Section 5
IWRP Phase I Results

The IWRP is based upon a holistic evaluation of Franklin's water resources. This concept is demonstrated in Figure 4-1**.** The process diagram demonstrates the water cycle for Franklin's water resources and utilities and how a single change may affect multiple systems. A combination of model results and qualitative scores for each performance measure resulted in a weighted composite score for each of the five alternatives initially developed by the stakeholders. These results allowed the stakeholders to understand the tradeoffs and drivers of the scores and combine options into hybrid alternatives aimed at satisfying many objectives broadly and being recommended for further analysis in Phase II.

5.1 Initial Alternative Scores

Results of the model are provided in the form of performance measure scores, which can be converted from the respective units related to each performance measure into a standardized scale. Section 3.6 includes a description of the process of converting raw scores (e.g., costs, frequencies, pollutant loads) into standardized scores, weighting the scores with the stakeholder developed weights, and aggregating the scores into a single composite score for each alternative. Once the scores for each performance measure were converted to a standardized scale, they were added into a composite score for each alternative developed by the stakeholders aimed at meeting the five most heavily weighted objectives:

- Reliability
- Efficiency
- Water Quality (and Ecological Health)
- Service at a Reasonable Cost (Cost)
- Safety and Security

Table 5-1 lists the performance measure scores for each alternative, **Figure 5-1** shows the standardized and weighted scores for the individual nine objectives for each of the alternatives, and **Figure 5-2** shows the comprehensive score as a stacked bar chart, with each color representing an objective. In addition to the five alternatives, a do-nothing alternative is shown on the graph. The raw scores are listed with their respective units. Qualitative scores were agreed upon by the steering committee for each alternative, and were assigned based on a relative scale of 0 to 5 that generally corresponded to a range of worse than current conditions, no change, and better than current conditions. The scores in the graphs are standardized (see Section 3.6), so a higher composite score for the cost objective means that the cost is more preferable, based on the performance measures for that objective, not higher.

The efficiency alternative was the overall best scoring alternative, and the composite scores demonstrates that doing nothing is not an effective plan for Franklin. Closer review of results reveals that while safety and security and low cost have similar scores overall, these composite scores differ in their components. Low cost does not score as well under the performance measures of safety and security (5) and sustainable biosolids handling (7) objectives; and safety and security does not score as well in the cost (4) objective. Generally, the five alternatives scored well with respect to the objectives they were targeting (i.e., the reliability alternative scored the best in the reliability performance measures).

The composite scores shown in **Figure 5-2** are not intended to rank the initial alternatives for inclusion in the final IWRP. Rather, they serve to help the stakeholders understand the tradeoffs involved with selecting different sets of options. The safety and security alternative and the efficiency alternative both scored well, overall, but for different reasons. A potential hybrid alternative would be to combine the projects that resulted in high scores in those two alternatives. Another example is the water quality alternative,aimed exclusively at improving water quality, which does not score as well in the efficiency objective. This is likely due to the selections of project options included in the alternative, which do not include building reclaimed water distribution infrastructure, addressing inflow and infiltration, or conservation. Augmenting the water quality alternative with these types of projects would likely result in a hybrid that scores better than the original.

5.2 Hybrid Alternative Development

During Workshop 4 the stakeholders reviewed the results from the initial five alternatives and discussed possibilities for improving the alternatives into hybrids aimed at meeting multiple objectives. The stakeholders developed four hybrid alternatives and agreed to recommend that each of them be studied further in Phase II of the IWRP process. The recommended hybrid alternatives are:

- **Efficiency + Safety and Security** – Through the analysis and discussion of the separate alternatives (efficiency and safety and security), a combination of the options in these two alternatives was selected with the intent of maximizing the performance of the resulting hybrid alternative.

- **Water Quality** – The evaluated water quality alternative was improved by selecting projects in the distribution system, water conservation, and reclaimed water sectors, since it had the second lowest efficiency score of the five alternatives.

- **Low Cost –** The low cost alternative was modified in its wastewater treatment plant option, switching from building a new WWTP at Goose Creek to upgrading and rerating the existing plant.

- **Reliability** – The reliability alternative was modified to include water conservation projects, since its initial score for efficiency was the lowest of the five alternatives.

Table 5-2 shows the four recommended alternatives and the project options that were selected for each. Discussion of the recommended alternative scores follows in Section 6.

