EXHIBIT 14-E

TECHNICAL MEMORANDUM
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To:	MPWMD	Date:	November 13, 2008
Attention:	Joe Oliver, P.G., C.Hg, Water Resources Manager	Project No:	06-0013
Copy to:	Henrietta Stern Matthew Sundt		
From:	Robert Marks, P.G., C.Hg		
Subject:	Review of Well Source and Pumping Impact Assessment for Dunnion Well, APN 013-321-010		

INTRODUCTION

Presented in this Technical Memorandum is a summary of our findings and conclusions based on our review of the above-referenced assessment report. The assessment report, dated September 5, 2008, was prepared for Tom and Ellen Dunnion by Bierman Hydrogeologic (Bierman) in support of a Water Distribution System (WDS) permit application for the above-referenced property. An existing well located on the parcel, identified as the Dunnion Well, is proposed to be utilized to supply potable and exterior landscape irrigation water for an approximate 24,400 square-feet commercial office building on the subject parcel. An existing California American Water connection will also be retained to supplement irrigation supply on the parcel.

Our review focused on evaluating the assessment report for compliance with the MPWMD Procedures for Preparation of Well Source and Pumping Impact Assessments (MPWMD Procedures), dated September 2005 (revised May 2006). A summary of our findings is presented below.

FINDINGS

Hydrogeologic Setting

The proposed WDS and subject well are located off of Garden Road. near the Monterey Airport. The well is greater than 1,000 feet from the mapped boundary of the Carmel Valley Alluvial Aquifer (CVAA), and is completed with perforations in fractured rock of the Monterey Formation (Tm). As such, Hydrogeologic Setting #2 of the MPWMD Procedures is applicable to this well.

Well Construction Summary

Presented below is a summary of the as-built construction of the subject well as documented on the Well Completion Report:

Well Construction Summary

Construction Feature	Dunnion Well
Date Drilled	10/12/07
Total Cased Depth (ft bgs[1])	610
Borehole Diameter (inches)	10.75
Casing Inside Diameter (inches)	5
Perforated Intervals (ft bgs)	Intermittent from 150 to 590
Static Water Level[2] (ft bgs)	103
DWR Well Completion Report No.	e18489
Date Signed	10/23/07
MCHD Permit No.	07-11148
Date Issued	9/27/07

Notes:
1 – feet below ground surface
2 – following well construction

General Testing Methods

MPWMD Procedures specify eight general testing methods which apply to all pumping tests, regardless of the hydrogeologic setting. The testing methods are described in the assessment report and were reviewed for compliance with MPWMD Procedures, as summarized in the table below:

General Testing Methods Summary

Test Method	Compliance	Comments
1 - Witnessed by MCHD[1]	Yes	
2 - Well Testing Method	Yes	Author performed test
3 - Timing of Test	Yes	Test performed in October 2007
4 - Discharge Rate	Yes	Test average 43.19 gpm
5 - Control of Well Discharge	Yes	To nearby storm drain
6 - Wells Monitored	Yes	No existing wells within 1,000 ft at test time

Test Method	Compliance	Comments
7 - Data Collection	Yes	Documented in Appendix C
8 - Water Level Monitoring	Yes	Pressure transducer/datalogger used

Notes:
1 – Monterey County Health Department

As shown above, the general testing methods complied with MPWMD Procedures with no variations.

Well Testing Data Summary

A 72-hour constant rate pumping and recovery test was conducted by Bierman during the period October 30 through November 5, 2007. Presented below is a summary of the well performance data developed from the testing program:

Pumping Test Data Summary

Test Parameter	Dunnion Well
Static Water Level (feet bgs)	103.34
Total Volume Pumped (gallons)	186,572
Test Average Pumping Rate (gpm)	43.19
24-Hour Specific Capacity Calculations	
Average Pumping Rate[1] (gpm)[2]	43.24
Pumping Level (ft bgs)	137.69
Drawdown (ft)	34.35
Specific Capacity (gpm/ft)[3]	1.26

Notes:
1 – During the initial 24-hrs
2 – gallons per minute (gpm)
3 – gallons per minute per foot of drawdown (gpm/ft)

Well Yield Calculations

According to MPWMD Procedures, the yield of a well is calculated by multiplying the 24-hour specific capacity by the available drawdown. Available drawdown for Setting #2 is defined as:

One-third of the vertical distance from the static water level to the bottom of the well perforations.

