



Integrating World-Class Nutrient Removal
with Urban Development Planning

State-of-the-Art Nitrogen Upgrade Program

Complex Challenges

A decorative graphic of a water splash in shades of blue, flowing from the top right towards the left across the top of the slide.

AlexRenew embraced various challenges in order to deliver their vision to protect the environment, contribute to a vibrant local economy, and engage the community

- **Regulatory**
 - Stringent/increasing nutrient discharge requirements
- **Constrained site**
 - 54-mgd plant on a 30-acre site
- **Future needs**
 - 2030 planning horizon
- **New neighbors**
 - Adjacent residential/commercial development (1.2 million SF)

Site Orientation

Residential/
Commercial
Developments

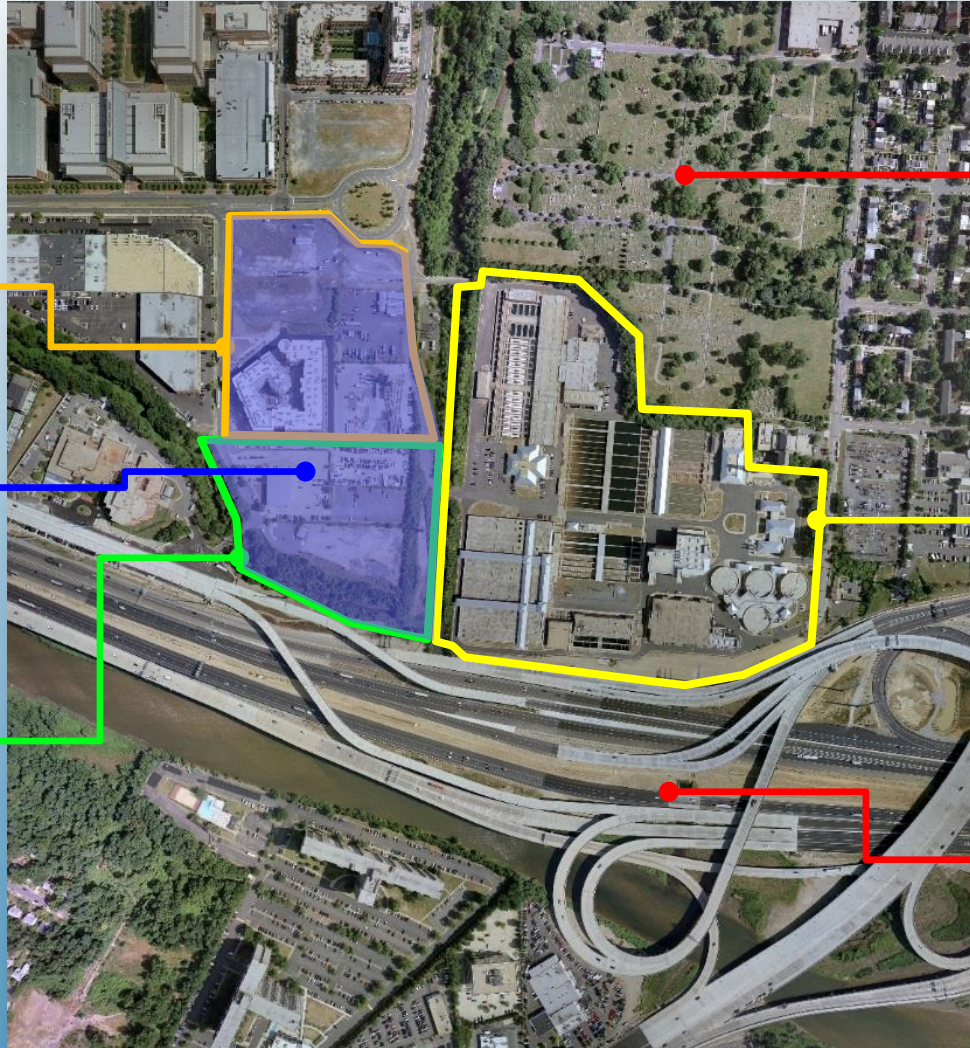
South Carlyle
Planning Area

AlexRenew
West Plant Site

Alexandria National
Cemetery

AlexRenew
Main Plant Site

Capital Beltway



Long-Range Plan

Implementation of long-range planning process allowed AlexRenew to meet current needs and enable the future