Table 5-1
Performance Measure Scores for Initial Alternatives

Objectives		Weight	Performance Measures	Units	Water Quality	Low Cost	Efficiency	Reliability	Safety & Security	Do Nothing
1	Reliability	31.1	% time all demands met	% time (all days)	27.7	33.2	56.1	57.9	24.7	24.7
			Avg magnitude of deficits (all uses)	MG	8.06	6.87	8.82	9.36	7.84	7.84
			Vol of WW capacity surplus or shortfall	mgd	4.19	5.83	3.56	2	3.56	0.29
			Supply redundancy	% volume	0	19.9	36.1	44	19.9	19.3
2	Efficiency	15.5	Volume of stormwater put to beneficial use	MGD (all days)	0.1	0	0.50	0.50	0	0.00
			% total reuse demand satisfied	% volume	38.2	52.4	60.7	60.1	37.2	37.3
			% demand reduction	% volume	0	5	5	0	5	0
			Reduction in inflow and infiltration	qualitative	5	4	5	2	5	2
			% reduction in unaccounted for water	% volume	0	50	50	0	50	0
3	Water Quality & Ecological Restoration	13.5	Frequency of low flow < September median	% time (all days)	7.37	9.11	0.81	0.92	0.81	9.11
			Average summer BOD load	LB/day (summer only)	960	1,030	1,020	1,030	1,100	1,130
			Average summer nitrogen load	LB/day (summer only)	240	250	280	280	390	380
			Ecological indicators	qualitative	4.5	3	4.5	3.5	3	3
			Negative impacts of stormwater reduced	qualitative	3.5	3	3	3	3.5	3
4	Service at a Reasonable Cost	13.2	Life-cycle cost of projects and policies	million $	566	405	605	759	677	360
			Combined change in water and sewer rates	qualitative	2.5	2.3	2	1.8	1.5	3
			Meet secondary drinking water standards	qualitative	2.5	3.5	5	4	3	3.5
5	Safety & Security	8.3	% of total wastewater on septic	% volume	0	4	0	0	0	4
			Change in 100 year flood elevation	qualitative	4	3	3	3	5	3
			Vulnerability of infrastructure & facilities	qualitative	1.5	4	4.5	4	4	1.5
			Emerging water quality concerns	qualitative	4	3.5	5	4	3.5	4
6	Achieve Regional Acceptance	5.7	Extent of regional focus	qualitative	4.5	3	4	3	3	3
			Likelihood of public acceptance	qualitative	3	4	3.5	2.5	3	1
7	Sustainable Biosolids Mgmt	4.7	Biosolids handled sustainably	qualitative	1	4	4.5	2	5	1
8	Improved Access & Aesthetics	4.5	% of streamflow that is WWTP effluent	% volume (Sept. only)	36	5	22	22	36	35
			Extent of bank stabilization	qualitative	5	1	5	1	5	1
			Erosion potential	qualitative	4.5	3	3.5	3	4	3
			Public accessibility	qualitative	3	3	3	3	2	3
9	Carbon Footprint	3.5	Average energy requirements	average kWh/day	95,800	35,200	30,500	134,900	57,600	72,600

Raw scores are planning-level estimates based on existing information and used only for initial comparison – they are subject to revision with more detailed evaluation in Phase II.

