



Lewes WWTF Long-Range Planning Study

**Lewes BPW Public Meeting
January 23, 2023**

Agenda

1. Introduction
 2. Study Scope and Key Criteria
 3. Concept Development
 4. Concept Evaluation
 5. Estimated Ratepayer Impact
 6. Questions
 7. Next Stages
- Appendix A – Water Quality Criteria



Cape Gazette – Nick Roth Photo

1. Introduction

- This workshop is a follow-up to the presentation on March 31, 2022, where the BPW introduced unexplored concepts to increase wastewater treatment resilience in Lewes.
- The Lewes BPW Wastewater Treatment Facility (WWTF) is located at a low elevation site and is vulnerable to sea level rise and flood damage. The BPW has evaluated multiple options to mitigate flood risk and/ or relocate the facility.
- Sussex County has an existing agreement in place with the BPW to transfer wastewater flows from the County to the Lewes WWTF when demand is lower in Lewes during the winter months. The County has indicated that they may be interested in working with the BPW to establish additional shared facilities for wastewater treatment.
- GHD was appointed to develop and evaluate upgrade options that will provide increased resilience for wastewater treatment within the BPW's service area up to the Year 2050, including options for further collaboration with Sussex County.
- GHD's analysis has been summarized in the Lewes WWTF Long Range Planning Study Conceptual Evaluation Report, which has been presented to the BPW Board
- The BPW Board will identify a preferred Option to be developed further, following consideration of GHD's analysis and feedback/ comments provided by community stakeholders

– Note: a preferred option has not yet been identified by the BPW Board

2. Study Scope

- GHD evaluated six (6) options to increase the resilience of BPW’s wastewater treatment to storm events and sea level rise:

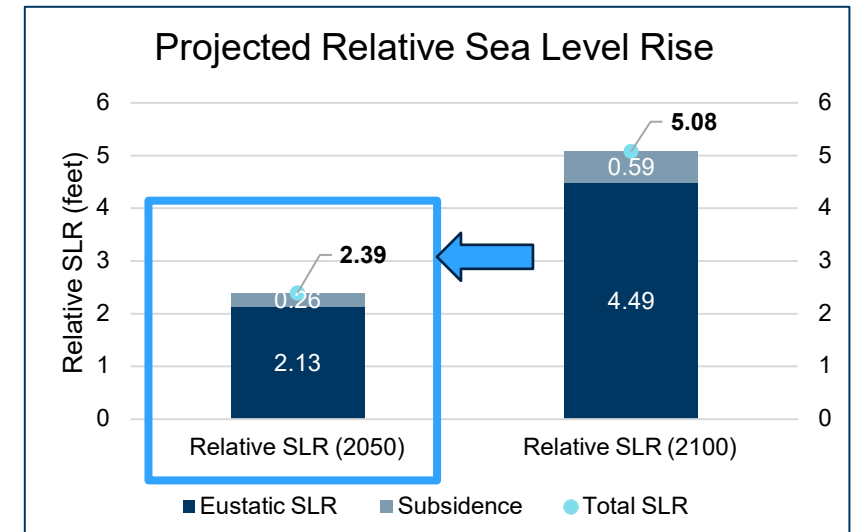
Option Ref	Option Title	Notes
1	Existing WWTF Hardening	Determine existing site improvements necessary to mitigate treatment impacts from sea level rise, subsidence, storm events including flooding, power loss etc., including: <ul style="list-style-type: none"> – Perimeter Dike around facility with stormwater/dewatering pumping station. – Raising and or flood proofing the biosolids unit processes. – On-site fuel storage for extended storm events/emergencies.
2 – a	Relocation & Spray Irrigation and/or RIBS	Determine if a suitable site can be found to construct a new WWTF using Rapid Infiltration Beds (RIBS) or spray irrigation for effluent disposal, and decommission the existing WWTF.
2 – b	Relocation & Utilization of Existing WWTP Outfall	Construct a new WWTF but maintain the existing permitted outfall, new force main, and decommission the WWTF.
2 – c	Relocation & New Ocean Outfall	Construct a new WWTF with new ocean outfall and decommission the existing WWTF.
3 – a	Partnership with Sussex County & Utilization of Existing WWTP Outfall	Network upgrades to transfer wastewater from the Lewes collection network to a new WWTP in Sussex County, and transfer treated flows back to the existing permitted, outfall in Lewes.
3 – b	Partnership with Sussex County & Constructed Wetland	Given a suitable site, provide network upgrades required to transfer wastewater from the Lewes collection network to a new WWTF in Sussex County and decommission the existing WWTF.

2. Study Criteria: Flood Elevation

- **Base Flood Elevation**
 - The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year (FEMA; March 2020).
 - Also referred to as the “100-yr Flood Elevation”.
- **2050 Basis of Design Flood Elevation**
 - The current Base Flood Elevation plus the projected Eustatic Sea Level Rise and Coastal Subsidence estimated to the year 2050.
- **Recommended Freeboard**
 - The recommended vertical offset from the Flood Elevation to building thresholds, equipment elevations and other critical components for treatment capacity.
 - Freeboard is not added to, or included in, the Flood Elevation; it is used to compare building and equipment elevations with projected water surface elevations.



Parameter	Value
2015 FEMA 100-yr Site Flood EL, ft	7
Projected 2050 Eustatic Sea Level Rise, ft	2.13
Projected 2050 Coastal Subsidence, ft	0.26
Estimated 2050 100-yr Design Flood Elevation, ft	9.39
Minimum elevation for structural slabs and building thresholds, ft (Provide 2ft freeboard)	11.39
Minimum elevation for critical equipment, ft (Provide 3ft freeboard)	12.39



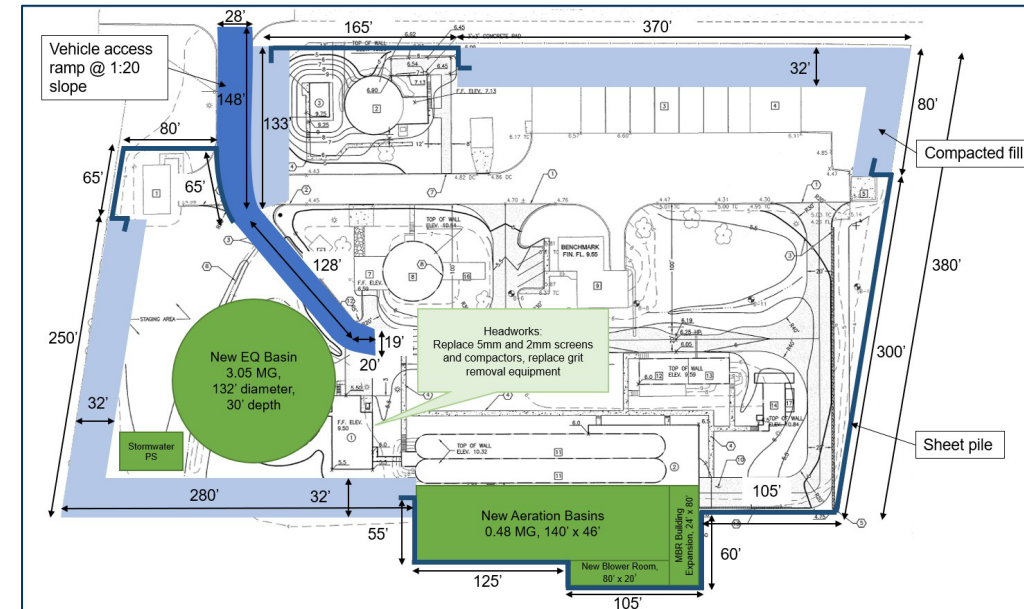
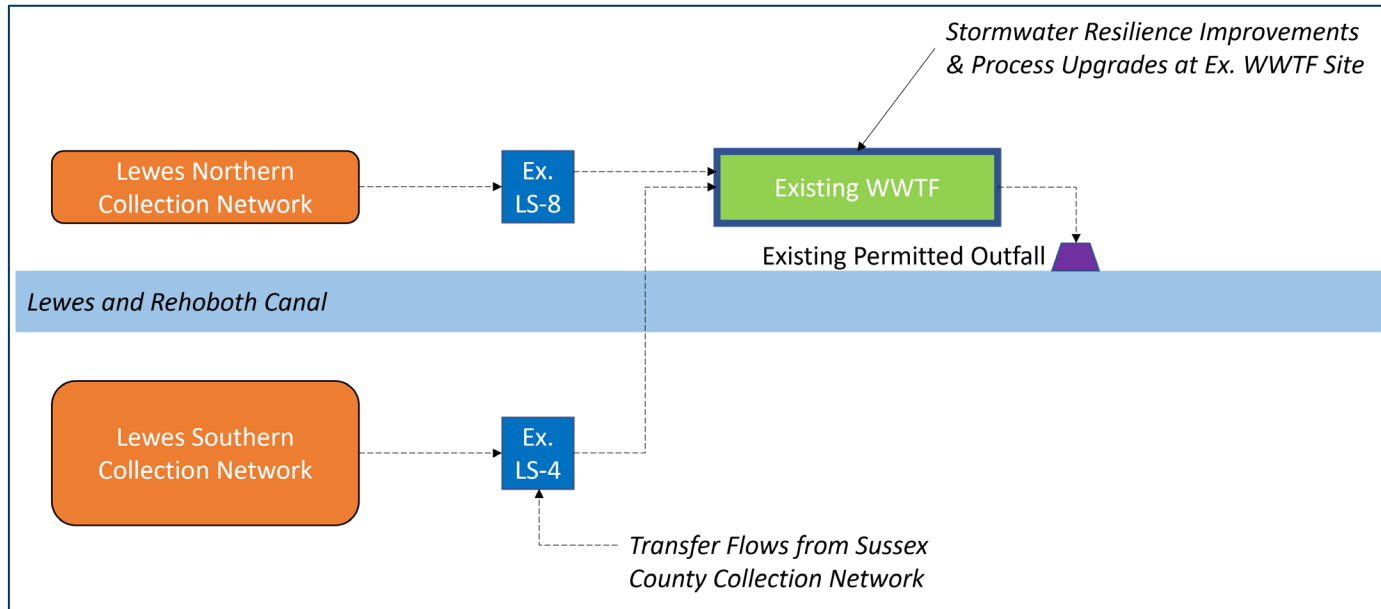
2. Study Criteria: Wastewater Flow Rates

