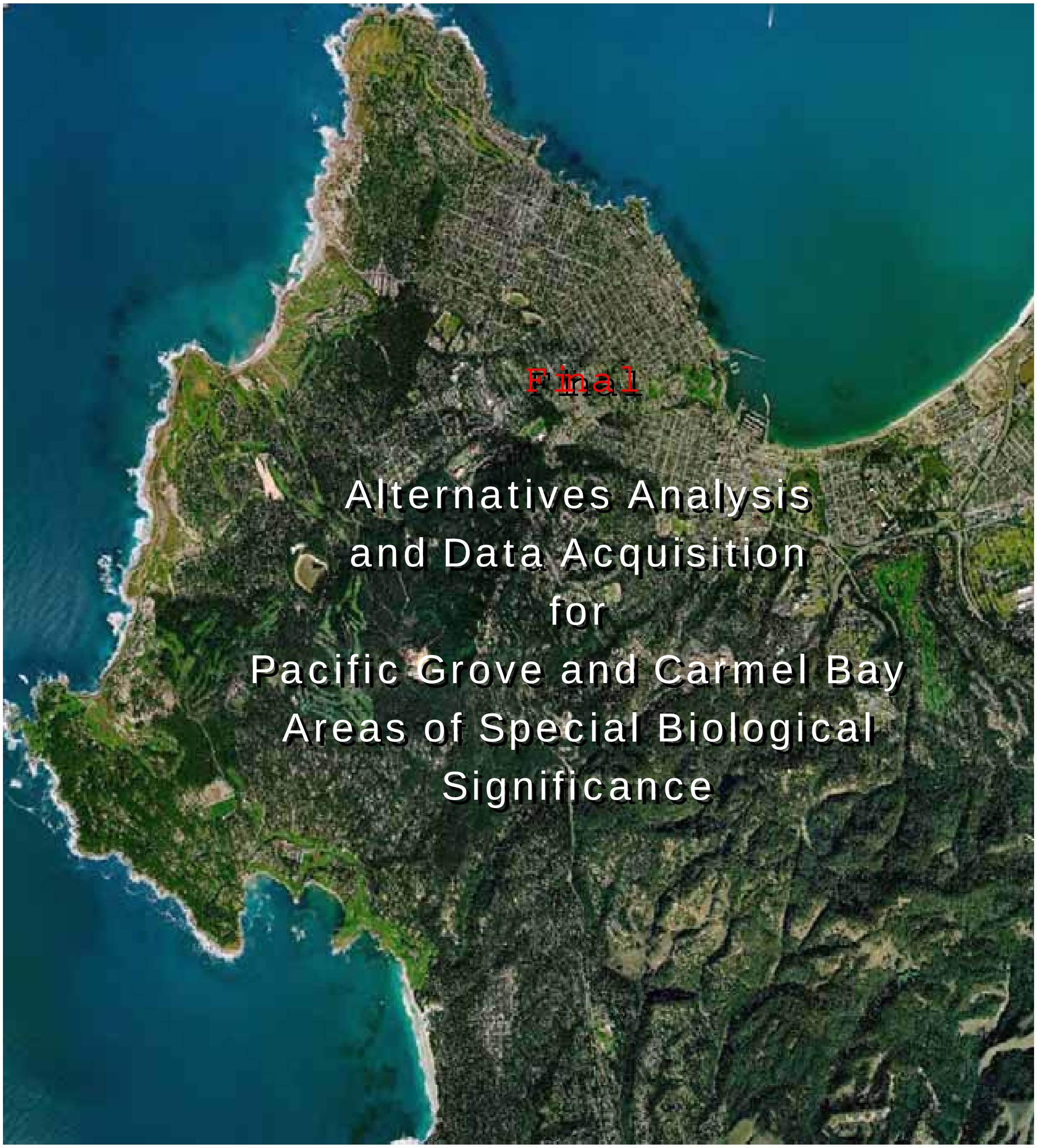

Final

Alternatives Analysis and Data Acquisition for Pacific Grove and Carmel Bay Areas of Special Biological Significance

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APPENDICES

EXECUTIVE SUMMARY

This report presents the results of alternatives analysis and data acquisition for storm water and non-storm water discharges to the Pacific Grove Area of Special Biological Significance (ASBS) and the Carmel Bay ASBS. MACTEC Engineering and Consulting, Inc. (MACTEC) performed the study to assess the feasibility of diverting, storing, treating, and/or reusing storm water from the Del Monte Forest, the New Monterey section of the City of Monterey, and the City of Pacific Grove, and preventing these storm water and non-storm water discharges from entering the Pacific Grove and Carmel Bay ASBS.

