APPENDIX C – PROJECT EVALUATION AND PRIORITIZATION METHOD

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C.1 PROJECT EVALUATION METRICS AND SCORING

As discussed in Section 4.2.2 of the West Slope SWRP, identified projects were evaluated using appropriate qualitative and quantitative methods for identifying projects that could provide the greatest benefit within each component. Table C.1 shows each criteria's assigned metric which allows for qualitative or quantitative measurement. Each metric ranges from a low score of zero (no benefit or not applicable) up to a high score of 3 (highest benefit). Identified projects within each component are evaluated against all the benefit category criteria and assigned a score based on the metric and assessment value range. Appendix D summarizes the evaluation assessment/value and scoring for each project.

Table C.1. Project Evaluation Metrics and Scoring

Benefit Category	Criteria	Metric	Assessment Value	Scoring
Water Quality 	Increased filtration and/or treatment of runoff	Volume of Treated Water (AF/year)	High Volume (>400 AF/year)	3
			Moderate Volume (200-400 AF/year)	2
			Low Volume (<200 AF/year)	1
			Not Applicable	0
	Nonpoint source pollution control	Pollutant Load Reduction	Reduces occurrence of pollutant loads at multiple locations	3
			Reduces occurrence of pollutant loads at one location	2
			Preventative (indirect) nonpoint source pollution control	1
			Not Applicable	0
	Reestablished natural water drainage and treatment	Volume of runoff reduced and/or treated (AF/year)	High Volume (>400 AF/year)	3
			Moderate Volume (200-400 AF/year)	2
			Low Volume (<200 AF/year)	1
			Not Applicable	0
Water Supply 	Water supply reliability	Amount of local supply generated	Supply used regionally	3
			Supply used only on project site	2
			Recycled supply generated	1
			Not Applicable	0
	Water conservation	Reduction in annual water use	Creates another water supply source	3
			Reduces current water use	2
			Indirectly conserves water	1
			Not Applicable	0
	Conjunctive use	Volume Recharged	High Volume	3
			Moderate Volume	2
			Low Volume	1
			Not Applicable	0

Table C.1. Project Evaluation Metrics and Scoring (contd.)

Benefit Category	Criteria	Metric	Assessment Value	Scoring
Flood Management	Decreased flood risk by reducing runoff rate and/or volume	Volume of runoff reduced (AF/year)	High Reduction (>400 AF/year)	3
			Moderate Reduction (200-400 AF/year)	2
			Limited or No Reduction (<200 AF/year)	1
			Not Applicable	0
	Reduced sanitary sewer overflows	Sanitary Sewer Overflows Reduction	Reduces Overflow at Multiple Locations	3
			Reduces Overflow at One Location	2
			Preventative Action to Reduce Overflows	1
			Not Applicable	0
Environmental	Environmental and habitat protection and improvement	Acres of habitat/ecosystem improved (varies)	High Improvement (>15,000 feet or > 4,000 acres)	3
			Moderate Improvement (2000-15,000 feet or 900-4,000 acres)	2
			Low Improvement (<2000 feet or <900 acres)	1
			Not Applicable	0
	Increased urban green space	Creation and/or reduction of green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation)	Creates Green Space at Multiple Locations	3
			Creates Green Space at One Location	2
			Improves Existing Green Space	1
			Not Applicable or Reduces Green Space	0
	Reestablishment of the natural hydrograph	Amount of instream flow rate improved	Regional Benefit (county-wide)	3
			Local Benefit (city/town)	2
			Project Site Benefit (neighborhood)	1
			Not Applicable	0
	Improved Air quality*	Degree of potential benefit or damage to air quality	Regional Benefit (county-wide)	3
			Local Benefit (city/town)	2
			Project Site Benefit (neighborhood)	1
			Not Applicable	0

Table C.1. Project Evaluation Metrics and Scoring (contd.)

