

KING COUNTY BIOSOLIDS PROGRAM STRATEGIC PLAN 2018–2037



King County

Department of Natural Resources and Parks
Wastewater Treatment Division

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Introduction

The King County Wastewater Treatment Division (WTD) Biosolids Program plays a key role in the County's future sustainability and its progress toward achieving carbon neutrality. To this end, in 2012, the Biosolids Program developed a four-year biosolids plan to expand its existing customer base and guide WTD through changes in the soil amendment industry. In the 2012 to 2016 plan, WTD committed to continue using 100 percent of its Class B¹ Loop[®] biosolids as a soil amendment, expanding its marketing and customer base, and supporting ongoing biosolids research. Although WTD consistently uses 100 percent of its Class B Loop biosolids and supports biosolids research, expanding its customer base remains a challenge.

In this updated 2018 to 2037 Biosolids Program Strategic Plan, WTD is committed to producing a King County-owned Class A biosolids product by 2023 and expanding the market for its Class B Biosolids Program. Producing Class A and B products in a diversified market will increase WTD's adaptive capacity to consistently and beneficially use 100 percent of its biosolids. The specific Class A production method used by the Biosolids Program will be determined as part of the implementation of this strategic plan.

Program Challenges

King County has used 100 percent of its Loop biosolids for decades; returning valuable carbon and nutrients back to the soil and helping the County fight climate change. However, the resiliency of WTD's Biosolids Program has decreased over the past decade. With a reduction in forestry application and a decline in compost production from the Biosolids Program's current compost partner, the program has become reliant on farmers in Douglas County to manage approximately 90 percent of WTD biosolids production.

Having only one reliable biosolids management approach leaves WTD vulnerable and with few options when highway passes close, fields are inaccessible, biosolids production increases, or farming practices change. Moreover, farmers are increasingly moving toward organic or no-till farming or both. While the Biosolids Program has made as many accommodations as possible to provide equipment capable of meeting the strict no-till methods, biosolids are not an approved fertilizer option for organic farming.

Additionally, while the program has been successful in creating a recognizable brand for its Loop biosolids product, this branding effort has also created some confusion among the public about who can purchase and use Loop. Currently, Loop biosolids are sold to commercial customers only, although the program has experienced increasing requests for the product from residential customers in and around King County. Unfortunately, because of federal use regulations with the current Class B product, WTD's only avenue for providing a retail product for the public is through a contract partnership with a private compost company that creates a

¹ Class A biosolids = 99–100% of pathogens eliminated; can be sold as a consumer retail product
Class B biosolids = 95–99% of pathogens eliminated; can be sold to permitted customers only

Class A product. Because King County does not make, own, or sell the final Class A compost product, this further limits the Biosolids Program in developing a consistent local market and expanding its customer base.

Strategic Plan Purpose

This Biosolids Program Strategic Plan re-evaluates WTD's biosolids management strategies from the 2012–2016 Biosolids Plan,² including marketing, production, further product development, technology, regulations, and cost.

Specifically, the Biosolids Program Strategic Plan:

- Identifies strategies and actions to sustain the long history of beneficial use of the Loop biosolids product and ensure cost-effective, beneficial use continues into the future
- Identifies opportunities for optimizing the resource value derived from Loop biosolids
- Identifies barriers and risks for Loop biosolids and the current Biosolids Program and evaluates options for the future of WTD's Class A and B biosolids products and corresponding Biosolids Program
- Identifies potential synergies between WTD's Biosolids, Energy, and Recycled Water Programs and the Technology Assessment and Innovation (TAIP) Program
- Initiates decision-making on capital investments to ensure that WTD's Biosolids Program meets the future needs of customers and King County
- Ensures WTD's biosolids-related decisions are integrated with other strategies and decisions across WTD (particularly operations), King County, and the region

The Biosolids Strategic Plan will be used by WTD to:

- Provide information for the Systemwide Comprehensive Plan for King County's regional wastewater system
- Provide direction for future program activities and decision-making
- Prioritize resources for programs within the division
- Communicate with stakeholders about the program's direction

Strategic Planning Process

Strategic planning is a continuous, iterative process that involves envisioning a successful future, identifying where a program is in relation to that vision, developing goals to fulfill that vision, implementing strategies to achieve those goals, and monitoring progress toward implementation. Strategic plans are dynamic documents that need updates over time as conditions and situations change.

