

WEST BASIN MASTER PLAN

Executive Briefing

October 2025



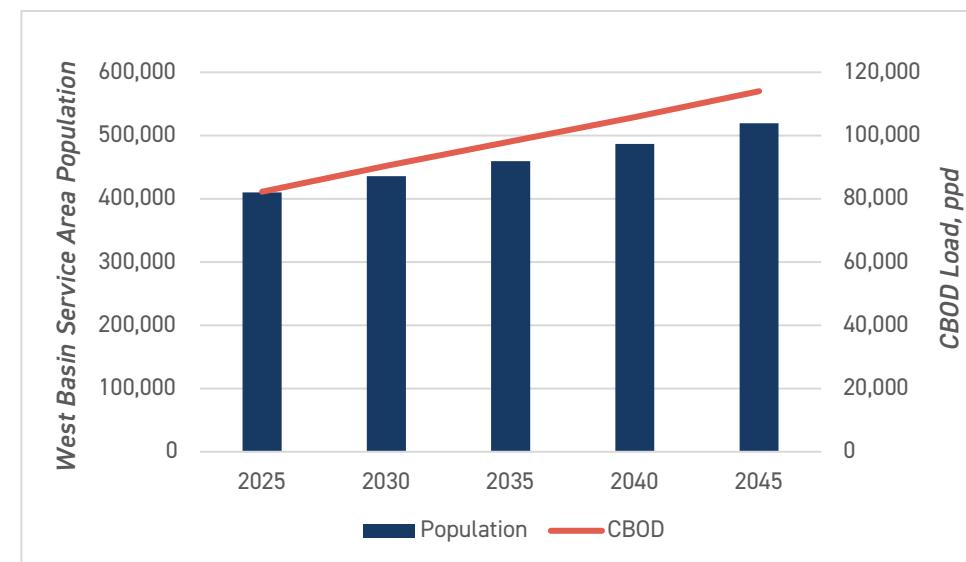
Introduction

The mission of Clean Water Services (the District) is to safeguard the Tualatin River's health and vitality, ensure the economic success of the region, and protect public health for over 610,000 residents and businesses in Washington County. This West Basin Master Plan (Plan) describes the District's approach to accomplishing this mission within the West Basin, which consists of an interconnected system serving the cities of Hillsboro, Beaverton, Forest Grove, Cornelius, North Plains, Gaston, and Banks. Along with conveyance infrastructure, the District's West Basin includes three water resource recovery facilities (WRRF) – the Rock Creek, Hillsboro, and Forest Grove WRRFs.

The recommendations of this Plan account for growth and emerging challenges anticipated over the planning period (through the year 2045) and beyond. These include:

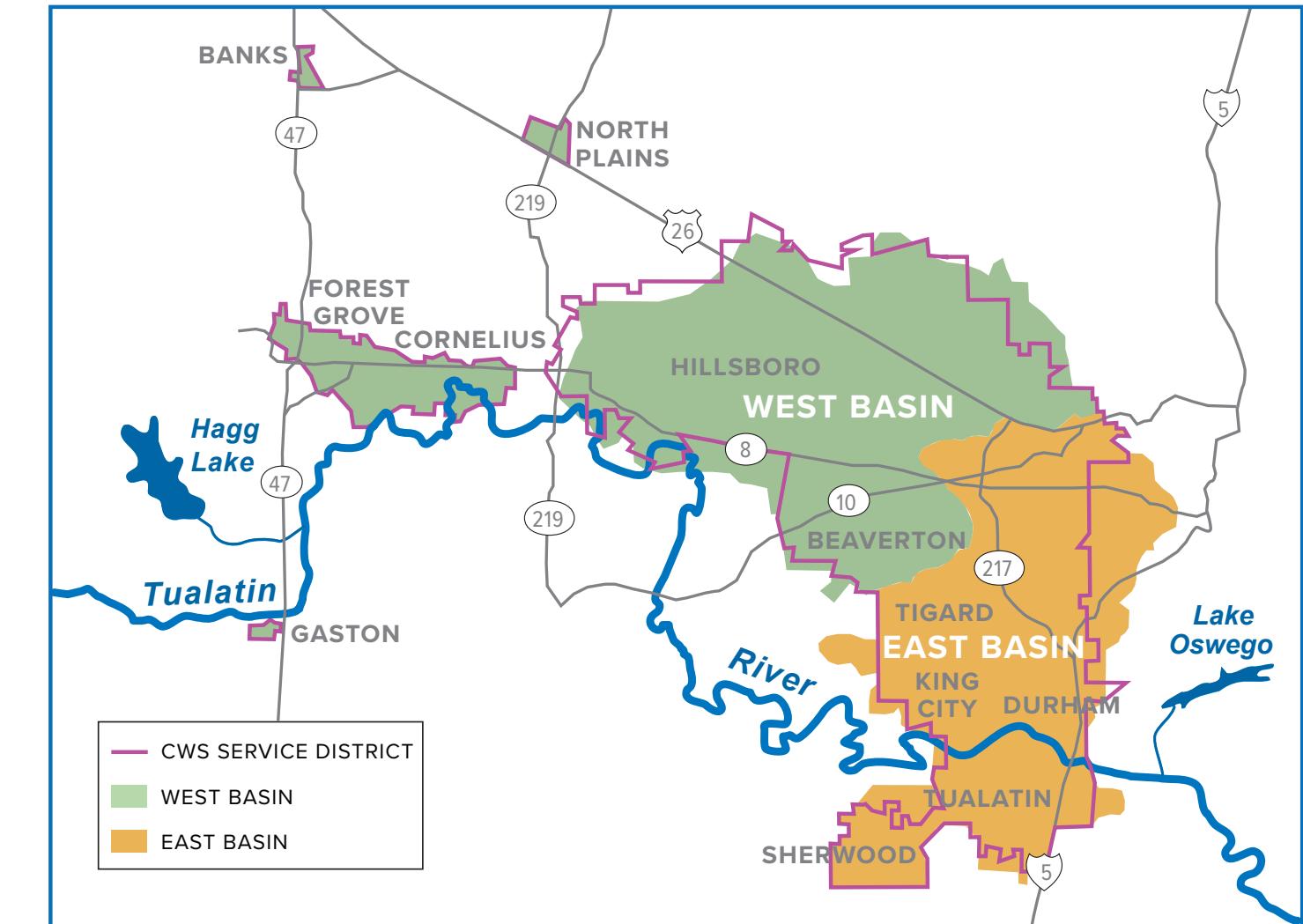
- Capacity to serve growth and industry.** This includes residential flow from infill of existing served areas (Oregon House Bill 2001 allows single family residential zoned areas to densify), expanding the collection system into the identified growth areas, including unincorporated Washington County and the cities of Beaverton, Hillsboro, Forest Grove, Cornelius, North Plains, Gaston, and Banks, and the ability to serve existing and future industrial customers and customers and co-implementer city goals.
- An uncertain regulatory environment.** The alternatives in the plan are flexible to adapt to changes in discharge limits (e.g., mass loads, nutrients, temperature) and take advantage of potential future reuse opportunities.
- Infrastructure age and condition.** Collection system projects in all basins target aging assets (pumping and conveyance pipelines), and several WRRF improvements are driven by the need to repair or replace components nearing the end of their useful life.
- Resilience for seismic events and climate change.** Throughout the collection system and at all WRRFs, the plan increases seismic resilience over time and accounts for the variability of flows due to climate change.

