SEWER STRATEGIC PLAN

2021-2024

CHARLES TOWN UTILITY BOARD

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Charles Town Utility Board (CTUB)
Sewer Strategic Plan
2021-2024

Adopted:

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EXECUTIVE SUMMARY

Purpose

The purpose of this Sewer Strategic Plan (SSP) is to document the Charles Town Utility Board's (CTUB) existing wastewater collection and treatment system to establish a plan for conveyance of all wastewater that will be generated within the region to the CTUB wastewater treatment plants during current and future periods of growth. The plan will evaluate future plans and implementation strategies both physically and financially. Another major purpose of this SSP is the identification of wastewater peak flows and the evaluation of the capacity of the existing collection and conveyance system to convey these peak flows without backups of wastewater into homes and businesses and without sanitary sewer overflows. The City of Charles Town, by and through CTUB first published a SSP in 2007. The most recent revision to the SSP was approved by CTUB on April 25, 2018. Pursuant to a resolution for a tri-annual SSP update, the current revision serves as the required April 2021 update. The SSP is adopted by the CTUB Board of Directors. Upon adoption, development of actions to implement the SSP can begin. The SSP provides an overall high-level direction to prioritize resources and achieve future success.

Since the adoption of the last SSP, CTUB, through the City of Charles Town, acquired the assets of the City of Ranson Sewer System and the Jefferson County Public Service District. These acquisitions occurred on July 1, 2018 and January 1, 2019, respectively. The wastewater treatment and collection systems of the consolidated regional utility are reviewed herein. Growth has been increasing in the region and will be monitored to ensure that appropriate measures are taken to address future capital improvements, operation and maintenance as well as capacity needs. Growth projections are included in this SSP, and will be, in part, considered in determining the timing of those future capital improvements. Communication with local planning and zoning authorities to acquire accurate growth projections is essential for successful monitoring of growth. This plan details the growth within the system based on growth projections provided by the local planning and zoning agencies.

Scope

The principal issues examined as part of this revision to the SSP include the following:

- Customer satisfaction and public education
- Analyze growth scenarios and develop plant and collection system expansion needs.
- Evaluate the existing wastewater collection system and treatment process in relation to future flows, loads and discharge standards.
- Assess system improvement needs, including capital costs and O&M requirements.
- Develop timeframes associated with necessary system improvements to encompass the plants and collection system.
- Update planning for future sewerage facilities to serve existing and expanded service area.

Plan Updates

CTUB has committed to updating this document on a tri-annual basis. Adjustments to the SSP are based on the condition and performance of the overall system, updated construction data and new information regarding growth. Previously published SSP's serve as guidance to achieve accuracy in planning and to enhance the development of current and historical data. The accuracy of the planning process continues to be enhanced through the development of current data and historical data captured in previous SSP's. CTUB makes every effort to involve customers, officials and stakeholders in this process.

Tri-annual updating is expected to proceed in accordance with the following schedule:

- January New data, information, and comments solicited from stakeholders
- February Plan updated. Board of Directors review DRAFT SSP
- March Draft Plan issued for comments
- April Plan revised, adopted and published

Project Planning

Since the last SSP was adopted, the consolidation of utilities has provided the opportunity to evaluate efficiencies and operational modifications to allow for costs savings and value engineering of capital improvements. This SSP serves as a framework for decision making outlining the specific goals, strategies and objectives for the purpose of planning for future capital improvements based on a 10-year planning period from 2021 to the year 2031. The Renewal and Replacement project detailed below has been discussed in prior SSP's and addresses needs at the CTWWTP and TWWTP as a result of aging infrastructure and critical equipment replacement. There are also numerous collection system projects that are currently designed or in design that will address improved efficiencies and upgrade or decommission pump stations to reduce operation and maintenance costs. Based on analysis of available information the following recommendation outline projected near and long-term improvements:

- Completion of Renewal and Replacement project
    - Charles Town Wastewater Treatment Plant (CTWWTP)
        - One fine screen
        - Grit removal
        - Three (3) influent pumps and control upgrades
        - SBR control panel upgrade
        - UV system upgrade
        - Sludge handling system and building
        - Lime Feed System
        - Main Utility Disconnect, ATS and MCC-1 Replacement
        - Wiring/Conduit and SCADA Replacement
    - Tuscawilla Wastewater Treatment Plant (TWWTP)
        - Two fine screens and channel modifications/Removal of existing fine drum screens
        - MBR Equipment upgrades
- Completion of the 2021 collection system projects
- Fairfax Crossing Parallel Line
- Forrest Avenue Pump Station relocation
- Future - Expansion of CTWWTP from 1.5 MGD to 3.5-4.0 MGD
- Future - Tuscawilla Phase 2 Upgrade to 1.0 MGD.

Project Recommendations

Critical infrastructure upgrades will be detailed in this SPP. This will include a review of completed projects and future capital improvements. Since the last version of the SSP, consolidation of the CTUB, Ranson and JCPSD sewer utilities has been executed which was a monumental accomplishment for the regional utility. Several projects noted above were initiated prior to consolidation and remain necessary for proper operation of the system. In addition to the system wide improvements, it is necessary to begin planning and engineering for expansion of the CTWWTP in the next 10 years.

Financial

The projected costs associated with the projects outlined above are detailed in this plan. CTUB is in the process of initiating a four-step process of rate equalization as well as development of a Capital Improvement Plan that will initiate evaluation of Capacity Improvement fees which may impact how these projects are financed. CTUB continues to pursue a strategy for funding upgrades, and expansions in a manner that will minimize the burden to the current and future ratepayers. The Board intends to fund the costs for the renewal and replacement project and the facility expansions through conventional rate impacts, payment of prior bonds and Capacity Improvement Fees (CIFs). The CTWWTP and TWWTP Phase 2 Upgrade to 1.0 MGD would require separate funding strategies in a future SSP publication. CTUB is also currently developing a class cost of service study to reassess rate and connection fees that need to be implemented to adequately fund operation and maintenance as well as future capital and growth-related projects. If the current sewer rates are insufficient to generate funds prior to the next phase of expansion, the City can consider increasing rates to defray the capital costs.

INTRODUCTION

Background

The Mission of the Charles Town Utility Board (CTUB) is to provide reliable water and sewer services that protect public health and the environment with financial accountability, regional stewardship, and superior customer service. Specific goals and key areas of focus are:

Customer Service – Provide efficient and effective level of service to meet customer and stakeholder expectations.

Environmental Stewardship – Take advantage of opportunities to invest in energy efficiency, renewable energy, water and sustainable practices that protect the environment. Meet all applicable regulatory notification and reporting requirements.

Infrastructure Maintenance – Properly manage, operate and maintain all parts of the wastewater collection system and provide best service in a cost-effective manner to the customer.

Financial Stability – Manage the CTUB finances to support the Utility needs and maintain reasonable sewer rates.

Workforce Planning and Development – Provide team-oriented workforce that is fully trained, fairly compensated, and accountable with clearly defined career paths for the evolving work environment.

Operational Optimization – Improve functions that support the administrative, financial, technical and field activities and provide the best service to the customer.

CTUB is a combined water and sewer utility that provides sanitary sewerage collection and treatment services for approximately 8,015 sewer customers comprising residential, commercial, industrial and public authority entities within the municipalities of the City of Charles Town, the City of Charles Town as well as the surrounding areas within Jefferson County. The County has a population of just over 57,000 and encompasses 212 square miles.

CTUB has a five (5) member Board of Directors that meets twice monthly to consider issues of substance for Utility operations, making recommendations to the Utility Manager regarding infrastructure management, finances and other policy questions. Subsequent to the Utility consolidation, the Board of Directors has representation from the City of Ranson and Jefferson County (including a voting member and non-voting County Commission liaison). The Board of Directors are appointed by the Mayor and Council of the City of Charles Town and serve staggered four-year terms. In addition to the appointment of the Board of Directors, the City of Charles Town is responsible for the following as it pertains to CTUB:

1) Retains ownership of the assets of the system
2) Authorization of all changes in rates and charges for the water and sewer system
3) Issuance of bonds, notes and other debt obligations secured by the gross revenues of the system
4) Approval of capital projects for the water and sewer system which are not in the "normal course of business"; and
5) Approval of real property condemnations for the System.

CTUB has 31 full-time employees, 2 part-time employees and a sewer operating budget of roughly $6 million annually. Infrastructure assets include three (3) wastewater treatment plants, 125 miles (over 100 miles of gravity and over 25 miles of force main) and 47 pump stations.

Utility Consolidation

Consolidation has been discussed for many years and throughout various SSP's. On July 1, 2018 and January 1, 2019, the acquisition of the City of Ranson Sewer system and JCPSD, respectively, by the City of Charles Town were complete. The consolidation efforts included incorporation of both the City of Ranson and JCPSD current rates and charges to the City of Charles Town Sewer Tariff. This acquisition can be attributed to the dedicated agencies and officials from Charles Town, Ranson and Jefferson County that had the foresight to acknowledge the environmental and operational efficiencies as well as economies of scale of utility consolidation. Thanks to all of those that participated in this monumental accomplishment.

Post consolidation, CTUB operates three wastewater facilities: the Charles Town Wastewater Treatment Plant (CTWWTP), the Tuscawilla Wastewater Treatment Plant (TWWTP) and the Deerfield Sewer Treatment Plant (not connected to the larger CTUB system as it serves the Deerfield residential development near Shepherdstown).

CTUB maintains over 125 miles of collection lines and 47 pumping stations which transfer flows from the customer point of connection to the treatment facilities. CTUB has the ability to treat flows interchangeably between the CTWWTP and TWWTP facilities through the Huntfield Transfer Pump stations.

