May 17, 2010

Alan Solomon
Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

RE: **Blythe Solar Power Project, Docket No. 09-AFC-6**
*Numerical Groundwater Modeling: Assessment of impacts from a revision in the well configuration for the proposed construction water supply*

Dear Mr. Solomon:

Attached please find the following Numerical Groundwater Modeling: Assessment of impacts from a revision in the well configuration for the proposed construction water supply.

If you have any questions on this submittal, please feel free to contact me directly.

Sincerely,

Alice Harron
Senior Director, Development

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# Numerical Groundwater Modeling: Assessment of impacts from a revision in the well configuration for the proposed construction water supply

**Blythe Solar Power Project**

**Docket No. 09-AFC-6**

Alice Harron
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**BLYTHE SOLAR POWER PROJECT**

**NUMERICAL GROUNDWATER MODELING: ASSESSMENT OF IMPACTS FROM A REVISION IN THE WELL CONFIGURATION FOR THE PROPOSED CONSTRUCTION WATER SUPPLY**

On April 17, 2010, in response to changes in the Blythe Solar Power Project (BSPP), the numerical groundwater model provided in the Application for Certification (AFC) was updated to assess pumping impacts from a change in the construction water demand to 4,100 acre-feet (average of ~640,000 gallons per calendar day over the 69-month construction period). The change was an increase of 1,000 acre-feet above the 3,100 acre-feet proposed in the AFC. The modeling was conducted assuming one water supply well for the construction supply. The numerical modeling was also updated for the operational supply, wherein four water supply wells (one at each Unit) were modeled though the operational volume did not change over the 600 acre-feet per year amount proposed in the AFC.

During the Soil and Water workshop of April 29, 2010, California Energy Commission (CEC) staff indicated they would want to see the numerical modeling done using the anticipated well configuration based on the Applicants best understanding of the well field from information gathered to date. As such, the numerical modeling has been revised to reflect a change in the number of construction water supply wells from one used in the prior modeling to three as shown on **Figure 1**. Based on the current estimates of well yield, it is anticipated that two additional wells will be needed for construction water supply. The operational configuration has not changed over what was modeled previously and provided on April 17, 2010.

The well configuration shown on **Figure 1** represents the currently proposed well field showing eight of the ten wells that are proposed for the BSPP. The inclusion of well TW-1 into the well field will depend on the final project design and layout, and if the well does not encroach into the solar field footings or process equipment. The additional two wells that are proposed for the Project will be installed based on the final disposition of well TW-1 and the performance of the wells shown on **Figure 1**.

**Implications for Project Impact Analysis:**

The groundwater model that was provided in the Project Design Revision submitted April 17, 2010, was revised to reflect a change in the number of construction water supply wells. **Table Soil and Water-191-1(rev1)** was unchanged showing the yearly volume proposed for the project through construction and operation. For the numerical simulations, the total water volume (4,100 acre-feet) was applied equally between the three wells over a 5-year period (60 months). No other changes were made in the operational water volume (600 afy) or aquifer characteristics, as provided in the modeling submitted on April 17, 2010. As provided previously, the full volume of operational water (600 afy) was segregated and applied uniformly through a pumping well at the northernmost part of each power block pumping at a rate of 150 afy **(see Figure 1)**.

The modeling was conducted for Project only pumping scenarios (Run 1 and Run 2 from prior modeling). A cumulative analysis was not done as the change only involves a change in the well configuration, the results of which were not significantly different than prior estimates of construction supply impacts. The model configuration and zonation (i.e., distribution) of transmissivity and storage coefficient were not changed over the configurations provided in the Project revision. Run 1 (lower transmissivity) and Run 2 (higher transmissivity) were established to provide a range of the distribution of transmissivities interpreted from published reports available aquifer test data and the test results from TW-1.

The model results are shown in **Table Soil and Water-191-2(rev2)**. As can be seen in the results, the maximum drawdown occurs at the end of construction (**see Figure 2 and 4)**. During the

operational period, the pumping rate drops slightly and is distributed uniformly in the area of the power blocks, as such so does the drawdown, the there is higher drawdown for the wells simulated adjacent to the McCoy Mountains. It is also noted that at the end of operation, the drawdown is slightly larger than at the middle of operation due to prolonged pumping **(see Table Soil and Water-191-2[rev2])**. The impact to adjacent water supply wells was also assessed using the radius of influence from the construction and operational pumping wells to the 5-foot drawdown and 1-foot drawdown contours. The maximum distance at 1-foot drawdown occurs at the end of operation for either scenario (Run1 or Run2), though there is no drawdown greater than 5 feet predicted beyond the Project footprint (**see Figure 3 and 5**). Additionally, during construction no off-site water supply wells are predicted to be affected by Project pumping causing a drawdown of 5 feet or more (**Figure 2 and 4)**. The scenarios modeled reveal that no off-site well is expected to be affected to a drawdown of 5 feet or more by the Project pumping.

