

- **Current permit through the Maryland Department of the Environment (MDE) under the National Pollutant Discharge Elimination System (NPDES) to meet stringent effluent limits (monthly averages):**
- **BOD5 10 mg/l**
- **Total Suspended Solids 10 mg/l**
- **Seasonal ammonia-N 2.0 / 5.7 mg/l (summer/winter)**
- **Total nitrogen ("BNR") 8 mg/l (annual average)**
- **Total Phosphorus 0.2 mg/l**
- **E.coli (disinfection) 126 MPN/ 100 ml**

Back River Wastewater Treatment Facility



Back River Wastewater Treatment Facility



Back River Wastewater Treatment Facility

Chesapeake Bay Restoration

Biological Nutrient Removal (BNR) (in late 1980's):

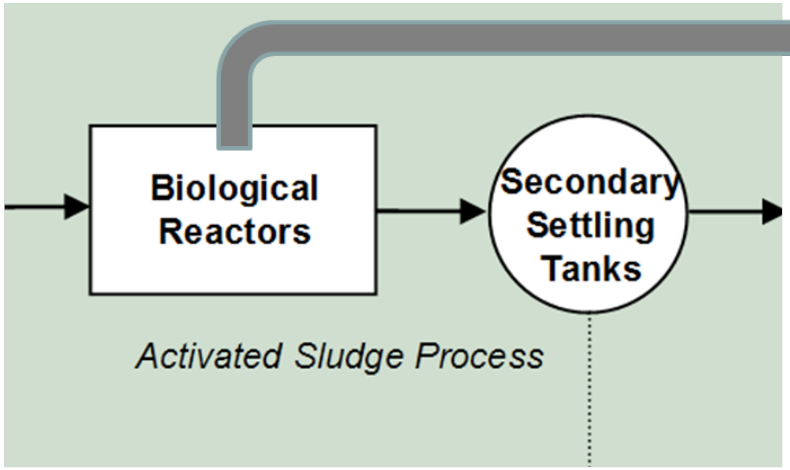
- Reduce total nitrogen (TN) 30 – 40 mg/l → 8 – 10 mg/l
- Reduce total phosphorus (TP) 4 – 6 mg/l → 0.2 mg/l

Enhanced Nutrient Removal (ENR) (in early 2000):

- Reduce total nitrogen (TN) 8 – 10 mg/l → 3 mg/l
- Reduce total phosphorus (TP) 0.2 mg/l → 0.3 mg/l

Back River Wastewater Treatment Facility

ENR Improvements

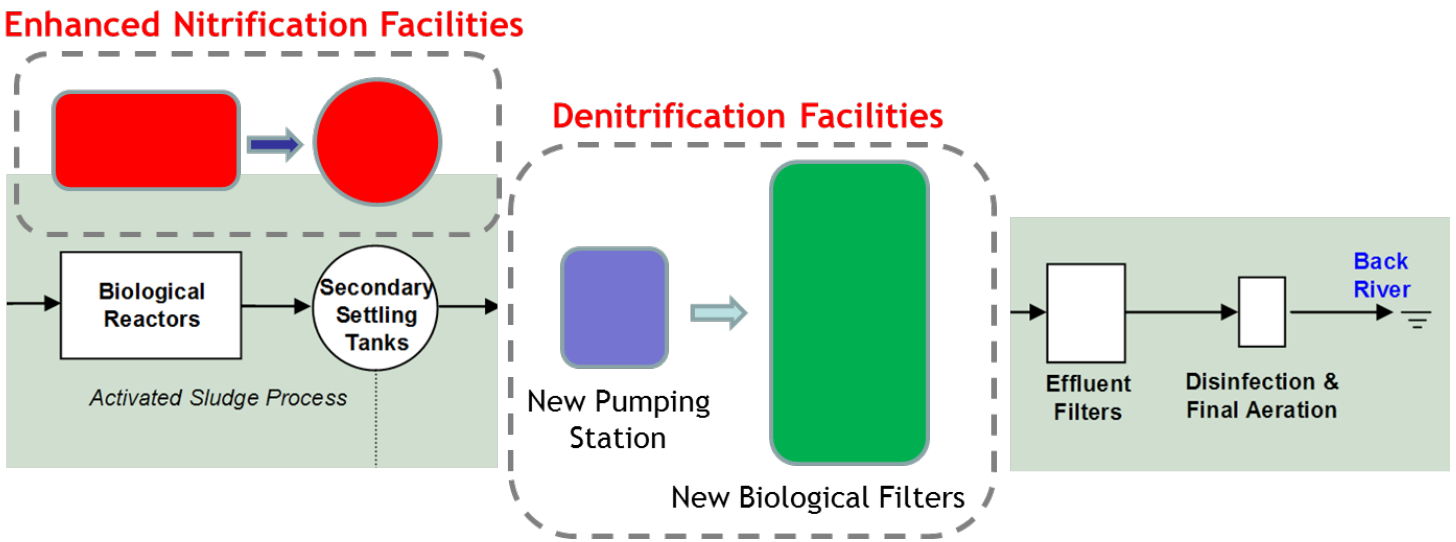


- **Multi-stage biological process for nitrogen removal:**
  - **Step 1**: "***nitrification***" - conversion of *ammonia* to *nitrate* in aerated reactor basins
  - **Step 2**: "***de-nitrification***" – conversion of *nitrate* to *nitrogen* gas in non-aerated basins