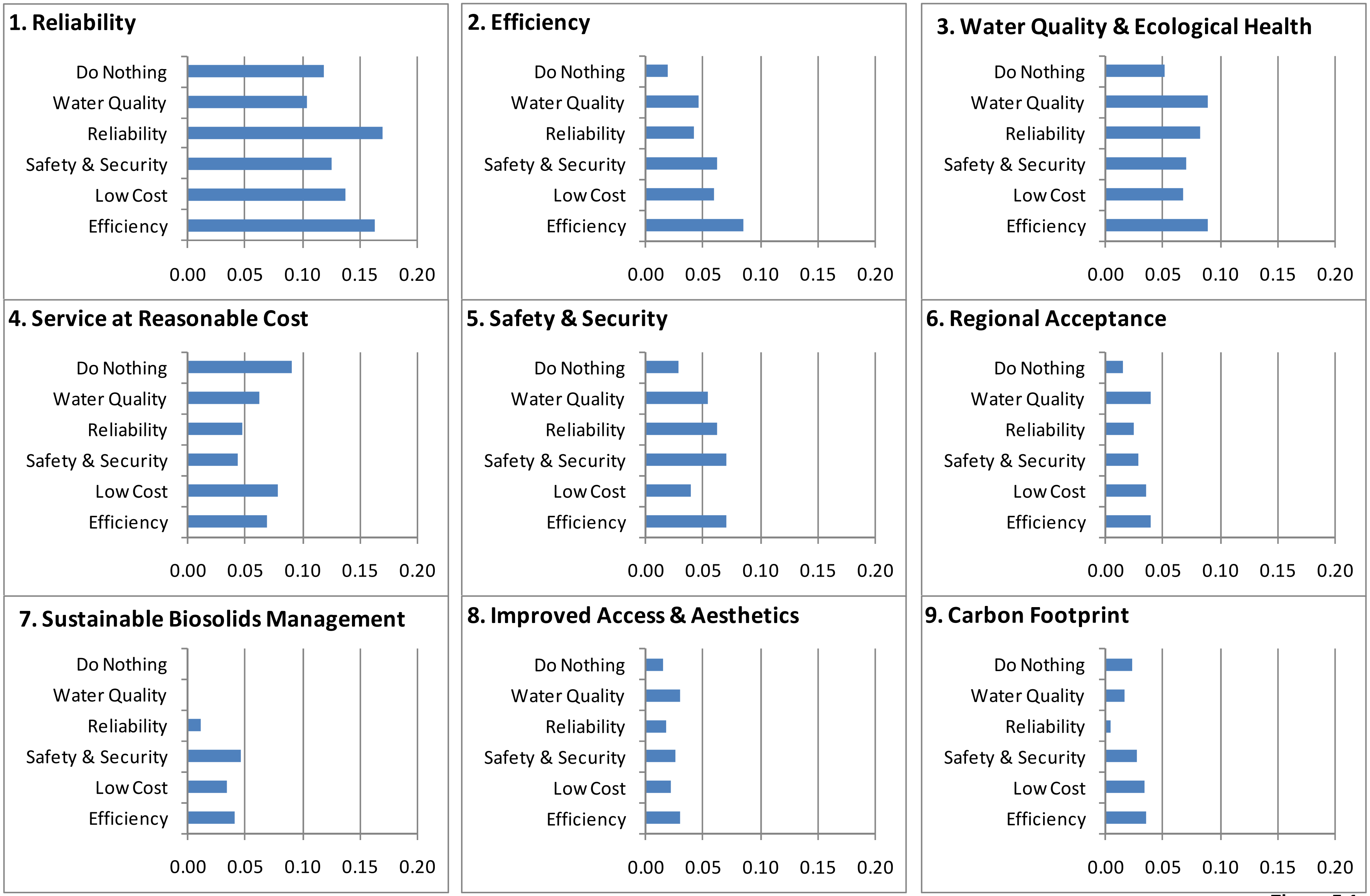

Figure 5-1
Weighted Objective Scores for the Initial Alternatives

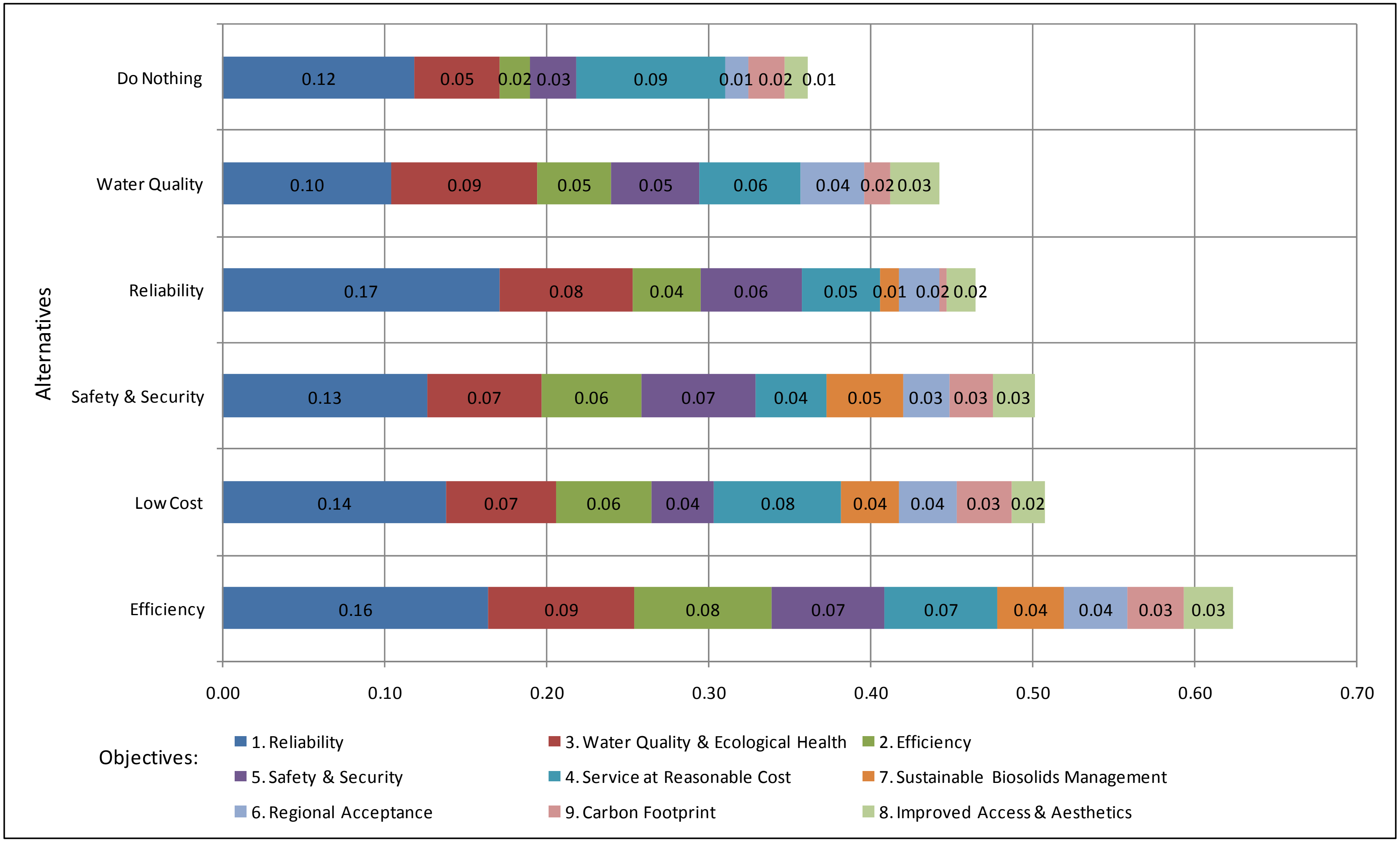

Figure 5-2
Composite Scores for the Initial Alternatives

Category	Options	Efficiency + Safety & Security	Water Quality Plus	Revised Low Cost	Revised Reliability
Stormwater Options	Residential rain barrels	X	X		X
	Commercial stormwater reuse	X	X		X
	Recreational stormwater reuse	X	X		X
	Rain gardens	X	X		
	Pervious pavement	X	X		
	Constructed wetlands	X	X		
	Conveyance upgrades	X	X		
	Increased storage	X	X		
Water Treatment Plant	Upgrade existing 2.1 mgd WTP and purchase remaining water from HVUD			X	
	Expand existing WTP to 4.0 mgd, upgrade WTP intake structure and purchase remaining water from HVUD	X			
	Repair water reservoir (ongoing)	X		X	
	Shut down existing WTP and purchase all water from HVUD		X		
	Construct raw water transmission line from the Cumberland River and upgrade water treatment plant to supply all City demand				X
Distribution System	Address water loss	X	X	X	
	Install advanced metering	X	X	X	X
	Remove outdated tanks	X	X		
	System management practices	X	X	X	X
Conservation Options	Indoor and outdoor conservation (public education, etc)	X	X	X	X
	Conservation ordinances	X	X	X	X
	Low flow incentives	X	X	X	X
	Rate block structure, etc	X	X	X	X
Wastewater Treatment Plant	Upgrade and rerate existing WWTP		X	X	X
	Construct new WWTP at Goose Creek	X			X
	Collect and treat wastewater from adjacent communities or other small systems (e.g., Lynwood, Cartwright Creek)	X	X		
	Treat discharged effluent to higher standard during summer months		X		
Collection System	Address inflow and infiltration	X	X	X	
	Hook up septic users to sewer	X	X		X
	System management practices	X	X		
