TODD GROUNDWATER

September 14, 2014

MEMORANDUM

To: Rob Saperstein, Esq., Brownstein Hyatt Farber Schreck

From: Gus Yates, PG, CHG

Re: Final Peer Review of Basin Plan for the Los Osos Groundwater Basin

I have completed a review of the draft Basin Plan for the Los Osos Groundwater Basin (Plan), dated August 1, 2013. The review focused on the accuracy of technical information, the reasonableness of assumptions and conclusions, and the overall adequacy of measures recommended in the Plan to address the long-term problems of nitrate contamination and seawater intrusion. The review focused on information presented in the Plan itself, with limited reference to related or older reports. Also, the review did not investigate strengths and weaknesses of the groundwater flow model in detail. I am generally familiar with the model, having personally developed two of its precursors and previously studied modeling reports prepared by Cleath Harris Geologists.

The draft version of this review raised numerous questions related to potential weaknesses or inadequacies of the Plan. At a subsequent meeting with Spencer Harris of Cleath Harris Geologists (CHG), substantial amounts of additional information were provided that largely allayed the initial concerns. To assist others who might have similar questions about the Plan, the initial concern for some topics is retained under the subheading "Initial Review Concern". That is followed by a section titled "Resolution of Concern" that describes how the concern was addressed by additional data and explanation provided by CHG.

The Plan is an important document and represents a milestone in the path toward sustainable water resources management in the Los Osos basin. It covers a broad array of topics and management options in great detail, and the large level of effort that went into preparing the Plan is apparent.

The seawater intrusion problem is urgent, and time is of the essence. A decade has already elapsed since intrusion was first reported, and 5 years since the basin adjudication process reached an interlocutory stipulated judgment (ISJ). The overriding concern with the draft Plan is whether it is sufficient in terms of effectiveness of measures, commitment to implementation, and speed of implementation. The Plan needs to be adopted as soon as possible and the recommended programs mandated by court order pursuant to the adjudication or by County ordinance.

All basin users should be required to participate in implementing the Plan, because all users contribute to the underlying overdraft problem. Participation will need to include implementation of conservation measures and contribution of funds.

Give the urgency of the problem, the intent of this review is not to discredit or delay the Plan, but rather to amplify and accelerate it. To the extent that the following comments point out possible weaknesses in the analysis, they should be interpreted as suggestions for modifications that might improve the Plan's long-term chances of success or achieve Plan objectives more cost-effectively.

Several additional major issues emerged during the review. These are discussed below with examples and specifics drawn from various parts of the Plan document. They are followed by a list of minor comments that do not significantly challenge the Plan's recommendations but that might be useful to consider while implementing them

BASIN YIELD

Initial Review Concern

In a number of places, the Plan indicates that moving pumping inland decreases intrusion and increases basin yield. For example: "Since groundwater production from the Central and Eastern Areas induces less seawater intrusion than production from the Western Area, this landward shift increases the Sustainable Yield of the basin" (page 10).However, pumping that is no longer supplied by seawater intrusion must be supplied by some other recharge source. In the short term, inland pumping can be supplied by storage depletion, but in the long run (>1 year), it must be supplied from one or more of the external boundary flows, which are:

- Water loss to the atmosphere from consumptive use
- Increased net percolation from Los Osos Creek
- Decreased groundwater discharge into Willow Creek, Los Osos Creek and Morro Bay.

Resolution of Concern

All of the pumping distributions contemplated in the Plan were simulated using the groundwater flow model, which does in fact enforce conservation of mass as suggested above. Simulation results for the recommended suite of programs included wells that pumped a small amount of seawater, but the percentage of seawater was small enough that the chloride concentration in water produced by the well was still less than the drinking water standard of 250 mg/L. And as expected, there were substantial changes in the aforementioned boundary flows. Diagrams illustrating water balance results were provided by CHG, and at least two should be included in the Plan: one for existing conditions and one for the recommended set of programs.

Local Water Balances

Initial Review Concern

The Plan carefully tracks the distribution of groundwater pumping among six sub-regions of the basin defined by three geographic zones (the western, central and eastern areas) and two depth intervals (the upper/alluvial aquifer and the lower aquifer). However, complete water balances need to be calculated for each sub-region to ensure that the proposed pumping is sustainable. The Plan does not present information in quite enough detail to construct those balances, but it appears that the water balance for the western plus central areas as a whole will remain negative if the Plan programs are implemented. This conclusion stems from a simple comparison of the amount of wastewater that would be removed from those areas by the sewer system with the amount of recycled water that would be returned.

