EXHIBIT A

# EXECUTIVE SUMMARY

This new City of Wilsonville (City) Wastewater Treatment Plant (WWTP) Master Plan (the Plan) has been developed to satisfy requirements associated with the State of Oregon Department of Environmental Quality (DEQ) guidance document entitled "Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities." To accommodate future flows and loads, projections were developed based on population projections and referencing WWTP historical data and DEQ wet weather projection methodologies. Similarly, to accommodate future water quality regulations, the Plan is adaptive and considers potential future regulatory changes.

The City prepared the Plan with the goal of developing a capital plan that identifies improvements required through the planning period (today through 2045) to comply with requirements of the WWTP National Pollutant Discharge Elimination System (NPDES) permit and potential future regulatory requirements, while accommodating growth identified in the City of Wilsonville Comprehensive Plan (October 2018, updated June 2020 - the 2018 Comprehensive Plan). These improvements are designed to provide the best value to the City's ratepayers by maximizing the use of existing infrastructure and improving system operation while continuing to protect water quality and human health and supporting economic development, consistent with goals and policies contained in the 2018 Comprehensive Plan and 2021-2023 City Council Goals.

The City's WWTP was originally built in the early 1970's and discharges treated effluent to the Willamette River. The WWTP underwent major upgrades in 2014 to expand the average dry weather capacity to four million gallons per day (mgd) to accommodate the City's continued growth. The WWTP processes include headworks screening and grit removal facilities, aeration basins, stabilization basins, secondary clarifiers, biosolids processing, cloth filtration, and disinfection processes. Additionally, the City contracts with Jacobs for operation of the WWTP, located at 9275 Southwest Tauchman Road.

This Plan identifies improvements taking into consideration:

- The age and condition of existing process equipment and structures,
- Growth in demand for sewer service due to increased population and economic development over the planning period,
- Potential changes to water quality regulations impacting process needs in order to meet effluent limitations and discharge prohibitions imposed by DEQ,
- City of Wilsonville Wastewater Collection System Master Plan (2014, MSA), and
- Consistency with the 2018 Comprehensive Plan and City Council 2023-2025 Strategy 1.

## ES.1 Planning Area Characteristics

Chapter 1 summarizes the City's wastewater service area characteristics relevant to assessing WWTP facility needs. The planning area considered by this Plan is consistent with the City's 2014 Collection System Master Plan and 2018 Comprehensive Plan including the urban growth boundary (UGB). The Basalt Creek Concept Plan, adopted in 2018, resulted in a modification of the future boundary between the cities of Tualatin and Wilsonville relative to the 2014 Wastewater Collection System Master Plan (CSMP). This decision is reflected in Figure ES.1, which shows the Study Area Boundary as analyzed in the 2014 CSMP, with the portion likely to annex to Tualatin now shown outside the current Study Area Boundary.

The northern portion of the City of Wilsonville is located within Washington County, and the majority of the City lies in the southwestern part of Clackamas County.

The City sits within the jurisdictional boundaries of Metro, the regional government for the Portland metropolitan area. By state law, Metro is responsible for establishing the Portland metropolitan area's UGB, which includes Wilsonville. Land uses and densities inside the UGB require urban services such as police and fire protection, roads, schools, and water and sewer systems. A figure of the City's existing land use is presented in Chapter 1. Also presented in

Chapter 1 are the City's physical characteristics, water resources, and population and employment information, which are all significant factors in planning for wastewater conveyance and treatment facilities.

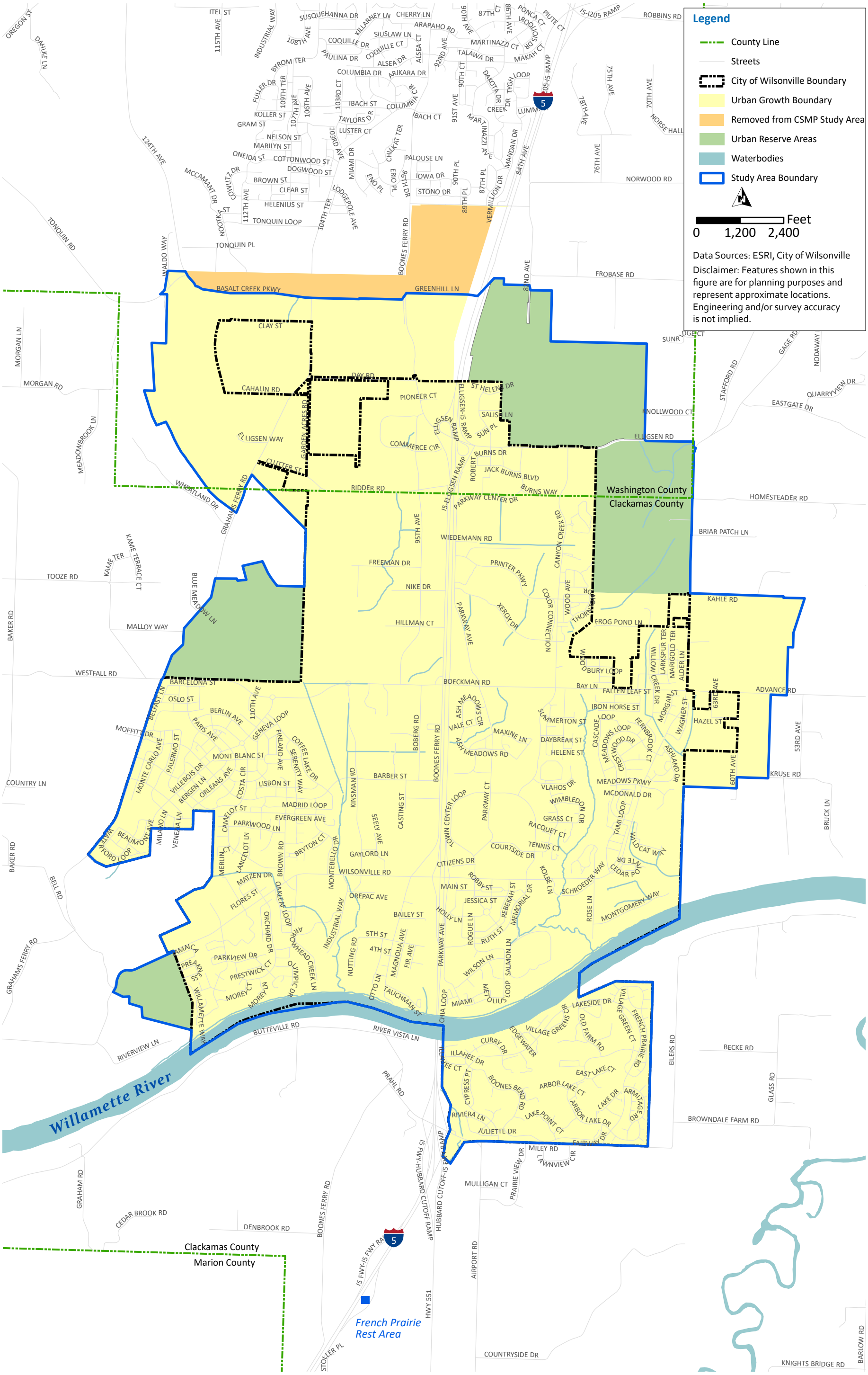




Figure ES.1 Planning Area

The Portland State University Population Research Center (PSU PRC) publishes annual estimates of populations for the previous year for cities in Oregon while Metro develops population projections for the future within the Portland metropolitan area, including Wilsonville. The PSU PRC estimated the City's population as 27,414 in 2022.