- The existing Lewes WWTF is rated for an Average Day Flow (ADF) of 1.5 mgd
 - Note: the current observed ADF is approx. 0.9 mgd, 60% of the rated capacity
- BPW conservatively estimate that, on the assumption that all available lots are developed per the current zoning designations, the 2050 ADF will increase to 1.75 mgd
 - Concept arrangements for all upgrade Options have been developed assuming an ADF from the Lewes collection network of 1.75 mgd
- Option 3 scenarios (Partnership with Sussex County) have been developed assuming Sussex County will contribute an equal proportion of the treated flow rate to the new facility, i.e. ADF of 1.75 mgd
 - The Option 3 facility will therefore be designed to treat a total 2050 ADF of 3.5 mgd

2. Study Criteria: Water Quality

- The Design Criteria for all of the upgrade concepts with regards to treated effluent water quality is:
 - **The future WWTF will meet all of the conditions of the existing NPDES permit**
- Option 1 concept (improve existing WWTF) would maintain the existing Membrane Bioreactor (MBR) treatment process
- All Option 2 and Option 3 concepts would include a new Activated Sludge Treatment facility with Tertiary Effluent Filtration
- Existing WWTF maintains Total Nitrogen (Total N) and Total Phosphorus (Total P) concentrations within the Permit Limit
 - Ex. WWTF currently operates at 60% capacity, when flows increase the nutrient concentrations will trend towards the permit limits
 - In order to increase flow capacity, the future WWTF (for all Options) will maintain lower Total N and Total P concentrations than the existing permit limits

3. Concept Development: Option 1 – Hardening of Existing Plant

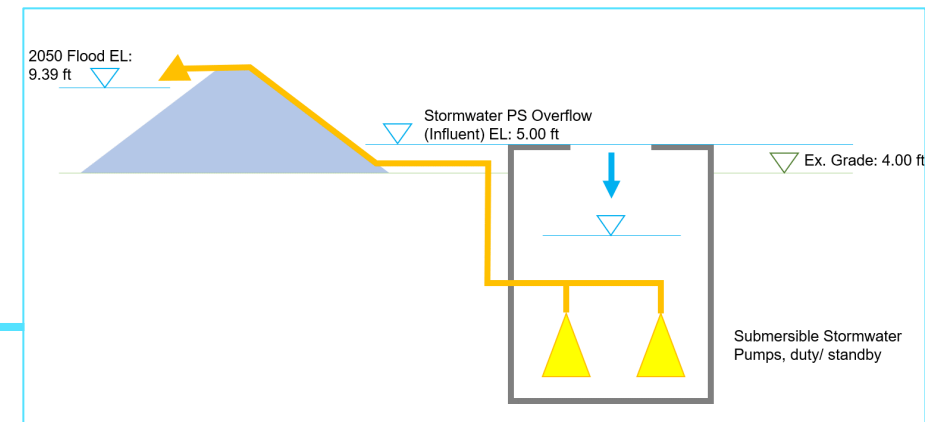
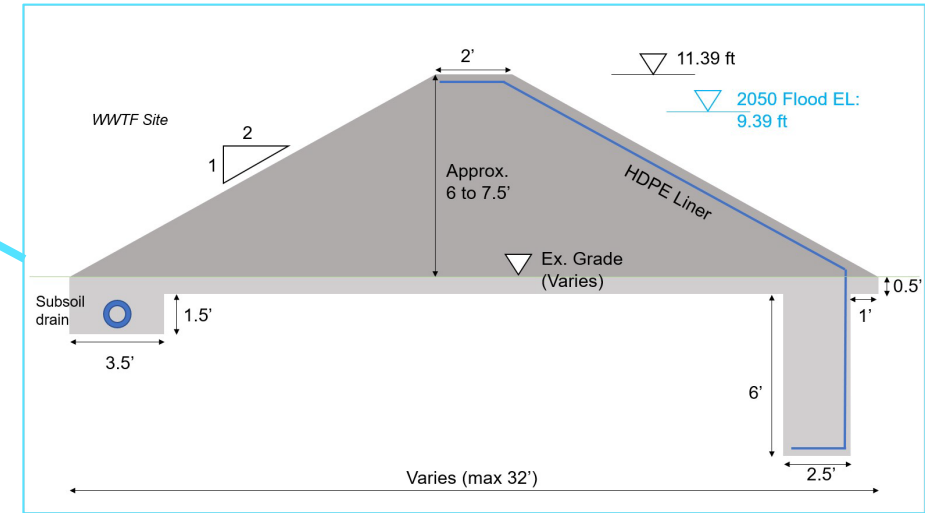
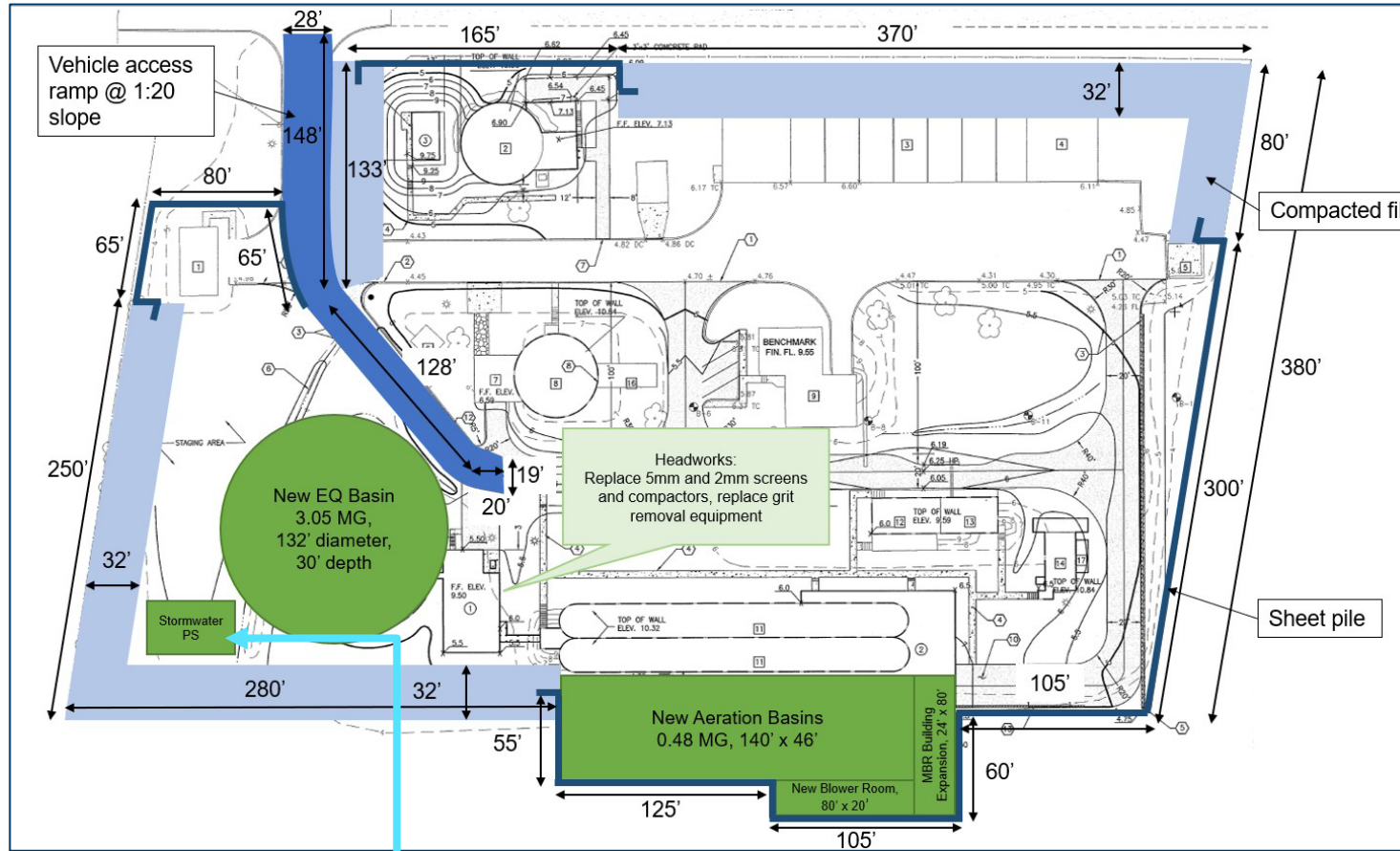