During the initial phase of project implementation, approximately 780 acre-feet per year (AFY) of wastewater would be collected from the western/central areas and treated for reuse (page 210). This amount would increase to 1,120 AFY at buildout. However, only 584 AFY of that water would be returned to the western/central areas for percolation or reuse (Table 32). That leaves a deficit of 196 AFY. The imbalance would only increase if the community grows towards its buildout population, because all further uses of recycled water are slated for agriculture in the eastern area (Table 31).

In order to achieve long-term sustainability, the amount of water removed from the western/central areas must be returned. Some of that return might be achievable through increased east-to-west groundwater flow associated with relocated pumping, but if so, model results should be presented confirming that increase. The ability of subsurface flow to return the exported water would become increasingly less likely if the community continues to grow towards buildout.

Municipal pumping in the eastern area might become necessary to avoid loss of overall basin yield due to reduced net percolation from Los Osos Creek. As growers along the creek valley switch from groundwater to recycled water as a source of irrigation supply, groundwater levels will tend to rise. That will decrease the amount of percolation from Los Osos Creek during periods of high flow and increase the amount of groundwater discharge to the creek during periods of low flow. Both of those effects decrease basin yield. They also create impacts on riparian, aquatic and wetland habitats dependent on base flow in the creek. These effects are an additional reason to ensure that local water budgets remain balanced.

The Plan terminology is somewhat misleading in its characterization of agricultural use of recycled water. The Urban Reinvestment Program actually includes 146 AFY of agricultural reuse, for which a certain amount of infrastructure will need to be built. But the Plan implies that the Agricultural Reinvestment Program—which simply consists of additional agricultural use of recycled water—is not needed unless the community continues to grow.

Resolution of Concern

Additional water balance information not included in the draft Plan but communicated by CHG revealed that the export of wastewater from the western and central areas was fully balanced by recycled water returned to those areas, increases in simulated groundwater inflow and decreases in simulated groundwater outflow. For example, the three municipal expansion wells included in Infrastructure Program C increased the simulated net groundwater flow from the eastern area to the central area by 300 AFY.

The Basin Yield Metric proved to be an important factor in the performance of the management strategies. For example, operating the basin at 100 percent of potential yield (Basin Yield Metric = 100) resulted in saltwater intrusion into the deepest parts of the basin (Zone E) as far inland as downtown Los Osos, whereas operating at a Basin Yield Metric of 80 avoided intrusion. Simulation results for the latter case showed the seawater intrusion front (250 mg/L isochlor) only moving inland as far as the western part of Morro Bay. Simulated water levels in Zone E also exceeded the Water Level Metric Target of 8 feet above sea level by several feet, thereby protecting the basin against seawater intrusion to a greater depth than suggested by the Water Level Metric Target.

Operating the basin at a Basin Yield Metric below 100 is also necessary to avoid internal salt accumulation associated with a closed basin. Recirculating recycled water back into the basin would gradually increase groundwater salinity if there is no groundwater outflow. This salinization process is unrelated to seawater intrusion. For example, simulated groundwater salinity in one simulation at a Basin Yield Metric of 70 leveled off at acceptable levels in inland areas. The Plan should include maps of the simulated seawater intrusion front under existing conditions and under the recommended programs.

INLAND PUMPING AND LOS OSOS CREEK

Initial Review Concern

The steady-state model cannot accurately simulate impacts on Los Osos Creek flow because stream flow and percolation are highly variable over time and nonlinearly dependent on simulated groundwater levels. Increased pumping in the central and eastern areas will increase percolation losses from the creek and decrease groundwater discharge into Los Osos Creek, Willow Creek and Morro Bay at various locations and times. These changes could have significant impacts on aquatic, riparian and wetland habitats.

Resolution of Concern

The model does simulate the effects of changes in pumping on seepage to and from the creek, but it does so assuming the creek is always flowing. Average annual simulated creek percolation under existing conditions is approximately 750 AFY. This equals roughly one-third of the median annual flow at the gage at Los Osos Valley Road (2,000 AFY), which is a high percentage. Data from percolation measurements collected by CHG under a range of flow conditions indicate that the percolation capacity of the creek channel upstream of the gage is approximately 10 cfs. Thus, median annual flow at the upstream location where Los Osos Creek enters the basin is more than 2,000 AFY by some amount, and simulated percolation is correspondingly smaller as a percentage of total flow. Additional analysis of flow duration statistics at the gage location is recommended to estimate annual stream flow where the creek enters the basin and ensure that simulated percolation volumes are realistic.

