Borrego Water District Board of Directors
Regular Meeting
June 28, 2017 @ 9:00 a.m.
806 Palm Canyon Drive
Borrego Springs, CA 92004

I. OPENING PROCEDURES

A. Call to Order
B. Pledge of Allegiance
C. Roll Call
D. Approval of Agenda
E. Approval of Minutes
1. May 16, 2018 Special Board Meeting Minutes (3-6)
2. May 24, 2017 Regular Board Meeting Minutes (7-10)

F. Comments from the Public and Requests for Future Agenda Items (limited to 3 min.)
1. AT&T Cellular Tower Lease Request near Rams Hill tank – G Poole

G. Comments from Directors

II. ITEMS FOR BOARD CONSIDERATION AND POSSIBLE ACTION

A. Presentation and discussion of Dudek Draft Working Technical Memorandum "Borrego Springs Sub Basin Groundwater Quality Risk Assessment" – T Driscoll, Dudek (11-54)
B. Discussion of Prop 1 grant applications – G Poole (55-56)
C. Authorize staff to enter into contract with David Dale for completion of the Plans and Specifications on Prop One Grant Applications – G Poole (57)
D. Interim funding of Groundwater Sustainability Plan Facilitation by Center for Collaborative Policy (CCP) – G Poole (58)
E. SGMA-related land use economic considerations proposal from Le Sar Development Consultants – L Brecht (59)

III. AD-HOC COMMITTEES (60)

A. Executive– Hart & Brecht\
B. Finance – Brecht & Tatusko
C. Operations and Infrastructure –Delahay & Tatusko
D. Personnel –Hart & Ehrlich
E. Public Outreach –Delahay & Ehrlich
F. Bond –Brecht & Ehrlich
G. Risk Management –Tatusko & Ehrlich
H. Legal Counsel – Brecht and Ehrlich

IV. STAFF REPORTS

A. Financial Reports – May 2017 (61-71)
B. Water and Wastewater Operations Report – May 2017 (72-73)
C. Water Production/Use Records – May 2017 (74-75)

D. General Manager

V. INFORMATIONAL ITEMS

A. Setting the Proper Reduction Period for SGMA Compliance – L. Brecht SGWP Draft Presentation – L Brecht (76-82)

B. Economics of Sustainable Water Supply – L. Brecht (83-88)

VI. CLOSED SESSION – Personnel

C. Public Employee Performance Evaluation (Government Code § 54957) - Title: General Manager

VII. CLOSING PROCEDURE

A. Suggested Items for Next/Future Agenda

B. The next Meeting of the Board of Directors is scheduled for July 18, 2017 at the Borrego Water District

Borrego Water District

MINUTES

Special Meeting of the Board of Directors
Tuesday, May 16, 2017
9:00 AM
806 Palm Canyon Drive
Borrego Springs, CA 92004

I. OPENING PROCEDURES

A. Call to Order: President Hart called the meeting to order at 9:00 a.m.

B. Pledge of Allegiance: Those present stood for the Pledge of Allegiance.

C. Roll Call: Directors: Present: President Hart, Vice-President Brecht (via teleconference, Items I and II.A, B and C only), Secretary/Treasurer Tatusko, Delahay, Ehrlich

Staff: Geoff Poole, General Manager
Greg Holloway, Operations Manager
Kim Pitman, Administration Manager
David Dale, District Engineer
Wendy Quinn, Recording Secretary

Public: Susan Percival, Club Circle East HOA
Debbie Riley, T2/Rams Hill (via teleconference)
Dave Duncan
Becky Holeman, T2/Rams Hill (via teleconference)
Warren Diven, Best, Best and Krieger

D. Approval of Agenda: ***MSC: Delahay/Tatusko approving the Agenda as written.***

E. Comments from Directors: Director Brecht announced that he would participate in the meeting only through the action on the CFD bonds.

F. Comments from the Public and Requests for Future Agenda Items: None

II. ITEMS FOR BOARD CONSIDERATION AND POSSIBLE ACTION

A. Consideration of the Approval of the Borrego Water District Debt Management Policies: Warren Diven explained that while SB 1029 does not mandate a debt management policy, the California Debt Advisory Commission must be notified if debt is incurred. It is appropriate to adopt the policy in conjunction with the CFD bonds. The Bond Committee and Geoff Poole will be responsible for ensuring compliance, and Mr. Poole will be primarily responsible for ensuring disclosure compliance. However, since the bonds under consideration today will be sold privately, there are no disclosure requirements. Upon approval, the next disclosure to be made on the Internet will be an announcement that the 2007 bonds have been extinguished. Mr. Diven will work with Taussig and Associates to ensure this happens. The District will be responsible for ensuring the new taxes are included on the tax roll.

Mr. Diven recommended that the Board retain the services of a Municipal Advisor to assist in developing a long-range debt financing plan and to review the Debt Management Policies to make sure his or her recommendations are consistent with it.

MSC: Delahay/Ehrlich approving the Debt Management Policies, including exhibits.

B. Resolution 2017-05-11 of the Board of Directors of the Borrego Water District, acting in its capacity as the Legislative Body of Community Facilities District No. 2007-1 (Montesoro) of the Borrego Water District, authorizing the issuance of the Community Facilities District No. 2007-1 (Montesoro) of the Borrego Water District Special Tax Refunding Bonds, Series 2017A in an aggregate principal amount not to exceed $1,100,000 for the purpose of defeasance and refunding a portion of the Series 2007 Special Tax Bonds of such community facilities district; approving the form of a Fiscal Agent Agreement and authorizing the direct sale of the Bonds to Considine Family Foundation and approving other related documents and actions: Mr. Diven summarized the proposed resolution, including the approval of a fiscal agent agreement between CFD 2007-1 and US Bank. The resolution established terms and conditions for issuing additional bonds and the levy of special taxes on 66 individually owned parcels and 21 owned by T2/Borrego. Obligations and terms will not change, and the 2007-1 bonds will be extinguished. The 2017A bonds will expire in 2032. ***MSC: Delahay/Ehrlich adopting Resolution 2017-05-11 of the Board of Directors of the Borrego Water District, acting in its capacity as the Legislative Body of Community Facilities District No. 2007-1 (Montesoro) of the Borrego Water District, authorizing the issuance of the Community Facilities District No. 2007-1 (Montesoro) of the Borrego Water District Special Tax Refunding Bonds, Series 2017A in an aggregate principal amount not to exceed $1,100,000 for the purpose of defeasance and refunding a portion of the Series 2007 Special Tax Bonds of such community facilities district; approving the form of a Fiscal Agent Agreement and authorizing the direct sale of the Bonds to Considine Family Foundation and approving other related documents and actions. The motion carried by roll call vote, with Director Tatusko abstaining and all other Directors voting aye.***

C. Resolution 2017-05-12 of the Board of Directors of the Borrego Water District, acting in its capacity as the Legislative Body of Borrego Water District Community Facilities District No. 2017-1, authorizing the issuance of the Borrego Water District Community Facilities District No. 2017-1 Special Tax Bonds, Series 2017B in an aggregate principal amount not to exceed $10,500,000, and the payment and discharge of a portion of the Community Facilities District No. 2017-1 (Montesoro) of Borrego Springs Series 2007 Special Tax Bonds, approving the form of a Fiscal Agent Agreement and authorizing the direct sale of the bonds to Considine Family Foundation and approving other related documents and actions: Mr. Diven summarized the proposed resolution, authorizing the levy of special taxes on the remaining Rams Hill property (not including the 76 parcels covered by the previous resolution). A fiscal agent agreement similar to the previous one was included. ***MSC: Delahay/Ehrlich adopting Resolution 2017-05-12 of the Board of Directors of the Borrego Water District, acting in its capacity as the Legislative Body of Borrego Water District Community Facilities District No. 2017-1, authorizing the issuance of the Borrego Water District Community Facilities District No. 2017-1 Special Tax Bonds, Series 2017B in an aggregate principal amount not to exceed $10,500,000, and the payment and discharge of a portion of the Community Facilities District No. 2017-1 (Montesoro) of Borrego Springs Series 2007 Special Tax Bonds, approving the form of a Fiscal Agent Agreement and authorizing the direct sale of the Bonds to Considine Family Foundation and approving other related documents and actions. The motion carried by roll call vote, with Director Tatusko abstaining and all other Directors voting aye.***

D. Presentation and Discussion of Draft FY 2017-18 Budget: Kim Pitman summarized the draft budget and proposed rate adjustments. The maximum increase was contemplated, six percent for water and four for sewer. The maintenance budget for the wastewater treatment plant was increased due to infrastructure requirements. Geoff Poole noted that some expenses may be covered by grant funding. Director Ehrlich requested the addition of $35,000 for a municipal advisor.

Ms. Pitman reported that the District has a new employee, Alan Asche. He will supervise the crew and is working toward his wastewater certification. JC Labs will continue to oversee the treatment plant until Roy Martinez takes his certification test. Funds have been included in the budget for a new entry level employee, should the need arise. Director Ehrlich recommended adopting a staffing resolution, and Ms. Pitman and Mr. Poole agreed to work on it. Director Tatusko suggested that if a new employee is hired, staff look for someone with computer skills who could help Greg Holloway in the office.

Director Ehrlich questioned the inclusion of sewer in the groundwater management budget, and Ms. Pitman agreed to remove it. Discussion followed regarding the CIP projects, and the possible Proposition 1 grant funding for some. Mr. Holloway pointed out that replacement of the twin tanks, the Wilcox diesel motor and the Indianhead Reservoir need to be done regardless of whether the grant is approved. Mr. Poole observed that the likelihood of a grant looks promising, but if it doesn't come through he will work with staff to resolve the problems with these facilities. Director Tatusko reported that Dudek had been requested to work on the engineering for odor control at La Casa Del Zorro. Mr. Holloway summarized the proposed budget for wells, booster stations, reservoirs and associated transmission mains, as well as the wastewater treatment facilities. Ms. Pitman announced that the budget and rate adjustments would be presented to the Board at its next meeting for approval.

E. Acceptance of BWD Wastewater Plant Tertiary Assessment Proposal: Mr. Poole explained that in order to prove to the State that tertiary treatment is not feasible at this time, this study is necessary. Dudek has submitted a proposal to do the work for $71,000. David Dale has reviewed two proposals and determined both to be responsive. Based on the lower cost and experience, staff and the Operations and Infrastructure Committee recommend Dudek. ***MSC: Ehrlich/Tatusko accepting the Dudek proposal and authorizing staff to work with the Operations and Infrastructure Committee and Legal Counsel to create the necessary contract documents.***

F. Acceptance of Flood Control Engineering Assessment at CFD 2007 & 2017: Mr. Poole explained that during the CFD refinancing process and review of the dedicated assets, the flood control system was identified as the biggest asset. BWD is responsible for maintaining it, and Director Brecht was concerned about its design criteria and current condition. Dudek has submitted a proposal to perform an assessment for $8,300. Mr. Holloway reported that staff inspects the facilities annually and performs repairs as needed. The facilities are in satisfactory condition. Discussion followed regarding the optional geotechnical evaluation in Dudek's proposal for an additional $25,000. The Board agreed to proceed with the basic assessment and address the geotechnical evaluation later. ***MSC: Ehrlich/Delahay accepting Dudek's basic proposal, provided that the General Manager will bring any additional proposed work back to the Board for approval.***

G. Replacement of BWD Ratepayer Representative on the Borrego Valley Groundwater Sustainability Plan Advisory Committee: Mr. Poole announced that Richard Dopp had submitted his letter of resignation as the BWD ratepayer representative on the GSP Advisory Committee. He requested direction from the Board regarding selection of a replacement. Director Ehrlich recommended using the original process whereby Mr. Dopp was appointed. Mr. Poole agreed to ask Michael Sadler to include an announcement in his next BWD article in the *Borrego Sun.* He noted that Ray Schindler and Dave Duncan had already expressed interest. Directors Ehrlich and Tatusko volunteered to serve on the selection committee, working with Mr. Poole.

III. INFORMATIONAL ITEMS

A. BWD Board Agenda Development Schedule: Mr. Poole requested submittal of Agenda material by the Wednesday before each Board meeting, so the draft can be distributed for comment on Thursday and the final version published on Friday.

B. Borrego Springs Library/Sheriff's Station and Park Update: Director Tatusko reported that he, Mr. Poole, Mr. Holloway and Martha Deichler met with the builders, architect and landscape architect for the new library, Sheriff's station and park. He recommended that at its next meeting, the Board consider authorizing the expenditure of up to $3,000 to bus students to the project site and provide materials. BWD representatives can talk to them about conservation and the facility planners can hear their input on the new complex. Discussion followed regarding possible assistance from Supervisor Horn and/or the School District with funding. Director Tatusko will contact them.

C. Demand Reduction Project: Swimming Pool Treatment: Director Tatusko invited the Board's attention to information in the Board package concerning a process for cleaning swimming pools without draining them, brought up last month by President Hart. There are companies in the area that perform this service. Discussion followed, concerning the possibility of distributing this information to local pool cleaning services, issues of high cost and brine disposal, and the possibility of offering rebates to customers who use this water-saving procedure.

D. BWD Event/Planning Calendar: The Event/Planning Calendar was included in the Board package.

IV. CLOSING PROCEDURE

A. Suggested Items for Next/Future Agenda: Items for the next or a future agenda will include the second reading of the Ordinance authorizing the levy of special taxes in CFD 2017-1, approval of the budget, discussion of the Santiago Estates Community Services District fee, possible change in legal counsel (Mr. Poole and Director Ehrlich to discuss this further), recommendation for retention of a Municipal Advisor, GSP information, report from the ACWA/JPIA conference, a solar project update, and a closed session to evaluate the General Manager's performance.

B. The next Meeting of the Board of Directors is scheduled for May 24, 2017 at 9:00 a.m. at the Borrego Water District Office, 806 Palm Canyon Dr., Borrego Springs, CA 92004: There being no further business, the Board adjourned at 11:25 a.m.

Borrego Water District
MINUTES
Regular Meeting of the Board of Directors
Wednesday, May 24, 2017
9:00 AM
806 Palm Canyon Drive
Borrego Springs, CA 92004

II. OPENING PROCEDURES

A. Call to Order: President Hart called the meeting to order at 9:00 a.m.

B. Pledge of Allegiance: Those present stood for the Pledge of Allegiance.

C. Roll Call:

Directors:	Present:	President Hart, Secretary/Treasurer Tatusko, Delahay, Ehrlich	
	Absent:	Vice-President Brecht	
Staff:	Geoff Poole, General Manager		
	Kim Pitman, Administration Manager		
	Greg Holloway, Operations Manager		
	Wendy Quinn, Recording Secretary		
Public:	Dick Walker	Susan Percival, Club Circle East HOA	
	Ray Schindler		

D. Approval of Agenda: ***MSC: Ehrlich/Tatusko approving the Agenda as written.*** **E.** Approval of Minutes:

1. April 18, 2017 Special Board Meeting Minutes

MSC: Ehrlich/Tatusko approving the Minutes of the Special Meeting of April 18, 2017 as written.

2. April 26, 2017 Regular Board Meeting Minutes

MSC: Ehrlich/Tatusko approving the Minutes of the Regular Meeting of April 26, 2017 as written.

F. Comments from the Public and Requests for Future Agenda Items: None

G. Comments from Directors: Some Board members were having difficulty accessing the Board package page numbers on their new tablets. Geoff Poole will work with them to resolve this.

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II. ITEMS FOR BOARD CONSIDERATION AND POSSIBLE ACTION

A. Adoption of Ordinance Authorizing the Levy of Special Taxes within Community Facilities District No. 2017-1: ***MSC: Ehrlich/Tatusko waiving the second reading of Ordinance No. 17-01 and adopting Ordinance of the Board of Directors of the Borrego Water District, Acting as the Legislative Body of Borrego Water District Community Facilities District No. 2017-1, Authorizing the Levy of a Special Tax in Such Community Facilities District. The motion carried by roll call vote with all Directors present voting aye.***

B. Selection of Municipal Advisor and Authorize Agreement for Services: Director Ehrlich reported that he and Director Brecht had contacted four municipal advisors, received responses from all and interviewed two. Director Ehrlich had worked with Fieldman, Rolapp and Associates previously and proposed to retain them to analyze the District's needs and help to develop a financing strategy, for a price not to exceed $26,000. Both firms interviewed were qualified, but the other submitted a higher bid. The Fieldman firm will work with Raftelis as necessary, and has worked with them before, and also with bond counsel Warren Diven. ***MSC: Ehrlich/Tatusko selecting Fieldman, Rolapp and Associates as municipal advisors and authorizing preparation of a contract not to exceed $26,000.*** Director Ehrlich and Mr. Poole will draft the contract.