Note: under this scenario the WWTF site will be operable within the proposed perimeter flood barrier. However, additional emergency plans and arrangements will be required by the BPW to enable personnel and materials to be brought to the site boundary

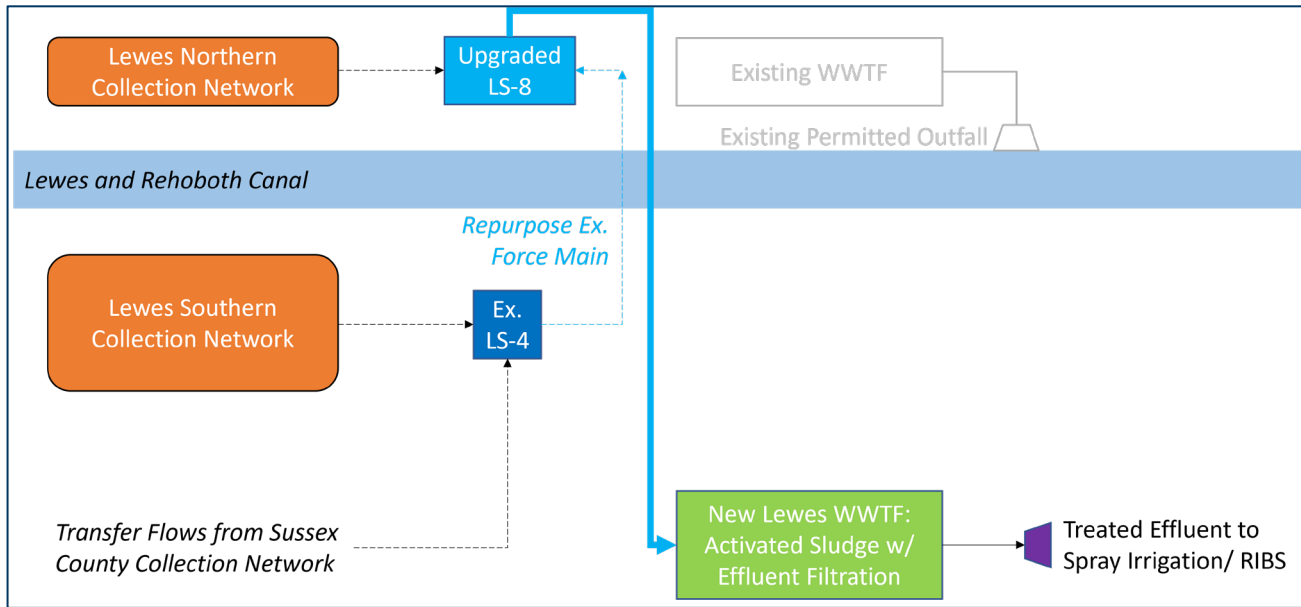
The following capital works are required as part of the Option 1 scope of work:

- Upgrades to the following treatment facilities to enable the existing Lewes WWTF to meet the Basis of Design Criteria up to 2050:
 - New Headworks facilities (screening and grit)
 - Demolish existing Flow EQ tank and install a new 3.03 MG tank.
 - Expand Aeration Basins to provide 12-hrs storage at average daily flow.
 - Install a fourth MBR cassette to increase the treatment capacity to 2.16 mgd.
 - Replace the existing UV reactors (2) like-for-like.
- Construction of a new Perimeter Flood Barrier and Vehicle Access Ramp.
- Construction of a Stormwater Discharge Pump Station.

3. Concept Development: Option 1 – Hardening of Existing Plant



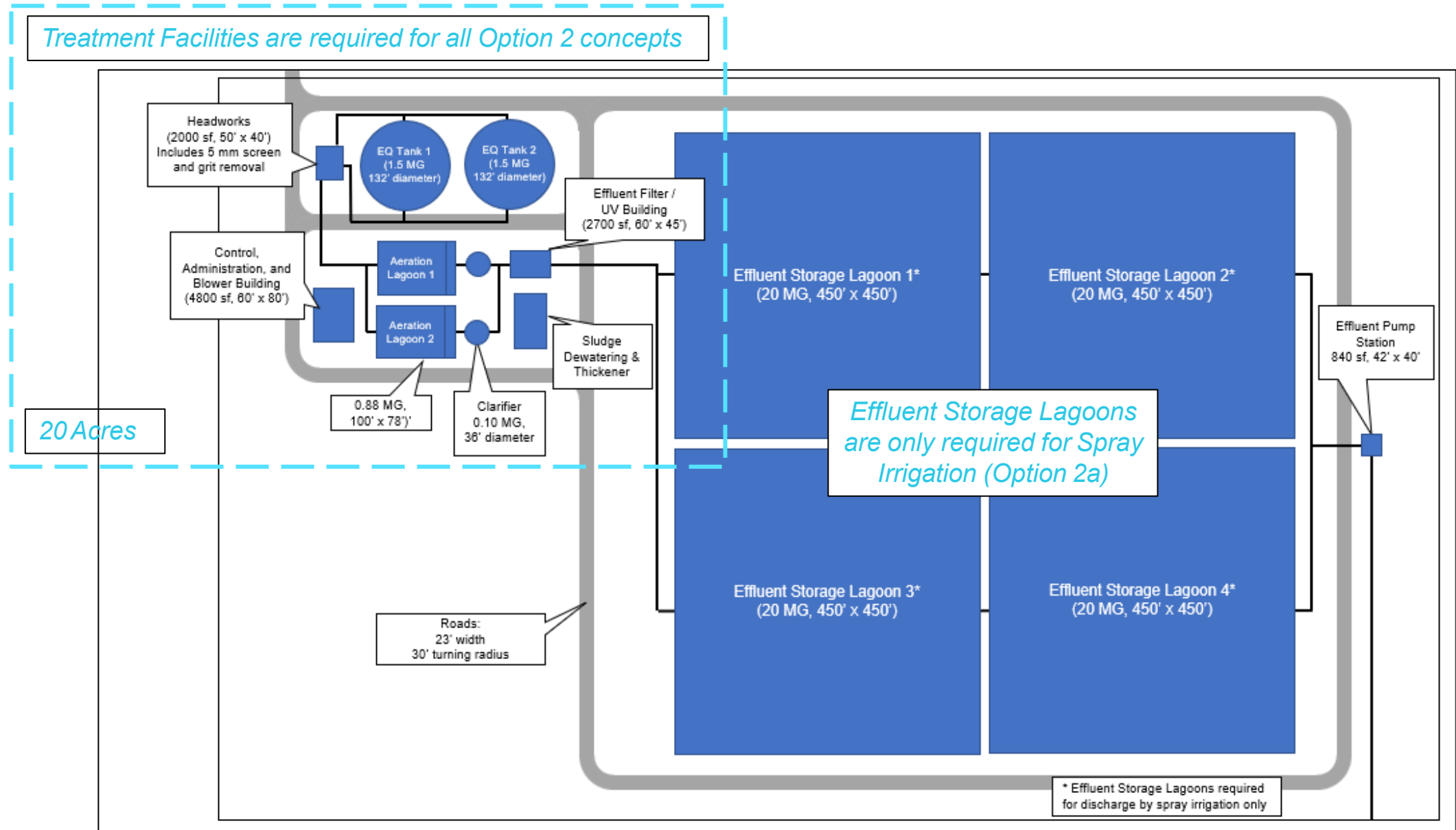
3. Concept Development: Option 2a – Relocated Plant with Spray Irrigation



