Integrated Water Resources Planning in Pinellas County

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Table 1. Pinellas Integrated Water Resources Management Plan Objectives

No.	Objective	Description
1	Meet Utility Needs Reliably	Provide potable water, wastewater, and reclaimed water services to meet existing and future demand in a reliable manner; accounting for resource availability, protection of the natural environment, system capacity, and efficient management of utility assets.
2	Provide Cost-Effective Solutions	Implement multipurpose/multibenefit solutions that are innovative and cost-effective when compared to the current industry standard approach.
3	Improve Ambient Water Quality	Implement solutions that improve the water quality of receiving waters, groundwater, and drinking water.
4	Protect Watersheds and Natural Systems	Implement solutions that protect, enhance, and educate about watersheds and the natural environment, including aquatic and terrestrial ecosystems.
5	Ensure Quality of Life	Maintain and improve the quality of life for residents with a focus on protecting and enhancing the natural and built environment, recreation, and open space; supporting a quality and diverse economy; providing for a healthy community; and public outreach and education.

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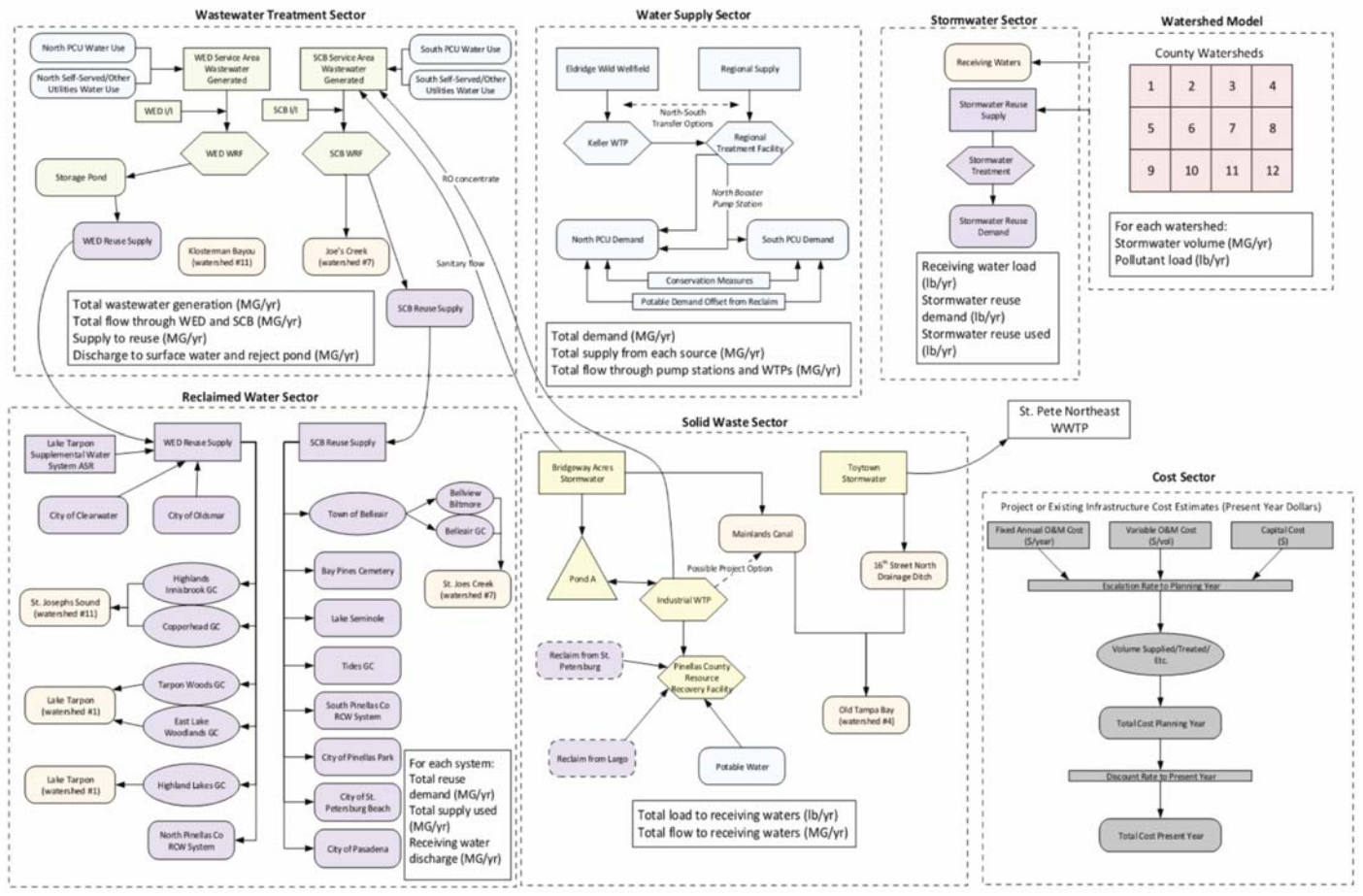
The Pinellas County strategic plan was adopted in 2015 and includes the goal to practice superior environmental stewardship. Demands and limitations of the water resources of the county include impaired surface water quality throughout the county, increased demand for alternative water supplies (including reclaimed water), and the potential effects of climate change, such as increased vulnerability of county facilities to flooding and increased Federal Emergency Management Agency (FEMA) insurance premiums.