In a numerical groundwater flow model, inflows and outflows of the model domain can be obtained using the model flow budget for each simulation. The cumulative difference between the inflows and outflows is the storage change for the aquifer. As can be seen from **Table Soil and Water-191-2 (rev 2)**, the largest net storage change occurs at the end of operation for either model scenario. Assuming a total recoverable storage of 5,000,000 acre-feet in the basin (DWR 1979), the impact of basin storage over the full term of the Project (30 years) is insignificant even for the largest storage change at the end of operation (0.44 percent).

The numerical modeling files are provided in **Appendix A**, which accompanies this submittal.

**TABLE**
**SOIL and WATER-191-1 (rev1)**
**PUMPING SCHEDULE FOR NUMERICAL GROUNDWATWER MODELING**
**PROJECT REVISION**
**CHANGE OF CONSTRUCTION WATER VOLUME TO 4100 ACRE-FEET**
**BLYTHE SOLAR POWER PROJECT**

| PROPONENT | BLM SERIAL ID | TECHNOLOGY | SOURCE | USE | WATER USE - SOLAR and OTHER RENEWABLE PROJECTS (af) | | | | | | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2015-2043 | |
| Bullfrog Green Energy, LLC | CA 49702 | Photovoltaic (500MW) | Groundwater | Construction | -- | 8 | 7 | 7 | -- | -- | **--** | Operation water use given as 6,000 gal/month (0.22 afy). No construction water use provided in POD; assume total 22 af over three years construction. |
| | | | | Operational | -- | -- | -- | -- | 0.22 | 0.22 | **0.22** | |
| US Solar | -- | Photovoltaic (100MW) | Groundwater | Construction | -- | 1.6 | 1.6 | -- | -- | -- | **--** | No water usage given in POD. Assume water usage to be 20% of water usage for similar PV project (Big Maria Vista). |
| | | | | Operational | -- | -- | -- | 0.04 | 0.04 | 0.04 | **0.04** | |
| Blythe Energy, LLC | -- | Combined/Cycle (520MW) | Groundwater | Construction | -- | 60 | 60 | -- | -- | -- | **--** | AFC (2004) indicates construction to last up to 22 months (76 acres) - no volume specified; Operational usage of 3,300 afy. Assume construction water usage 60 gal/cy. Further, assume grading encompasses entire site (76 acres) to an average depth of 5 feet (~620,000 cy). |
| | | | | Operational | -- | -- | -- | 3,300 | 3,300 | 3,300 | **3,300** | |
| First Solar | -- | Photovoltaic (7.5 MW) | Groundwater | Construction | -- | 0.1 | 0.1 | -- | -- | -- | **--** | Assumes 24 month construction period. No water amount specified. Given small output, assume minimal water usage for construction and operational use. |
| | | | | Operational | -- | -- | -- | 0.01 | 0.01 | 0.01 | **0.01** | |
| First Solar (formerly OptiSolar) | CA 49377 | Photovoltaic (601MW) | Groundwater | Construction | 2 | 7 | 7 | 7 | 4 | -- | **--** | POD assumes construction period beginning mid-2010 with facility startup in 2013 or 2014. Assumes 27 af total water for construction and 3.8 afy for operational use thereafter. |
| | | | | Operational | -- | -- | -- | -- | 3 | 3.8 | **3.8** | |
| enXco | CA 49490 | Photo Tower (136MW) | Groundwater | Construction | -- | 1000 | 150 | 75 | -- | -- | **--** | POD assumes 30-month construction period with facility startup at end of 2013. Assumes water use of 1,225 af over total construction period and 600 afy for operational use thereafter. |
| | | | | Operational | -- | -- | -- | 75 | 600 | 600 | **600** | |
| Solar Millennium LLC **Data Response January 2010** | CA 48811 | Parabolic Trough (484MW) | Groundwater | Construction | | 620 | 620 | 620 | 620 | 620 | **--** | POD assumes 69 month (5.75 years) construction period with total water usage during construction to be **3,100 af** and 600 afy usage during operational phase. Construction water usage averaged over a period of 5 years starting in 2011. |
| | | | | Operational | -- | -- | | 150 | 300 | 450 | **600** | |
| Solar Millennium LLC Project Revision **April 2010** | CA 48811 | Parabolic Trough (484MW) | Groundwater | Construction | | 820 | 820 | 820 | 820 | 820 | **--** | POD assumes 69 month (5.75 years) construction period with total water usage during construction to be **4,100 af** and 600 afy usage during operational phase. Construction water usage averaged over a period of 5 years starting in 2011. |
| | | | | Operational | -- | -- | | 150 | 300 | 450 | **600** | |