² The 2012–2016 Biosolids Plan is available at:
https://www.kingcounty.gov/~media/services/environment/wastewater/resource-recovery/docs/biosolids/Biosolids_Plan.ashx?la=en

The Biosolids Program followed six steps to develop its strategic plan:

- 1) **Standardization of strategic planning elements** across the Biosolids and Recycled Water Programs and TAIP
- 2) **Goals and objectives** development and development of targets and/or measures for tracking progress toward objectives
- 3) **Strategies** development
- 4) **Alternatives** identification, evaluation, and selection
- 5) Strategies **prioritization**
- 6) **Actions** development

Program staff participated in team meetings at each step of the strategic planning process, one workshop involving the Recycled Water and TAIP teams, and regular check-ins with WTD management. The Biosolids Program Strategic Plan was also informed by technical research conducted by a consultant-team subject matter expert.

Strategic Plan Overview

The following table summarizes all final goals, objectives, alternatives, strategies, and actions developed for the Biosolids Program Strategic Plan.

GOALS ⁱ	OBJECTIVES ⁱⁱ	STRATEGIES ⁱⁱⁱ	ACTIONS ^{iv}
1: Recycle 100% of Loop – Consistently and reliably achieve 100% beneficial use of Loop biosolids.	1.1) Impacts from transportation delays are reduced by 2019 <ul style="list-style-type: none"> • Target A): Secure west-side storage site by fall 2019. • Target B): Contract with City of Everett is ceased. 	1a) Secure flexible and large-capacity west-side emergency storage (two-year strategy).	<ul style="list-style-type: none"> • Increase mobile storage: Implement trailer storage at existing sites/facilities within 1 year. • Contract with current partners to secure storage site.
	1.2) WTD management adopts a plan for phosphorus removal by 2025 <ul style="list-style-type: none"> • Target A): One written plan for phosphorus removal by 2020 	1b) In advance of regulatory restrictions, implement a nutrient study focused on phosphorus removal (six-year strategy).	<ul style="list-style-type: none"> • Commission TAIP to partner with University of Washington fellowship program to examine phosphorus removal and recovery from biosolids, including: <ul style="list-style-type: none"> ○ Available recovery technologies and options for both liquid and solid streams ○ Phosphorus levels in liquid and solid streams after removal ○ Additional uses, products, and markets (for byproducts of phosphorus recovery) • Complete research by 2020 and use outcomes of research to inform next steps for phosphorus recovery.
	1.3) Biosolids Program serves an expanded Class B market. <ul style="list-style-type: none"> • Target A): One additional Washington State Department of Natural Resources (WA DNR) application site by 2020 	1c) Expand partnerships with WA DNR to expand lands in Western Washington for biosolids applications.	<ul style="list-style-type: none"> • Explore feasibility of expanded WA DNR application with WA DNR staff. • Develop a proposal with WA DNR for expansion, preferred locations, site requirement access, amount of product, and other requirements. • Meet permit requirements and prepare addendums to existing permits or apply for new permits as needed. • Amend existing agreements as necessary. • Coordinate truck availability and South Treatment Plant operations plan to accommodate expanded forestry program. • Develop a business plan for second mobile operation, including equipment, staffing, and Contractors.
		1d) Expand agricultural land application in Eastern Washington through regional partnerships, communication, and demonstration of Class B biosolids	<ul style="list-style-type: none"> • By April 2018, West Lincoln Project Beneficial Use Facility is permitted • Provide technical support to potential farmers interested in permitting their own Beneficial Use Facility. • Attend more farmer-focused events and meetings and continue word-of-mouth marketing and relationship-building to stay up-to-date on the newest trends and research.
2: Diversify biosolids products and distribution – Manage a resilient program that can withstand market changes in one or more sectors and has broad geographic distribution.	2.1) Begin process to produce a Class A product by 2023—either owned/operated by King County or through regional partnerships <ul style="list-style-type: none"> • Target A): Pilot compost facility to begin in 2019 • Target B): Capital project process in progress • Target C): Marketable Class A product by 2023 	2a) Start a capital project for biosolids improvement to Class A compost by 2020 and develop a product by 2023.	<ul style="list-style-type: none"> • Gain 2019–2020 budget approval for full-scale compost pilot facility. • Begin operations of a compost pilot facility by 2020. • Put full-scale compost facility in capital project formulation. • Begin the capital project process for full-scale compost facility by 2023. • Evaluate and implement regional partnerships for a King County-owned Class A product. • Evaluate land availability and potential partners for Western Washington beneficial use program (using Class A products only).
		2b) As digesters are upgraded, invest in solids treatment process technology to reduce biosolids volume (through improved solids destruction) and produce a Class A biosolids cake product by 2048.	<ul style="list-style-type: none"> • Develop a plan for coordination between treatment plant operations staff and Biosolids Program for digester upgrades at the West Point Treatment Plant and other treatment plants as upgrades occur.