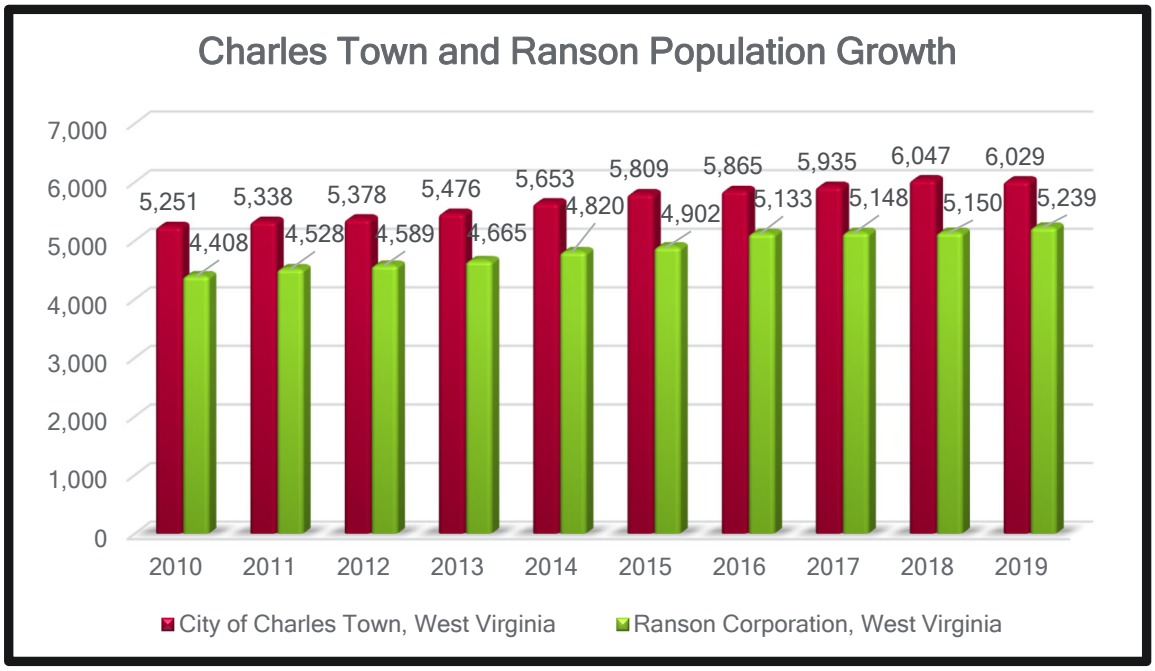
Facilities Plan Summary

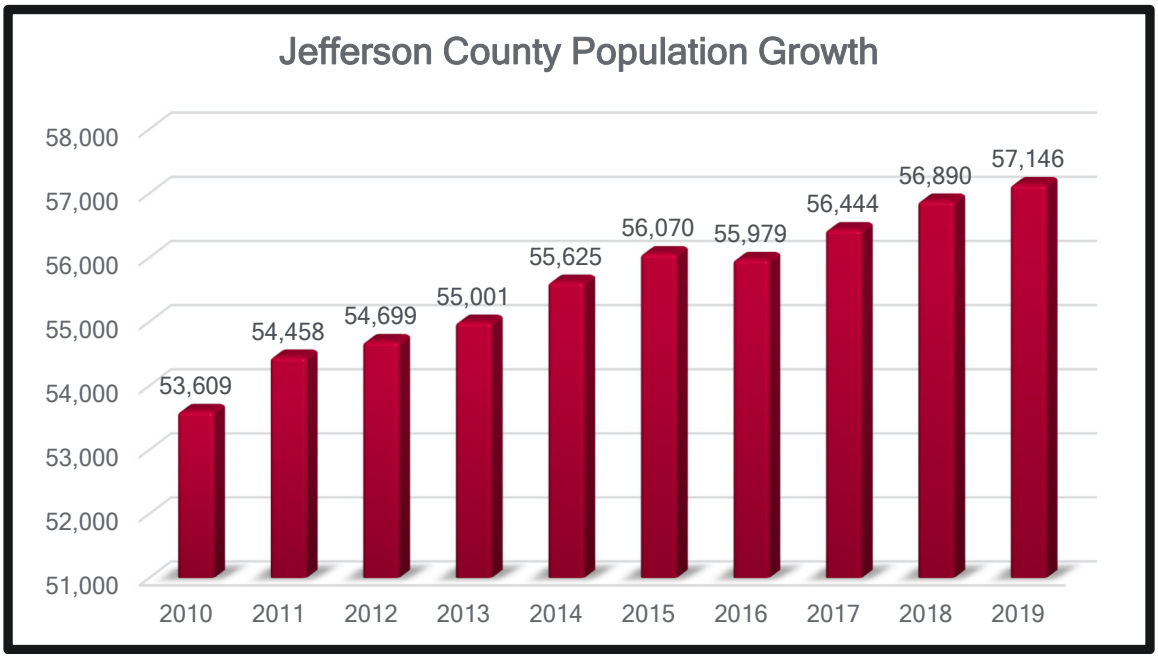
The period used for planning efforts for the Renewal and Replacement projects and 2021 collection system projects are based on a 10-year planning period. This period is the basis for evaluating population growth, estimating treatment capacity requirements, operational needs and evaluating treatment process alternatives. The overall planning period extends from 2021 to 2031 which includes short-term and long-term planning objectives. CTUB intends to complete a sewer master plan in 2021 upon completion of the sewer modeling efforts to assist with development of updated capacity improvement fees requirements and capital improvement projects for the next 15 years. Any capital projects identified in the sewer master plan will be included in future SSP's.

EXISTING CONDITIONS

Regional Growth and Service Area

The City of Charles Town, City of Ranson and Jefferson County have continued to experience consistent growth since the issuance of the last SSP. A demonstrated in the charts below, the growth rates in the region have maintained a steady 1% growth increase on an annual basis:





Reference: Annual Estimates of the Resident Population for Incorporated Places in West Virginia: April 1, 2010 to July 1, 2019 (SUB-IP-EST2019-ANNRES-54). Source: U.S. Census Bureau, Population Division, Release Date: May 2020.

The City of Charles Town, City of Ranson and the Jefferson County Department of Planning, Zoning and Engineering have provided information regarding permits obtained since the issuance of the last SSP. Table 1.1 illustrates the past three years of residential and commercial development data. This historical data shows that an average of 129 residential units are built per year.

Table 1.1 - Development Growth Trend 2018-2020

			New Connections		
Region	**Subdivision**	**Type**	**2018**	**2019**	**2020**
County	Deerfield	Residential	2	1	2
County	Aspen Greens	Residential	10	10	18
County	Beallair	Residential	3	7	3
County	Locust Hill	Residential	6	6	0
County	Walnut Grove	Residential	1	0	2
County	Burr Park	Commercial	2	2	4
County	Somerset	Commercial	1	0	0
County	Cambridge	Residential	0	5	0
County	Woodland MHP	Residential	0	2	0
County	Charles Town	Residential	0	6	4
County	Tuscawilla	Residential	0	1	0
County	Orchard Hills	Residential	0	0	1
Charles Town	CT Limits	Commercial	1	1	1
Charles Town	CT Limits	Residential	6	3	5
Ranson	Ranson Limits	Commercial	0	0	2
Ranson	Ranson Limits	Residential	4	3	1
Ranson	President's Pointe	Residential	0	0	70
Ranson	Shenandoah Springs	Residential	34	30	7
Ranson	Briar Run	Residential	21	31	21
Ranson	Jefferson Crossing	Residential	24	0	36

Total Residential Building Permits	**111**	**105**	**170**
Total Commercial Building Permits	**4**	**3**	**7**

Future Development Projections

In addition to the historical information that was provided, future development forecasts were obtained from the City of Charles Town, City of Ranson and Jefferson County Department of Planning Zoning and Engineering that will be monitored to determine necessary improvements to the sewer system. For the purposes of these future projections and average annual build-out of 20 units per year for larger subdivisions/developments was used based on the historical trends of building within the County. These projections may vary depending on various economic factors such as growth and development trends. Details of the projections are presented in Table 1.2 and known historical data has been utilized for future volumetric capacity forecasting. A full copy of the Development Forecast is included in Appendix A. Refer to Exhibit 1-2 in Appendix C for the location of projected developments.