**TABLE 191-2 (rev2)**
**RESULTS OF NUMERICAL MODELING**
**CHANGE IN THE NUMBER OF CONSTRUCTION WATER SUPPLY WELLS**
**CONSTRUCTION WATER SUPPLY 4,100 ACRE-FEET**
**BLYTHE SOLAR POWER PROJECT**

| Model Scenario[1] | Zone 1 | | Zone 2 | | Year | CONSTRUCTION PUMPING[4] | | | OPERATIONAL WELLS (SEE FIGURE 1)[4] | | | | Storage change | Storage Change[2] | Water level change[3] | Objective |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | S | T | S | | TW-1 | WELL NO.1 | WELL NO.4 | WELL NO.1 | WELL NO.2 | WELL NO.3 | WELL NO. 4 | | | | |
| | | | | | | Drawdown | Drawdown | Drawdown | Drawdown | Drawdown | Drawdown | Drawdown | Acre-ft | % of Recoverable | feet | |
| Run 1 | 10,000 | 0.2 | 6,300 | 0.2 | 2015 | 7.9 | 6.7 | 6.8 | -- | -- | -- | -- | 4,994 | 0.10% | 0.11 | Project only impacts assessment using THREE wells for construction supply and FOUR wells (one in each Power Block for operation). Pumping follows schedule shown on Table DR Soil and Water-191-1 (rev1). Results shown on Figure 2 and 3. |
| | | | | | 2029 | -- | -- | -- | 4.159 | 3.907 | 4.404 | 3.812 | 13,356 | 0.27% | 0.30 | |
| | | | | | 2043 | -- | -- | -- | 4.993 | 4.569 | 5.205 | 4.441 | 22,181 | 0.44% | 0.49 | |
| Run 2 | 28,000 | 0.2 | 26,000 | 0.2 | 2015 | | | | -- | -- | -- | -- | 4,951 | 0.10% | 0.11 | Project only impacts assessment using THREE wells for construction supply and FOUR wells (one in each Power Block for operation). Pumping follows schedule shown on Table DR Soil and Water-191-1 (rev1). Results shown on Figure 4 and 5. |
| | | | | | 2029 | -- | -- | -- | 1.604 | 1.658 | 1.655 | 1.6 | 12,566 | 0.25% | 0.28 | |
| | | | | | 2043 | -- | -- | -- | 1.851 | 1.883 | 1.883 | 1.806 | 19,463 | 0.39% | 0.43 | |