Ecological Restoration Options	Removal of low head dam at the water treatment plant intake	X	X	X	
	Address old dump site (from downtown to Liberty Creek) and convert to Harpeth River access area				
	Use of Robinson Lake to provide enhanced base flow in the Harpeth River during dry periods	X	X		
	Cattle exclusion	X	X		
	Widespread stream and bank restoration	X	X		
Reclaimed Water Options	Complete the 12" Long Lane line and retrofit the existing 500,000 gallon Long Lane water reservoir for reclaimed water service	X	X		
	Complete the distribution loop around the city by constructing the 12" Columbia Avenue/Southeast Parkway reclaimed line and construct a 500,000 gallon storage tank in the vicinity of Winstead Hill	X	X		X
	Convert the Franklin Green/Horton Lane sanitary force main for reclaimed water distribution	X	X	X	
	Increase City-wide reuse by increasing customer base	X	X	X	
	Install additional pumps to increase the station capacity to approximately 12 million gallons per day	X	X		X
	Establish additional reclaimed water storage facilities/ convert existing water storage tanks to reclaimed storage tanks	X	X		X
	Identify and establish dedicated reclaimed water sites	X	X	X	
	System management practices	X	X	X	
Biosolids Options	Upgrade solids handling facilities to produce Class A solids				X
	Upgrade solids handling facilities to drying/ERS (ash disposal)				X
	Upgrade solids handling facilities to produce higher TS content sludge				
	Solids disposal at BFI (108 miles/trip)				
	Solids trucked to Metro Nashville for disposal/processing			X	
	Class A biosolids to Franklin's composting facility		X		
	Land application (Switch grass production)	X			
	Upgrade biosolids facilities for biogas to energy	X	X	X	

Table 5-2
Recommended Alternatives