SECTION 5
Basis of Planning

5.1 Basis for Design

Understanding and documenting the various water quality and treatment requirements applicable to the TCWTP within the planning horizon is necessary to establish regulatory required LOS, which will serve as planning/design criteria, and to anticipate future facility upgrades and improvements to the TCWTP wastewater conveyance and treatment systems.

Ultimately, the wastewater facilities plan must prepare alternatives that will meet not only the requirements of today's regulatory environment, but also provide flexibility to meet as yet undetermined and undefined discharge requirements. The objective of this section is to define the current and anticipated regulatory criteria and document the outcomes from meetings with the regulatory agencies with jurisdiction over the proposed improvements to the TCWTP wastewater treatment and conveyance systems.

The planning effort for the TCWTP facilities includes developing a plan that will provide sewer services through 2040. This exceeds the 20-year planning period required by DEQ. A key planning aspect is to consider potential future regulatory changes in development and selection of improvements.

A 30-year planning period (2010 to 2040) is generally consistent with the design life of wastewater treatment facilities. A planning horizon of 0 to 10 years will be used for short-term improvements and 10 to 30 years for long-term improvements. Wastewater collection facilities typically have a design life of 50 to 75 years. Collection facilities consider the maximum foreseeable population and economic growth in the project area. This is referred to as the ultimate planning period. When sizing and siting treatment facilities, the ultimate planning period is also used to consider whether adequate space is available for expanding treatment facilities to meet ultimate capacity needs.

5.1.1 Levels of Service

As described in Section 1.2, the TCWTP facilities planning approach was to establish planning and evaluation criteria on the basis of BES Strategic LOS and the Vision and Guiding Principles. The BES Strategic LOS are listed in Appendix A. The Strategic LOS set the stage for development of Tactical LOS specific to TCWTP facilities planning and in alignment with the Vision and Guiding Principles. The Tactical LOS are analogous to baseline planning criteria, which are defined as the *minimum* requirements for long-term (30-year) treatment plant alternatives. The Tactical LOS for this facilities plan are listed in Appendix A with specific technical criteria and notes regarding how they relate to the BES Strategic LOS and support the Vision and Guiding Principles.

Sufficient odor, noise, and aesthetic mitigation consistent with the Tactical LOS is considered to be a prerequisite of any alternative considered as part of the facilities plan evaluations. Provisions and corresponding costs for mitigation were included in the development of each unit process that was considered to be an odor or noise source, or considered to have a potential for a negative aesthetic impact.

5.1.2 Regulatory Requirements

5.1.2.1 Current Regulatory Requirements

The Federal Water Pollution Control Act (or Clean Water Act) Amendments of 1972 through 1987 established the National Pollutant Discharge Elimination System (NPDES) and provided authority to regulatory agencies to control point source pollution discharges to specified effluent limitations. DEQ is the regulatory agency charged with the administration of the NPDES permit program in the State of Oregon.

The TCWTP currently operates under the NPDES Permit Number OR-002689-1, issued by DEQ on November 4, 2004 (provided in Appendix N). Under the terms of this permit, the TCWTP is required to provide secondary treatment and disinfection for wastewater discharged to the Willamette River. A permit renewal application was submitted by BES to DEQ in 2009. The permit renewal is still pending, so the TCWTP continues to operate under the terms of the 2004 permit.

The effluent limits and requirements for the TCWTP are defined in Schedule A of the current NPDES permit. The treated effluent discharge has both mass load and concentration limits for BOD_5 and TSS. These limits are further defined for season variations in flows and loads. These are shown in Table 5-1.

TABLE 5-1
TCWTP NPDES Discharge Requirements
Tryon Creek Wastewater Treatment Plant Facilities Plan

Parameters	30-Day Average [a]		7-Day Average [a]	
Wet Season (November 1 - April 30)				
BOD_5 [b]	30 mg/L	3,100 ppd	45 mg/L	4,600 ppd
TSS [b]	30 mg/L	3,100 ppd	45 mg/L	4,600 ppd
Dry Season (May 1 - October 31)				
BOD_5 [b]	20 mg/L	1,400 ppd	30 mg/L	2,100 ppd
TSS [b]	20 mg/L	1,400 ppd	30 mg/L	2,100 ppd
Other Parameters (Year-Round)				
E. coli Bacteria	126/100 mL		406/100 mL	
pH	Shall be within the range of 6.0 to 9.0 standard units			
Total Residual Chlorine	Shall not exceed a daily maximum of 1.7 mg/L or a monthly average of 0.7 mg/L			
BOD_5 and TSS removal efficiency	Shall not be less than 85% as a monthly average			

[a] Arithmetic mean except for *E. coli* Bacteria, which is a geometric mean.

[b] 30-day average percent removal shall not be less that 85 percent of influent concentration.
BOD_5 = 5-day biochemical oxygen demand; mg/L = milligrams per liter; mL = milliliter; ppd = pounds per day; TSS = total suspended solids.

These current mass load limits are based on an average dry weather design flow of 8.3 mgd and an average wet weather design flow of 12.3 mgd. The mass load limit is suspended during flows that exceed 16.6 mgd. These discharge limits and requirements are specific for the treated effluent.

Currently, the NPDES permit does not specifically address blending during high flow events. The treatment plant does split flow around the secondary process under certain high flow conditions.

Mixing Zone. DEQ issued its *Regulatory Mixing Zone Internal Management Directive* (IMD) in May 2012. This IMD presents the DEQ guidance for mixing zone studies that will be required by DEQ as part of the NPDES permit renewal application package. At this time, it is expected that a new mixing zone study will be required for the next permit renewal application, and the Level 3 requirements from the new IMD will be needed. These requirements include field mixing measurements with a dye study, field measurements of receiving water cross sectional area and velocity at critical conditions, a discussion of model selection and application, a description of near- and far-field mixing and plume dynamics, outfall descriptions, and environmental mapping. The results of the mixing zone study will define dilutions for the NPDES permit development and may also result in changes to the allowable mixing zone dimensions for the discharge of treated effluent into the Willamette River.

Biosolids Quality. Currently, all biosolids generated at the TCWTP are hauled to the CBWTP. There, the solids are combined with biosolids generated at CBWTP and stabilized before reuse in land application. All biosolids leaving the CBWTP must meet state and federal regulations applicable to land application.

Both federal and state regulations apply to land application of biosolids from wastewater treatment plants. Federal regulations include Title 40 Part 257 of the Code of Federal Regulations (40 CFR 257) and approved 40 CFR 503. State of Oregon regulations include OAR 340-50. Since the passing of the federal 503 regulations, the state has prepared and passed amendments to OAR 340-50 that adopt provisions outlined in the 503 regulation. In some instances, state regulations may impose more stringent requirements than federal regulations. However, federal regulations apply if no state regulations are adopted.

Current federal regulations for land treatment of biosolids are listed in the Federal Register under 40 CFR 257, "Criteria for Classification of Solid Waste Disposal Facilities and Practices," dated September 13, 1979. In the past, Part 257.3-5 has regulated solid waste application to food crops; however, these regulations have been considered too general. Therefore, new regulations under 40 CFR 503, were required by Section 405 (d) of the Clean Water Act of 1977 (as amended by the Water Quality Act of 1987). The new regulations under 40 CFR 503, have gone through several scientific community and public reviews and were released as final in late 1992.