	Appendix A - CTUB Sewer Strategic Plan 2021-2040 Development Forecast																		
Map Reference	Development	Total Design EDUs	Total Built as of 2021	20 year forecast to be built	Total Flow	Beyond 20 year forecast	Year 1 2021	Year 2 2022	Year 3 2023	Year 4 2024	Year 5 2025	Year 6 2026	Year 7 2027	Year 8 2028	Year 9 2029	Year 10 2030	Years 11-20 2031-2040	TOTAL @ Year 20	TOTAL REMAINING
1	American Heritage (Huntwell)	500	0	500	75,000	200	0	0	0	20	20	20	20	20	20	20	160	300	200
2	Aspen Green	203	46	157	30,450	0	20	20	20	20	20	20	20	17	0	0	0	157	0
3	Beallair	372	112	260	55,800	0	20	20	20	20	20	20	20	20	20	20	60	260	0
4	Blackford Village	338	0	338	50,700	0	0	0	20	20	20	20	20	20	20	20	178	338	0
5	Breckenridge East	300	0	300	45,000	100	0	0	0	0	0	0	0	0	0	0	200	200	100
6	Briar Run	131	122	9	19,650	0	9	0	0	0	0	0	0	0	0	0	0	9	0
7	Burr Industrial Park & Bardane	200	170	30	30,000	0	3	3	3	3	3	3	3	3	3	3	0	30	0
8	Cambridge	134	85	49	20,100	0	5	5	0	0	0	0	0	0	0	0	39	49	0
9	Charles Town Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	50	100	150
10	Clayhill Farm	300	0	300	45,000	20	0	0	0	0	0	20	20	20	20	20	180	280	20
11	Daniels Forest	192	0	192	28,800	0	0	0	0	0	0	20	20	20	20	20	92	192	0
12	Fritts Property	370	0	370	55,500	50	0	0	0	0	20	20	20	20	20	20	200	320	50
13	Harvest Hills	392	6	386	58,800	166	0	0	0	0	0	0	0	0	0	20	200	220	166
14	Huntfield	3,200	421	2,779	480,000	2,459	0	0	0	0	20	20	20	20	20	20	200	320	2459
15	Jefferson Heights North	262	0	262	39,300	122	0	0	20	20	15	15	15	15	15	15	10	140	0
16	Tate Manor	80	0	80	12,000	0	20	20	20	20	0	0	0	0	0	0	0	80	0
17	Lakeland Place / Lloyd's	600	0	600	90,000	220	0	20	20	20	20	20	20	20	20	20	200	380	220
18	Jefferson Orchards	888	0	888	133,200	688	0	0	0	0	0	0	0	0	0	0	200	200	688
19	Langlet	1,000	0	1,000	150,000	800	0	0	0	0	0	0	0	0	0	0	200	200	800
20	Lloyd Property	500	0	500	75,000	300	0	0	0	0	0	0	0	0	0	0	200	200	300
21	Locust Knoll	359	0	359	53,850	59	0	0	0	0	0	20	20	20	20	20	200	300	59
22	Magnolia Springs	300	0	300	45,000	0	20	20	20	20	20	20	20	20	20	20	100	300	0
23	Norborne Glebe	1,050	246	804	157,500	484	0	0	0	20	20	20	20	20	20	20	180	320	484
24	Old Town Ranson - Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	50	100	150
25	Potomac Marketplace	54	0	54	8,100	0	0	5	5	5	5	5	5	5	5	5	9	54	0
26	President's Pointe	1,100	77	1,023	165,000	0	50	50	50	50	50	50	50	50	50	50	523	1,023	0
27	Prospect Place	170	0	170	25,500	0	0	0	0	0	9	9	25	25	25	25	52	170	0
28	Ranson Gateway / Boulevard	1,175	0	1,175	176,250	835	0	0	0	20	20	20	20	20	20	20	200	340	835
29	Shenandoah Springs	705	259	446	105,750	46	20	20	20	20	20	20	20	20	20	20	200	400	46
30	Stolipher	324	0	324	48,600	124	0	0	0	0	0	0	0	0	0	0	200	200	124
31	Washington Landing	274	0	274	41,100	0	0	0	0	50	50	50	50	50	24	0	0	274	0
32	Winchester Cold Storage	675	0	675	101,250	125	0	0	0	0	0	0	0	0	0	50	500	550	125
33	Windmill Crossing	150	146	4	22,500	0	1	1	1	1	0	0	0	0	0	0	0	4	0
	Total Projected Development	**16,798**	**1,690**	**15,108**	**2,519,700**	**7,098**	**178**	**194**	**229**	**339**	**362**	**422**	**438**	**435**	**392**	**438**	**4,583**	**8,010**	**6,976**
* See Exhibit 1-2 Projected Development for locations																			

The housing market in the region has continued in an upward trend with several large housing developments currently under construction. Commercial growth and the completion of the Rockwool Facility since the development of the last SSP have contributed to growth in the CTUB system.

WASTEWATER TREATMENT

Description of Existing Treatment Systems

CTUB operates three wastewater plants: the Charles Town Wastewater Treatment Plant (CTWWTP), the Tuscawilla Wastewater Treatment Plant (TWWTP) and the Deerfield Sewer Treatment Plant. These wastewater facilities are designed to process the wastewater collected throughout the community and return the treated water to the environment. The treat methods included a number of physical and biological processes designed to provide optimal conditions for nutrient removal. CTUB is regulated by the West Virginia Department of Environmental Protection (WVDEP) through the U.S. Environmental Protection Agency (EPA).

Charles Town Wastewater Treatment Plant (CTWWTP)

The CTWWTP is located on WV route 115 in Charles Town. The facility is a Sequencing Batch Reactor (SBR) treatment facility which operates as an Intermittent Cycle Extended Aeration System (ICEAS) and has a hydraulic capacity of 1.75 million gallons per day (MGD). Wastewater treatment components include preliminary treatment consisting of one (1) grinder (Muffin Monster) removed from service on April 8, 2019, one (1) coarse bar screen and compactor, one (1) grit removal system with a washer/compactor, one wet well with three (3) submersible pumps, an influent distribution box, three (3) SBR process trains operated in parallel with chemical addition for phosphorus removal, one (1) post SBR equalization tank, six (6) denitrification filters operated in parallel (currently bypassed) with chemical addition for phosphorus removal and carbon addition for denitrification, one (1) ultraviolet (UV) disinfection system and a utility water system (currently not in use). The solids handling consists of three (3) aerobic digesters operated in parallel, that were converted from secondary clarifiers, one (1) "day tank" digester, one (1) 573,000-gallon aerobic digester (currently not in use), one (1) sludge transfer pump, one (1) belt filter press with conveyor and one (1) lime silo with one (1) dry feed system and screw auger. The belt filter solids are land applied on farms permitted by the WV DEP.

The Charles Town facility originally consisted of primary treatment, activated sludge tanks, secondary settling basins, disinfection by chlorination, aerobic sludge digestion and sand drying beds. The plant was expanded in 1987 to include a third aeration basin and settling basin. Additionally, the plant added an open-channel Ultraviolet Disinfection (UV) unit and a belt filter press with the associated structures. The sand drying beds were removed as part of this expansion.

The plant was upgraded in 2001 and converted the SBR to an ICEAS process. The current influent pump station, headworks building and blower building were also constructed as part of this upgrade. The 573,000-gallon aerobic digester tank was added to the facility during an upgrade in 2005. The digester tank was built to provide additional sludge processing time and increased storage capacity in an effort to produce higher quality solids. Additionally, denitrification filters were installed at the facility in 2016, which included chemical addition facilities for a coagulant for phosphorus precipitation and carbon for denitrification.

The CTWWTP accepts non-domestic wastewater from the Charles Town Water Plant. The Utility Board currently hauls approximately 6,000-9,000 gallons per week of non-domestic liquid

water treatment facility sludge from their existing plant to the CTWWTP digester for processing and thickening. This sludge which is 2-6% solids, consists primarily of river laden material such as sand and dirt along with an aluminum-based coagulant from the sedimentation basins and conventional sand filters. The contents are generally rich in total organic carbon (TOC) from the river source and are difficult to press with the existing Ashbrook belt filter press. The filtrate from the press is returned back to the headworks. The maximum daily permitted volume is 10,000 gallons. The designated NPDES discharge is Outlet No. 001.

The water treatment plant sludge requires a significant amount of polymer addition and adds to the total amount of generated dry tons. It also increases the amount of lime needed for raising the solids pH content. CTUB is currently pursing alternative options to treat and dispose of the water treatment facility sludge. The future plans consist of completely eliminating the sludge from the wastewater treatment facility process.

The CTWWTP operates under the West Virginia NPDES No. WV0022349. The current permit, reissued on July 21, 2016, expires on June 30, 2021. The permit renewal application to WVDEP was submitted in December 2020 and CTUB will be working with WVDEP on the permit renewal in the first half of 2021. The permit renewal will incorporate the CTWWTP and TWWTP along with the JCPSD Permit WV0083461 which includes the Industrial Users connected to the CTUB system.

The CTWWTP is permitted for an annual average flow of 1.75 million gallons per day (MGD). Additionally, if the facility discharges 90% (1.58 MGD) or more of its permitted flow over 3 consecutive months, a Plan of Action must be developed and submitted to the Department. The 2018 monthly average effluent flows for November and December exceeded 1.58 MGD. The monthly average influent flows during 2018 compared to the same month's monthly average effluent flow ranged from 0.239 to 0.808 MGD greater.

This facility serves a population equivalent of approximately 17,500 persons in the City of Charles Town, the City of Ranson and the surrounding areas of Jefferson County and discharges treated wastewater through Outlet No. 001 to Evitts Run, approximately 4.5 miles from its mouth, of the Shenandoah River of the Potomac River.

CTWWTP Flows and Loading

Historical flow and loading data have been compiled and analyzed for the system. This data provides the basis for projecting future flows and loadings to better understand the timing when a capacity restriction may occur at one of the treatment processes and thus must be addressed in order to provide adequate capacity to serve future growth. Table 1.3 summarize the historical and current values for flow for the CTWWTP.

TABLE 1.3: CTWWTP PLANT FLOWS 2018-2020

2018			2019			2020		
	TOTAL	AVERAGE		TOTAL	AVERAGE		TOTAL	AVERAGE
JANUARY	32.66	1.05	JANUARY	51.37	1.66	JANUARY	39.05	1.26
FEBRUARY	30.25	1.08	FEBRUARY	43.72	1.56	FEBRUARY	36.74	1.27
MARCH	32.34	1.04	MARCH	44.32	1.43	MARCH	36.76	1.19
APRIL	31.04	1.04	APRIL	37.29	1.24	APRIL	33.32	1.11
MAY	52.19	1.68	MAY	45.1	1.45	MAY	35.50	1.15
JUNE	39.84	1.33	JUNE	33.83	1.13	JUNE	33.44	1.11
JULY	39.86	1.29	JULY	39.09	1.26	JULY	34.45	1.11
AUGUST	43.63	1.41	AUGUST	33.33	1.08	AUGUST	32.65	1.05
SEPTEMBER	42.24	1.41	SEPTEMBER	30.89	1.03	SEPTEMBER	32.43	1.08
OCTOBER	45.50	1.47	OCTOBER	32.86	1.06	OCTOBER	33.91	1.09
NOVEMBER	50.36	1.68	NOVEMBER	30.65	1.02	NOVEMBER	33.49	1.12
DECEMBER	50.97	1.64	DECEMBER	36.55	1.18	DECEMBER	40.39	1.3
Annual Total	**490.87**	**1.34**	**Annual Total**	**459**	**1.26**	**Annual Total**	**422.13**	**1.15**

Table 1.4 below summarizes the historical plant flow for the CCWWTP from 2016 through 2020. The percent plant capacity on a Maximum 3-month average daily flow basis varied from 71% to 95%. The plant expansion has been noted in the past several SSP's and is further discussed in the future projects section of this SSP. Growth has continued to increase and will be monitored to ensure that appropriate measures are taken to address sewer infrastructure and capacity needs in order to meet the needs of the regional utility.