GOALS ⁱ	OBJECTIVES ⁱⁱ	STRATEGIES ⁱⁱⁱ	ACTIONS ^{iv}
	<p>2.2) A comprehensive biosolids market strategy and communications plan is developed by 2020</p> <ul style="list-style-type: none"> • Target A): Increase number of new research initiatives <ul style="list-style-type: none"> ▪ Measure: Number of research initiatives • Target B): Develop a list of grants and alternative funding sources by the end of 2019. • Target C): A written internal and external communications plan is in use by 2019 and a marketing plan is in use by 2020 <ul style="list-style-type: none"> ▪ Measure: Increased internal and external awareness of Loop biosolids brand and Biosolids Program 	<p>2c) Emphasize research studies on the benefits of biosolids.</p> <p>2d) Increase awareness and support of the Loop biosolids product and program with internal and external stakeholders, customers, and policy-making audiences.</p>	<ul style="list-style-type: none"> • Propose new research ideas and partnerships, internally and externally. • Ensure that research studies also evaluate alternatives to biosolids. • Leverage other agencies and NW Biosolids to pool resources. • Identify grants or alternative funding sources to expand existing research program. <ul style="list-style-type: none"> • Identify target audiences. • Identify potential partner agencies and community groups, internally and externally. • Engage in relationship-building with policy-making audiences. • Promote science-based policy changes that allow wider use of biosolids. • Expand awareness and use of biosolids products across King County departments and divisions. • Write a long-term communications plan that prioritizes target audiences, strategies, and actions to meet specific communications goals by 2020. <ul style="list-style-type: none"> ○ Identify potential customers and a go-to market strategy. ○ Create a long-term marketing plan. ○ Create a long-term policy plan.
<p>3: Integrate activities across the division – Ensure Biosolids, Energy, and Recycled Water Programs and TAIP planning and projects are synchronized across the division and within WTD’s capital system.</p>	<p>3.1) Capital projects that could impact the Biosolids Program align with the strategic goals of the Biosolids Program.</p> <ul style="list-style-type: none"> • Target A): Biosolids Program has a mechanism to evaluate resource recovery considerations in capital projects 	<p>3a) Establish shared understanding of priorities across the division, increase collaboration with the capital project process, and seek opportunities to coordinate and formally integrate resource recovery considerations in the planning process.</p> <p>3b) Include biosolids as part of WTD’s comprehensive planning workgroup.</p>	<ul style="list-style-type: none"> • Work with the sustainability team to identify opportunities to integrate resource recovery considerations and potential biosolids impacts early in the capital improvement process through the sustainability scorecard or a similar mechanism. <ul style="list-style-type: none"> • Identify workgroup lead and opportunities for participation.