C. Borrego Basin Groundwater Sustainability Plan Update: Mr. Poole reported on the third meeting of the GSP Advisory Committee, May 15. The attendance was good. The AC discussed its Bylaws and hopes to adopt them at the next meeting, June 29. It is anticipated that the meetings will continue to be held on the fourth Thursday of each month. The Committee also discussed communication with constituent groups, and Suzanne Lawrence reported on her group, the Stewardship Council. President Hart added that facilitator Meagan Wylie prepared an outline for meeting preparation scheduling pursuant to the Brown Act. Although the Act doesn't require that the complete agenda package be published prior to the meeting, only the cover page, the Committee elected to follow BWD's procedure and publish the entire package to the extent possible. Handouts at the meeting which are not published in advance will be included in the next agenda package. Although AC agendas are posted on the County website, President Hart requested that they be posted on the BWD website as well.

Also in the AC meeting, Rebecca Falk reported on the new herb farm and wondered about regulations governing expansion of an existing agricultural parcel. Although not consistent with SGMA, it is still legal. Bill Berkley spoke about future plans for Rams Hill, and further information will be included on the next AC agenda. Trey Driscoll made a presentation regarding the GSP, and whether the existing inflow/outflow data from the USGS study are appropriate. This will be discussed further at the next AC meeting, and will probably be the Committee's first major task. Ray Schindler referred to the discussion of water credits, and the fact that the contract for water credit sales indemnifies the seller in the event the value declines. Mr. Poole expressed concern regarding the estimated cost of farmland in Mr. Driscoll's presentation, believing it to be too high.

D. School District Student Focus Group for Water and Power Conservation in the Design of the new Library, Park and Sheriff Station: Director Tatusko reported that the recent focus group meetings regarding the new library, park and sheriff station had been attended primarily by adults. He pointed out that the new facilities will be testaments to water and power conservation, and the library and park will be important resources for local students. He recommended in order to provide students' input to the design team, BWD provide up to $3,000 for bussing, supervising and coordination with the Boys and Girls Club so that teachers and students may attend the final pubic meeting in the morning and other adults could attend later the same day. He has spoken to Martha Deichler about the proposal, as well as the builder, architect and landscape architect. It was well received by the County. Director Tatusko will continue to follow through with the project. ***MSC: Tatusko/Ehrlich approving the student focus group proposal in concept, with the details to be worked out.*** Mr. Holloway pointed out that three meetings on the project had been held at the high school for students, and he recommended any future sessions be also held at the school. He objected to bussing students and paying for their lunch. President Hart noted that if both elementary and high school students were to be included, some would have to be bussed. Director Tatusko will discuss these issues with Ms. Deichler.

E. ACWA/JPIA Conference Summary: Director Ehrlich reported on his attendance at the recent ACWA/JPIA conference. JPIA is trying to keep insurance costs down, but they may go up five percent. There is a new rate for GSAs, but current ACWA members get a half price rate. Director Ehrlich reported that some ACWA members are offering lower water rates to low income customers. Justification is required, and there is a legislative bill pending to set up a process. Mr. Poole will follow up on the GSA insurance. President Hart asked Mr. Poole to present a status report on the statewide water bond measure at the next meeting.

F. Approval of FY 2017-18 Budget and Resolution Adopting New Water & Sewer Rates and Charges to be Effective July 1, 2017: Kim Pitman invited the Board's attention to the updated budget letter and organizational chart. After learning that Ramona Water District uses an organizational chart to accompany its budget rather than a staffing resolution, she opted to do the same. Mr. Poole also wrote a letter to accompany the budget package. The operations and maintenance reserves were increased from three months' worth to four months. ***MSC: Ehrlich/Tatusko adopting Resolution No. 2017-05-02, Resolution of the Board of Directors of the Borrego Water District Establishing Water and Sewer Service Rates for FY 2017-2018; and Resolution No. 2017-05-01, Resolution of the Board of Directors of the Borrego Water District Approving the Operations, Maintenance, Capital Improvements and Groundwater Management Budgets and Board Designated Reserves Fund Policy for Fiscal Year 2017-2018.***

III. AD-HOC BOARD COMMITTEES

A. Executive: President Hart reported that the Committee had been working with the AC and the County.

B. Finance: Director Tatusko reported that the Committee would review the annual audit soon. Ms. Pitman reported that the auditors would be visiting the District on June 30 to audit the inventory, followed by a fiscal audit the week of August 7. She hoped to bring it before the Board in September.

C. Operations and Infrastructure: Director Delahay reported that the Committee had been working on the budget.

D. Personnel: Deferred to closed session.

E. Public Outreach: Director Delahay reported that the farmers' market was closed for the summer.

F. Legislative: Director Ehrlich reported that the Committee had been working with Mr. Poole on the bond refunding.

G. Risk Management: Mr. Poole suggested that the Committee meet with Mr. Holloway and him. Mr. Holloway pointed out that it is important to update Windows whenever available. Ms. Pitman reported that a District Home Depot charge card issued to a former employee had been used without authorization. Staff will update the list of authorized signers on all credit cards.

H. BWD Groundwater Sustainability Plan Advisory Committee Nomination: Director Tatusko reported that the Committee met this morning to review the application package. The ad will appear in the *Borrego Sun* on June 1, the Committee will make a selection on June 14 and the nominee will be presented to the Board for approval on June 20. Mr. Poole will contact those who applied for the position in the past.

IV. STAFF REPORTS

A. Financial Reports – April 2017: Ms. Pitman explained that the personnel expense had increased due to vacation and sick leave payout upon the resignation of Troy Depriest. New line items had been added for solar expenses, and the last payment will be made in May. The final payment has been made to Spring Brook for the computer upgrade. The District will now pay only for annual maintenance, beginning July 1.

Ms. Pitman reported that the District had received a $14,000 rebate from JPIA due to their safety record. President Hart will work with Mr. Poole on a recommendation to the Board concerning distribution of these funds, which have been divided among staff members in the past.

B. Water and Wastewater Operations Report – April 2017: Mr. Poole explained that the wastewater backflow levels were high due to problems with the meter. It has been recalibrated and the readings are declining.

C. Water Production/Use Records – April 2017: The Water Production/Use Records were included in the Board package.

D. General Manager: Mr. Poole reported he had been interviewed by a local news station. It should air in the next couple of weeks, and he will let the Board know when. He also met with Ms. Deichler regarding lead testing at the schools. Mr. Poole explained that decisions are being made regarding repair versus replacement of reservoirs for the Proposition 1 applications, and plans and specifications are required. David Dale may be asked to help. Mr. Poole reported that he and Mr. Schindler were meeting with the owner of the new herb farm after today's meeting. He is awaiting San Diego Gas and Electric's inspection of the new solar facilities.

V. ATTORNEY'S REPORT

None

VI. CLOSED SESSION – Personnel

A. Public Employee Performance Evaluation (Government Code §54957); Title: General Manager: The Board adjourned to closed session at 10:30 a.m., and the open session reconvened at 11:15 a.m. There was no reportable action.

VII. CLOSING PROCEDURE

A. Suggested Items for Next Agenda: These were covered during previous discussions.

B. The next Meeting of the Board of Directors is scheduled for June 20, 2017 at the Borrego Water District. There being no further busines

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL II.A

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Presentation and discussion of Dudek Draft Working Technical Memorandum "Borrego Springs Sub basin Groundwater Quality Risk Assessment" – T Driscoll, Dudek

RECOMMENDED ACTION:

Receive report from Trey Driscoll and direct staff accordingly

ITEM EXPLANATION:

Dudek has completed an assessment of groundwater quality risks and will present it to the Board at the meeting.

ATTACHMENTS:

Borrego Springs Sub Basin Groundwater Quality Risk Assessment

DUDEK

MAIN OFFICE
605 THIRD STREET
ENCINITAS, CALIFORNIA 92024
T 760.942.5147 T 800.450.1818 F 760.632.0164

DRAFT WORKING TECHNICAL MEMORANDUM

To:	Geoff Poole, General Manager, Borrego Water District
From:	Trey Driscoll, PG, CHG; Dan Ritter, PhD; and Jill Weinberger, PG, PhD
Subject:	Borrego Springs Subbasin Groundwater Quality Risk Assessment
Date:	June 16, 2017
cc:	Jim Bennett, Leanne Crow, County of San Diego
Attachment(s):	Figures 1–14

EXECUTIVE SUMMARY

The Borrego Springs Groundwater Subbasin of the Borrego Valley Groundwater Basin (BVGB) has been determined to be in "overdraft."[1, 2] Recent studies estimate that water users within the Borrego Springs Groundwater Subbasin of the BVGB currently withdraw approximately 19,000 acre-feet per year (AFY) and that the "sustainable yield" of the Borrego Springs Groundwater Subbasin is 5,700 AFY. Thus, the current estimated "overdraft" rate is 13,300 AFY. The State Groundwater Sustainability Plan mandates that the BVGB attain a long-term withdrawal rate less than or equal to the sustainable yield by the end of the prescribed 20-year water reduction period, in this case by the year 2040.[3]

This Technical Memorandum has been prepared to assess the potential risk associated with temporal changes in groundwater quality that may result in exceedances of California drinking water maximum contaminant levels (MCLs) in Borrego Water District (BWD) production wells due to the long-standing critical overdraft. Thus, it assesses current and historical groundwater quality data and the inter-relationship between groundwater levels and groundwater quality. Here, based on our current understanding of groundwater quality conditions, the main constituents of concern (COCs) are arsenic, nitrate, sulfate, fluoride, total dissolved solids (TDS), and radionuclides. Of primary concern is the potential for water quality degradation and the relative risk that the groundwater supply will not meet MCLs.

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1 The overdraft of the BVGB was definitively established by the U.S. Geological Survey (USGS) work conducted in 1982 for San Diego County. Since 1982, the overdraft has more than doubled. See http://www.borregowd.org/uploads/BWD_Report_USGS_1982.pdf.

2 The Department of Water Resources approved BWD's request for a scientific internal modification of the BVGB into the Borrego Springs Subbasin (7-024-.01) and Ocotillo Wells Subbasin (7-024.02) in October 2016.

3 The 20-year water reduction period is promulgated in CWC Section 10727.2(b).

The U.S. Geological Survey (USGS), in cooperation with the BWD, recently published Scientific Investigation Report 2015–5150 that evaluated available groundwater quality data in Borrego Springs and Ocotillo Wells Groundwater Subbasins of the BVGB (Faunt et al. 2015). The USGS found that concentrations of TDS and nitrate exceed their respective water quality standard thresholds in portions of the upper aquifer of the Borrego Springs Groundwater Subbasin (for reference with depth the BVGB is comprised of three aquifers: upper, middle, and lower). The highest concentrations of both constituents were generally found in the northern portion of the Borrego Springs Groundwater Subbasin, and the concentration of TDS was found to increase as groundwater levels decline. Sulfate, another COC, was also found to increase in concentration as groundwater levels decline. In addition to nitrate, TDS, and sulfate, other potential COCs in the BVGB include arsenic and gross alpha radiation, though the latter appears to be confined to the Ocotillo Wells Groundwater Subbasin.

Since the compilation of available groundwater quality data by the USGS in 2015, additional data have been collected by the BWD for its active production wells in 2016 and for seven private wells located in the South Management Area (SMA) of the Borrego Springs Groundwater Subbasin. This recent data indicates that arsenic concentrations exceed the California drinking water MCL of 10 micrograms per liter (µg/L) in portions of the lower aquifer in the SMA. Additionally, review of historical arsenic data for BWD wells located in the SMA indicates an increasing arsenic trend in well ID1-2, and a linear regression analysis indicates a good correlation of fit among arsenic concentration, groundwater production, and declining groundwater levels in well ID1-8. Based on the 2-year lag linear regression of groundwater production and arsenic data from well ID1-8, groundwater production in excess of 300 AFY at well ID1-8 is predicted to exceed the arsenic drinking water standard of 10 µg/L. Thus, arsenic concentrations in the lower aquifer of the Borrego Springs Groundwater Subbasin are determined to be a primary COC. Because groundwater quality data for the Borrego Springs Groundwater Subbasin are limited, further data collection and evaluation is required to verify the predicted exceedance of the arsenic drinking water standards in well ID1-8 and potential for other wells in the Borrego Springs Groundwater Subbasin to exceed the arsenic drinking water standard or other COC.

INTRODUCTION

The BVGB is located in the northeastern part of San Diego County and the western part of Imperial County (Figure 1). The BVGB was recently divided into two subbasins: Borrego Springs Groundwater Subbasin (7-024.01) and Ocotillo Wells Groundwater Subbasin (7-024.02), based on a scientific internal basin boundary modification (DWR 2016, Dudek 2016). This Technical Memorandum is primarily focused on the Borrego Springs Groundwater Subbasin of the BVGB. The boundary of the Borrego Springs Groundwater Subbasin is generally defined by the contact of unconsolidated deposits with plutonic and metamorphic basement deposits. The trace of the Coyote Creek fault, which trends northwest–southeast to the north and east of the Borrego Springs Groundwater Subbasin, and the San Felipe Wash to the south, which is approximately co-located with a basement high known as the Yaqui Ridge/San Felipe anticline and San Felipe fault, are recognized barriers to flow that form additional boundaries of the subbasin (Figure 1).

Groundwater pumped from the Borrego Springs Groundwater Subbasin is the sole source of supply to meet agricultural, municipal, and recreational water demands for the community of Borrego Springs. Since the 1950s when intensive groundwater pumping began, extraction has exceeded recharge. Almost 500,000 acre-feet of groundwater has been permanently removed from groundwater storage, and groundwater levels have dropped by more than 100 feet in portions of the Borrego Springs Groundwater Subbasin (Faunt et al. 2015). Today, groundwater extraction continues to exceed recharge. Water users within the Borrego Springs Groundwater Subbasin currently withdrawal approximately 19,000 AFY of groundwater, and the “sustainable yield” is 5,700 AFY. Thus, the current estimated overdraft is 13,300 AFY. Approximately a 70% pumping reduction would be required to balance extraction with long-term average recharge.

The Sustainable Groundwater Management Act was passed in September 2014 as a means of regulating groundwater use throughout the State of California. As a result of the Sustainable Groundwater Management Act, all groundwater basins designated as medium and high priority by the Department of Water Resources (DWR) must designate a Groundwater Sustainability Agency (GSA) by June 2017. The BWD and the County of San Diego have jointly formed a GSA under a memorandum of agreement.[4]

The GSA must prepare a Groundwater Sustainability Plan (GSP). As the Borrego Springs Groundwater Subbasin is in critical overdraft, the deadline to prepare a GSP is January 2020.[5] The GSP is required to address the management needs of the basin in order to avoid undesirable results. The undesirable results have been defined by DWR and include such items as the chronic lowering of groundwater levels, reduction in groundwater storage, and unreasonably degraded water quality.

In addition to developing a water quantity path to sustainability, it is essential to evaluate groundwater quality to ensure availability of potable water for both domestic and irrigation

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4 The BWD provided notice to DWR on October 27, 2015, to become a GSA for the portion of the BVGB within the boundaries of the BWD. The County of San Diego Board of Supervisors authorized the County of San Diego to become a GSA over BVGB on January 6, 2016. The BWD and County of San Diego authorized a Memorandum of Understanding for Development of a Groundwater Sustainability Plan for the Borrego Valley Groundwater Basin on October 19, 2016.

5 The Borrego Springs Subbasin is designated as being in critical overdraft. The Final List of Designation of Critical Overdraft is available here: http://www.water.ca.gov/groundwater/sgm/pdfs/COD_BasinsTable.pdf.

supply. This technical memorandum has been prepared to assess the potential risk associated with temporal changes in groundwater quality that may result in exceedances of California drinking water MCLs in BWD production wells due to the long-standing critical overdraft. To date, the BWD has been able to supply customers with groundwater without the need for any additional treatment other than disinfection by chlorination as required by the State Water Resources Control Board's Division of Drinking Water (DDW). The potable groundwater served by the BWD currently meets all drinking water standards, and no water quality violations have been identified in active wells.