Simulating flow in Los Osos Creek as perennial might not result in overestimating the effects of increased pumping on annual creek percolation. Percolation estimates during periods when the creek is in fact flowing are probably reasonable. During periods when the creek is not actually flowing, the model would continue to simulate percolation. In reality, a groundwater storage deficit would begin to accumulate along Los Osos Creek Valley. When stream flow resumes, the deficit would temporarily increase the percolation rate from the creek (which is a function of groundwater levels). Averaged over periods of a year or more, stream percolation simulated assuming perennial flow could be similar to stream percolation under seasonal flow. Thus, water balance errors resulting from steady-state representation of Los Osos Creek are probably not large.

Selection of Urban Water Conservation Measures

A long laundry list of water conservation measures is included in the Plan, but the method used to quantitatively rank their effectiveness and cost is not clear. Conservation measures were apparently screened for effectiveness and cost, but the details were not documented and the results were questionable in some cases. Furthermore, estimates of the amount of water savings were apparently based on statewide data and calculated as percentages of initial use, neither of which are likely accurate for Los Osos water use as of 2014. The indoor water use data cited from the Pacific Institute (2003) report are out of date. For example, more recent research on California residential water use by Aquacraft (2011) revealed that toilet flushing is no longer the dominant indoor water use, largely as the result of continued replacement of pre-1992 toilets with 1.6 gpf and 1.28 gpf models.

Given that residential consumption is presently only 66 gpcd, it seems plausible that the 24 conservation measures proposed for implementation under Urban Water Efficiency Program D are more than enough to reduce consumption to 50 gpcd. A lower target is feasible and would be desirable in terms of maintaining local water balances. The City of Santa Cruz, for example, has already achieved average indoor residential water use of 42 gpcd.

The calculations of effectiveness and implementation rates that went into developing Figures 50-52 were not documented sufficiently to enable a rigorous review. However, the following comments are offered related to measures that were included in or excluded from Urban Water Use Efficiency Program D:

- There is no benefit to the water balance or nitrate management of fixing leaks in the water distribution system. It is an activity that makes a favorable impression on other agencies and the public, but money allocated for that activity would be better spent on other elements of the Plan.
- Weather-based irrigation controllers are popular in the eastern and Midwestern United States, where it often rains during the irrigation season. They are less effective in California because our Mediterranean climate is divided relatively cleanly into a dry season—when irrigation is needed—and a wet season, when it is not. Day-by-day tracking of rain or ETo probably does not perform much better than fixed seasonal schedules (off in winter, low in spring and fall, high in summer), with fluctuations in root zone soil moisture absorbing short-term variations in ETo.
- The overall cost and feasibility of implementing the conservation measures should be compared with cost and feasibility of increasing recycled water recharge in the western/central areas (e.g. another facility like Broderson). If all recycled water could be returned to the western/central areas for percolation or reuse, then conservation would not provide any water balance benefit.
- The Plan wisely does not include rainwater and greywater systems among the recommended implementation measures. These only increase groundwater yield to the extent that they use rainwater that would not otherwise infiltrate into the ground and greywater that would not otherwise be re-used in the form of recycled water. Thus, they produce little real benefit at relatively high cost. The issue is not that those activities are counterproductive, it is that they are not cost-effective and that they divert money and effort away from more cost-effective solutions.
- The Efficient Outdoor Use Education Program was not recommended, even though the savings potential is significant. Although residential outdoor use is reportedly only 18 percent of total urban use (Figure 49), many homeowners have no idea how to choose appropriate sprinkler timer settings for their various irrigation zones. Over-irrigation is common. Selecting the appropriate irrigation frequency and duration for each zone requires calculating the weekly or biweekly crop water demand based on the irrigated area, CIMIS ETo and a WUCOLS plant water factor,

and dividing by the measured sprinkler or drip flow rate. It is not rocket science, but it requires a bit of field work and arithmetic.