West Basin Service Population



CBOD: carbonaceous biochemical oxygen demand
PPD: pounds per day

West Basin Study Area



Sanitary basin plans are one element of the District's overall planning efforts, along with strategies for stormwater management and natural enhancement and ongoing adaptations based on water quality data. The District's planning efforts interface with local planning, land use, and community needs, and the District's co-implementers at cities within the West Basin service area provided input on projected areas of growth or new development. As the Plan was developed, the District team provided regular updates to and sought input from the Clean Water Services Advisory Commission (CWAC). CWAC feedback helped develop the non-cost criteria used to evaluate potential conveyance projects.



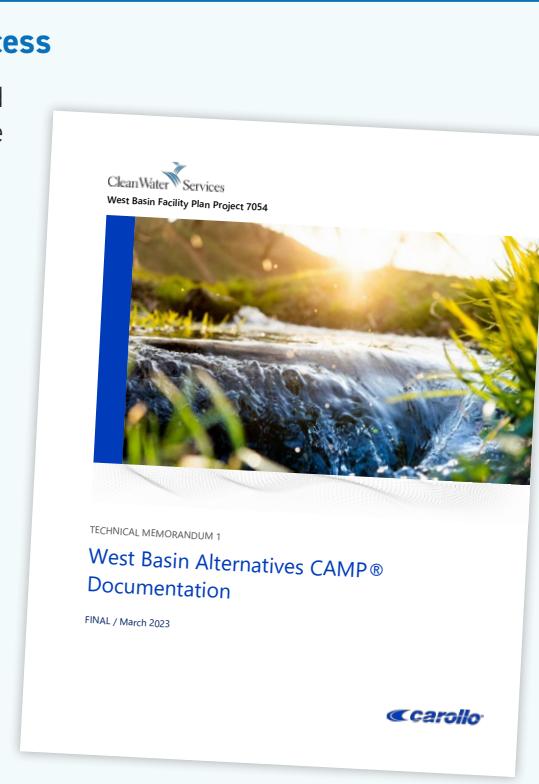
Basin Analysis

The West Basin planning process started with a multiday working session involving treatment, conveyance, and regulatory specialists from the District and consultant team. The team evaluated different scenarios encompassing the treatment and conveyance infrastructure within the West Basin.

Four conveyance and two treatment scenarios were considered, with the conveyance scenarios assuming different distributions of flows and loads between Forest Grove, Hillsboro, and Rock Creek, and the treatment scenarios assuming different National Pollutant Discharge Elimination System (NPDES) permit limits and options for treating solids generated at each WRRF. Major findings of the process framed the more detailed evaluation of alternatives conducted during the next planning phase.

Key Findings of the Initial Planning Process

- The most effective use of conveyance and treatment infrastructure should maximize flows to the Rock Creek WRRF, with flows from Banks and West Forest Grove diverted to the Forest Grove WRRF.
- Under the current regulatory environment, there is sufficient space at the Rock Creek WRRF to accommodate treatment requirements through the planning period. Should the regulatory picture change, space should be retained at the Forest Grove WRRF for liquid stream expansion and/or a regional solids treatment facility, and the use of the regional conveyance system should be reevaluated.



Detailed Evaluation of Alternatives

Once the preferred conveyance and treatment scenario was identified, the team performed more detailed evaluations of conveyance and treatment alternatives to achieve the planning goals for capacity and performance. The recommended alternatives for conveyance and each WRRF are summarized later in this document. Key objectives were sought for each conveyance and treatment alternative, as summarized below.

Optimization to Maximize Use of Existing Facilities

Basin planning helped the team optimize treatment and conveyance within the West Basin. The subsequent, more detailed evaluations of conveyance and treatment alternatives identified additional opportunities for optimization, such as:

- **Regional Conveyance of Solids and Peak Flows.** Currently, the District uses two high head pump stations (HHPS) and twin 24-inch force mains to shift flows and loads on a seasonal basis, maximizing the capacity of existing treatment units across the West Basin. Key HHPS improvements will allow this process to continue in the future, deferring major treatment expansions at both Forest Grove and Hillsboro WRRF.
- **Getting the Most From Existing Treatment Processes.** Existing tertiary treatment (filtration) processes at Rock Creek are approaching capacity. The District is planning to expand the filters considering multiple parameters including chemical dose, the degree of pretreatment, and filter loading rate. The District will conduct full-scale testing of existing filters as part of the expansion project, defining these parameters to optimize project timing and capacity.
- **Conveyance Optimization:** The team evaluated optimal level of infiltration and inflow (I&I) removal for cost-effectiveness across conveyance and treatment systems. In the Rock Creek system, the team performed an optimization across thousands of conveyance options with objectives to reduce costs and increase system performance.

Innovation to Increase Performance

In multiple process areas, the planning team evaluated innovative processes to maximize performance and reduce capital cost. For example:

- **Secondary Process Densification.** Before expanding secondary treatment, the District will continue to test processes that increase mixed liquor density in the activated sludge process. Incorporating densification into secondary treatment improvements may help the District get more secondary capacity within a smaller footprint.
- **Primary Sludge Heating.** The District is evaluating an alternative to optimize the process that thickens primary solids and generates volatile fatty acids (VFA) to enhance biological phosphorous removal, also known as unified fermentation and thickening (UFAT.) By heating primary solids prior to thickening and/or by modifying operation of the UFAT system, the District may be able to defer a multimillion dollar UFAT expansion project.

Flexibility to Adapt to Change

The planning team worked closely with the District's Regulatory Affairs Department to determine the likely future permit requirements. The group considered the impact of the following permit conditions:

- **Aluminum.** With the Environmental Protection Agency's establishment of aquatic life criteria for aluminum, future tertiary treatment requirements at Rock Creek WRRF are uncertain. Currently, Rock Creek requires addition of aluminum (in the form of alum, a chemical coagulant) in the tertiary processes to meet the 0.1 mg/L total phosphorus (TP) limit. This could result in elevated aluminum concentrations in the effluent that may impact the ability to meet future aluminum limits. An effluent phosphorus limit of 0.5 mg/L can be met with reduced alum addition early in the process where the aluminum will be effectively removed from the effluent. The recommended plan preserves space to meet a 0.1 mg/L TP limit with an aluminum limit in place. Pilot testing the tertiary filtration process will help the District understand how to maximize the existing tertiary treatment infrastructure with minimum alum addition, to minimize the aluminum concentration in the final effluent.
- **Phosphorous.** Water quality modeling suggests that the Tualatin River is no longer as sensitive to phosphorus inputs as it once was. To address the needs of the river and mitigate impacts from aluminum requirements, the District continues to work with the Oregon Department of Environmental Quality to support an update of the phosphorus Total Maximum Daily Load (TMDL). Based on this uncertainty, two effluent TP scenarios were evaluated: (1) 0.1 mg/L TP and (2) 0.5 mg/L TP.
- **Bubbled Total Suspended Solids (TSS) Mass Load.** In addition to meeting TSS concentration limits at each of the District's four WRRFs, the District four WRRFs must also meet a bubbled mass load limit. The District is currently able to meet this limit with tertiary filtration at the Rock Creek and Durham WRRFs. If the mass load limit is not raised, sometime between the year 2045 and buildout, the District will need to consider different alternatives to comply with the limit. This Plan evaluated tertiary filtration expansion alternatives at the Rock Creek WRRF and recommends an approach that minimizes capital expenditure and preserves space for tertiary filters at the Forest Grove WRRF, if needed to comply with the bubbled mass load limit beyond the planning period.
- **Per- and polyfluoroalkyl substances (PFAS).** The future of regulatory action on PFAS is uncertain, however there may be restrictions that could affect the land application of biosolids. Therefore, solids stabilization processes that destroy PFAS or the ability to cost-effectively add processes that could destroy PFAS were considered during the solids planning process.

