

Subcontract Work or Change Order Form
Effective Date: 1 July 2020

WORK ORDER 3: FY 20/21 FLOW CONDITIONS SPECIAL STUDY

This Work or Change Order ("Order") shall, upon execution of the parties, be incorporated into the Project Specific Subcontract Services Agreement ("Agreement") between Geosyntec Consultants, Inc. ("Prime Contractor") and Southern California Coastal Water Research Project ("Subcontractor") and dated 27 February 2019.

Project #: PNW0343J Work Order Change Order

The form of currency for this Order is USD.

Authorized Representatives:

For Prime Contractor:
Name: Aaron Poresky
Address: 920 SW Sixth Avenue, Ste 600
Portland, OR 97204
Telephone #: 971.271.5891
Email Address: aporesky@geosyntec.com

For Subcontractor:
Name: Bryan Nece or Eric Stein
Address: 3535 Harbor Blvd., Suite 110
Costa Mesa, CA 92626
Telephone #: 714.755.3201; 714.755.3233
Email Address: bryann@sccwrp.org; erics@sccwrp.org

Scope of Work and Schedule:

Subcontractor will perform Task 6, 7, 8, 9, 10, 11, and 12 of the scope of work described in Prime Contract Task Order #10 (dated 8/6/2020, attached).

Rates and Price:


The total price for this Order is \$138,215.00 on a time and materials basis which will not be exceeded without Prime Contractor's advance written consent.

Subcontractor will invoice Prime Contractor at the rates set forth in Prime Contract Task Order #10 (attached).

The terms and conditions of the Project Specific Subcontract Services Agreement referenced above shall apply to this Order. Any modification to this Order must be approved in writing by authorized representatives of the parties.

Acceptance of the terms of this Order is acknowledged by the following signatures of the Authorized Representatives.

PRIME CONTRACTOR




Signature
Aaron Poresky, P.E.

Typed or Printed Name
Principal Engineer

Title
8/26/2020

Date of Signature

SUBCONTRACTOR



Signature
Steve Weisberg

Typed or Printed Name
Executive Director

Title
8/26/2020

Date of Signature

**REVISED SCOPE OF WORK
TASK ORDER NO. 09
FLOW ECOLOGY SPECIAL STUDY FY2020-2021**

**Agreement MA-080-18010919
On-Call Watershed Management Plan/Water Quality Improvement Plan Development and
Implementation
Geosyntec Consultants**

This revised scope of work is intended to result in completion of the Flow Ecology Special Study (FESS) by building on the accomplishments of the previous two fiscal years. In the coming months, Geosyntec and the Southern California Coastal Water Research Project (SCCWRP) anticipate completing and documenting the hydrologic model and the related scenario analyses, completing the three tiers of flow ecology analyses, prioritizing areas for future management actions, and expanding our initial work on these from the Aliso Creek watershed to the other watersheds of South OC. The work needed to complete this project has been divided into several tasks that are described below. Work on these tasks will be sequenced with the goal of completing the Special Study report by the end of calendar year 2020 in accordance with the timeline specified in the South OC WQIP. Some effort and documentation may be submitted in calendar year 2021.

Task 1 (Geosyntec): Client Meetings and Stakeholder Engagement

Activities

Geosyntec will continue participating in biweekly team calls through the end of 2020. We will also assist in preparation for two meetings of the Technical Advisory Group (TAG) or Stakeholder Advisory Group (SAG) of this project and attend each meeting virtually. Geosyntec will respond to comments on TAG or SAG presentations from June 2020 that pertain to hydrology, and Geosyntec will participate in ongoing conversations with stakeholder groups and resource agencies as appropriate. This task also includes time for project administration.

Assumptions

This task assumes that team conversations and project administration duties will continue at approximately the same rate as has occurred throughout the study thus far and that Geosyntec participation will not be requested at more than two advisory group meetings.

Deliverables

Deliverables for this task will consist of informal weekly updates on project progress and contributions to slide decks for TAG or SAG meetings.