In December 1984, DEQ defined rules for the land application and disposal of sewage treatment plant biosolids and biosolids-derived products, including septage (OAR 340-50). These regulations are currently in the process of being updated to conform to the adopted federal regulations. According to current state and federal regulations (40 CFR 503), biosolids samples should be analyzed for the parameters listed in Table 5-2. Currently, regular sampling and analysis is being performed only on the combined, stabilized biosolids at CBWTP. Because the CBWTP does not require analysis of TCWTP biosolids, only total solids and volatile solids of digested biosolids are regularly monitored at the TCWTP.

Under the new federal regulations 40 CFR 503, maximum concentrations, cumulative pollutant loading rates, average pollutant limits or "clean biosolids," and annual pollutant loading rates have been established for nine heavy metals. Table 5-3 shows the acceptable levels for land application. These rates are used to determine site life, which is the number of years that biosolids with a uniform metal content can be applied to a specific site.

Because of the low concentration of industrial facilities in the TCWTP service area, the biosolids generated at the plant would be expected to be high quality. Semi-annual sampling at the CBWTP has also shown the biosolids from TCWTP to be high quality. Therefore, it is not expected that the CBWTP will place any limits on the quality of biosolids from TCWTP.

Because it is unlikely that biosolids quality will be a limiting factor in disposal, biosolids management should be evaluated based on compatibility with current biosolids management at CBWTP and land application practices. Specific criteria include:

- Effect on CBWTP biosolids quality
- Need for additional storage
- Production of "exceptional quality" biosolids that allows unrestricted use

TABLE 5-2
Sampling Requirements for EPA 40 CFR 503 Sludge Regulations [a]
Tryon Creek Wastewater Treatment Plant Facilities Plan

Parameter	Units
Arsenic	mg /kg dry weight
Beryllium	mg/kg dry weight
Cadmium	mg/kg dry weight
Copper	mg/kg dry weight
Lead	mg/kg dry weight
Mercury	mg/kg dry weight
Molybdenum	mg/kg dry weight
Nickel	mg/kg dry weight
Selenium	mg/kg dry weight
Zinc	mg/kg dry weight
Total nitrogen	% dry weight
Nitrate nitrogen	% dry weight
Ammonia nitrogen	% dry weight
Phosphorus	% dry weight
Potassium	% dry weight
pH	standard units
Total solids	% dry weight

TABLE 5-2
Sampling Requirements for EPA 40 CFR 503 Sludge Regulations [a]
Tryon Creek Wastewater Treatment Plant Facilities Plan

Parameter	Units
Volatile solids	% dry weight
PCBs [b]	µg/kg

[a] From 40 CFR, Part 503 (December 1992).

[b] PCBs (polychlorinated biphenyls) include PCB-1016, -1221, -1232, -1242, -1248, -1254, and -1260.

TABLE 5-3
New Federal Regulations (40 CFR 503) for Heavy Metals
Tryon Creek Wastewater Treatment Plant Facilities Plan

Parameter	Maximum Concentration (mg/kg)	Cumulative Loading (kg/ha)	Average Concentration (mg/kg)	Average Concentration Loading Rate (kg/ha/yr)
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum	75	18	-	0.90
Nickel	420	420	420	21
Selenium	100	100	100	5.0
Zinc	7,500	2,800	2,800	140

*From 40 CFR 503 (December 1992).

kg/ha = kilograms per hectare; kg/ha/yr = kilograms per hectare per year; mg/kg = milligrams per kilogram.

5.1.2.2 Emerging and Future Water Quality Issues

Discharge regulations are expected to become stricter over the planning period. While it is currently unclear how quickly DEQ and EPA may adjust the regulated discharge parameters, it is prudent to plan for any anticipated regulations to the extent feasible. The following section summarizes some of the potential parameters that may be regulated over the planning period and will therefore be considered during facilities plan alternative development (and accommodated in future treatment facilities where appropriate).

Bacteria. EPA published updated water quality criteria on November 26, 2012, which include two sets of numeric concentration thresholds, designed to protect the designated use of primary contact recreation. Table 5-4 summarizes the magnitude component of the recommendations. The waterbody geometric mean should not be greater than a 10 percent excursion frequency of the selected statistical threshold value magnitude in the same 30-day interval (EPA, 2012).

TABLE 5-4
EPA Recommendations for Bacteria Criteria
Tryon Creek Wastewater Treatment Plant Facilities Plan

Criteria Elements	Recommendation 1		Recommendation 2	
Indicator	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (cfu/100 mL)	Geometric Mean (cfu/100 mL)	Statistical Threshold Value (cfu/100 mL)
Enterococci (marine and fresh)	35	130	30	110
E. coli (fresh)	126	410	100	320

Dissolved Oxygen. The Willamette River in the Tryon Creek area is not included in the 303(d) list for dissolved oxygen (DO). The current DO standard is based on the Oregon Water Quality Standard; however, there is no current numerical minimum in the NPDES permit. It is possible that a more stringent numerical minimum could be imposed in future NPDES permits. The implementation of a future DO numerical minimum may require future treatment facilities. However, for purposes of this facilities plan, no specific accommodations for DO will be considered.

Organic/Solids Concentration Limits. Requirements for a summer effluent limitation of 10 milligrams per liter (mg/L) BOD_5 and 10 mg/L TSS (10/10 standard) in the Willamette River is the current basin standard. Although DEQ has not rigorously enforced this standard in recent permit renewals, the limit can be triggered with facility modification, expansion, or upgrade (OAR 340-41-0345). Imposing these limits on the TCWTP is at DEQ's discretion as part of the regular NPDES permit renewal process. It is expected that implementation of the 10/10 standard, and the maintenance or modification of existing mass limits, would be discussed as part of permit renewal discussions. Once the standard is applied, DEQ would provide a timeline for implementation to allow for design and construction of any facilities required to meet the standard.

Currently, the TCWTP is not designed meet the 10/10 standard during the summer months, though it frequently does so. It should be assumed that the Willamette River basin standards of 10/10 will be imposed early in the planning horizon. Therefore, any proposed treatment plant improvements should enhance the reliability and robustness of the secondary process as well as include the flexibility to add processes designed to consistently meet these requirements.

Temperature. The segment of the Willamette River to which the TCWTP discharges serves as a migration corridor for salmonids. OAR 340-041-0028(4)(d) states that the 7-day maximum temperature of a stream identified as a migration corridor may not exceed 20 degrees Celsius (∨C) (68 degrees Fahrenheit).

The DEQ temperature total maximum daily load (TMDL) was approved by EPA on September 29, 2006. The final TMDL included a river-flow-based waste load allocation (WLA) for excess thermal load (ETL) for TCWTP of 49 to 52 million kilocalories (kcal)/day. At projected buildout effluent flows of 6.455 mgd during the temperature compliance period, and an effluent temperature of 21.8∨C, the actual ETL from the facility is 44 million kcal/day.

A recent final judgment on a lawsuit (NW Environmental Advocates vs. EPA) regarding EPA's approval of Oregon DEQ's temperature standards, invalidated the state's natural conditions criteria. While it is unclear as to how DEQ rulemaking will address this finding, the numeric biological criteria are still applicable and the WLA for TCWTP is no longer pertinent. DEQ has begun issuing permits for facilities whose effluent can meet the pre-TMDL human use allowance (i.e., < 0.3□C increase after mixing) and the thermal plume limitations (e.g., migration blockage, thermal shock, etc.) specified in the temperature section of the state water quality standards. The permits being processed are generally ones that will not require a temperature limit.