Building Resilience Over Time

In 2018, the District completed a detailed evaluation of the seismic resilience of existing treatment processes at the Rock Creek WRRF. The study developed level of service (LOS) goals to be achieved over time, which are shown in the table on the following page. The planning team applied this process to the facilities at Forest Grove and Hillsboro. In addition, the District completed a Regional Climate Change Modeling Approach Evaluation as part of the West Basin planning process, which informs future efforts to estimate the impact of climate change on key parameters including population growth and peak flows due to rainfall-derived I&I. In the conveyance system, the District considered opportunities to build resiliency for creek crossings and above-ground pipelines including coordination with bridge resiliency projects.

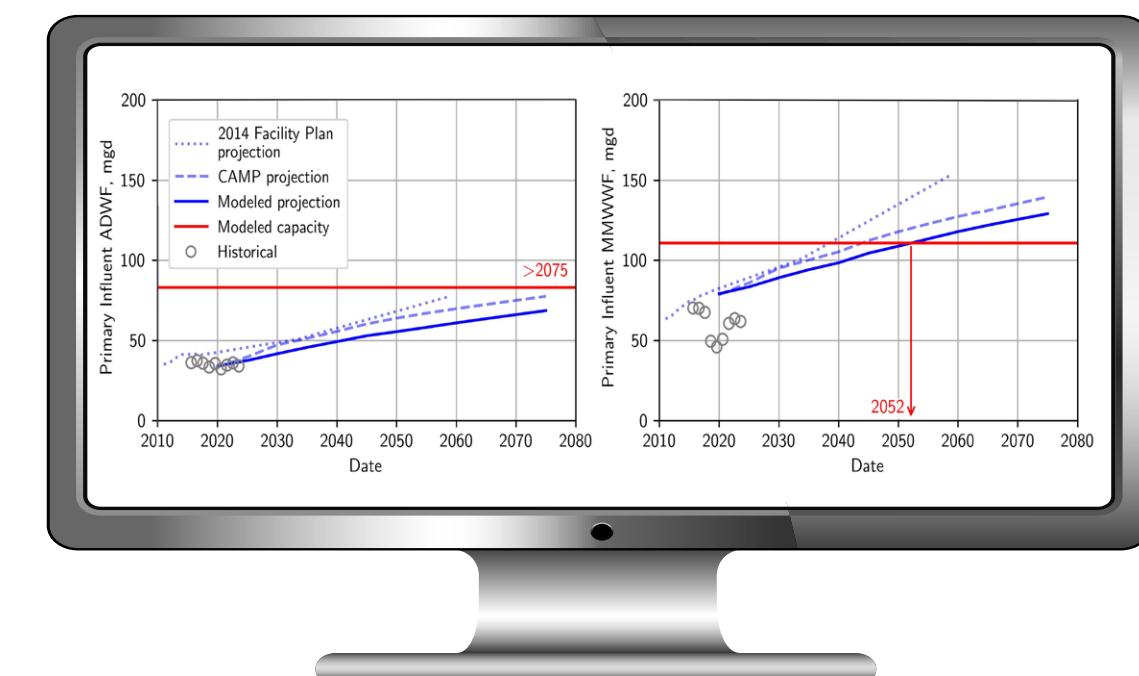
LOS Goals for WRRFs

Phase	Time Horizon	Power Status	Treatment Objective
Immediate	First 24 hours	Unavailable	Pumped bypass with disinfection
Midterm	First 3 months	Unavailable	Primary treatment with disinfection
Midterm	First 6 months	Available	Secondary (30/30) treatment
Long term	Beyond 6 months	Available	Full NPDES compliance

Just-In-Time Capacity

"Just-In-Time Capacity" refers to the District's philosophy of continually assessing growth and the timing of projects to add conveyance and treatment capacity, so that the District is always able to serve residents, businesses, and industries. Initiating process expansions to match flow and load increases due to growth is fundamental to the District's planning process. The West Basin planning team developed a family of trigger plots for each liquid and solids stream treatment process, considering the key flow and load parameters that influence that specific unit processes capacity. These plots represent flow and load increases based on population data taken from the Portland State University Population Research Center.

In cases where recent trends differ from these projections, the planning team developed a range of trigger years (i.e., the earliest date based on projections, the later date reflecting current trends). The potential to distribute capital expenditures over the planning period by selecting the later trigger year is reflected in the Capital Improvement Plan (CIP) presented in this Executive Briefing.



Trigger plots developed for each WRRF process help the District add treatment capacity to match growth. Similarly, trigger plots developed for the conveyance system identify critical capacity bottlenecks in the collection system.

Collection System Planning Process

Collection System Decision-Making Process

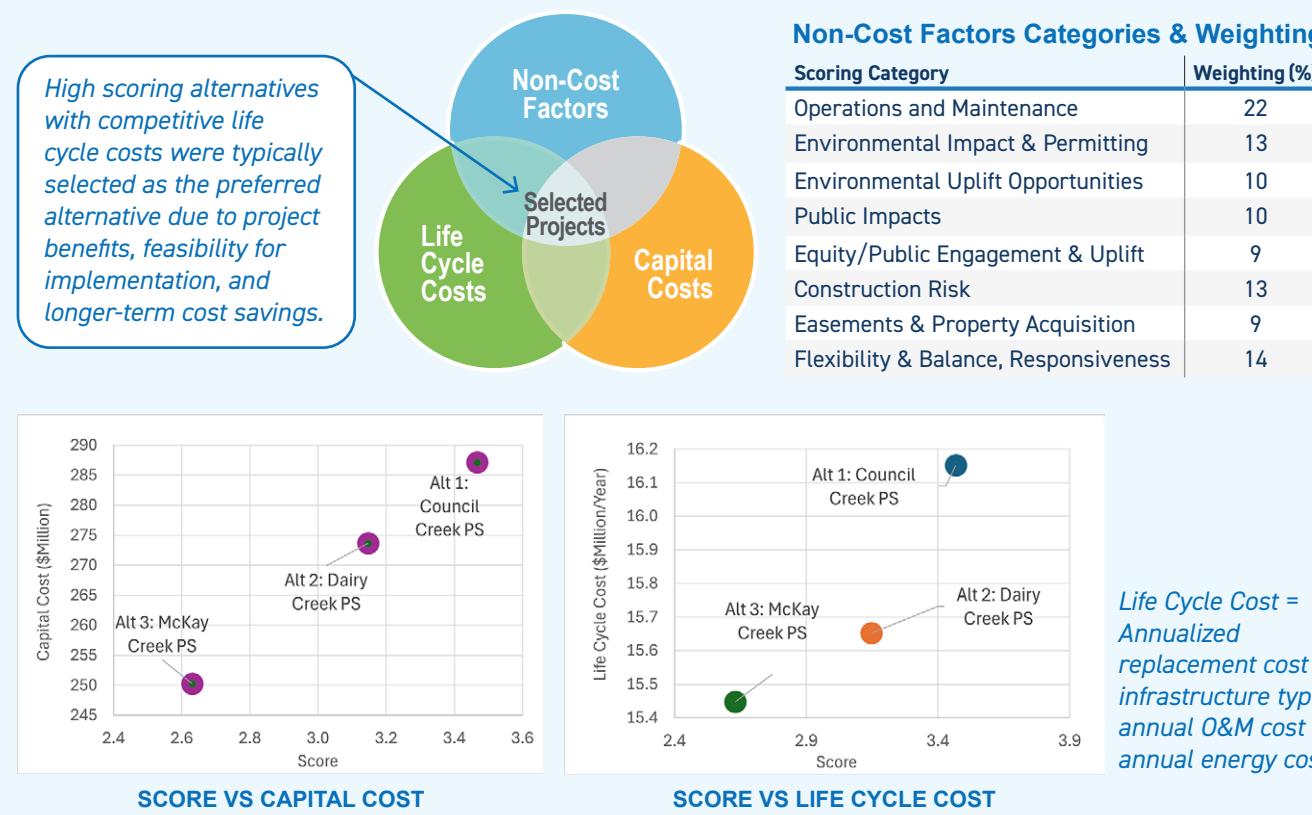
The planning team collaborated with District staff to evaluate, score, and select conveyance system improvements from many alternatives. The process integrated multiple perspectives in discussing and selecting each improvement project including participation from conveyance, pumping and treatment, natural resources, and operations and maintenance (O&M) staff. Weighted scoring criteria covering improvement project feasibility, risk, and opportunities were established with higher weighting for scoring categories with long-term benefits such as O&M.