The technical approach for this study consists of the following three phases.

- Phase 1: Data Gathering
- Phase 2: Systems Analysis
- Phase 3: Alternatives Analysis

The purpose of the systems analysis was to develop planning-level estimates of dry and wet weather flow rates and volumes that may require diversion, storage, and/or treatment for each option evaluated. The systems analysis also assessed the capacity of existing wastewater treatment systems, identified targeted design constituents (TDCs) in dry and wet weather flows, water reuse opportunities, and assessed the types of treatment needed to treat these TDCs.

The results of the Carmel Bay ASBS systems analysis indicated peak flow rates between 3.35 cubic feet per second (Sub-watershed 4 for the 85^{th} percentile event) and 118.16 cubic feet per second (Sub-watershed 3 for the 25-year, 1-hour event). Water quality volumes varied between 2,249 cubic feet for the 85^{th} percentile event and 749,333 cubic feet for the 25-year, 24-hour event. Dry weather flows were measured as 76 gpm from all outfalls combined.

The results of the Pacific Grove ASBS systems analysis indicated peak flow rates between 3.7 cubic feet per second (Sub-watershed G for the 85^{th} percentile event) and 291 cubic feet per second (Sub-watershed C for the 25-year event). Water quality volumes varied between 1,370 cubic feet for the 85^{th} percentile event and 628,337 cubic feet for the 25-year, 24-hour event. Dry weather flows were measured as 119 gpm from all outfalls combined

Results of wet weather sampling conducted by the cities of Monterey and Pacific Grove on March 6, 2006 were used to identify possible TDCs and possible treatment requirements. Based on comparison of the results to the benchmarks, the TDCs varied depending on the discharge location (i.e., Pacific Ocean versus Carmel River) and included metals (i.e., aluminum, copper, iron, lead, and zinc), bacteria (total and fecal coliform), and organics (i.e., PAHs).

Each option providing treatment included at least one of the following:

- Trash screens
- Sedimentation basins
- Media filters
- Constructed treatment wetlands
- Wet Ponds
- Infiltration through soils
- Disinfection

The approach for alternatives analysis consisted of addressing the options individually and also integrating various options into possible optimal alternatives. MACTEC not only evaluated the benefits of a single option (i.e., re-routing infrastructure), but also evaluated integrated options, such as the combination of retention and infiltration methods with other BMPs as well as aquifer injection to decrease flow to the ASBS and mitigate seawater intrusion.

As part of the alternatives analyses, this report provided estimated engineering needs, overall costs, and the potential routing of:

- 5 diversion, detention, treatment, and/or reuse options related to wet- and dry-weather flows that originate at the Del Monte Forest and discharge to the Carmel Bay ASBS.
- 22 diversion, detention, treatment, and/or reuse options related to wet- and dry-weather flows that originate in the City of Pacific Grove and New Monterey and discharge to the Pacific Grove ASBS.
- Overall regional analysis of the cities of Monterey and Pacific Grove and the Del Monte Forest, evaluating the feasibility of treatment, water reuse for irrigation, and injection of wet- and dry-weather flows that currently discharge to the Pacific Grove ASBS and Carmel Bay ASBS into the local aquifer(s).

Each option targeting the diversion and/or treatment of wet weather flows was evaluated for four different rainfall recurrences to assess the benefits and costs of treating different volumes and flow rates. The rainfall recurrences were the 85th percentile, 2-year, 10-year, and 25-year events.

Life-Cycle Costs (LCC) were calculated for each option as a Net Present Value over a 20-year period. Water quality benefits were determined through concentration-based and pollutant load-based assessments of each option. The concentration-based assessment consisted of comparing estimated treatment BMP effluent limitations to applicable benchmark criteria. A Cost-Effectiveness Ratio (CER) was calculated for each option. The CER was the annual present worth cost of an option divided by its annual water quality benefits in terms of pounds of TSS removed.