Task 2 (Geosyntec): Refinement and Spatial Extension of Hydrologic Model Calibration

Activities

In response to comments received from TAG members on June 2020 workshop materials and based on the pending results of isotope analyses in Aliso Creek, Geosyntec will refine the dry-weather calibration of the LSPC model of the South Orange County watersheds. Geosyntec will also extend the existing calibration to Salt Creek, Laguna Canyon, Prima Deshecha, and Segunda Deshecha based on the calibration in Aliso Creek and available flow monitoring data. Specific sub-tasks will include:

- Interpretation of results from the isotope study that is presently underway.
- Adjusting irrigation and dry weather parameterization to improve the model estimation of dry weather flows further based on isotope study results.
- Further differentiation between hydrologic response units to capture variation between, e.g., different types of impervious land or different types of undeveloped land cover.
- Application of the Aliso Creek calibration to Laguna Canyon Creek, Salt Creek, Prima Deshecha, and Segunda Deshecha.

Assumptions

This task assumes that:

- Additional data like isotope study results and flow monitoring data will become available by the end of August 2020, in time to benefit this study
- Model boundary conditions like precipitation time series and geometries of stream reaches will not be adjusted further.
- The calibration during wet time periods will not be adjusted.
- No additional postprocessing metrics will be required.

Deliverables

The update to the calibration will be presented in a slide deck to the study team during a biweekly call. Model output from the updated model will be provided to SCCWRP and OCPW promptly upon the completion of calibration.

Task 3 (Geosyntec): Hydrologic Scenario Analyses

Activities

Geosyntec will continue the scenario analyses that were begun in FY2019-2020. Activities will focus on scenarios that evaluate climate change and water conservation.

Finishing climate change scenarios for Aliso Creek will involve adjusting evaporation in stream channels to account for different evapotranspiration in a future climate condition, running the model with precipitation and evaporation time series drawn from output from four different

downscaled global climate models, and examining results before sending model output to SCCWRP.

A sensitivity analysis focusing on potential future water conservation practices will involve adjustment of irrigation, point withdrawals, and stream losses in the model for two increments (low and high) of future water conservation progress. To develop water conservation parameters, Geosyntec will not attempt to define a specific estimate of water conservation; rather, Geosyntec will define reasonable points (low and high) on a sensitivity curve. Applicable data from recent drought years will be used as a line of evidence to develop parameter values. As part of executing this task, Geosyntec will outline the technical approach for applying water conservation within the model and obtain input from OCPW. Model results will be evaluated for reasonableness before model output is transmitted to SCCWRP.

As calibrations are updated and finalized for Aliso Creek and also for minor creeks in South Orange County, scenario analyses, including the reference condition scenario completed in FY2019-2020, will be rerun. Rerunning scenarios will be minimized by prioritizing calibration activities described above ahead of the water conservation scenario.

Assumptions

This task assumes that climate change sensitivity findings from Aliso Creek can be extrapolated to other watersheds without downloading additional output from global climate models for these watersheds.

Deliverables

When each scenario analysis is complete, a set of model results will be sent to SCCWRP for its use in flow ecology analyses. OCPW will receive a copy of these model results when they are provided to SCCWRP. Scenarios will be documented in a technical memorandum.

Task 4 (Geosyntec): Documentation and Delivery of Hydrologic Modeling Products

Activities

Geosyntec has divided the documentation and delivery of this work into two parts.

Task 4A: Models, Data, and Metadata

Geosyntec will focus its documentation activities on the creation of discrete product packages that can be shared publicly via the Flow Ecology Special Study website. Each will be accompanied by a brief “metadata” document that describes the creation of that product package and its intended utility for those who may download it. Anticipated product packages are shown in Table 1.

Table 1. Anticipated Product Packages

Product	Description	Present Status
Conceptual Model	Semi-quantitative assessment of dry weather water balance of key reaches in the study area	In draft form for higher priority reaches.
Precipitation Time Series	Continuous, 30-year time series of precipitation at 16 locations in South Orange County	Time series complete through Spring 2019. Documentation started.
Irrigation Estimate	Hourly patterns of urban outdoor water application in the Moulton-Niguel Water District derived from MNWD data	Analysis complete.
Subbasin Boundaries	GIS shapefiles	Complete. No further refinement anticipated.
Stream Reaches and Characteristics	Geometry of stream reaches used in the model	Assembly of stream reaches is complete. Documentation started.
Impoundment Inventory	Inventory of impoundments and flow diversions assembled for the model	Inventory complete. Documentation started.
LSPC Model Files	Final model files representing the base condition and the scenario analyses	Model refinements and scenario analyses to be performed as part of this scope.
LSPC Results Timeseries	Results timeseries for each LSPC model file	To be completed as part of this scope.