The historical per capita flow and loads presented in this master plan are based on the PSU PRC certified population estimates while future flow and load projections are based on the CSMP estimates to maintain consistency with prior water and sewer enterprise planning (with the slight modification to exclude the portion of the Basalt Creek Planning Area (BCPA) mentioned above). Figure ES.2 details the current population along with the historical population and growth expected for the City using the CSMP projections. As is shown in Figure ES.2, the WSMP (2003) assumption of a 2.9 percent growth rate lines up well with the PSU PRC and US census data for the years 2010 through 2022. Current and future population are described in greater detail in Chapter 3.

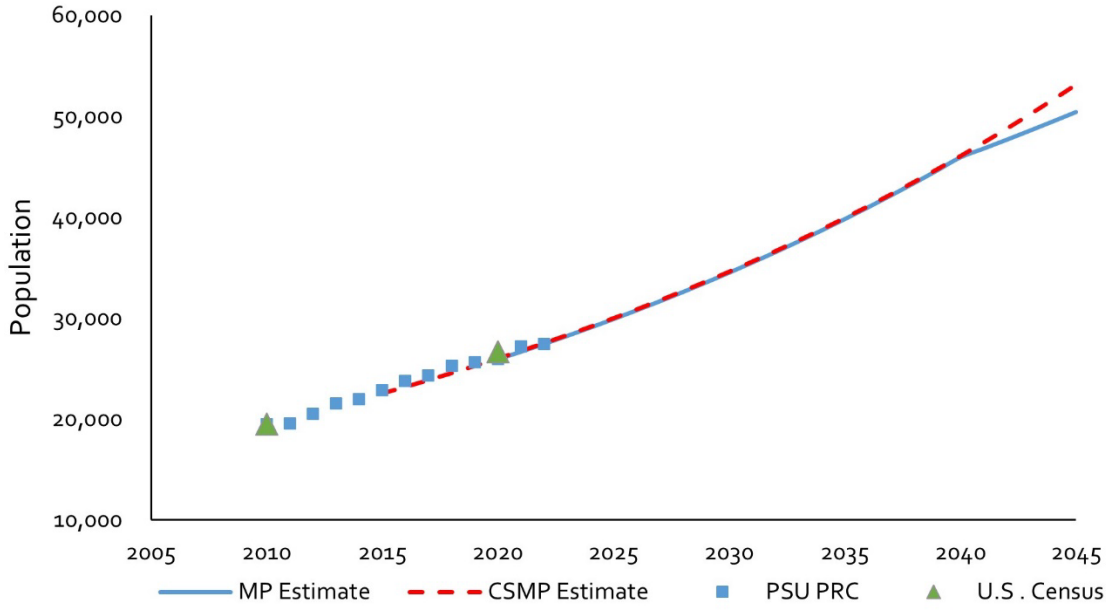


Figure ES.2 Historical Population and Expected Growth for the City of Wilsonville

## ES.2 WWTP Condition Assessment

Carollo Engineers, Inc. (Carollo) reviewed prior condition assessments performed by others, conducted geotechnical investigations and performed seismic assessments at the WWTP in the course of Plan development.

In 2019, Jacobs Engineering Group Inc. (Jacobs) and Brown and Caldwell both completed condition assessments at the City's WWTP. A total of 322 major assets (per Jacobs' report), including process and mechanical equipment, motors and drives, control panels, generators, instrumentation, and structures, were examined for a variety of conditions that may signify their need for maintenance or replacement. Chapter 2 presents a summary of critical assets that require short term rehabilitation or replacement, as well as a list of assets that are less critical to operations, or have minor condition issues, but may be included in a short-term improvements project or a task order for Jacobs operations personnel. Table ES.1 displays the condition driven rehabilitation or replacement projects from Chapter 2 that were included in the recommended Capital Improvement Plan (CIP) in Chapter 7. The City undertook an updated assessment of WWTP condition in the summer of 2023. The 2023 assessment did not identify additional issues requiring significant capital outlays compared to the 2019 assessments.

Table ES.1 CIP Condition Driven Replacement Projects

| Asset | Description |
|---|---|
| Trojan UV 4000 System | While only used as a backup to the Suez UV system, the Trojan system's HMI has errors that prevent it from showing the status of the lamps in module 3. Since it is used infrequently, the system's condition is largely unknown. After review of the 2019 condition assessment reports and discussion with the City and Jacobs staff, it was concluded that the UV 4000 unit must be replaced. |
| Secondary Clarifiers No. 1 and No. 2 | Ovivo completed a field review of the plant's secondary clarifiers No. 1 and No. 2 in April 2022. Although both units were operational, repairs were identified to improve the operation of the clarifiers. The recommended repairs include drive controls for both units, new skimmers for both units, squeegees for both tanks rake arms, EDI chains, one motor and reducer assembly, one skimmer arm assembly, and new secondary clarifier mechanisms. |

Notes:
Abbreviations: EDI - electronic data interchange; HMI - human-machine interface; No. - number; UV - ultraviolet.

## ES.3 Seismic Analysis

In 2021, Carollo performed a seismic evaluation and analysis of the City's WWTP as part of the overall plant condition assessment. Because the WWTP was substantially upgraded and expanded in 2014, most of its infrastructure is designed in accordance with the 2010 Oregon Structural Specialty Code (OSSC) and follows modern seismic design and detailing. During Tier 1 evaluations, Carollo identified potential deficiencies and areas for additional investigation. A Tier 1 seismic analysis is an initial evaluation performed to identify any potential deficiencies, whether structural or non-structural, in a building based on the performance of other similar buildings in past earthquakes. Subsequent to the Tier 1 analysis, a more detailed seismic evaluation of five older and potentially seismically vulnerable structures on the WWTP site was conducted. Those structures receiving a more detailed evaluation included the following:

- Operations Building.
- Process Gallery.
- Workshop.
- Aeration Basins and Stabilization Basins.
- Sludge Storage Basins and Biofilter.

The five potentially vulnerable structures were compared against an S-4 Limited Safety structural performance level and N-B Position Retention non-structural performance level for an M9.0 Cascadia Seismic Zone (CSZ) earthquake. The M9.0 CSZ is reflective of a catastrophic natural disaster event that has an estimated 35 percent likelihood of occurring within the next 50 years. Following the Tier 1 evaluation, Carollo began Tier 2 evaluations for a select number of identified deficiencies. Although none of the structures showed significant irregularities, the team did identify seismic deficiencies. The recommended seismic retrofits are included in the CIP for this Plan.

Prior to the 2021 seismic evaluation, Carollo's subconsultant, Northwest Geotech, Inc. (NGI), completed a seismic response and geologic hazards assessment of the City's WWTP. Through past and present site investigations and engineering analyses, NGI determined that the native soils beneath the site's granular pit backfill have low risk of liquefaction and its slopes do not pose undue risk. NGI concluded that the WWTP's primary site hazard is the differential settlement that may be caused by soil piping (development of subsurface air-filled voids), which raises the risk of sinkholes forming beneath structures and pipelines. Soil piping usually develops in unsaturated soils when a water source percolates into the ground. While the site is mostly paved and stormwater is being collected, there may be areas where infiltration is occurring next to structures or below pipelines. In spring 2023, NGI performed a visual crack survey and mapped existing cracks at accessible structure floor and foundation stem wall locations. In addition, NGI completed a 50-foot boring utilizing a sonic drilling technique to assist in determining grouting conditions, prior maximum excavation depths, and fill materials present in the vicinity of secondary clarifier 3.Recommended actions from NGI to mitigate the risk of soil piping and considerations for new structure foundations are presented in Chapter 2.