Benefit Category	Criteria	Metric	Assessment Value	Scoring
Environmental (contd.)	Ecological Improvement*	Degree of potential benefit or damage to ecosystems/flora/fauna (varies)	High Improvement (>15,000 feet or > 4,000 acres)	3
			Moderate Improvement (2000-15,000 feet or 900-4,000 acres)	2
			Low Improvement (<2000 feet or <900 acres)	1
			Not Applicable	0
	Energy footprint	Reduced energy use reducing greenhouse gas emissions, reduced urban heat island effects, and/or providing a carbon sink.	Regional Benefit	3
			Project Site-Specific or Local Benefit	2
			Indirect Reduction in Energy Footprint	1
			Not Applicable or Increases Energy Footprint	0
	Water temperature improvements	Reduction in water temperature	Direct reduction in water temperature	3
			-	2
			-	1
			Not applicable	0
Community	Public Education	Geographic scale of people benefiting from the enhanced and/or created recreational and public use areas	Regional benefit (county-wide)	3
			Local benefit (city/town)	2
			Limited (neighborhood)	1
			Not Applicable	0
	Community Involvement	Involvement of stakeholders in project development	High Community Involvement	3
			Moderate Community Involvement	2
			Low Community Involvement	1
			Not Applicable	0
	Environmental Justice*	Perceived benefits/impacts distributed throughout the community (versus to specific communities)	Benefits distributed throughout community(ies)	3
			-	2
			-	1
			Not Applicable	0

Table C.1. Project Evaluation Metrics and Scoring (contd.)

Benefit Category	Criteria	Metric	Assessment Value	Scoring
Community (contd.) 	Recreational Benefit Recreational Benefit	Enhancement and/or creation of recreational and public use areas (acres) Enhancement and/or creation of recreational and public use areas	High Improvement	3
			Moderate Improvement	2
			Low Improvement	1
			Not Applicable	0
	Employment opportunities provided	Increased Opportunities for Employment	Long-Term Employment	3
			Short-Term Employment	2
			No construction activities. Part-time employment or volunteer opportunities only.	1
			Not Applicable	0
Project Cost* 	Project Funding Mechanism*	Degree of project funding mechanism availability and complexity	Very easy: Funding mechanism already in place; can be funded from existing structures without increases	3
			Typical: Funding mechanism can be created using normal business processes	2
			Complex: New funding mechanisms required; relatively simple to create	1
			Not Applicable	0
	Eligibility for External Funding*	Likelihood that outside funding will be available for this project	Likely	3
			Possible	2
			Unlikely	1
			Not Applicable	0
Implementation Complexity* 	Constructability*	Degree of engineering complexity of project	Planning Documents/Studies Available	3
			Cost Information, No Engineering Details	2
			No Planning Documents, Best Engineering Judgment Applied	1
			Not Applicable	0
	Institutional Complexity*	Degree of new partnerships and agreements needed	No partnerships needed	3
			Partnerships Needed, Likely Similar to Existing Agreement	2
			Partnerships Needed, Likely New Agreement	1
			Not Applicable	0

Table C.1. Project Evaluation Metrics and Scoring (contd.)

Benefit Category	Criteria	Metric	Assessment Value	Scoring
Implementation Complexity* (contd.) 	Regulatory & Permitting Compliance*	Degree of regulatory compliance needed (permits, CEQA)	Categorical Exemption, or no permits	3
			IS/ND/MND, or some State and/or local permits	2
			EIR/EIS, or multiple Federal/State/local permits	1
			Not Applicable	0
	Public Acceptance*	Degree of acceptance by public	Public Acceptance and Wide Support	3
			Some Public Acceptance and Moderate Support	2
			Low Public Acceptance and Support	1
			Not Applicable	0
	Right of Way*	Need for, or difficulty of, acquiring necessary parcels/easements	Existing ROW/Not Applicable	3
			Willing Property Owner Identified	2
			Willing Property Owner Identified With Compensation	1
			No Willing Property Owner Identified	0

Note:
*Benefit categories and criteria added beyond the suggested State Water Board's Stormwater Resources Plan Guidelines Table 4
Units.
Key:
AF/year = acre-feet per year

C.2 PAIRED COMPARISON ANALYSIS

As discussed in Section 4.2.3 of the West Slope SWRP, to help identify which projects best meet the priorities and goals of the West Slope SWRP, weights were developed and assigned to each benefit category. Benefit category weights were developed using a paired comparison analysis which is a decision-making method used to identify the relative importance of each possible option by pairing it against all other options. This method informs which option is the most important based on participant's comparison results.

