ATTACHMENT 8. WATER QUALITY AND OTHER EXPECTED BENEFITS –

Projects analyzed: ***Carmel River Lagoon and Beach Studies***
Sanitary Sewer System Repair
Carmel River Watershed Volunteer Program

ATTACHMENT 8. WATER QUALITY AND OTHER EXPECTED BENEFITS – CARMEL RIVER WATERSHED VOLUNTEER PROGRAM

Table 16 includes documentation of the water quality and other expected benefits derived during the CRWVP. In addition to these calculations, there are three other statements CWC and its partners hope to articulate. The first is about expected improvements to water quality, habitat and flow, and the challenge of demonstrating those gains over a relatively short timeframe. Secondly, this project proposes the further refinement of an approach CWC is developing to document reductions in pollutant concentrations and pollutant loads being contributed to receiving waters. Third, it is a challenging exercise to place a monetary value on increases in public awareness and engagement. Additional explanation of these three points is included here as a narrative to accompany the calculations in Table 16.

The CRWVP includes numerous public education and outreach activities, as well as efforts to encourage behavior change and individual action through implementing BMPs on privately-owned property. The objectives include improvements in habitat, flow and water quality, all of which will be measured as part of the monitoring and data analysis activities. It is inappropriate, however, to anticipate discernable changes in habitat, flow conditions or water quality parameters during the course of this project life. This is due to the inherent variability in environmental data caused by year to year changes in weather patterns and seasonal variation in hydrologic conditions. Therefore, while improvements in the physical conditions of the Carmel River are anticipated, there is no expectation that these gains can be demonstrated through monitoring results, even over a three year period. Accordingly, CWC is describing these gains here rather than including them as a quantitative target which would be rolled into a grant agreement. To be clear, the project does include work toward improvements in flow conditions, reductions in sediment and nutrient loads, and improvements in steelhead habitat.

Second, CWC proposes an alternative approach to documenting progress towards physical conditions in the Carmel River. This approach represents a partial solution to the challenge just explained – the inherent variability in environmental data. Regulatory water quality objectives (WQO) focus on concentrations of key constituents in receiving waters (i.e., surface waters, including rivers such as the Carmel River). Monitoring programs, such as those included in this project, allow us to measure changes in the concentrations of key constituents, but as explained, these improvements are difficult to demonstrate over the short- and mid-term. The new approach CWC is developing includes quantifying the improvement of each individual best management practice (BMP). Once a value is established (from established research literature) for each specific BMP, calculating the benefit to the watershed is as simple as tallying the number of BMPs implemented in a watershed or basin, and multiplying those counts by the established benefit per BMP. This simple accounting allows for calculations of reductions in pollutant loads discharging into the receiving waters. Reductions in concentrations of key pollutants *and* reductions in polluted storm water runoff volume can then be calculated, per basin, per watershed, each year and on a cumulative basis.

CWC is currently developing this new approach of documenting public involvement and the implementation of BMPs in watersheds throughout the Central Coast. For the Carmel River, objectives and tasks are included in the Work Plan and Task List to further refine and implement the approach. A key benefit to DWR's investment in development of this method is that it is scalable to other watersheds within the Monterey Peninsula IRWM Region, to other regions within the Central Coast Funding Area, and throughout California. CWC anticipates working with CCRWQCB staff in refining the approach.

Third, the outcomes related to increased watershed awareness and improved water literacy of Carmel River watershed residents clearly represent benefits to the watershed, the IRWM Region, funding area and the state. However, it is challenging, at this time, to place an economic or other quantifiable value on these benefits. While these benefits are not documented here in numeric terms, CWC wishes to make the case that this project offers substantial benefit to the Carmel River, to other projects in the region, funding area, and indeed further the

RWMG's goals and DWR's goals of broad-based support for sustainable solutions to water supply, water quality and flood control challenges.

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project: Carmel River Watershed Volunteer Project

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.000	n/a
2010	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.943	n/a
2011	Volunteers hours donated	Hours	-	2,396	2,396	$25.00	$59,900	0.890	$53,311
	Equipment donated	Items	-	5	5	$200.00	$1,000	0.890	$890
	Supplies donated	Items	-	1	1	$100.00	$100	0.890	$89
	Contractual services donated	Contracts	-	4	4	$1,714.68	$6,859	0.890	$6,104
	Mileage donated by	Miles	-	1,000	1,000	$0.50	$500	0.890	$445
2012	Volunteers hours donated	Hours	-	2,396	2,396	$25.00	$59,900	0.840	$50,293
	Equipment donated	Items	-	5	5	$200.00	$1,000	0.840	$840
	Supplies donated	Items	-	1	1	$100.00	$100	0.840	$84
	Contractual services donated	Contracts	-	4	4	$1,714.68	$6,859	0.840	$5,759
	Mileage donated by	Miles	-	1,000	1,000	$0.50	$500	0.840	$420
2013	Volunteers hours donated	Hours	-	2,396	2,396	$25.00	$59,900	0.792	$47,446
	Equipment donated	Items	-	5	5	$200.00	$1,000	0.792	$792
	Supplies donated	Items	-	1	1	$100.00	$100	0.792	$79
	Contractual services donated	Contracts	-	4	4	$1,714.68	$6,859	0.792	$5,433
	Mileage donated by	Miles	-	1,000	1,000	$0.50	$500	0.792	$396
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries	$172,381