Though this situation continues to evolve, it is not expected that there will be a temperature limit at TCWTP in the near term. At this point, it is prudent to monitor effluent temperature and track temperature policy. Despite the current uncertainty, it is reasonable to expect that a temperature limit could be implemented at TCWTP within the planning horizon. Thermal credits and effluent reuse represent the best solutions for TCWTP. Thermal load credits can be purchased from another source or project that has implemented measures to reduce its thermal load, or credits can be generated from activities such as riparian shading.

Level of Secondary Treatment for Wet Weather Flows. Currently, the facility provides secondary treatment for only a portion of its flows (up to approximately 20 mgd) during high flow events. EPA published a draft peak flow policy in 2005 that re-classified blending under the bypass provision (40 CFR 122.41(m)) and required publicly owned treatment works (POTWs) to conduct a no feasible alternatives analysis (NFAA) to justify the blending approach. The policy described the circumstances under which anticipated bypasses could be approved as part of the NPDES permitting process. The policy identified the content of an appropriate NFAA that POTWs would submit with their permit applications to facilitate development of appropriate permit conditions. The policy outlined the decision process involved in reviewing a utility analysis and determining whether approval of peak wet-weather flow diversions is appropriate. The draft peak flows policy has yet to be finalized.

In July 2009, EPA issued Draft Guidance on Preparing a Utility Analysis, which was designed to assist utilities in preparing the NFAA with the intent of incorporating the draft peak flows policy in issuing NPDES permits. The National Association of Clean Water Agencies (NACWA), which represents the collective interest of POTWs, has strong objections to the draft guidance document with the main argument that EPA has issued guidance based on a new interpretation of the bypass regulations that has never been officially stated, and in turn, is using the guidance to implement a policy that has never been finalized. NACWA maintains that the draft guidance will be used by states and EPA regions as EPA's latest thinking on the subject. Recently, several NPDES permits have been reissued in Oregon by DEQ that have not incorporated the draft peak flow policy or the related utility analysis guidance.

This draft policy was never finalized in part because of disagreement within EPA on how to proceed (some at EPA wanting a strict interpretation of the Clean Water Act that all flows would have to receive full secondary treatment, whereas others wanting to enable more flexibility as long as receiving water quality standards could be met) and because EPA wanted a better understanding of the water quality constituents (with an emphasis on pathogens) with and without blending.

Collection system master planning by both Lake Oswego and BES proposes improvements that would allow for conveying a 25-year storm event to the TCWTP. Therefore, improvements at the TCWTP should consider hydraulically managing those peak flows (without overflows at the plant) to ensure all flow receives preliminary and primary treatment, as well as disinfection. In the near term, maximizing the capacity of existing secondary treatment process units is recommended. Provisions for secondary expansion to provide full secondary treatment of all flows should be provided within the planning horizon.

Turbidity. Oregon's water quality standard for turbidity is currently under review and may result in turbidity effluent limitations and monitoring requirements once the standard is finalized. The latest draft of the revised standard would restrict turbidity increases at the edge of the mixing zone to 3 nephelometric turbidity units (NTU) as monthly average, or 5 NTU averaged over 1 hour. Implementation of these criteria could drive implementation of filtration technology at the facility. Therefore, any proposed treatment plant improvements should include the flexibility to add processes designed to meet more stringent turbidity standards.

Ammonia Toxicity. Ammonia can be toxic to most aquatic organisms. Accordingly, ammonia water quality criteria were originally developed by EPA in 1984 and subsequently updated in 1992 and 1999 as new toxicological information became available. Ammonia toxicity and associated criteria are a function of both pH and temperature. Unionized ammonia (NH_3), and not the ammonium ion (NH_4^+), is the principal toxic form of ammonia. Aqueous ammonia equilibrium is affected by pH, causing the fraction of unionized ammonia in solution to increase as pH increases. Therefore, ammonia toxicity increases as pH increases. Ammonia toxicity has also been shown to increase as temperature increases.

Currently, ammonia discharge is not regulated at the TCWTP, although testing is required. The existing outfall includes a diffuser that provides high dilution; consequently, ammonia effluent concentrations have not been a concern. The current discharge permit does have requirements for weekly monitoring of TKN, nitrate plus nitrite, ammonia, and total phosphorus during the dry weather season.

Ammonia limits impact the extent that nitrification is required, critical in defining secondary treatment needs, and has far reaching implications in terms of site footprint, staffing, energy use, etc. DEQ's RPA was performed for ammonia for three possible scenarios: Oregon's current ammonia toxicity standards, EPA's 1999 revised standards, and EPA's 2013 standards that account for freshwater mussels and snails. These analyses determined that there is no reasonable potential to exceed acute or chronic criteria for ammonia toxicity for any of these three regulatory scenarios. This is in part due to the high dilutions provided by TCWTP's existing outfall diffuser.

Specific to ammonia toxicity, an ammonia limit may be considered if diffuser modifications result in lower dilution ratios. Diffuser modifications could be required to provide additional hydraulic capacity for peak flows and they could also be required if the new mixing zone study (discussed above under Mixing Zone) indicates that lower dilution ratios are being achieved.

Nutrient Limits. EPA is discussing a change to how it defines “secondary treatment” under the Clean Water Act, which could result in a requirement to reduce effluent nitrogen and phosphorus concentrations. At the national level, the EPA is currently developing guidance on regional nutrient criteria. On January 9, 2001, EPA published a notice in the Federal Register that numeric criteria have been developed for specific ecoregions throughout the United States, including criteria for lakes and reservoirs, streams and rivers, and wetlands. The EPA notice included reference conditions for two causal variables (total nitrogen and total phosphorus) and two response variables (chlorophyll *a* representing algal biomass and turbidity to provide a measure of water clarity) for each ecoregion and sub-ecoregion. These are for use by the states and tribes as starting points in establishing their own criteria and standards to protect uses. The reference conditions represent the natural, least impacted conditions.

If a state is not able to develop its own reference conditions, the conditions developed by the EPA may be established as the criteria. EPA’s initial expectation was that states would develop a plan to adopt these criteria within 3 years of the Federal Register notice, formally including these criteria in their water quality standards by 2004. This has not happened, however, with only several states actually adopting numeric criteria to date. On May 25, 2007, EPA sent a memorandum to the states that reemphasized EPA’s intent for all states to move forward expeditiously to adopt numeric nutrient criteria, and more recently, in January 2009, EPA notified one state (Florida) that EPA will promulgate federal numeric nutrient criteria for Florida if the state does not adopt EPA-acceptable criteria on its own within 1 year of the date of the determination letter from EPA to the state. Most recently (in 2010), EPA proposed draft public comment criteria for some waters in Florida. In 2011, EPA published a memorandum (*Working in Partnership with States to Address Phosphorous and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions, EPA, March 16, 2011*) reaffirming its commitment to partnering with states and stakeholders to address nitrogen and phosphorus pollution. This memorandum presents a framework that states can use to reduce nitrogen and phosphorus pollution while developing numeric criteria.