## ES.4 Wastewater Flow and Load Projections

Chapter 3 of the Plan evaluates the historical and projected wastewater flows and loads generated in the City of Wilsonville's service area. The load projections include total suspended solids (TSS), biochemical oxygen demand ($BOD_5$), ammonia ($NH_3$), and total phosphorous (TP) loads.

Service area, residential population, industrial contribution, and rainfall records were all considered in the flow and load projection analyses. Facility planning involves estimating rates of growth in wastewater generation within the service area which are unlikely to align precisely with the actual growth observed. During the planning period, City staff will need to assess service area growth at regular intervals and revisit the analysis presented in this Plan.

The City previously estimated population for build-out of their service area. These estimates were taken from the City's Collection System Master Plan (2014, MSA) and as assumed in that document, projected the UGB reaches build-out in 2045. Figure ES.2 details the historical population and growth expected for the City. In addition, the City service area boundary upon which 2045 UGB build-out projections were based on the 2014 CSMP, has been altered slightly to account for a portion of the Basalt Creek Planning Area (BCPA) which is now expected to annex to the City of Tualatin and therefore will not receive wastewater service from the City of Wilsonville. Figure ES.2 illustrates the 2014 UGB build-out population projections from the CSMP compared to those based on the modified service area boundary.

The flow and load projections presented in Chapter 3 are based on the Collection System Master Plan projections (with the slight modification to exclude the portion of the BCPA mentioned above).

A determination will need to be made whether projected flows and loads (which drive assessments of unit process capacity) are aligned with calendar projections presented in this plan and consider if conclusions presented regarding capacity and timing of recommended improvements remain valid. If not, adjustments to the plan will need to be undertaken to ensure sufficient capacity remains available to serve anticipated growth. As actual future wastewater generation rates may also be slightly different than the unit factors considered in this Plan, operations staff at the plant will need to be familiar with the flow and load triggers for planning and design of logical increments of treatment capacity presented in this plan. If growth rates are higher, the schedule for improvements in this plan will need to align with calendar dates presented herein. If growth occurs more slowly, the City will be able to phase WWTP improvements on a less aggressive schedule.

Analysis of flow projections were completed through two different methods: (1) analysis of historical plant records and (2) DEQ Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon, which is referred to as the DEQ methodology in this Plan. Since there is no DEQ methodology for load analysis, all projections were developed based on historical plant records. Figure ES.3 summarizes the measured and projected maximum month, peak day and peak hour flows. The projections for the remaining flow elements can be found in Chapter 3. As is shown in Figure ES.3, the peak hour flow is projected to exceed the peak hour flow of 16 mgd listed on the 2014 Improvements Drawings close to the year 2040.The projected 2045 peak hour flow is based on a 10-year (rather than a 5-year) design storm and does not account for storage or flow attenuation in the collection system. In 2023 the City undertook a hydraulic analysis of the WWTP concluding that certain elements will be deficient as the service area develops. This is discussed in greater detail in Chapter 4. This has important implications for facility improvement costs recommended in this Master Plan, which are based on estimates and projections of flows and loads which may not align with the timelines presented in this Master Plan. As such it is recommended the City perform additional evaluation of the WWTP and collection system, along with monitoring actual flows, to further evaluate whether future flow equalization can be achieved and whether recommended improvements at the WWTP will all be triggered within the planning period.

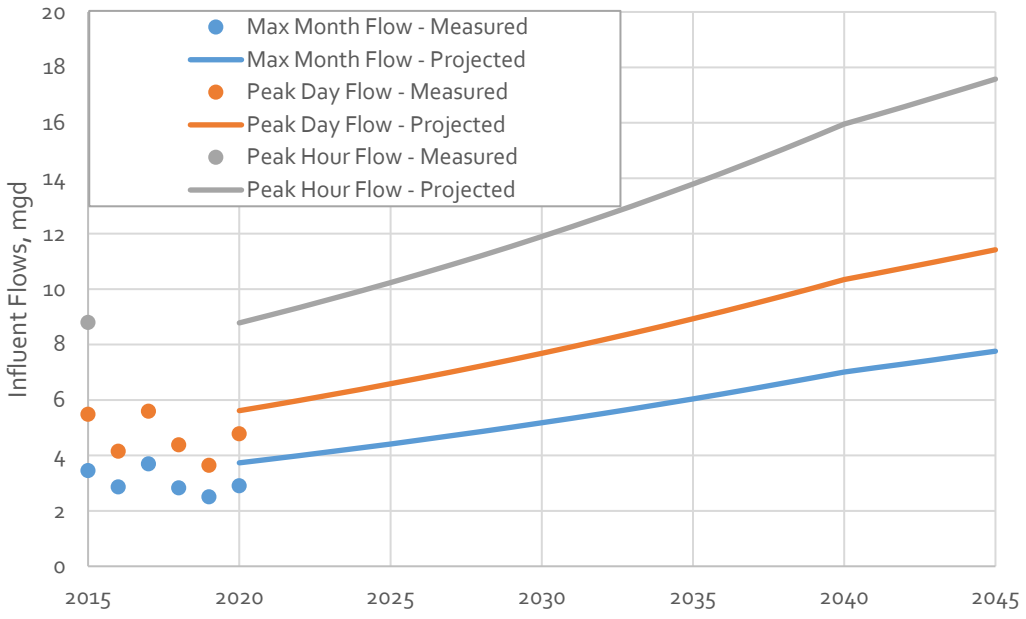


Figure ES.3 Flow Projection Summary

Load projections were calculated for influent TSS, $BOD_5$, $NH_3$, and TP. Figure ES.4 summarizes the measured and projected influent maximum month BOD and TSS loads. The projections for the remaining load elements can be found in Chapter 3.

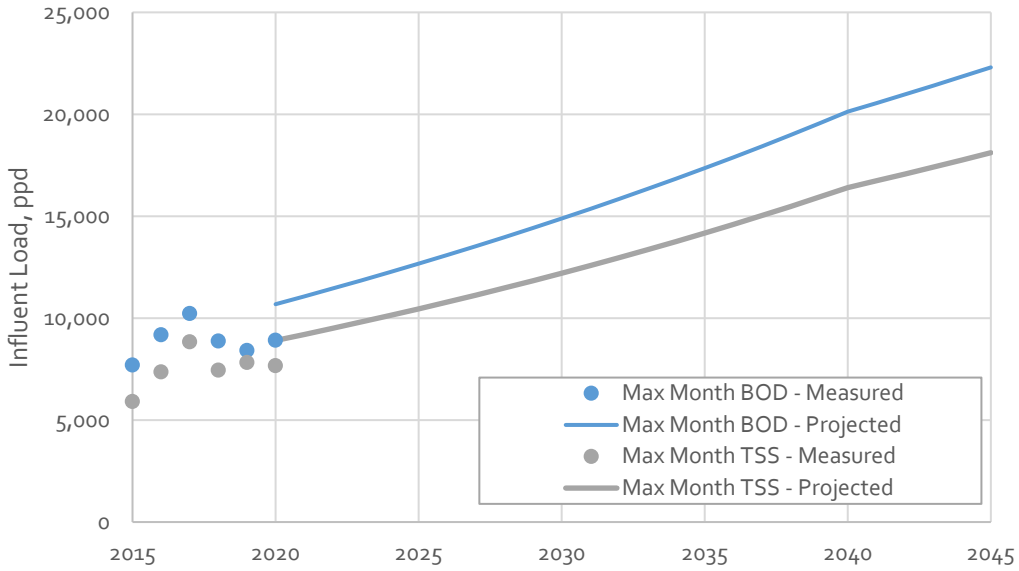


Figure ES.4 Load Projection Summary

The projected flows and loads developed in Chapter 3 were compared against the rated capacity for each of the WWTP's unit processes to determine whether expansion would be required within the planning period. The findings of this capacity analysis are discussed in the next section.

