Aquifer Characterization and Groundwater Modeling

Marsh Landing Generating Station

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CEC Workshop - October 14, 2009

Objectives

- Characterize the geologic and hydraulic properties of the aquifer 70’ – 120’ bgs
- Evaluate potential source-water quality
- Evaluate the feasibility of using groundwater
- Investigate the potential impacts of pumping on regional water levels, the San Joaquin River, and areas of known groundwater contamination

Approach

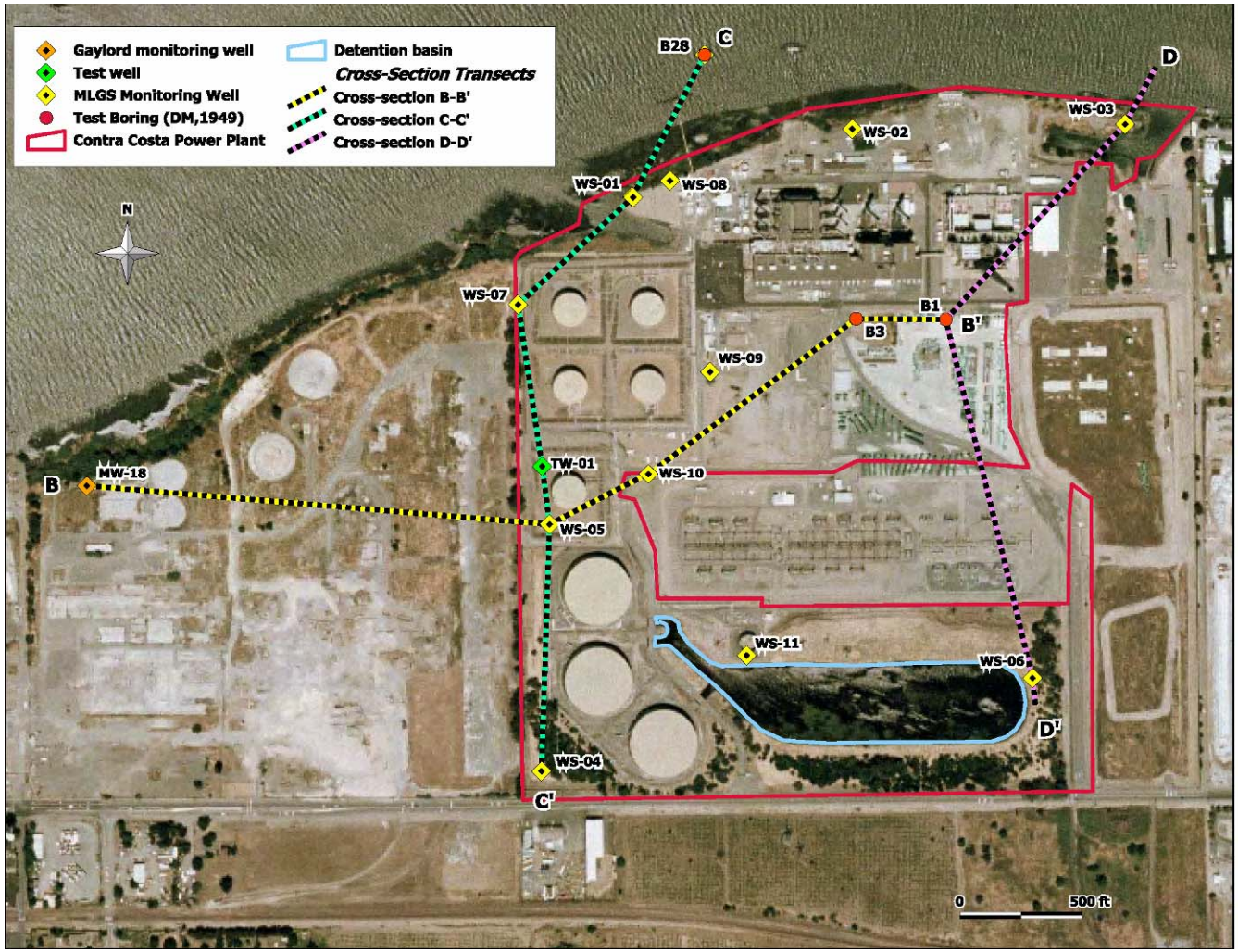
- Field Work
  - Exploratory test drilling
  - Aquifer pumping test
- Analytic Work
  - Hydraulic characterization
  - Groundwater flow modelling

