

Proposal for Carmel River Ten-Year Bioassessment Summary Report

Prepared for:

Monterey Peninsula Water Management District

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Introduction

This proposal outlines the tasks for consolidating and summarizing benthic macroinvertebrate (BMI) and associated habitat data collected for the Carmel River Bioassessment Program (CRBP) for ten successive years starting in the fall of 2000. It is anticipated that the final data set for inclusion into the report will be gathered in the fall season of 2009. The 10-year summary report will build on the previous three-year (fall 2000 to spring 2003) summary report. However, recent developments in multimetric approaches for characterizing BMI assemblages will produce a more consistent and representative biological signal, which will facilitate a more refined analysis and interpretation of bioassessment data.

Why would one wish to monitor BMI assemblages? They are an essential component of the food web in aquatic habitats where they cycle nutrients by feeding on algae and organic detritus and by preying on a wide range of small organisms. They are an important food resource for fishes, amphibians, reptiles, birds and mammals. Because of BMI abundance, taxonomic diversity and range of response to changes in their aquatic environment, they are commonly the resident biota used to monitor the quality of water resources throughout the United States (Davis et al. 1996). Justifications for their use as indicators of water and habitat quality have been described by Hutchinson (1993), Karr and Chu (1999), Resh and Jackson (1993), Rosenburg and Resh (1993) and others. Additional advantages of BMI-based biological assessment include long holding times for preserved samples and the establishment of BMI voucher collections. Voucher collections, which are archived BMIs, provide verification of work product and can be used as a resource for local watershed groups and professional taxonomists.

Background

The Monterey Peninsula Water Management District (District) has been conducting standardized stream bioassessment surveys on the Carmel River since the fall of 2000. Initially, four sites on the Carmel River between Mid-Carmel Valley (Red Rock, River Mile [RM] 7.5) and below Los Padres Dam (RM 24.0) were sampled twice each year beginning in the fall of 2000, using the methods outlined in the CSBP (Harrington 1999). In the spring of 2001, two new sites were sampled as part of a large wood habitat project (DeDampierre, RM 13.6, CRDDus and CRDDds). In the fall of 2002, another site was added at the Russell Wells (CRRW), RM 16.2, between the Stonepine Resort (CRSP), RM 15.6, and Sleepy hollow (CRSH), RM 17.6, to better analyze the effects of the future sediment release from San Clemente Reservoir. Starting in the fall of 2004 sampling was initiated at a site upstream of Los Padres Reservoir, within the Ventana Wilderness of the Los Padres National Forest.

The District conducted the benthic sampling and habitat assessments and BioAssessment Services (BAS) processed the benthic samples using the CSBP and prepared annual summary reports and a three-year summary report (2000 to 2003) was prepared in 2004. The annual reports included laboratory methods and tables of biological metric values and BMI taxonomic lists. The three-year summary report included spatial and temporal site comparisons using composite metric scores and exploratory analyses for identifying associations between selected habitat variables and composite metric scores.

The objectives of work outlined in this proposal are to consolidate the ten years of biological and habitat data and identify trends in BMI assemblages through time and space using both multimetric and multivariate approaches. In addition, associations between habitat variables and BMI assemblages will be examined.

Scope of Work

Task I – Literature Review

This task will include compiling existing information on BMIs and associated habitat data within the Carmel River drainage including the lagoon and nearby streams (e.g. San Lorenzo, Pajaro, Salinas and Big Sur Rivers). Information has already been compiled for the three-year bioassessment report so the focus of this task will be to update relevant information. In addition, an IBI has been published for streams within the coastal central and southern California region (Ode et al. 2005) and another IBI is in progress, which may be more regionally specific. These IBI will be evaluated for the purpose of characterizing the Carmel River monitoring sites. Pertinent background information including bioassessment data will be summarized and, if applicable, integrated into the analysis of Carmel River bioassessment data. The District will assist BAS by identifying sources of relevant background information.

Task II - Data Processing and Analysis

BMI data for the ten-year monitoring period will be reviewed for consistency. The CSBP was changed in 2003 to include an option for compositing the three samples collected at each

site and subsampling 500 organisms. This modification was adopted for the CRBP in 2004 so previous BMI data sets (2000 to 2003) will be standardized to correspond with the current method. Standardizing pre-2004 data sets is necessary for the application of indices of biotic integrity, which are based on metric scoring criteria derived from metrics calculated from 500 organism subsamples. "Resampling Stats for Excel" will be used to randomly resample (without replacement) pre-2004 taxonomic lists and metrics comprising the IBI will be recalculated using the standardized taxonomic lists. In addition, during the ten-year monitoring period the taxonomic standard changed from the California Aquatic Macroinvertebrate Laboratory Network (CAMLnet) to the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT). Consequently, some minor revisions to taxonomy will be made. Habitat and site location data gathered by the District will be input into an MS Access® data base from which queries can be made for organizing data for analysis and presentation in tables.