## ES.5 Capacity Analysis

Summaries of plant process area capacity assessments and conclusions are presented in this Plan. These assessments focus on the need for improvements or upgrades to existing facilities to address capacity deficiencies identified in the course of Master Plan evaluations. A site plan of the City's existing WWTP is presented in Figure ES.5.

Chapter 4 identifies existing capacity ratings and deficiencies for the liquid and solids stream treatment processes at the City's WWTP. Analyses are based on operational practices in place at the time and existing effluent limits established by the WWTP's NPDES permit. Biological process modeling was performed using BioWin version 6.2 to predict plant performance under current and future flow and loading conditions to assess when unit process capacities may be exceeded within the planning period (present through 2045).

A summary of the capacity assessment completed using growth projections described in Section ES.1 is detailed below in Table ES.2. Chapter 4 presents the methodology and findings in greater detail.


LEGEND:

1 - DEWATERING & DRYING BUILDING
2 - PROCESS GALLERY
3 - SECONDARY CLARIFIER NO. 1
4 - SECONDARY CLARIFIER NO. 2
5 - UV DISINFECTION SYSTEM
6 - WORKSHOP
7 - SECONDARY PROCESS FACILITY
8 - STABILIZATION BASIN
9 - SLUDGE STORAGE BASINS AND BIOFILTERS 12 - SECONDARY CLARIFIER NO. 3
10 - HEADWORKS
11 - DISK FILTERS
12 - COOLING TOWERS
13 - W3 REUSE PUMP STATION
14 - OPERATIONS BUILDING
15 - SITE ENTRANCE

0 30' 60' 120'
SCALE: 1" = 60'

**Figure ES.5**
**EXISTING WILSONVILLE WWTP**
CITY OF WILSONVILLE

carollo

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Table ES.2 Unit Process Capacity Assessment

| Unit Process | Capacity Assessment |
|---|---|
| **Preliminary Treatment** | |
| Screening | There is sufficient hydraulic capacity with both mechanical screens operational to accommodate a PHF of 17.6 mgd. Hydraulic modeling conducted by Jacobs in 2023 indicates that hydraulically the influent screening can pass the projected PHF. |
| Grit Removal | The 2012 WWTP Improvement documents indicate a design capacity of 16 mgd for the vortex grit basin. However, Hydraulic modeling conducted by Jacobs in 2023 indicates that hydraulically, the grit removal system can pass a PHF of 17.6 mgd. At this flow rate the anticipated performance would be poor. |
| **Secondary Treatment** | |
| Secondary Treatment | Based on maximum week MLSS predicted from BioWin modeling at peak day flow with all clarifiers in service (and assuming a 5-day SRT), there is only sufficient capacity through 2027. Upsized process piping is expected to be necessary to convey flow from the headworks to the secondary process and to return activated sludge within the secondary process under future flow conditions |
| Aeration Blowers | The air demands of the secondary treatment process are projected to exceed the firm capacity of the aeration blowers under peak conditions by 2027. |
| **Tertiary Treatment and Disinfection** | |
| Disk Filters | The existing disk filter capacity is expected to be exceeded by 2032 with one unit out of service or in backwash mode based on effluent limitations included in the City's DBO Contract with Jacobs. At this time the City expects to relax these contract limitations rather than invest in additional capacity. |
| Secondary Effluent Cooling Towers | The projected peak day flow during the months of June through September is expected to exceed the capacity of the colling tower by the year 2036. |
| UV Disinfection | The existing UV channels do not have adequate capacity to disinfect the 2045 PHF with all units in service. However, the firm capacity of the UV system is sufficient to treat the PDDWF through the year 2045 with one channel out of service. The City currently has an older UV unit in place as an emergency backup to the primary system. That backup unit is aging and the City plans replacement during the planning period. By the year 2040, the UV channels are expected to exceed their hydraulic capacity. |
| Outfall | Even with the Willamette River at its 100-year flood elevation, it is expected that the outfall pipeline can accommodate approximately 19 mgd before the UV channel effluent weirs are at risk of submergence upstream. Since this flow is well above the hydraulic capacity of the rest of the plant, no expansion will be needed until after 2045.(1) Jacobs found that under projected 2045 PHF conditions certain process and effluent piping, including piping just upstream of the Willamette River outfall and diffuser system, may be hydraulically deficient. At PHF 17.6 mgd and assuming a 0.8 mgd recycle scenario the headworks screens and grit removal systems are expected to be unsubmerged. However, upsized outfall piping between MH-B and MH-D2 is expected to be necessary to convey flow from the headworks to the secondary process under these conditions |
| **Solids Handling** | |
| Gravity Belt Thickener | Assuming continuous operation, the capacity analysis results indicate adequate capacity for thickening the current and projected maximum week WAS loads with one unit out of service. These units are aging and the City plans replacement during the planning period. |
| TWAS Storage | The TWAS storage volume is sufficient to accommodate the expected maximum week solids loads for two days (assuming TWAS is thickened to 4 percent). |
| Dewatering Centrifuges | The rated capacity of the current centrifuges is sufficient to process the maximum week load with one unit out of service though 2042 assuming operating times of 24 hours per day for 7 days per week, per the criteria detailed in Chapter 4.(2) These units will reach the end of useful life during the planning period and the City plans replacement accordingly. |
| Biosolids Dryer and Solids Disposal | The capacity of the biosolids dryer is adequate for handling the current and projected max week solids loads (in year 2045) on the basis of its design evaporation rate, assuming dewatered cake is dried from 20 percent TS to 92 percent TS and the dryer is operated for 24 hour per day for 7 days per week.(3) This unit is aging, has had recent performance issues and the City plans replacement during the planning period. |

Notes:
(1) The existing outfall was recently modified and equipped with five parallel diffuser pipes equipped with duckbill check valves to improve the mixing zone characteristics in the Willamette River.
(2) The centrifuges have exhibited inconsistent performance. The City recently refurbished these units and expects they will provide sufficient capacity through 2045.
(3) The existing solids dryer has sufficient capacity through 2045 but has exhibited inconsistent performance.. See Alternative 2B, Chapter 6.
Abbreviations: DBO - Design-Build-Operate; gpd/sf - gallons per day per square foot; MLSS - mixed liquor suspended solids, SPA - State Point Analysis; SRT - solids residence time; TS - total solids; TWAS - thickened waste activated sludge.

Table ES.3 further summarizes the capacity assessment by listing each unit process, associated design parameters and year of possible capacity exceedance.