Initial capital costs and life cycle costs were also compared for each alternative. Life cycle costs consist of annualized replacement costs of different asset types (pumps vs pipes) with varied life spans, annual O&M costs, and annual energy costs.

An example decision process for the Hillsboro and Forest Grove systems is presented below where three alternatives were considered for a new diversion pump station using cost comparisons and the scoring methodology.

Alternatives Selection Process

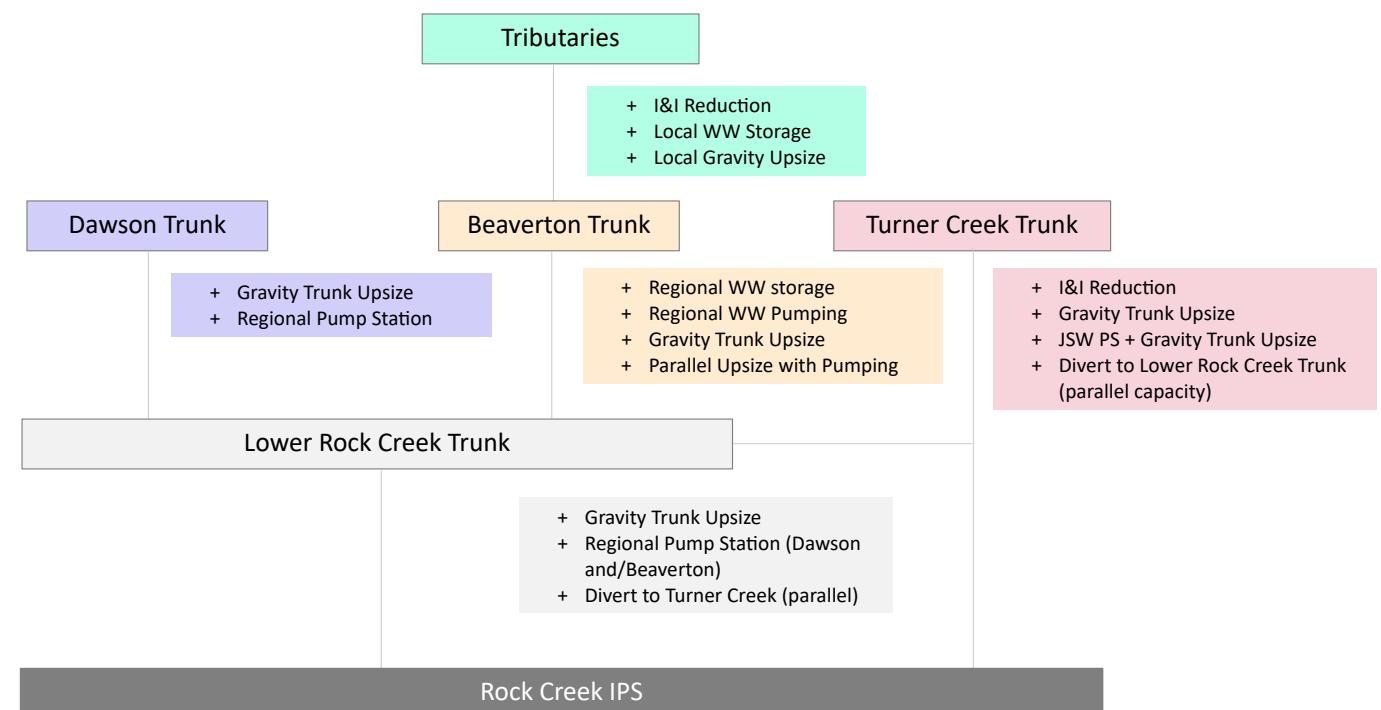
The example below includes three integrated alternatives with a range of gravity system improvements and three pump station and force main options between the Hillsboro and Forest Grove basins. The preferred alternative (highest score, Council Creek Pump Station) was selected due to feasibility of construction and flexibility for phasing. The Council Creek Pump Station alternative had a higher initial capital cost and a competitive life cycle cost while scoring higher than other alternatives on non-cost categories.



The Rock Creek system is complex with hundreds of potential combinations of improvement projects making up thousands of alternatives. The schematic below presents the combinations of improvement types considered for different areas of the system including I&I abatement, pipe upsizing, wet weather storage, regional pump stations, and basin rerouting via diversion pumping.

For the alternative review process in the Rock Creek system, the planning and District team first optimized for a wide range of improvement alternatives for initial capital cost, life cycle cost, and improvement scoring and then narrowed the discussion to high-scoring and low-cost alternatives for finalizing improvement project selection.

Rock Creek Composite Options and Scenarios



I&I = Rainfall-Derived Infiltration and Inflow
WW = Wet Weather
JSW = Jackson School West
PS = Pump Station
IPS = Influent Pump Station

Collection System Improvements

Based on the alternatives scoring and review, improvements were selected in the categories presented below and shown on the adjacent maps. Growth projections and system capacity were coordinated with co-implementer cities (Hillsboro, Beaverton, Forest Grove, Cornelius, Banks, Gaston, and North Plains). Gravity conveyance pipeline projects smaller than 24 inches in diameter and within city limits are implemented by the cities. All pump station and force main projects are implemented by the District. Gravity conveyance pipelines projects 24 inches and larger located anywhere within the District, or smaller than 24 inch but located in unincorporated Washington County are also implemented by the District.

1. Wet Weather and Growth Capacity – Projects are required due to a combination of limited existing capacity, influence of I&I, and future growth.

- Beaverton Trunk System and Tributary Trunks (Erickson Creek Trunk coordinated with the City of Beaverton).
- Lower Rock Creek Trunk System.
- Turner Creek Trunk System (upper trunk system coordinated with the City of Hillsboro).
- Minter Bridge Trunk System (coordinated with the City of Hillsboro).
- McKay Creek Tributary Trunk (coordinated with the City of Hillsboro).
- Council Creek Pump Station (alleviates capacity issues in the Lower Hillsboro Trunk System).
- Central Forest Grove Trunk System (coordinated with the City of Forest Grove).
- Aloha Pump Station and Trunk System.

2. Growth Capacity – Projects are primarily driven by co-implementer city and county growth.

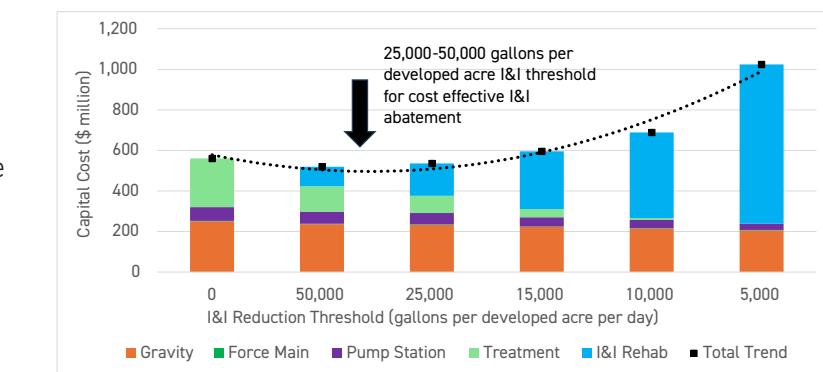
- North Hillsboro Pump Station and Trunk System (Jackson School East coordinated with City of Hillsboro and developers).
- Dawson Pump Station and Trunk System.
- South Hillsboro Pump Stations and Trunk System (multiple pump stations and diversion from the Aloha Basin).
- West Forest Grove Trunk System (coordinated with the City of Forest Grove).
- Cornelius Trunks (coordinated with the City of Cornelius).
- Gaston Pump Station.
- Banks Pump Stations.
- North Plains Pump Station.