Figure 1. Pinellas County Integrated Model Conceptual Design



To achieve the goals of the plan and to address the other demands on water resources, the county departments must work efficiently and collaboratively. As a result, the county wished to develop an integrated water resources management plan to identify opportunities for greater sustainable water supply collaboration, expanded use of reclaimed wastewater, improved protection of groundwater and surface water, and better management of stormwater resources. Because of connections to regional water use and reclaimed reuse, the Southwest Florida Water Management District (SWFWMD) partnered with the county in the execution of this integrated water resources management plan (IWRMP).

The IWRMP defines the overarching objectives of the programs for water, wastewater, surface water, solid waste, and reclaimed water; identifies the performance measures to determine the degree of achieving the objectives; assesses interactions among the program elements; and assesses alternatives that are based on project options (i.e., projects and activities) using modeling and decision support tools.

To address both short- and long-term projects and activities, especially due to the long-term issue of climate change, the IWRMP defined four planning horizons:

- Early out (less than two years out)
- Short-term (five to 10 years out)
- Medium-term (25 years out)
- Long-term (50 years out)

The early-out options were projects and activities that were already planned or being completed in a very short period of time; these projects were identified to the county but not included as part of the IWRMP. Also, the long-term options were related to climate change, where coastal sea-level rise may affect the vulnerability of county facilities.

Description of Programs

Each sector of interest was analyzed for simplified water resources relationships. The existing facilities and programs for water supply, surface water (including stormwater), wastewater, reclaimed water, and solid waste (surface water discharges only) were identified and relationships considered. An overall picture of the interconnected sectors is provided in Figure 1. Major interconnections for the overall program are:

- *Water Supply to Wastewater*: While the county service areas for water supply and

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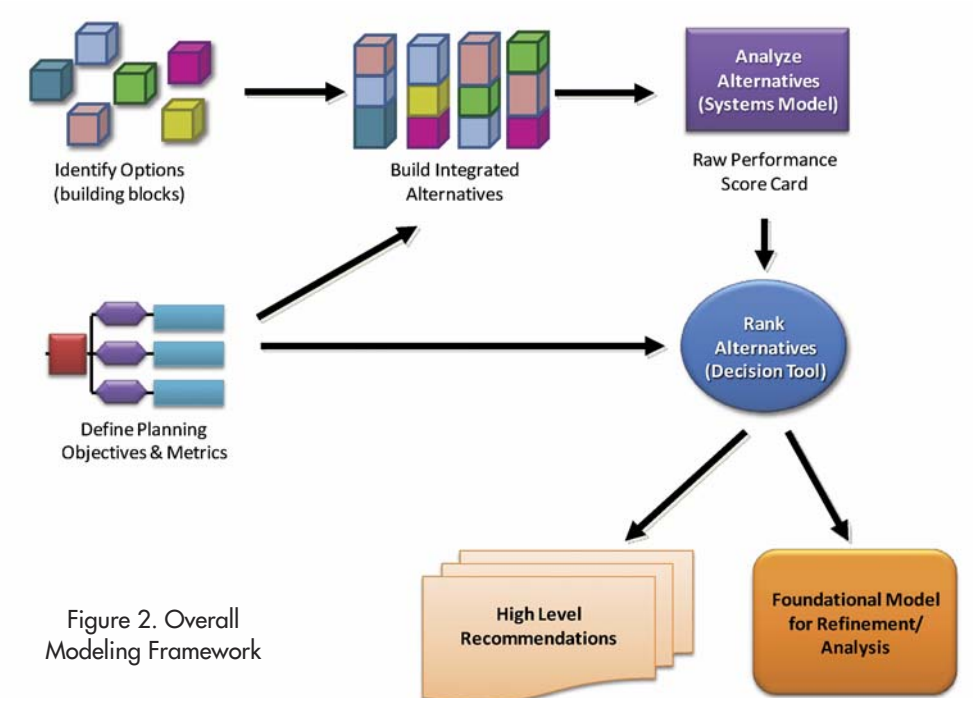