Tentatively, biological metrics and scoring criteria described in the southern coastal California streams IBI (SoCal B-IBI; Ode et al. 2005) will be used to characterize the Carmel River sites. The SoCal B-IBI was developed from BMI data gathered and analyzed from a region comprising coastal areas from Monterey County southward to the border of Mexico. Task one will include determining whether or not there is a more regionally specific IBI that could be applied to the CRBP data. An additional analysis will include nonmetric multidimensional scaling (NMS) following guidelines described by McCune and Grace (2002) and McCune and Mefford (1999). NMS is an ordination technique that orients sample units in relative space based on the similarity of BMI taxonomic composition determined for each sample unit. In addition, categorical and quantitative variables will be included in the ordination analysis to provide insight into the effects of physical habitat and water quality constituents on BMI composition. With these two analytical tools, IBI and NMS, spring and fall season data sets and trends along the elevation gradient will be explored. Data from other bioassessment programs may be integrated into the analyses when appropriate.

Task III - Report Preparation

A draft report will include five sections:

- 1) Introduction - Background on the CRBP, its value as an indicator of water quality and implementation of the program in 2000. Much of this background information was consolidated into the 2003 summary report by District staff but it is anticipated that this section will be updated to include changes in the monitoring program that occurred since 2003.
- 2) Methods – Description of study design, field sample collection methods, site locations, laboratory procedures, and analyses of data. Information pertinent to the study design will be provided by District staff. Exceptions to the CSBP sampling techniques will also be discussed by District staff if necessary.
- 3) Literature Review – Summaries of work done in the Carmel River watershed pertaining to BMIs. Background bioassessment information was consolidated into the three-year summary report by BAS but it is anticipated that this section will be updated to include any pertinent information available after 2003. Some of the information sources will be provided by District staff.
- 4) Results – Organization of taxa lists, metrics, and site-scale habitat data into tables and presented in appendices for the ten-year monitoring effort. Results of analyses including IBI and NMS ordination will be presented in the body of the report. Tables of site scale habitat and water quality data will also be included in the body of the report. Instantaneous water quality values measured during the sampling events will be tabulated but not emphasized. Photomicrographs of 12 numerically dominant BMI taxa sampled from the Carmel River drainage were included in the three-year summary report but may be amended if there were changes in dominant taxa. BAS will coordinate with District staff with regard to selection of BMI photomicrographs to be used in the report. Maps, site and transect scale habitat data, site coordinates and background program information will be provided by District staff.

Note regarding maps: the assignment of an ecological subregion to each of the monitoring sites will be an important categorical variable to be used for ordination (NMS) analysis. This task could be easily accomplished if the District has access to an ecological subregion GIS file to overlay the existing GIS site map that was used in the three-year monitoring report.

- 5) Discussion/Conclusions - Patterns, relationships and trends in biological and habitat data will be discussed including possible changes to the findings in the three-year summary report. A discussion of the relative quality of Carmel River BMIs in terms of metrics will be enhanced since the three-year summary report because of the recent development of a regional IBI. Important categorical and quantitative variables that influence BMI assemblages will be identified and discussed as well as possible seasonal differences in BMI composition and metrics.

It is anticipated that a draft report will be prepared and submitted to District staff by the end of December 2009 for review and comment providing that samples for the fall season 2009 are submitted to BAS by the end of October or early November. District staff will be informed if target date needs to be pushed forward. Recommendations/ comments by District staff will be integrated into a final report.

Cost Summary

Task I – Literature Review

10 hours @ \$20.00 per hour.....\$ 200.00
 8 hours @ \$50.00 per hour.....\$ 400.00

Task II - Data Processing and Analysis

8 hours @ \$20.00 per hour.....\$ 160.00
 48 hours @ \$50.00 per hour.....\$2,400.00

Task III – Report Preparation

8 hours @ \$20.00 per hour.....\$ 160.00
 40 hours @ \$50.00 per hour.....\$2,000.00

Total.....\$5,320.00

Literature Cited

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