Task 4B: Support for Study Final Report

Geosyntec will review a draft of the final report for the Flow Ecology Special Study as requested by SCCWRP. Geosyntec will provide limited contributions to these documents where requested.

Assumptions

Task 4A assumes that OCPW staff will assist by posting product packages on the Flow Ecology Special Study website.

Documentation of the calibration and scenario results will be provided in the slide decks produced as part of Task 1. We will not prepare separate reports on these topics.

Deliverables

Ten product packages are the deliverables for this task.

Task 5 (Geosyntec): San Juan Basin Hydrologic Analysis

Activities

Geosyntec will extend the hydrologic modeling scope to include the reaches of interest in Trabuco Canyon, Tijeras Creek, upper Gobernadora and Wagon Wheel Creeks, Dove Canyon, Bell Canyon, and Horno Creek. This work will leverage substantial existing progress made to date: the precipitation time series, land use descriptions, stream reach characteristics, impoundment inventory, and calibration database are complete for these watersheds and should require only minor review as part of calibration activities. Major activities will include (1) consideration of outdoor irrigation application rates (if this information can be provided by SMWD), (2) representation of Dove Canyon diversion and Dove Canyon Reservoir, and (3) parameterization of infiltration and soil storage to improve model calibration.

Assumptions

This assumes that SMWD/Wildermuth Environmental (WEI) will not provide data or modeling support for the Flow Ecology Special study effort. If results are provided SMWD/WEI in time to be used in this study, this scope will be adapted to involve review and assimilation of these results. If results are provided later, then results will be held and considered as part of future refinements.

Deliverables

This task will produce time series of model output at geographic locations of interest to SCCWRP in the important tributaries to San Juan Creek. These will be described in a slide deck presented to the study team and added to the documentation described above. These deliverables will resemble those presented for the Aliso Creek calibration.

Task 6 (SCCWRP): Stakeholder Coordination

Activities

SCCWRP will facilitate meetings with the SAG and perhaps also the TAG to solicit the input and participation of these groups, define desired outcomes, and discuss preliminary findings. As needed, individual stakeholder meetings with key stakeholders and/or technical experts may be coordinated to further discuss species selection or additional details on the technical approach.

Deliverables

Stakeholder meeting summaries and meeting presentations.

Task 7 (SCCWRP): Assess Degree of Hydrologic Alteration

Task 7A: Assess hydrologic baseline conditions

Activities

Reference or baseline flow conditions can be estimated from historical hydrologic observations prior to urban development, or by modeling hydrologic response of undeveloped watershed conditions using hydrologic models. Baseline hydrology will be assessed for the remaining sub-watersheds in the study region, including Laguna Canyon, Salt Creek, and Segunda Deshecha, produced by Geosyntec and tributaries in the San Juan Creek watershed to define baseline conditions. Key functional flow metrics will be evaluated to understand the key components of the annual hydrograph that support a broad suite of ecological functions and support a characteristic set of aquatic and riparian plants and animals.

Deliverable

Summary of baseline hydrology based on hydrologic models

Task 7B: Evaluate hydrologic alteration of current flow conditions

Activities

The hydrologic watershed model developed by Geosyntec to support various elements of the WQIP and the County's stormwater management program and potentially the groundwater-surface water model developed for San Juan Creek watershed by WEI will be used to estimate current flow conditions for several ungauged assessment reaches in the SOCWMA. Hydrologic alteration will be estimated based on current and baseline flow conditions for the remaining sub-watersheds in the study region, including Laguna Canyon, Salt Creek, Segunda Deshecha, and tributaries in the San Juan Creek watershed. Hydrologic alteration will be synthesized across seasons and various aspects of the annual hydrograph.

Deliverables

Maps (figures), GIS layers, and tabular summary of degree of hydrologic alteration by stream reach

Task 8 (SCCWRP): Flow Ecology Assessments

This task will involve developing or refining flow-ecology relationships for benthic invertebrates, algae, and higher trophic level species.