- More emphasis should be placed on behavioral conservation opportunities, which are substantial. Passing reference is made to this possibility (page 202) but without details or commitment. The education program should emphasize these options. Purveyor conservation programs (including this one) typically overemphasize plumbing and appliances and underemphasize behavior. Attached, for your information, is a comparison of potential savings from plumbing measures versus behavioral measures prepared by this reviewer as part of a water conservation business start-up in 2010. That analysis led to a conclusion that behavioral conservation measures can save about as much water as changes in plumbing and appliances.
- Was conservation pricing (measure 1J) omitted from the recommended program because the purveyors have already adopted tiered rate structures? The importance of pricing as a conservation tool should not be underestimated. It would be worth listing it among the recommended water efficiency program elements for awareness purposes, even if rates are already tiered.

METRICS AND TARGETS

The Nitrate and Chloride Metric Targets were selected to achieve an acceptable future condition, rather than a particular historical condition. This is reasonable. While the target concentrations for nitrate (10 mg/L as N) and chloride (100 mg/L) are higher than predevelopment concentrations, they are fully protective of beneficial uses. Achieving lower targets might be philosophically appealing but would would provide no material benefits to humans or the environment. Given the high cost of implementing the proposed Plan, lower targets are not justifiable.

The Basin Yield Metric Target of 80 (pumping limited to 80 percent of basin yield) is an appropriate acknowledgment of uncertainty in the yield calculations, and is reasonable in magnitude.

Initial Review Concern

In contrast, the Water Level Metric Target (8 ft) was selected based on a historical value rather than the future condition that it would achieve. It is too low to protect the basin from intrusion down to an adequate depth. The Water Level Metric had a value of 8 ft in 1975 but was plummeting at that time (Figure 35). Intrusion could already have been underway. Using a simple Ghyben-Herzberg relationship, a water-level metric of 8.5 ft would be needed to prevent intrusion to the bottom of Zone D (an elevation of approximately -350 ft msl, per Figure 24), and a metric of 12.5 ft would be needed to prevent intrusion to the bottom of Zone E (approximately -500 ft msl). Several existing wells extend to Zone E. The selection of a target of only 8 ft essentially abandons Zone E to intrusion. The Plan does not make this clear, nor does it evaluate implications related to potential up-coning of saltwater into Zone D wells if Zone E becomes saltwater or loss of fresh groundwater storage that could be tapped temporarily during droughts.

Resolution of Concern

The recommended set of programs would result in pumping equal to 80 percent of the basin yield (Basin Yield Metric = 80), which results in higher water levels than if the basin were operated at 100 percent. Simulations of the recommended locations and depths of municipal pumping resulted in groundwater elevations in Zone E of around 12 feet, or 4 feet higher than the Water Level Metric Target. Concurrently, the simulated location of the 250 mg/L isochlor—which represents the seawater intrusion front—was only slightly inland of the Morro Bay sand spit in Zone E. It was far from the locations where wells produce from that zone. These results demonstrate that the recommended amount of municipal pumping was constrained by the Basin Yield Metric Target, and the associated water levels were not close to exceeding the Water Level Metric Target. Nevertheless, raising the Water Level Metric Target to 12 feet is recommended, in case the Basin Yield Metric Target is changed at some point in the future.

KEY WELLS FOR WATER LEVEL, NITRATE AND CHLORIDE METRICS

Initial Review Concern

The Nitrate Metric calculation needs to include a larger number of wells. More than chloride and water levels, nitrate is often highly variable in time and space. Averaging measurements over a larger number of wells would provide a more robust measure of nitrate concentrations and trends. Also, wells that have had high concentrations or large changes in concentration in the past might not be the ones that exhibit large changes in the future. The Plan proposes to use only five wells.

The two sandspit wells might not be worth including in the Water Level Metric calculation because they are too far from pumping wells and too close to the stabilizing effect of the ocean boundary to vary much over time. Conversely, many more wells are needed in Los Osos, where municipal pumping is concentrated. Presently, only three wells in that area are proposed for use in calculating the metric (Figure 36). Water level patterns will change dramatically following the geographic and vertical redistribution of pumping, the elimination of septic recharge and the onset of Broderson recharge. Many wells will be needed to characterize those new patterns and verify that water levels are adequate to prevent intrusion. In particular, more wells in the upper and lower aquifers west of the new center of pumping are needed to assess water levels where intrusion is most likely to occur.