The groundwater system is generally subdivided by the USGS into three aquifers denoted as the upper, middle, and lower.[6] The upper aquifer is comprised of coarse sediments sourced from the Coyote Creek watershed. The thickness of the upper aquifer thins from a maximum thickness of about 643 feet where Coyote Creek enters the basin to about 50 feet near the Borrego Sink (Faunt et al. 2015) and becomes mostly unsaturated south of the Desert Lodge anticline near Rams Hill. The upper aquifer yields as much as 2,000 gallons per minute and has been extensively dewatered. The middle aquifer contains finer sediments thought to originate from lower energy sediment sources prior to the initiation of slip along the Coyote Creek fault (Faunt et al. 2015). The middle aquifer like the upper aquifer thins from the northeast to southwest and varies in thickness from about 1,000 feet to 50 feet. "The middle aquifer yields moderate quantities of water to wells, but is considered a non-viable source of water south of San Felipe Creek because of its diminished thickness" (Mitten 1988). The lower aquifer is comprised of partly consolidated continental sediments up to 3,831 feet thick and is thickest in the eastern part of the basin near the Borrego Airport. The lower aquifer yields smaller quantities of water to wells than the upper and middle aquifers. Understanding the spatial distribution of the upper, middle, and lower aquifers, as well as faulting and folding in the basin, is important to evaluate groundwater quality.

Production wells in the subbasin are generally screened in the upper, middle, or lower aquifers or cross-screened in multiple aquifers. Due to the variable thickness of the individual aquifers (i.e., thickness of aquifers generally thin to the south), BWD production wells are predominantly cross-screened in the upper, middle, and lower aquifers in the northern part of the subbasin; cross-screened in the middle and lower aquifers in the central part of the subbasin; and cross-screened in the middle and lower aquifers in the southern part of the subbasin (see Figures 6, 8, and 11).

Three management areas are proposed to better support groundwater management within the subbasin: the north management area (NMA), central management area (CMA), and south

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6 The upper, middle, and lower aquifers represent a generalized description of the Borrego Springs Subbasin stratigraphy based on work performed by Moyle (1982) and described in detail in Faunt et al. (2015).

management area (SMA).[7] These management areas are based on both subsurface geological features such as the Desert Lodge anticline that limits hydrologic communication between the southern part of the subbasin and the central part of the subbasin, as well as on differences in groundwater production demands, well screens, and pumping depressions between the southern, central, and northern parts of the subbasin.

The NMA is dominated by agricultural land use with groundwater production occurring from primarily the upper and middle aquifers. The CMA is currently the primary production area for municipal supply with groundwater production from the upper, middle, and lower aquifers. The SMA includes some municipal and domestic pumping but is currently dominated by pumping for recreational use. Pumping in the SMA only occurs in the middle and lower aquifers.

General Regulatory Drinking Water Requirements

As a public water system, the BWD is regulated by the State Water Resources Control Board's DDW. California regulations related to drinking water are contained within California Code of Regulations (CCR) Title 17 and Title 22. California drinking water MCLs that shall not be exceeded in the water supplied to the public are listed in CCR Title 22 Chapter 15. The BWD samples groundwater quality from water wells at intervals required by the DDW. While bacteriological sampling of the water system occurs frequently, sampling for general minerals, aggregate properties, solids, metals, and nutrients occurs every 3 years. The BWD groundwater quality data reviewed for the analysis includes data through the 2016 DDW sampling event. Sampling of the BWD water wells for general minerals, aggregate properties, solids, metals, and nutrients is not required again until 2019.

GROUNDWATER QUALITY

Constituents of Concern

There are both anthropogenic and natural sources of the COCs in the BVGB. Anthropogenic sources that may contribute to degradation of the current water quality in the basin include agricultural use of pesticides and fertilizers, salt accumulation resulting from agricultural irrigation practices, and household septic system return flows. Natural sources of COCs in the BVGB include the rocks and minerals that comprise the aquifer matrix material. These naturally occurring COCs include evaporite minerals, which can dissolve and increase TDS concentration

[7] "Management area" refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors (CCR Title 23, Division 2, Chapter 1.5. subchapter 2, Article 2, Section 351).

in the aquifer; silicate minerals, which can contribute arsenic to the groundwater; and sulfate minerals, which as their name suggests can contribute sulfate to the groundwater, All are found in differing amounts in the upper, middle, and lower aquifers. Differences in the mineralogical composition of the aquifers can result in groundwater quality differences between the aquifers.

Arsenic

Naturally occurring arsenic concentrations in groundwater are highly variable, though naturally occurring concentrations that exceed the California drinking water primary MCL of 10 µg/L are common in semi-arid and arid groundwater basins in the western United States (Welch et al. 2000, Anning et al. 2012). In these basins, groundwater recharge is limited due to low precipitation and the residence time of the groundwater in the basin is high. The long residence time of the groundwater in the basin allows for more interaction between the groundwater and the minerals that comprise the aquifer matrix material. With time, arsenic desorbs from sediments and enters the groundwater. This process is more efficient in groundwater with higher pH. The groundwater in the BVGB has a pH of 7.5 to 9.0, a range that is conducive for this transfer of arsenic from the sediment to the water.

Fluoride

Fluoride is a naturally occurring element in groundwater resulting from the dissolution of fluoride-bearing minerals from the aquifer sediments and surrounding bedrock. Brown staining or mottling of teeth and resistance to tooth decay as a result of drinking water with high concentrations of fluoride has been known since the 1930s. While drinking fluoridated water at low concentrations (i.e., 0.7 ppm) is beneficial to prevent tooth decay, excessive exposure to fluoride can result in dental and skeletal fluorosis. The California drinking water primary MCL for fluoride is 2 milligrams per liter (mg/L).

Nitrate

Sources of nitrate in groundwater are typically associated with specific land use but it can also occur naturally. Fertilizers and septic tanks are common anthropogenic sources of nitrate detected in groundwater. Potential natural sources of nitrate in groundwater may result from leaching of soil nitrate, which occurs by atmospheric deposition, and dissolution of evaporative minerals, igneous rocks, and deep geothermal fluids. In desert groundwater basins, the largest source of naturally occurring nitrates in groundwater occurs from incomplete utilization of nitrate by sparse vegetation. This nitrate accumulates in the unsaturated zone and may become mobile when surficial recharge percolates through the unsaturated zone (Walvoord et al. 2003). In arid environments, nitrate stored in the unsaturated zone may become mobilized by artificial recharge from irrigation return flow, septic effluent, and infiltration basins. The Borrego Spring Subbasin lacks appreciable evaporitic deposits, and anthropogenic sources or mobilization as a result of artificial recharge is likely the main contributor of nitrates to the subbasin. The California drinking water primary MCL for nitrate is 10 mg/L as nitrogen (N) 45 mg/L as nitrate (NO_3).

Sulfate

Natural sulfate sources include atmospheric deposition, sulfate mineral dissolution, and sulfide mineral oxidation of sulfur. Gypsum is an important source near localized deposits such as in the Ocotillo Wells Subbasin near Fish Creek Mountains in Imperial County. Fertilizers can also be a source of sulfate in groundwater but typically do not result in exceedance of drinking water standards. The California drinking water secondary MCL for sulfate is recommended at 250 mg/L, with upper and short-term limits of 500 mg/L and 600 mg/L, respectively.

Total Dissolved Solids

TDS is a measure of all dissolved solids in water including organic and suspended particles. Sources of TDS in groundwater include interaction of groundwater with the minerals that comprise the aquifer matrix material. Over time, TDS will increase as more minerals in contact with groundwater dissolve. In desert basins, evaporative enrichment near dry lake beds (playas) is known to naturally increase TDS in groundwater. This process also occurs in plants, both in agriculture and natural systems. Anthropogenic sources include synthetic fertilizers, manure, wastewater treatment facilities, and septic effluent. The California drinking water secondary MCL for TDS is recommended at 500 mg/L with upper and short-term limits of 1,000 mg/L and 1,500 mg/L, respectively.

Radionuclides

Radionuclides are naturally occurring elements of the Earth and observed in groundwater as a result of interaction with an aquifer matrix material that contains trace levels of radioactive isotopes. Gross alpha and beta measurements are screening tools for quantification of radioactivity in groundwater, which is measured as activity units of picocuries per liter (pCi/L). The California drinking water primary MCL for gross alpha is 15 pCi/L based on a four-quarter average. Other radionuclides with California drinking water primary MCLs include radium-226 + radium-228 (5 pCi/L), strontium-90 (8 pCi/L), tritium (20,000 pCi/L) and uranium (20 pCi/L).

Below, we discuss the current distribution and trends of COCs overall and as occurs within each proposed Borrego Springs Subbasin management areas (Figure 1).

Historical Groundwater Quality

This analysis evaluates historical groundwater quality for BWD wells and seven private wells located in the SMA. Data for select groundwater quality constituents are provided in Table 1 and displayed graphically in Figures 2–5, and Figures 7, 9, 10, 12, 13, and 14.

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
North Management Area Wells							
ID4-4[c]	9/25/1954	NM	NM	1.81	418	NM	7.9
ID4-4[c]	5/16/1972	NM	0.68	70.48[d]	417	NM	7.6
ID4-4[c]	5/23/1973	NM	0.46	3.61	283	NM	7.4
ID4-4[c]	5/19/1975	<RL	0.47	0.50	127	508	7.76
ID4-4[c]	12/15/1975	<10	NM	13.10	NM	NM	NM
ID4-4[c]	4/29/1976	NM	NM	11.07	NM	NM	NM
ID4-4[c]	8/6/1976	NM	NM	14.01	NM	NM	NM
ID4-4[c]	9/30/1976	NM	NM	11.07	NM	NM	NM
ID4-4[c]	12/6/1976	NM	NM	14.91	NM	NM	NM
ID4-4[c]	8/18/1978	NM	NM	9.49	NM	NM	NM
ID4-4[c]	9/14/1978	NM	NM	10.40	NM	NM	NM
ID4-4[c]	11/9/1978	NM	NM	11.97	NM	NM	NM
ID4-4[c]	7/17/1979	NM	0.11	0.68	99	244	8.14
ID4-4[c]	9/26/1979	NM	0.18	0.79	129	360	7.84
ID4-4[c]	3/31/1980	<10	0.94	0.79	127	322	7.68
ID4-4[c]	10/24/1980	NM	NM	13.00	NM	NM	NM
ID4-4[c]	11/19/1980	3	0.20	NM	120	327	7.90
ID4-4[c]	8/18/1981	NM	NM	0.79	NM	NM	NM
ID4-4[c]	2/4/1983	<2	0.29	0.97	147	310	7.46
ID4-4[c]	12/9/1985	<5	0.41	0.86	132	326	7.82
ID4-4[c]	6/11/1991	<10	0.18	0.21	102	317	7.97
ID4-4[c]	12/28/1994	2	0.33	0.91	122	348	7.80
ID4-4[c]	9/8/1998	<2	0.16	0.91	120	312	7.73
ID4-4[c]	5/17/2001	<RL	0.20	0.90	120	350	7.80
ID4-4[c]	1/14/2002	<2	1.07	NM	NM	NM	NM
ID4-4[c]	4/15/2004	<RL	0.13	1.03	110	295	7.91
ID4-4[c]	5/8/2007	2.2	0.20	0.68	110	320	8.00
ID4-4[c]	6/3/2008	NM	NM	0.63	NM	NM	NM
ID4-4[c]	5/13/209	NM	NM	0.63	NM	NM	NM
ID4-4[c]	5/11/2010	2.2	0.20	0.61	120	340	7.90

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
ID4-4[c]	6/7/2011	NM	NM	0.54	NM	NM	NM
ID4-4[c]	5/22/2012	NM	NM	0.54	NM	NM	NM
ID4-4[c]	7/24/2013	2.7	0.20	0.59	110	330	7.80
ID4-4[c]	8/19/2014	NM	NM	0.43	NM	NM	NM
ID4-4[c]	8/11/2015	NM	NM	0.56	NM	NM	NM
ID4-4[c]	4/12/2016	2.9	0.20	0.56	110	310	7.90
ID4-11	5/17/1995	<2	0.29	0.22	125	396	8.45
ID4-11	9/8/1998	<2	0.2	0.39	114	387	7.55
ID4-11	5/17/2001	<RL	0.2	NM	110	390	7.7
ID4-11	12/27/2002	NM	0.23	NM	101	410	NM
ID4-11	12/31/2002	NM	NM	0.32	NM	NM	NM
ID4-11	12/18/2003	NM	0.25	0.39	NM	NM	NM
ID4-11	4/15/2004	<RL	0.2	0.36	98.9	318	7.78
ID4-11	4/18/2006	NM	NM	0.36	NM	NM	NM
ID4-11	5/8/2007	<2	0.3	0.43	91	390	8
ID4-11	6/3/2008	NM	NM	0.45	NM	NM	NM
ID4-11	5/13/2009	NM	NM	0.59	NM	NM	NM
ID4-11	5/11/2010	<2	0.3	0.50	95	370	7.8
ID4-11	6/7/2011	NM	NM	0.45	NM	NM	NM
ID4-11	5/22/2012	NM	NM	0.47	NM	NM	NM
ID4-11	10/24/2013	NM	0	0.56	86	340	7.8
ID4-11	2/14/2014	<2	0.3	0.61	NM	NM	NM
ID4-11	6/1/2014	2.23	NM	NM	NM	NM	NM
ID4-11	8/12/2014	NM	NM	0.61	NM	NM	NM
ID4-11	8/11/2015	NM	NM	0.61	NM	NM	NM
ID4-11	4/12/2016	<2	0.3	0.66	85	320	7.8
ID4-18	6/18/1984	5	1.2	0.12	237	594	7.04
ID4-18	12/9/1985	<2	1.1	0.08	246	562	7.96
ID4-18	6/11/1991	<10	0.68	0.04	253	617	7.61
ID4-18	12/28/1994	<2	1.03	0.32	254	617	7.37
ID4-18	9/8/1998	<2	0.85	0.50	253	604	7.43
ID4-18	5/17/2001	<RL	0.7	NM	270	620	7.5
ID4-18	12/31/2002	NM	NM	0.27	NM	NM	NM
ID4-18	4/15/2004	<RL	0.84	0.28	242	558	7.72
ID4-18	5/8/2007	<2	0.9	NM	240	590	7.8
ID4-18	5/13/2009	NM	NM	0.29	NM	NM	NM
ID4-18	5/11/2010	<2	0.8	0.36	260	620	7.7

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
ID4-18	6/7/2011	NM	NM	0.32	NM	NM	NM
ID4-18	5/22/2012	NM	NM	0.45	NM	NM	NM
ID4-18	6/10/2013	<2	1.3	0.32	250	620	7.8
ID4-18	8/12/2014	NM	NM	0.38	NM	NM	NM
ID4-18	8/11/2015	NM	NM	0.50	NM	NM	NM
ID4-18	5/16/2016	<2	0.9	0.5	250	610	7.7
MW-1	9/8/2011	3.8	NM	0.015	223	480	8.7
Central Management Area Wells							
ID4-10	6/19/1989	10[a]	0.59	1.70	66	629	8.19
ID4-10	6/11/1991	<10	0.35	1.49	17	529	7.74
ID4-10	12/28/1994	<2	0.4	2.42	26	528	7.6
ID4-10	9/8/1998	<RL	0.38	2.39	28.4	516	7.32
ID4-10	5/17/2001	<RL	0.4	2.71	27	530	7.4
ID4-10	4/15/2004	<RL	0.34	2.21	22.9	459	7.54
ID4-10	5/26/2005	NM	NM	1.74	NM	NM	NM
ID4-10	4/18/2006	NM	NM	2.06	NM	NM	NM
ID4-10	5/8/2007	<2	0.4	2.10	23	490	7.6
ID4-10	6/3/2008	NM	NM	1.92	NM	NM	NM
ID4-10	5/13/2009	NM	NM	2.10	NM	NM	NM
ID4-10	10/26/2009	0.76	0.41	2.44	25.7	NM	7.5
ID4-10	5/11/2010	<2	0.4	1.97	24	510	7.6
ID4-10	6/7/2011	NM	NM	1.81	NM	NM	NM
ID4-10	5/22/2012	NM	NM	1.97	NM	NM	NM
ID4-10	6/10/2013	<2	0.6	2.10	23	500	7.5
ID4-10	8/12/2014	NM	NM	2.48	NM	NM	NM
Wilcox	1/27/2000	7	0.6	1.90	127	267	8.27
Wilcox	5/17/2001	3	0.6	1.58	18	250	8.1
Wilcox	4/15/2004	3.4	0.51	0.40	13.8	200	8.74
Wilcox	5/26/2005	NM	NM	0.77	NM	NM	NM
Wilcox	5/8/2007	4.4	0.7	0.99	14	210	8.4
Wilcox	6/3/2008	NM	NM	0.93	NM	NM	NM
Wilcox	5/13/2009	NM	NM	1.42	NM	NM	NM
Wilcox	5/11/2010	6.1	0.8	0.36	16	220	8.7
Wilcox	6/7/2011	NM	NM	0.77	NM	NM	NM
Wilcox	5/22/2012	NM	NM	0.90	NM	NM	NM
Wilcox	3/16/2013	4.2	1	1.29	18	230	8.3
Wilcox	6/1/2014	7.8	NM	NM	NM	NM	NM