- Assessment of drivers (regulatory, etc.)
- Assessment of viable technologies and approaches
- Workshop-based collaborative effort
- Output
 - Boundary conditions
 - Phased approach to meet AlexRenew's 2011 and 2030 goals

Alexandria Sanitation Authority
Advanced Wastewater Treatment Facility
Enhanced Nitrogen Removal (ENR+)
Planning & Scope Development

SUSTAINABILITY

Long Range Planning Report
Volume 1
May 2009

ASA SANUP: Evaluation Criteria (Version 06/17/09)

People	Environmental Leadership	Efficiency	Community Awareness	Fiscal Responsibility
21	26	15	16	22
Ease of Operation Weight: 11	Current Permit Compliance Weight: 5	Reliability Weight: 3	Neighborhood/City Relations Weight: 10	Capital Cost Management Weight: 11
Staff Engagement Weight: 10	Flexibility to Adapt to Changing Regulations Weight: 12	Capacity Weight: 4	Public Partnering Weight: 6	Annual Cost Weight: 11
	Manage Environmental Footprint Weight: 9	Site Open Space Weight: 5		
		Embed Sustainable Practices Weight: 3		

Boundary Conditions

Boundary Condition	Elements
<p>2030 Most Restrictive Limits and Sustainable Practices</p>	<p>Limits on nutrient effluent discharge concentrations down to limit-of-technology (LOT) levels:</p> <ul style="list-style-type: none"> ❖ TN = 1 mg/l ❖ TP = 0.01 mg/l
	<p>Limits on the discharge of polychlorinated biphenyls (PCBs)</p>
	<p>Ban on land application of biosolids and/or potentially all land-based uses of biosolids</p>
	<p>Reuse of plant effluent water for irrigation in city parks (5 mgd between March and November)</p>
<p>2011 Requirements</p>	<p>Limits on nutrient effluent concentrations to take effect in 2011 down to state-of-the-art (SOA) levels:</p> <ul style="list-style-type: none"> ❖ TN = 3 mg/l ❖ TP = 0.18 mg/l
	<p>Continuing production of Class A Exceptional Quality Biosolids and alternative reuse options to bulk land application</p>

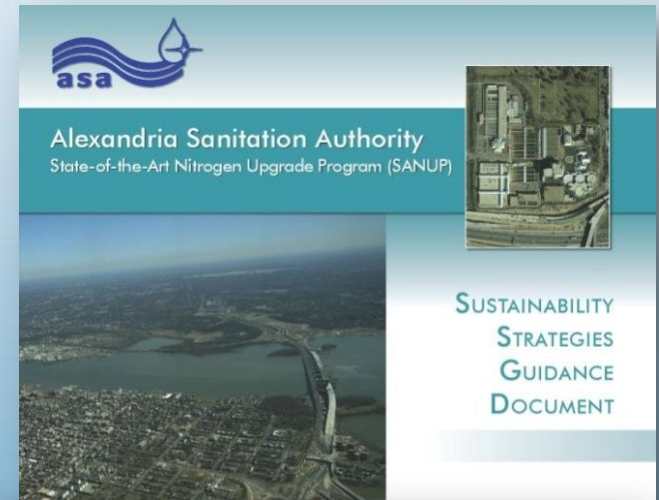
SANUP Objectives

Project Criteria	Requirement
Flow (Design)	54 mgd
Total Nitrogen	3 mg/l* (enable plan for 1 mg/l)
Total Phosphorous	0.18 mg/l*
Odor Control	5 D/T (99.9% compliance)
Supplemental Carbon	Enable alternative sources, expand capacity, optimize usage
Increase Secondary Treatment Reliability	<ul style="list-style-type: none">❖ Expand reactor basin volume/add polishing❖ Diurnal nutrient storage❖ Sidestream treatment of centrate
Reclaimed Water	Extend pipeline to potential users
Sustainability	Consider through all aspects of design and construction
Engage Community	Become integral to the community, aesthetically pleasing

Sustainable Approach

A defined approach at the outset ensured sustainability was integrated throughout design and construction

- Defined overarching sustainability categories and objectives
- Developed and monitored key performance indicators (KPIs)
- Tracked progress throughout project
- Offered incentives