Notes

1 The pumping schedule is provided in Table DR Soil and Water-191-1(rev1)

2 The storage change is based on a recoverable storage of 5,000,000 acre-feet as reported by the DWR (2004)

3 Estimate of basin-wide water level change after Fetter (1988):

V = A*S*dh

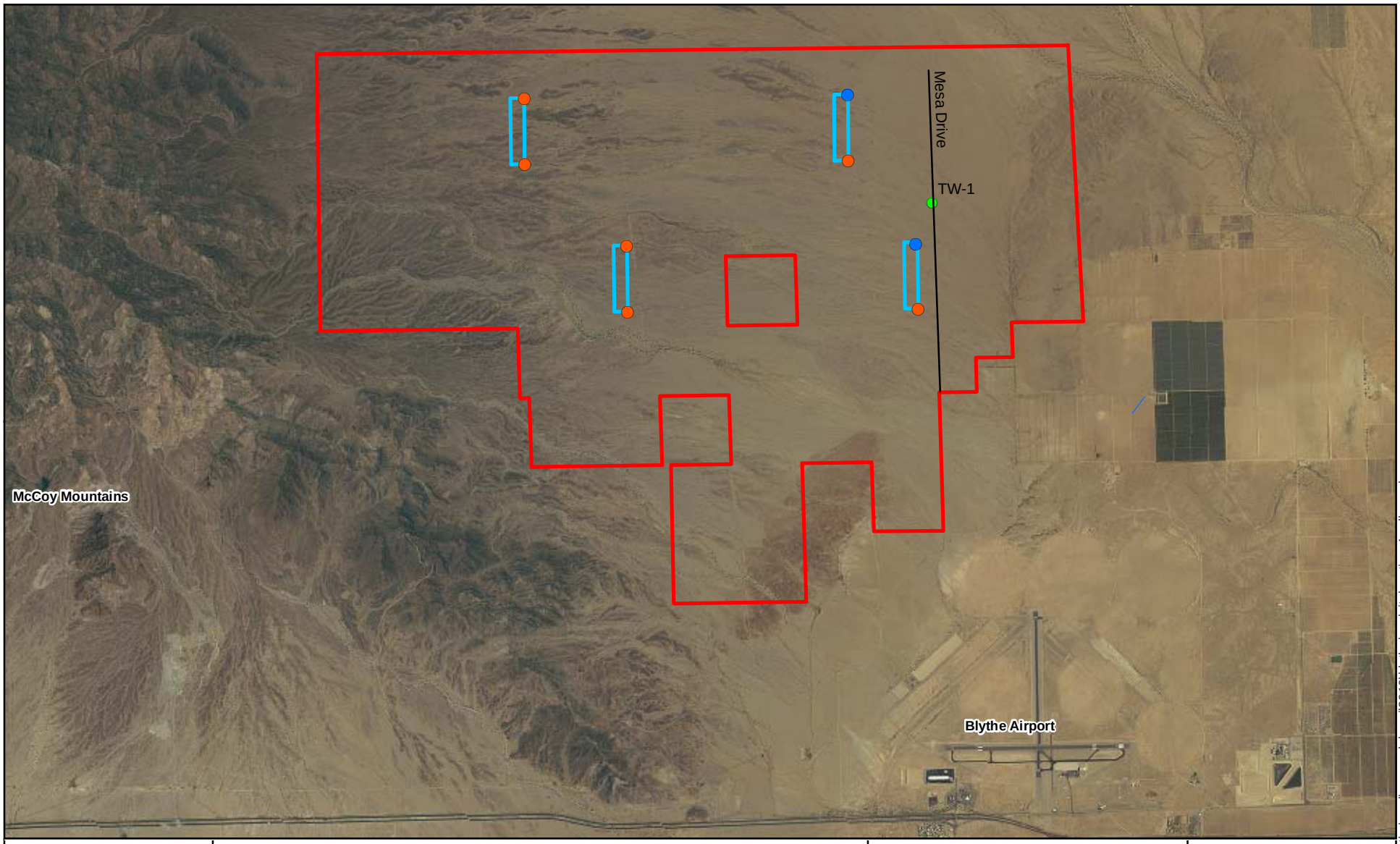
V - volume of water released or taken into storage

A - area of the aquifer (353 square miles)

S- aquifer storage (assumed to be 0.20)

dh - change in water level (inches)

4 The extent of pumping influence is shown on Figures 2 and 4 (construction supply) and Figures 3 and 5 (operational supply). Well locations are shown on Figure 1.




Map Location


Legend

- Project Right-of-Way
- Power Blocks
- Test Well (TW-1)
- Both Construction and Operational Water Supply Well
- Operational Water Supply Well

0 1 2 Miles

Data Sources:
Air Photo, California Spatial Information Library, NAIP, 2009 Riverside County

Note:
10 Wells are proposed, only 8 are shown. The remaining 2 wells will be installed based on the results of the installations show above.