Previous Studies and Available Data

Title	Year	Citation	Description of Information
Foundation Investigation	1949	[DM, 1949]	Borings logs from the site and the river
Foundation Investigation Units 6 & 7	1962	[DM, 1962]	Boring logs
Flatland Deposits of the San Francisco Bay Region, California	1973	[Helley and Lajoie, 1979]	Regional geology
Preliminary Geologic Map Emphasizing Bedrock Formations in Contra Costa County, California	1994	[Graymer et al., 1994]	Geologic description and stratigraphy of Contra Costa County
Final Report on the Isotope Project in the Brentwood Region of East Contra Costa County, California	1995	[Davisson and Campbell, 1995]	Description of groundwater resource for region east of site
Phase I Environmental Site Assessment	1997	[CDM, 1997]	General site description, including geology
Phase II Environmental Site Assessment	1998	[Fluor-Daniel, 1998]	General site description, including geology
Groundwater Study and Water Supply History of the East Bay Plain, Alameda and Contra Costa Counties, CA	1998	[Figuers, 1998]	Regional geology
Future Water Supply Implementation- Draft EIR, CCWD	1998	[CCWD, 1998]	Description of water supply in region east of site
Geology of Contra Costa County	1998	[Helley and Graymer, 1998]	Regional geology
Investigation of Ground-Water Resources in the East Contra Costa Area	1999	[LSCE, 1999a]	Regional description of groundwater resource
Water Master Plan for Discovery Bay	1999	[LSCE, 1999b]	Groundwater info for region east of site
Geotechnical Data Report, CCPP Unit 8	2001	[URS, 2001]	Borings logs
Contra Costa County Watershed Atlas	2003	[CCC, 2003]	Watershed boundaries
Groundwater Study- Emerson and Burroughs Properties, Contra Costa County, California	2005	[Engeo, 2005]	Groundwater study in an Oakley neighborhood
East Contra Costa County Habitat Conservation Plan and and Natural Community Conservation Plan	2006	[Jones and Stokes, 2006]	Watershed boundaries
Diablo Water District Groundwater Management Plan for AB 3030	2007	[LSCE, 2007]	Description of groundwater resource in and around Oakley