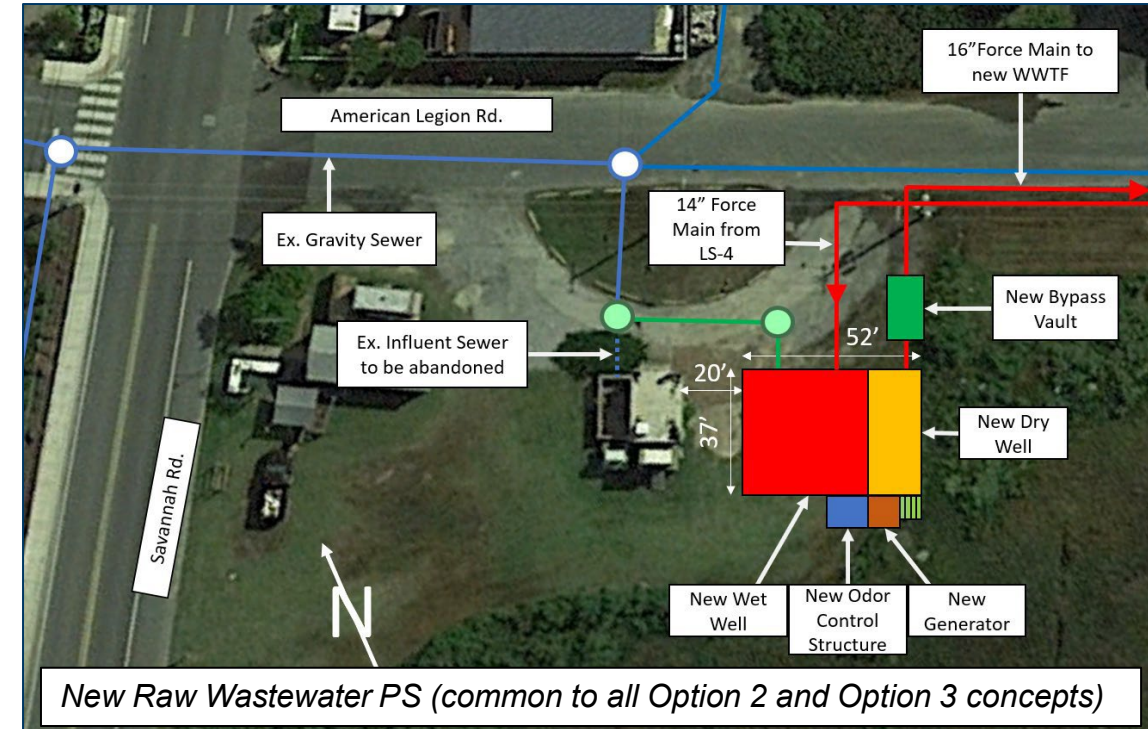
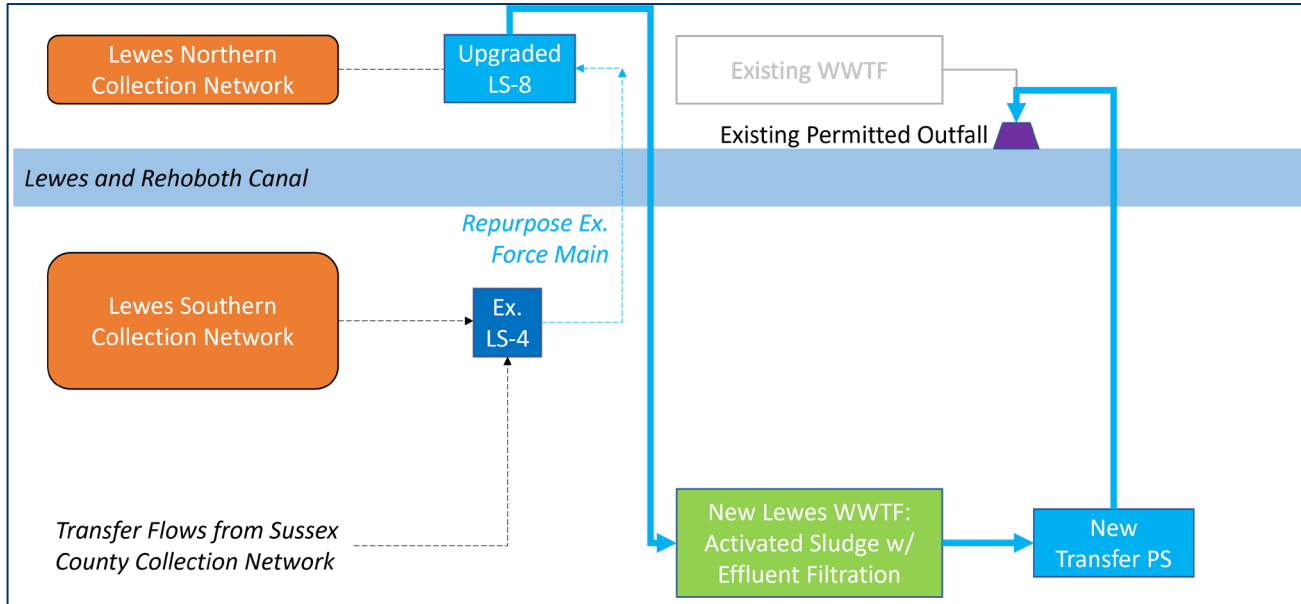
The following capital works are required as part of the Option 2a scope of works:

- Reconfiguration of LS-4 and LS-8 piping to consolidate all Lewes wastewater collection network flows at LS-8.
- LS-8 modifications to create new raw wastewater pump station.
- New Tertiary Treatment WWTF at high elevation, **discharging via spray irrigation.**
 - Total site area required: 250 acres
 - Note: spray irrigation area does not have to be contiguous

3. Concept Development: Option 2a – Relocated Plant with Spray Irrigation



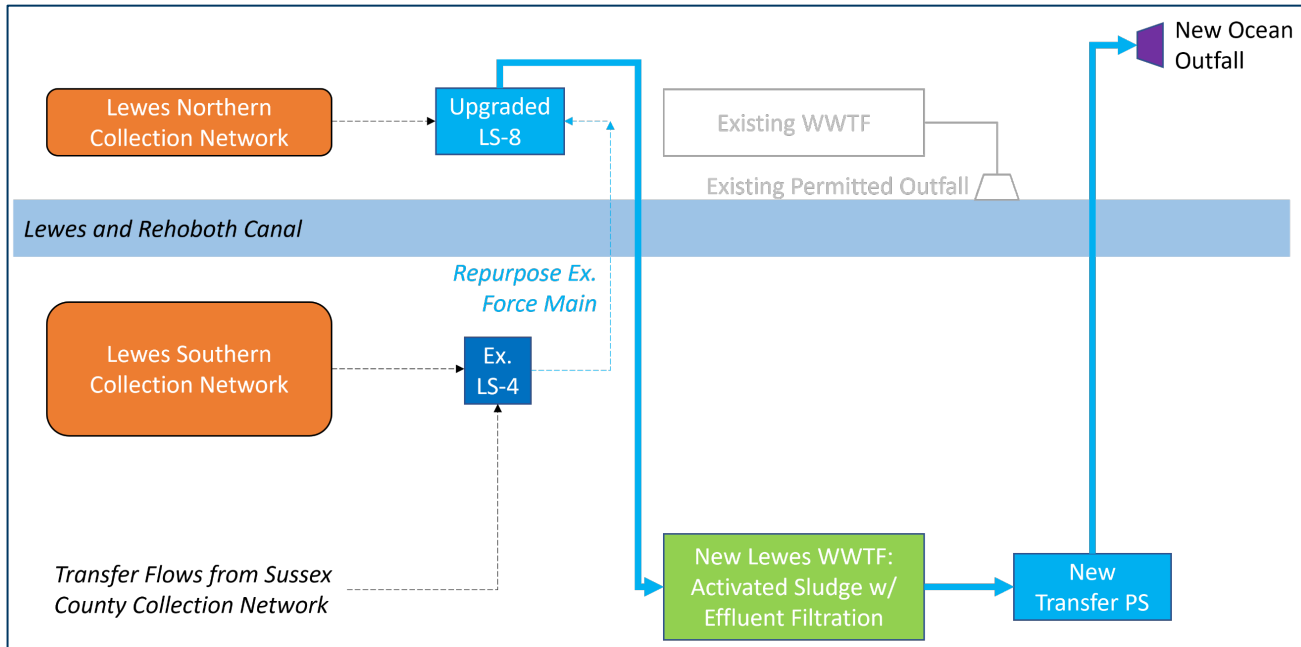
3. Concept Development: Option 2b – Relocated Plant with Canal Outfall