Table ES.3 Unit Process Capacity Year Summary

| Unit Process | Design Parameter | Redundancy Criteria | Year of Capacity Exceedance |
|---|---|---|---|
| Influent Screening | PHF | Bypass channel with manual bar rack in service and one mechanical screen out of service | >2045 |
| Grit Chamber | PHF | All units in service | >2045(1) |
| Secondary Treatment | MW MLSS Inventory at PDF | All units in service | 2027 |
| Secondary Effluent Cooling Towers | June 1 - Sept 30 PDF | All units in service | 2036 |
| Disk Filters | MWDWF | One unit in backwash | 2032(2) |
| UV Disinfection Channels | PHF | All units in service | 2040(1) |
| Outfall | PHF | - | >2045 |
| Gravity Belt Thickening | MW Load | One unit out of service | 2042 |
| Dewatering Centrifuges | MW Load | One unit out of service | >2045(3) |
| Biosolids Dryer | MW Load | All units in service | >2045(3) |

Notes:

(1) The plant hydraulic modeling done as a part of the 2012 WWTP Improvements Project only evaluated plant flows as high as 16 mgd. The projected peak hour flows presented in Chapter 3 exceed this flow by the year 2045. There are some unit processes including the grit removal system, secondary clarification and UV disinfection that have a peak hydraulic capacity of 16 mgd. The hydraulic analysis conducted by Jacobs in 2023 found that under projected 2045 PHF conditions certain process and effluent piping may be hydraulically deficient. At PHF 17.6 mgd and assuming a 0.8 mgd recycle scenario the headworks screens and grit removal systems are expected to be unsubmerged. However, upsized piping is expected to be necessary to convey flow from the headworks to the secondary process under these conditions .

(2) Existing Disk Filters are predicted to exceed reliable capacity (one unit out of service) in 2028 based on vendor provided design criteria. This conclusion assumes limitations for effluent total suspended solids contained in the WWTP DBO contract, which are far more stringent than the City's NPDES permit. At this time the City expects to relax these contract limitations rather than invest in additional capacity. Following startup of secondary treatment membrane bioreactors in 2030, the tertiary filters will be required less to meet the effluent requirements of the NPDES permit. It is anticipated the City will maintain these facilities to allow flexibility in operation to account for servicing and membrane facility downtime.

(3) As noted previously, the existing centrifuges and biosolids dryer appear to have sufficient capacity through the planning year 2045, however condition and age are likely to require replacement during the planning period. It is recommended the City reassess available replacement technologies prior to replacement and consider loading appropriate to the planning horizon of any new units selected.

Abbreviations: MW - maximum week

## ES.6 Regulatory Considerations and Strategy

It is the responsibility of the Oregon DEQ to establish and enforce water quality standards that ensure the Willamette River's beneficial uses are preserved. Discharges from wastewater treatment plants are regulated through the (NPDES. All discharges of treated wastewater to a receiving stream must comply with the conditions of an NPDES permit. The Wilsonville WWTP discharges to the Willamette River at River Mile 38.5 just upstream of the Interstate 5 bridge. The existing permit limits for the Wilsonville WWTP are shown in Table ES.4. This permit became effective on September 1, 2020 and expires July 30, 2025.

Table ES.4 Current Effluent Permit Limits

| Parameter | Average Effluent Concentrations | | Monthly Average, (ppd) | Weekly Average, (ppd) | Daily Maximum, (lbs) |
|---|---|---|---|---|---|
| | Monthly | Weekly | | | |
| **May 1 - October 31** | | | | | |
| $CBOD_5$ | 10 mg/L | 15 mg/L | 190 | 280 | 380 |
| TSS | 10 mg/L | 15 mg/L | 190 | 280 | 380 |
| **November 1 - April 30** | | | | | |
| $BOD_5$ | 30 mg/L | 45 mg/L | 560 | 840 | 1100 |
| TSS | 30 mg/L | 45 mg/L | 560 | 840 | 1100 |
| **Other Parameters Limitations** | | | | | |
| E. coli Bacteria | • Shall not exceed 126 organisms per 100 ml monthly geometric mean.<br>• No single sample shall exceed 406 organisms per 100 ml. | | | | |
| pH | • Instantaneous limit between a daily minimum of 6.0 and a daily maximum of 9.0 | | | | |
| $BOD_5$ Removal Efficiency | • Shall not be less than 85% monthly average | | | | |
| TSS Removal Efficiency | • Shall not be less than 85% monthly average | | | | |
| ETL June 1 through September 30 | • Option A: 39 million kcal/day 7-day rolling average<br>• Option B: Calculate the daily ETL limit | | | | |

Notes:
Abbreviations: $CBOD_5$ - five-day carbonaceous biochemical oxygen demand; ETL - excess thermal load; kcal/day - kilocalories per day; lbs - pounds, mg/L - milligrams per liter; ml - milliliter.

The WWTP has been compliant with NPDES permit limits, generally. However due to construction issues that required that aeration basins be offline, equipment failure and issues with solids processing, the WWTP did violate their NPDES permit over eight months between 2015 and 2020 (December 2015, February 2017, April 2017, January 2018, August 2018, May 2020, June 2020 and July 2020). Most of these violations were due to the daily effluent TSS load exceeding the maximum daily load limit in the NPDES permit. It is anticipated that once the issues with solids processing are addressed, the City's current treatment process will be able to meet permit limits.

Chapter 5 details potential regulatory issues the City will need to take into consideration in coming years. Several possible regulatory actions by the Oregon DEQ could drive investments in

future improvements at the City's WWTP. The plant discharges to the Willamette River and existing and future effluent limitations contained in the NPDES permit dictate, in large part, the necessary treatment processes and configuration at the WWTP necessary to maintain compliance.

Future treatment upgrades may be required when DEQ establishes total maximum daily loads (TMDL) for the lower Willamette River. Dissolved oxygen and nutrient limits, such as phosphorus limitations, are possible. The dissolved oxygen in the lower part of the river does not always meet water quality standards, and indications of excessive nutrients, such as chlorophyll-a, aquatic weeds, and harmful algal blooms, are present in the lower Willamette River. DEQ has begun its triennial review of Oregon's water quality criteria. The review could result in more stringent or new discharge requirements, but this process will take several years. For planning purposes, providing plant footprint to accommodate future treatment to remover phosphorus and address dry weather seasonal limits on dissolved oxygen should be anticipated. In addition, the City should continue to engage with DEQ regarding any proposed receiving water temperature regulatory actions.

## ES.7 Alternative Development and Evaluation

Chapter 6 presents the methodology and findings of a process improvements alternatives evaluation. The plant's treatment process needs were defined by comparing the plant's existing condition, capacity and reliability, with the projected flows, loads, and regulatory constraints for the recommended alternatives. Where capacity deficiencies were predicted, at least two alternatives were analyzed for each corresponding unit process. Process modifications associated with each alternative were modeled in BioWin to evaluate the overall impact on plant operations.

As identified in Chapter 4, the secondary treatment process is expected to require additional capacity during the planning horizon (2045). Chapter 6 details two alternatives to address these capacity limitations. The two alternatives considered to increase secondary capacity are:

1. Expansion of the existing conventional activated sludge process; and
2. Intensification of the existing treatment process using membrane bioreactor (MBR) technology.

Due to the higher capital and operating costs of intensification, construction of a new conventional aeration basin is recommended as the first phase to increase secondary capacity. As flows and loads increase, or regulatory requirements become more stringent, it is expected to become necessary to intensify treatment. It is recommended the City revisit this evaluation as the need for 1) additional capacity to accommodate growth nears or 2) more stringent effluent limitations are considered. This offers the opportunity to take advantage of potential advances in technology as well as confirming the predicted time frame of capacity exceedance. A new aeration basin project is included in the Capital Improvement Plan in Chapter 7. As loads continue to increase, this plan includes the gradual conversion of the existing conventional activated sludge process to a membrane bioreactor process.