As nutrient removal treatment technologies have improved over the past few years, a movement toward technology-based effluent limitations for nutrients has gained momentum. State regulators are considering and have requested that EPA implement effluent nitrogen and phosphorus limitations for POTWs based on the availability of the technology (Smithee, AISWPCA, 2007, personal communication). The letter did not identify what the nutrient limits should be. In addition, on November 27, 2007, the Natural Resources Defense Council filed a petition to EPA to establish nutrient limits within the definition of secondary treatment for POTWs. The petition identified limits of 3.0 mg/L for total nitrogen and 0.3 mg/L for total phosphorus. Although EPA has not taken action on these requests to date, it is taking them seriously and considering what the appropriate course of action should be.

It is prudent to assume that these levels of nutrient removal will be required within the planning horizon for the TCWTP.

Microconstituents. Microconstituents are chemicals and chemical compounds in trace amounts measuring in concentrations of parts per billion or parts per trillion. As equipment and laboratory procedures to detect microconstituents have increased, so have media attention and public concern. Microconstituents are also referred to as emerging constituents, endocrine disrupting compounds (EDCs), trace organic compounds (TOrCs), pharmaceutically active compounds (PhACs), and pharmaceuticals and personal care products.

Microconstituents may become an issue in the Willamette River and in relation to disposal of biosolids. EDCs, synthetic compounds that may interfere with the endocrine system of organisms, are of specific concern for the Willamette River. Endocrine disruptors have the potential to:

- Mimic the action of naturally occurring hormones
- Block cell receptors, preventing action of naturally occurring hormones
- Affect synthesis, transport, metabolism, and excretion of hormones

Many types of compounds can be considered EDCs: pesticides, surfactants, heavy metals, and PhACs. For some of these, such as heavy metals, EDCs will only occur at dosages greater than any established water quality standards. However, many other compounds that act as EDCs have been found in the environment in trace amounts. Natural hormones are found in humans and animals. Soybeans and alfalfa contain phytoestrogens. PhACs are synthetically produced hormones, such as those used for oral contraceptives, hormone replacement treatment, and animal feed additives. PhACs are used for diagnosis, treatment, alteration, or prevention of disease or health condition. PhACs are also used for similar veterinary purposes. Industrial chemicals, such as cleaning agents, pesticides, and plastics, contain synthetically produced hormones. Although some potent pesticides and herbicides have been banned, many other sources of EDCs see continued use.

The concern surrounding EDCs centers on the potential effects on wildlife, the environment, and humans. Although recent studies suggest minimal human health risk associated with PhACs in surface and drinking water, several studies have identified effects or potential effects of EDCs on aquatic life. Many concerns surround PhACs in particular. PhACs are able to pass through conventional wastewater treatment facilities. PhACs are typically designed to be resistant to biological degradation, and therefore resistant to biological treatment, but some treatment processes are available to remove the PhAC compounds.

Because of the concerns identified above, the Water Environment Research Foundation has been conducting and is continuing to conduct extensive research on the following:

- Wastewater treatment plant removal of TOrCs. One finding is that wastewater treatment plants that employ longer solids retention times (SRTs)—such as plants removing nutrients—have greater TOrC removal efficiencies than plants with short SRTs.
- Fate of estrogenic compounds during municipal sludge stabilization.
- Presence of TOrCs in biosolids and whether that should be of concern.
- Aquatic ecosystem and human health effects.

There is some potential for a requirement to begin monitoring for microconstituents, but it is unlikely that these constituents will be regulated in the upcoming permit. It is not possible at this time to predict whether microconstituents will be regulated in the form of discharge limitations at some point in the future. However, if microconstituents are proven to adversely impact water quality, increase human health risk, or increase risk to aquatic life, it is reasonable to assume some regulation will occur. Such regulation may take the form of source control, discharge limitations, or some combination of the two. Prescription drug take back programs provide a secure, safe, free, and convenient drop-off site for pharmaceuticals that could otherwise end up in the TCWTP influent. These highly successful anti-drug programs have substantial and obvious pollution prevention and public health and safety benefits and should be encouraged.

It would be premature to define effluent quality criteria for microconstituents in this facilities plan, but it is reasonable and prudent to identify and reserve footprint on the site to allow for advanced treatment in the future. The city should continue to track this important issue.

Toxic Substance Limitations. OAR 340-041-0033 requires that the levels of toxic substances shall not exceed the criteria listed in Table 20 and toxic substances shall not be introduced above the natural background levels in amounts that may be harmful in the environment or may accumulate in sediments or bioaccumulate in aquatic life. DEQ has recently issued revised water quality standards that increased the fish consumption rate from 17.5 grams/day to 175 grams/day, which will likely significantly impact the discharge permit requirements for wastewater treatment plants. This is because the human health criteria are now ten times more stringent than previous criteria. Some of these likely impacts include:

- More complex and lengthy permit renewal process
- More stringent permit limits
- More—and more complex—monitoring (for permit renewal, for DMRs, for ambient water quality)
- More challenging public processes (permit renewal, budget, pollution prevention)
- Greater pressure on source control efforts (and on pretreatment programs and industrial discharges)
- More 303(d) listings and TMDLs for human health pollutants

These criteria are now incorporated into Table 40 and are effective under state and federal law for Clean Water Act programs, including NPDES permitting. Table 40 criteria became effective following Oregon

Environmental Quality Commission adoption on June 16, 2011, and EPA approval on Oct. 17, 2011. EPA approved revisions to the manganese criteria and withdrawal of iron on June 9, 2011. These revisions are reflected in Table 40.

DEQ has recently issued a revised IMD on RPA (DEQ, 2012). RPA is a calculation designed to estimate whether there is a reasonable potential for a toxic pollutant to cause an exceedance of a water quality criterion in the receiving water. If a reasonable potential for a pollutant is found, then the NPDES permit is required to contain an effluent limitation for that pollutant. The Fact Sheet developed by DEQ for the current NPDES permit (provided in Appendix N) indicates that given the high dilution available, there is no reasonable potential for mercury to violate current water quality standards under the current regulations. BES performed background sampling of the Willamette River background for toxics from 2001 to 2003, using sampling and analytical methods designed to avoid contamination and provide low detection levels; these high-quality data were used by DEQ in the last permit cycle for the RPA. Additional sampling of both effluent and Willamette River background, according to the RPA IMD (DEQ, 2012), is recommended to provide a strong and realistic data set. A comprehensive data set will provide a good basis for appropriate determination of whether TCWTP discharges meet water quality standards with respect to toxics.

The new rulemaking defines “implementation” aspects that should be considered as part of a toxics regulatory compliance strategy. These include utilization of intake credits and development of site-specific background pollutant criterion, as well as existing processes for compliance schedules, variances, site specific criteria, and use attainability analyses.

Treatment methodologies for these constituents are not established or common in the municipal industry. Given the uncertainty of potential effluent criteria specific to toxics and since there are multiple steps involved in defining those criteria that are triggered by the next permit renewal, it would be premature to define effluent quality criteria in this facilities plan. However, it is reasonable and prudent to identify and reserve footprint on the site to allow for advanced treatment in the future.

Effluent Reuse Requirements. An alternative to direct river discharge of treated effluent during dry weather is to apply treated effluent to meet irrigation demands at agricultural lands, golf courses, landscaped areas, and parks. Effluent can also be reused as recycled water for specific nonagricultural industrial uses, such as cooling water. The standards for effluent reuse in Oregon are established by the DEQ through OAR 340-55. Although TCWTP currently does not practice reuse outside the plant site, DEQ requires that effluent reuse be considered and addressed as part of the facilities planning process.