Sustainable Construction Log
ARNew SANUP Package C - Nutrient Management Facility

Issued by: Annelle Logan
Issue Date: 7/3/13
Project Number: Clark US # 101
Report Period: June 2013
Construction Manager: Jeff Young
Project Start (month/year): March 2011

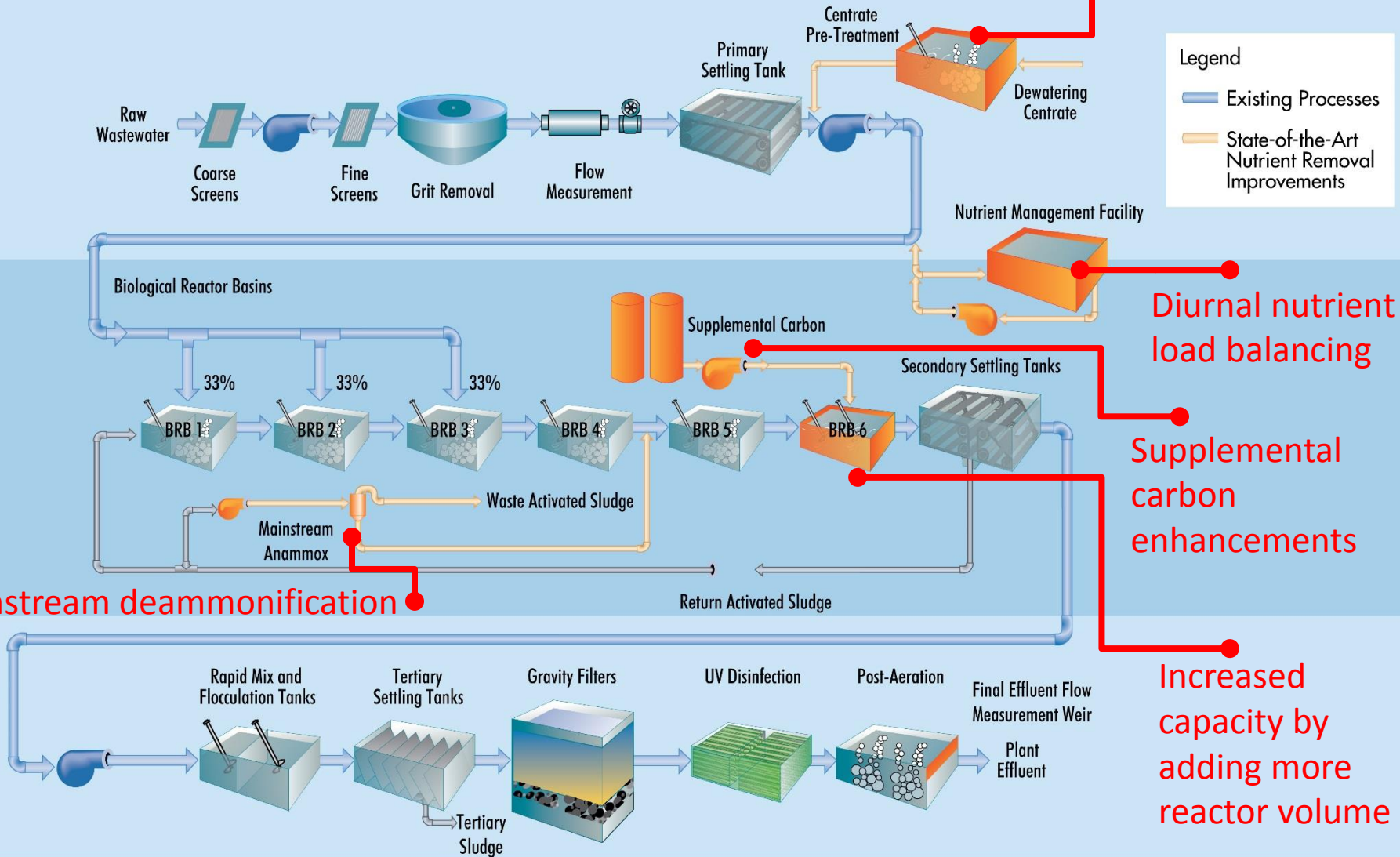
Waste Management: Heavy Equipment Fuel Received: _____ gallons
Weight Recycled/Salvaged: # _____ lbs/tons
Waste Landfilled: # _____ lbs/tons
Diesel 700? _____ gallons
Total: # _____ Percent Recycled/Salvaged: 0%
Percent Bio-based: 0%