The Chloride Metric should similarly involve a larger number of wells. The metric should be monitored and calculated separately for the upper and lower aquifers. Both will be at risk of intrusion in the future, following the upward shift in municipal pumping. Also, intrusion can occur through sand lenses of limited extent, bypassing monitoring wells, as acknowledged in the Plan (page 85). For example, chlorides began increasing in well 18L2 in 2009, bypassing well 13M1 (Cleath Harris Geologists, 2010). Consequently, the four wells proposed for inclusion in the chloride metric (Figure 36) are far too few.

Resolution of Concern

The reason for using a subset of the monitoring wells ("key" wells) rather than all monitoring wells to calculate the metrics was to focus the metrics on locations where the recommended programs would most likely cause changes in water levels and quality. In particular, key wells were selected to focus on the area between Morro Bay and the inland pumping centers, which is the region where water levels would have the greatest influence on seawater intrusion. Ideally, key wells would have the following characteristics:

- Known screened interval
- Long period of record
- Representative of patterns seen in most wells
- Landowner permission for monitoring
- Location likely to respond to recommended programs.

Few wells meet most or all of these criteria, and the key wells selected in the plan are the best of the available wells. More importantly, data for all monitoring wells will still be evaluated for signs of favorable or unfavorable effects of the recommended programs. For example, if early indications of seawater intrusion appeared at a non-key well, appropriate follow-up would still be implemented. The purpose of the key wells and metrics is to provide a representative overview of groundwater conditions that can easily be communicated.

Data provided by CHG showed that the sandspit wells do in fact exhibit long-term water-level changes reflecting increased pumping in the basin. So they are appropriate to include as key wells for the Water Level Metric.

CHG concurs that there is a gap in coverage along the western shore of Morro Bay and supports a recommendation for an additional monitoring well cluster to fill that gap, which is between monitoring wells UA 3 and UA 5 in the upper aquifer (Figure 40) and LA 4 and LA 11 in the lower aquifer (Figure 41).

Basin Monitoring

The Plan proposes a monitoring program that is intended to meet several regulatory requirements in addition to the needs of the Plan itself. The regulatory requirements include monitoring of groundwater levels and quality consistent with criteria for groundwater management plans (AB3030 and SB1938), the California Department of Water Resources' CASGEM database (SBx7 6), permit terms and conditions for the Los Osos Wastewater Project, and the Recycled Water Management Plan. The locations, frequency and constituents for groundwater monitoring documented in the Plan appear to generally meet all of those criteria. CASGEM requires that the water-level monitoring program be able to demonstrate seasonal trends. Although this is commonly done with semiannual measurements in spring and fall, the minimum annual water level in agricultural areas often occurs in mid-summer at the peak of the irrigation season. Careful consideration should be given to the purpose of seasonal monitoring and the timing and interpretation of seasonal water-level measurements.

Additional monitoring locations are recommended to improve the calculation of basin metrics, as described in the above comments on "Key Wells for Water Level, Chloride and Nitrate Metrics". In particular, the wells selected for upper aquifer monitoring over-represent the eastern part of the Central Zone, which includes mostly homes served by domestic wells and septic systems (Figure 40). Changes in groundwater conditions in that area will likely be smaller than in the main Los Osos-Baywood Park area. It would be preferable to include more wells in central Baywood Park and the western part of Los Osos, and especially along the Morro Bay shoreline between wells UA3 and UA5. Intrusion will become a threat in the Upper Aquifer, and sentry wells are needed.

Additional wells are also needed for the lower aquifer (Figure 41). Again, more wells west of the future center of pumping would be particularly useful, such as along the Morro Bay shoreline between wells LA4 and LA11. With changes in pumping location, intrusion might enter anywhere along that boundary. Water levels should also be measured at water-quality wells LA11, LA12 and/or LA23, if possible, because the northern part of the basin is not well represented in the water level monitoring coverage.

The Plan does not provide for preparation of a groundwater recharge map and a discussion of the contribution of the mapped recharge areas to groundwater replenishment. These became required components of groundwater management plans as of January 2013, if the Plan is intended to qualify the basin partners to receive State grant funds [pursuant to AB359, now codified as Water Code Sections 10753.7(a)(1) and (a)(4)]. It would not be difficult to create a map showing the geographic areas of various sources of recharge, including septic systems and the Broderson and Bayridge recycled water percolation facilities.