Treatment and Monitoring Requirements for Effluent Reuse. Through OAR 340-55, DEQ has established treatment and monitoring requirements for potential agricultural and nonagricultural uses of the treated effluent. The treatment requirements and possible beneficial uses described in the recycled water rules are summarized in Tables 5-4 and 5-5. Treatment requirements as well as limits for total coliform (organisms/100 mL) and turbidity (NTUs) have been established for each category. These standards serve as a general guideline for defining the anticipated water quality required for the various uses. In addition to the water quality limits, DEQ has provided standards for the minimum monitoring required for total coliform and turbidity based on the category of treatment. Table 5-5 summarizes the treatment and monitoring requirements for each reuse category.

TABLE 5-5
General Treatment and Monitoring Requirements for Use of Recycled Water
Tryon Creek Wastewater Treatment Plant Facilities Plan

	Category				
Factor	**Class A**	**Class B**	**Class C**	**Class D**	**Non-Disinfected**
Biological Treatment (Oxidized)	X	X	X	X	X
Disinfection	X	X	X	X	
Filtration	X				
E. Coli (organisms/100 mL):					
30-Day Log Mean	N/L	N/L	N/L	126	N/L
Single Sample Maximum			N/L	406	N/L
Monitoring Frequency	N/L	N/L	N/L	1 per week	As in NPDES or WPCF permit
Total Coliform (organisms/100 mL):					
Median of Last 7 Samples	2.2	2.2	23		N/L
Maximum in any Sample	23	23	N/L	N/L	N/L
Maximum in 2-Consecutive	N/L	N/L	240	N/L	N/L
Monitoring Frequency	1 per day	3 per week	1 per week	1 per week	As in NPDES or WPCF permit
Turbidity (NTU):					
24-Hour Mean	2	N/L	N/L	N/L	N/L
5% of Time During a 24-Hour Period	5	N/L	N/L	N/L	N/L
Maximum at Any Time	10				
Sampling Frequency	Hourly				
Public Access	Public Notification.	Golf course, no public contact. Other uses require public notification.	As Class D plus public notification.	Milk animals restricted from contact. Notification of personnel for irrigation of sod, nursery stock, Christmas trees (fences, gates, locks).	Prevented (fences, gates, locks).
Set-Back Requirements	None required.	Irrigation directly to soil: no setback. Sprinkler: 10 ft.	Irrigation directly to soil: 10 ft. Sprinkler: 100 ft.	Irrigation directly to soil: 10 ft. Sprinkler: 100 ft.	150 ft from water supply source, plus site specific.

N/L = No Limit.

General Reuse Requirements. A number of general requirements have been outlined in OAR 340-55. These requirements address agricultural and nonagricultural uses that are acceptable based on the effluent water quality level, irrigation system, public access requirements, and buffer zones for irrigation. Table 5-6 summarizes these general requirements based on the different levels of recycled water quality.

TABLE 5-6
Allowable Uses for Recycled Water
Tryon Creek Wastewater Treatment Plant Facilities Plan

	Category of Treatment				
Beneficial Purpose	**Class A**	**Class B**	**Class C**	**Class D**	**Non-disinfected**
Irrigation					
Fodder, fiber, seed crops not intended for human ingestion, commercial timber	Yes	Yes	Yes	Yes	Yes
Firewood, ornamental nursery stock, Christmas trees	Yes	Yes	Yes	Yes	No
Sod	Yes	Yes	Yes	Yes	No
Pasture for animals	Yes	Yes	Yes	Yes	No
Processed food crops	Yes	Yes	Yes	No	No
Orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil	Yes	Yes	Yes	No	No
Golf courses, cemeteries, highway medians, industrial or business campuses	Yes	Yes	Yes	No	No
Any agricultural or horticultural use	Yes	No	No	No	No
Parks, playgrounds, school yards, residential landscapes, other landscapes accessible to the public	Yes	No	No	No	No
Industrial, Commercial, or Construction					
Industrial cooling	Yes	Yes	Yes	No	No
Rock crushing, aggregate washing, mixing concrete	Yes	Yes	Yes	No	No
Dust control	Yes	Yes	Yes	No	No
Nonstructural firefighting using aircraft	Yes	Yes	Yes	No	No
Street sweeping or sanitary sewer flushing	Yes	Yes	Yes	No	No
Standalone fire suppression systems in commercial and residential buildings	Yes	Yes	No	No	No
Non-residential toilet or urinal flushing, floor drain trap priming	Yes	Yes	No	No	No
Commercial car washing	Yes	No	No	No	No
Fountains when the water is not intended for human consumption	Yes	No	No	No	No
Impoundments or Artificial Groundwater Recharge					
Water supply for landscape impoundments including, but not limited to, golf course water ponds and non-residential landscape ponds	Yes	Yes	Yes	No	No
Restricted recreational impoundments	Yes	Yes	No	No	No
Water supply for landscape impoundments including, but not limited to, residential landscape ponds	Yes	No	No	No	No
Nonrestricted recreational impoundments including, but not limited to, recreational lakes, water features accessible to the public, and public fishing ponds	Yes	No	No	No	No
Artificial groundwater recharge	Yes	No	No	No	No

Source: Table 2 of *Internal Management Directive: Implementing Oregon's Recycled Water Use Rules* (DEQ, 2009b).

5.1.3 Effluent Quality

TCWTP has consistently met its current NPDES permit discharge requirements. Current and future effluent quality requirements are described above in Section 5.1.1.

5.1.4 Treatment Effectiveness

The technology-based requirement of 85 percent removal for BOD_5 and TSS on a monthly average basis through the treatment plant is assumed to remain in place over the course of the planning horizon.

5.1.5 Plant Reliability Criteria

EPA requires that wastewater facilities meet the requirements for reliability and redundancy in their treatment components and associated equipment. The reliability standards establish minimum levels of reliability for three classes of wastewater works. The standards are intended to protect the environment, particularly receiving waters, against unacceptable degradation resulting from power failure, flood, peak loads, equipment failure, and maintenance shutdowns. The standards are divided into three, increasingly stringent, classes of reliability: III, II, and I. The guidelines for classifying wastewater works are defined in Table 5-7. The treatment plant currently operates under a Class II requirement; however, DEQ has indicated that all facilities in the Willamette Valley are Class I facilities. Class I requirements will compel TCWTP to provide backup power source for secondary and advanced treatment and additional redundancy within any future advanced treatment systems. The Class I and II requirements are outlined in Table 5-8.

TABLE 5-7
Guidelines for Classifying Wastewater Works into Reliability Classes
Tryon Creek Wastewater Treatment Plant Facilities Plan

Reliability Class	Guidelines
I	These are works whose discharge, or potential discharge, (1) is into public water supply, shellfish, or primary contact recreation waters, or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted. Examples of Reliability Class I works are those with a discharge or potential discharge near drinking water intakes, into shellfish waters, near areas used for water contact sports, or in dense residential areas.
II	These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days). Examples of a Reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.
III	These are works not otherwise classified as Reliability Class I or Class II.

Source: *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*, U.S. Environmental Protection Agency, 1973.