The existing aeration blower system firm capacity is expected to be deficient by 2027. An additional aeration blower (with approximately double the capacity of the current blowers) would provide for the first phase of capacity expansion. As loads continue to increase, the plan includes the gradual upsizing of the existing blowers.

The projected peak day flow between June through September is expected to exceed the capacity of the existing cooling tower. Since the existing cooling tower system was designed to be expanded with the addition of one more tower, the plan assumes the expansion of the existing cooling tower process by the year 2036 to meet the projected summer peak day flows.

Additional tertiary filtration capacity is predicted to be needed by 2032 to provide full treatment of the MWDWF with one disc filter out of service or in backwash mode. As the City has selected an intensification technology utilizing membranes, this is likely to eliminate tertiary filtration capacity concerns as the membranes replace the filtration process for TSS removal in plant effluent.

While the capacity assessment findings presented in Chapter 4 determined existing gravity belt thickeners and dewatering centrifuges have sufficient capacity assuming continuous operation, the remaining equipment service life may require replacement within the planning horizon. The centrifuges, installed in 2014, were recently refurbished, but by 2045, will have been in service for over 30 years. In addition, the gravity belt thickeners (GBT) which thicken the sludge prior to delivery to the centrifuges for dewatering, have been in service even longer. The City should plan for their replacement within the planning horizon and consider whether a capacity increase is needed at the time of replacement based on projections of solids production and processing needs. Additionally, the secondary process was modified in 2020 and has experienced extended periods where mixed liquor concentrations have been elevated above typical ranges for conventional activated sludge or extended aeration processes. Due to the complications with secondary process operation and performance issues with the centrifuges, it is recommended the City study the secondary treatment and dewatering processes to confirm that the assumptions and conclusions regarding centrifuge capacity in Chapter 4 may be relied upon. A dewatering performance optimization study is recommended so the City can collect and analyze secondary treatment and solids processing performance data. For budgeting purposes, an opinion of probable cost for replacing the existing centrifuges is presented in Chapter 7. Timing of that equipment replacement will depend on performance of the existing units, future loading assumptions, and observed condition.

The existing solids dryer has experienced operational issues in recent years, including a fire that caused extensive damage to the equipment in April 2019 and a leaking rotary joint and damaged seal in 2021. As of February 25, 2022, the dryer has been repaired and is operating. Because of the City's commitment to solids drying as the preferred process to achieve Class A biosolids, the alternatives evaluation presented in this Plan for future dryer replacement was conducted with a focus on thermal drying options only.

Chapter 6 details an analysis of the following alternatives to improve the drying system:

1. Alternative 1 - Continue operating the existing biochemical reactor (BCR) paddle dryer and defer replacement.
2. Alternative 2 - Modify the existing Dewatering and Drying Building to accommodate a different solids dryer technology or a redundant dryer.
3. Alternative 3 - Construct a new dryer building with a different solids dryer technology.

While it is anticipated the existing dryer has useful life through at least 2026 (current DBO contract expiration), by 2031 the dryer will have been in operation for over 15 years. It is recommended the planning and design of upgrades to provide reliable dryer capacity begin in 2031, or sooner if further operational concerns arise. The City has indicated a preference for a

variation of Alternative 2 which involves expanding the existing Dewatering and Drying Building to accommodate a second solids paddle dryer. This alternative provides backup capacity to allow the City to continue delivering Class A solids during periods of downtime if a mechanical failure occurs or to accommodate regular maintenance of one dryer train. As mentioned previously, this Plan recommends the City complete a study of the secondary sludge quality, performance of that process, chemical addition types and locations, and solids handling process performance overall prior to making a final selection of the preferred dryer alternative from the alternatives detailed in Chapter 6. For purposes of capital planning, this Plan assumes the City will implement Alternative 2b (modification of Dewatering and Drying Building to accommodate a second paddle dryer) with a study and confirmation of this selection beginning in 2031.

Lastly, the City wants to establish a direct connection between the City's fiber optics network and the WWTP. This addition consists of routing two new conduits (one spare) and fiber optic cabling from the WWTP's Operations Building to the site entrance, where the conduits will be tied into the City's fiber optics network. Chapter 6 details one potential routing from the Operations Building to the site entrance that would minimize impact to existing yard utilities. The fiber optic cable addition is included in Chapter 7 and the City's 5-year CIP.

Table ES.5 below summarizes the alternatives evaluated in Chapter 6 including recommendations for future WWTP improvements.

Table ES.5 Summary of Alternatives

| Unit Process | Alternatives Considered | Selected Alternative |
|---|---|---|
| Secondary Treatment | • Expansion of the existing conventional activated sludge process.<br>• Intensification of the existing treatment process. | • Expansion of the existing conventional activated sludge process through the addition of another aeration basin. Further phased expansion of capacity through addition of membrane bioreactor (MBR) and fine screening facilities. |
| Solids Dryer | • Continue operating the existing BCR paddle dryer and defer replacements.<br>• Modify the existing Dewatering and Drying Building to accommodate a different solids dryer technology or a redundant dryer.<br>• Construct a new dryer building with a different solids dryer technology. | • Modify the existing Dewatering and Drying Building to accommodate a different solids dryer technology or a redundant dryer by expanding the Dewatering and Drying Building to accommodate a second solids paddle dryer. |

## ES.8 Recommended Alternative

Figure ES.6 presents a WWTP site plan identifying locations of recommended improvements resulting from condition and capacity assessments, including evaluation of alternatives, as described.

Summaries of opinions of probable costs and anticipated phasing for the improvements recommended for inclusion in the City's WWTP CIP are provided in Table ES.6.

The expected cash flow for the planning period was determined for the recommended improvements summarized in Table ES.6. The cash flow through 2045 includes an escalation rate of three percent, and the estimated peak expenditure for any fiscal year is

approximately $55,434,000 in fiscal year 2030. The projected CIP expenditures are presented in Figure ES.7. Capital costs estimated in the Plan will be considered as the City assesses the need to adjust sewer enterprise rates and charges in coming months. It will be important to distinguish capacity and condition (repair and replacement) driven improvements in assigning costs to existing rate payers and future users.

Table ES.6 WWTP CIP - Recommended Alternative Opinion of Probable Cost and Phasing

| Plant Area | Project[1] | Opinion of Probable Cost[2] | Approximate Year Online |
|---|---|---|---|
| Solids Handling | Dewatering Performance Optimization | $150,000 | 2025 |
| Communications/IT | Fiber Optic Cable Addition | $60,000 | 2025 |
| UV System | Backup UV System Improvement | $1,705,000 | 2026 |
| Support Buildings | Seismic Improvements | $1,082,000 | 2026 |
| Secondary Treatment | New Conventional Aeration Basin and Blower | $10,222,000 | 2027[3] |
| Secondary Treatment | New Secondary Clarifier Mechanisms | $1,775,000 | 2027 |
| Secondary Treatment | New MBR, Blowers and Fine Screens (Phase 1) | $69,727,000 | 2031 |
| Solids Handling | Solids Dryer Improvement | $17,130,000 [7] | 2033 |
| Solids Handling | Existing Centrifuge and GBT Replacement | $3,701,000 [4,6] | 2033[5] |
| Cooling Towers | New Effluent Cooling Tower | $642,000 | 2036 |
| Secondary Treatment | Additional MBR and Blower Capacity (Phase 2) | $2,330,000 | 2039 |
| UV System | UV Equipment Replacement | $2,571,000 | 2040 |
| Outfall | Outfall Improvements | $1,244,000 | 2040 |
| Secondary Treatment | Additional MBR and Blower Capacity (Phase 3) | $8,117,000 | 2044 |
| **TOTAL** | | **$120,456,000** | |

Notes:
White rows indicate projects that are in the City's 5-year CIP and blue rows indicate projects that are outside the 5-year CIP window.