Monitoring of Los Osos Creek flow only at the existing gage at Los Osos Valley Road would not be capable of detecting all impacts of the recommended programs, some of which will occur downstream of that location. However, if agricultural use of recycled water (and associated decrease in groundwater pumping for irrigation) is balanced by increased pumping for municipal use in the eastern area, stream flow impacts will probably be small and a second gage would arguably be unnecessary.

The Recycled Water Management Plan requires monitoring of wetland, creek, riparian and marsh plant and animal abundance. The Plan does not include that monitoring and does not indicate what agency will be meeting those requirements.

OTHER COMMENTS

1. The Plan is long (301 pages) and in places confusing. Its encyclopedic coverage of previous basin studies, regulatory programs and water conservation measures are useful but contain more information than many readers will need. Perhaps some of that material could be shifted to appendices. Confusion arises from the large number of management measures—and combinations of management measures—with similar descriptors or challenging acronyms. The Plan covers seven major water-resource topics, some of which contain multiple programs and elements. For example, water use efficiency considers 33 demand management measures grouped in various combinations as Programs A through E. The basin infrastructure program contains 16 elements in four groups, also labeled Programs A through D. To compound matters, when the Plan arrives at "Solutions for the Basin", eleven programs/elements are given new acronyms then evaluated in 12 water-supply combinations and nine water demand combinations under two development scenarios, which are then reduced to a matrix of 18 supply combinations by five demand combinations. The extent of the systematic screening analysis is impressive and perhaps necessary, but only a dedicated reader will be able to keep track of it all.
2. Water use numbers are difficult to track and compare because they do not cover a consistent geographic area. This appears to stem from the underlying data, and to that extent might be unavoidable. However, additional clarification might be possible. For example, some water use numbers are for the entire Plan area, while others are for the developed area or the Prohibition Zone or the western-central-eastern areas. With respect to time, some water use numbers are for 2012, while others represent a 5-year-average, and still others are for future buildout. Some water use numbers are for residential only (for example, the 50 gpcd indoor target), while others are for entire water use in purveyor service areas (residential, commercial, institutional, industrial and agricultural), or might include users outside the purveyor service areas. To the extent that this time-geographic complexity can be reduced, it would help readers understand the Plan.
3. The discussion of seawater intrusion rates (pages 84-86) is tricky to follow because it references multiple wells and date intervals. More importantly, it lacks a discussion of future implications. How long could those rates conceivably continue? The initial concern was that intrusion might continue and eventually reach the new inland expansion wells. However you divide the 1985-2010 intrusion period, the average rate of interface advance to reach the Palisades Well was 183 ft/yr (4,580 ft over 25 years). The Palisades Well is only 9,200 ft from Los Osos Creek, and the intervening area is where the Plan proposes to locate new municipal wells under Basin Infrastructure Program C. If the historical rate of intrusion continues, all of those wells will become salty in less than 50 years (9,200 ft/183 ft/yr= 50 years). This concern was generally resolved by local water balance information from the groundwater model that indicated that the recommended programs would succeed in raising groundwater levels to

protective elevations and preventing saltwater from encroaching into the central part of the basin.

4. It was initially unclear how a steady-state groundwater flow model produced some of the results shown in the Plan. For example, how was the saltwater interface location simulated (page 108)? The steady-state model by necessity will have a balanced water budget, but that budget could include a stationary interface in the presence of continuous flow of saltwater to one or more wells. Were the results checked to confirm that all supply wells were pumping water of acceptable quality? CHG confirmed that simulated water quality at all wells was checked to make sure it met the target chloride concentration of 250 mg/L or less. This proved to be a limiting constraint. Some wells did in fact pull in a small amount of saltwater, and pumping had to be limited such that the overall chloride concentration in the produced water did not exceed the target.

Summary of Recommendations

The principal recommendations of this review can be summarized as follows:

- Include diagrams of water balances for the western, central and eastern areas under existing conditions and under the recommended programs.
- Show maps of the simulated seawater intrusion location (250 mg/L isochlor) under existing and recommended conditions.
- Add a monitoring well cluster (upper and lower aquifers) to fill the gap in coverage along the western shore of Morro Bay.
- Shift some detailed material to appendices.
- Raise the Water Level Metric Target to 12 feet.
- Prepare a map of groundwater recharge.

References Cited

Aquacraft Water Engineering and Environment. April 20, 2011. California single-family water use efficiency study. Boulder, CO. Prepared for Irvine Ranch Water District.

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