Safety: Number of Reportable Incidents: # _____
Number of Reportable Incidents: # _____
Traffic: Number of Days Lost to Site Traffic Congestion: # _____

Entry No.	Date	Item Description	Follow-up Action/Recommendation
1	6/15/13	Lowered water levels in toilets saving approximately 75 gallons this month	Continue, possibly lower more
2	6/11/13	Ordered filing folders with recycled content	Order supplies with recyc. when possible
3	6/30/13	Purchased 4 jars of animal crackers in reusable containers; containers reused on site for storage	Reuse containers for storage
4	6/10/13	Aronette took public transportation to work three times saving 15 miles over the month	Continue, encourage others to take public transportation
5	6/30/13	CNS staff using single sized 200 paper cups over month	Continue, usage for guests?
6	6/30/13	Cuppeded fives plate to teachers saving 1 mile round trip per person totaling 14 miles over the month	Continue
7	6/14/13	Continued daily checklist for turning lights/electronics (as off) at the end of the day.	Continue, add new items to check list
8	6/4/13	Jeff walked to work saving one mile over the month	Continue
9	6/3/13	Purchased 10 reams of 100% recycled content paper	Continue

Implementation of SANUP Elements

Schematic of AlexRenew WRRF's Liquid Treatment Processes



Enhanced Supplemental Carbon Systems

- New larger tanks for methanol
- Re-purposed existing tanks for alternative carbon sources
- Optimized dosing for enhanced nitrogen removal



Innovative Sidestream Treatment

Cutting-edge technology provides focused treatment of ammonia-rich dewatering centrate while reducing operating costs

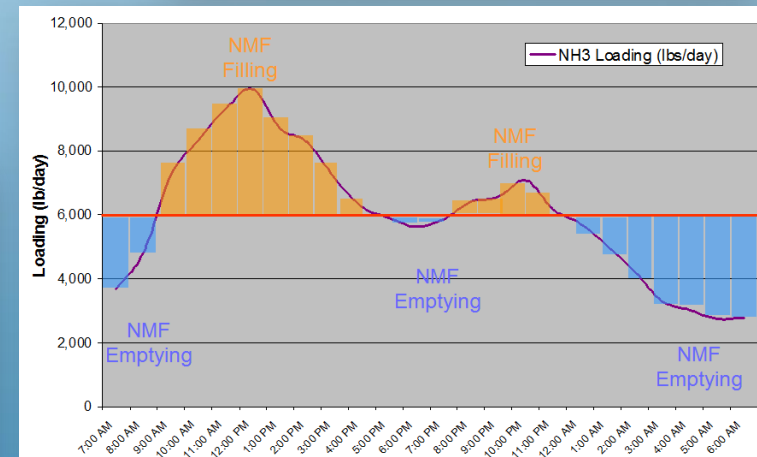
- Use of innovative deammonification process (DEMON™)
- Multiple operating modes in sequencing batch reactors
- 85% TN removal for 20% of plant's nitrogen loading
- Reduced air and supplemental carbon requirements



Diurnal Nutrient Balancing

Diversion and return of diurnal flows maintains consistent nitrogen loading to the biological process

- Improved process reliability
- 18 MG of primary effluent storage
- Multiple control modes
- Integrated wet weather wet well for a future 128-mgd pump station
- Athletic field for public use



Additional Biological Reactor Volume

- Addition of sixth biological reactor basin (4 MG)
- Anoxic volume for final polishing of TN
- Crossover channel required to tap into existing mixed liquor channel



Process Optimization with Mainstream Anammox

AlexRenew is the world's first utility to implement full-scale mainstream deammonification with stringent nutrient requirements

- Aeration control using instrumentation (DO, ammonia, nitrate/nitrite)
- Anammox microbes are grown in sidestream reactors and seeded to mainstream
- Cyclones used for annamox granule retention and to improve settleability
- Construction completed in fall 2015, process still in startup mode
- Estimated \$400,000 annual O&M savings in energy and chemicals (sidestream and mainstream)
- Research collaborations with other facilities will yield benefits for the industry