Hourly rainfall records, between 1995 and 2006, from the Monterey weather station were modeled using HEC-STORM to estimate the amount of wet weather flows diverted and treated for each option and rainfall recurrence considered. Based on this modeling, the percent captures for each event are were as follows:

- 85th percentile event: 80 percent storm capture
- 2-year, 24-hour duration event: 88 percent storm capture
- 10-year, 24-hour duration event: 96 percent storm capture
- 25-year, 24-hour duration event: 100 percent storm capture

These percent captures did not account for the dry weather flows that would be captured for each option evaluated. Assuming that each option captures 100 percent of the dry weather flows as well as the above-listed percent of average annual runoff, the average annual flows captured by storage (equalization basins) and treatment BMPs were:

- 93 percent storm capture for the 85th percentile event
- 96 percent storm capture for the 2-year, 24-hour duration event
- 98 percent storm capture for the 10-year, 24-hour duration event
- 100 percent storm capture for the 25-year, 24-hour duration event

Options targeting the capture of the 85 percentile storm event had the smallest CERs, i.e., the greatest water quality benefits for the least cost. Primarily because the cost to construct equalization basins, pump stations, pipelines, and treatment facilities greatly increased for larger than the 85th percentile event due to the increase in size requirements to equalize, transport, and treat the greater flows and volumes. The corresponding reduction in pollutants was only marginally greater for the larger storm events. As an example, for the Del Monte Forest Option 1, infrastructure designed to capture runoff from the 2-year event costs 74 percent more than infrastructure designed to capture the 85th percentile event. However, the incremental load reduction is only 2.5 percent greater.

Recommendations were provided to divert dry and/or wet weather flows from the ASBS and treat, reuse, or inject the flows into local aquifers while maximizing the cost-effectiveness in terms of both 20-year life cycle costs and load reductions. Recommendations were provided for each ASBS individually as well as both ASBS combined (via the regional analysis). The most cost-effective option(s) (in terms of the CER) was selected for each and a proposed implementation plan was outlined.

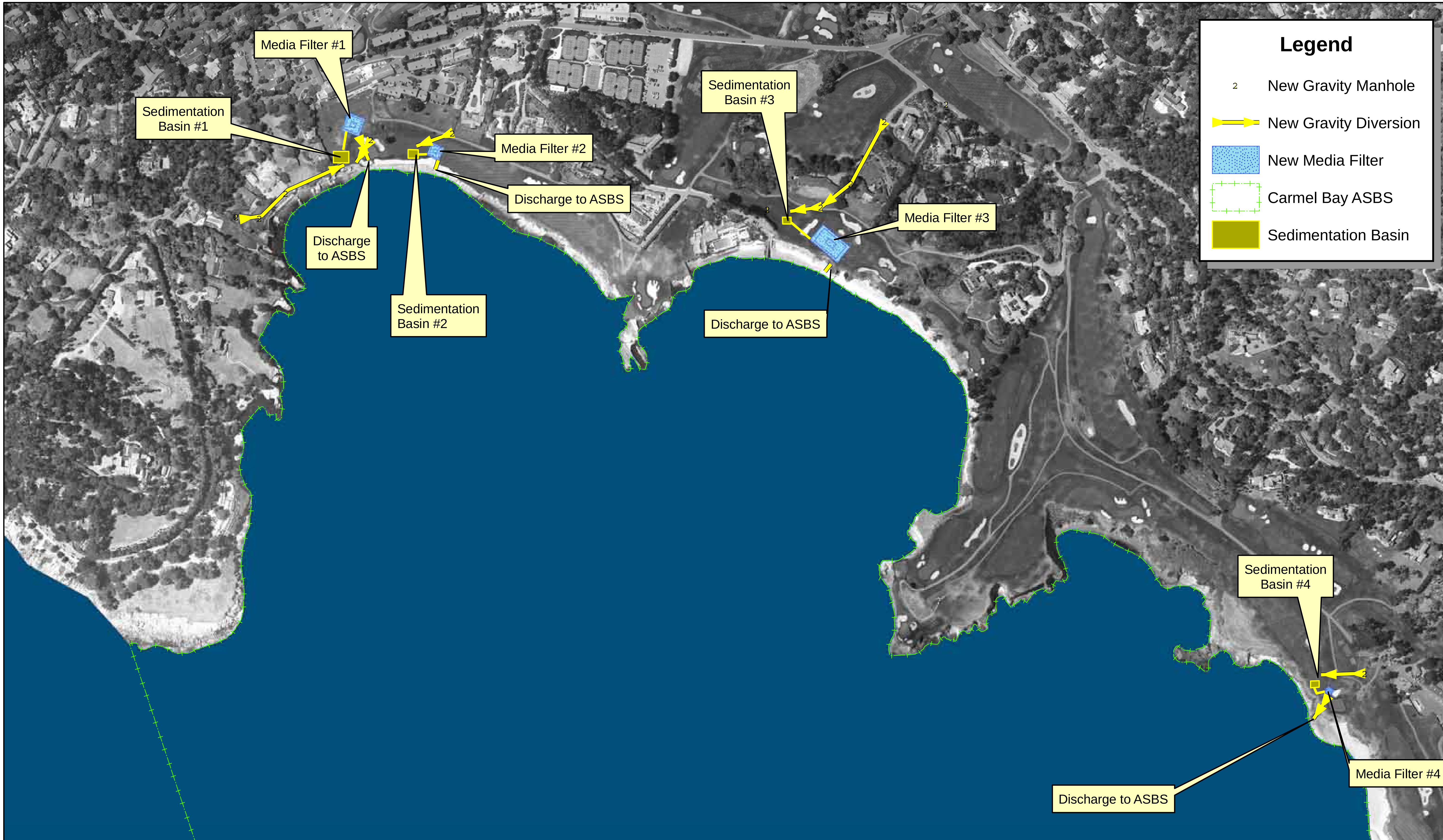
The most cost-effective option to divert dry weather flows from the Carmel Bay ASBS and treat wet weather flows to reduce concentrations of TDCs below benchmark criteria is a combination of Options 1 and 2 for the 85th percentile event (Figures ES-1 and ES-2). Option 1 addressed treating dry and wet weather flows on-site, while Option 2 addressed diverting dry weather flows from the Carmel Bay ASBS. If both options were combined, then dry weather flows could be treated by media filtration and then diverted outside of the ASBS, while wet weather flows would be treated and then discharged into the Carmel Bay ASBS. This would provide potential compliance with the proposed Special Conditions for Areas of Special Biological Significance (SWRCB, 2006) at the least cost. Additionally, the dry and wet weather discharges would both be treated to below Ocean Plan limits. The resulting capital cost would be approximately $4 million and the resulting 20-year life cycle costs would be approximately $4.7 million. The annual load reduction would be approximately 210,000 lbs of TSS per year.