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
Wilcox	8/19/2014	NM	NM	0.68	NM	NM	NM
Wilcox	8/11/2015	NM	NM	0.45	NM	NM	NM
Wilcox	3/22/2016	4.4	0.8	0.92	16	220	8.2
ID1-10	9/26/1972	<RL	0.78	0.43	105	352	8.3
ID1-10	3/17/1988	10	0.57	1.31	73	252	7.72
ID1-10	5/22/1991	<10	0.54	1.47	63	274	7.77
ID1-10	12/28/1994	2	0.46	1.61	50.7	260	7.74
ID1-10	5/17/2001	5	0.6	1.58	96	460	8
ID1-10	12/5/2002	NM	0.54	1.47	NM	250	NM
ID1-10	12/31/2002	NM	NM	1.58	NM	NM	NM
ID1-10	4/15/2004	3.3	0.42	0.82	79	274	8.17
ID1-10	5/26/2005	NM	NM	1.49	NM	NM	NM
ID1-10	4/18/2006	NM	NM	1.40	NM	NM	NM
ID1-10	5/8/2007	5.9	0.5	1.54	47	250	8.3
ID1-10	6/3/2008	NM	NM	1.56	NM	NM	NM
ID1-10	5/13/2009	NM	NM	1.72	NM	NM	NM
ID1-10	10/27/2009	9.9	0.43	2.02	46.9	NM	8.2
ID1-10	5/11/2010	7.1	0.5	1.78	45	240	8.4
ID1-10	6/7/2011	NM	NM	1.63	NM	NM	NM
ID1-10	5/22/2012	NM	NM	1.65	NM	NM	NM
ID1-10	7/22/2013	7.5	0.7	1.63	54	280	8.2
ID1-10	6/1/2014	12.2	NM	1.85	NM	NM	NM
ID1-10	8/11/2015	NM	NM	1.27	NM	NM	NM
ID1-10	4/12/2016	4	0.5	1.40	62	340	8
ID1-12	3/17/1988	7	0.45	0.44	104	242	7.23
ID1-12	5/22/1991	<10	0.5	0.42	105	292	8.3
ID1-12	12/28/1994	3	0.47	0.50	101	290	7.96
ID1-12	9/8/1998	2	0.37	0.51	106	268	8.22
ID1-12	5/17/2001	3	0.4	0.45	97	290	8.1
ID1-12	5/13/2002	NM	NM	0.52	NM	NM	NM
ID1-12	12/18/2003	NM	0.42	0.25	NM	NM	NM
ID1-12	4/15/2004	2.2	0.34	0.39	94.9	246	8.38
ID1-12	4/18/2015	NM	NM	0.38	NM	NM	NM
ID1-12	5/8/2007	<RL	0.4	0.38	91	260	8.3
ID1-12	6/3/2008	NM	NM	0.38	NM	NM	NM
ID1-12	5/13/2009	NM	NM	0.41	NM	NM	NM
ID1-12	5/11/2010	<RL	0.5	0.38	100	240	8.2

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
ID1-12	4/3/2013	3	0.6	0.38	94	270	8.2
ID1-12	6/7/2011	NM	NM	0.34	NM	NM	NM
ID1-12	5/22/2012	NM	NM	0.38	NM	NM	NM
ID1-12	10/18/2012	2.5	0.35	0.441	93	NM	8.4
ID1-12	4/3/2013	3	NM	0.38	NM	NM	NM
ID1-12	6/1/2014	3.79	NM	0.38	NM	NM	NM
ID1-12	8/12/2014	NM	NM	0.38	NM	NM	NM
ID1-12	8/11/2015	NM	NM	0.36	NM	NM	NM
ID1-12	6/5/2016	3.1	0.4	0.38	90	300	8
ID1-16	7/15/1993	NM	NM	NM	74	312	7.76
ID1-16	2/25/1997	2	0.5	0.9	66	330	8.1
ID1-16	9/22/1998	<2	0.48	2.1	67.6	346	8.08
ID1-16	5/17/2001	<RL	0.5	1.4	64	360	7.9
ID1-16	12/13/2002	NM	NM	1.2	NM	NM	NM
ID1-16	12/18/2003	NM	0.56	1.2	68.8	NM	NM
ID1-16	3/6/2003	NM	NM	NM	NM	328	NM
ID1-16	4/15/2004	<RL	0.46	1.1	61.9	326	8.21
ID1-16	5/26/2005	NM	NM	1.1	NM	NM	NM
ID1-16	4/18/2006	NM	NM	1.1	NM	NM	NM
ID1-16	5/8/2007	2	0.6	1.1	60	320	8.2
ID1-16	6/3/2008	NM	NM	1.1	NM	NM	NM
ID1-16	5/13/2009	NM	NM	0.8	NM	NM	NM
ID1-16	5/11/2010	<2	0.5	1.2	66	340	8.3
ID1-16	6/7/2011	NM	NM	1.1	NM	NM	NM
ID1-16	5/22/2012	NM	NM	0.8	NM	NM	NM
ID1-16	12/18/2013	4.3	0.5	1.2	56	280	8.2
ID1-16	8/12/2014	NM	NM	1.1	NM	NM	NM
ID1-16	8/11/2015	NM	NM	1.1	NM	NM	NM
ID1-16	5/16/2016	3.2	0.5	0.95	56	300	8
ID5-5	3/2/2004	<RL	0.85	0.45	106	320	7.54
ID5-5	5/11/2010	<2	1.2	0.25	95	330	8.1
ID5-5	6/7/2011	NM	NM	0.43	NM	NM	NM
ID5-5	5/22/2012	NM	NM	0.47	NM	NM	NM
ID5-5	4/19/2013	2.1	1.4	0.45	100	310	8
ID5-5	8/12/2014	NM	NM	0.41	NM	NM	NM
ID5-5	8/11/2015	NM	NM	0.50	NM	NM	NM
ID5-5	3/22/2016	<2	1	0.44	95	350	7.8

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
Cocopah	9/27/2007	6	1.6	<1.0	170	410	8.8
Cocopah	3/22/2013	6.4	2.2	<1.0	170	390	8.7
MW-4[b]	1/9/2007	<2.0	0.5	2.4	330	720	7.8
MW-5A	1/9/2007	3.9	1.3	<1.0	700	1,300	8.0
MW-5B	12/18/2006	<2.0	0.8	<0.20	1,200	2,300	7.6
South Management Area Wells							
ID1-1	6/6/1972	<RL	0.8	0.50	197	560	8.3
ID1-1	3/17/1988	5	0.62	0.68	311	724	8.04
ID1-1	6/11/2014	<RL	0.3	0.99	570	1,300	8
ID1-1	6/2/2016	<RL	0.2	0.96	650	1,400	7.7
ID1-2	7/10/1972	NM	1.0	1.5	60	400	8
ID1-2	2/8/1983	2	0.51	4.7	39	496	7.86
ID1-2	3/17/1988	4	0.61	4.2	51	290	8.54
ID1-2	4/9/2014	6	0.4	3.2	32	340	8.8
ID1-2	6/2/2016	9	0.5	3.1	37	270	8.8
ID1-8	10/10/1972	NM	1.1	0.90	49	364	8.3
ID1-8	3/17/1988	14[c]	0.92	1.59	59	314	8.07
ID1-8	5/22/1991	11[c]	1.05	1.29	47	328	8.46
ID1-8	12/28/1994	5	0.68	1.88	81.4	400	7.78
ID1-8	9/22/1998	2	0.55	0.67	82	411	8.27
ID1-8	5/17/2001	5	0.6	1.79	96	460	8
ID1-8	12/5/2002	NM	0.55	1.59	120	490	NM
ID1-8	12/31/2002	NM	NM	1.74	NM	NM	NM
ID1-8	4/15/2004	4.7	0.47	1.47	119	446	8.31
ID1-8	5/26/2005	NM	NM	1.59	NM	NM	NM
ID1-8	5/8/2007	4.6	0.7	2.12	77	430	8.3
ID1-8	6/3/2008	NM	NM	2.12	NM	NM	NM
ID1-8	5/13/2009	NM	NM	2.10	NM	NM	NM
ID1-8	5/11/2010	6.8	0.7	2.10	110	460	8.2
ID1-8	6/7/2011	NM	NM	1.97	NM	NM	NM
ID1-8	5/22/2017	NM	NM	2.05	NM	NM	NM
ID1-8	4/3/2013	6.1	1	2.18	82	500	8.1
ID1-8	6/17/2013	4.8	0.67	2.37	91.1	NM	8.2
ID1-8	8/19/2014	NM	NM	2.28	NM	NM	NM
ID1-8	8/11/2015	NM	NM	2.46	NM	NM	NM
ID1-8	3/22/2016	5.3	0.7	2.0	85	490	8
RH-3	9/29/2014	15	1.4	0.60	67	310	9

Table 1
Historical Groundwater Quality

Well ID	Date	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)[a]	Sulfate (mg/L)	TDS (mg/L)	pH
RH-3	6/2/2016	15	1.1	1.3	63	290	8.9
RH-4	1/22/2015	22	1.4	0.33	45	300	8.9
RH-4	6/2/2016	18	1.1	0.43	81	360	8.9
RH-5	3/18/2015	4.6	0.6	6.6	180	770	8.5
RH-5	6/2/2016	16	1.3	3.8	120	510	8.8
RH-6	7/27/2015	15	1.3	3.2	25	290	9
RH-6	6/2/2016	15	1.2	3.3	28	300	9
Jack Crosby	6/2/2016	13	0.9	0.32	140	450	8.6
WWTP-1	4/5/2016	NM	0.3	119.52	87	690	7.8

Source: BWD 2016, Dudek 2016, DDW 2016
Notes: Not all historical laboratory reports were available to verify the reported laboratory result.
NM = not measured
<RL = less than laboratory reporting limit
a. Nitrate as N x 4.4288 = Nitrate as NO_3
b. MW-4 is not depicted on Figure 8.
c Analysis taken when well No. ID4-4 was first reactivated after several years of non-use. Waters entering well near static water level were found to be very high in dissolved minerals. These highly concentrated waters were sealed off by the Roscoe Moss Company during the summer of 1972. After several weeks of operating, salinity was reduced to acceptable levels noted in May 1973. Well No. 4 (ID4-4) was originally drilled for DiGiorgio Farms and carried in the DiGiorgio records as Well No. 10. Well ID4-4 was drilled in 1979 in the same location as Well No. 4.

The groundwater quality data are presented in the figures relative to the MCL for each of the COCs. Concentrations that lie between half of the MCL and the MCL are noted. While the concentrations are below the MCL for most of these points, increasing concentrations of many of the COCs are being observed with ongoing groundwater level decline so the upper range concentration data are highlighted in this risk assessment.

Groundwater Concentration Trend Statistical Analysis

Historical groundwater quality data that extends through early 2016 was evaluated to determine groundwater concentration trends for COCs (arsenic, fluoride, nitrate, sulfate, TDS, and pH). Radionuclides are of potential concern but limited radionuclide data available for BWD wells precluded trend analysis.

The Mann-Kendall test was applied to assess trends in groundwater quality. The Mann-Kendall test does not require regularly spaced sample intervals, is unaffected by missing time periods, and does not assume a pre-determined data distribution. The Mann-Kendall test assesses whether or not a dataset exhibits a trend within a selected significance level. A significance level of 0.05 or confidence level of 95% was selected for this analysis. Results of the Mann-Kendall test are listed in Table 2.

Table 2
Mann-Kendall Trend Analysis Results

Well ID	Arsenic (µg/L)	Fluoride (mg/L)	Nitrate (as N) (mg/L)	Sulfate (mg/L)	TDS (mg/L)	pH
North Management Area Wells						
ID4-4	No trend	No trend	Decreasing	Decreasing	No trend	No trend
ID4-11	Insufficient data	***Increasing***	***Increasing***	Decreasing	No trend	No trend
ID4-18	Insufficient data	No trend	***Increasing***	No trend	No trend	No trend
MW-1	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Central Management Area Wells						
ID4-10	Insufficient Data	No trend	No trend	No trend	*Decreasing*	No trend
Wilcox	No trend	***Increasing***	No trend	No trend	No trend	No trend
ID1-10	No trend	No trend	***Increasing***	Decreasing	No trend	No trend
ID1-12	No trend	No trend	Decreasing	Decreasing	No trend	No trend
ID1-16	No trend	No trend	Decreasing	Decreasing	No trend	No trend
ID5-5	Insufficient data	Insufficient data	No trend	No trend	No trend	No trend
Cocopah	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
MW-4	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
South Management Area Wells						
ID1-1	Insufficient data	No trend	No trend	***Increasing***	***Increasing***	Decreasing
ID1-2	***Increasing***	No trend	No trend	No trend	No trend	No trend
ID1-8	No trend	No trend	***Increasing***	***Increasing***	***Increasing***	No trend
RH-3	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
RH-4	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
RH-5	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
RH-6	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Jack Crosby	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data
WWTP-1	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Note: A minimum of four data points are required to calculate trend (non-detects were not used as data points in this analysis to calculate trend).
Sources: BWD 2016, Dudek 2016, DDW 2016.

Increasing groundwater concentration trends were exhibited for arsenic in well ID1-2; fluoride in the Wilcox Well; nitrate in wells ID1-11, ID1-18, ID1-10, ID4-10 and ID1-8; sulfate in wells ID1-1 and ID1-8; and TDS in wells ID1-1 and ID1-8. Decreasing groundwater concentration trends were exhibited for nitrate in ID4-4 and ID1-16; sulfate in wells ID4-4, ID4-11, ID1-10, ID1-12, and ID1-

16; TDS in well ID4-10; and pH in ID1-1. A minimum of four data points are required to calculate trend. Insufficient data indicates wells were no trend was established because either four data points were not available or data reported was less than laboratory reporting limits.

Arsenic

Arsenic concentrations have been detected above laboratory reporting limits at several wells in the Borrego Springs Subbasin since the 1980s.[8] Arsenic has been detected in non-potable wells up to 22 µg/L in Rams Hill Golf Course well RH-4. The California drinking water MCL for arsenic is 10 µg/L.

Arsenic wellhead concentrations from 2016 for the Borrego Springs Subbasin are shown in Figure 2. Arsenic concentrations for wells located in the NMA were less than half the MCL (< 5 µg/L) for wells screened in the upper, middle, and lower aquifers. NMA well information including elevation, well depth, groundwater level, pump information, screen interval, casing diameter, and production rate is provided in Figure 6.

Arsenic concentrations from 2016 for wells located in the CMA were less than half the MCL (< 5 µg/L) for wells predominantly screened in the middle aquifer and less than the MCL (<10 µg/L) for wells predominantly screened in the lower aquifer. CMA well information including elevation, well depth, groundwater level, pump information, screen interval, casing diameter, and production rate is provided in Figure 7. No recent wellhead sample is available for the upper aquifer overlying the CMA.

Arsenic concentrations from 2016 for wells located in the SMA ranged from less than half the MCL (< 5 µg/L) to greater than the MCL (>10 µg/L). The screen intervals of wells in the SMA predominantly intercept the lower aquifer though most wells are partially screened in the middle aquifer as well. No recent wellhead sample is available for the upper aquifer overlying the SMA as this portion of the aquifer is currently unsaturated.

Historical arsenic data for BWD wells ID4-4, ID4-11, ID4-18, and MW-1 located in the NMA were reviewed to determine trends (Figure 7). These wells have arsenic concentrations less than the California drinking water MCL (< 10 µg/L). These wells display no trend or there is insufficient data to determine trend as many of the arsenic results are below laboratory reporting limits.

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8 Prior to the 1980s, laboratory detection limits for arsenic where often established at 10 µg/L or 50 µg/L and results were reported as below the laboratory detection limit.

Historical arsenic data for BWD wells ID1-10, ID1-12, ID1-16, Wilcox, ID4-10, ID5-5, MW-4, and the private Cocopah well located in the CMA were reviewed to determine current lateral distribution and trends (Figures 9 and 10). These wells have arsenic concentrations less than the California drinking water MCL (< 10 µg/L), except for one non-compliance sample collected from well ID1-10 in 2014 by M.H. Rezaie-Boroon et al. (2014). Subsequent compliance sampling completed by the BWD in 2016 indicates that the well ID1-10 arsenic concentration is below the MCL at a concentration of 4 µg/L. These wells display no trend or there is insufficient data to determine trend as many of the arsenic results are below laboratory reporting limits.