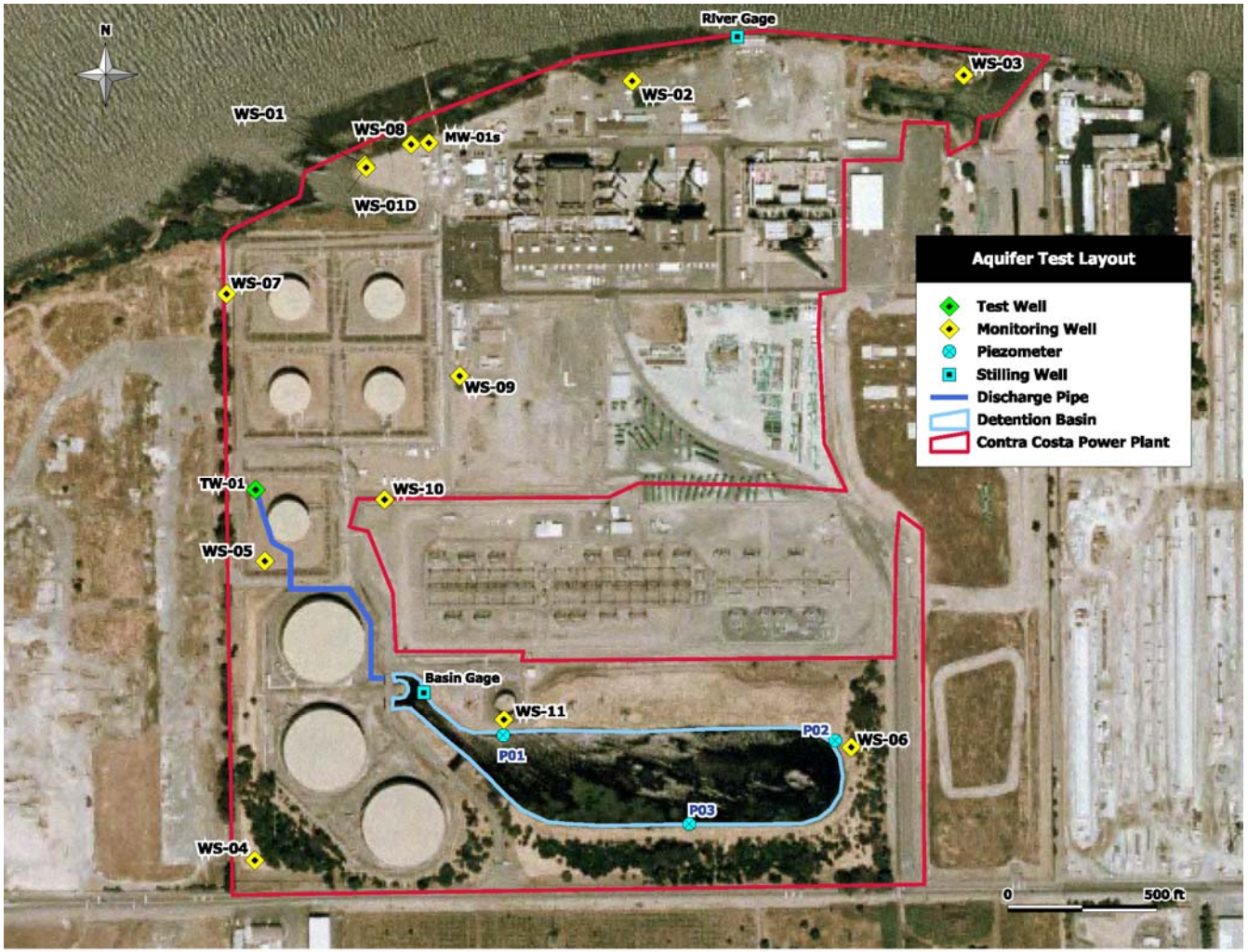
Exploratory Test Drilling

- New borings to describe local conditions
- 11 sonic drilling test borings
  - 10: 105-135 feet bgs
  - 1:195 feet bgs
- 1 standard boring to 640 feet bgs
- Grain-size analysis