ⁱ Goals = broad, aspirational outcomes the organization wishes to achieve related directly to its values

ⁱⁱ Objectives = outcomes that represent progress toward goals and better define what success looks like for each goal. Objectives should be SMART—Specific, Measurable, Attainable, Relevant, and Time-Bound.

ⁱⁱⁱ Strategies = specific types of actions taken to achieve goals and objectives. Strategies describe *how* goals and objectives will be achieved.

^{iv} Actions = discrete, actionable tasks that implement one or more strategies

Alternatives Evaluation and Selection

Strategic planning alternatives are specific options for how strategies can be achieved. They are variations/iterations of strategies that require analysis and comparison and that determine different sets of actions for implementing a strategy and, ultimately, achieving a goal.

The Biosolids Program considered 12 alternatives that would guide the future direction of the Biosolids Program and many of the strategies, and strategy prioritization, in this strategic plan:

- **Existing Class B Program:** The County produces approximately 120,000 wet tons of Class B biosolids each year, the majority of which is used as a soil amendment for agricultural crops in Eastern Washington or commercial forests in east King County.
- **Class B Land Application Program with Western Washington Sites:** The County would procure land to develop a local land application program and eventually construct an off-site biosolids storage or handling facility.
- **Class A Dryer:** Thermal drying technology removes water via evaporation from dewatered biosolids, reducing the volume and weight of dewatered cake making a Class A dried product.
- **Class A Lime Stabilization:** Alkaline treatment stabilization (e.g., the use of lime) typically raises the pH of biosolids above 12.0 to produce a Class A product.
- **Class A Biosolids Composting – Static Aerated Pile and Covered Aerated Static Pile:** Composting typically requires mixing biosolids with a carbonaceous bulking agent such as sawdust, wood chips, or ground yard debris. Composting is a treatment process that uses time and temperature to produce a final Class A product.
- **Class A Thermophilic Digestion:** Anaerobic digestion is a biological process in which anaerobic bacteria convert organic matter into methane and carbon dioxide (sometimes called biogas) in the absence of air. The process stabilizes the organic matter in wastewater solids, reduces pathogens and odors, and reduces the total solids quantity.
- **Class A Solar Drying:** The basic principle of operating a solar drying system is to evaporate water from biosolids using the sun's solar energy. The drying process occurs in impervious drying beds and produces a Class A product.
- **Contract Management of Biosolids – Haul Class B to Contractor/Municipal Class A Facility:** The County would haul Class B biosolids to a third-party contractor or other municipality for further treatment to achieve a Class A product.
- **Thermal Conversion – Incineration:** Incineration is a thermal oxidation or combustion process in which the organic matter or volatile fat is destroyed at high temperatures and in the presence of oxygen. Incineration of biosolids is typically accomplished using a fluidized bed incinerator or a multiple hearth furnace.
- **Thermal Conversion – Gasification:** Gasification is a process sometimes implemented outside of North America to recover the energy contained within the organic fraction of biosolids. Gasification is accomplished by heating the feedstock under low quantities of air and sometimes with the addition of steam.
- **Class A Thermal Hydrolysis:** Thermal hydrolysis is a pretreatment process that uses heat and pressure to treat primary sludge and waste activated sludge streams prior to digestion. This process reduces the volume of biosolids.

Alternatives Evaluation

As part of the strategic planning process, WTD and the consultant-team subject matter expert performed a triple bottom line (TBL) analysis of the 12 biosolids management alternatives considered. This analysis supports prioritization of strategies and conclusions reached in other phases of the planning process and provides information to consider in implementing the Biosolids Program Strategic Plan. Further evaluation, costing analysis, and technical review may be required to explore an alternative in more detail (these factors were not within the scope of strategic plan development).