3. Strategic Rainfall-Derived I&I Abatement Program (pipe and lateral rehabilitation) – A program to reduce the influence of rainfall and groundwater into the system. In many cases, downstream capacity projects are required, but when balanced with I&I abatement, infrastructure sizing is more feasible for construction and longer-term O&M.

The I&I abatement program is coordinated with co-implementer cities in key areas. Within city limits a 50/50 shared cost program is available. Cities perform I&I assessment and abatement within city limits and the District performs the same work in unincorporated Washington County and for all pipelines 24 inches and larger. Areas planned for I&I abatement include:

- City of Beaverton in tributary system to the Beaverton Trunk and Rock Creek WRRF (Erickson and Johnson Creek basins).
- City of Hillsboro in tributary systems to the Turner Creek Trunk, Rock Creek WRRF, and McKay Creek Trunk.
- City of Forest Grove in downtown and west Forest Grove reducing impact to the Forest Grove WRRF.
- Aloha Basin and Cross Creek Basin in unincorporated Washington County with impacts to the Aloha Pump Station, South Hillsboro Pump Stations, and Rock Creek WRRF.

A critical part of the Plan was to identify a cost-effective level of investment in the I&I abatement program when balanced with capacity upgrades for conveyance and treatment. The map on the next page shows the results of the analysis where varied thresholds of I&I removal were considered in combination with capacity upgrades to understand the optimal investment across the system.

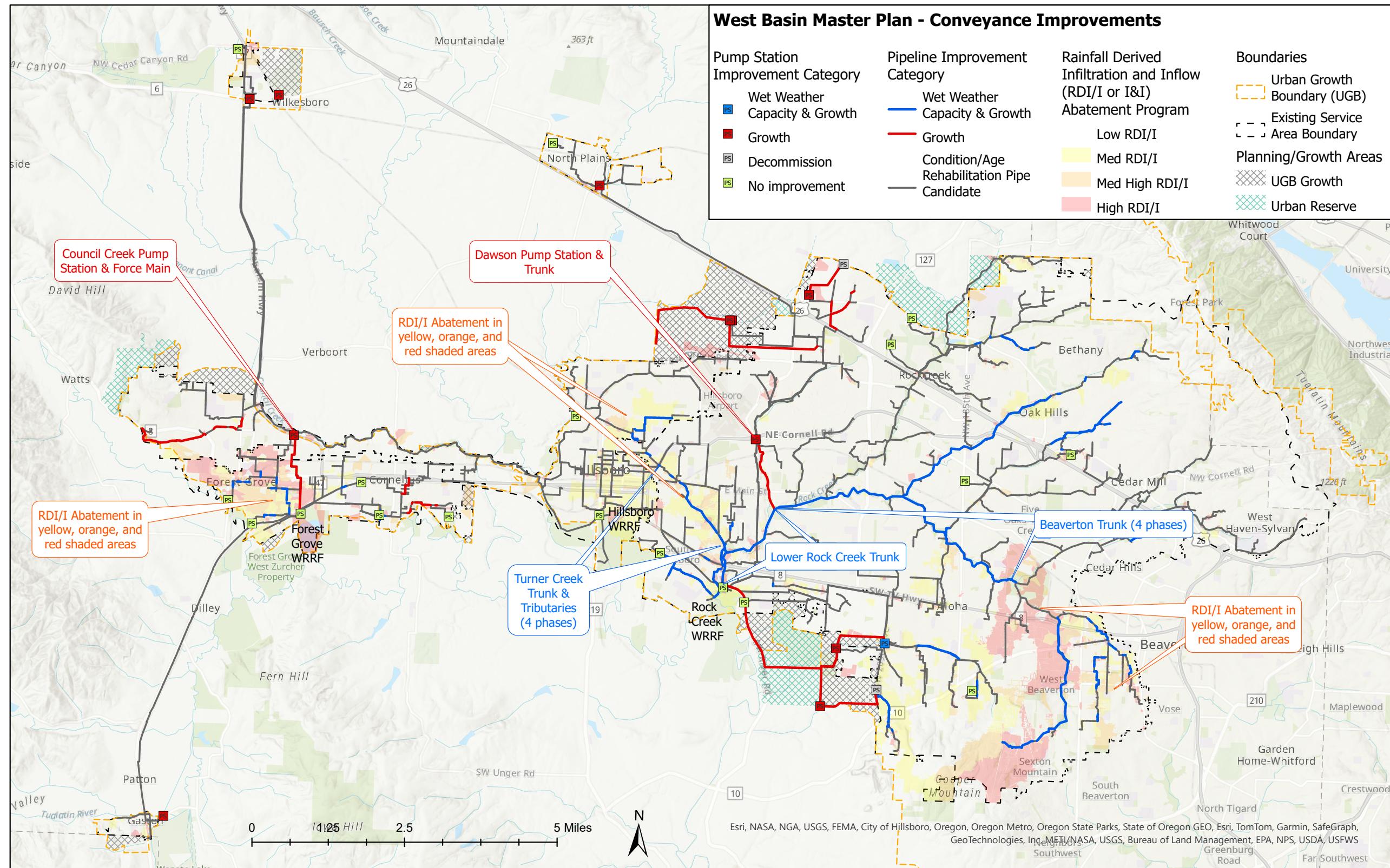


4. Large Diameter Pipeline Infrastructure Age/Condition – A program to fund repair and replacement (R&R) of existing gravity pipelines as assets reach the end of their useful life.

Individual projects were not defined, but a program cost was estimated based on available age, material, and condition data. Future program work will include more detailed risk assessment of assets and prioritization of funding for assets with the highest risk for structural failure or increased O&M requirements. The R&R program will be coordinated with the I&I abatement program and capacity upgrades as some assets are impacted by poor condition, I&I, and existing capacity limits. Pump station asset replacement and costs are tracked by District staff and were not documented within the plan.

See map on following page.

Collection System Improvements



The West Basin conveyance system capital improvement plan includes projects for growth capacity and wet weather capacity, and programs for I&I abatement and pipeline rehabilitation. This map illustrates project locations and highlights four key capacity projects. These four projects are also described in more detail on pages 13 and 14.

Collection System Capital Improvement Plan



The conveyance capital improvement plan includes more than 50 capacity projects (~\$648 million) plus the I&I abatement program (~\$260 million) and R&R program (~\$168 million). Project costs are class 5 estimates in 2025 dollars (-50 percent to +100 percent planning accuracy where project concepts are at ~2 percent maturity). Costs include city shared funding contributions. Several of the larger projects are described below and an overall capital improvement plan timeline for major projects presented of below.

1 Council Creek Pump Station and Force main

Timing: 2025-2029

Estimated Project Cost: \$19 million (2025 dollars)

- Driver: Alleviate capacity constraints in Lower Hillsboro Trunk and accommodate growth in West Forest Grove.
- 10-11 million gallon per day (mgd) pump station with 20- to 24-inch force main (~7,000 linear feet).
- Diversion structure on Council Creek Trunk can split flow between Forest Grove and Hillsboro treatment facilities.