The paired comparison activity was performed during the Stormwater Resource Strategy Development Workshop (Workshop) (October 25, 2017) where elective officials, managers, and technical staff were asked to give feedback on the relative importance on each benefit category used in the SWRP (Attachment A lists the participants). The feedback obtained was used to create weights for the benefit categories used to evaluate and prioritize the projects.

During the Workshop, the participants completed a paired comparison activity to determine the relative importance of the following seven benefit categories used in the SWRP:

1. Water Supply
2. Water Quality
3. Flood Management
4. Environmental
5. Community
6. Project Cost
7. Implementation Complexity

Figure C.1 was provided to each participant. Under each blank cell the benefit category from the column and the row was compared and the benefit category of higher importance was selected. To quantify the degree of importance of the selected benefit category, a score of 1 to 3 was given. A value of 1 signifies that the selected benefit category was only slightly more important. A value of 3 signifies that the selected benefit category was significantly more important. After the comparison was complete, the count for each benefit category was determined by counting the total number of times the benefit category was selected over another. The weighted value was determined by summing the scores given to each selected benefit category.

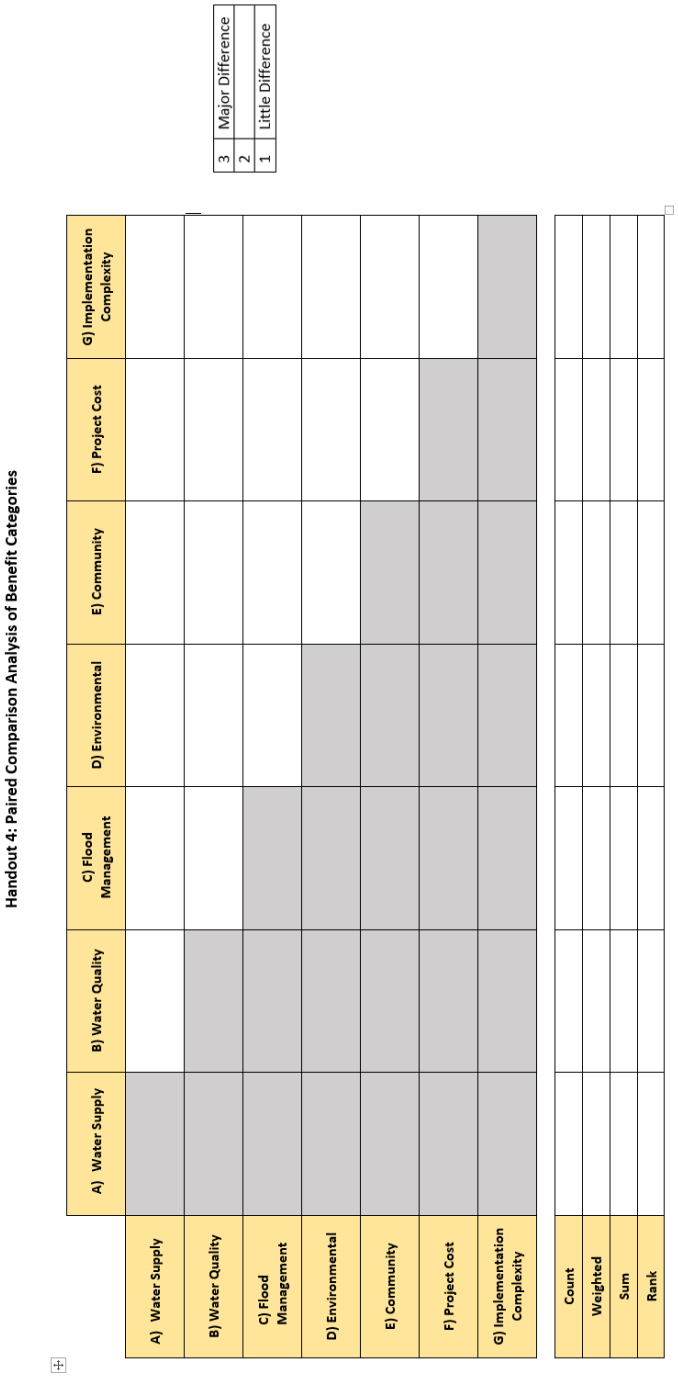

Figure C.1. Paired Comparison Handout for Benefit Categories

An example of a paired comparison exercise is presented in Table C.2. The paired comparison analysis demonstrated the individual overall prefers spending the summer days in nature, closely followed by being with family. The individual strongly prefers to neither write a book nor go on long walks.