Back River Wastewater Treatment Facility

ENR Improvements

- **Treatment Requirements:** To achieve more than 90% reduction of incoming Nitrogen ("ENR")
- **How:** By enhancing both "Step 1" and "Step 2" – through addition of new facilities:



Back River Wastewater Treatment Facility

ENR Improvements

- 40 MG biological ("nitrification") reactor tankage **(Step 1)**
- Twelve 160-foot diameter clarifier/ settling tanks (2 MG each)
- Pumping Station (300 million gallon/day pumping capacity)
- 52 biological ("de-nitrification") filters (each 100' Lx12' W) **(Step 2)**
- Chemical Facilities
- Supporting Plant Infrastructure:
- Underground utilities (piping, electrical, gas, communications)
- Roadways
- Communications and plant process control systems
- Total ENR upgrade costs approximately $600,000,000

Back River Wastewater Treatment Facility

Energy Improvements

- **2008 cogeneration facility to reduce the purchase of electrical power by $1.4 million annually by using the methane gas produced at Back River to generate electricity.**
- **2012 solar array: 4,200 American-made panels, installed at a cost of about $4 million, supply about 5 percent of the energy — up to 1,000 kilowatts per hour — needed to run the plant.**

Back River Wastewater Treatment Facility

Additional Improvements

- **Screen and Grit Facility improvements**
- **New influent wet weather pumping station**
- **Peak flow equalization (36 MG storage) to protect downstream treatment processes**