2 Turner Creek Trunk

Timing: Four phases (Phases 1 & 2, 2025-2030; Phase 3, 2030-2035; Phase 4, 2040-2045)

Estimated Project Cost: \$74.5 million (2025 dollars)

- Driver: Existing capacity and I&I influence.
- Lower range of sizing available with target I&I abatement.
- Trunk sewer upsized to 18- to 36-inch diameters with some local 10- to 12-inch diameters (>17,000 linear feet).
- Local park opportunities (City of Hillsboro) for uplift or linear storage.
- Consider routing opportunities to improve access for O&M.

3 Beaverton and Lower Rock Creek Trunks

Timing: Five phases (Beaverton Trunk Phase 1, 2027-2032; Phase 2, 2032-2037; Phase 3, 2037-2042; Phase 4, 2042-2046; Lower Rock Creek Trunk, 2045+).

Estimated Project Cost: \$285 million (2025 dollars)

- Driver: Existing capacity, I&I influence, and growth.
- Lower range of sizing available with target I&I abatement.
- Trunk sewer upsized to 66- to 90-inch diameters (>36,000 linear feet).
- Lower range of sizing protects the Rock Creek Influent Pump Station by allowing surcharged storage and greater level of peak flow attenuation.

4 Dawson Pump Station and Trunk

Timing: (Pump Station, 2027-2032; Trunk, 2040-2045, may be delayed indefinitely depending on North Hillsboro development and type of industry).

Estimated Project Cost: \$27 million (2025 dollars).

- Driver: Industrial growth (North Hillsboro).
- Pump station expansion (expand from 18 mgd to 27.5 mgd), no additional force mains.
- Trunk sewer upsized to 42-inch diameter (>6,000 linear feet).
- Creek uplift opportunities with trunk sewer project.

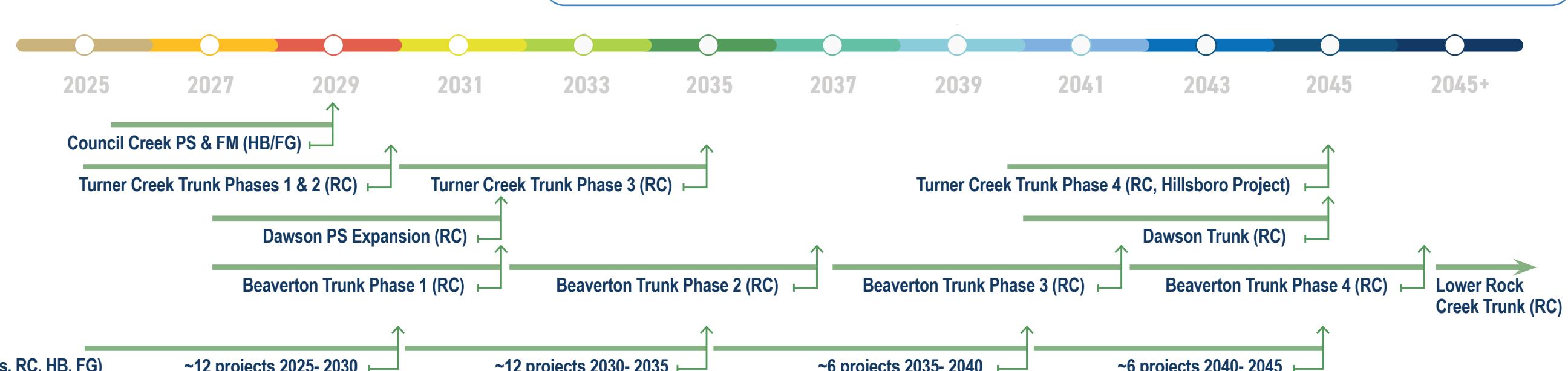
Collection System Project Timeline

The figure at right shows the expected CIP for collection system projects.

KEY — Design & Construction Duration

I&I = Rainfall-derived infiltration and inflow, PS = Pump Station, FM = Force Main, RC = Rock Creek Basin, HB = Hillsboro Basin, FG = Forest Grove Basin

Large Projects (multiple phases)



Additional Projects

(coordinated with cities, RC, HB, FG)

~12 projects 2025- 2030

~12 projects 2030- 2035

~6 projects 2035- 2040

~6 projects 2040- 2045

I&I Abatement Program (coordinated with cities, RC, HB, FG)

Pipeline Rehabilitation Program (RC, HB, FG)

ROCK CREEK WRRF IMPROVEMENTS

Rock Creek WRRF Projects

The planning team identified over \$396 million in process improvement projects at the Rock Creek WRRF that will be needed through the planning period (through year 2045). As previously described, most projects incorporate some combination of optimization, innovation, and a just-in-time approach to matching capacity with growth. Additional projects have been identified as being needed to meet buildout flow and load conditions. The figure at right is a site plan illustrating the conceptual layout of these projects.

The estimated timeline of each improvement identified within the planning period is shown in the figure on the following pages. Several key projects that will be triggered in the relative near term are described below.

1 Tertiary Filter Expansion, Phase 1

Trigger Date: 2029
Estimated Project Cost: \$50 million

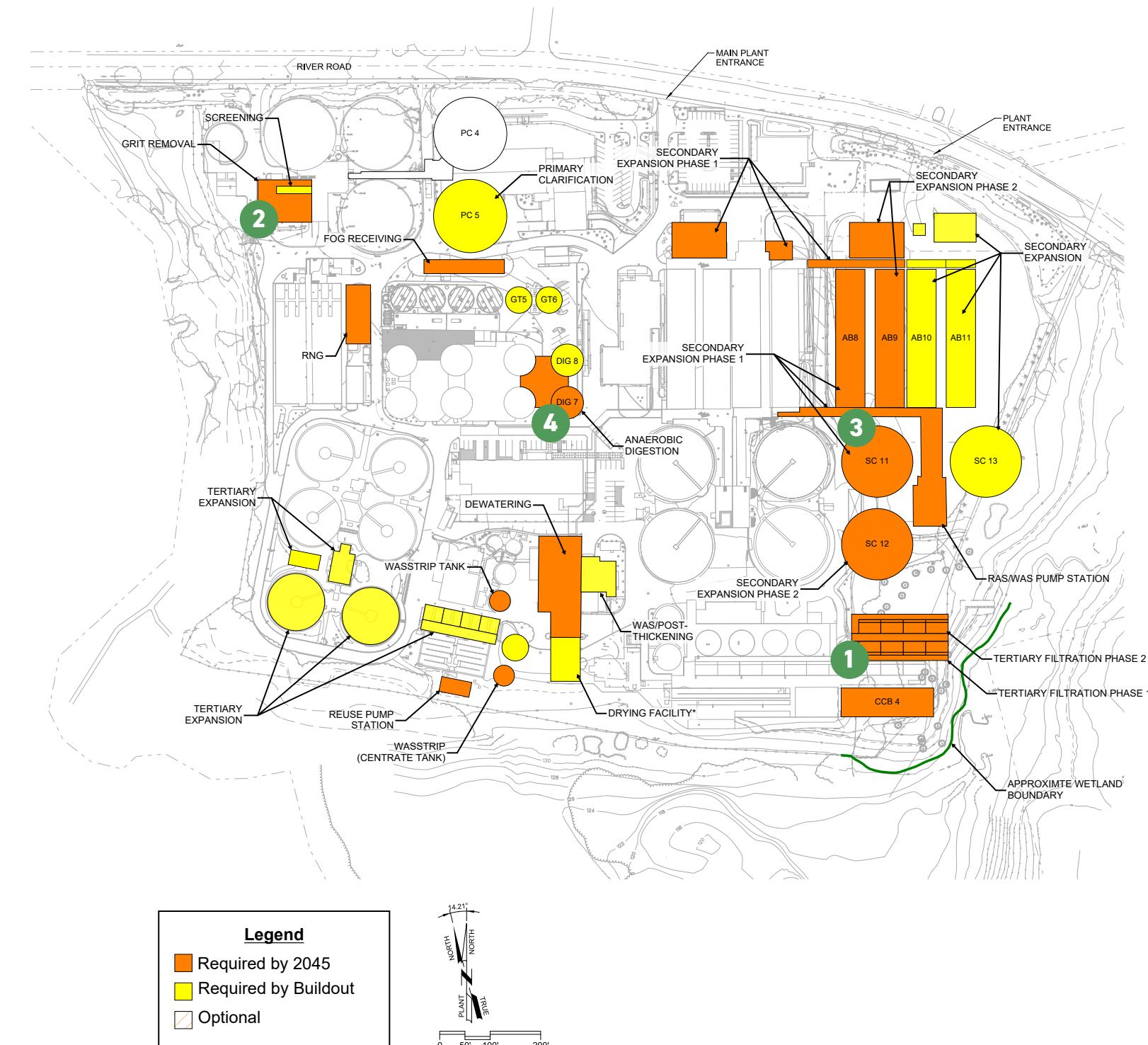
Driven by TSS and phosphorous limits, the Phase 1 Tertiary Filter Expansion Project will include up to four new granular media filters (GMF) constructed as part of the existing East filter complex. Support facilities including backwash facilities will also be included. The number of GMFs will be determined based on pilot testing and constructability review during preliminary design.