**Blythe Solar Power Project**

**Figure 1**
**Project Water Supply Wells**

**Palo Verde I, LLC**

AECOM

Project: 60139695
Date: May 2010

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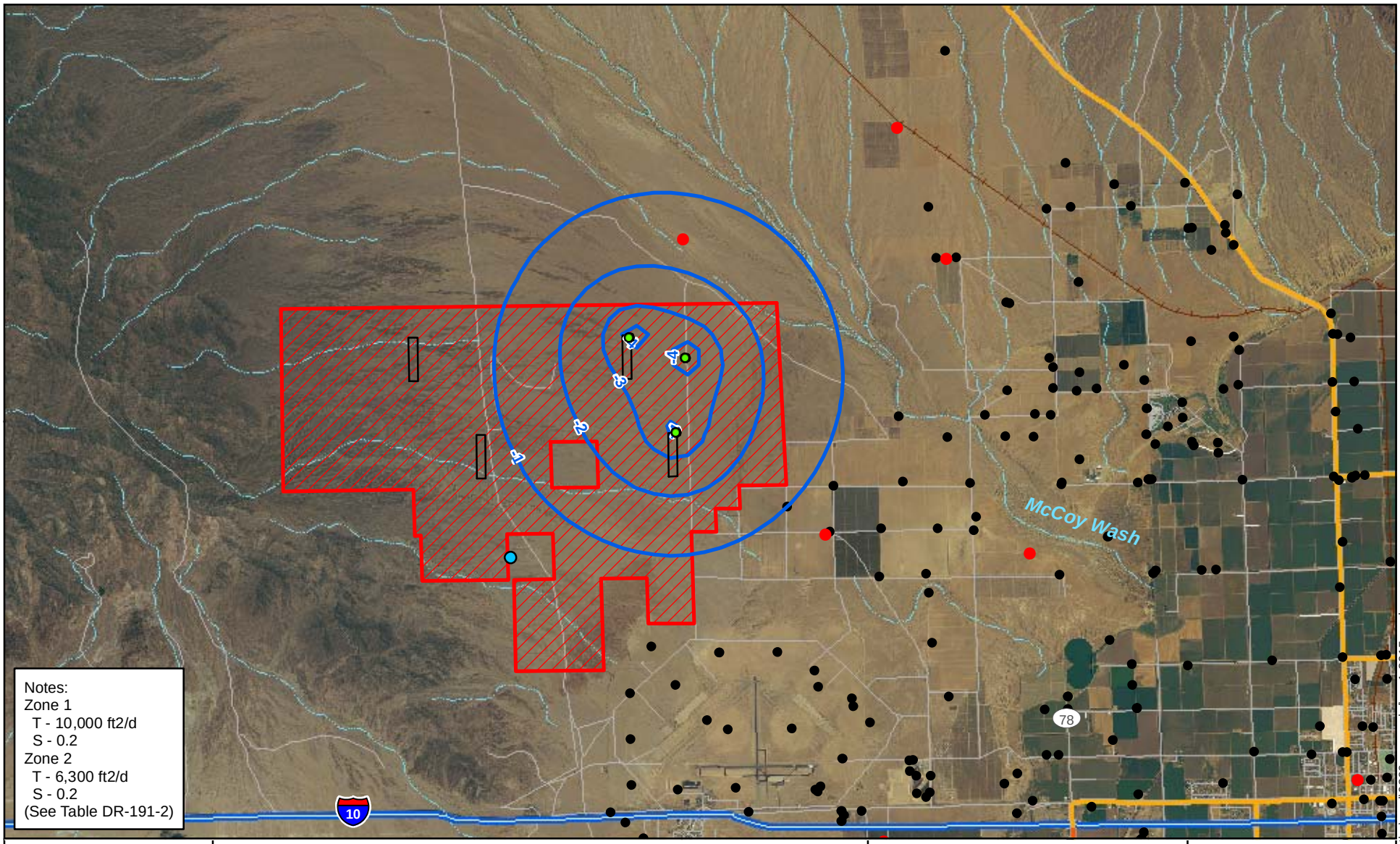


Map Location


**Legend**

- pblocks
- Contours of Drawdown (feet) 5-9-10
- Groundwater Wells Identified as Potentially Active in AFC
- Groundwater Well Location
- Possible Well Location Not Identified in USGS or DWR Database
- Blythe Solar Power Project Right of Way

1 inch = 8,000 feet

0 6,000 12,000 Feet

Data Sources:
Air Photo, NAIP, 2005
Basemap, (Roads, streams, cities), ESRI

**Blythe Solar Power Project**

**Soil and Water**
**Figure 2**
**Groundwater Modeling of Proposed Project Pumping**
**Run 1**
**Year 2015-End of Construction**