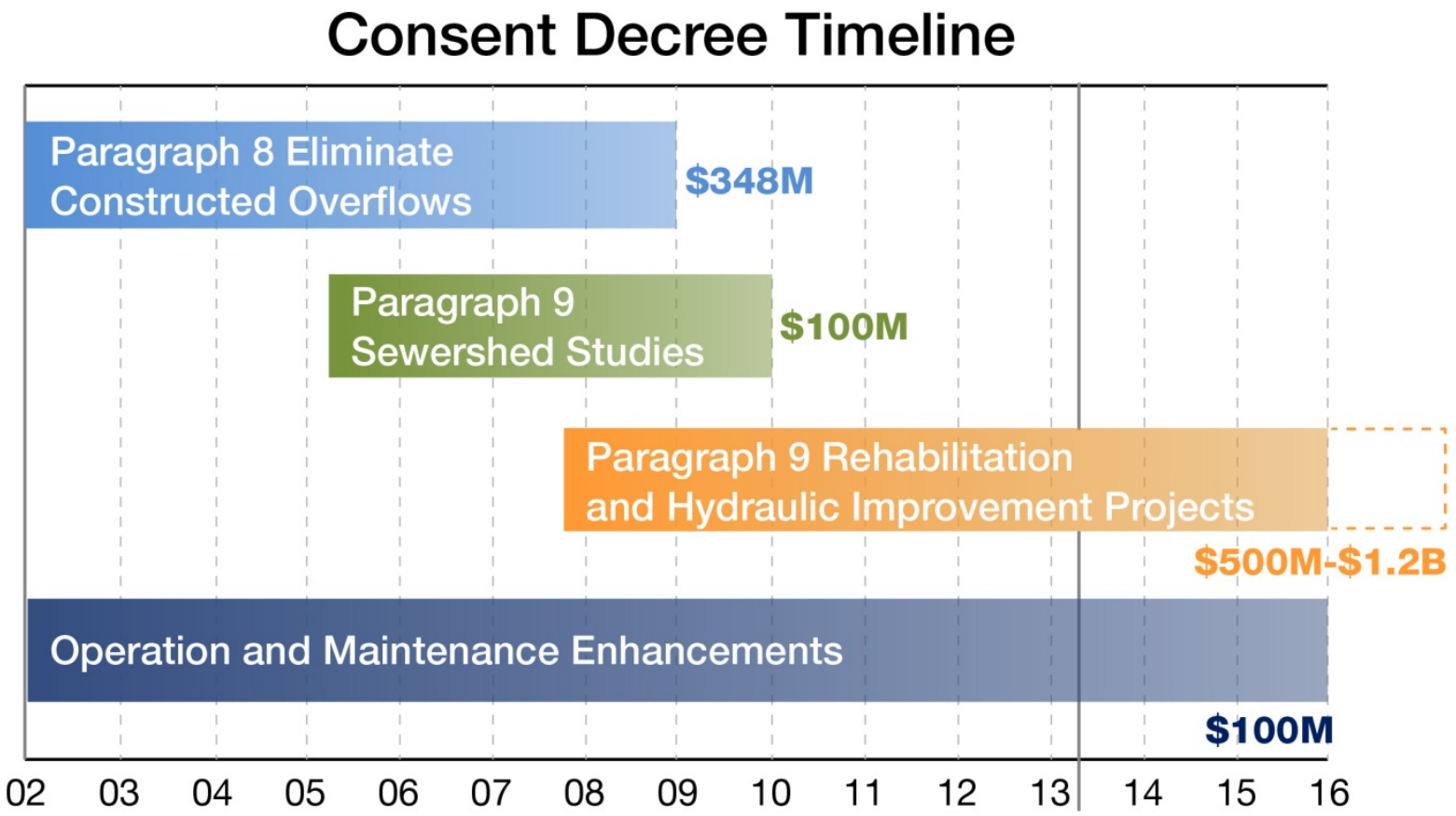
Consent Decree

Like most large cities in the nation, Baltimore City faces the challenges of dealing with an aging infrastructure. In 2002, we entered into a consent decree, or agreement, with the U.S. Environmental Protection Agency and the Maryland Department of the Environment to inspect, identify, and improve the entire sanitary sewer system. This agreement focuses primarily on the elimination of sewage overflows.

Consent Decree

- **Under CD requirements, the City has completed:**
  - **Sanitary Sewer Evaluation Survey (SSES)**
  - **Flow Monitoring**
  - **Hydraulic Model Development**
  - **Sewershed Study Plans**
  - **GIS Updates**
  - **Rehabilitation of Sewer Collection System**
- **The City plans to complete the structural improvements by January 1, 2016**
- **Hydraulic Improvements are being negotiated with EPA and MDE**

Consent Decree



Consent Decree

Paragraph 8 Projects

- Major CD milestones met for all projects
- Over 29 miles of sewer rehabilitation
- Upgrade to the Jones Falls Pumping Station from 35 MGD to 55 MGD
- Elimination of 60 out of 62 engineered overflow structures
- 39 Projects Completed (over $340 Million)

Consent Decree

Paragraph 9 Studies

- Inspected Approx. 33,000 MHs
- Inspected Approx. 1,100 miles of ≥ 8" pipes
- Developed hydraulic model
- Carried out flow monitoring
- Identified and corrected illegal connections
- Submitted all Sewershed Plans to EPA & MDE on schedule

$100 M Planning Projects Completed to Date

Approved Plans was the road map for structural rehabilitation work between 2010 and 2016

Consent Decree

Paragraph 9 Rehabilitation of Sewer Collection System

Sewers:

- Pipe Replacement/Upsizing
- New Pipe Construction
- Point Repairs
- CIPP Lining
- Pipe Bursting
- Sewer Cleaning

Manholes:

- Manhole Rehabilitation
- Manhole Replacement
- New Manhole Construction

Approx. 200 miles of Sewers and more than 8,000 Manholes will be Rehabilitated/Repaired in all 8 Sewersheds Structural Rehabilitation Projects

Implementing ~ $300 million in Structural Rehabilitation Projects

Consent Decree

Paragraph 9 Rehabilitation of Sewer Collection System

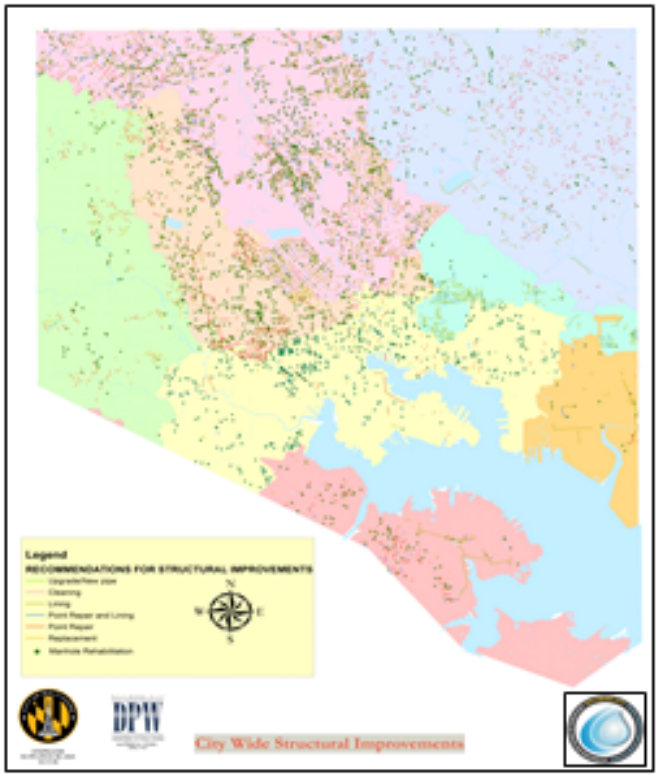
- Trenchless Technologies is being utilized where possible to reduce impacts to the citizens
- Evaluated innovative designs that led to cost effective construction methods
- Established Protocols and Developed Standard Documents
- Coordinated with Key Stakeholders

Deliver Projects On Time

Consent Decree

Paragraph 9 Rehabilitation of Sewer Collection System

- Identified 26 open-cut and trenchless construction projects.
- 19 design consultants under contract
- Construction activities have started
- Developed an overall standardization approach



Consent Decree

Cleaner Waterways

Bureau of Water and Wastewater

QUESTIONS?

RUDY.CHOW@BALTIMORECITY.GOV