The following capital works are required as part of the Option 2a scope of works:

- Reconfiguration of LS-4 and LS-8 piping to consolidate all Lewes wastewater collection network flows at LS-8.
- LS-8 modifications to create new raw wastewater pump station.
- New Tertiary Treatment WWTF at high elevation, **discharging to existing (relocated outfall) at Lewes and Rehoboth Canal.**
 - Total site area required: 20 acres

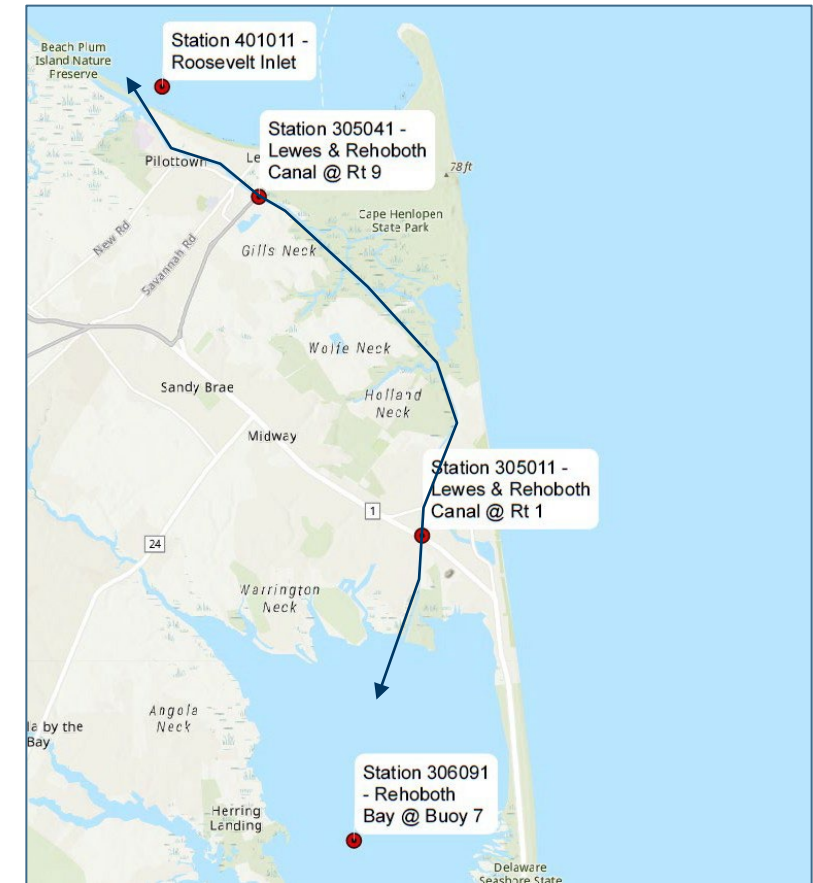
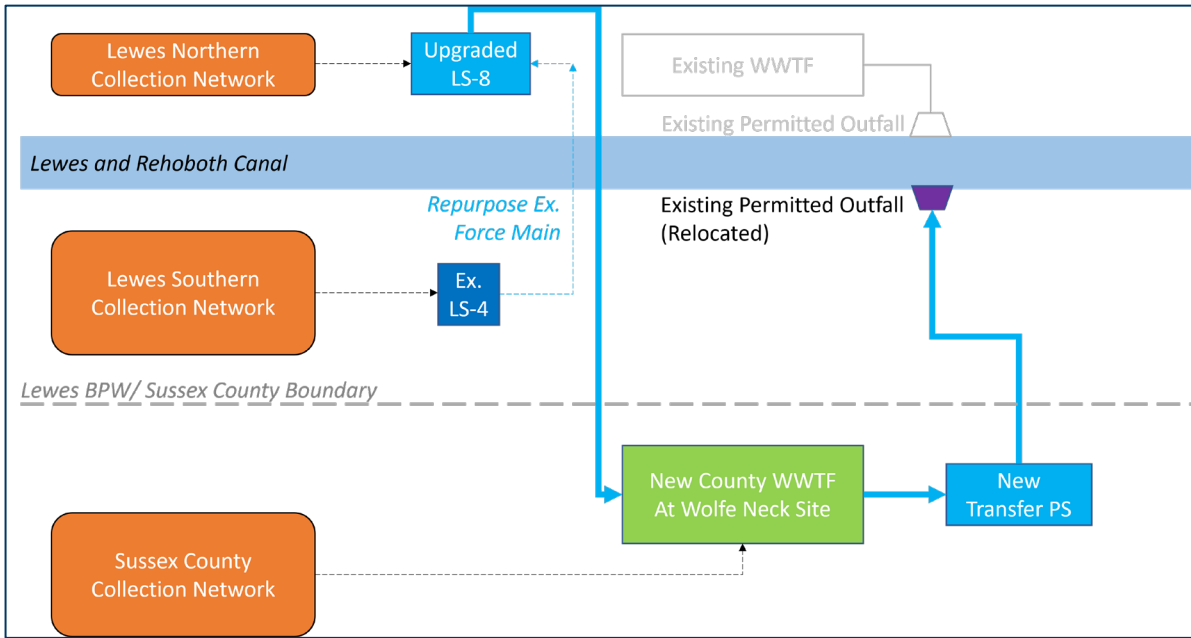
3. Concept Development: Option 2c – Relocated Plant with Ocean Outfall



The following capital works are required as part of the Option 2c scope of works:

- Reconfiguration of LS-4 and LS-8 piping to consolidate all Lewes wastewater collection network flows at LS-8.
- LS-8 modifications to create new raw wastewater pump station.
- New Tertiary Treatment WWTF at high elevation, **discharging via new ocean outfall.**
 - Total site area required: 20 acres

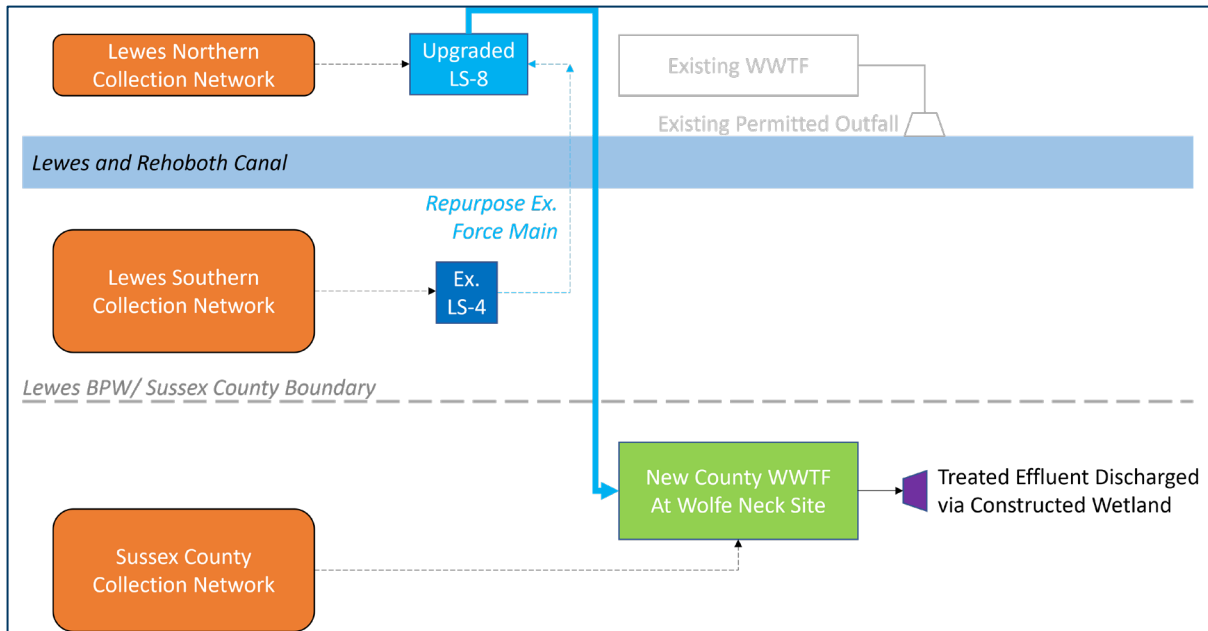
3. Concept Development: Option 3a – Sussex County Partnership with Canal Outfall



The following capital works are required as part of the Option 3a scope of work:

- Lewes BPW Responsibility:
 - Raw wastewater pump station.
 - Raw wastewater force main from the pumping station to the scope boundary.
- Sussex County Responsibility:
 - Raw wastewater force main from the scope boundary to the Wolfe Neck site.
 - New wastewater treatment facilities at the Wolfe Neck site – **owned and operated by Sussex County**
 - Treated effluent pump station – **will discharge only on the outgoing tide**
 - Treated effluent force main from Wolfe Neck to Relocated Outfall Location.
 - Relocated Outfall.