It should be noted that 2018 was a year of extraordinary rainfall, however the 2019 running average approached the permit conditions as well. Based on this review, there are several optimization efforts that have been recommended by CTUB Engineer's Gwin, Dobson & Foreman in advance of the CTWWTP expansion that may extend the service life of the existing facility, enhance process operations and provide additional capacity and improve treatment efficiencies. These optimization efforts include proper digesting of sludge through the addition of equipment which will reduce costs for sludge handling and disposal.

Table 1.4: Historical Plant Flow CTWWTP

Year	Total Annual Flow (MG)	Annual Average Daily Flow (MGD)	Average Daily Flow (3 month max.)	Permit Capacity (MGD)	Percent Capacity (Average 3 month max/Permit)
2016	419	1.14	1.26	1.75	72%
2017	393	1.25	1.43	1.75	82%
2018	491	1.34	1.67	1.75	95%
2019	459	1.25	1.56	1.75	89%
2020	420	1.15	1.25	1.75	71%

The CTWWTP and TWWTP Facilities share total effluent loading limits to the Chesapeake Bay via Outfall 003. Table 1.5 below details the outlets associated with WV0022349:

Table 1.5: WV/NPDES WV0022349 Outfall Descriptions	
Outfall ID	**Project Description**
001	Charles Town Plant outlet to Evitts Run
002	Tuscawilla Plant outlet regardless of whether it is discharged to Evitts Run or used for spray irrigation
202	Contribution of the total load from the Tuscawilla Plant that is used by the golf course for spray irrigation
203	Contribution of the total load from the Tuscawilla Plant that is discharged directly to Evitts Run through the new effluent line
003	Total load actually discharged to Evitts Run. This is the calculated sum of the loads determined from Outlet 001 and Internal Outlet 203.

The effluent limits for Outfall 001 are listed below in Tables 1.6 through 1.8 and the minimum sampling and monitoring frequencies are listed in Table 1.6. The tables below include the following parameters:

Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Ammonia (NH3), Total Nitrogen (TN) Total Phosphorous (TP). TN and TP concentrations.

Table 1.6: NPDES EFFLUENT LIMITS (OUTLET 001) BOD5, TSS AND AMMONIA-NITROGEN						
Effluent Characteristics	**Monthly Average Loading Rate, lbs./day**	**Weekly Average Loading Rate, lbs./day**	**Max Daily Loading Rate, lbs./day**	**Monthly Average Concentration, mg/L**	**Weekly Average Concentration, mg/L**	**Max Daily Concentration, mg/L**
BOD5	301	N/A	601	20.6	N/A	41.2
TSS*	438	N/A	876	30	N/A	60
Ammonia-Nitrogen as N	60	N/A	120	4.1	N/A	8.2

Table 1.7: TMDL ANNUAL WASTELOAD ALLOCATIONS: NITROGEN AND PHOSPHOROUS			
Effluent Characteristics	Charles Town Plant (Outfall 001)	Tuscawilla Plant (Outfall 203)	Annual Total Load Limit (Outfall 003)
Total Nitrogen	32,115 lbs.	10,740 lbs.	42,855 lbs.
Total Phosphorus	3,577 lbs.	1,790 lbs.	5,367 lbs.

Table 1.8: EFFLUENT LIMITS (OUTFALL OO1); COLIFORM, RESIDUAL CHLORINE, Ph AND D.O.		
Effluent Characteristics	**Maximum**	**Minimum**
Fecal Coliform	200 Counts/100 mL (Geo. Mean) 400 Counts/100 mL (Maximum)	N/A
pH	9	6
Dissolved Oxygen (All Year)	N/A	6.0 mg/L at anytime

Table 1.9: ANNUAL NPDES PERMIT MINIMUM MONITORING REQUIREMENTS (OUTLET 001)		
Effluent Characteristics	**Measurement Frequency**	**Sample Type**
BOD5	Once per week	24-hour composite
BOD5 % Removal	Four per month	Calculated
Total Suspended Solids (TSS)	Once per week	24-hour composite
Suspended Solids % Removal	Four per month	Calculated
Fecal Coliform	Once per week	Grab
pH	Once per week	Grab
Dissolved Oxygen	Once per week	Grab
Ammonia Nitrogen	Once per week	24-hour composite
Total Nitrogen as N (Monthly)	Once per week	24-hour composite
Total Nitrogen as N (Yearly)	Once per year	Calculated
Total Phosphorous (Monthly)	Once per week	24-hour composite
Total Phosphorous (Yearly)	Once per year	Calculated
Total Copper	Once per quarter	24-hour composite
Total Lead	Once per year	24-hour composite
Total Zinc	Once per year	24-hour composite
Total Arsenic as As	Once per year	24-hour composite
Total Cadmium	Once per year	24-hour composite
Hexavalent Chromium	Once per year	24-hour composite
Cyanide	Once per year	Grab
Total Mercury as Hg	Once per month	Grab
Total Nickel	Once per year	24-hour composite
Total Silver	Once per year	24-hour composite
Total Hardness as CaCO3	Once per 6-month period	Grab
Total Aluminum	Once per quarter	24-hour composite
Chloride as Cl	Once per quarter	24-hour composite
Chronic Tox. - Cerlodaphina Dubia	Once per year	24-hour composite
Chronic Tox. - Pimephales Promelas	Once per year	24-hour composite
Flow	Continuous	Measured

Annual effluent loading limits contained in the permit were established under the Chesapeake Bay Total Maximum Daily Load (TMDL) for total nitrogen (TN) and total phosphorus (TP). The Charles Town and Tuscawilla Facilities share total effluent loading limits to the Chesapeake Bay via Outfall 003. The other discharge limits are typical water quality - based limitations developed by the West Virginia Department of Environmental Protection.

Table 1.10: SUMMARY CTWWTP FLOW DATA AND LOADING REVIEW

Flow Type	Measurement Frequency	Remarks
Minimum Hourly Flow *	0.138	Minimum daily flow for the period from January 2016-December 2019
Monthly Average Flow*	1.5	Monthly average flow for the period from January 2016- December 2019
Permitted Plant Capacity*	1.75	WVDEP Permitted Plant Capacity
Permitted Maximum 3 Month Average Flow	1.58	90% Permitted Plant Capacity
Maximum Monthly Average Flow*	2.22	Maximum monthly average flow occurred in September 2018
Maximum Weekly Flow	1.39	Log Pearson Type III analysis of 50% probability occurrence of all from January 2016 through December 2019 flow events
35% Probability Occurrence, Peak Flow	1.55	Log Pearson Type III analysis of 35% probability occurrence of all from January 2016 through December 2019 flow events
20% Probability Occurrence, Peak Flow	1.9	Log Pearson Type III analysis of 20% probability occurrence of all from January 2016 through December 2019 flow events
Maximum 3 month Running Average	2	Log Pearson Type III analysis of 9% probability occurrence of all from January 2016 through December 2019 flow events
Maximum Daily Flow	2.2	Log Pearson Type III analysis of 5% probability occurrence of all from January 2016 through December 2019 flow events
Peak Hourly Flow	2.56	Log Pearson Type III analysis of 2% probability occurrence of all from January 2016 through December 2019 flow events
Peak Instantaneous Flow*	4.34	Maximum system flow of 4.339 MGD recorded from January 2016 through December 2019

Tuscawilla Wastewater Treatment Plant (TWWTP)

The TWWTP is a Biological Nutrient Removal (BNR) intergraded with a Membrane Bio-Reactor (MBR) treatment facility having a hydraulic capacity of 0.50 million gallons per day (MGD). Wastewater treatment components include preliminary treatment consisting of one (1) coarse bar screen and compactor, one (1) grit removal system with a washer/compactor, one (1) flow equalization impoundment, one (1) wet well with four (4) submersible pumps and two (2) fine drum screens and compactor, two (2) BNR process treatment trains operated in parallel, chemical addition for phosphorus removal and carbon addition for denitrification, three (3) MBR basins operated in parallel, one (1) ultraviolet (UV) disinfection system and a utility water system. The solids handling consists of an aerobic digester. Liquid aerobic sludge is transported to the CTWWTP for further processing and disposal. The facility primarily serves the Tuscawilla Hills Subdivision and Locust Hills area. Treated wastewater is discharged to the Tuscawilla Golf Course ponds and irrigation system (to the west) and also into Evitts Run, which is a tributary to the Shenandoah River, via a pumping system (to the east). The upgraded TWWTP has been in operation since 2014. In August of 2020 the MBR filters in Basin #3 were replaced with Toray Filters. The TWWTP operates under the West Virginia NPDES No. WV0022349. The current permit, reissued on July 21, 2016, expires on June 30, 2021. The permit renewal application to WVDEP was submitted in December 2020 and CTUB will be working with WVDEP on the permit renewal in the first half of 2021. The permit renewal will incorporate the CTWTTP and TWWTP along with the JCPSD Permit WV0083461 which includes the Industrial Users connected to the CTUB system. The TWWTP is permitted for an annual average flow of 0.5 million gallons per day (MGD).

TWWTP Flows and Loading

Historical flow and loading data have been compiled and analyzed for the system. This data provides the basis for projecting future flows and loadings to better understand the timing when a capacity restriction may occur at one of the treatment processes and thus must be addressed in order to provide adequate capacity to serve future growth. Table 2.1 summarize the historical and current values for flow, BOD, TSS, NH3, TN and TP concentrations.