In addition to the criteria in Table 5-8, all operational components are required to be above the 100-year flood elevation (34.3 feet at the TCWTP site, National Geodetic Vertical Datum 29). The facility must be designed to hydraulically pass peak flows with any unit out of service. Federal criteria include that pump stations remain functional during 500-year flood conditions; this requirement applies when federal funds are utilized for construction of such facilities. The *Oregon Standards for Design and Construction of Wastewater Pump Stations* (DEQ, 2001) specifies that elevations of pump station ground-level finished floors and the top of submersible pump station wet wells shall be designed for a minimum of 2 feet above the 100-year base flood elevation. Figure 5-1 generally illustrates the extent of facilities within the 100-year floodplain.

For the purposes of this planning effort, it is assumed that all plant electrical systems will be located above the 500-year flood elevation.

TABLE 5-8
EPA Requirements for Reliability
Tryon Creek Wastewater Treatment Plant Facilities Plan

Component	Reliability Class I	Reliability Class II
Pumps, lift stations, raw sewage, RAS and WAS effluent	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow. *	
Mechanically cleaned bar screens	A backup bar screen (manually or mechanically cleaned) shall be provided. Facilities with only two bar screens shall have at least one manually cleaned bar screen.	
Primary clarifiers	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 50 percent of the design flow. *	
Aeration basins	At least two equal volume basins shall be provided.	
Aeration blowers or mechanical aerators	With the largest unit out of service, remaining units shall be able to maintain design oxygen transfer. A backup unit may be uninstalled.	
Air diffusers	With the largest section of diffusers isolated or out of service, oxygen transfer capacity shall not be measurably impaired.	
Secondary clarifiers	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 75 percent of the design flow. *	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 50 percent of the design flow. *
Filters/advanced treatment	The units shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 75 percent of the design flow. *	No backup required.
Disinfection basins	The basins shall be sufficient in number and size so that, with the largest unit out of service, the remaining units have capacity for at least 50 percent of the design flow.*	
Electrical power sources	Two separate and independent electric power sources from either two separate utility substations or one substation and one standby generator shall be provided. The backup power source shall be sufficient to operate all main pumping, screening, primary treatment, and disinfection facilities, along with critical lighting and ventilation during peak wastewater flow conditions.	
	The provision of backup power capacity for secondary treatment, final clarification, and advanced treatment is required. The provision of capacity for degritting and sludge handling and treatment is optional.	The provision of backup power capacity for secondary treatment, final clarification and advanced treatment is optional. The provision of capacity for degritting and sludge handling and treatment is not required.
Sludge holding tanks	The volume of the holding tank shall be based on the expected time necessary to perform maintenance and repair of the component in question.	
Anaerobic sludge digestion	At least two digestion tanks shall be provided. Backup sludge mixing equipment shall be provided or the system shall be flexible enough such that with one piece of equipment out of service, total mixing capacity is not lost. Backup equipment may be uninstalled.	
Sludge pumping	Pumps sized to pump peak sludge quantity with one pump out of service. Backup pump may be uninstalled.	

Source: *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*, U.S. Environmental Protection Agency, 1973.

* Per Appendix E of DEQ *Preparing Wastewater Planning Documents and Environmental Reports* (DEQ, 2013), "peak flow" is defined as peak instantaneous flow and "design flow" is defined as annual average flow

RAS = return activated sludge; WAS = waste activated sludge.

FIGURE 5-1
Limits of 100-year Floodplain at TCWTP
Tactical Levels of Service

5.1.6 Unit Process Design Considerations

Unit process design criteria are captured in Unit Process Fact Sheets described in Section 6 and included as Appendix O.

5.1.7 Summary

Table 5-9 summarizes the treatment requirements over the planning period upon which alternative development will be based.

TABLE 5-9
Assumed Treatment Requirements for Facilities Plan Alternatives Development
Tryon Creek Wastewater Treatment Plant Facilities Plan

	Planning period		
Parameters	**Existing** [a]	**Short Term (0 to 10 years)**	**Long Term (10 to 30 years)**
Effluent Requirements			
Wet Season (November 1st to April 30th)			
BOD_5, monthly average/weekly average (mg/L)	30/45	30/45	30/45
TSS, monthly average/weekly average (mg/L)	30/45	30/45	30/45
Dry Season (May 1st to October 30th)			
BOD_5, monthly average/weekly average (mg/L)	20/30	10/15	10/15
TSS, monthly average/weekly average (mg/L)	20/30	10/15	10/15
Temperature (million kcals/day)	NA	NA	TBD [b]

TABLE 5-9
Assumed Treatment Requirements for Facilities Plan Alternatives Development
Tryon Creek Wastewater Treatment Plant Facilities Plan

	Planning period		
Parameters	**Existing** [a]	**Short Term (0 to 10 years)**	**Long Term (10 to 30 years)**
Annual Criteria			
E. coli bacteria (count/mL)	126/100 mL	126/100 mL	126/100 mL
pH	6.0–9.0	6.0–9.0	6.0–9.0
Chlorine, maximum day/monthly average (mg/L)	1.7/0.7	1.7/0.7	1.7/0.7
Dissolved oxygen (mg/L)	NA	NA	NA
Turbidity, background increase at mixing zone, monthly average/peak hour (NTU)	NA	NA	3/5
Ammonia (mg/L)	NA	NA [c]	NA [c]
Total nitrogen	NA	NA	3.0
Phosphorus (mg/L)	NA	NA	0.3
Toxics (mg/L)	NA	NA [c]	NA [c]
Treatment Effectiveness	85% removal	85% removal	85% removal
Level of Secondary Treatment for Wet Weather Flows	~ 20 mgd	~ 20 mgd	5-year, 24-hour storm
Biosolids Regulatory Parameters	Class B	Class B	Class B
Facility Reliability and Redundancy Classification	Class I	Class I	Class I

[a] Current discharge permit requirements.
[b] Dependent on revised DEQ Rulemaking.
[c] Unless triggered by regulatory changes or reduction of mixing zone as a result of diffuser modifications.
kcals/day = kilocalories per day; mg/L = milligrams per liter; mL = milliliters; NA = not applicable; NTU = nephelometric turbidity unit.

5.2 Basis for Cost Estimate

The proposed economic analysis is conducted using the present worth of the alternatives, including capital costs and O&M costs. All costs will be reported in 2013 dollars. Construction cost projections will be made at stated escalation rates. Costs developed for the TCWTP facilities plan will be Class 5 estimates as defined by the Association for the Advancement of Cost Engineering (AACE) International and adopted by the American National Standards Institute in Recommended Practice No. 17R-97: *Cost Estimate Classification System* (2011) and Recommended Practice No. 18R-97: *Cost Estimating Classification System as Applied in Engineering, Procurement, and Construction for the Process Industries* (2011).

Construction, operation, maintenance, and salvage value cost opinions will be developed to allow comparison of alternatives for the short- and long-term planning periods. The sizes of support buildings (if required) will be selected based on similar-sized designs, and current similar building prices per square foot will be applied to the floor space requirements. The cost of electrical and instrumentation and control, yard piping, site work, bond, insurance, mobilization, painting, and coatings is estimated by applying percentages of the construction subtotal of the process unit costs. The percentages will be based on CH2M HILL's experience and knowledge of the costs of these items on similar wastewater treatment plant projects. On past projects, this method of preliminary planning level construction cost estimating has been found to be very reliable for comparison of alternatives. One of the cost estimating tools used will be the CH2M HILL Parametric Cost Estimating System (CPES). CPES generates quick, and relatively accurate and detailed cost estimates at the conceptual stage of a project, before little or any design work has taken place. The system contains many "mini-models" or cost estimates of facilities that are based on real projects. These mini-models have relationships (or algorithms) built into them that allow the system to adjust their costs based on project-specific information. The CPES model will be supplemented with vendor-supplied budgetary quotes for equipment where applicable.