Table C.2 Paired Comparison Example: How to Spend Summer Days

	A	B	C	D
A: Writing a book		B,3	C,1	D,1
B: With Family			C,2	B,1
C: In nature				C,2
D: Long walks				

Count	0	2	3	1
Weighted	0	4	5	1

Source: Continuous Improvement Toolkit. www.citoolkit.com

Activity Results

After each participant completed their paired comparison handout (Figure C.1), they marked their weighted value and rank results on a large print-out posted on the workshop wall. Results were then discussed amongst the participants. It was agreed that the overall trends and relative importance of each benefit category made sense and that these results could be used to inform the weights used in the West Slope SWRP.

The handouts were collected, and after the workshop, the handout data was compared against what was presented in the large printouts to verify the results. In comparing the results from the handouts and what was posted in the large printouts, there was some discrepancy in the count results (e.g., count of zero but was posted as rank one on the wall). Some participants noted that their handout results varied from what they posted on the wall because of a misunderstanding in comparing the first benefit category listed, water supply. Since the water supply category column was greyed out, some participants thought we were not assessing water supply. As a result, those participants performed quick adjustments as they gained better understanding about the process and after further workshop discussion. It was suggested that we used the results posted on the wall instead of the handout for that benefit category. Using this information, the workshop posted results, and handouts, the count and weighted values were verified as best as possible to most accurately represent each participant's comparison results.

These verified results are shown in Figure C.2. This figure shows that there is generally a linear relationship between count and weighted values. This is as expected since the higher the count (i.e., times the participant listed a benefit category as more important), the higher the weight would be since a 1 to 3 weight is given each time to the benefit category selected as more important. There were several outliers, and these mostly occurred due to human error, as described in the above paragraph.