**Palo Verde I, LLC**

AECOM

Project: 60139695-6200
Date: May 2010

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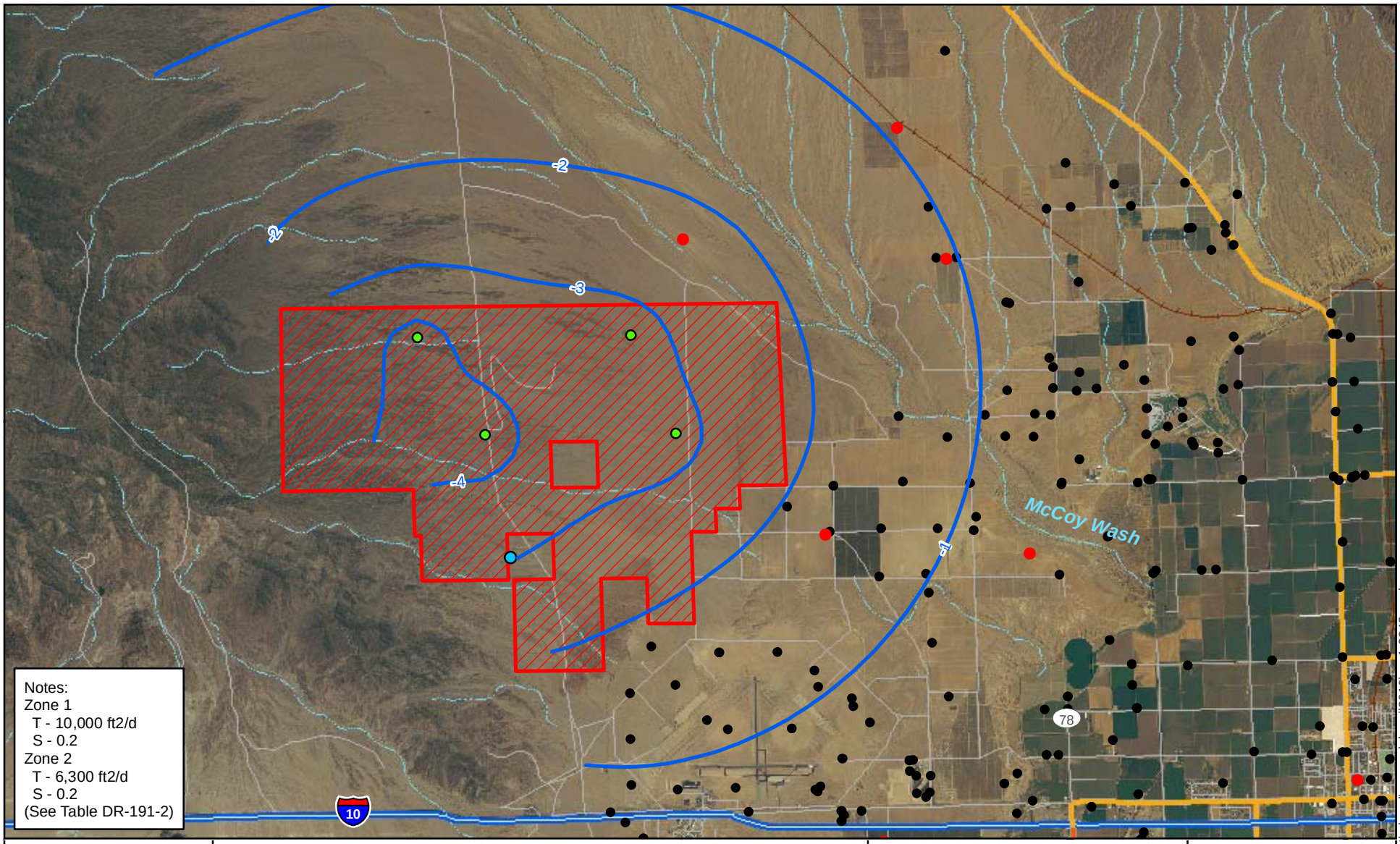


Map Location


**Legend**

- Contours of Drawdown (feet) 5-9-10
- Groundwater Wells Identified as Potentially Active in AFC
- Groundwater Well Location
- Pumping Well
- Possible Well Location Not Identified in USGS or DWR Database
- Blythe Solar Power Project Right of Way

1 inch = 8,000 feet

0 6,000 12,000 Feet

Data Sources:
Air Photo, NAIP, 2005
Basemap, (Roads, streams, cities), ESRI

**Blythe Solar Power Project**

**Soil and Water**
**Figure 3**
**Groundwater Modeling of Proposed Project Pumping Run 1**
**Year 2043-End of Operations**