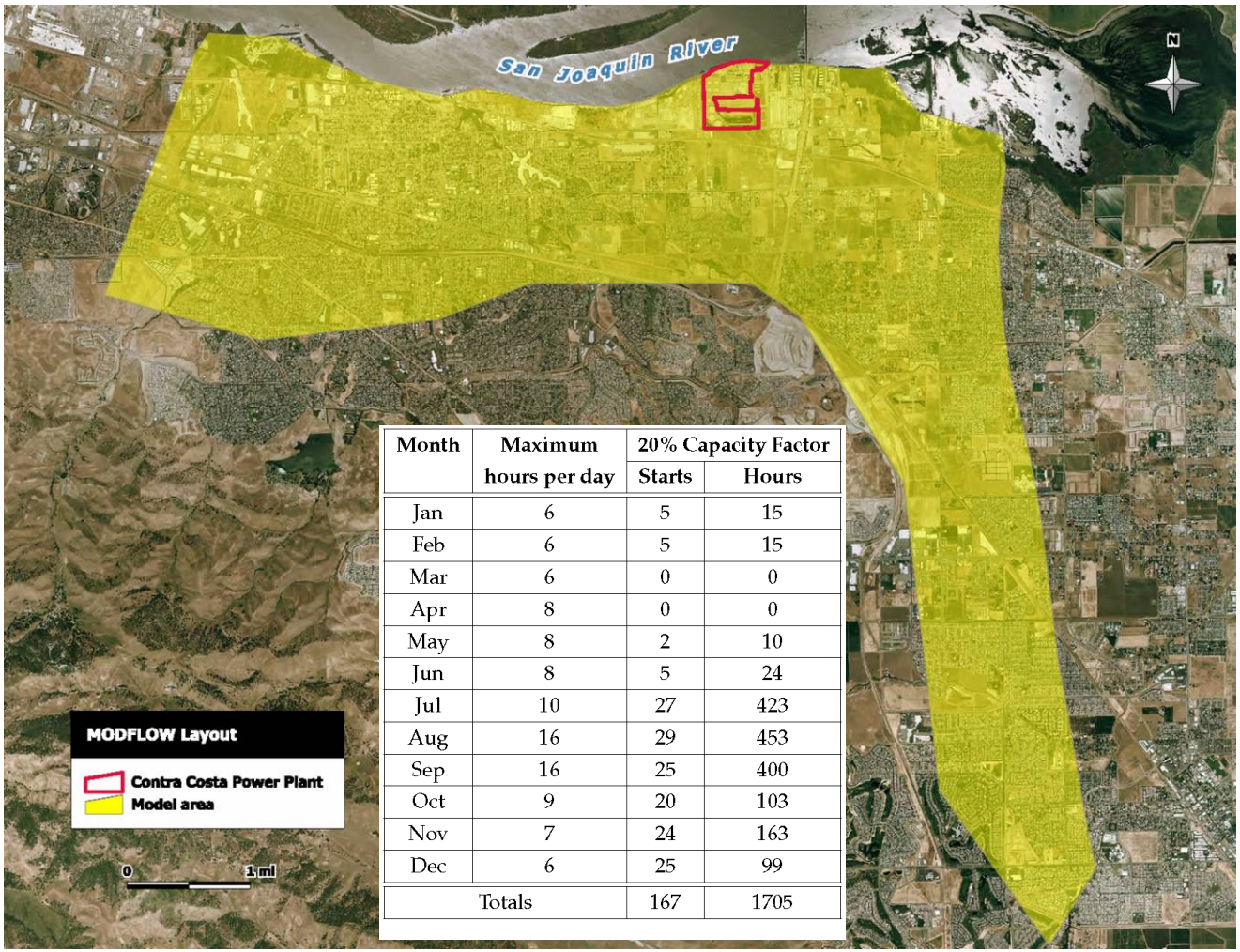
Aquifer Pumping Test

- Test well screened 95-115 ft bgs
- 72-hour constant rate pumping test
- 840 gpm (1.2 mgd)
- 11 monitoring wells
  - 8 at > 105’ bgs
  - 3 at < 25’ bgs



Groundwater Flow Modeling

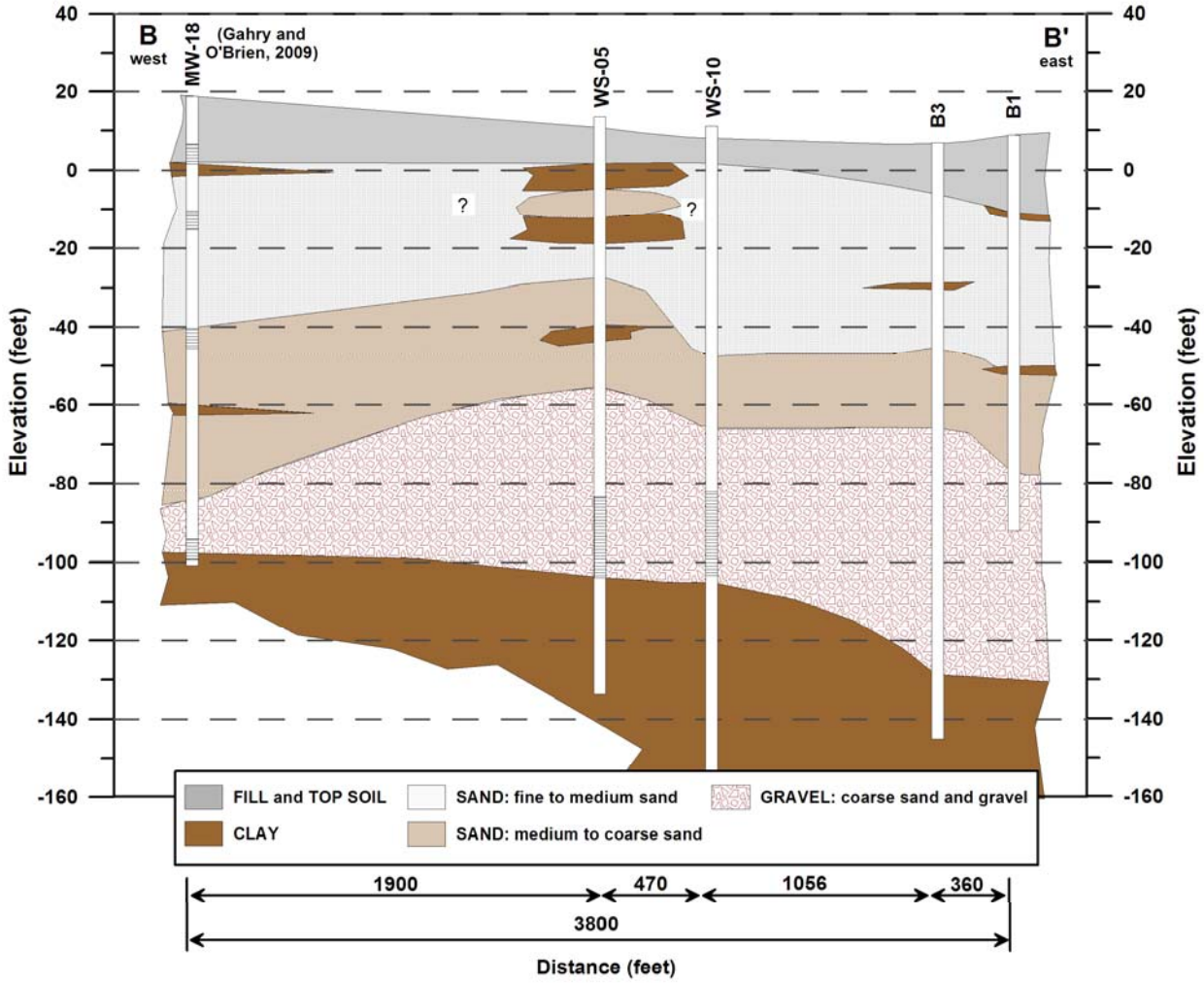
- Flow modeling based on maximum 20% annual capacity factor (<50 AFY)
- Modeling boundaries determined by analysis
- Transient MODFLOW model coupled with MTD3 transport model
- Incorporates planned pumping scheme and seasonal changes in river stage