A Winning Partnership/ Team Effort



Starting with Sustainability in Mind

Bringing engineers, operators, and maintenance staff together to discuss sustainability encouraged creative approaches

- Full-day workshop held the day after chartering
- Promoted education and brainstorming of sustainable concepts that could be implemented
- Developed targets and planted seeds for delivery of a sustainable project



Energy

- Reduce Energy Consumption
- Generate Energy/ Increase Use of Renewable Energy

Climate Change/ GHG Emissions

- Minimize Life-Cycle GHG Emissions
- Adapt to Climate Change

Site Development & Natural Environment

- Create Aesthetically Pleasing Environment
- Increase Value of Ecologically Viable Areas

Stormwater & Water Management

- Maximize Use of Stormwater Resource
- Maintain Stormwater Quality
- Beneficial Reuse of High Quality Effluent

Human Health

- Eliminate/Reduce Physical/Chemical Hazards
- Maintain Healthy Air Quality
- Ensure Worker Safety During Construction & Operations

Materials & Waste

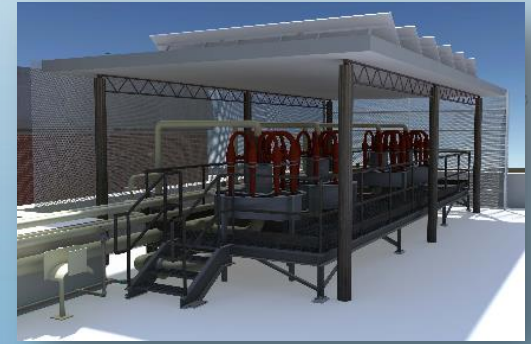
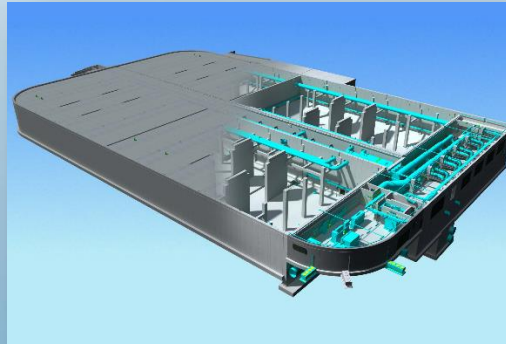
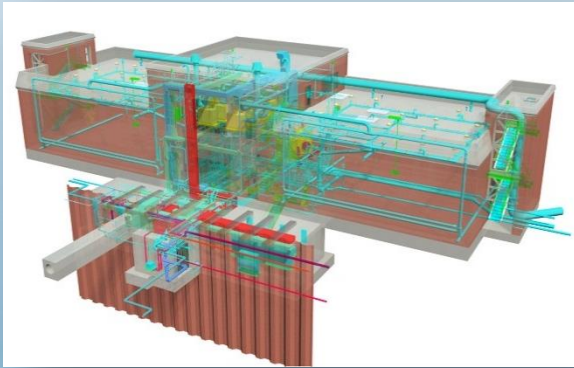
- Use Environmentally Preferable Materials
- Standardize Equipment Units & Spare Parts
- Utilize Sustainable Approaches for Project Execution
- Minimize Wastes Produced

Community Relations

- Achieve Public Acceptance
- Minimize Traffic
- Minimize Odors
- Minimize Post Construction Operational Noise
- Minimize Post Construction Light Impacts
- Minimize Construction Impacts