3. Concept Development: Option 3b – Sussex County Partnership with Constructed Wetlands



The following capital works are required as part of the Option 3b scope of works:

- Lewes BPW Responsibility:
 - Raw wastewater pump station.
 - Raw wastewater force main from the pumping station to the scope boundary.
- Sussex County Responsibility:
 - Raw wastewater force main from the scope boundary to the Wolfe Neck site,
 - New combined wastewater treatment facilities at the Wolfe Neck site, including a constructed wetland with vertical discharge – **owned and operated by Sussex County and will discharge only on the outgoing tide**

4. Concept Evaluation: Multi-Criteria Analysis

- A Multi-Criteria Analysis (MCA) was performed to evaluate the concept options based on a series of **non-cost criteria**.
- Criteria were assigned a weighting to reflect the relative criticality of each item
 - Longer term impacts, water quality issues and treatment facility resilience were generally assigned a higher weighting
 - Shorter term impacts were assigned a lower weighting
- The evaluation criteria, performance measures, rating scale, and weighting factors used for the multi-criteria analysis are summarized below
 - **Category 1 of 3:**

Evaluation Category	Evaluation Criteria	Performance Measure	Weighting	Rating = 1 (Worst)	Rating = 3 (Average)	Rating = 5 (Best)
Permitting & Schedule	Permitting Complexity	The expected volume and complexity of permitting procedures	1	Greater than other options	Comparable to other options	Less than other options
	Delivery Schedule	The length of the overall project implementation schedule including design, permitting and construction stages	2	Greater than other options	Comparable to other options	Less than other options
	Property & Easement Acquisition	The complexity of obtaining required additional property and easement acquisition for treatment facilities and conveyance piping	2	Greater than other options	Comparable to other options	Less than other options
	Interagency & Regulatory Coordination	The schedule risk associated with coordination and approvals from other political bodies (such as Sussex County) or regulatory approvals which are outside of the control of the Lewes Board of Public Works	1	Greater than other options	Comparable to other options	Less than other options

4. Concept Evaluation: Multi-Criteria Analysis

- The evaluation criteria, performance measures, rating scale, and weighting factors used for the multi-criteria analysis are summarized below
 - Category 2 of 3:**

Evaluation Category	Evaluation Criteria	Performance Measure	Weighting	Rating = 1 (Worst)	Rating = 3 (Average)	Rating = 5 (Best)
Community & Environmental Impacts	Stakeholder Impacts - Construction Stage	Temporary impacts to the community during the construction stage due to traffic volume, road closures, noise and other factors	1	Greater than other options	Comparable to other options	Less than other options
	Stakeholder Impacts - Long Term	Long term impacts to the community due to ongoing site traffic, odor, aesthetics and other factors	2	Greater than other options	Comparable to other options	Less than other options
	Water Quality Impacts for Inland Bays	The likelihood that the proposed treatment process will negatively impact the water quality of the Inland Bays	3	More Likely than other options	Comparable to other options	Less Likely than other options
	Overall Environmental Risk	Likelihood of environmental impacts due to failure/ flood damage at treatment facilities, force mains, pumping facilities or other components	3	More Likely than other options	Comparable to other options	Less Likely than other options
	Sustainability and Energy & Chemical Use	Energy, chemical usage and overall sustainability associated with the proposed treatment and conveyance facilities	1	Less Sustainable than other options	Comparable to other options	More Sustainable than other options
	Land Use within City of Lewes	Amount of land required within the City of Lewes for wastewater treatment infrastructure	1	Greater than other options	Comparable to other options	Less than other options

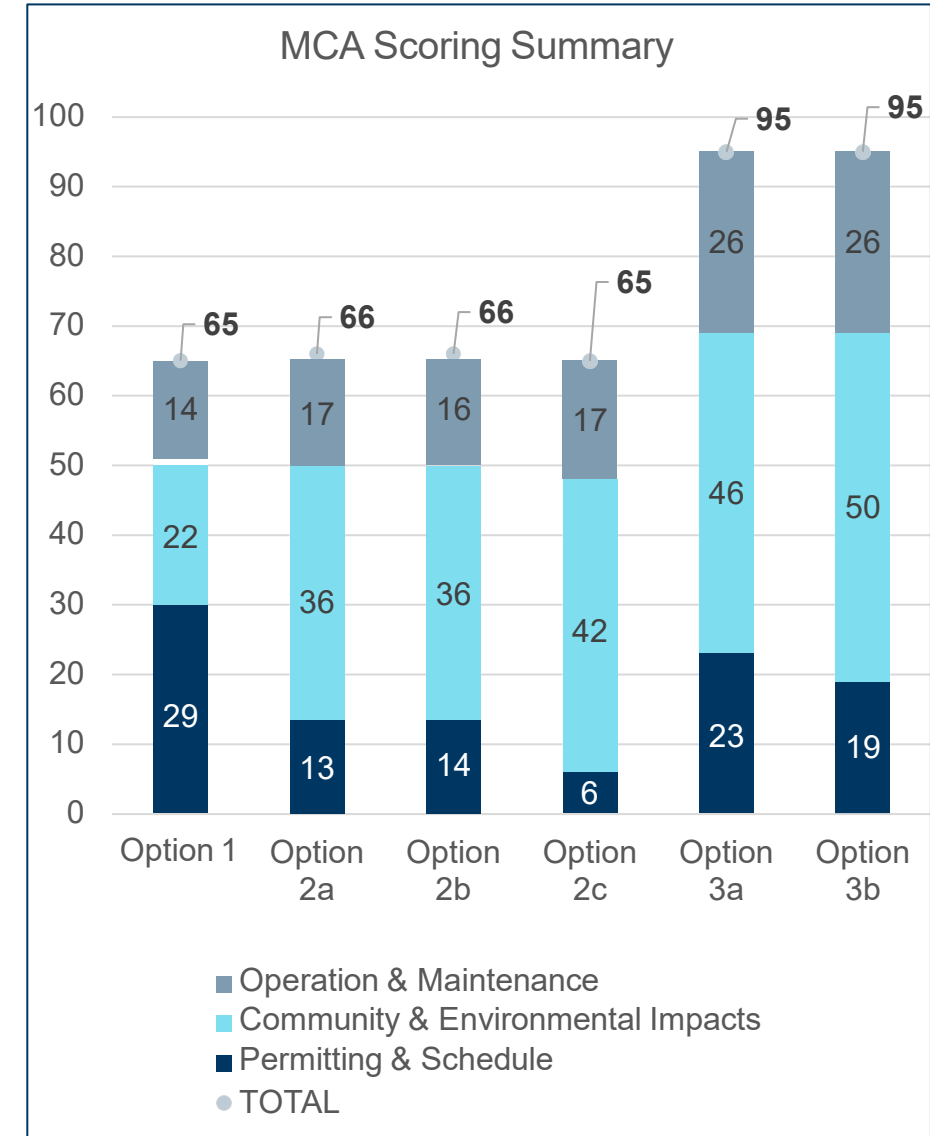
4. Concept Evaluation: Multi-Criteria Analysis

- The evaluation criteria, performance measures, rating scale, and weighting factors used for the multi-criteria analysis are summarized below:
 - Category 3 of 3:**

Evaluation Category	Evaluation Criteria	Performance Measure	Weighting	Rating = 1 (Worst)	Rating = 3 (Average)	Rating = 5 (Best)
Operation & Maintenance	Impact to WWTF Operations During Construction	The extent to which the proposed upgrades will affect the operation and resilience of existing treatment and conveyance facilities	1	More Likely than other options	Comparable to other options	Less Likely than other options
	Operational Complexity	The level of operational effort required to maintain treatment performance and the difficulty in obtaining qualified staff	3	Greater than other options	Comparable to other options	Less than other options
	Future Flexibility	The extent to which the proposed treatment and conveyance facilities can be adapted to meet future environmental and compliance conditions	2	Less Likely than other options	Comparable to other options	More Likely than other options

4. Concept Evaluation: Multi-Criteria Analysis

- The Key findings of the MCA are summarized below:
- Option 3a and Option 3b have the joint-highest MCA scores
- Option 3a scores higher for the Permitting & Schedule category,
 - Due to the relative uncertainty associated with the constructed wetland discharge arrangement under Option 3b
- Option 3b scores higher for the Community & Environmental Impacts
 - No requirement to pump treated effluent back to Lewes
- The Option 1 and Option 2 concepts have very similar overall MCA scores
 - Option 1 scores lower for Community & Environmental Impacts due to the residual flood risk at the existing site
 - Option 2 concepts score lower for Permitting & Schedule due to land acquisition and significant lengths of transfer force mains in public roads
 - Option 2c scores particularly low in this category due to the permitting complexities associated with constructing a new ocean outfall
 - Option 2c scores higher in the Community & Environmental Impacts category as treated effluent no longer discharged to the Canal



4. Concept Evaluation: Cost

Costs presented are the costs that would be incurred by Lewes BPW only; costs incurred by Sussex County are not included in the analysis.