TABLE 2.1: TWWTP PLANT FLOWS 2018-2020

2018		
	TOTAL	AVERAGE
JANUARY	4.00	0.13
FEBRUARY	3.52	0.13
MARCH	3.71	0.12
APRIL	3.79	0.13
MAY	6.29	0.20
JUNE	8.27	0.28
JULY	5.97	0.19
AUGUST	7.42	0.24
SEPTEMBER	8.94	0.30
OCTOBER	7.10	0.23
NOVEMBER	10.90	0.36
DECEMBER	8.31	0.27
Annual Total	**78.22**	**0.21**

2019		
	TOTAL	AVERAGE
JANUARY	6.25	0.2
FEBRUARY	4.98	0.18
MARCH	7.53	0.24
APRIL	5.28	0.18
MAY	7.88	0.25
JUNE	3.75	0.12
JULY	4.2	0.14
AUGUST	3.75	0.12
SEPTEMBER	3.64	0.12
OCTOBER	3.97	0.13
NOVEMBER	3.66	0.12
DECEMBER	0.35	0.01
Annual Total	**55.24**	**0.15**

2020		
	TOTAL	AVERAGE
JANUARY	0	0
FEBRUARY	0	0
MARCH	0	0
APRIL	0	0
MAY	0	0
JUNE	0	0
JULY	0	0
AUGUST	1.09	0.16
SEPTEMBER	0	0
OCTOBER	0	0
NOVEMBER	0	0
DECEMBER	0	0
Annual Total	**1.09**	**0.013**

Table 2.2 summarizes the historical plant flow for the TWWTP from 2016 through 2020. The percent plant capacity on a Maximum 3-month average daily flow basis varied from 35% to 65%.

Table 2.2: Historical Plant Flow TWWTP

Year	Total Annual Flow (MG)	Annual Average Daily Flow (MGD)	Average Daily Flow (3 month max.)	Permit Capacity (MGD)	Percent Capacity
2016	49	0.13	0.32	0.5	65%
2017	48	0.14	0.28	0.5	56%
2018	78	0.21	0.31	0.5	63%
2019	55.24	0.15	0.22	0.5	45%
2020	1.09**	0.16	0.16	0.5	32%

* Data for 2013 and 2014 are excluded due to start-up of the new facility.

** TWWTP was offline for the majority of 2020 due to MBR replacement

Table 2.3: NPDES EFFLUENT LIMITS (OUTLET 002) BOD5, TSS AND AMMONIA-NITROGEN

Effluent Characteristics	Monthly Average Loading Rate, lbs./day	Max Daily Loading Rate, lbs./day	Monthly Average Concentration, mg/L	Max Daily Concentration, mg/L
BOD5	42	83	10	20
TSS*	125	250	30	60
Ammonia-Nitrogen	8.3	16.7	2	4

Table 1.7: TMDL ANNUAL WASTELOAD ALLOCATIONS: NITROGEN AND PHOSPHOROUS

Effluent Characteristics	Charles Town Plant (Outfall 001)	Tuscawilla Plant (Outfall 203)	Annual Total Load Limit (Outfall 003)
Total Nitrogen	32,115 lbs.	10,740 lbs.	42,855 lbs.
Total Phosphorus	3,577 lbs.	1,790 lbs.	5,367 lbs.

Table 2.4: EFFLUENT LIMITS (OUTFALL OO2); COLIFORM, RESIDUAL CHLORINE, Ph AND D.O.

Effluent Characteristics	Maximum	Minimum
Fecal Coliform	200 Counts/100 mL (Geo. Mean) 400 Counts/100 mL (Maximum)	N/A
pH	9	6
Dissolved Oxygen (All Year)	N/A	6.0 mg/L at anytime

Annual effluent loading limits contained in the permit were established under the Chesapeake Bay Total Maximum Daily Load (TMDL) for total nitrogen (TN) and total phosphorus (TP).

Nutrient offsets continue to enhance the City's ability to expand wastewater treatment capacity in light of the nutrient removal requirements of the Chesapeake Bay Program. Because the Tuscawilla WWTP is adjacent to the Locust Hills Golf Course, a portion of its effluent flow is utilized for course irrigation. Telemetry triggers the use of the Tuscawilla Effluent Line for direct discharge to Evitts Run (Outlet 203) when flows exceed Golf Course irrigation use.

Annual reports are submitted to WVDEP for reporting period September through August. Table 2.5 demonstrates CTUB's ability to achieve Chesapeake Bay nutrient limits:

Table 2.5: Nutrient Reporting

Year	CTWWTP Nitrogen lbs/year	CTWWTP Phosphorous lbs/year	TWWTP Nitrogen lbs/year	TWWTP Nitrogen lbs/year	Total Nitrogen (Outlet 003) ***Annual Limit 42,855***	Total Phosphorous (Outlet 003) ***Annual Limit 5,367***	Golf Course Total Nitrogen (Outlet 202)	Golf Course Total Phosphorous (Outlet 202)
2016-2017	20,755	1,396	1,633	254	20,922	1,422	1,466	228
2017-2018	20,544	1,523	1,623	303	21,260	1,675	906	151
2018 - 2019	23,235	1,898	3,410	709	26,250	2,351	395	256
2019-2020	29,699	2,520	1,185	194	29,701	2,520	1,183	194

Deerfield Treatment Plant

The Deerfield Sewer Treatment Plant is located off Route 480 on Southpaw Lane between Route 9 and Shepherdstown. The facility consists of two adjacent Ashco re-circulating sand filter wastewater treatment plants, one pump station and twelve septic tanks with associated piping. The effluent from this system is distributed just below ground level into two disposal fields.

The Deerfield operates under the West Virginia Department of Environmental Protection Underground Injection Control Permit No. 1503-20-037. The current permit was renewed in December 2020 with an expiration date of 2026. The monitoring requirements are detailed in Table 3.1:

Table 3.1: DEERFIELD PERMIT MINIMUM MONITORING REQUIREMENTS

Effluent Characteristics	Measurement Frequency	Sample Type
Dissolved Oxygen	Once per 6 months	Grab
BOD, 5-day	Once per 6 months	Grab
Total Suspended Solids (TSS)	Once per 6 months	Grab
Total Nitrogen	Once per 6 months	Grab
Total Phosphorous	Once per 6 months	Grab
Flow	Once per 6 months	Grab
Fecal Coliform	Once per 6 months	Grab
pH	Once per 6 months	Grab

Performance and Capacity of Existing Treatment Systems

Effluent results indicate that both the CTWWTP and TWWTP facilities produce effluent water quality consistently meeting the permit requirements. The effluent data demonstrates that BOD and TSS concentrations are generally below the 30-day average permit value. Average monthly effluent NH3 concentrations are also observed to be below the minimum daily maximum permit values.

Flow projections for the CTWWTP indicate expansion improvements will be necessary within the next ten years. The 2018 SSP indicated expansion of the CTWWTP to 2.25 MGD and a potential future expansion of the TWWTP Phase 2 Expansion to 1.0 MGD. Based on the data in Table 1.10, growth projections in Table 1.2 and Appendix A, CTUB will begin preliminary evaluation of options for regional wastewater facility needs and expansion in 2024/2025 based on the extensive time required to design and permit a substantial plant upgrade. It is anticipated that the CTWWTP upgrade may need to be increased based on growth projections to 3.5 – 4.0 MGD. This is substantiated by the flow data and anticipated growth in the region.

Nutrient Management

Nutrient Management continues to be critical in the regulatory permitting and treatment of sanitary sewer. Previous versions of the SSP documented the history of the implementation of US Environmental Protection Agency (USEPA) 2010 Chesapeake Bay Watershed Initiative. As a headwater partner in the Chesapeake Bay Program, West Virginia established permitted Total Nitrogen and Total Phosphorous pounds. CTUB continues to follow changes in the regulatory requirements to determine necessary changes that may be forthcoming in the Watershed Implementation Program (WIP). CTUB is compliant with nutrient management requirements. CTUB must report nutrient removal for the annual period September 1 to August 31. Table 4.1 depicts permitted pounds and actual pounds removed for the period 2017 through current reporting.

Table 4.1: Nutrient Management

	Total Permitted Nitrogen (lbs/yr)	Total Reported (lbs/yr)	Total Permitted Phosphorous (lbs/yr)	Total Reported (lbs/yr)
2017-2018	42,855	21,260	5,367	1,675
2018-2019	42,855	26,250	5,367	2,351
2019-2020	42,855	29,701	5,367	2,520

Forecasted capacity must now also be based on nutrient limitations. In addition to volumetric capacity, nutrient limits will be a factor in determining the timing of capital projects. The ability to achieve the reported levels, as shown in Table 4.1, will eliminate the need for the CTWWTP Nutrient Removal Phase 2 Project.