Total *construction costs* include contractor markups and profit, sales tax, and appropriate contingency. Actual construction costs will depend on a variety of factors such as the final project scope and market conditions at the time of project bidding. Overall project costs include the total construction costs, but also an additional markup to estimate the costs of engineering design, construction contracting, construction management, project administration, and legal costs.

Cost comparisons are made on the basis of present-worth costs over the planning period. The present-worth analyses include an assumed inflation of the annual costs. This stipulation is based on the assumption that prices for treatment and collection facilities will tend to change over time by approximately the same percentage. Changes in the general level of prices will not affect analysis results but will impact the overall funding requirements for the selected alternative.

5.2.1 Level of Accuracy

All project costs will be derived using the same level of estimating accuracy and, therefore, will be comparable. Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate at the time a project is bid.

Figure 5-2 shows the relationship of level of detail to the expected accuracy of the estimate. The level of detail used in the development of cost estimates in this facilities plan is 3 to 5 percent, which is comparable to the project definition level of detail depicted in Figure 5-2. This corresponds with a typical Class 5 estimate. An estimate of this type is normally expected to be within +100 percent or –50 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report but this level of accuracy is suitable for comparing the relative costs among alternatives and to provide a foundation for more detailed evaluations in the future.

It is important to communicate this level of accuracy to policymakers, decision-makers within both organizations (Portland BES and Lake Oswego), and stakeholders. The range of accuracy for a Class 5 cost estimate is broad (+100 percent to –50 percent of the actual construction cost), but these are typical levels of accuracy for planning work and they apply equally to all alternatives so that the relative estimated costs of the alternatives are comparable and can be used for sound decision-making.

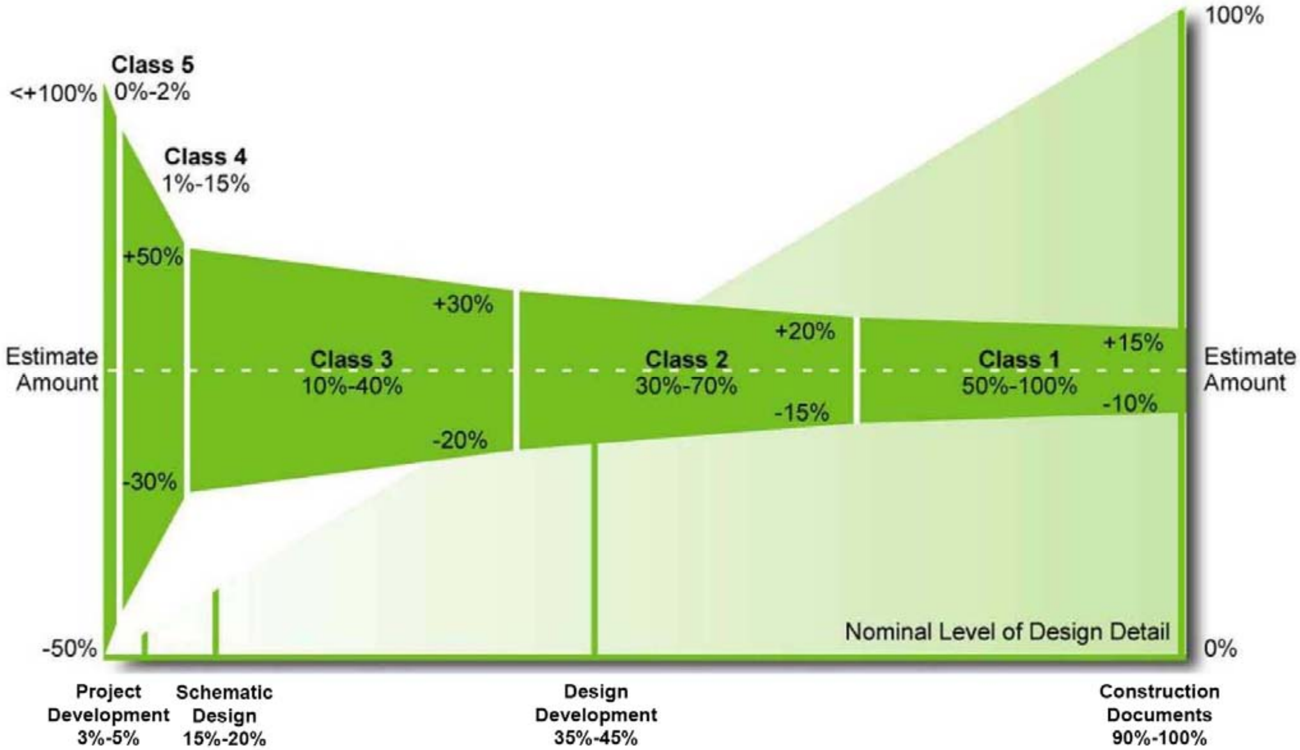

FIGURE 5-2
Cost Estimate Accuracy as a Function of Design Detail

5.2.2 Planning Period

The planning effort for the TCWTP facilities plan includes developing a plan that will provide sewer services through 2040. This exceeds the 20-year planning period required by DEQ. A key planning aspect is to consider potential future regulatory changes in development and selection of improvements.

A 30-year planning period (2010 to 2040) is generally consistent with the design life of wastewater treatment facilities. A planning horizon of 0 to 10 years will be used for short-term improvements and 10 to 30 years for long-term improvements. Wastewater collection facilities typically have a design life of 50 to 75 years. Collection facilities consider the maximum foreseeable population and economic growth in the project area. This is referred to as the ultimate planning period. When sizing and siting treatment facilities, the ultimate planning period is also used to consider whether adequate space is available for expanding treatment facilities to meet ultimate capacity needs.

5.2.3 Project Cost Parameters

Costs are based on facilities to accommodate the projected flows and loads for the 30-year planning period. All costs include facilities sized for the 2040 flows and loads. All costs will be estimated and presented in 2013 dollars.

5.2.3.1 Cost Index

Cost estimates will be obtained from projects in different locations and in different years. In order to bring all costs to a common, comparable base, the *Engineering News-Record* (ENR) Construction Cost Index (CCI) was used. This is a common, industry-accepted means for adjusting costs from different time periods and locations. The ENR CCI tracks construction costs in 22 U.S. cities and is computed from construction, materials, and labor costs. For this project, adjustments to costs will be made with the ENR 20 Cities Average CCI. The current ENR CCI for January 2013 is 9,437.27.

5.2.3.2 Discount and Inflation Rate

Currently, BES assumes that capital improvements can be financed at an assumed interest rate of about 5.0 percent per year. As of early 2012, inflation is assumed to be about 2.5 percent per year. The real value of money is the interest rate less the inflation rate or about 2.5 percent per year. All present-worth analyses are based on a real discount rate of 2.5 percent per year, which is consistent with other BES capital planning projects.