Capital Cost Estimates:

Component Cost	Option 1	Option 2a	Option 2b	Option 2c	Option 3a	Option 3b
General Conditions	\$ 2,000,000	\$ 13,500,000	\$ 10,000,000	\$ 16,000,000	\$ 1,500,000	\$ 1,500,000
Land Purchase	\$ -	\$ 12,500,000	\$ 1,000,000	\$ 1,000,000	\$ -	\$ -
Demolition – Ex. Facility	\$ -	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000	\$ 3,500,000
Network Upgrades	\$ -	\$ 9,500,000	\$ 13,500,000	\$ 49,000,000	\$ 4,000,000	\$ 4,000,000
Civil – WWTF	\$ 1,500,000	\$ 14,500,000	\$ 4,500,000	\$ 4,500,000	\$ -	\$ -
Arch/HVAC	\$ 500,000	\$ 2,000,000	\$ 2,000,000	\$ 2,000,000	\$ -	\$ -
Structural Concrete	\$ 3,000,000	\$ 7,500,000	\$ 7,000,000	\$ 7,000,000	\$ -	\$ -
Mech/Equipment	\$ 4,000,000	\$ 13,500,000	\$ 13,000,000	\$ 13,500,000	\$ -	\$ -
Electrical	\$ 2,500,000	\$ 15,500,000	\$ 13,000,000	\$ 14,000,000	\$ 2,500,000	\$ 2,500,000
Construction Subtotal	\$ 13,500,000	\$ 92,000,000	\$ 67,500,000	\$ 110,500,000	\$ 11,500,000	\$ 11,500,000
Contingency (35%)	\$ 4,700,000	\$ 32,400,000	\$ 23,700,000	\$ 38,700,000	\$ 4,100,000	\$ 4,100,000
Construction Total	\$ 18,200,000	\$ 124,400,000	\$ 91,200,000	\$ 149,200,000	\$ 15,600,000	\$ 15,600,000
Legal, Admin., and Eng. (25%)	\$ 4,600,000	\$ 31,200,000	\$ 22,800,000	\$ 37,300,000	\$ 4,000,000	\$ 4,000,000
TOTAL	\$ 22,800,000	\$ 155,600,000	\$ 114,000,000	\$ 186,500,000	\$ 19,600,000	\$ 19,600,000

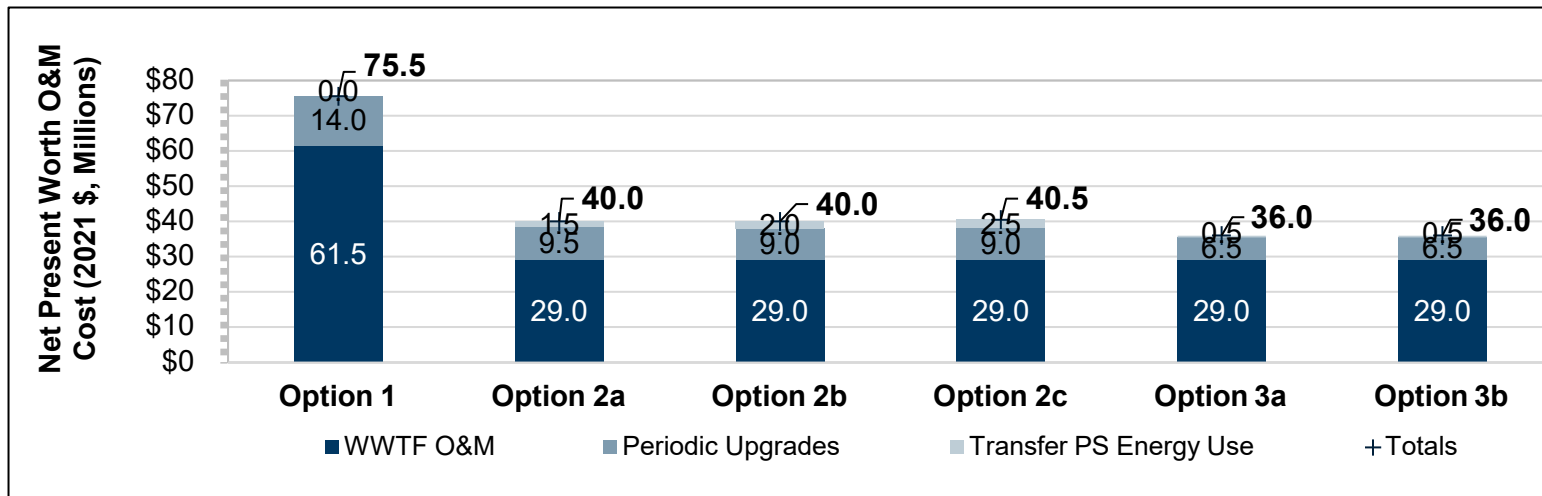
4. Concept Evaluation: Cost

Costs presented are the costs that would be incurred by Lewes BPW only; costs incurred by Sussex County are not included in the analysis.

Estimated Annual Operation & Maintenance Costs (2022 US Dollars):

Parameter	Option 1	Option 2a	Option 2b	Option 2c	Option 3a	Option 3b
WWTF Operations & Maintenance	\$1,520,000	\$720,000	\$720,000	\$720,000	\$720,000	\$720,000
Periodic Equipment Replacement	\$500,000	\$330,000	\$320,000	\$320,000	\$240,000	\$240,000
Transfer Pump Station Energy Use	\$0	\$30,000	\$50,000	\$60,000	\$20,000	\$20,000
TOTAL	\$2,020,000	\$1,080,000	\$1,090,000	\$1,100,000	\$980,000	\$980,000

2050 Net Present Value (NPV) Operation & Maintenance (O&M) Cost:



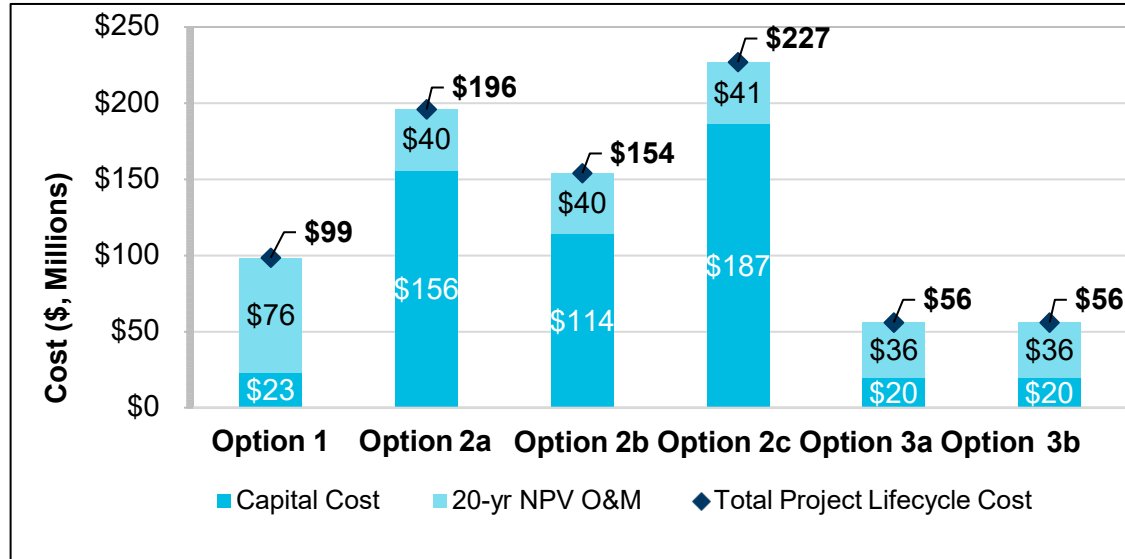
Per the existing BPW / Sussex County Agreement, BPW will pay a proportion of the running costs for the County's new facility, equal to the proportion of the flow contributed by BPW (assumed 50%)

An estimate of the total cumulative O&M expenditure (including an allowance for inflation) up to Year 2050

4. Concept Evaluation: Summary

Costs presented are the costs that would be incurred by Lewes BPW only; costs incurred by Sussex County are not included in the analysis.