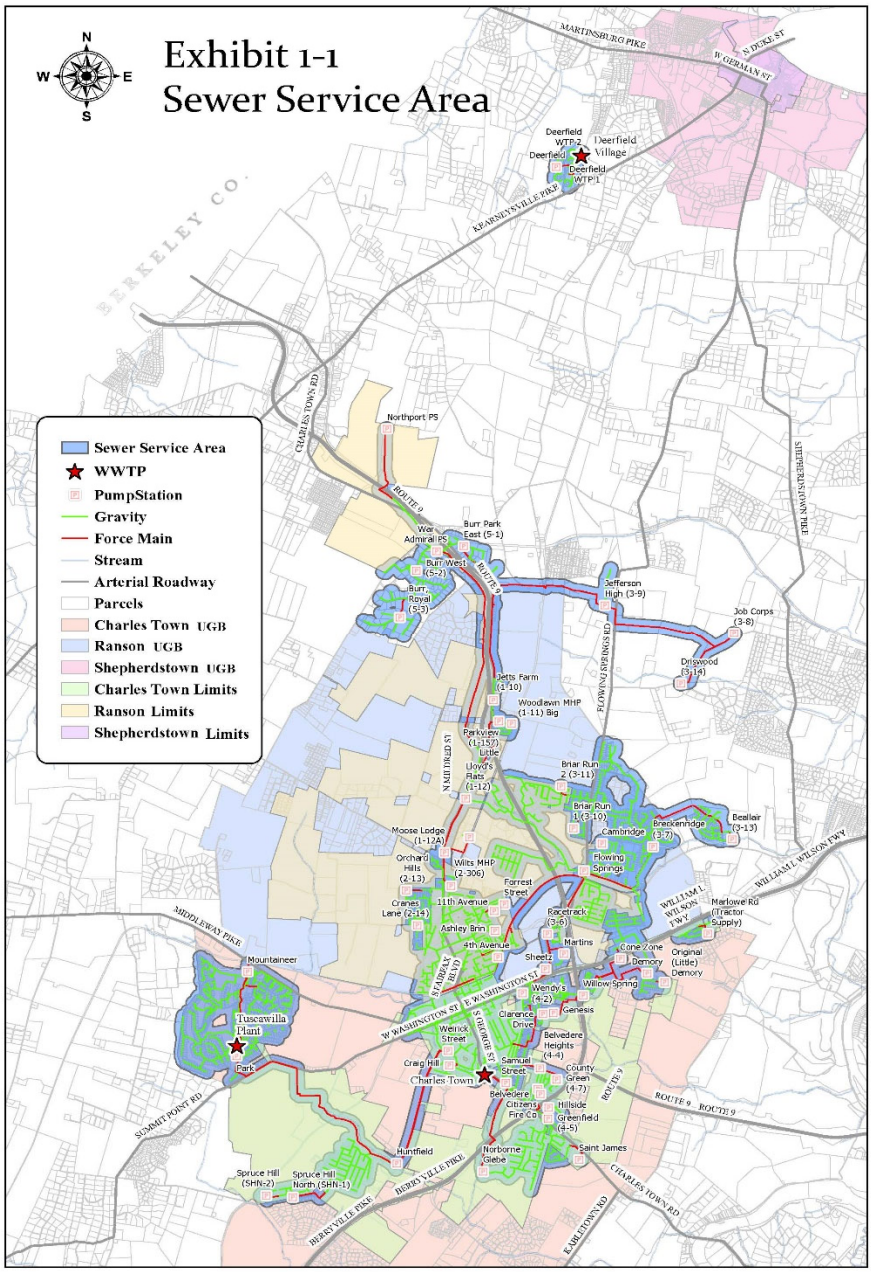
Sludge Disposal

Sludge Management is covered under the West Virginia NPDES No. WV0022349. The current permit, reissued on July 21, 2016, expires on June 30, 2021. The permit renewal application to WVDEP was submitted in December 2020 and CTUB will be working with WVDEP on the permit renewal in the first half of 2021. The permit renewal will likely incorporate provisions for alternatives to the current process for sludge disposal as the approved land application site owners may not wish to continue the partnership after the current agreement term ends in August 2022. Alternatives may include other land application sites or landfill disposal. These alternatives and costs will be reviewed in 2021. The requirements for sludge management reporting are

extensive and are covered in the permit. The Charles Town Plant currently accepts all of the waste sludge from Tuscawilla as well as the water treatment plant process waste. An upgrade to the sludge process is included with the Renewal and Replacement project. Additionally, the waste from the water treatment plant creates operational issues at the Charles Town Plant. Alternative disposal methods will be considered in 2021.

COLLECTION SYSTEM, TRANSMISSION MAINS AND PUMP STATIONS

CTUB provides wastewater service to over 8,000 sewer customers through a network of collection and transmission systems through over 125 miles (over 100 miles of gravity and over 25 miles of force main) and 47 pump stations to the three (3) treatment facilities noted in the previous section. Refer to Exhibit 1-1 and Appendix B for the current collection system service area and pump station locations. The service has been expanded to include the Route 9 Sewer Project from the latest SSP. This area extends up Route 9 towards Martinsburg approximately 3 miles from previous service boundary.



Collection System and Pumping Stations

The collection system includes gravity and force mains that range from 1.5 to 24 inches in diameter. The collection system comprises of varying pipe materials including asbestos-cement, clay, ductile, cast and PVC piping. There are significant portions of the collection system that are aging and will likely need of repairs or replacement. A sewer hydraulic model was completed in January 2021 that identified several portions of the conveyance system that may need to be addressed due to capacity concerns. Specifically, the study identified capacity concerns along the Evitt's Run interceptor as well as the gravity line through Jefferson Memorial Park. Additionally, studies have focused on manholes structures throughout the system that need to be repaired or replaced in the near future. To the extent possible these will be achieved within the annual operation and maintenance budgets. CTUB will continue to perform flow monitoring throughout the system to assess capacity constraints.

Pump stations and force mains are used to pump flows to another gravity collection system, to a master pump station or directly to the wastewater treatment facilities. There are 47 pump stations in the CTUB system. As a result of utility consolidation, efficiencies have been realized that allow for the installation of gravity sewer mains and decommissioning of pump stations. Where possible, the efficiencies will be pursued to reduce overall operation and maintenance expenses. To the extent possible these projects may be performed in-house to reduce overall project costs. Since 2019, two pump stations have been decommissioned resulting in significant operation and maintenance expenses. In the next two years, CTUB expects to decommission another four (4) pump stations with construction of gravity lines. One (1) new pump station is anticipated to be added in Magnolia Springs.

Fats, Oils and Grease

Overflows and sewer backups are commonly caused by fats, oil and grease (FOG). FOG gets into the sewer from household drains and neglected grease interceptors at businesses and restaurants. The FOG blocks sewer pipes, causing health hazards and leading to expensive fixes. CTUB will focus on community education and outreach to reduce the damage to the utility sewer system.

Inflow and Infiltration

Inflow occurs when stormwater flows directly into the sewer collection system. This may be through a manhole cover, or a cross connection between a storm drain and the sewer collection system. Infiltration is typically caused by ground water entering the collection system at defects in mains, laterals or manholes. CTUB has initiated efforts to evaluate Inflow and Infiltration (I&I) in the combined system with a most recent smoke testing study completed in 2019. Staff is working on completing all recommendations in the Condition Assessment Report which included repairs to laterals, mains and manholes to address I&I. Another component that remains to be addressed is disconnection of any cross connections of storm drains to the sewer system which are considered illegal connections. CTUB is working with the City of Charles Town staff and officials to determine the appropriate enforcement actions to remove the illegal connections from the sewer system.

PROJECT REVIEW

Completed Projects

Since the last issuance of the SSP, significant improvements have been made throughout the treatment and collection system. Necessary upgrades and improvements to the CTWWTP and TWWTP were completed to address WVDEP Inspection requirements as well as operation and maintenance improvements to the collection and pump station network have been made as a result of consolidation into a regional utility. These improvements include elimination of pump stations through installation of gravity lines which reduce operation and maintenance expenses as well as projects that address rehabilitation of aging pump stations and lines to further reduce utility expenses.

Table 5.1: Projects Completed since 2018 SSP

Year	Project Description
2018	CTWWTP Basin Lining
2018	New Gorman Rupp pump installation at Park Pump Station
2019	New Pump installation at Flowing Springs Pump Station
2019	Smoke Testing Efforts completed, including 122,025 linear feet of sewer mains, manholes and cleanouts.
2019	Orchard Hills Pump Station rehabilitation
2019	Cranes Lane Pump Station rehabilitation
2020	Route 9 Sewer Project Completed. Including two pump stations, 9,400 linear feet of gravity line and 16,000 linear feet of forcemain.
2020	Decommissioning of Euclid Pump Station
2020	Decommissioning of Parkview MHP Pump Station
2020	Installation of MBR Filters in Basin #3 at Tuscawilla Plant

It should be noted that with the completion of the Route 9 Sewer Project noted in Table 5.1, as well as the consolidation of utilities, a project to divert flows from the northern region into the Route 9 sewer line can be completed which will allow for additional capacity in other portions of the sewer system. This project is detailed in the *Current Development and Projects* section herein.

Additionally, as noted above CTUB has completed a first phase of a hydraulic wastewater model through RK&K Engineers. This model includes the larger diameter portions of the collection system along with all of the pump stations. Hydraulic models are generally used to assist with identification of areas where additional capacity is needed to convey projected long-term flows to the treatment facilities. As this hydraulic model was recently completed at the end of 2020, CTUB staff will be evaluating the results of this model over the next several months to identify additional capital improvements needed for the collection system likely after adoption of this SSP.

Current Development and Projects

There are numerous on-going sewer projects that CTUB is evaluating:

Inflow and Infiltration Studies

CTUB has completed a first phase of Inflow and Infiltration (I&I) investigation, through smoke testing, in selected areas of the collection system. The study which was conducted by Hydrostructures in 2019 identified numerous defects in the sewer system that needed to be repaired or investigated further. CTUB is nearly 95% complete with these efforts and will likely focus on other aging segments of the system to conduct similar studies with the goal of reducing I&I.

Sewer Modeling Efforts

CTUB completed an initial step in sewer modeling efforts late in 2020 that considered the larger portions of the system along with the pump stations. The model will be evaluated to determine where bottlenecks and capacity issues may exist in the system as funding allows. This effort aligns with recent projects such as cooperative efforts with the Magnolia Springs Development which have afforded operation and maintenance cost savings through upsizing of a new pump station and ability for CTUB to decommission two (2) existing upstream pump stations that would have required significant upgrades in coming years.

Shenandoah Junction Public Sewer Corporation (SJPS)

This private sewer corporation has expressed interest to connect to the CTUB system. This request will require payment of CIF's to CTUB, decommissioning of the existing wastewater plant and construction of a pump station by SJPS. The connection of 187 customers has been evaluated and the connection can be made with no modification of the existing CTUB system. It is unknown at this time when this connection might be made.

Cave Quarter Estates Utility Acquisition and Development Expansion

CTUB has evaluated route alternatives and cost for extending service to Cave Quarter Estates that includes 45 existing homes and 140 proposed single-family homes. While this development has not been annexed into the City of Charles Town, this land is in the Charles Town Growth Boundary. Connection to public water and sewer could be viable with the extension of services to and through adjacent annexed parcels. It is unknown at this time when this connection might be made.