Therefore, the available drawdown for the Dunnion Well is calculated as:

Available Drawdown = 1/3 (depth to bottom of perforations - static water level)
= 1/3 (590.00 ft – 103.34 ft)
= 162.22 ft

MPWMD Procedures further require consideration of any shifts in the apparent transmissivity during the test as well as water level recovery data to determine if any adjustments to the calculated 24-hour specific capacity and/or yield should be made. A summary of these adjustment considerations is presented below:

Drawdown Curve and Transmissivity

The assessment report presents calculated transmissivity values ranging between approximately 951 to 1,100 gallons per day per foot (gpd/ft), depending on the analytic method and portion of the curve analyzed. The aquifer parameter estimates account for casing storage effects in the initial portion of the drawdown curve[1]. The drawdown curve displayed a conventional drawdown response after casing storage effects had expired and there was not a decrease in the apparent transmissivity between the first half and the end of the test; therefore, an adjustment to the 24-hour specific capacity is not required.

Recovery Data

Water level recovery data were collected for a little more than 3 days following termination of pumping, and the water level recovered to approximately 96 percent within this period (residual drawdown was approximately 1.53 feet); therefore, no adjustment is required.

Calculated Well Yield

Based on the above, the well yield calculations for the Dunnion Well are summarized below:

Well Yield Calculations Summary

Parameter	Dunnion Well
24-Hour Specific Capacity (gpm/ft)	1.26
Ratio of Late to Early Time Transmissivity	NA[1]
Adjusted 24-Hour Specific Capacity (gpm/ft)	NA
Available Drawdown (ft)	162.22

[1] We note that Bierman calculated the time at which casing storage effects expire (t_c) to be approximately 12 minutes, whereas we calculate t_c at approximately 2 to 3 minutes; however, this slight difference in t_c did not affect the transmissivity calculations.

Parameter	Dunnion Well
Adjusted Calculated Well Yield (gpm)	NA
Recovery Adjustment (gpm)	NA
Final Calculated Well Yield (gpm)	**204.4**[2]

Notes:
1 – Not Applicable
2 - Value differs slightly from that presented in the report due to differences in rounding off of the various calculation factors.

Water Demand Estimate

The subject well is proposed to provide non-potable irrigation supply to the proposed WDS. Presented below is a summary of the estimated demand calculations for the subject WDS[2]:

Demand Calculations Summary

Demand Category	Dunnion WDS
Average Annual (afy)[1]	2.2
Average Day (gpd/gpm)[2]	1,964 / 1.36
Dry Season (gpd/gpm)	2,357 / 1.64
Maximum Day (gpd/gpm)	2,946 / 2.05
Maximum Day 12-hour (gpm)	**4.09**

Notes:
1 – acre feet per year (afy)
2 – gallons per day (gpd); gallons per minute (gpm)

We note that the assessment report estimated a greater maximum day demand of 3.06 gpm (equivalent to a 12-hour demand of 6.12 gpm) utilizing a peaking factor of 2.25 times the average day demand, as required by California Department of Public Health's Waterworks Standards (revised March 2008), rather than a peaking factor of 1.5 as prescribed by MPWMD procedures.

Confirmation of Well Capacity

As presented above, the calculated well-yield for the Dunnion Well is approximately 204 gpm, which is significantly greater than the maximum day 12-

[2] It is our understanding that this demand estimate was based on MPWMD Water Use Factors and has been reviewed by MPWMD staff. The demand estimate was not, therefore, independently verified as part of this review.

hour demand value of 4.09 gpm (or 6.12 gpm). Therefore, based on MPWMD Procedures the well capacity is considered sufficient for the proposed WDS demand.

It is important to note that the above well-yield calculation is a theoretical maximum sustained pumping rate based on calculations prescribed by MPWMD Procedures. The actual maximum rate achievable by the well is practically limited by other factors, including: (a) the size of the selected pump and motor, (b) the pump (and intake) setting, (c) well casing diameter, and (d) discharge piping diameter.