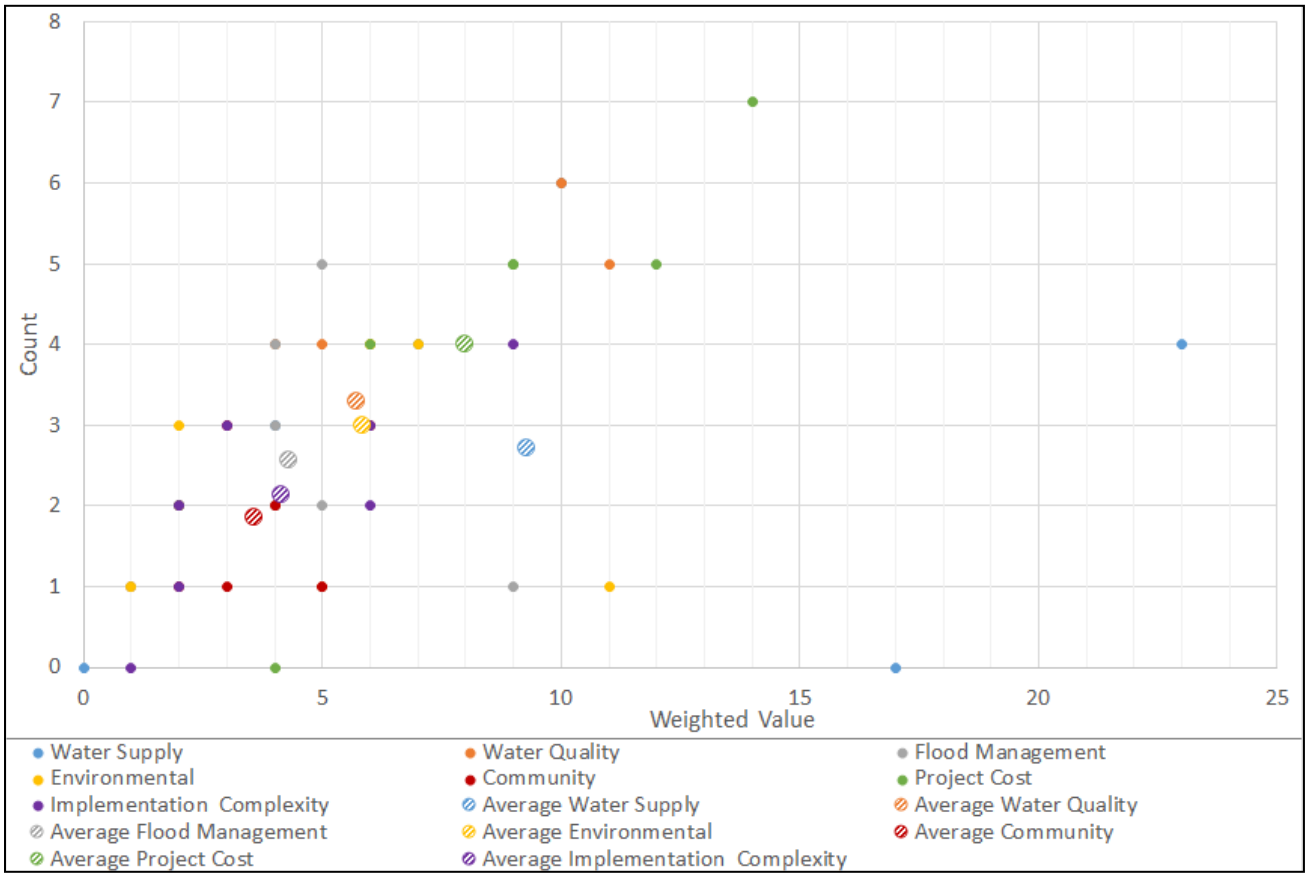

Figure C.2. All Data: Count vs. Weighted Value

Given the linear trend and the existence of only a few outliers, it was assumed that data obtained from the workshop is valid for developing weights for the benefit categories. Since both count and weighted value are correlated, and the weight results had less discrepancies due to having both the workshop posted results and handouts to verify results, the weight value results from the paired comparison exercise were chosen to develop the weights for the benefit categories. The weights developed from the paired comparison exercise reflect how the participants viewed the relative importance of the benefit categories.

Figure C.3 shows the spread of weighted values obtained from each participant from the paired comparison exercise. The blue points represent the weighted values obtained by each participant for each benefit category and the black point represents the average of the observed weighted values among all participants. The largest spread in results was for Water Supply, but as described this was due to human error in performing the assignment. It was agreed during the workshop that despite the spread, the average value accurately represents what the weighted value should be. Community had the smallest spread of values, representing an overall agreement on the weighted value of this benefit category. The other 5 benefit categories had roughly the same spread of results.