2 Grit Removal Improvements

Trigger Date: 2029
Estimated Project Cost: \$4 million

The existing grit removal system, which removes grit from primary sludge settled in the primary clarifiers, is nearing the end of its service life and lacks redundancy under peak conditions. Several alternatives were evaluated to improve system capacity, reliability, and performance. During preliminary design, the District will perform testing to compare a conventional grit removal with an innovative process that produces a cleaner, dryer grit project, which has the potential to reduce the cost of grit disposal.



3 Secondary Expansion Phase 1

Trigger Date: 2032
Estimated Project Cost: \$80 million

Expansion of the current secondary (activated sludge) process is expected to be needed between 2032 and 2036. Space for building a new aeration basin and secondary clarifier is provided on the east side of the WRRF site. In addition to multiple secondary support facilities (e.g., primary sludge pumping, return activated sludge/waste activated sludge, aeration blowers), the District will evaluate intensification to increase the capacity per unit volume gained by the expansion.



4 Digester Improvements

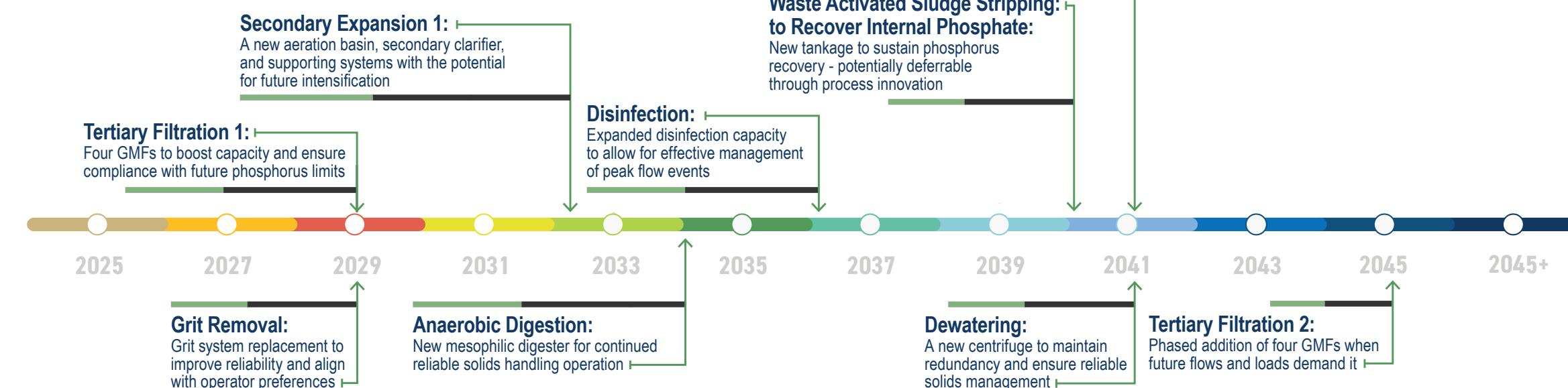
Trigger Date: 2034
Estimated Project Cost: \$40 million

The existing digestion system at Rock Creek will reach its reliable capacity to treat solids under maximum loading conditions within the planning period. The recommended alternative expands the current, proven mesophilic digestion process. The recommended alternative also maintains space on the site for future improvements that dry biosolids to achieve a Class A product to reduce hauling costs and/or as one step in a process to destroy PFAS, if needed.



Rock Creek WRRF Project Timeline

The figure at right shows the expected CIP for improvements at the Rock Creek WRRF with a trigger year within the planning period. The figure shows the expected duration of each project, including design and construction. As shown, multiple, overlapping projects will likely be needed over the next decade.



HILLSBORO WRRF IMPROVEMENTS

Hillsboro WRRF Projects

The Hillsboro WRRF will continue to play a critical function in the West Basin, providing wet weather treatment capacity and helping to distribute flows and loads from the Hillsboro service area to other treatment facilities during the regulatory dry weather season. Although no expansion projects are identified during the planning period, the planning team identified important improvements to the headworks as well as other improvements to address the reliable performance of preliminary treatment and ultraviolet (UV) disinfection systems, with total estimated CIP project costs ranging from \$14 million to \$60 million.