2021 Collection System Project (formerly JCPSD Flowing Springs Project/Modified Flowing Springs Plan)

On March 23, 2017, the WV PSC issued an Order in CASE NO. 16-0616-PSD-PC-CN wherein the Commission granted the application for a certificate of convenience and necessity and approved a Post-Project rate increase. Funding for the Project consisted of (i) a $3,575,000 USDA RD loan at a 2.5 percent interest rate over 40 years. And (ii) a DEP SRF loan of $2,844,984 at .25 percent interest, and a .25 percent administrative fee for a term up to 40 years, and debt forgiveness in the amount of $500,000 per the January 17, 2017 DEP assurance letter. During the consolidation of utilities, CTUB committed to the WV PSC completing necessary components of the Flowing Springs project through submission of a Modified Flowing Springs Plan in March 2018. Since the utility consolidation and completion of the Route 9 sewer project, CTUB has evaluated efficiencies and operational alternatives to significantly reduce components and costs of the Modified Flowing Springs Plan. The Flowing Springs Project and Modified Flowing Springs plan have evolved into a 2021 Collection System projects which consists of necessary improvements to the CTUB collection system. The Route 9 Sewer Project is now complete, with the exception of minor punch-list items, to serve the Rockwool Facility and adjacent Jefferson Orchards property customers along the Route 9 corridor. The construction of this project allows for diversion of flows from northeastern region to the new Route 9 sewer infrastructure thereby freeing up capacity in other segments of the system for future customers. Table 5.2 includes a summary of the anticipated components and costs of this project.

Forrest Avenue Pump Station Relocation and Fairfax Crossing Parallel Gravity Project

As part of the acquisition of the City of Ranson Sewer System in July 2018, some preliminary evaluation of collection system improvements were anticipated to include approximately $2 million in projects. One of the projects included the relocation of the existing Forrest Avenue Pump station along with provisions for future capacity for areas within the sewer shed that could flow to the pump station. Additionally, as a result of the Route 9 Sewer project alignment easement acquisition through the Fairfax Crossing/Potomac Marketplace, CTUB committed to the installation of a parallel 10" gravity line from the railroad track bordering the western boundary of Fairfax Crossing to Route 9. This will include the installation of approximately 2,600 linear feet of 10" gravity line. Table 5.2 includes a summary of the anticipate components and costs of this project.

2021 Renewal and Replacement Project for CTWWTP and TWWTP

In 2019 Gwin, Dobson and Foreman (GDF) prepared an assessment of the CTWWTP and TWWTP facilities which indicated several opportunities for optimization and improvement as follows:

- Headworks screening at both plants are in need of upgrades. Operations at the Charles Town Plant are severely hindered by poor headworks screening and the previous operation of a grinder ahead of the screen. Fine and stringy material is passing through the headworks screen which leads to debris accumulation downstream and is causing havoc on the treatment units. Given the age and current operating condition of the grit system at Charles Town, a new grit removal facility should be considered. The Tuscawilla Plant requires improved fine screening equipment due to current screening operational and maintenance issues.

- The influent and effluent pump stations as well as the UV disinfection system at the Charles Town Plant are in need of replacement, as the units have reached the end of useful life.
- The membrane modules at the Tuscawilla Facility are in need of replacement due to excessive sludge buildup and irreversible fouling. It is recommended to implement a membrane module and hose replacement program along with enhanced cleaning operations and process adjustments to maximize membrane life and lower the operating transmembrane pressure (TMP).

- The Charles Town Plant currently accepts all of the waste sludge from Tuscawilla as well as the water treatment plant process waste. There is no backup for the sludge pump or belt filter press at the plant. A redundant dewatering system should be considered in the short term to ensure sludge produced by any of the facilities may continue to be processed during shut down or failure of the sludge pump or belt press. Additionally, the waste from the water treatment plant creates operational issues at the Charles Town Plant. Alternative disposal methods should be considered.
- Both facilities require significant Supervisory Control and Data Acquisition (SCADA) system modifications to improve the treatment process along with additional online instrumentation devices which will aid in plant optimization.

Table 5.2 below illustrates the anticipated costs associated with the 2021 projects:

Table 5.2: 2021 Projects Summary	
Route 9- Northern Region Improvements	
DESCRIPTION	TOTAL COST
RK&K Task 7 Parkview MHP Pump Station Decommission	To be completed in-house
RK&K Task 7 Jett's Farm Option 2: PS and FM Modifications	$362,300.00
RK&K Task 7 Lloyd's Flat Pump Station Decommission	To be completed in-house
RK&K Task 7 Moose Lodge Option 2: Forcemain and PS Mod.	$194,200.00
RK&K Task 4 Northern/Burr Flow Diversion	$580,600.00
Upgrade Existing Ranson FS PS	$300,000.00
Route 9 - Northern Region Improvements Total	$1,437,100.00
Eastern Region Improvements	
Upgrades to Existing Pump Station 3-6	To be completed in-house
Upgrades to Existing Pump Station 4-2	To be completed in-house
Miscellaneous Improvements	
RK&K Task 10 Jefferson Memorial Park forcemain	$200,000.00
Miscellaneous Improvements Sub-Total	$200,000.00
Construction Sub-Total	$1,637,100.00
Contingency (±10%)	$163,710.00
TOTAL CONSTRUCTION COST	$1,800,810.00
PROFESSIONAL FEES - Engineering, Accounting, Legal, etc.	$500,000.00
TOTAL COLLECTION PROJECT COST	$2,300,810.00

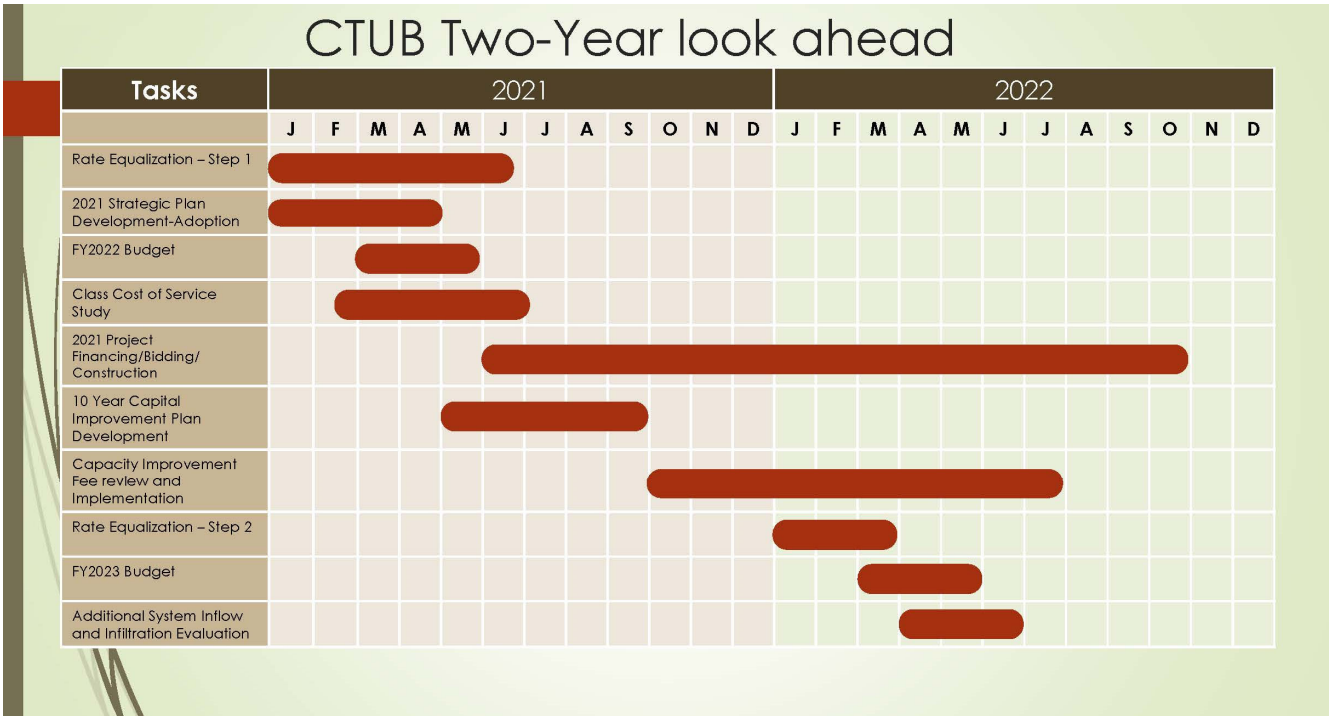
Ranson Projects	
DESCRIPTION	TOTAL COST
Fairfax Crossing parallel 10" gravity line	$650,000.00
Forrest Avenue Pump station relocation/Fairfax Crossing	$615,000.00
Construction Sub-Total	$1,265,000.00
Contingency and Professional Fees (30%)	$379,500.00
TOTAL RANSON PROJECT COST	$1,644,500.00

Renewal and Replacement Project	
DESCRIPTION	TOTAL COST
CTWWTP	$3,000,000.00
TWWTP	$1,063,820.00
TOTAL RENEWAL AND REPLACEMENT PROJECT COST	$4,063,820.00

TOTAL ALL PROJECTS	**$8,009,130.00**

Project Schedule

A forecast of anticipated timeframes for completion of projects noted in the SSP are detailed in the diagram below:



This look-ahead is a forecast of anticipated top level strategic efforts. There are many factors that could affect this timeline.

Future Projects

As part of the consolidation into a regional utility in 2019, CTUB has initiated various efforts that will likely result in future projects that have not been formally vetted to date. As discussed in this SSP, the recent completion of a hydraulic wastewater model may result in additional capital projects for the collection and transmission system. The development of a 10-year Capital Improvement Plan (CIP) Expenditure Plan in conjunction with the evaluation of capacity improvement fees will provide a structure for the completion of these projects. The CIP will prioritize planning projects that are needed as a result of the following factors:

- Regulatory Compliance
- Condition/Probability of Failure
- Consequences of Failure/Risk
- Capacity / System Operational Efficiencies
- Improved Operations and Maintenance costs
- Safety
- Design Life / Best Replacement Practices
- Redundancy / Reliability
- Opportunity Projects
- Development Extensions

The CTUB Asset Management Plan will be updated to assist with the development and maintenance of a CIP.