**Palo Verde I, LLC**

AECOM

Project: 60139695-6200
Date: May 2010

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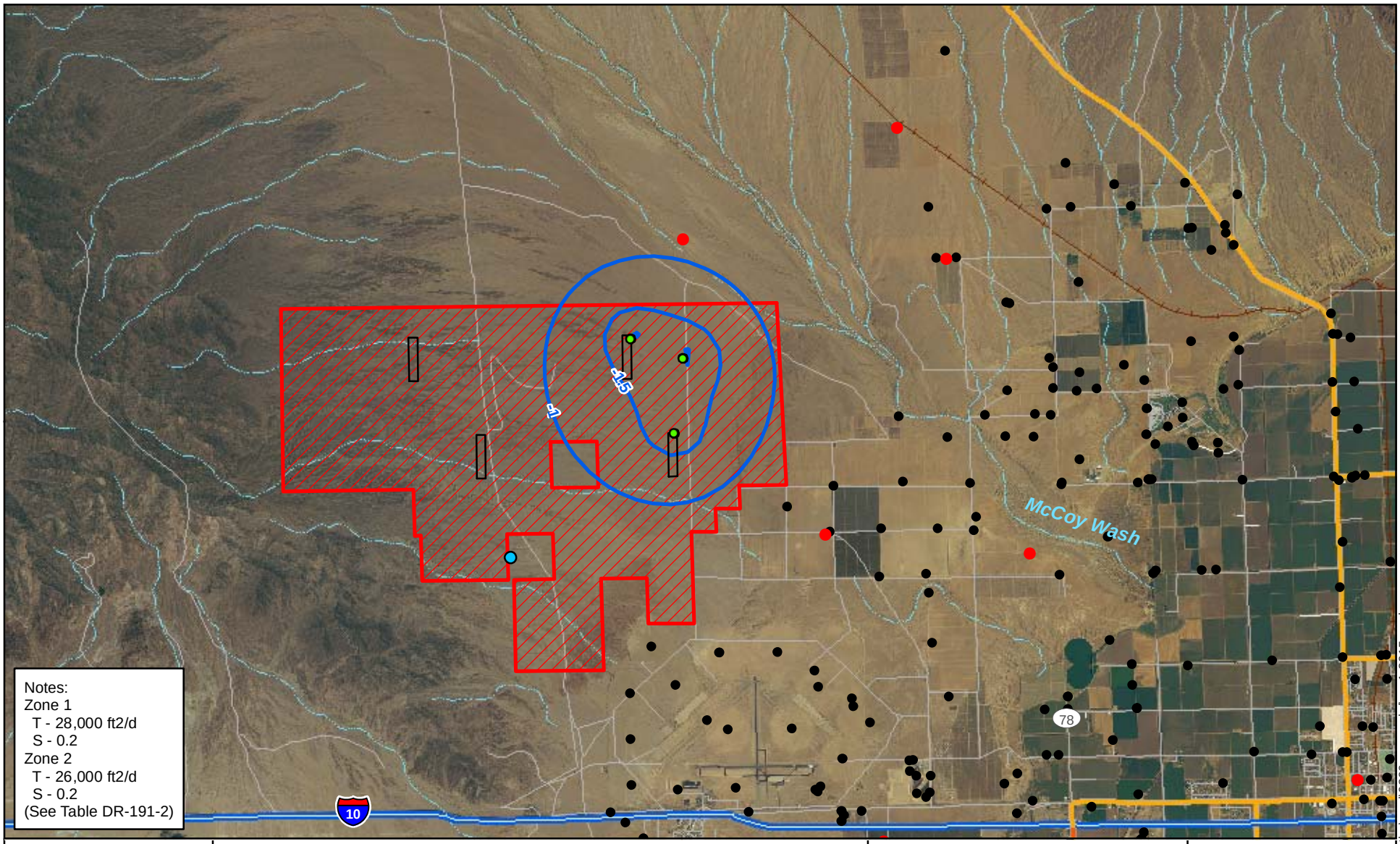


Map Location


**Legend**

- pblocks
- Contours of Drawdown (feet) 5-9-10
- Groundwater Wells Identified as Potentially Active in AFC
- Groundwater Well Location
- Possible Well Location Not Identified in USGS or DWR Database
- Blythe Solar Power Project Right of Way

1 inch = 8,000 feet

0 6,000 12,000 Feet

Data Sources:
Air Photo, NAIP, 2005
Basemap, (Roads, streams, cities), ESRI

**Blythe Solar Power Project**

**Soil and Water**
**Figure 4**
**Groundwater Modeling of Proposed Project Pumping**
**Run 2**
**Year 2015-End of Construction**