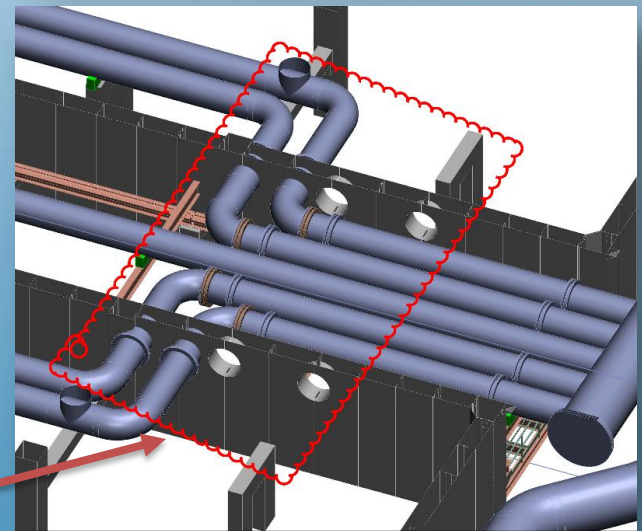
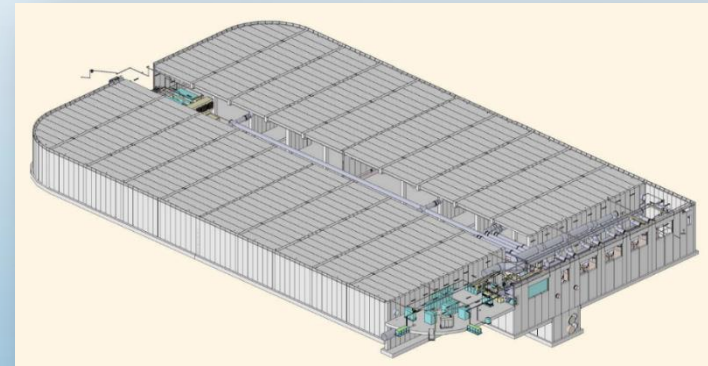
Leveraging 3-D Design

- Used 3-D modeling extensively to identify conflicts, enhance design reviews, and obtain stakeholder endorsement



Integration of Design Changes

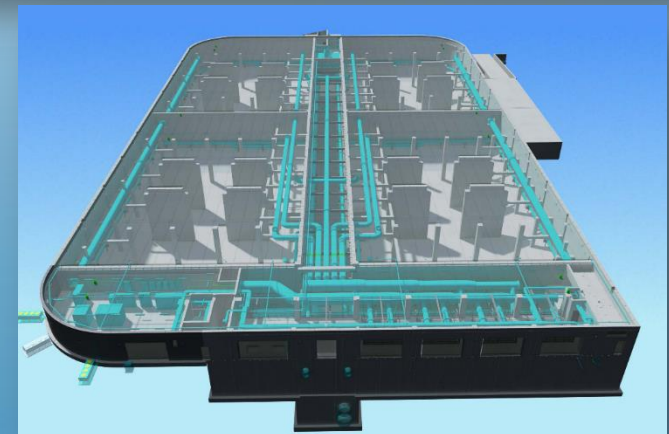
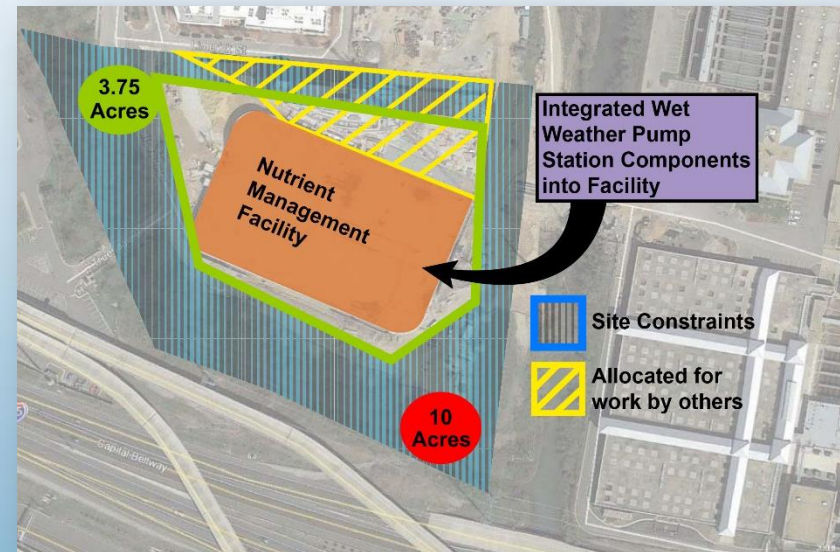
- Nutrient Management Facility designed as cast-in-place, then value engineered to precast, post-tensioned concrete construction
 - 1,700 panels
 - Panel seams
 - Enclosed tensioning wires
 - 6-month coordination effort during construction
 - 3-D modeling coordination used to mitigate all issues and capture \$6 million in savings