5.2.3.3 Engineering, Legal, and Administration

Legal services often are required to coordinate construction efforts with the local governmental agencies, and to facilitate permitting, and interagency coordination. Similarly, ancillary engineering services will be required, such as special investigations, surveys, foundation reports, location of interfering utilities, detailed design, preparation of plans and specifications, construction inspection and materials testing, startup assistance, and O&M manual preparation. These potential fees for legal and ancillary engineering services are not included in the base construction cost estimates. An administrative effort (project management) will also be required to coordinate the engineering and legal efforts of all projects. A factor of 45 percent has been added to base construction costs to account for engineering, legal, permitting, and administrative costs for projects described in this report.

5.2.3.4 Land

Capital cost for land is defined as the sum of the estimated purchase cost plus a 5 percent allowance for administration and legal costs. Costs are rounded as appropriate.

5.2.3.5 Contingencies

Budgetary studies represent a rough level of construction cost estimating. To account for unknowns, construction cost estimates of alternatives include a contingency factor of 35 percent. For the recommended plan, the cost estimates were refined and the contingency was lowered to 30 percent.

5.2.4 Annual Cost Parameters

O&M costs will be used primarily for present worth comparisons of options or alternatives. O&M costs are estimated based on the following:

- Current annual power costs: $0.08/kilowatt-hour (kWh)
- Current annual chemical costs:
  - Sodium hypochlorite: $0.64/gallon
  - Ferric chloride: $1.67/gallon
  - Polymer: $2.29/pound
- Current solids hauling costs: $150/trip (sludge); $100/ton (screenings and grit)

Labor costs (separate from labor associated with solids hauling) are not expected to differ between the alternatives, therefore they are not included in annual cost estimates.

In addition to extrapolating current TCWTP costs, O&M costs will also be estimated through CH2M HILL's proprietary CPES estimating tool. O&M costs are based on actual O&M costs from current and historical CH2M HILL projects and are adjusted to 2013 dollars by the ENR CCI for January 2013.

O&M costs are presented in 2013 dollars and are applied in the year the O&M costs are expected to be incurred. If O&M costs are related to increases in flows and loads, costs are increased each year of the planning period by the same rate of increase as flow and/or load projections. Some O&M costs may remain constant over the planning period.

5.2.5 Present-Worth (Life Cycle Cost) Analysis

Initial capital expenditures are assumed to be made in 2015 because this is the earliest anticipated start of construction. Therefore, these costs are brought back to 2013 by applying a single-payment present-worth (P_w) factor for a period of 2 years. Other capital expenditures that may occur within the planning period are brought back in the same manner, depending on when they occur.

The present worth of O&M costs is estimated with a geometric series present-worth factor. This factor brings O&M costs back to 2015; then they are brought back to 2013 with a single-payment present-worth factor.

Present worth is defined as:

$$PW = P_w\ (capital) + P_w\ (O\&M)$$

5.3 Receiving Water

The TCWTP discharges treated wastewater to the Willamette River through a multi-port diffuser at River Mile 20.3. The beneficial uses for this area of the Willamette River are listed in Table 340A of OAR 340 and include: Public & Private Domestic Water Supply, Industrial Water Supply, Irrigation, Livestock Watering, Fish & Aquatic Life, Wildlife & Hunting, Fishing, Boating, Water Contact Recreation, Aesthetic Quality, Hydro Power, and Commercial Navigation & Transportation. Applicable water quality standards from the Willamette River that protect these uses are found in OAR 340 Division 41.

DEQ's 2010 Integrated Water Quality (303(d)) Database lists the Willamette River for violations of water quality standards in the vicinity of the TCWTP discharge for the following pollutants:

- Aldrin
- Biological Criteria
- Chlordane
- Chlorophyll a
- Cyanide
- DDT
- Dieldrin
- Hexachlorobenzene
- Iron
- Manganese
- PCBs
- Pentachlorophenol
- Polynuclear Aromatic Hydrocarbons

5.4 Design Capacity of Wastewater Treatment Plant

Table 5-10 summarizes the hydraulic and process capacities associated with various design criteria for each of the main liquid treatment processes. Where multiple criteria exist for a given design basis, the most stringent criterion defines the unit process capacity. Where pertinent, the design criterion used as the basis for capacity is included as well.

TABLE 5-10
TCWTP Liquid Treatment Process Capacity Assessment
Tryon Creek Wastewater Treatment Plant Facilities Plan

Equipment/Unit Process	Design Basis	Hydraulic Capacity	Process Capacity
Preliminary Treatment			
Mechanically Cleaned Screen	Peak Hour Flow	42.4 mgd	Not applicable
Manually Cleaned Screen	Peak Hour Flow	Unknown	Not applicable
Primary Clarifiers			
Average Criteria (1,000 gpd/ft^2)	Average Annual Flow	Not applicable	14.1 mgd
Peak Flow Criteria (2,500 gpd/ft^2)	Peak Hour Flow	42.4 mgd	35.3 mgd
Primary Effluent Pump Station			
Firm Capacity	Peak Hour Flow	37.5 mgd	Not applicable
Secondary Process			
Wet Weather Capacity	Peak Hour Flow	~ 50 mgd (submerged secondary clarifier split flumes)	29.3 mgd
Dry Weather Capacity	Maximum Day Flow/Load	Not applicable	16.5 mgd

TABLE 5-10
TCWTP Liquid Treatment Process Capacity Assessment
Tryon Creek Wastewater Treatment Plant Facilities Plan

Equipment/Unit Process	Design Basis	Hydraulic Capacity	Process Capacity
Chlorine Disinfection			
Average Criteria (60 minute detention time)	Average Annual Flow	Not applicable	14.2 mgd
Peak Flow Criteria (20 minute detention time)	Peak Hour Flow	Limited capacity at high river levels	42.8 mgd
Outfall and Diffuser			
At 25-year river flood stage	Peak Hour Flow	16 mgd	Not applicable
At 50-year river flood stage	Peak Hour Flow	9.75 mgd	Not applicable
At 100-year river flood stage	Peak Hour Flow	Flooded	Not applicable

gpd/ft^2 = gallons per day per square foot; mgd = million gallons per day; ppd = pounds per day.

The capacities of the solids processes at TCWTP are a function of how the treatment processes are configured and operated, as well as the practice of hauling solids to CBWTP. Biological wasting from the secondary process and thickening of WAS is performed 5 days/week, 8 hour/day, and is the basis for this capacity assessment as well as solids handling alternatives developed in Section 6. As discussed in Section 5.1.1, TCWTP biosolids are hauled to CBWTP where they are combined with CBWTP biosolids and treated for reuse in land application. Therefore, production of a Class B biosolid at the TCWTP is not a design criterion for this facilities plan. Specific design criteria for solids handling unit processes are described in Table 5-11.

TABLE 5-11
TCWTP Solids Process Capacity Assessment
Tryon Creek Wastewater Treatment Plant Facilities Plan

Processes	Number of Units	Capacity (each)
Primary Sludge Thickening		
Gravity Thickener	2	9,000 ppd
Waste Activated Sludge Thickening		
Gravity Belt Thickener	1	400 gpm
Anaerobic Digestion		
Primary Digester	1	406,500 gallons
Secondary Digester	1	377,000 gallons

gpm = gallons per minute; ppd = pounds per day.