Month	Maximum hours per day	20% Capacity Factor	
		Starts	Hours
Jan	6	5	15
Feb	6	5	15
Mar	6	0	0
Apr	8	0	0
May	8	2	10
Jun	8	5	24
Jul	10	27	423
Aug	16	29	453
Sep	16	25	400
Oct	9	20	103
Nov	7	24	163
Dec	6	25	99
Totals		167	1705

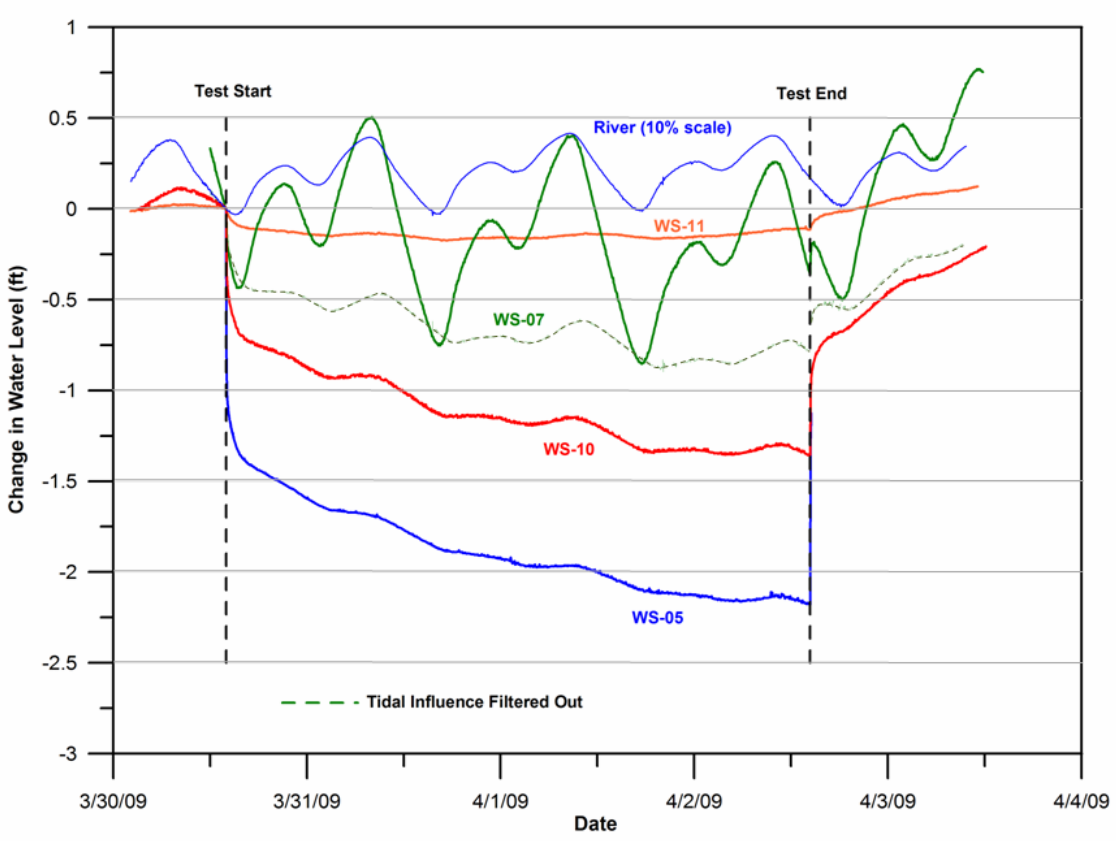
Geologic Conclusions

- Continuous zone of permeable deposits present across site, coarsening with depth to about 125 feet bgs
- Locally, no permeable deposits encountered in deep boring between 120 - 640 feet bgs



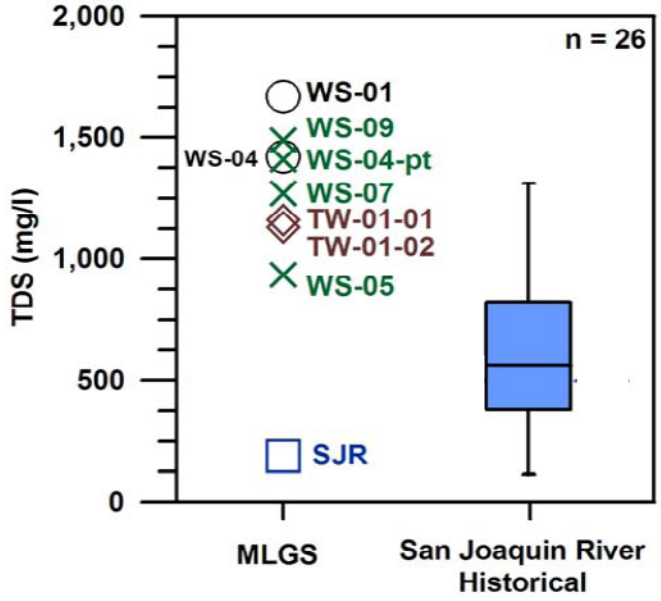
Hydraulic Conclusions

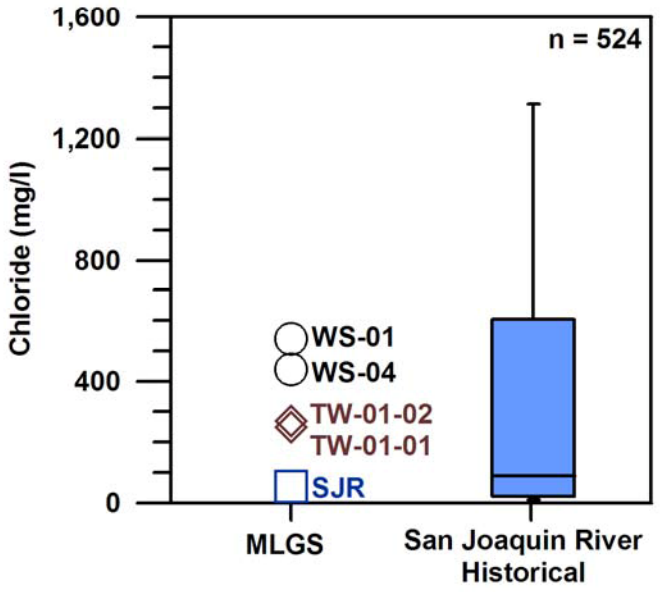
- Estimated transmissivity of shallow sand and gravel formation is 140,000-160,000 gpd/ft (highly productive).
- Sand and gravel formation under site capable of producing well in excess of anticipated demands.