Historical arsenic data for BWD wells ID1-1, ID1-2, and ID1-8 located in the SMA was reviewed to determine trend. Well ID1-8 is the only potable BWD production well located in the SMA. Wells located at the Borrego Air Ranch are also used for potable water supply in the SMA. Well ID1-2 displays an increasing arsenic concentration with time, whereas well ID1-8 arsenic concentration fluctuates over time (Figure 8).[9] Well ID1-1 typically tests below the laboratory detection limit for arsenic and has different overall water chemistry than wells ID1-2 and ID1-8. SMA well information including elevation, well depth, groundwater level, pump information, screen interval, casing diameter, and production rate is provided in Figure 11.

Fluoride

The USGS identified three wells with fluoride concentrations that exceed the California drinking water primary MCL of 2 µg/L. Fluoride concentrations in these wells ranged from 2.69 to 4.87 mg/L (Faunt et al. 2015).

Historical fluoride data for BWD wells ID4-4, ID4-11, ID4-18, and MW-1 located in the NMA were also reviewed to determine trends. Fluoride concentrations of the BWD wells in the NMA are below one-half the California drinking water MCL for these wells. No trend for fluoride is indicated for these wells.

Historical fluoride data for BWD wells ID1-10, ID1-12, ID1-16, Wilcox, ID4-10, ID5-5, MW-4, and the private Cocopah well located in the CMA were reviewed to determine current lateral distribution and trends. Fluoride concentrations of the BWD wells in the CMA are typically below one-half the California drinking water MCL except for ID5-5 and the Cocopah Well. Fluoride concentration in well ID5-5 is below the California drinking water MCL. One sample tested above the California drinking water standard in the Cocopah Well at concentration of 2.2 mg/L. No trend for fluoride is indicated for any of these wells.

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9 Wells ID1-1 and ID1-2 were sold by the BWD to Rams Hill golf course around 2014.

Historical fluoride data for wells ID1-1, ID1-2, and ID1-8 located in the SMA was reviewed to determine trend. Fluoride concentrations of the BWD wells in the SMA are typically below one-half the California drinking water MCL. No trend for fluoride is indicated for any of these wells.

Nitrate

The USGS found that the concentration of nitrate as nitrogen (as N) from samples throughout the BVGB ranged from less than 1 mg/L to approximately 67 mg/L. The California drinking water primary MCL for nitrate as N is 10 mg/L. (The MCL has also been historically expressed as 45 mg/L nitrate as nitrate [as NO_3], and careful review of historical data is required to verify reporting units.)[10] Only 5 of the 36 wells sampled had nitrate concentrations that exceeded the MCL. These five wells are in the vicinity of Henderson Canyon Road in the northern part of the valley, adjacent to areas of agricultural use, and three of the five wells were screened in the upper aquifer. The concentration of nitrate measured in the remaining 31 wells was less than 7 mg/L nitrate as N (Faunt et al. 2015).

Historical nitrate data for BWD wells ID4-4, ID4-11, ID4-18, and MW-1, located in the NMA, were also reviewed to determine trends. These wells are located on the fringe of current and historical agricultural production in both the upper and middle aquifers. A decreasing nitrate as N concentration trend is observed in ID4-4. Both ID4-11 and ID4-18 show an increasing nitrate as N concentration trend. Insufficient data has been recorded for MW-1 to determine a nitrate as N concentration trend (Figure 3). All concentrations of the BWD wells are below one-half the California drinking water MCL for nitrate as N.

Historical nitrate data for BWD wells ID1-10, ID1-12, ID1-16, Wilcox, ID4-10, ID5-5, MW-4, and the private Cocopah well located in the CMA were reviewed to determine current lateral distribution and trends. These wells are located in or near to the primary area of municipal groundwater production in the Borrego Springs Subbasin. Golf courses and septic return flow with limited areas of agriculture are the probable anthropogenic sources of nitrate to wells in this area of the subbasin. A decreasing nitrate as N concentration trend is noted in ID 1-16. An increasing nitrate concentration trend is observed in well ID1-10. No trend is observed for wells ID1-1, ID1-2, ID4-10, and the Wilcox well. Insufficient data exist to determine a trend for MW-4 and the Cocopah well. Concentrations in all CMA wells are below one-half the California drinking water MCL for nitrate as N (Figures 5, 9 and 10).

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[10] The Division of Drinking Water recently made revisions to California drinking water standards for nitrate in California Code of Regulations Sections 64431 (MCL), 64432 (DLR), and 64482 (Health Information). The revisions specify that nitrate laboratory results must be expressed as nitrate as nitrogen. As a result, the MCL for nitrate is now expressed as "10 mg/L (as nitrogen)" instead of "45 mg/L (as nitrate)".

Historical nitrate data for wells ID1-1, ID1-2 and ID1-8 located in the SMA was reviewed to determine trend. Well ID1-8 displays an increasing nitrate as N concentration trend. No trend is observed for well ID1-2 with insufficient data available from well ID1-1. Concentrations for SMA wells are below one-half the California drinking water MCL (Figure 3). Well ID1-8 is downgradient from the Rams Hill golf course, which is potentially an anthropogenic source of nitrates in the SMA in addition to the percolation ponds at the wastewater treatment plant. Rams Hill wells RH-5 and RH-6, which are located on the old golf course, indicate elevated nitrate as N concentrations at 6.6 mg/L and 3.3 mg/L, respectively. Rams Hill will monitor water quality annually from its wells as part of the Long-Term Cooperation Agreement with the BWD. Additionally, Dudek recommends monitoring wells MW-3 and the WWTP well to determine groundwater quality in the middle aquifer.

TDS

TDS concentrations that exceed the California drinking water secondary MCL of 1,000 mg/L were detected in 8 of the 36 wells sampled by the USGS. Each of the wells that exceeded the MCL for nitrate also exceeded the secondary MCL for TDS. Additionally, two wells screened in the middle aquifer and one well screened in the lower aquifer that had concentrations of nitrate as N below 7 mg/L had TDS concentrations above 1,000 mg/L. Typically, however, the concentration of TDS in the lower aquifer was lower than that in the middle and upper aquifers for the wells analyzed as part of the USGS study (Faunt et al. 2015).

Historical TDS data for BWD wells ID4-4, ID4-11, ID4-18, and MW-1 located in the NMA were reviewed to determine trends. These wells display relatively stable TDS concentrations with no trend from the early 1980s to present (Figure 3).

Historical TDS data for BWD wells ID1-10, ID1-12, ID1-16, Wilcox, ID4-10, ID5-5, MW-4, and the private Cocopah well located in the CMA were reviewed to determine current lateral distribution and trends. These wells display stable TDS concentrations with no trend in each well for the period of record monitored (Figures 5 and 6).

Historical TDS data for wells ID1-1, ID1-2, and ID1-8 located in the SMA were reviewed to determine trend. Wells ID1-1 and ID1-8 indicate an increasing trend with respect to TDS concentrations since 1972 (Figure 8). No trend was observed for TDS in well ID1-2.

Sulfate

None of the samples analyzed as part of the USGS study had concentration of sulfate that exceeded the California secondary MCL for sulfate of 500 mg/L; however, four wells had increasing sulfate concentrations with time.[11] The USGS was not able to determine the reason for the increasing concentration trend observed in these wells, and the wells are spread throughout the valley, with no immediate geographic link to the observed trends.

Historical sulfate data for BWD wells ID4-4, ID4-11, ID4-18, and MW-1 located in the NMA were reviewed to determine trends. Wells ID4-4 and ID4-11 display a decreasing trend with respect to sulfate concentrations. No trend was observed for sulfate in well ID4-18 and insufficient data was available for well MW-1 (Figure 3).

Historical sulfate data for BWD wells ID1-10, ID1-12, ID1-16, Wilcox, ID4-10, ID5-5, MW-4, and the private Cocopah well located in the CMA were reviewed to determine current lateral distribution and trends. These wells display relatively stable sulfate concentrations for the period of record monitored in each well (Figures 5 and 6). A decreasing trend for sulfate was indicated in wells ID1-12 and ID1-16. All wells indicate concentrations below the California drinking water secondary recommended MCL of 250 mg/L, except MW-4 at a concentration of 330 mg/L and MW-5A and MW-5B at concentrations of 1,300 mg/L and 2,300 mg/L.

Historical sulfate data for wells ID1-1, ID1-2, and ID1-8 located in the SMA was reviewed to determine trends. Wells ID1-1 and ID1-8 indicate an increasing trend with respect to sulfate. No trend was indicated in well ID1-2. All wells indicate concentrations below the California drinking water secondary recommended MCL, except ID1-1 at a concentration of 650 mg/L.

Radiation

There is limited radionuclide data available for BWD wells. Gross alpha and gross beta results available for BWD indicate concentrations detected are below primary MCLs.

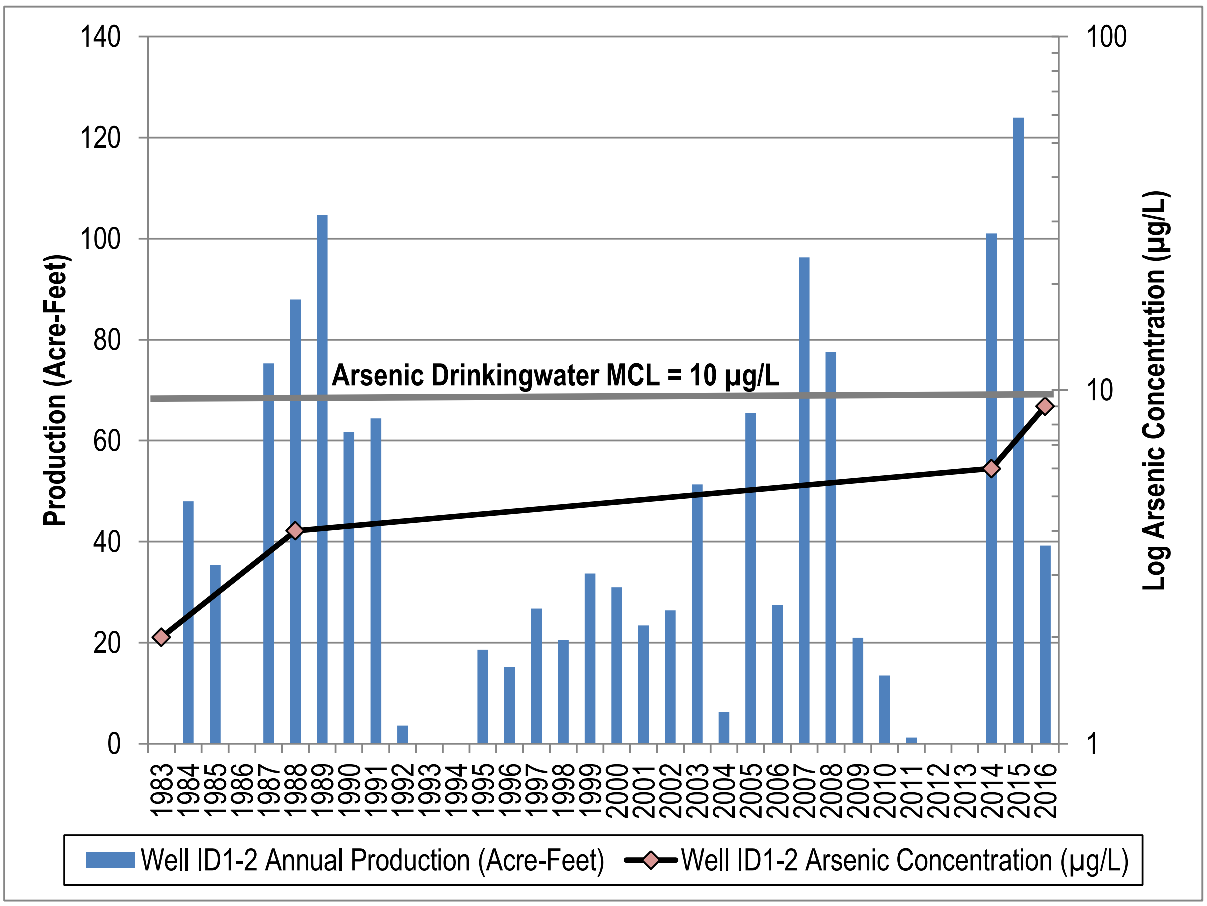
[11] The recommended, upper, and short-term California drinking water secondary MCLs for sulfate are 250 mg/L, 500 mg/L, and 600 mg/L, respectively.

Evaluation of Increasing Arsenic Concentration with Groundwater Pumping and Groundwater Levels for Wells ID1-2 and ID1-8

Well ID1-2

As indicated by the Mann-Kendall trend analysis, arsenic concentrations in Well ID1-2 has a statistically-increasing trend. Annual groundwater production at well ID1-2 was compared with available arsenic concentration data as shown in Exhibit 1.

Exhibit 1
Well ID1-2 Groundwater Production and Arsenic Data



A linear regression analysis of the dependent variable, arsenic concentration was plotted versus the independent variable, annual groundwater production for Well ID1-2. The goodness of fit for well ID1-2 linear regression was poor (R square value = 0.03).

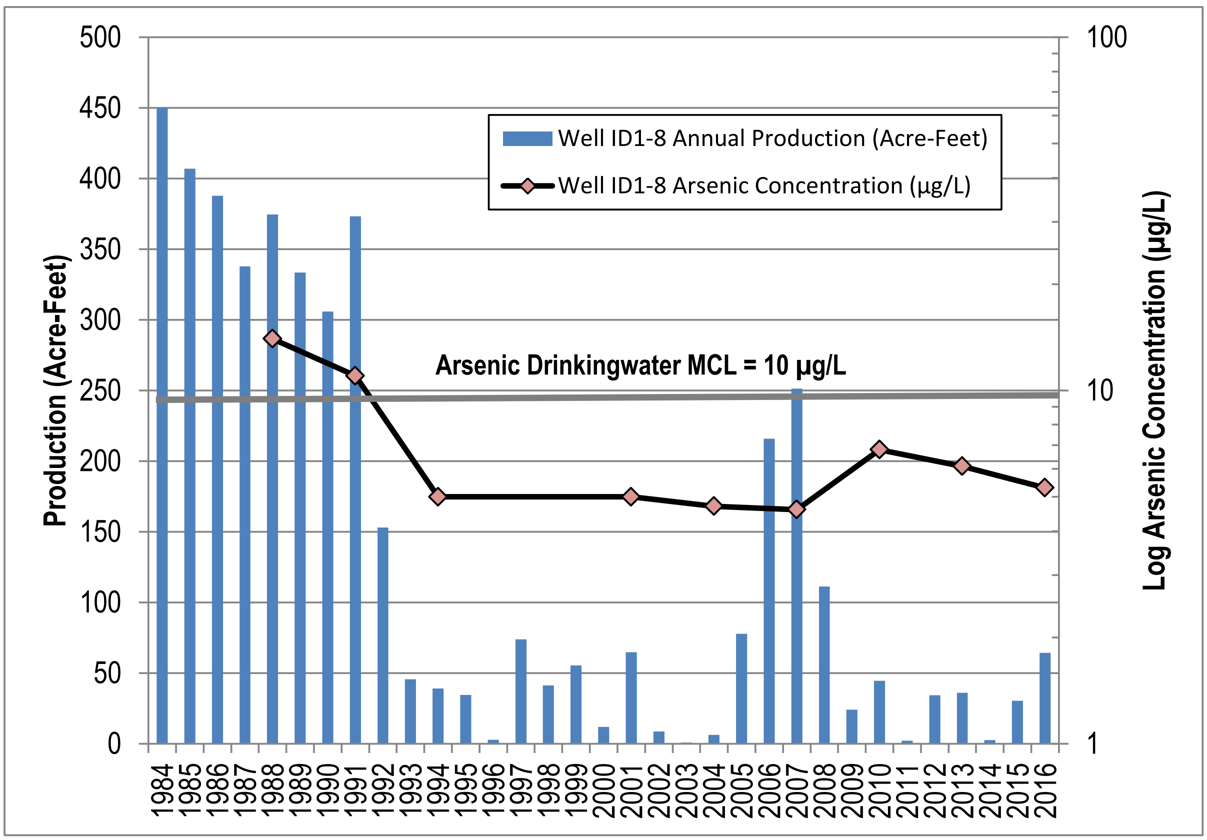
Sufficient groundwater level data is not available over the period of record to determine if there is a correlation between arsenic concentration and groundwater levels. Additional arsenic concentration, production, and groundwater level data is required to make any further correlation of the data for well ID1-2.

ID1-8

As indicated by the Mann-Kendall trend analysis, arsenic concentrations in well ID1-8 have no statistically determined trend. Visual review of the data shown in Exhibit 2 suggests that arsenic concentrations initially dropped and are now stable. However, since arsenic concentrations can vary with depth, further review of the data was conducted with respect to groundwater levels and production rates.