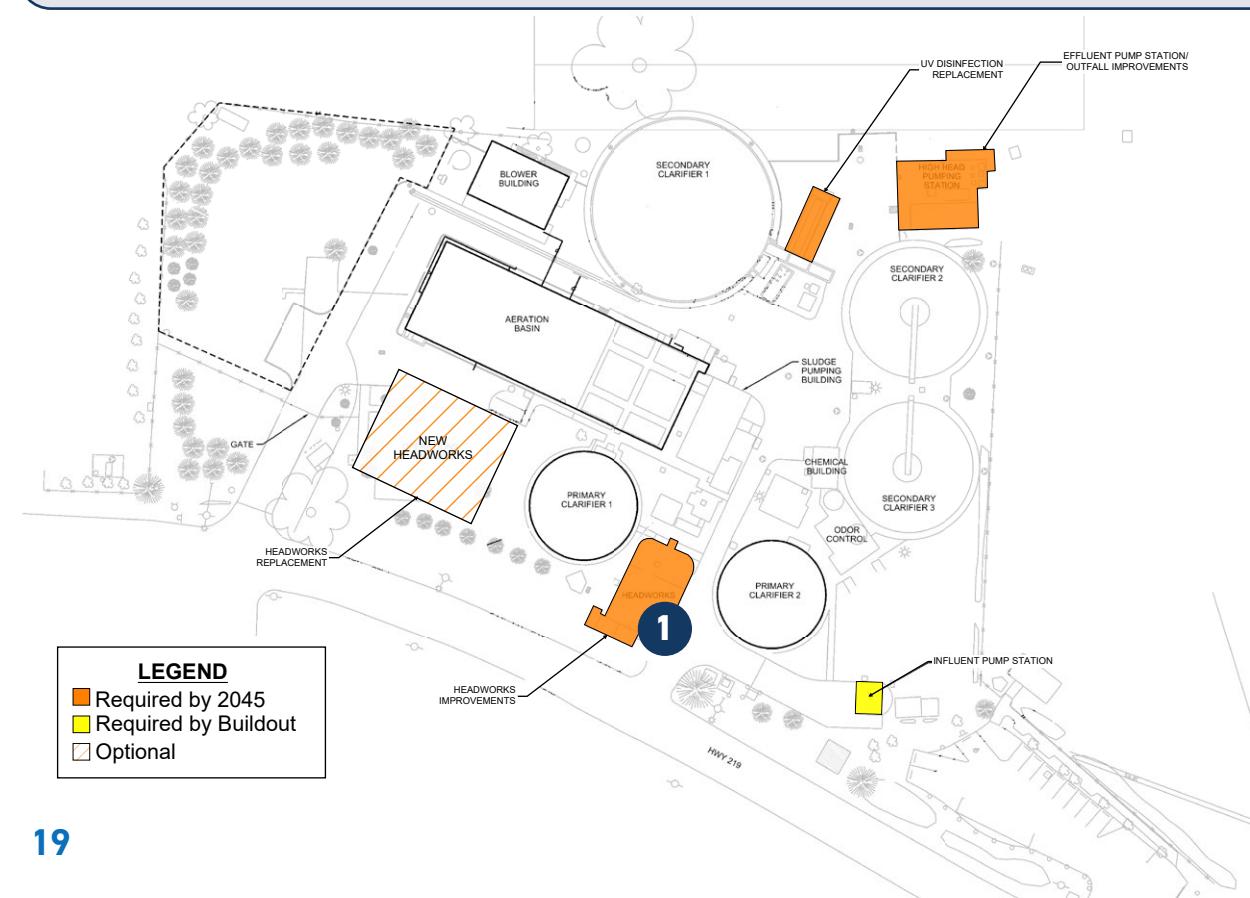
The estimated timeline of each improvement identified within the planning period is shown in the figure on pages 21 and 22. A key project that will be triggered in the relative near-term is described below.

1 Headworks Improvements

Trigger Date: 2025+

Estimated Project Cost: \$4 million to \$40 million

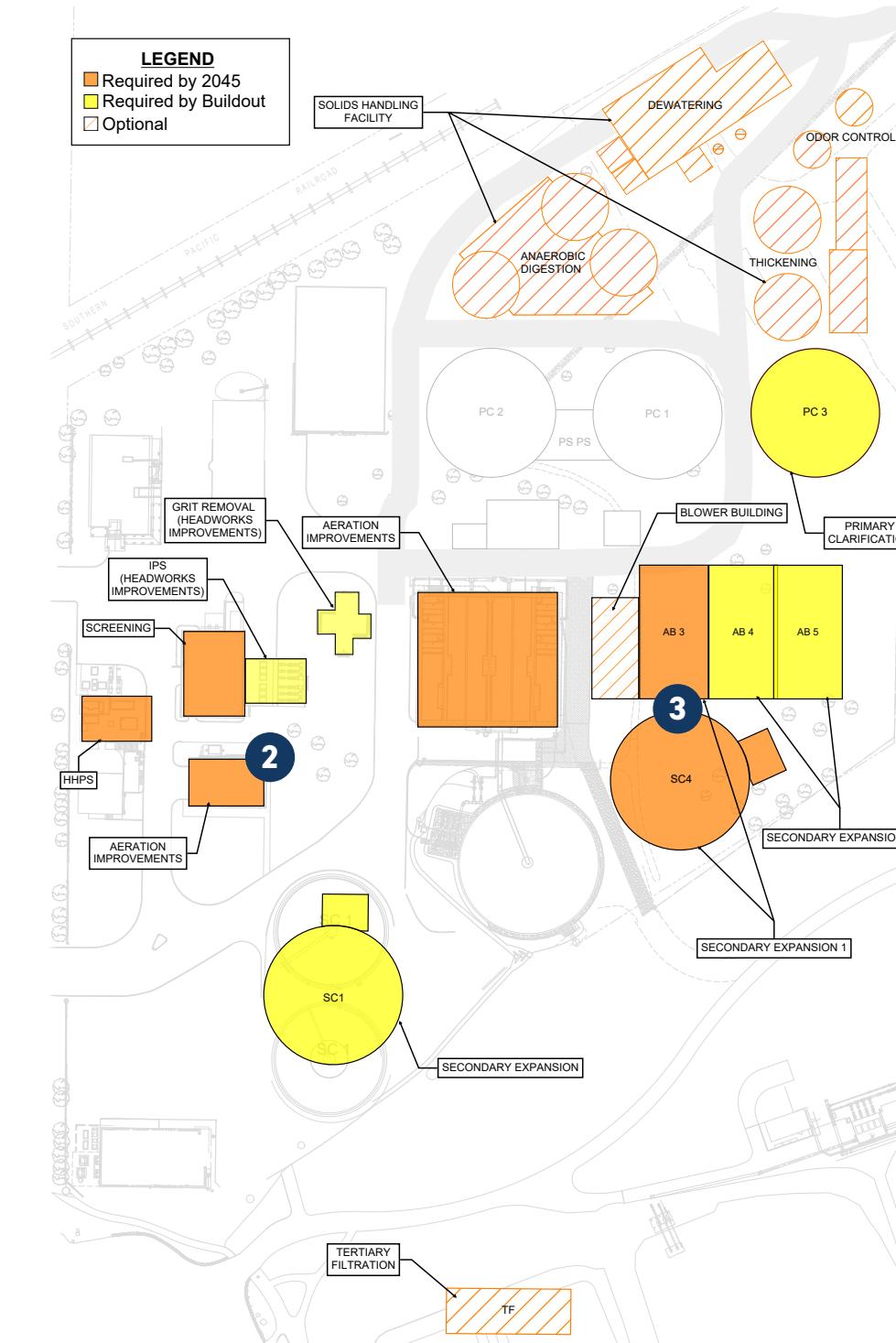
Improvements to the existing headworks at Hillsboro are needed to address equipment reliability and working conditions within the building. The planning team considered two alternatives – more modest improvements to the existing structure, or construction of a new facility. Accordingly, the CIP includes a range of costs. As this project moves forward, the District will select the preferred set of improvements to meet CIP constraints and performance goals.



FOREST GROVE WRRF IMPROVEMENTS

Forest Grove WRRF Projects

Due to its location in the West Basin regional system and available space at the site, the Forest Grove WRRF will see more significant expansion over the planning period. Key improvements at Forest Grove, totaling over \$57 million in estimated project costs, will address secondary capacity due to service area growth and to treat flows and loads that will be rerouted from Hillsboro.



The estimated timeline of each improvement identified within the planning period is shown in the figure at the bottom of the page. Key projects that will be triggered in the relative near term are described below.

2 Aeration Improvements

Trigger Date: 2029

Estimated Project Cost: \$10 million

Improvements to the existing Forest Grove aeration system are needed to increase treatment capacity, efficiency, and reliability of assets. The project will include new high efficiency blowers to supply air to the secondary process, new aeration piping and diffusers in the existing aeration basins, and automated controls.



3 Secondary Expansion Phase 1

Trigger Date: 2034

Estimated Project Cost: \$30 million

Following aeration system improvements, the secondary process will require expansion to accommodate growth. A new aeration basin and secondary clarifier are required within the planning period. There is space for an additional primary clarifier and secondary expansion to meet buildout flows and loads, while leaving room to the north of the site for a potential future regional solids treatment facility.

Forest Grove & Hillsboro WRRF Project Timeline

KEY
 — Design Duration
 — Construction Duration