Wall penetrations don't match and are on panel seams

Team Adaptability

- **Nutrient Management Facility**
 - Acquisition of West Plant Site, formerly a historic landfill
 - Comprehensive environmental assessment and entry into Voluntary Remediation Program
 - Integrated components for future 128-mgd wet weather pump station
 - Construction Management at Risk Approach
 - Adoption of value engineering changes and re-engineering



Game Changing Public-Private Partnership

Execution of integrated projects in South Carlyle Planning Area was consistent with City's future development of East Eisenhower Corridor

- Formed core planning team to coordinate all projects
- Integrated designs to link green spaces and provide a common theme
- Held routine coordination meetings to resolve issues



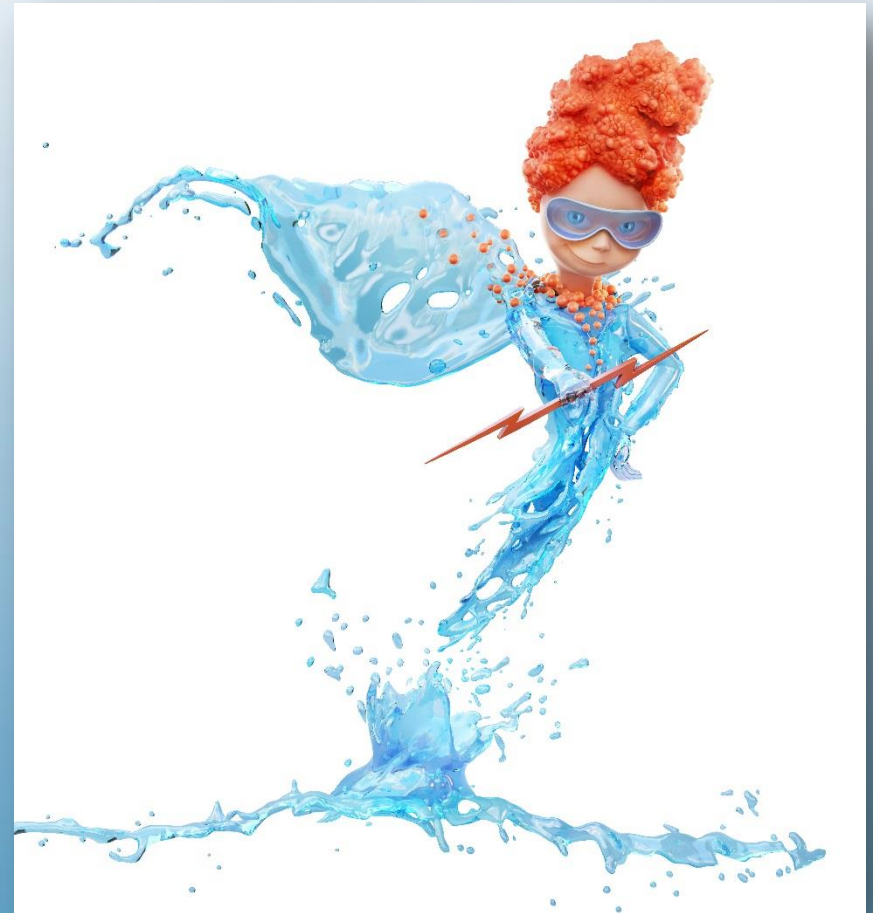
Environmental Stewardship

- State-of-the-art nitrogen removal protects Chesapeake Bay
- Historic landfill site was transformed
- Rain on athletic field is collected in tanks for treatment
- Aggressive approach to odor removes 99.9% H_2S , 5 D/T



Community Engagement

- AlexRenew's environmental spokeshero: Moxie
 - Her job is to reach out to children grades K-8, helping to explain the water cleaning process and teach about the importance of water stewardship



Community Engagement

- Facility tours
- Limerick Street Field dedication and Family FieldFest events held in October 2015



Program Achievements

A decorative graphic of a water splash, with a clear stream of water flowing from the left and splashing into droplets on the right, set against a light blue background.

- Sustainable delivery approach to enhance environmental stewardship and protect the Chesapeake Bay
- Creative development of a constrained site and transformation of a historic landfill
- Cutting-edge technology to provide reliable world-class nutrient removal while reducing operating costs
- Public-private partnership integrated community planning and created a new benchmark for public engagement



Thank you!
Questions?