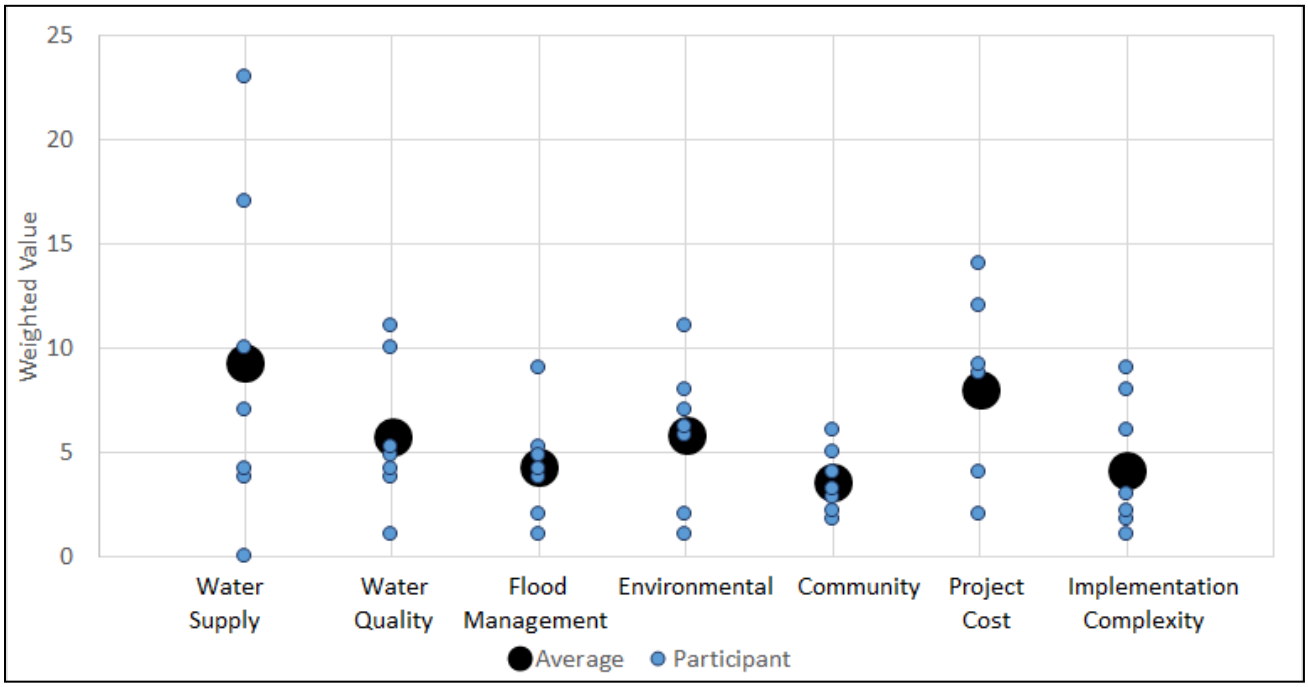

Figure C.3. Paired Comparison Exercise: Weighted Value Distribution Results

Benefit Category Weights

Figure C.4 shows an example of a box and whisker plot. Box and whisker plots show the distributional characteristic of a group of scores as well as the level of the scores. Each quartile group represents 25 percent of all scores. The median value marks the mid-point of the scores and is shown by the line that divides the box into two parts. The box represents the middle 50 percent of scores. The upper half of the box represents scores that are greater than or equal to the median while the lower half represents scores less than the median. The upper quartile is the top line of the box and shows 75 percent of the scores are below the upper quartile. The lower quartile is the bottom line of the box and shows that 25 percent of the scores fall below the lower quartile. The upper and lower whiskers represent scores outside the middle 50 percent. Figure C.5 shows the box and whisker plot of the weighted results from the paired comparison analysis.

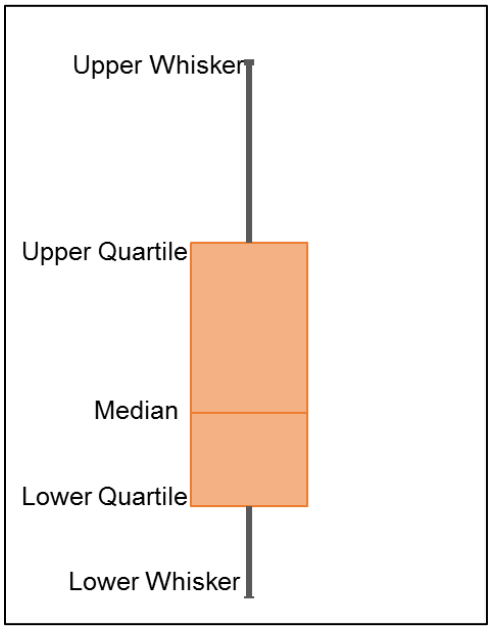

Figure C.4 Example of Box and Whisker Plot

Figure C.5 is a box and whisker plot using the data from Figure C.3 to better visualize the distribution of weighted values obtained by each participant during the paired comparison exercise. From Figure C.5, it can again be seen that the largest degree of distribution (0 to 23) was seen for the benefit category of Water Supply. The smallest degree of distribution was seen for Community, with the minimum weight of 2 also being the first quartile value. In comparing the average versus median values, the average values tended to be slightly higher than the median values in all benefit categories except for Project Cost. Despite this, the overall order is the same (e.g., Water Supply has both the highest average and median weighted value followed by Project Cost and then Environmental). The maximum value follows a similar trend to the average and median values, but more benefit categories have the same value (e.g., the highest weighted value assigned by a participant for both Water Quality and Environmental was an 11). The minimum value did not follow any of the other trends, but some of this was in part due to error in performing the exercise. Based off of these different results, it was determined that the average weighted value would best reflect the data presented and the participants' views on the benefit categories.