Triple Bottom Line Analysis Overview

A TBL analysis presents a range of values for measuring organizational and societal success for the County's Biosolids Program, including social, environmental, and economic values. Criteria are specified within each TBL category, and each biosolids alternative was scored for each criterion. All TBL criteria are found in Appendix C. The end analysis of this evaluation was a number from 1 to 100, with 1 being the lowest-rated (least preferred) alternative possible and 100 being the highest-rated (most preferred) alternative possible. Complete results of the TBL evaluation are presented in Table 1 and detailed in Appendix C.

Table 1. TBL Evaluation Results

Alternative	TBL Evaluation Score
Class A Covered Aerated Static Pile Composting	69
Class A Static Aerated Pile Composting	67
Existing Class B Program	61
Class A Thermophilic Digestion	61
Class B Land Application Program with Western Washington Sites	56
Contract Management of Biosolids	54
Solar Drying	50
Class A Thermal Hydrolysis (includes soil blending)	47
Class A Dryer	36
Class A Lime Stabilization	34
Thermal Conversion – Incineration	17
Thermal Conversion – Gasification	14

Scoring systems established for the TBL evaluations allow objective comparisons between alternatives. Twenty-year high-level life cycle costs, including capital and operations and maintenance costs, were estimated for incineration and the three highest ranking biosolids management alternatives:

- Class A Aerated Static Pile Composting (with or without membrane cover system)
- Class A Thermophilic Digestion with Soil Blending
- The existing Class B Land Application Program

The highest-ranking alternative was Class A biosolids composting. This alternative received the highest ranking because it produces a highly marketable, King County-owned, local retail product. It also implements well-established technologies. A compost product allows entry into a variety of local markets and addresses current program challenges regarding transportation, market portfolio, and public perception. Additionally, Class A biosolids composting aligns closely with the Biosolids Program's strategic plan goals, priority

strategies, and actions, and it also aligns with WTD's and King County's goals for equity and social Justice, sustainability, and resiliency.

A brief description of incineration, and the three highest ranking biosolids management alternatives, is provided below. Detailed TBL scores for all management alternatives considered are shown in the consultant-team subject matter expert's TBL report in Appendix C.

Alternatives Description and Scores

Class A Biosolids Composting – Aerated Static Pile and Aerated Static Pile with Membrane System

The highest-ranking alternative was Class A biosolids composting for a variety of reasons. This alternative received the highest ranking because it produces a highly marketable, King County-owned, and local retail product. It also implements well-established technologies. A compost product allows entry into a variety of local markets and addresses current program challenges regarding transportation, market portfolio, and public perception. Other key benefits of this alternative include: relatively short haul distances and availability for emergency storage; availability of wood debris bulking agents from King County Road Services, Solid Waste, and Parks divisions; and avoidance of significant recycling and tipping fees. Class A biosolids composting aligns closely with the Biosolids Program's strategic plan goals, priority strategies, and actions. Some drawbacks include: capital costs, need for local land acquisition, and market fluctuations in sourcing additional reliable bulking agents.

Existing Class B Land Application Program

Maintaining the County's existing Class B land application program was the second-highest-ranked alternative. The County produces approximately 120,000 wet tons of Class B biosolids each year, the majority of which is used as a soil amendment for agricultural crops in Eastern Washington or commercial forests in east King County. A small percentage of biosolids is presently sent to a private composter that produces and sells compost. The biosolids portfolio for the County is presently trending toward a reduction in the diversity of end users. There are several key benefits of maintaining the current program, including the following: there are no major program changes required; the Eastern Washington agricultural market is large, with an established customer base; and the program is well known to WTD and operations staff. The program has several drawbacks including: limited diversity in market portfolio, long hauling distances, winter pass closure issues, farmers moving toward organically certified practices, price of wheat (primary market) is declining, and more regulatory restrictions on Class B product use are being realized.