Figure 2. Overall Modeling Framework

Table 2. Objective and Performance Measure Weighting

Objective	Weight	Performance Measure	Sub-weight (%)
Meet utility needs reliably	20	Percent of county-generated reclaimed water beneficially reused	20
		Percent of time that supply meets demands on an annual basis (reclaimed)	20
		Percent reduction in sanitary sewer overflow occurrences	20
		Amount of stormwater beneficially used	20
		Increase potable water conservation	20
Provide cost-effective solutions	20	Total capital cost	30
		Total annual average operations and maintenance (O&M)	30
		Dollars saved through partnership opportunities	20
		Ease of Implementation	20
Improve ambient water quality	20	Pounds of nitrogen removed from discharges	30
		Pounds of phosphorus removed from discharges	30
		Households removed from septic systems	5
		Additional water quality improvements	30
		Benefits brownfield site cleanup	5
Protect watersheds and natural systems	20	Miles of stream enhancement/protection	50
		Acres of habitat protection/restoration/creation	50
Ensure quality of life	20	Properties with flood control improvements	12.5
		Property protection from erosion	12.5
		Acres of recreation/open space protected or created	12.5
		Impact to underserved communities	12.5
		Public education/participation	12.5
		Economic benefits	12.5
		Public health protection	12.5
		Resiliency	12.5

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wastewater treatment do not cover the same exact areas, there is overlap so that some of the water supplied by the county is used and returned as wastewater to the William E. Dunn (WED) and South Cross Bayou (SCB) water reclamation facilities.

- *WED Reuse Supply to Reclaimed Water*: Reclaimed water from the WED facility, augmented by reclaimed water from Clearwater and Oldsmar, is provided to a number of golf courses. Discharge to surface water is possible with excess reclaimed water.
- *SCB Reuse Supply to Reclaimed Water*: Reclaimed water from the SCB facility is provided to golf courses, municipalities, and southern Pinellas County. Discharge to surface water is possible with excess reclaimed water.
- *Water Supply and Reclaimed Water*: Reclaimed water used for irrigation or other needs will reduce the demand for potable supply for the same purposes.
- *Reclaimed/Wastewater to Surface Waters*: Treated wastewater, reclaimed water, and solid waste stormwater are discharged to surface waters, if there is no demand for them.

Table 3. Options Included in Each Alternative

Sector	Option	No Action	Low Cost	Reclaimed	Water Quality	Flood Control	Hybrid
Reclaimed Water	South-North Interconnect			X	X		
	Offset irrigation water use permits in County			X	X		
	Expand mixed use reclaimed water			X	X		
Solid Waste	Pond A reduced discharge				X		
	Toytown leachate diversion to Pond A		X				
Surface Water	McKay Creek Hickory Lane water quality improvements		X		X	X	X
	Central Lealman drainage improvement				X	X	X
	Dredging sediment in Cross Bayou					X	X
	Walsingham Reservoir drawdown		X			X	X
	Targeted brownfield site				X	X	X
	Increase street sweeping				X		
	Stormwater harvesting opportunities at County facilities				X	X	X
	LID Improvements		X		X	X	X
	Granger flooding and septic removal		X		X	X	X
	Permitted facility improvements		X		X	X	X
Wastewater	Septic Tank Reduction Program				X		X
	I&I Reduction in SCB collection system				X		X
	Connect private WWTP to WED System		X				
	Connect private WWTP to SCB System		X				

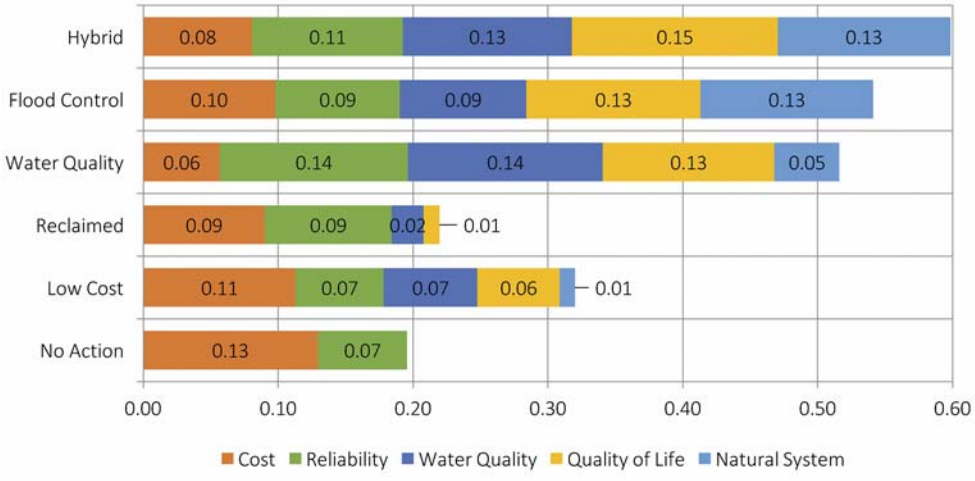

Figure 3. Alternative Scores, Including Hybrid

Project Objectives and Performance Measures

In the first of three workshops (Workshop 1), the stakeholders identified over 50 potential objectives for the IWRMP. Through discussion, these were narrowed down to five major objectives, as described in Table 1.