Water Quality

A water-quality sample was collected from the well at the end of pumping, and was analyzed at a State Certified Laboratory for Title 22 general mineral, general physical and inorganic chemical parameters, as well as an expanded list of Title 22 constituents (organic and synthetic organic compounds, asbestos, etc.). The results indicate that the water met all of the Maximum Contaminant Level (MCL) drinking-water standards[3] for primary inorganic constituents. However, the water did slightly exceed the recommended MCLs for the following secondary (aesthetic consumer acceptance-based) constituents:

Water Quality MCL Exceedance Summary

Constituents	Unit	Recommended MCL	Result
Odor	TON	3	4
Specific Conductance	mg/L	900	1,788
Total Dissolved Solids	mg/L	500	1,060

As a commercial office facility, treatment of the produced well water prior to consumption may be required. Although a treatment system has not been designed, the assessment estimated system and treatment losses of 7 and 15 percent, respectively, and a correspondingly greater maximum day 12-hour demand value of 7.75 gpm (equivalent to approximately 2.8 afy, assuming a peaking factor of 2.25). The MCHD should, however, be contacted for treatment recommendations and/or requirements for this WDS.

Analysis of Offsite Impacts

MPWMD Procedures require an evaluation of the potential well-pumping drawdown effects at existing wells or other Sensitive Environmental Receptors (SERs) within 1,000 feet of the subject well. Projected drawdown impacts were

[3] Updated October 11, 2007.

calculated utilizing the Modified Theis Nonequilibrium Equation[4]. The calculations assumed continuous pumping for 183 days at a dry-season demand rate of 1.62 gpm.

We note that the report text erroneously states that a dry-season demand pumping rate of 3.24 gpm was utilized in the calculations; however, the technical calculations presented in Appendix E show that a rate of 1.62 gpm was actually (and appropriately) utilized. We also note that the recovery curve-derived transmissivity value of 1,100 gallons per day per foot (gpd/ft) was utilized, rather than the late-time drawdown curve-derived value of 951 gpd/ft as required by MPMWD Procedures; however, based on our calculations this discrepancy results in an insignificant difference (0.07 feet) in the drawdown impact calculations. A storage coefficient value of 0.033[5] (dimensionless) was also used in the calculations.

Potential Impacts on Existing Wells

One existing well is located within 1,000 feet of the subject well at a distance of approximately 250 feet. This well (DMC Construction) was evidently drilled following the testing of the subject well. The analysis of projected drawdown indicates 0.57 to 0.64 feet of drawdown impacts are calculated at the existing offsite well as a result of pumping the subject well at the above-noted rate and duration for this WDS. Assuming the DMC Construction well is similarly constructed as the subject well, this amount of drawdown impact represents less than approximately 0.4 percent of the available drawdown, which is less than significant. There are no other SERs as defined by the MPWMD within 1,000 feet of the well.

CONCLUSIONS

Based on our review of the subject assessment report, we offer the following conclusions:

Well Capacity

The maximum day 12-hour demand for the subject WDS was calculated to range between approximately 4.09 gpm to 7.75 gpm, depending on the peaking factor utilized and treatment losses assumed, which is significantly less than the calculated well yield of 204.4 gpm; therefore, based on MPWMD Procedures the well capacity is considered **sufficient** for the **2.2 to 2.8 afy** annual demand for this WDS.

[4] The projected drawdown calculations were verified as part of our review utilizing the Theis Equation.
[5] Derived from Warren Root, Double Porosity, Fracture Flow Method analysis of the drawdown curve.

Water Quality

The water quality results indicate that the water met all of the Maximum Contaminant Level (MCL) drinking-water standards for primary inorganic constituents. However, the water did exceed the recommended MCLs for several secondary (aesthetic consumer acceptance-based) constituents; therefore, the MCHD should be consulted regarding treatment recommendations and/or requirements for this source and WDS.

Analysis of Offsite Impacts

Analysis of projected drawdown at the offsite well as a result of pumping the subject well to meet the demands of the subject WDS indicates that the impacts would not be significant. There are no other SERs located within 1,000 feet of the subject well.

CLOSURE

This memorandum has been prepared exclusively for the Monterey Peninsula Water Management District for the specific application to processing of a Water Distribution System permit. The findings and conclusions presented herein were based on our review of the subject assessment for compliance with MPWMD Procedures. No other warranty, express or implied, is made.

It is noted that the long-term sustainable capacity of wells completed in fractured-bedrock settings is dependant on a variety of factors that cannot be fully evaluated through analysis of relatively short-duration pumping tests. The movement and long-term availability of groundwater in these materials is controlled by the occurrence, connectedness, and distribution of fractures. The distribution and connectedness of fractures to sources of recharge are essentially random, and the volume of groundwater in storage in these systems is often limited. The low volume of groundwater in storage can limit long-term supply, particularly during periods of deficient recharge. The implications of these factors should, therefore, be taken into consideration when planning long-term use of wells that are completed in fractured-bedrock settings.