Class A Thermophilic Digestion

Thermophilic digestion is capable of producing Class A biosolids. In this alternative, it was assumed the existing digesters are upgraded to thermophilic digestion at West Point Treatment Plant to maintain the existing treatment plant footprint. The digesters would produce Class A biosolids. Twenty-thousand wet tons of Class A biosolids will be trucked to a County-owned soil-blending facility to be developed into a soil-blend product that will be locally marketed. The remaining Class A biosolids will continue to be used for forestry and agricultural application. The key benefits from this alternative include: alignment with asset management of West Point digesters; County-owned and marketed product; revenue from retail sales; short haul distances and availability of emergency storage; availability of wood debris bulking agents from King County Road Services, Solid Waste, and Parks divisions; and avoidance of significant recycling and tipping fees. There are several potential drawbacks of this alternative, including: capital costs and need for land acquisition, long timeframe for implementation, and market fluctuations in sourcing additional reliable bulking agents.

Thermal Conversion – Incineration

Although incineration ranked very low in the TBL analysis, it is summarized here because of external stakeholder interest in the technology. Incineration is a thermal oxidation or combustion process in which the organic matter or volatile fat is destroyed at high temperatures and in the presence of oxygen. All the energy going into the biosolids is burned and converted to hot gases, which are exhausted through an emission stack. Heat is required when combusting raw or digested biosolids to remove the water. All of the energy in the digested biosolids is, therefore, lost. Incineration of biosolids is a typical method for biosolids disposal that creates a small-volume, inert material for landfilling.

A key benefit of incineration is that there is no product to manage except ash (which requires landfilling). Incineration typically provides an alternative to landfill disposal of municipal solid waste, but without the benefit of energy recovery. Many existing facilities were designed this way before the era of high energy prices and sustainability considerations. Conversely, an incineration facility requires major capital investment and air quality permitting, has high energy use and a large carbon footprint, faces potential social justice concerns with facility location, typically encompasses a long timeframe for implementation, and possesses no opportunity for resource recovery. Therefore, more biosolids incinerators are being taken out of commission nationally than are being constructed. Finally, the Washington State Department of Ecology (Ecology) does not consider incineration to be a beneficial use of biosolids.

Alternatives Conclusions

As a result of this TBL analysis, incineration will not be considered further for WTD biosolids. The remaining three alternatives informed the refinement and prioritization of biosolids strategies and actions.

Goals, Objectives, and Strategies Background

The goals, objectives, and strategies of the Biosolids Program Strategic Plan address biosolids beneficial use and reliability, biosolids products and distribution, and integration of Biosolids Program activities with the rest of WTD. This section describes how these goals, objectives, and strategies were developed.

Goals and Objectives

Biosolids Program staff brainstormed program goals, from which a smaller set was identified to include in the plan. For goals 1 and 2, program staff conducted a strengths, weaknesses, opportunities, and challenges (SWOC) analysis. The SWOC analysis helped staff refine the wording of goals, identify measurable objectives, and consider potential strategies.

Strategies

Biosolids Program staff developed an initial list of potential strategies to achieve program goals, which program staff further refined to develop a prioritized list of 10 strategies. Staff also identified a small list of strategies for future consideration. Additional details are found in the Strategies Prioritization section of this plan.

Technical Research

Strategic planning consultant team subject matter experts conducted a TBL analysis to inform the identification, evaluation, and selection of future WTD biosolids management alternatives. The consultant and WTD staff developed social, economic, and environmental criteria for evaluating 12 potential biosolids management alternatives. The consultant then described and evaluated each alternative. After the Biosolids Program narrowed down its consideration to four alternatives, the consultant provided a conceptual or high-level cost estimate for those alternatives to inform the Biosolids Program's selection of an alternative as well as strategies and actions to implement. Results of the TBL analysis are found in the Alternatives Evaluation and Selection section and in Appendix C.