CTWWTP Plant Expansion

Expansion of the CTWWTP is expected within the next 10 years based on the historical flow data in Table 1.4 as well as the development projections detailed in Table 1.2. Design efforts should be initiated in 2024/2025. In advance of the plant expansion, Gwin, Dobson and Foreman may be engaged to provide recommendations that may provide optimization enhancements to extend the service life of the existing facility, enhance process operations, provide additional capacity and improve treatment efficiencies. These targeted, cost-effective improvements may result in a more robust and reliable process for meeting regulatory standards until such time that a larger and more centralized treatment plant is constructed to meet planning period demands.

There are various factors that need to be evaluated with an expansion of the CTWWTP including location, size, type of facility and environmental protection. An expansion from 1.75 MGD to 3.5/4.0 MGD is estimated to cost between $15 million and $20 million in today's dollars. Every effort will be made to provide the most cost effective design to minimize any burden to ratepayers.

RATE EQUALIZATION, FUNDING AND FINANCIAL OPTIONS

Rate Equalization

During the consolidation of utilities, the City of Charles Town agreed to exercise its best efforts to equalize the rates and charges for water service of all water and sewer customers within 10 years after the closing date. To fulfill this obligation, CTUB and the Charles Town City Council will be working on strategies to initiate a stepped approach to rate equalization within the 1st quarter of 2021.

Rate equalization has an impact on each and every CTUB sewer customer. An added complexity is the equalization of three different utility rates and one having a significantly different rate structure (JCPSD single tier). The Charles Town and City of Ranson rate structures follow the tiered rate approach consistent with the WVPSC Commodity-Demand method which most water and sewer utilities follow in West Virginia. The Commodity-Demand method makes significant use of peak demand factors by customer class and isolates costs that are purely volume related and customer driven. Demand factors are significantly different for customer classes (i.e., residential, commercial). Peaking factors generally significantly decline when comparing the residential class to the commercial and other classes. This approach is the WVPSC recommended, most conventional and fairest for systems with multiple and material customer classes. The importance of this discussion on tiering is that the most practical and needed approach to rate equalization will be to transition the JCPSD single tier structure in a stepped manner to the multiple tiered structures of the City of Charles Town and City of Ranson. In addition to the recommendations below, CTUB staff and its financial advisors recommend maintaining a minimum debt/service coverage ratio of 130%. The debt service coverage ratio required by bondholders for the combined utility is 115%.

As part of the rate equalization process CTUB has authorized the completion of a Class Cost of Service Study which will identify the most appropriate rate structure and rate equality between the customer classes. This should be completed shortly after adoption of this SSP.

Funding and Financial Planning

In addition to the rate equalization discussion, CTUB will be working with the Mayor and City Council on funding options for the projects discussed in this SSP:

- 2021 Renewal/Replacement Project
- 2021 Collection System Projects
- Forrest Avenue Pump Station relocation and Fairfax Crossing Parallel Gravity project

CTUB continues to pursue a strategy for funding upgrades and expansion in a manner that will minimize the burden to the current and future ratepayers. CTUB intends to fund the costs for the above projects through conventional rate impacts, payment of prior bonds and Capacity Improvement Fees. The development of a capital improvement plan will identify future capital purchases that are necessary for the operation of the sewer system. CTUB will be preparing a Capital Improvement Plan that will identify system needs and will aid in the evaluation of the Capacity Improvement fees. This plan and evaluation is anticipated to be underway in 2021.

Future CTWWTP expansion is expected to be necessary within the next 10 years. This will require a significant capital outlay and funding strategies in a future SSP and project discussion. It is anticipated that plant expansion could range from $15 to $20 million.

APPENDIX A – GROWTH PROJECTIONS

Table 1.2 -CTUB Sewer Strategic Plan 2021-2024 Development Forecast																										
Development	Total Design EDUs	Total Built as of 2021	20 year forecast to be built	Total Flow	Beyond 20 year forecast	Year 1 2021	Year 2 2022	Year 3 2023	Year 4 2024	Year 5 2025	Year 6 2026	Year 7 2027	Year 8 2028	Year 9 2029	Year 10 2030	Year 11 2031	Year 12 2032	Year 13 2033	Year 14 2034	Year 15 2035	Year 16 2036	Year 17 2037	Year 18 2038	Year 19 2039	Year 20 2040	Years 11-20 2031-2040	TOTAL @ Year 20	TOTAL REMAINING
American Heritage (Huntwell)	500	0	500	75,000	200	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	160	300	200
Aspen Green	203	46	157	30,450	0	20	20	20	20	20	20	20	17	0	0	0	0	0	0	0	0	0	0	0	0	157	0
Beallair	372	112	260	55,800	0	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	0	0	0	0	0	60	260	0
Blackford Village	338	0	338	50,700	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	18	0	178	338	0
Breckenridge East	300	0	300	45,000	100	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	100
Briar Run	131	122	9	19,650	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0
Burr Industrial Park & Bardane	200	170	30	30,000	0	3	3	3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	30	0
Cambridge	134	85	49	20,100	0	5	5	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	4	0	0	39	49	0
Charles Town Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150
Clayhill Farm	300	0	300	45,000	20	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	180	280	20
Daniels Forest	192	0	192	28,800	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	12	0	0	0	0	0	92	192	0
Fritts Property	370	0	370	55,500	50	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	320	50
Harvest Hills	392	6	386	58,800	166	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	200	220	166
Huntfield	3,200	421	2,779	480,000	2,459	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	320	2459
Jefferson Heights North	262	0	262	39,300	122	0	0	20	20	15	15	15	15	15	15	10	0	0	0	0	0	0	0	0	0	10	140	0
Tate Manor	80	0	80	12,000	0	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0
Lakeland Place / Lloyd's	600	0	600	90,000	220	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	380	220
Jefferson Orchards	888	0	888	133,200	688	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	688
Langlet	1,000	0	1,000	150,000	800	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	800
Lloyd Property	500	0	500	75,000	300	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	300
Locust Knoll	359	0	359	53,850	59	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	300	59
Magnolia Springs	300	0	300	45,000	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	0	0	0	0	100	300	0
Norborne Glebe	1,050	246	804	157,500	484	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	180	320	484
Old Town Ranson - Infill	250	0	250	37,500	150	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	100	150
Potomac Marketplace	54	0	54	8,100	0	0	5	5	5	5	5	5	5	5	5	5	4	0	0	0	0	0	0	0	0	9	54	0
President's Pointe	1,100	77	1,023	165,000	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	73	523	1,023	0
Prospect Place	170	0	170	25,500	0	0	0	0	0	9	9	25	25	25	25	25	27	0	0	0	0	0	0	0	0	52	170	0
Ranson Gateway / Boulevard	1,175	0	1,175	176,250	835	0	0	0	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	340	835
Shenandoah Springs	705	259	446	105,750	46	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	200	400	46
Stolipher	324	0	324	48,600	124	0	0	0	0	0	0	0	0	0	0	20	20	20	20	20	20	20	20	20	20	200	200	124
Washington Landing	274	0	274	41,100	0	0	0	0	50	50	50	50	50	24	0	0	0	0	0	0	0	0	0	0	0	0	274	0
Winchester Cold Storage	675	0	675	101,250	125	0	0	0	0	0	0	0	0	0	50	50	50	50	50	50	50	50	50	50	50	500	550	125
Windmill Crossing	150	146	4	22,500	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
Total Projected Development	**16,798**	**1,690**	**15,108**	**2,519,700**	**7,098**	**178**	**194**	**229**	**339**	**362**	**422**	**438**	**435**	**392**	**438**	**535**	**526**	**495**	**475**	**467**	**435**	**435**	**434**	**408**	**373**	**4,583**	**8,010**	**6,976**

APPENDIX B – EXISTING SERVICE AREA

Exhibit 1-1
Sewer Service Area

N
W
E
S

- Sewer Service Area
- WWTP
- PumpStation
- Gravity
- Force Main
- Stream
- Arterial Roadway
- Parcels
- Charles Town UGB
- Ranson UGB
- Shepherdstown UGB
- Charles Town Limits
- Ranson Limits
- Shepherdstown Limits

MARTINSBURG PIKE
N DUKE ST
W GERMAN ST
Deerfield WTP 2
Deerfield
Deerfield Village
Deerfield WTP 1
KEARNEYSVILLE PIKE
BERKELEY CO.
CHARLES TOWN RD
Northport PS
ROUTE 9
War Admiral PS
Burr Park East (5-1)
Burr West (5-2)
Burr, Royal (5-3)
Jefferson High (3-9)
Job Corps (3-8)
FLOWING SPRINGS RD
Driswood (3-14)
SHEPHERDSTOWN PIKE
Jetts Farm (1-10)
Woodlawn MHP (1-11) Big
Parkview (1-157)
N MILDRED ST
Little Lloyd's Flats (1-12)
Briar Run 2 (3-11)
Briar Run 1 (3-10)
Breckenridge
Cambridge (3-7)
Beallair (3-13)
Moose Lodge (1-12A)
Orchard Hills (2-13)
Wilts MHP (2-306)
Flowing Springs
WILLIAM L WILSON FWY
Forrest Street
Cranes Lane (2-14)
11th Avenue
Racetrack (3-6)
Marlowe Rd (Tractor Supply)
Ashley Brin
4th Avenue
Martins
Sheetz
Cone Zone
Demory
Original (Little) Demory
MIDDLEWAY PIKE
Mountaineer
S FAIRFAX BLVD
E WASHINGTON ST
W WASHINGTON ST
Wendy's (4-2)
Willow Spring
Genesis
Clarence Drive
Weirick Street
S GEORGE ST
Belvedere Heights (4-4)
Tuscawilla Plant
Park
Craig Hill
Charles Town
Samuel Street
County Green (4-7)
Belvedere
Citizens Fire Co
Hillside
Greenfield (4-5)
ROUTE 9
SUMMIT POINT RD
Huntfield
Norborne Glebe
Saint James
Spruce Hill (SHN-2)
Spruce Hill North (SHN-1)
BERRYVILLE PIKE
KABLETOWN RD

APPENDIX C – PROJECTED DEVELOPMENTS

Exhibit 1-2
Projected Developments

Refer to Appendix A for Project reference.