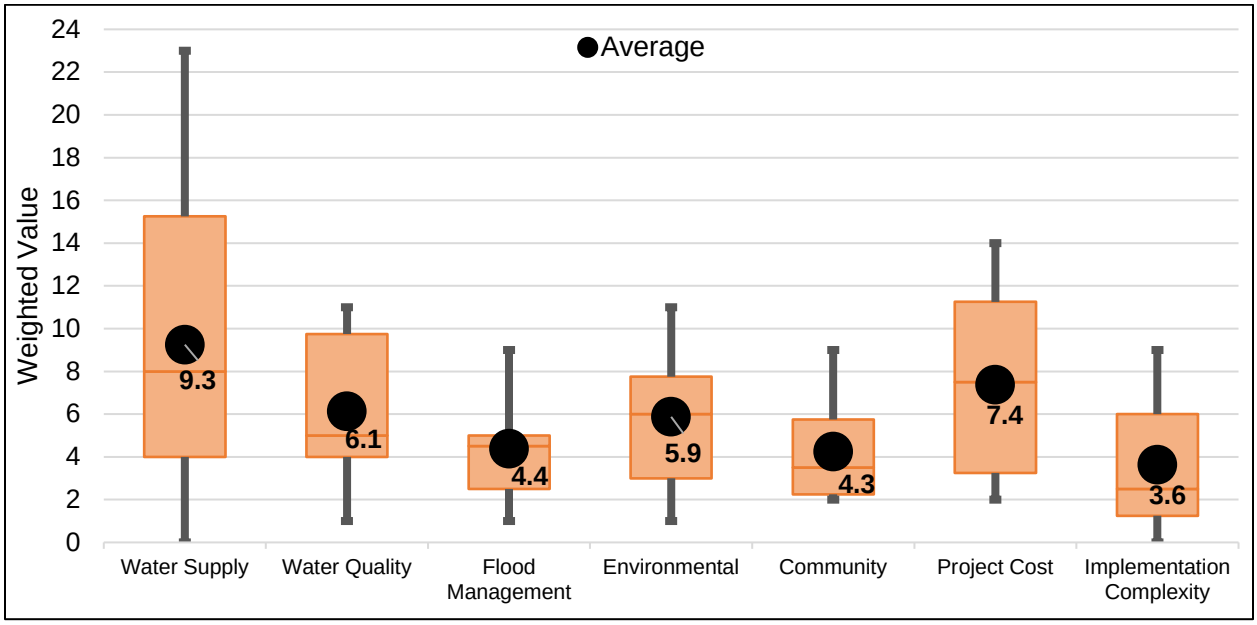

Figure C.5. Paired Comparison Analysis Results – Box and Whisker Plot

Interpreting this distribution is important when determining which weighted score to assign to each benefit category. It was agreed during the workshop that despite the distribution in some of the benefit categories, the average weighted value most accurately represented each benefit category, represented by the black dot in Figure C.5. Table C.3 shows the average weighted values for each benefit category.

Table C.3. Paired Comparison Exercise: Average Weighted Value

Water Supply	Water Quality	Flood Management	Environmental	Community	Project Cost	Implementation Complexity
9.3	6.1	4.4	5.9	4.3	7.4	3.6

The average weighted scores in Table C.3 were adjusted to have the sum of the weighted scores equal to 100. This was calculated by taking each benefit category's weighted score and dividing by the sum of the weighted scores and multiplying by 100. Adjusted weighted scores for each benefit category are shown in Table C.4 and Figure C.6. The participants viewed Water Supply as the benefit category with the most importance at 23 percent weight, followed by Project Cost at 18 percent weight. Water Quality was next highest at 15 percent followed by Environmental, Flood Management, Community, and lastly Implementation Complexity.

The benefit category weights are intended to be used for discussing the initial ranking and prioritization with the participants. Based on feedback from the participants, additional adjustments to the weights may be made before application to final project evaluations.

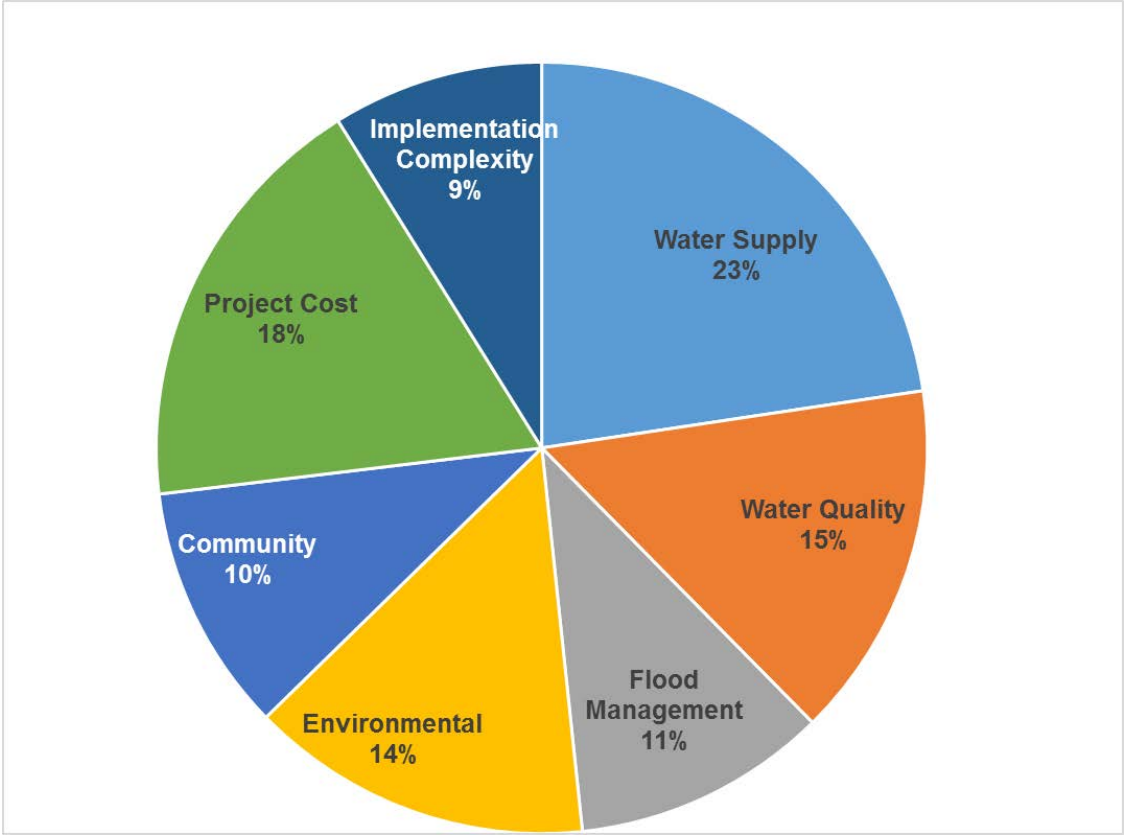

Figure C.6 Benefit Category Weights

Attachment A. Paired Comparison Activity Participants

Name	Organization
Brendan Ferry	EDC, Community Development Services
Brian Mullens	EDC, Department of Transportation
PJ Patton	EDCWA, Fiscal Assistant
Ken Payne	EDCWA, Interim General Manager
Amy Philips	EDC, Community Development Services
Michael Ranalli	EDC/EDCWA, Board member, District IV
Pierre Rivas	City of Placerville, Development Service Director
Brian Veerkamp	EDC/EDCWA, Board member, District III

Key:
EDC = County of El Dorado
EDCWA = El Dorado County Water Agency