(1) Details of each project can be found in Chapter 2 or Chapter 6 of this Master Plan.
(2) The estimated opinion of probable costs include the construction costs plus ELA (or soft costs). Details on the estimated project costs can be found in Chapter 2 or Chapter 6 of the plan, with the exception of costs for the backup UV system and centrifuges which are presented earlier in Chapter 7. All costs presented are based on an August 2023 ENR index of 13473.
(3) As identified in Chapter 4, the secondary treatment process at the Wilsonville WWTP is expected to require additional capacity by the year 2027. Since design and construction of a new aeration basin may take longer than the year 2027, the City will likely need to operate at SRTs lower than 5 days during the maximum week condition if growth occurs as predicted in Chapter 3.
(4) For budgeting purposes, the Option B centrifuge cost from Table H-2 in Appendix H is used for the project cost summary and the CIP.
(5) Replacement timing dependent upon satisfactory equipment performance.
(6) The centrifuges installed with the City's 2014 upgrade project have exhibited inconsistent performance in recent months. The City recently refurbished these units and expects they will provide sufficient capacity through 2042. However, by that time, the units will have been in service for over 30 years. It is recommended the City plan for replacement of these units during the planning horizon of this Master Plan. Assuming replacement occurs in the mid-2030's the City should reassess capacity needs of those units beyond the 2045 horizon, consistent with the expected service life of the new equipment.
(7) The existing solids dryer has sufficient capacity through 2045. As with the dewatering centrifuges, the dryer equipment will soon have been in operation for a decade. It is recommended the City plan for replacement of the dryer during the planning horizon of this Master Plan. The City plans to replace the existing dryer with a new piece of equipment using similar technology and potentially rehabilitate the existing unit to serve as a backup. See Alternative 2B, Chapter 6.

The years in which key processes are projected to exceed capacity are presented in Figure ES.8. The green line illustrates projected MM BOD triggers for existing and proposed new secondary treatment facilities. Projected PHF is shown in blue indicating capacity exceedance of the cooling tower and certain elements of plant hydraulics. Prior to the year of projected exceedance, planning, design, and construction activities will be required to allow upgrades to be commissioned to prevent capacity exceedances. It is important to note that the timing of improvements should be driven by the rate of growth in influent flow and load. Dates indicated in Figure ES.8 and elsewhere in this document should be considered best, conservative estimates based on projections presented herein and professional judgment.