Alternatively, if Option 1 were combined with a diversion of treated dry and/or wet weather flows to Forest Lake for mixing with the tertiary-treated wastewater, the resulting capital cost would be approximately $5.2 million. The benefits would be zero discharge to the ASBS and the beneficial reuse of treated dry and wet weather flows for irrigation.

The most cost-effective option to divert and treat dry and wet weather flows from the Pacific Grove ASBS to reduce concentrations of TDCs below benchmark criteria is Option 3. Option 3 has a CER for the 85th percentile event of 1.5 dollars per pound of TSS removed. Option 3 is the treatment of dry and wet weather flows on-site and the discharge of treated flows outside of the ASBS (albeit still within a Marine Protected Area).

The resulting capital cost would be approximately $7.5 million and the resulting 20-year life cycle costs would be approximately $7.7 million. These costs are less than if the City of Pacific Grove and New Monterey implemented separate options focusing only on their discharges. The annual load reduction would be approximately 250,000 lbs of TSS per year.

For the regional analysis, when combining both Del Monte Forest and Pacific Grove/New Monterey, the most cost-effective option is Collection Options 1 and 3 and Excess Discharge Option 3. Collection Option 1 is the diversion and treatment of dry and wet weather flows from Del Monte Forest for pumping to Forest Lake. Collection Option 3 is the diversion of dry and wet weather flows from Pacific Grove/New Monterey for pumping to the Cal-Am reservoir for treatment and then transmission to Forest Lake. Treated dry and wet weather flows from Del Monte Forest and Pacific Grove/New Monterey would mix with tertiary-treated wastewater for eventual irrigation of the golf course. The CER of this option is 1.9 and the resulting capital cost is approximately $16 million. The annual load reduction would be approximately 542,000 lbs of TSS per year.