**Palo Verde I, LLC**

AECOM

Project: 60139695-6200
Date: May 2010

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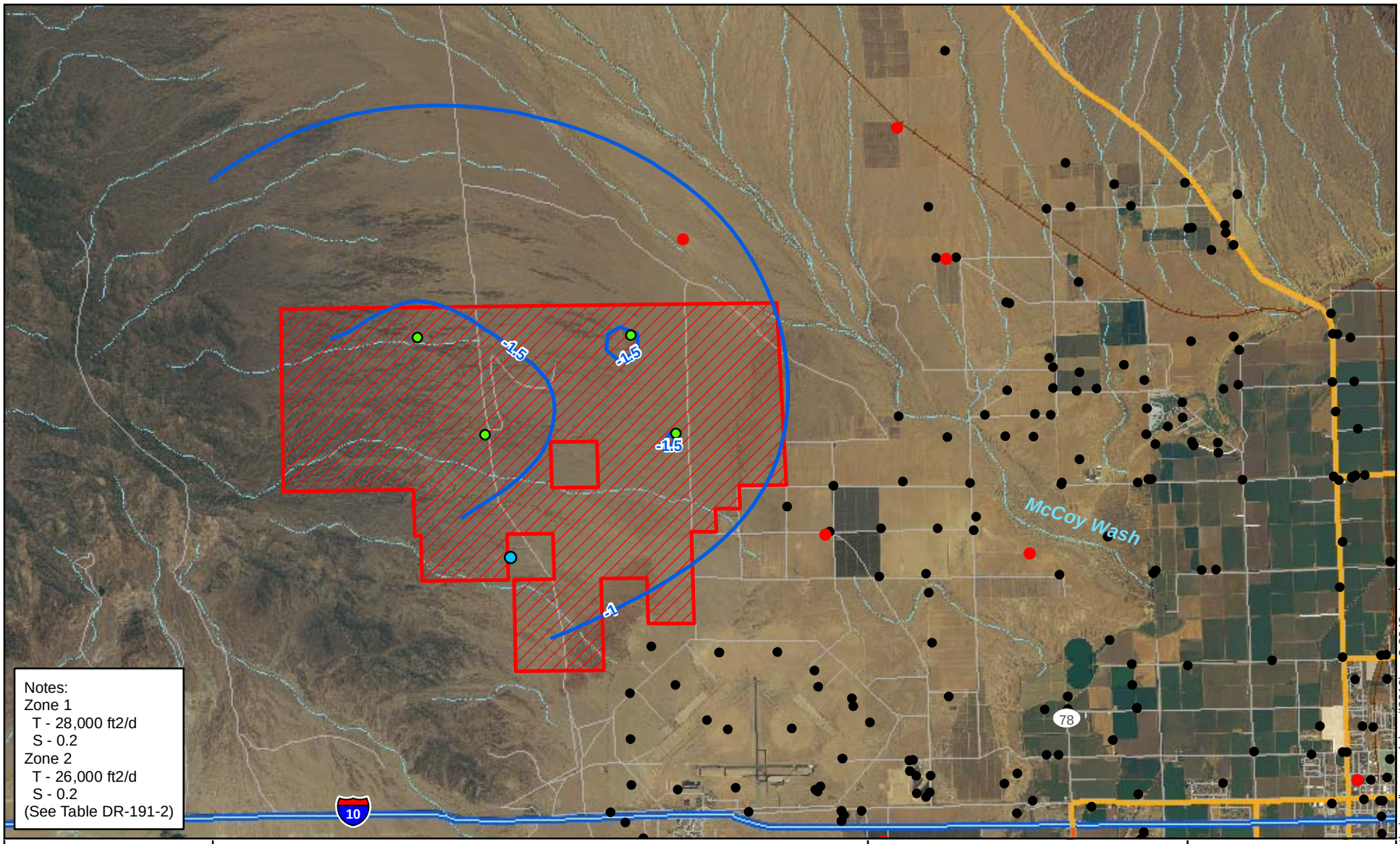


Notes:
Zone 1
T - 28,000 ft2/d
S - 0.2
Zone 2
T - 26,000 ft2/d
S - 0.2
(See Table DR-191-2)

Map Location


**Legend**

- Contours of Drawdown (feet) 5-9-10
- Groundwater Wells Identified as Potentially Active in AFC
- Groundwater Well Location
- Pumping Well
- Possible Well Location Not Identified in USGS or DWR Database
- Blythe Solar Power Project Right of Way

1 inch = 8,000 feet

0 6,000 12,000 Feet

Data Sources:
Air Photo, NAIP, 2005
Basemap, (Roads, streams, cities), ESRI

**Blythe Solar Power Project**

**Soil and Water**
**Figure 5**
**Groundwater Modeling of Proposed Project Pumping Run 2**
**Year 2043-End of Operations**

**Palo Verde I, LLC**

AECOM

Project: 60139695-6200
Date: May 2010

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# APPENDIX A

# GROUNDWATER MODELING FILES – REVISED WELL CONFIGURATION FOR CONSTRUCTION WATER SUPPLY BLYTHE SOLAR POWER PROJECT

**STATE OF CALIFORNIA**
**ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION**

***In the Matter of:***
**APPLICATION FOR CERTIFICATION**
**for the *BLYTHE SOLAR POWER PROJECT***

**Docket No. 09-AFC-6**
**PROOF OF SERVICE**
***(Revised 1/26/2010)***

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## DECLARATION OF SERVICE

I, Carl Lindner, declare that on, May 17, 2010, I served and filed copies of the attached Blythe Solar Power Project Materials:

Numerical Groundwater Modeling: Assessment of impacts from a revision in the well configuration for the proposed construction water supply

The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at:

**[http://www.energy.ca.gov/sitingcases/solar_millennium_blythe]**.

The document has been sent to the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

**(*Check all that Apply*)**

**For service to all other parties:**

__X___ sent electronically to all email addresses on the Proof of Service list;

_____ by personal delivery or by overnight delivery service or depositing in the United States mail at Camarillo, California with postage or fees thereon fully prepaid and addressed as provided on the Proof of Service list above to those addresses **NOT** marked "email preferred."

***AND***

**For filing with the Energy Commission:**

__X_ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (preferred method);

***OR***

_____ depositing in the mail an original and 12 paper copies, along with 13 CDs, as follows:

**CALIFORNIA ENERGY COMMISSION**
Attn: Docket No. 09-AFC-6
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct.