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DRAFT TECHNICAL MEMORANDUM

To: Mid-County Groundwater Agency Executive Staff

From: Cameron Tana

Date: November 4, 2016

Subject: Concepts for Model Simulations (Task 5)

1. INTRODUCTION

This technical memorandum documents concepts for simulations of future groundwater management alternatives using the GSFLOW model of the Santa Cruz Mid-County Groundwater Basin (Basin) currently under development. The goal of the simulations is to evaluate strategies to recover the Basin to achieve sustainability by 2040 and maintain sustainability beyond that.

2. GROUNDWATER MANAGEMENT STRATEGIES AND PLANS

The simulations will evaluate three basic groundwater management strategies that have been proposed in the basin: in-lieu recharge, injection of highly purified water, and aquifer storage and recovery (ASR) of treated surface water.

These strategies can be achieved with various supplemental supplies, some of which are already being evaluated by member agencies of the Santa Cruz Mid-County Groundwater Agency..

1. In-lieu recharge is essentially a reduction in pumping. This can be achieved by conservation, transfer of surface water supply, desalination, and direct potable reuse.
2. Injection of highly purified water involves dedicated injection wells that support pumping at other wells. This is the strategy behind the Pure Water Soquel project that is currently undergoing environmental review by Soquel Creek Water District (SqCWD). The City of Santa Cruz (City) also is undergoing a Recycled Water Facilities Planning Study (RWFPS) that includes evaluation of this strategy.

3. Aquifer storage and recovery is being evaluated by the City of Santa Cruz that would store excess surface water treated to drinking water standards and extraction from the same wells as water supply during drought years.

Although the simulations of these strategies for the MGA will be based on projects being planned or evaluated by SqCWD and City, they will not be exactly the same in order to focus the simulations on evaluating individual strategies to sustainability for the whole basin. SqCWD and the City's specific projects have additional goals besides basin sustainability but the MGA simulations can help guide those evaluations. Additional runs are already planned for those projects separate from the MGA scope.

In addition, these initial MGA simulations will evaluate the three strategies individually, even though the strategies could be implemented in combination. Based on results of these simulations, the MGA can scope additional runs to evaluate different variations or combinations of strategies.

3. SIMULATION ASSUMPTIONS

3.1. Pumping and Injection

The assumed pumping and injection for the simulations are based on demand history and projections as well as plans that have been developed by SqCWD and the City with modifications to focus on sustainability for the whole basin.

The no-project simulation that will be used for Pure Water Soquel EIR will also be used for basis of comparison for the three management scenarios. Pumping will be based on demand from before the most recent drought, demand projections, or specified pumping plans.

The in-lieu recharge simulation will be based on pumping amounts or estimates achieved by conservation during the most recent drought and a potential transfer of City winter surface water supply to SqCWD based on current infrastructure limits.

The injection of highly purified water simulation is based on an expansion of the Pure Water Soquel project that uses full injection capacity of all potential injection well sites that SqCWD has identified because the Pure Water Soquel project is not planned to inject enough water to achieve basinwide recovery and sustainability. Although total pumping will be the same as no-project simulation, the simulation will include redistribution of pumping to pump more in aquifers receiving injection in order to reduce pumping in aquifers not receiving injection.

The ASR simulation is based on Building Block 2 of the City's Water Supply Advisory Committee Building Block memo (WSAC, 2015) with injection based on available surface water supply, and recovery for City supply based on its demand shortfall. In order to ensure there is always net progress for basin recovery and sustainability, the City's cumulative recovery will be limited to a percentage of what is cumulatively injected. Although pumping beyond ASR recovery will be the same as no-project simulation, the simulation will include redistribution of pumping to pump more in aquifers receiving injection in order to reduce pumping in aquifers not receiving injection.

The total amounts of supplemental supply are different for each of these simulations as they are based on preliminary documentation of what is reasonably feasible. The simulations are not based on previous estimates for basinwide pumping goals for recovery and long-term sustainability based on water balance evaluations (HydroMetrics WRI, 2015). The different strategies may be able to achieve recovery and sustainability at different yield values so it is our recommendation to evaluate strategies based on what is currently considered feasible rather than targeting a generalized basinwide estimate.

3.2. Climate Data Sets

Each simulation will initially be run on two climate data sets:

1. The historical climate of Water Years 1985-2015 that is the calibration period. It is important to simulate for calibrated climate conditions when comparing simulation results.
2. An initial climate change scenario based on a catalog of historical climate as documented in a separate memo. This simulation will also include adjustment of offshore boundary condition for sea level rise.

4. Model Results Evaluation

The primary evaluation of model results will be of simulated groundwater levels, specifically in comparison with protective elevations that are estimated to protect the Basin's production aquifers from seawater intrusion. Pending development of measurable objectives for the MGA's Groundwater Sustainability Plan, achieving protective elevations at all coastal monitoring wells will define basin recovery and maintaining groundwater levels at those elevations will define long-term sustainability.

Even though there are plans to implement the Seawater Interface (SWI2) package in the GSFLOW model, it still makes sense to compare groundwater level results to protective elevations that represent the range of possible offshore aquifer properties that cannot be calibrated due to the lack of groundwater level data in offshore aquifers. However, simulated seawater interface results may lead to the need to re-evaluate protective elevations.

The other main model output that will be evaluated will be water budget components, most notably effects on streamflows.

5. REFERENCES

HydroMetrics WRI, 2015, Estimated Effects on Sustainable Yield and Pumping Goals of Climate Change and Updated Basin Consumptive Use Using Water Balance Approach, technical memorandum to Ron Duncan, Soquel Creek Water District, October 27.

WSAC Technical Team, 2015, Updated Information on Portfolio Building Blocks, prepared for City of Santa Cruz Water Supply Advisory Committee, July 1