PROJECT NO.: 5012-06-0009 DATE: 07/17/2006 DRAWN BY: SKR CHECKED BY:	MACTEC MACTEC Engineering and Consulting Inc.	**ASBS ALTERNATIVES ANALYSES** **Carmel Bay ASBS**	**CARMEL BAY ASBS OPTION 1**	FIGURE ES-1

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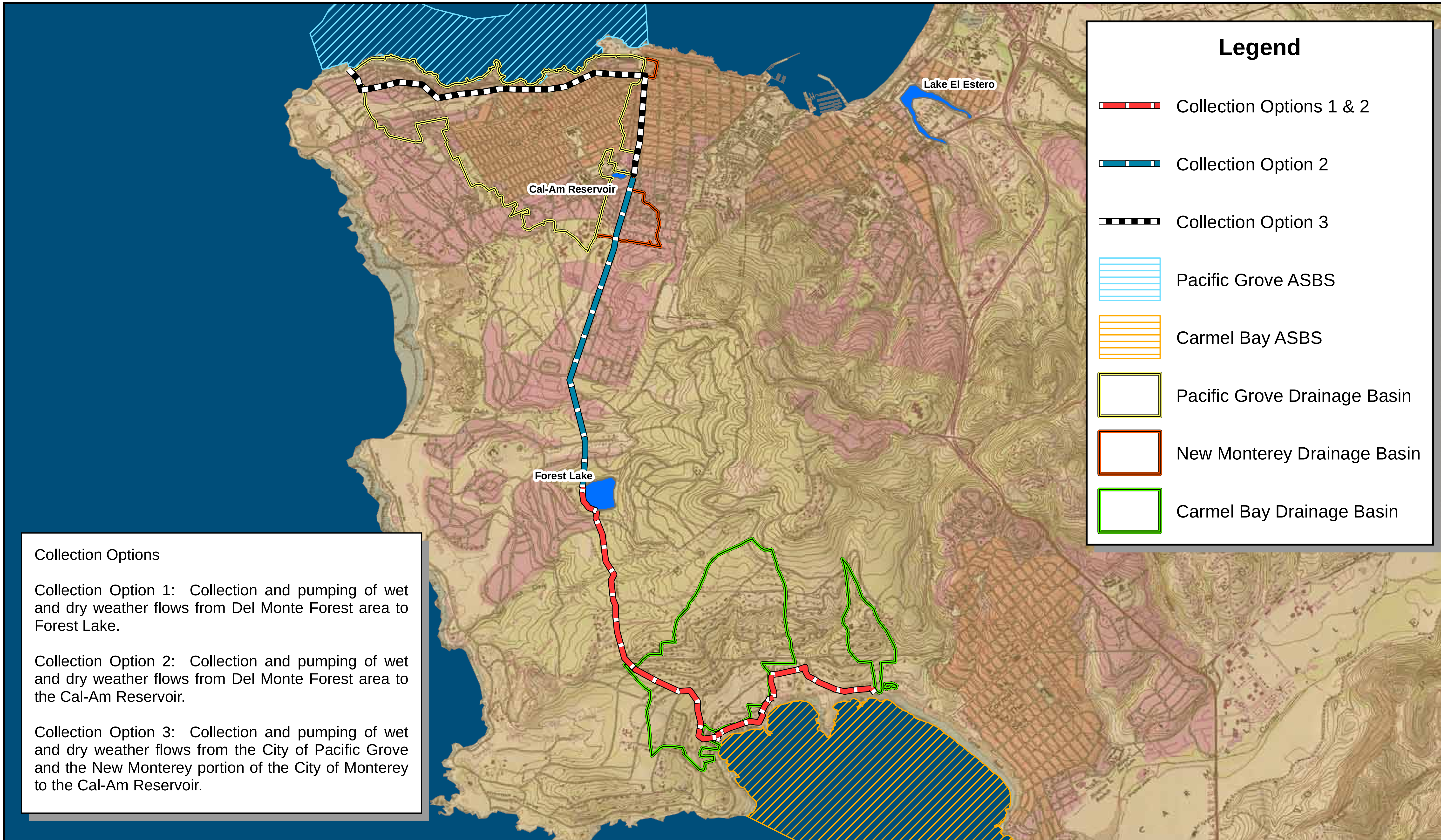
ASBS ALTERNATIVES ANALYSES
Pacific Grove ASBS

PACIFIC GROVE ASBS
OPTION 3

FIGURE
ES-3



Collection Options

Collection Option 1: Collection and pumping of wet and dry weather flows from Del Monte Forest area to Forest Lake.

Collection Option 2: Collection and pumping of wet and dry weather flows from Del Monte Forest area to the Cal-Am Reservoir.

Collection Option 3: Collection and pumping of wet and dry weather flows from the City of Pacific Grove and the New Monterey portion of the City of Monterey to the Cal-Am Reservoir.

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ASBS ALTERNATIVES ANALYSES

REGIONAL COLLECTION

FIGURE

ES-4