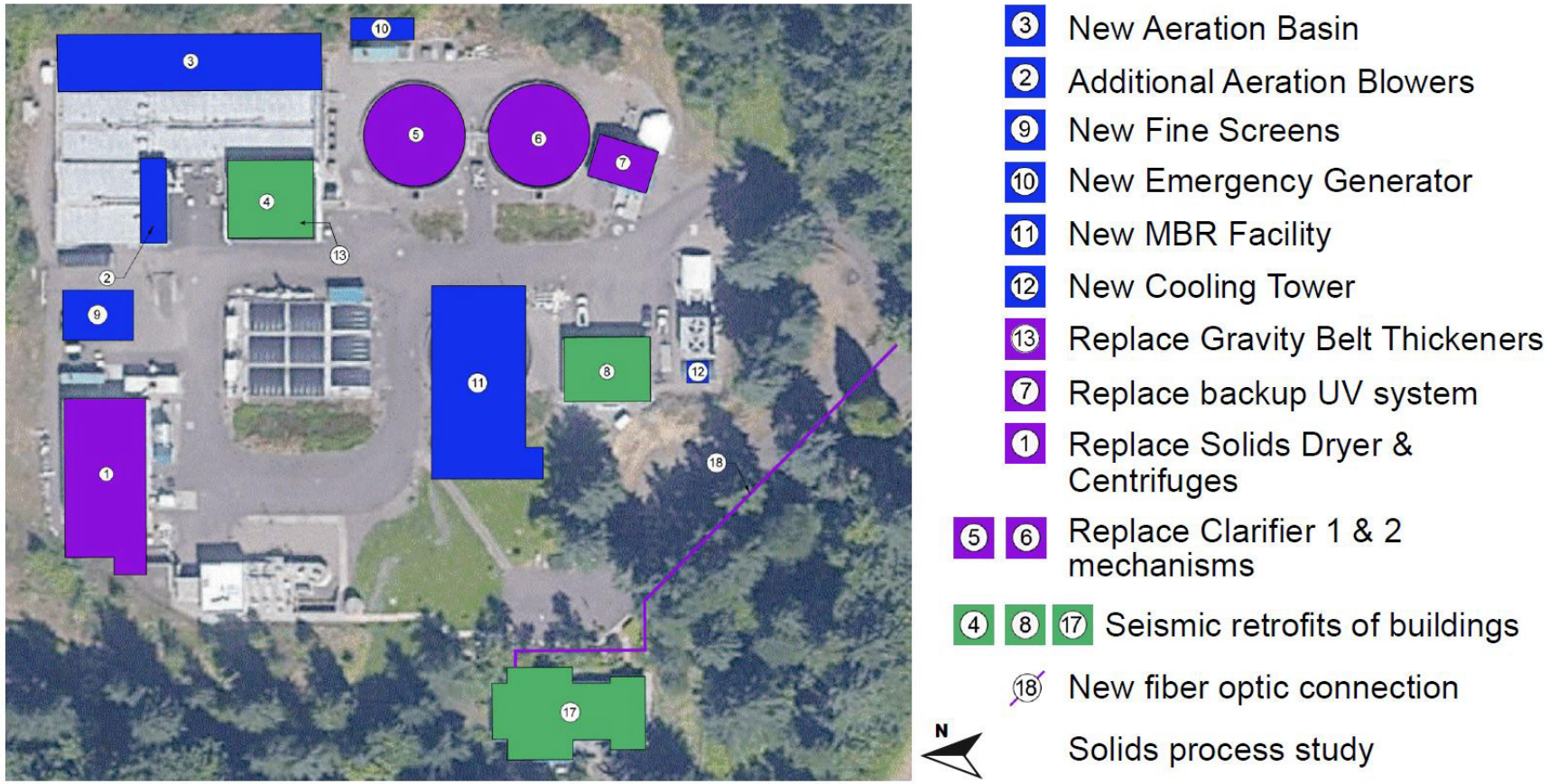


Figure ES.6 Proposed WWTP Improvements Site Plan

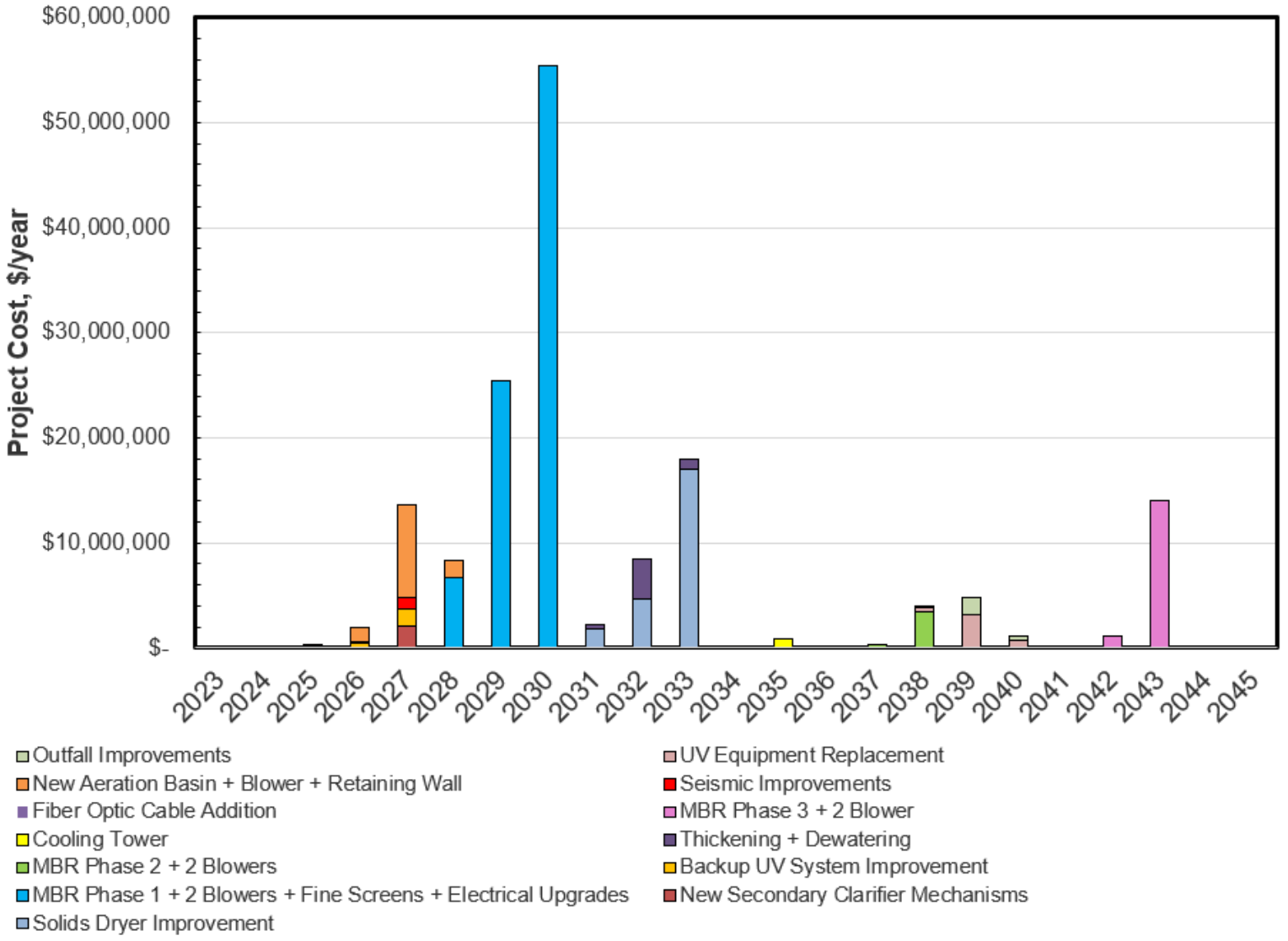


Figure ES.7 Projected 20-Year CIP Expenditures

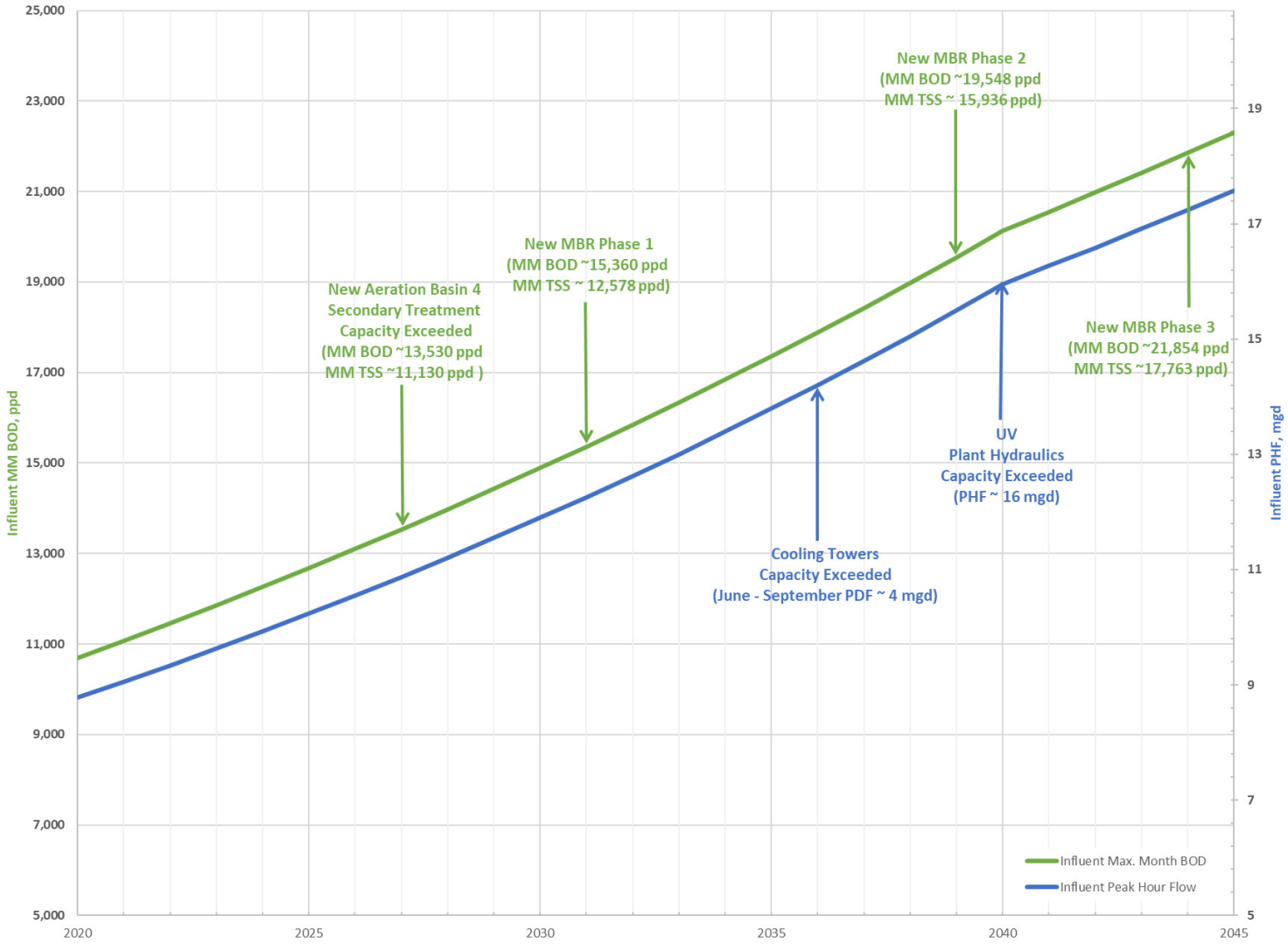


Figure ES.8 Capacity Trigger Graph