Annual groundwater production at Well ID1-8 was compared with available arsenic concentration data as shown in Exhibit 2.

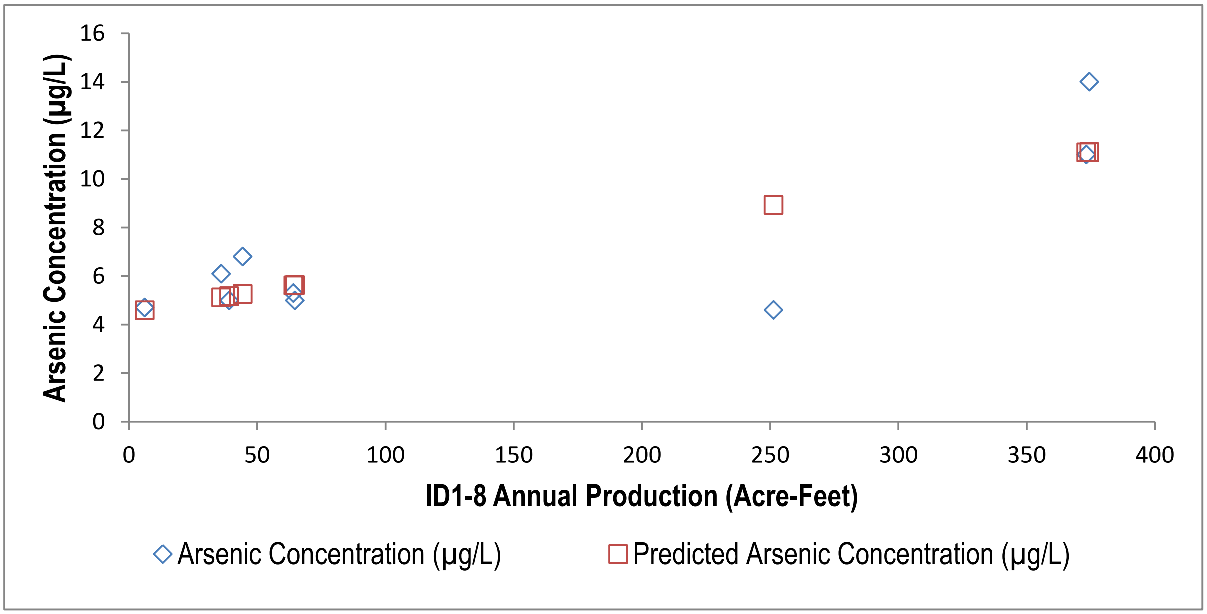
Exhibit 2
Well ID1-8 Groundwater Production and Arsenic Data



Sources: Production and groundwater quality data provided from BWD files.

A linear regression analysis of the dependent variable, arsenic concentration was plotted versus the independent variable, annual groundwater production for well ID1-8 (Exhibit 3). The goodness of fit for well ID1-8 linear regression was good (R square value = 0.65).

Exhibit 3
Well ID1-8 One-Way Linear Regression



Additional linear regression analysis was performed of the dependent variable, arsenic concentration plotted versus the independent variables, annual groundwater production, and groundwater elevation for well ID1-8 (Exhibits 4a and 4b). The goodness of fit for the two-way well ID1-8 linear regression was good (R square value = 0.66) and slightly better than the one-way linear regression.

Exhibit 4A
Well ID1-8 Two-Way Linear Regression

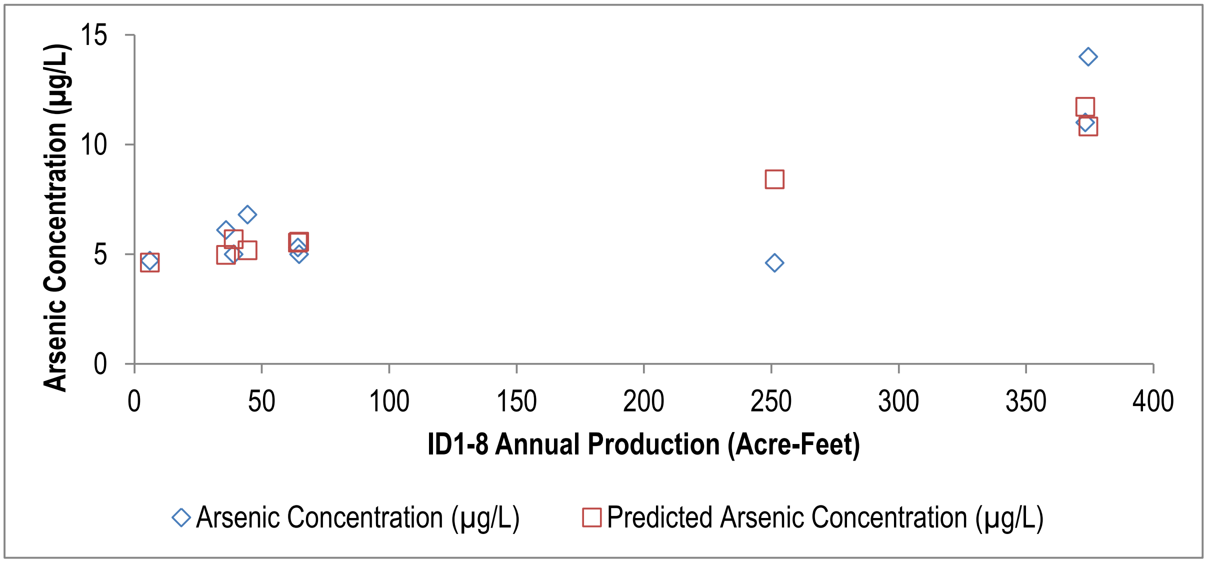
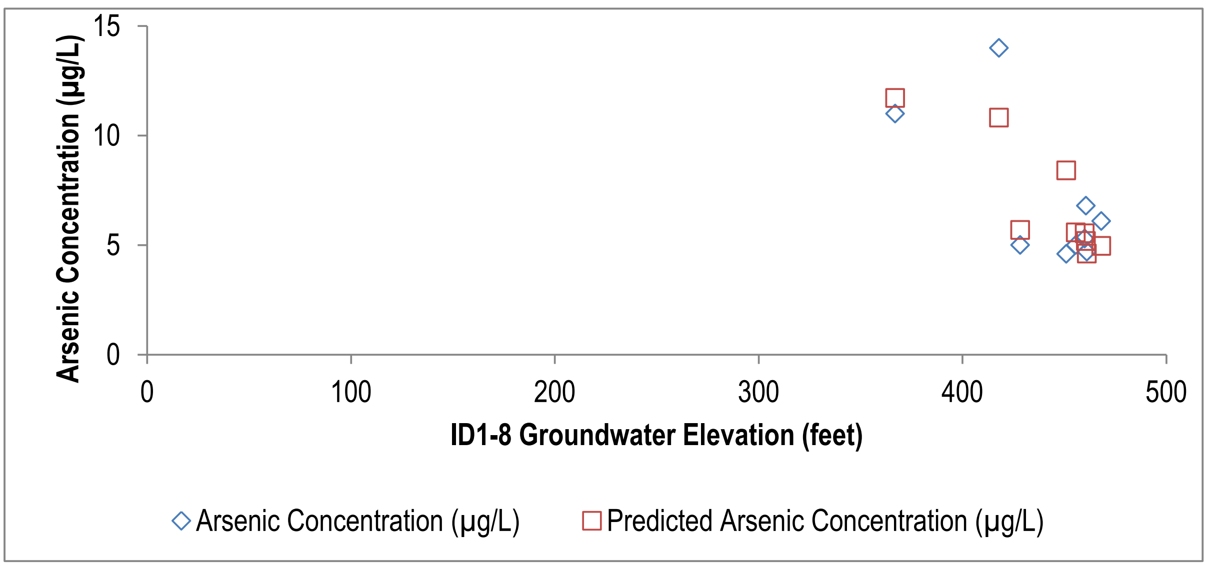


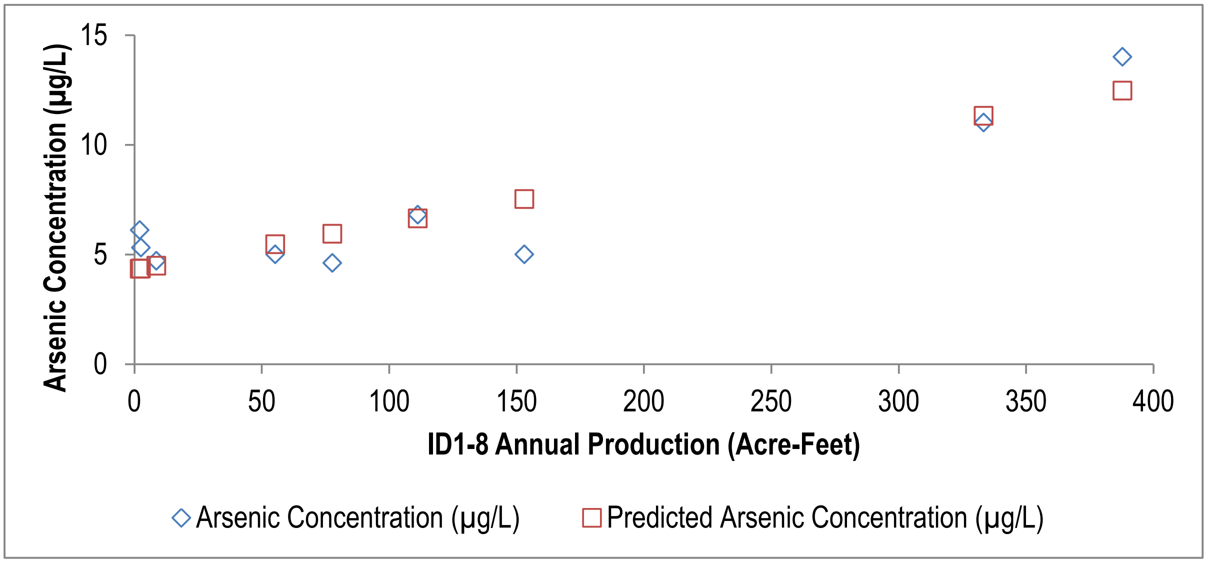
Exhibit 4B
Well ID1-8 Two-Way Linear Regression



Notes: The upper graph displays ID1-8 annual production vs. arsenic concentration linear regression while the lower graph displays ID1-8 groundwater elevation vs. arsenic concentration linear regression.
Sources: Production, groundwater level and groundwater quality data provided from BWD files.

As there appears to be about a 2-year lag in increased arsenic concentration versus pumping, an alternative linear regression was performed by forcing the data with a 2-year correction. A linear regression analysis of the dependent variable, arsenic concentration was plotted versus the independent variable, annual groundwater production with a 2-year lag applied for well ID1-8 (Exhibit 5). The goodness of fit for Well ID1-8 linear regression 2-year lag was best (R square value = 0.83).

Exhibit 5
Well ID1-8 2-Year Lag Linear Regression



Sources: Production, groundwater level and groundwater quality data provided from BWD files.

If the linear regression equation: y = Arsenic = 4.293 + (0.0177*Production Rate) from the 2-year lag regression is applied for predictive analysis, then a predicted arsenic concentration is arrived for each annual production rate (Table 3).

Table 3
2-Year Lag Predictive Arsenic Concentration ID1-8

Annual Production Rate (acre-feet)	Predicted Arsenic Concentration (µg/L)
100	6.06
200	7.83
300	9.60
400	11.37
500	13.14

Table 3
2-Year Lag Predictive Arsenic Concentration ID1-8

Annual Production Rate (acre-feet)	Predicted Arsenic Concentration (µg/L)
600	14.92
650	15.80
700	16.69
800	18.46
900	20.23
1,000	22.00

Note: The predicted arsenic concentration is based on the 2-year lag linear regression equation for pumping at ID1-8.

Based on the 2-year lag linear regression of production and arsenic data from well ID1-8, groundwater production in excess of 300 acre-feet per year at well ID1-8 is predicted to exceed the arsenic drinking water standard of 10 µg/L after approximately 2 years of production at this rate.. Assuming the 1988 and 1991 measured arsenic concentration of 14 µg/L and 11 µg/L, respectively, represent true values, there is a high probability that the current rate of groundwater production (in excess of 1,000 acre-feet) in the SMA could potentially result in exceedance of the arsenic drinking water standard at well ID1-8. Because available data is limited (only 2 years of data for newly drilled wells) in the SMA, additional analysis could not be performed.

NON-TREATMENT AND TREATMENT ALTERNATIVES

While none of the BWD's wells currently exceed California drinking water MCLs, treatment alternatives for COCs are discussed herein to explore options in the event that groundwater quality were to become impaired. Non-treatment and treatment options to meet drinking water standards typically include blending, wellhead treatment, or supplementing the impaired source of supply. In brief, the options include the following.

Switch Sources. As indicated in this Draft Working Technical Memorandum, the BWD is supplied from several wells located in the NMA, CMA, and SMA of the Borrego Springs Subbasin. If a BWD well were to exceed a drinking water standard, the likely most cost-effective option would be to switch supply to an existing water well(s).

Procurement of a New Source. If additional quantity of groundwater meeting California drinking water MCLs was required by the BWD, then acquiring existing wells or drilling new water wells in the basin may be a cost-effective option. The BWD has already initiated preliminary review of potential new sources of supply in the Borrego Springs Subbasin and should further identify strategic sources of supply that meet Title 22 potable drinking water quality requirements.

Blending. If a system has supply sources with low and high concentrations of COCs, blending is a practical option if the source of supply with a low concentration of the COCs is reliable and the sources can be brought together for mixing at a common header (i.e., blending location which may occur within a pipeline). To allow for a safety margin, target concentration of the blended stream is typically set 20% below the respective MCL.

Sidestream Treatment. If COCs were to exceed a respective MCL by a small margin, then sidestream treatment could be a viable option for some COCs such as arsenic. Sidestream treatment involves splitting flow, treating one stream, and blending it with the untreated stream prior to distribution.

Wellhead Treatment. If the typically more cost-effective options above were exhausted, then wellhead treatment would be evaluated in the event that COCs were to exceed drinking water standards. The U.S. Environmental Protection Agency (EPA) identifies several best available technologies for arsenic removal, which are discussed in further detail in a previous Dudek study, *Water Replacement and Treatment Cost Analysis for the Borrego Valley Groundwater Basin* (Dudek 2015).

CONCLUSIONS AND RECOMMENDATIONS

Groundwater quality in the Borrego Springs Subbasin varies both geographically from north to south in the subbasin and with depth in the aquifer. Dudek recommends considering the designation of three groundwater quality management zones to improve management of the subbasin. These will address the geographic effects on groundwater quality and better manage water quality moving forward. Three management areas are proposed for the subbasin: North Management Area (NMA), Central Management Area (CMA), and a South Management Area (SMA). These management areas are based on both subsurface geological features such as the Desert Lodge anticline that limit hydrologic communication between the southern part of the subbasin and the central part of the subbasin, as well as on differences in groundwater production demands, well screens, and pumping depressions between the southern, central, and northern parts of the subbasin.

Potential risks were examined in this technical memorandum associated with temporal changes in groundwater quality specific to potential exceedances of drinking water MCLs in BWD production wells due to the long-standing critical overdraft. A review of available historical groundwater quality data has identified numerous COCs in the Borrego Springs Subbasin including arsenic, fluoride, nitrate, sulfate, and TDS.

- Statistical analysis of the data indicates increasing trend for arsenic, fluoride, nitrate, sulfate, and TDS in select wells. In the NMA, well ID4-11 indicates increasing trend for fluoride, and wells ID4-11 and ID4-18 indicate increasing trend for nitrate as N. In the CMA, the Wilcox well indicates increasing trend for fluoride, and well ID1-10 indicates increasing trend for nitrate as N. In the SMA, well ID1-2 indicates increasing trend for arsenic; well ID1-8 indicates an increasing trend for nitrate as N; and wells ID1-1 and ID1-8 indicate an increasing trend for sulfate and TDS.

- Areas of the subbasin where COC concentrations exceed MCLs include arsenic in multiple wells and TDS in one well in the SMA. Historical exceedance of nitrate as N in the upper aquifer of the NMA is based on data collected from old well ID4-4. Sulfate exceeding the secondary MCL is indicated in wells MW-5A and MW-5B in the CMA at the Borrego Sink, and well ID1-1 in the SMA.
- Groundwater quality changes with depth are most pronounced in the lower aquifer of the SMA that has elevated arsenic concentrations above the California drinking water standard. Review of limited available data are uncertain as to whether arsenic or other COCs increase as a function of depth in the subbasin. Additional data collection is required to characterize groundwater quality and fill the data gap to determine whether as groundwater levels decrease if groundwater quality degrades.