Project Lifecycle Cost Estimates:



	Option 1	Option 2a	Option 2b	Option 2c	Option 3a	Option 3b
Preliminary Capital Cost Estimate	\$22,800,000	\$155,600,000	\$114,000,000	\$186,500,000	\$19,600,000	\$19,600,000
2050 NPV O&M Cost Estimate	\$75,500,000	\$40,000,000	\$40,000,000	\$40,500,000	\$36,000,000	\$36,000,000
Project Lifecycle Cost	\$98,300,000	\$195,600,000	\$154,000,000	\$227,000,000	\$55,600,000	\$55,600,000
MCA Score	65	66	66	65	95	95
Cost per MCA Scoring Point	\$1,510,000	\$2,960,000	\$2,330,000	\$3,490,000	\$590,000	\$590,000

5. Estimated Ratepayer Impact (**Revised Slide**)

- An initial estimate on the potential, relative impact of each option for an average** customer's bill is summarized below:

Option	Estimated % Impact Range	Reason/Rationale
Option 1	+40%-55%	Debt service for headworks upgrades, Hardening upgrades and the ongoing O+M of a more expensive membrane filtration plant
Option 2A	+330%-345%	Debt service for headworks upgrades, new plant with spray irrigation and the ongoing O+M with lower costs compared to membrane filtration.
Option 2B	+230%-245%	Debt service for headworks upgrades, new plant and piping debt service and lower O+M costs compared to membrane filtration.
Option 2C	+405%-420%	Debt service for headworks upgrades, Ocean Outfall with New Plant debt service and the ongoing O+M with lower costs compared to membrane filtration.
Option 3A	+0%-15%	Lowest capital investment options (debt service) along with headworks debt service and lowest cost O+M.
Option 3B	+0%-15%	Lowest capital investment options (debt service) along with headworks debt service and lowest cost O+M.

**** Please note that the above % impact range only references the sewer portion of an average customer's bill and does not consider further sewer system collection upgrades beyond the scope of the WWTF Long-Range Plan.**

6. Questions

We appreciate and thank you for your attendance and encourage your feedback!



Cape Gazette – Nick Roth Photo

7. Next Stages: Identify Preferred Option

The next steps to advance the Lewes WWTF Long Range Planning Study and address the underlying issues are as follows:

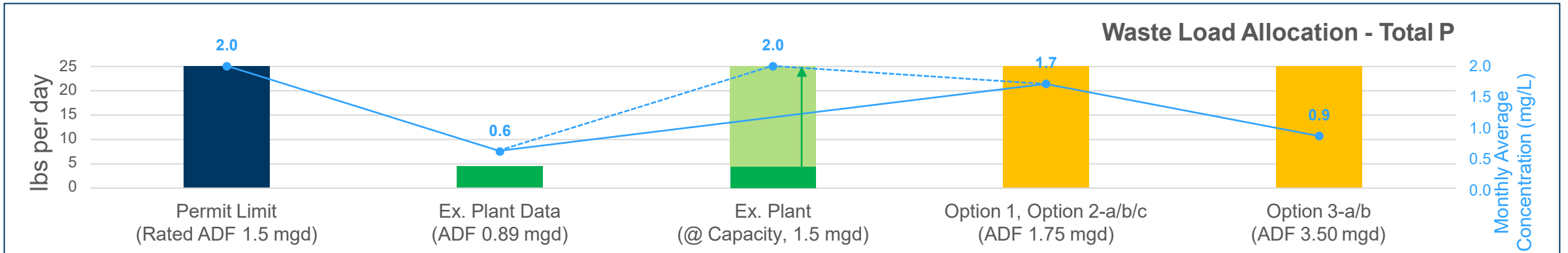
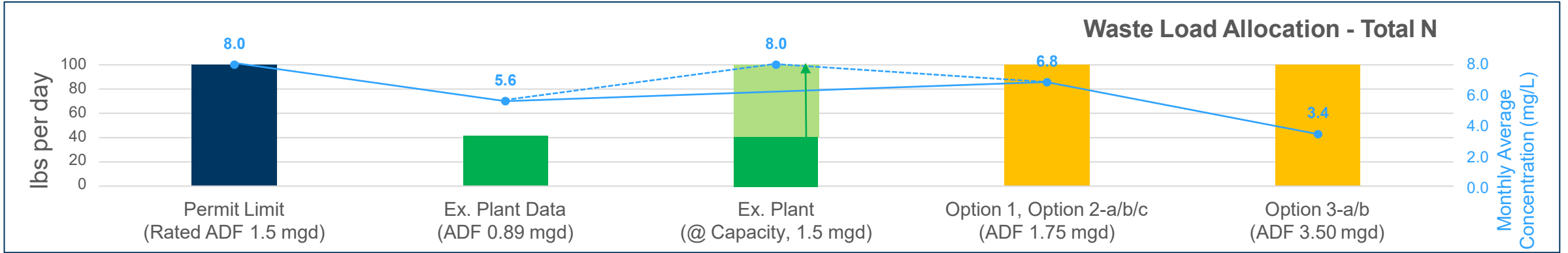
1. BPW requests that all written comments (both electronically and by mail) from the attendees/ community stakeholders are submitted by February 6th, 2023.
 - A link will be provided on the BPW website to submit comments
2. BPW will include the Long Range Planning Study on the agenda for a further Board meeting and at that time the Board will identify a preferred option for further design development.
 - This meeting is yet to be scheduled but is expected to take place in March 2023.
3. The identified option will advance for further development, including (but not limited to): field investigations, modeling, conceptual design and permitting design stages.
 - If an Option 3 concept is the identified option, the County have indicated that Canal Modeling and a Hydrogeological Site Evaluations will be one of the next critical tasks

Appendix A – Water Quality Criteria

- The Design Criteria for all of the upgrade concepts with regards to treated effluent water quality is:
 - **The future WWTF will meet all of the conditions of the existing NPDES permit**
- Option 1 concept (improve existing WWTF) would maintain the existing Membrane Bioreactor (MBR) treatment process
- All Option 2 and Option 3 concepts would include a new Activated Sludge Treatment facility with Tertiary Effluent Filtration
- Existing WWTF (MBR) performance for pH, Enterococcus, TSS and BOD is consistently well below the Permit Limits
 - **A similar level of performance can be achieved with an Activated Sludge Process**
- Existing WWTF maintains Total N and Total P concentrations within the Permit Limit
 - Ex. WWTF currently operates at 60% capacity, when flows increase the nutrient concentrations trend towards the permit limits
 - **Future WWTF (for all Options) will maintain lower Total N and Total P concentrations in order to meet the Permit Conditions – see next slide**

Parameter	Existing WWTF Performance [Sep '20 to Sep '21]			Permit Limit
	Min.	Ave.	Max.	
pH	7.1	7.3	7.5	6 - 9
Total Nitrogen (mg/L)	3.5	5.6	7.7	8 (daily av.)
Total Phosphorous (mg/L)	0.05	0.59	1.66	2 (daily av.)
Enterococcus (cfu/100 mL)	0.50	0.89	2.0	10 (daily av.); 104 (daily max)
Total Suspended Solids (TSS, mg/L)	0.25	0.33	0.40	15 (daily av.); 23 (daily max)
Biochemical Oxygen Demand (BOD, mg/L)	1.2	1.2	1.3	15 (daily av.); 23 (daily max)
Average Daily Flow (mgd)	0.39	0.89	1.69	-

Appendix A – Water Quality Criteria



Permit Limit represents the expected performance of the existing WWTF at the rated capacity (1.5 mgd).

Ex. Performance (Sep '20 to Sep '21) when Average Daily Flow was 0.89 mgd (60% capacity).

As flows increase towards the rated capacity, nutrient monthly average concentrations will trend towards permit limits due to reduced retention time in the aeration basins.

The future WWTF will meet all the conditions of the existing discharge permit.

In order to maintain the total waste loads within the existing permit limits at the 2050 Basis of Design flow rates, the new WWTFs will need to maintain TN and TP concentrations below the stated permit limits.

For Option 1 & 2 concepts, this will result in TN and TP concentrations higher than the existing performance data. However, the WWTF currently operates at only 60% of the rated capacity.