Water Quality Conclusions

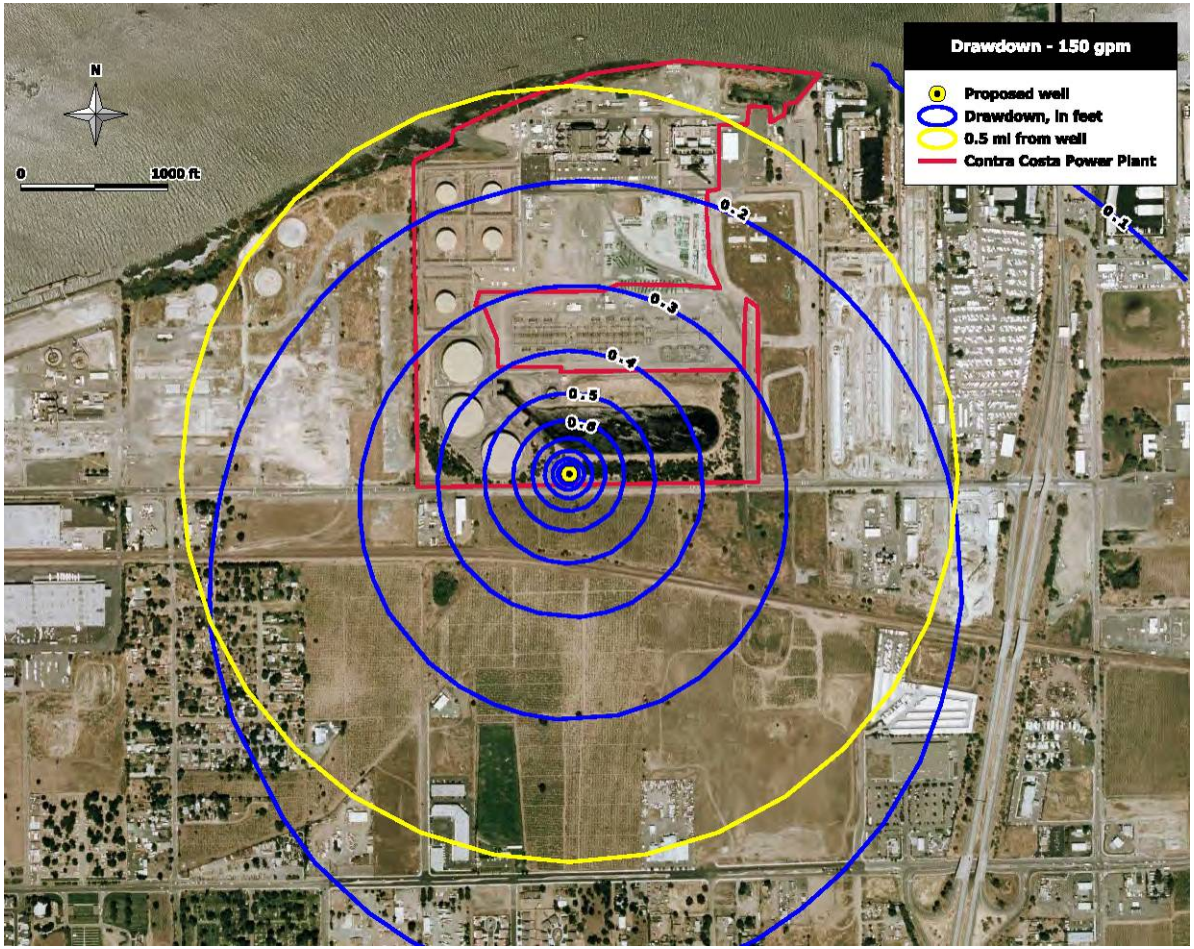
- Proposed aquifer is not potable groundwater
- Proposed aquifer meets CEC definition for brackish water
  - TDS: 1,000-30,000 mg/l
  - Chloride: 250-12,000 mg/l
- Proposed aquifer exceeds secondary drinking water standards for TDS, chloride, iron, manganese, aluminum, and sulfate





Pumping Conclusions

- Approximate 3 inch drawdown expected at ½-mile radius
- Source of water is inland groundwater with no water from the San Joaquin River
- Known groundwater plumes not expected to reach proposed well during operational life of project (30 years)



Note: contours shown above at peak seasonal pumping rate

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
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1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION FOR THE MARSH LANDING *GENERATING STATION*

Docket No. 08-AFC-3

PROOF OF SERVICE
(Revised 5/22/2009)

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* indicates change

DECLARATION OF SERVICE

I, Mineka Foggie, declare that on October 20, 2009, I served and filed copies of the attached Aquifer Characterization and Groundwater Modeling for the Marsh Landing Generating Station Project (08-AFC-3) October 14, 2009 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/marshlanding/index.html]**. The document has been sent to both 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:

(C*heck all that Apply*)

For service to all other parties:

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

__✓__ by personal delivery or by depositing in the United States mail at Sacramento, CA with first-class postage 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:

__✓__ 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, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-3
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.

Originally Signed By
Mineka Foggie