Comments: Volunteer hours are valued at $25/hour, a reasonable estimate for the value of their donated services. Equipment and supplies donated are valued as estimates based on anticipated items donated from local individuals and partner organizations. Contractual services donated are calculated using anticipated discounts provided by contractors (e.g. reduced laboratory analysis fees, discounted web hosting fees, discounted professional rates for performance assessment services).

Table 17- Annual Cost of Project

(All costs are in 2009 Dollars)

Project: __Carmel River Watershed Volunteer Program_____

	Initial Costs	Operations and Maintenance Costs (1)						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total cost From Table 7 (row (i), column (d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs (g) x (h)
2009	$0	$0	$0	$0	$0	$0	$0	1.000	$0
2010	$0	$0	$0	$0	$0	$0	$0	0.943	$0
2011	$230,196	$0	$0	$0	$0	$0	$230,196	0.890	$204,873
2012	$230,196	$0	$0	$0	$0	$0	$230,196	0.840	$193,277
2013	$230,196	$0	$0	$0	$0	$0	$230,196	0.792	$182,337
							Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		$580,487

Comments: Costs in column "a" are from Table 7. Because this implementation project is not a combination of initial capital costs and ongoing operations and maintenance costs, all implementation costs, which are operational costs, are included in column "a." The sum of costs in column "a" include administration, operation, and maintenance/monitoring costs.

ATTACHMENT 8. WATER QUALITY AND OTHER EXPECTED BENEFITS – CARMEL RIVER LAGOON AND BEACH STUDIES

Water Quality: At the end of the dry season, high waves often overtop the barrier beach, significantly increasing the salinity of the Lagoon water (the high saline water sinks to the bottom of the Lagoon) and can drive steelhead up toward the surface to find fresher water where predation can occur much more readily. The temperature of the water above the saline layer also increases during the dry season, and dissolved oxygen levels tend to decrease.

Without this project, the water quantity and quality in the Lagoon degrade during the dry season and particularly during drought or low-flow years. A deeper lagoon will increase water quality. The MPWMD has been monitoring and testing the water quality and depth in the Lagoon and can verify the degradation of the water quality and depth during the dry season (see Work Plan, Addendum F).

The beneficiaries of this project are the threatened species (steelhead and CA red-legged frogs) whose rearing habitat in the Lagoon could be significantly improved by increasing the water depth and volume of the Lagoon. The benefits would be achieved during each year following the installation of the EPB. There is some uncertainty as to how long the increased water volume will remain in the Lagoon due to the loss or outflow of Lagoon water through the barrier beach at low tide and when the height of the Lagoon is greater than the height of the ocean on the opposite side of the barrier beach.

Also, there is Ecosystem Restoration involved in this project—ecosystem improvements and preservation and fish enhancement as a direct consequence of increasing the depth and volume of the Lagoon as well as the water quality that is critical for the rearing habitat of threatened species. A Habitat Evaluation Procedure is planned as part of the later phases of this project.

<u>Prevention of "take" of steelhead from artificial breaching of barrier beach</u>: Deaths of dozens of juvenile steelhead flushed out into the ocean before they are ready to migrate have been observed by many members of the Carmel River Steelhead Association and nearby residents on numerous occasions. Although, no regulatory agencies have verified these mortalities, it has been shown that steelhead can be harmed from entering into saline water before the smoltification process is complete and the fish are ready to be at sea. For this analysis, it is estimated that artificial breaches could result in loss of habitat and harm to 100 juveniles as a result of each mechanical breach. This could occur from artificial breaches prior to the time an unmanaged breach would occur or from periodic natural cycling (opening and closing) after an artificial breach. The Carmel River Steelhead Association has estimated the lifetime value of each steelhead at $1,600. NMFS has valued steelhead at $25,000/fish. The total benefit, assuming that there are three artificial breaches per year resulting in harm to 100 steelhead in each breach, are: 300 x $1600 = $480,000 on the low side estimate and $7,500,000 on the high estimate.

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project: Carmel River Lagoon and Beach Studies

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	Prevention of take	Steelhead			0		$0	1.000	$0
2010					0				
2011					0				
2012					0				
2013					0				
2014	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.747	$358,560
2015	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.705	$338,400
2016	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.665	$319,227
2017	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.627	$301,158
2018	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.592	$284,111
2019	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.558	$268,029
2020	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.527	$252,858
2021	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.497	$238,545
2022	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.469	$225,043
2023	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.442	$212,304
2024	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.417	$200,287
2025	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.394	$188,950
2026	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.371	$178,255
2027	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.350	$168,165
2028	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.331	$158,646
2029	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.312	$149,666
2030	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.294	$141,195
2031	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.278	$133,202
2032	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.262	$125,663
2033	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.247	$118,550
2034	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.233	$111,839
2035	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.220	$105,509
2036	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.207	$99,537
2037	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.196	$93,902
2038	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.185	$88,587
2039	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.174	$83,573
2040	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.164	$78,842
2041	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.155	$74,380
2042	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.146	$70,169
2043	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.138	$66,198
2044	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.130	$62,451
2045	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.123	$58,916
2046	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.116	$55,581
2047	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.109	$52,435
2048	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.103	$49,467
2049	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.097	$46,667
2050	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.092	$44,025
2051	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.087	$41,533
2052	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.082	$39,182
2053	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.077	$36,964
2054	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.073	$34,872
2055	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.069	$32,898
2056	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.065	$31,036
2057	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.061	$29,279
2058	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.058	$27,622
2059	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.054	$26,058
2060	Prevention of take	Steelhead	0	300	300	$1,600	$480,000	0.051	$24,583
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries	$5,926,921

Comments:

Table 17- Annual Cost of Project (All costs should be in 2009 Dollars) Project: Carmel River Lagoon and Beach Studies									
	Initial Costs	Operations and Maintenance Costs (1)						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total cost From Table 7 (row (i), column (d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs (g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$70,000	$0	$0	$0	$0	$0	$70,000	0.890	$62,300
2012	$165,500	$0	$0	$0	$0	$0	$165,500	0.840	$139,020
2013	$65,000	$0	$0	$0	$0	$0	$65,000	0.792	$51,480
2014	$1,135,000	$0	$0	$0	$0	$0	$1,135,000	0.747	$847,845
2015	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.705	$63,450
2016	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.665	$59,855
2017	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.627	$56,467
2018	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.592	$53,271
2019	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.558	$50,256
2020	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.527	$47,411
2021	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.497	$44,727
2022	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.469	$42,196
2023	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.442	$39,807
2024	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.417	$37,554
2025	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.394	$35,428
2026	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.371	$33,423
2027	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.350	$31,531
2028	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.331	$29,746
2029	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.312	$28,062
2030	$0	$10,000	$40,000	$40,000	$75,000	$0	$165,000	0.294	$48,536
2031	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.278	$24,975
2032	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.262	$23,562
2033	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.247	$22,228
2034	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.233	$20,970
2035	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.220	$19,783
2036	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.207	$18,663
2037	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.196	$17,607
2038	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.185	$16,610
2039	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.174	$15,670
2040	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.164	$14,783
2041	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.155	$13,946
2042	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.146	$13,157
2043	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.138	$12,412
2044	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.130	$11,709
2045	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.123	$11,047
2046	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.116	$10,421
2047	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.109	$9,831
2048	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.103	$9,275
2049	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.097	$8,750
2050	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.092	$8,255
2051	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.087	$7,787
2052	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.082	$7,347
2053	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.077	$6,931
2054	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.073	$6,539
2055	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.069	$6,168
2056	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.065	$5,819
2057	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.061	$5,490
2058	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.058	$5,179
2059	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.054	$4,886
2060	$0	$10,000	$40,000	$40,000	$0	$0	$90,000	0.051	$4,609
Project Life	$1,435,500	$460,000	$1,840,000	$1,840,000	$75,000	$0	$5,650,500	...	
Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									$2,166,774

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project: City of Monterey & Pacific Grove – Sewerline Rehabilitation Grant Proposal

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	a				0		$0	1.000	$0
	b				0		$0	1.000	$0
	c				0		$0	1.000	$0
	..				0		$0	1.000	$0
2010	a				0		$0	0.943	$0
	b				0		$0	0.943	$0
	c				0		$0	0.943	$0
	..				0		$0	0.943	$0
2011	reduced maintenance cost	dollars	$9,000	$2,550	-$6,450	$1	-$6,450	0.890	-$5,741
	b				0		$0	0.890	$0
	c				0		$0	0.890	$0
	..				0		$0	0.890	$0
Project Life								…	
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries	-$5,741

Comments: This project will reduce our maintenance cost in this area for our sewer mains. We will not need to hydraulic jet the lines as often, provide root foaming, or respond to sewer overflows due to blockages.

Table 11- Annual Cost of Project

(All costs should be in 2009 Dollars)

Project: City of Monterey & Pacific Grove – Sewerline Rehabilitation Grant Proposal

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$1,000,000	$3,395		$2,550			$1,005,945	0.890	$895,291
2012							$0	0.840	$0
Project Life								…	
Total Present Value of Discounted Costs (Sum of Column (i)) Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									$895,291

Comments: City Admin cost is based on $0.41/Lf *(5,263 lf + 3016 lf) of sewer main. Maintenance cost is based on cleaning 5,000 LF/day(two man crew with jet truck $96.25/hr) and two cleaning in the year.