Due to the limited available groundwater quality data, there is often insufficient data to determine trend, and it is recommended that BWD begin to sample wells annually rather than every 3 years as required by the DDW, at least for wells that indicated detections of COCs above one-half the drinking water MCL or where increasing concentration trend is indicated.

Groundwater quality data support that water quality decreases with depth, and it is anticipated that a greater percentage of groundwater production will be derived from the middle and lower aquifers before groundwater levels are stabilized under the GSP. However, since many of the wells have very long open screen lengths, the groundwater quality data reflect a blend of water with depth and do not clearly provide depth-specific data. It is also recommended that to better assess risks to groundwater quality and future sources of BWD supply that additional existing private wells be sampled and the potential to conduct depth-discrete sampling of existing wells and/or drilling of test/monitoring wells be evaluated.

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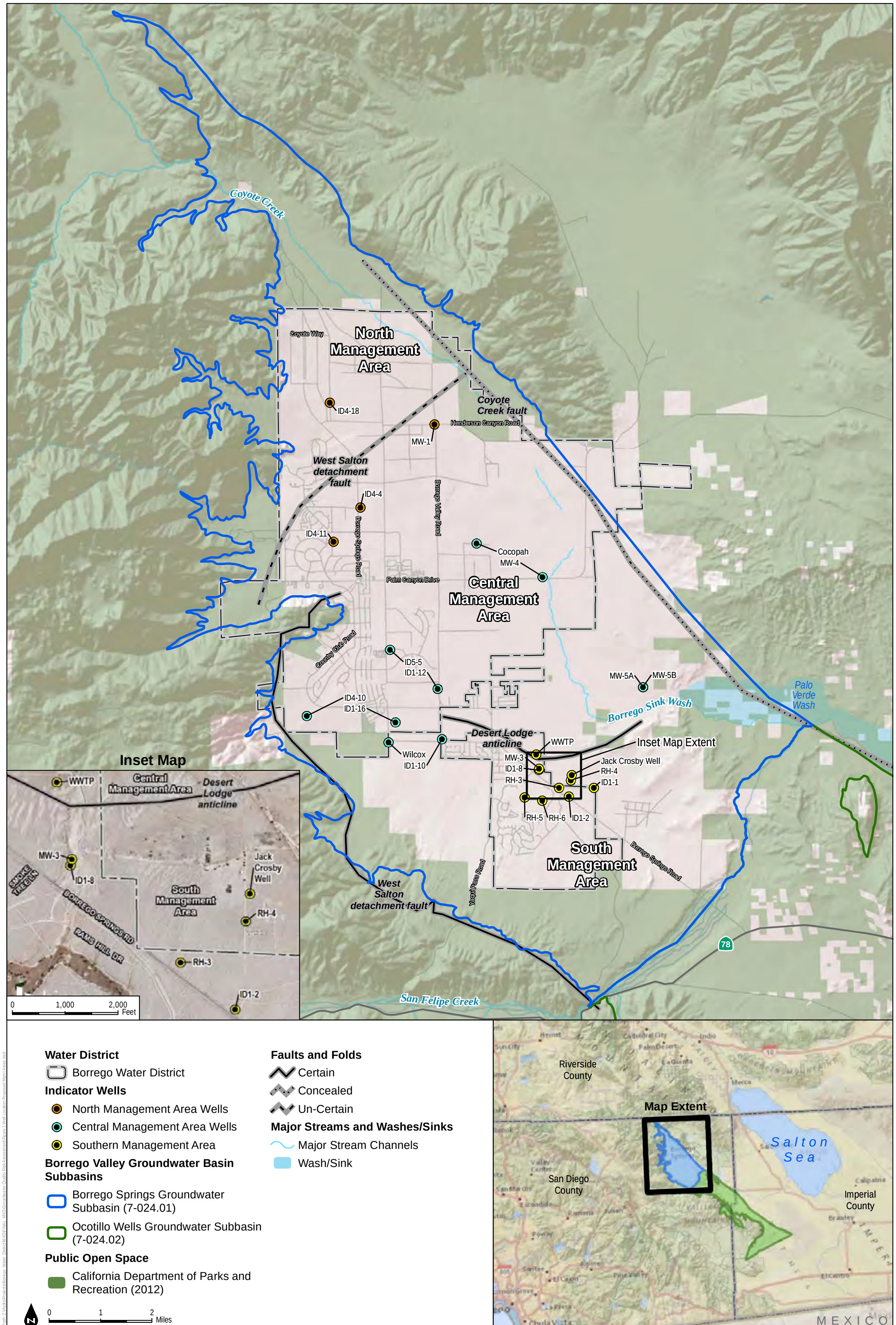


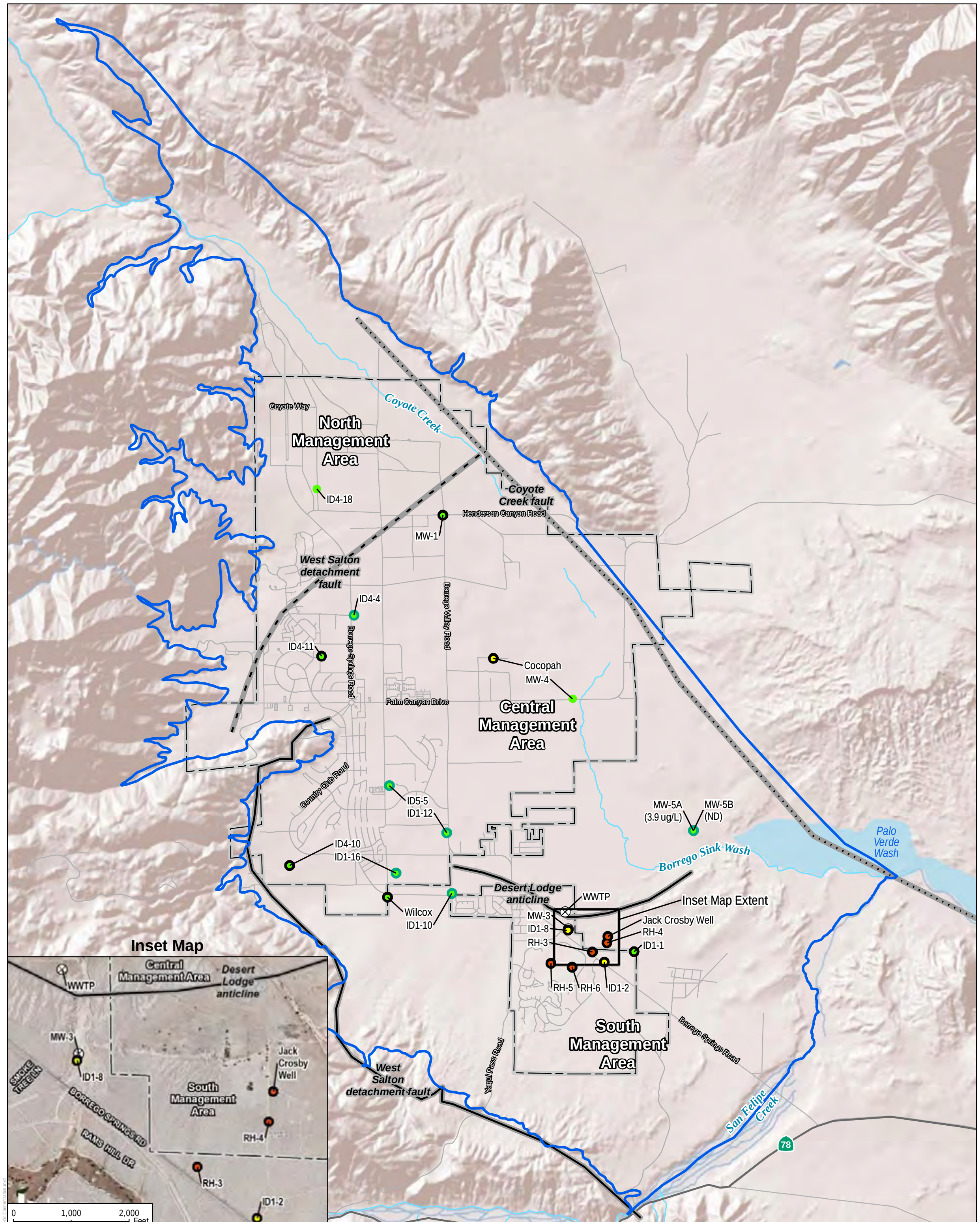
DUDEK

SOURCE: USGS; DWR; BWD; Steely et. al. 2009

Figure 1
Indicator Well Location Map and Proposed Management Areas

Borrego Springs Subbasin Groundwater Quality Risk Assessment

DRAFT June 2017



Borrego Water District
Borrego Springs Groundwater Subbasin (7-024.01)

Faults and Folds

Certain
Concealed
Un-Certain

Major Streams and Washes/Sinks

Major Stream Channels
Wash/Sink

Arsenic Wellhead Concentrations

Upper Aquifer

Less than 1/2 the MCL (5 ug/L)

Middle Aquifer

Less than 1/2 the MCL (5 ug/L)

Lower Aquifer

No Sample
Less than 1/2 the MCL (5 ug/L)
Less than the MCL (10 ug/L)
Greater than the MCL (10 ug/L)

Note: Many wells are screened in multiple aquifers, but wells have been designated by aquifer based on the assumed preferential pumping zone.
Wellhead concentrations are based on the most recent sampling events.

N
0 1 2 Miles

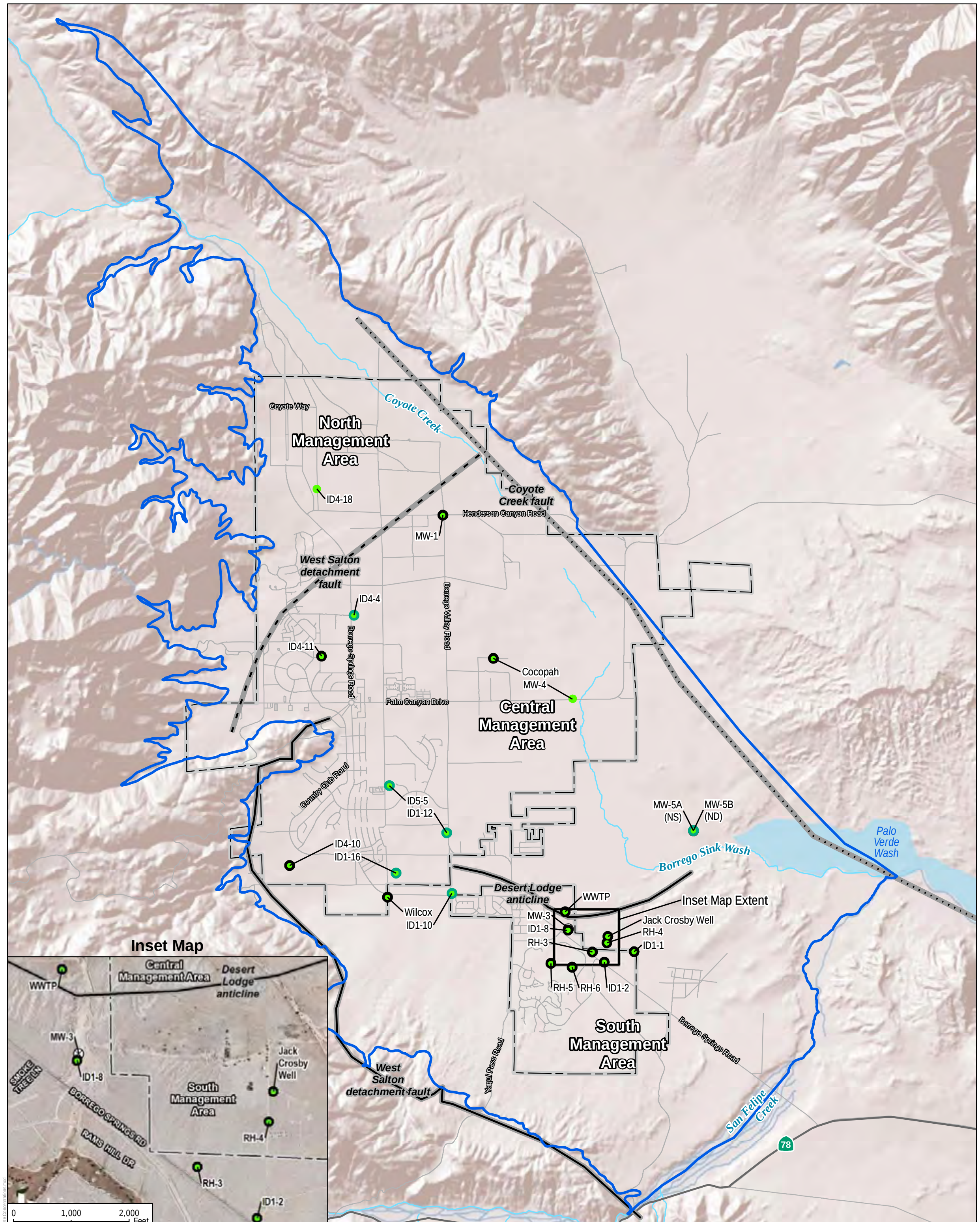
DUDEK

SOURCE: USGS; DWR; BWD; Steely et. al. 2009

Figure 2
Arsenic Wellhead Concentrations

Borrego Springs Subbasin Groundwater Quality Risk Assessment

DRAFT June 2017



Borrego Water District

Borrego Springs Groundwater Subbasin (7-024.01)

Faults and Folds

Certain

Concealed

Un-Certain

Major Streams and Washes/Sinks

Major Stream Channels

Wash/Sink

Nitrate as Nitrogen (N) Wellhead Concentrations

Upper Aquifer

Less than 1/2 the MCL (5 mg/L)

Middle Aquifer

No Sample

Less than 1/2 the MCL (5 mg/L)

Lower Aquifer

No Sample

Less than 1/2 the MCL (5 mg/L)

Less than the MCL (10 mg/L)

Note: Many wells are screened in multiple aquifers, but wells have been designated by aquifer based on the assumed preferential pumping zone. Wellhead concentrations are based on the most recent sampling events.

N

0 1 2 Miles

DUDEK

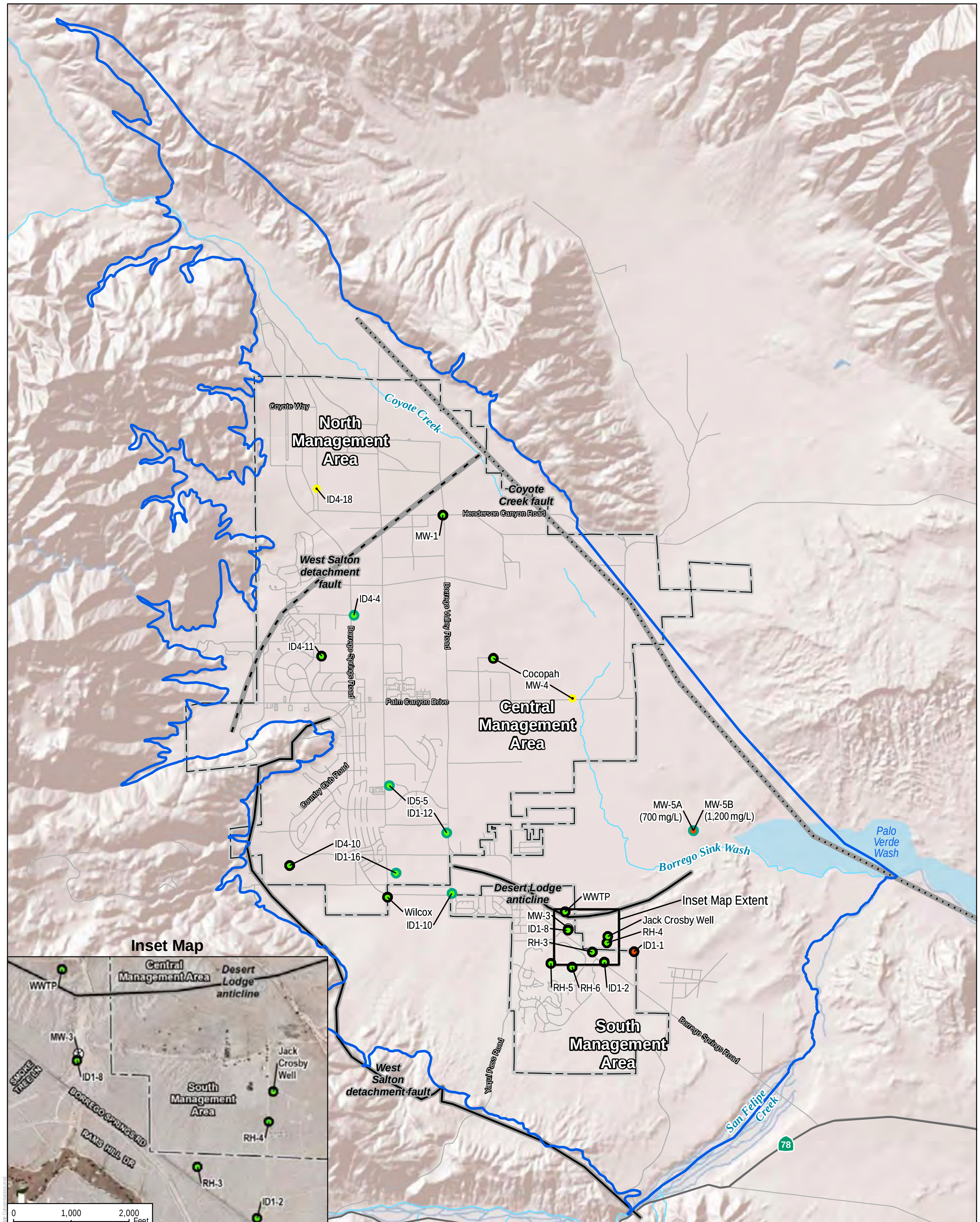
SOURCE: USGS; DWR; BWD; Steely et. al. 2009

Figure 3

Nitrate as Nitrogen (N) Wellhead Concentrations

Borrego Springs Subbasin Groundwater Quality Risk Assessment

DRAFT June 2017



Borrego Water District
Borrego Springs Groundwater Subbasin (7-024.01)

Faults and Folds
- Certain
- Concealed
- Un-Certain

Major Streams and Washes/Sinks
- Major Stream Channels
- Wash/Sink

Sulfate Wellhead Concentrations

Upper Aquifer
- Less than the secondary MCL (500 mg/L)

Middle Aquifer
- Less than 1/2 the secondary MCL (250 mg/L)
- Greater than the secondary MCL (500 mg/L)

Lower Aquifer
- No Sample
- Less than 1/2 the secondary MCL (250 mg/L)
- Greater than the secondary MCL (500 mg/L)

Note: Many wells are screened in multiple aquifers, but wells have been designated by aquifer based on the assumed preferential pumping zone.
Wellhead concentrations are based on the most recent sampling events.