The IWRMP also included resiliency as a measure and goal of the plan; however, resiliency was considered independently from the objectives.

Modeling Framework

Figure 2 illustrates the overall IWRMP process used for this project. Internal stakeholders identified planning objectives and metrics, as well as options (projects and activities). From these, alternatives were identified and analyzed using the Systems Thinking Experiential Learning Laboratory (STELLA) model. The decision support tool (Criterium Decision Plus, or CDP) provided a scorecard to rank alternatives relative to each of the metrics for comparison.

Besides the objectives, the internal stakeholders also identified a potential list of performance measures to objectively judge how an option would achieve the objectives. Table 2 provides a list of the measures associated with each objective, as well as the weighting. Initially, each of the objectives and performance measures had the same weights (stakeholder priorities), and a sensitivity analysis was performed to test the final ranking of alternatives to other potential weighting scenarios.

To help in the quantification of the performance measurements, a nutrient loading model was used to estimate the nutrient loading benefits (reductions) associated with project options. The model was developed and run by Janicki Environmental Inc., and annual loadings for total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and biochemical oxygen demand (BOD) were estimated from 1985 to 2011. A future scenario, which considered future land-use projections, was also provided. This model helped identify the benefits of pertinent nutrient reduction project options.

Project Options and Alternatives

In Workshop 2, the internal stakeholders identified a series of project options and activities. Through facilitated discussion, the options and the alternatives in which they were placed were combined and narrowed to a list of 19 options, shown in Table 3. As expected, since

the major theme of the IWRMP is water quality improvements, the majority of the options were related to surface water projects. The five initial alternatives are:

- *No Action*: This alternative acts as the baseline condition in which no project options are selected.
- *Low Cost*: The lowest-cost options within each sector were selected based on annualized cost to the county.
- *Reclaimed Water*: Options that maximize the availability and use of reclaimed water were selected.
- *Water Quality*: Options that minimize pollutant loads to surface water were selected.
- *Flood Control*: Options that minimize the risk of flooding were selected.

Alternative Analysis

Each of the alternatives were simulated in STELLA to provide a quantitative indication on each of the modeled performance measures, and each qualitative measure was added. Ultimately, each was scored via CDP to provide a comparative measure of achievement of each objective. The initial results were reviewed by the internal stakeholders during Workshop 3 and a new hybrid alternative was suggested by including all options in the surface water sector, as well as the septic system reduction program and inflow and infiltration reduction program from the wastewater sector. Figure 3 illustrates the resulting scores for each alternative, including the hybrid.

The hybrid has the highest score of the alternatives. The hybrid scored the highest or second highest for reliability, water quality, quality of life, and natural systems, while still balancing cost considerations.

The scoring process was tested to check the sensitivity of each weight to the ultimate scores. For each measure, the weight was set to 50 percent of the total score and the remaining 50 percent equally distributed to the rest of the weights. These sensitivity tests determined that the hybrid alternative was the highest-ranked under each weight considered.

Recommendations

Based on the STELLA model analysis and the scoring using CDP, the alternative that best achieves the internal-stakeholder-driven objectives is the hybrid alternative. Project options included in the hybrid alternative are listed in Table 3. The total estimated capital costs were $67.1 million, with annual O&M fixed costs of $1.27 million. Costs potentially saved through partnerships with SWFWMD and federal grants were estimated at $19.3 million. Based on the pollutant loading model results, the hybrid alternative would result in a receiving water loading reduction of about 43,600 pounds per year of total nitrogen and 11,250 pounds per year of total phosphorus.

Through the Pinellas County IWRMP, water-related programs within the county were addressed as an interconnected system, and systemic and sustainable alternatives were promoted. This approach to water resource planning encourages interagency collaboration, connecting many departments in the county government, as well as multibenefit, multipurpose programs and projects. Future work on the IWRMP could include municipal partners in the areas of reclaimed water sharing and watershed-based pollutant reduction projects, as well as public stakeholders to confirm overall objectives and goals.