Goals Rationale

This section summarizes the Biosolids Program’s reasoning behind all three of its goals and strategies to achieve those goals. The goals of the Biosolids Program were developed to specifically address the program challenges and issues described in the Introduction section, including issues surrounding the resiliency of the program to market and regulatory changes, maximizing resource recovery, identification of barriers and risks, responding to customer needs, and integration with other WTD programs.

Goal 1: Recycle 100 Percent of Loop

WTD has a long history of 100 percent beneficial use of Loop biosolids, and all biosolids producers are required by Ecology to beneficially use biosolids while being protective of human health and the environment. Landfill and incineration are not authorized beneficial uses per WAC 173-308, which is enforced by Ecology. Biosolids goal 1 seeks to ensure that Loop is not diverted to landfills. (See pages 7-8 for actions to implement strategies for achieving goal 1).

Goal 2: Diversify Biosolids Products and Distribution

In 2016, 94 percent of Loop biosolids was delivered east of the Cascade mountains, almost entirely to one of two long-time agricultural partners: Boulder Park and Natural Selection Farms, located in Douglas County and the Yakima Valley, respectively. The majority of this agricultural application went to Boulder Park and was used to provide nutrients for wheat and other crops. The remaining biosolids went to forestry applications in Western Washington (5.5 percent) and a local composter (0.5 percent). King County does not have ownership of a Class A product, limiting WTD’s ability to broaden potential equity, social justice, and sustainability goals. Building a resilient program requires inclusion of local use and decreased operational risk. Goal 2 broadens the biosolids customer base from rural communities outside of King County to urban communities within King County.

Goal 3: Integrate Activities Across the Division

While Biosolids and Recycled Water Program and TAIP strategic plans include goals, objectives, and strategies for individual programs, there are commonalities and interconnections across all resource recovery programs and other programs within WTD. This common goal is shared among the Biosolids Program, Recycled Water Program, and TAIP. This common goal also ensures that the implementation of individual plan strategies is done in a way that increases the efficiency of implementation, draws from overlapping efforts across WTD, and considers how strategies affect other WTD programs.

Implementing Actions

Methods to implement Biosolids Program actions will vary significantly depending on the type of action and its complexity. Actions will be incorporated into WTD's work planning process, and the following strategic planning details will be identified through that process:

- **Champions:** Strategic plan champions are individuals who advocate for and support an action or set of actions. Champions advocate for actions to program decision-makers and search for solutions to barriers to implementing actions. Often, the champion for an action is different from the individual(s) leading an action to completion.
- **Leads:** Action leads take responsibility to ensure an action is successfully implemented by tracking progress, monitoring the budget, and delegating work to complete an action during strategic plan implementation.
- **Costs:** During the strategic planning process, the budget for implementing an action may not be known. However, the program should be able to identify *types* of costs that may be required to implement an action, such as capital, operational, travel, membership, consultant, or other costs.
- **Measures and Milestones Refinement:** The program should identify specific measures and milestones for tracking progress toward targets they set for each objective. This can be done through updates to the program's existing internal work planning processes.
- **Timeframe:** During the strategic planning process, it may not be feasible to identify specific milestones and deadlines for completing different parts of an action. However, the program should be able to identify the approximate *timeframe* for starting and completing an action. Also, to the extent possible, the program should identify the *sequence* for implementing actions (i.e., which actions should be started first, second, etc., and which actions must be completed before other actions can begin).
- **Stakeholder Engagement:** Key stakeholder groups will be consulted throughout implementation of the strategic plan.
- **Monitoring and Maintenance:** The program should develop a system for regularly monitoring progress toward achievement of strategic plan goals. Measures identified for each objective will be a useful guide in plan monitoring. Also, the strategic plan may occasionally be revisited and updated as conditions change.

Appendices

- **Appendix A:** Biosolids Strategic Plan Charter
- **Appendix B:** WTD Strategic Planning Team Members
- **Appendix C:** Biosolids Program Alternatives Triple Bottom Line (TBL) Analysis