Task 8A: Flow ecology for benthic invertebrates and algae

Activities

Southern California regional flow-ecology relationships based on changes in flow to changes in stream health (California Stream Condition Index, CSCI and Algal Stream Condition Index,

ASCI) are being updated based on the functional flow metrics and will be applied to the study watersheds. Regional relationships allow us to couple hydrologic alteration to biological alteration and assess all reaches, not just those where bioassessment data have been collected. Predictive statistical models (e.g., CART, Random Forest) will be used to identify functional flow metrics that have the highest likelihood in explaining differences in site condition (ASCI and CSCI). Maps will be produced to identify locations where flow alteration most likely will have an impact on bugs and algae.

Deliverables

Regional flow-ecology relationships for bugs and algae and maps of biologically important alteration based on bugs and algae, including associated GIS layers, figures, and tabular summaries

Task 8B: Flow ecology for riparian habitat

Activities

Changes in flow characteristics can greatly impact riparian habitat and biological condition of a stream system. SCCWRP will apply riparian habitat flow ecology relationships that are currently being developed for the Los Angeles region (RB4) focusing on changes to non-storm discharges that could affect the ability to support riparian plant communities with a goal being to provide opportunities to support these habitats.

Deliverable

Map of flow management recommendations for riparian habitat, including associated GIS layers, figures, and tabular summaries

Task 8C: Flow ecology for focal aquatic species

Activities

Changes in flow characteristics can greatly impact sensitive aquatic species. SCCWRP will develop flow ecology relationships for two focal species of management concern. Life history needs of the focal species will be evaluated based on available literature and expert opinion and flow management recommendations will be developed.

Deliverables

Flow ecology relationships for selected focal species, including any associated GIS layers, figures, and/or tabular summaries

Task 9 (SCCWRP): Flow Ecology Synthesis

Task 9A Prioritize areas for future management actions

Activities

Addressing the unnatural water balance requires identification of stream reaches that have the greatest potential for biological improvement due to flow management. SCCWRP will develop a prioritization scheme that incorporates both impacts (i.e., biologically relevant alteration based on bugs and algae and alteration based on higher trophic species needs) and opportunities (i.e., degree of hydrologic alteration, channel structure, hydrologic control, and spatial extent of alteration) to prioritize areas for future management actions and restoration. The specific prioritization approach will be developed in coordination with the project TAG and SAG.

Deliverables

Map of priority areas for future flow management and restoration efforts

Task 9B Recommend flow targets

Activities

Various flow management recommendations can emerge from Task 8, depending on spatial location, species of management concern, and management objectives. Flow recommendations are vital for facilitating discussion between MS4 permittees and regulatory and resource agencies on quantifiable management objectives against which progress can be evaluated. This task will involve meeting with local and regional experts (TAG) to discuss prioritization of ecological endpoints, which will shed light for ranking and optimization of recommended flow targets. Qualitative guidance for flows necessary to support ecological endpoints in prioritized reaches will be developed.

Deliverables

Recommended flow targets by reach or sub-basin.

Task 10 (SCCWRP): Revise Flow Recommendations Based on Future Scenarios

Activities

Future changes in climate and water conservation may impact both the hydrology and ecology of the region. The goal of this task is to evaluate the relative impacts of future scenarios simulated with the LSPC model on hydrology (i.e., functional flow metrics) and ecology (i.e., focal species). Climate change and water conservation effects will be evaluated throughout the study area to determine whether recommended flow targets or priorities should be adjusted based on anticipated future conditions (independent of any flow management actions by the MS4 co-permittees).

Deliverable

Summary of potential effects of changes in climate and water conservation on recommended targets and priorities

Task 11 (SCCWRP): Metadata Reporting and Data Management

Activities

Many datasets, models, and tools will be developed through this study. SCCWRP will prepare a short technical memorandum highlighting the summary of findings and metadata to document and catalogue all of the tools and compiled datasets in a clear and consistent manner. A database may be developed that includes associated details on the tools and products.

Deliverable

Summary of findings technical memorandum, metadata report, and GIS layers and all compiled data

Task 12 (SCCWRP): Project management and coordination

Activities

SCCWRP will prepare quarterly status updates and participate in project meetings with county staff, consultants, and regional water board staff as necessary to ensure coordination among all relevant efforts

Deliverables

Quarterly status updates

BUDGET

Work will be performed on a time and materials basis up according to the terms and rate schedules agreed upon in Agreement MA-080-18010919. A summary budget for this scope of work appears in Table 2, and a detailed project budget appears in Tables 3A and 3B.