0 1 2 Miles

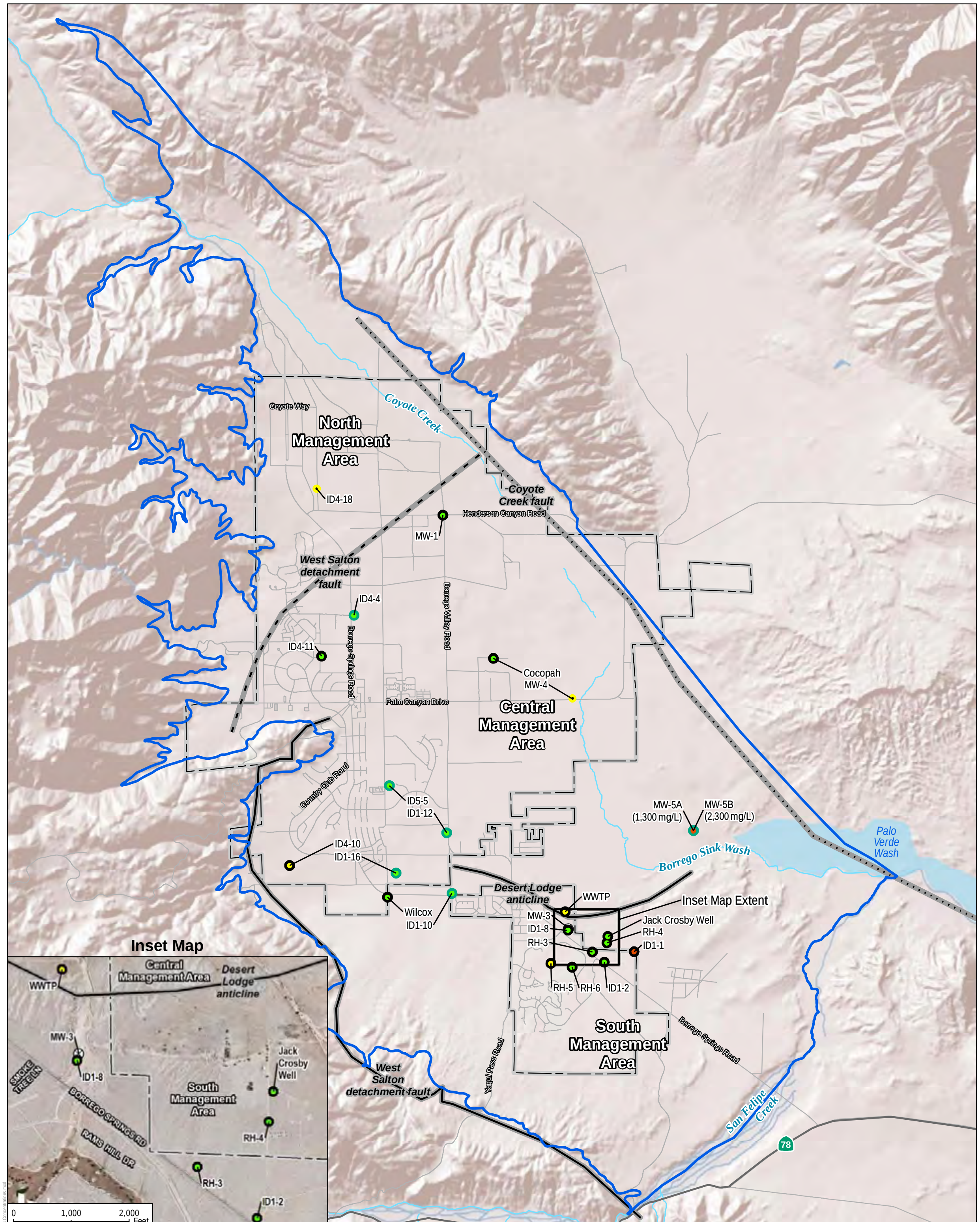
DUDEK

SOURCE: USGS; DWR; BWD; Steely et. al. 2009

Figure 4
Sulfate Wellhead Concentrations

Borrego Springs Subbasin Groundwater Quality Risk Assessment

DRAFT June 2017



Borrego Water District
Borrego Springs Groundwater Subbasin (7-024.01)

Faults and Folds

- Certain
- Concealed
- Un-Certain

Major Streams and Washes/Sinks

- Major Stream Channels
- Wash/Sink

Total Dissolved Solids (TDS) Wellhead Concentrations

Upper Aquifer

- Less than the secondary MCL (1,000 mg/L)

Middle Aquifer

- Less than 1/2 the secondary MCL (500 mg/L)
- Greater than the secondary MCL (1,000 mg/L)

Lower Aquifer

- No Sample
- Less than 1/2 the secondary MCL (500 mg/L)
- Less than the secondary MCL (1,000 mg/L)
- Greater than the secondary MCL (1,000 mg/L)

Note: Many wells are screened in multiple aquifers, but wells have been designated by aquifer based on the assumed preferential pumping zone. Wellhead concentrations are based on the most recent sampling events.

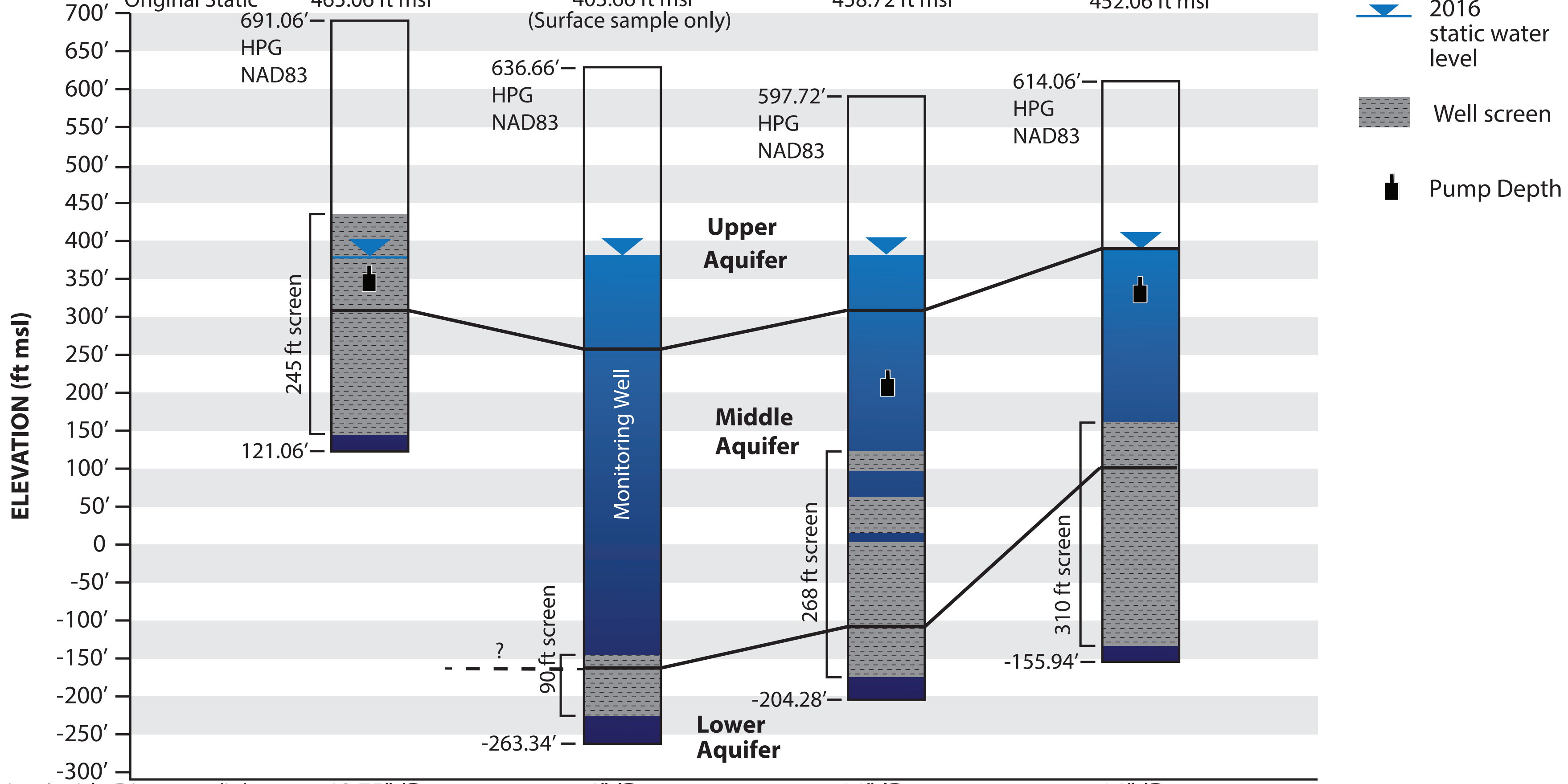
0 1 2 Miles

DUDEK

SOURCE: USGS; DWR; BWD; Steely et. al. 2009

Figure 5
Total Dissolved Solids Wellhead Concentrations

Well ID	ID4-18	MW-1	ID4-4	ID4-11
Current gpm	Q=220gpm	Q=150gpm	Q=380gpm	Q=1,100gpm
Original gpm*	Q=1,200gpm*	N/A	Q=1,155gpm*	Q=2,000gpm*
Year Drilled	(1982)	(2004)	(1979)	(1995)
Original Static	465.06 ft msl	403.66 ft msl (Surface sample only)	458.72 ft msl	452.06 ft msl



	ID4-18	MW-1	ID4-4	ID4-11
Casing Inside Diameter (in):	12.75″ ID	4″ ID	14″ ID	14″ ID
Well Depth (ft bls):	570′ bls	900′ bls	786′ bls	770′ bls
Borehole Depth (ft bls):	699′ bls	1,238′ bls	802′ bls	800′ bls
Pump Size (HP):	50 HP	N/A	150 HP	200 HP
Pump Depth (ft msl):	251 ft msl	N/A	219 ft msl	269 ft msl
Specific Capacity (gpm/ft):	12.83 gpm/ft	00.36 gpm/ft	12.83 gpm/ft	86.95 gpm/ft
Current Production Rate (gpm):	220gpm	Monitoring Well	400gpm	1,1000 gpm
Casing Type:	Mild Steel	PVC	Mild Steel	Mild Steel

*Indicates original tested production rate when drilled

SOURCE: DWD, Pump Check 2013, DWR Well Completion Reports '79/'95/'82/'04

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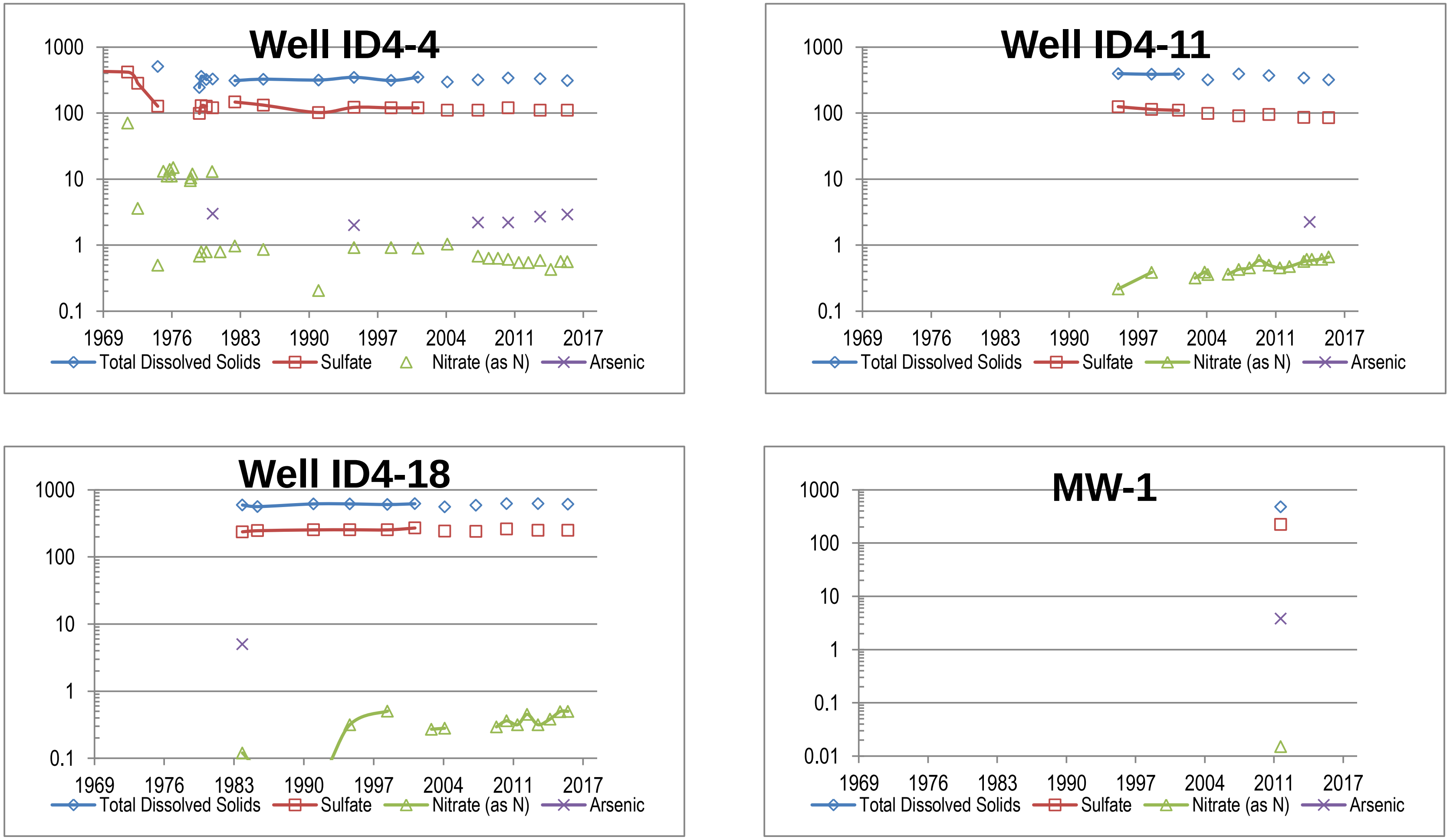
June 2017

FIGURE 6

DRAFT: North Management Area Wells

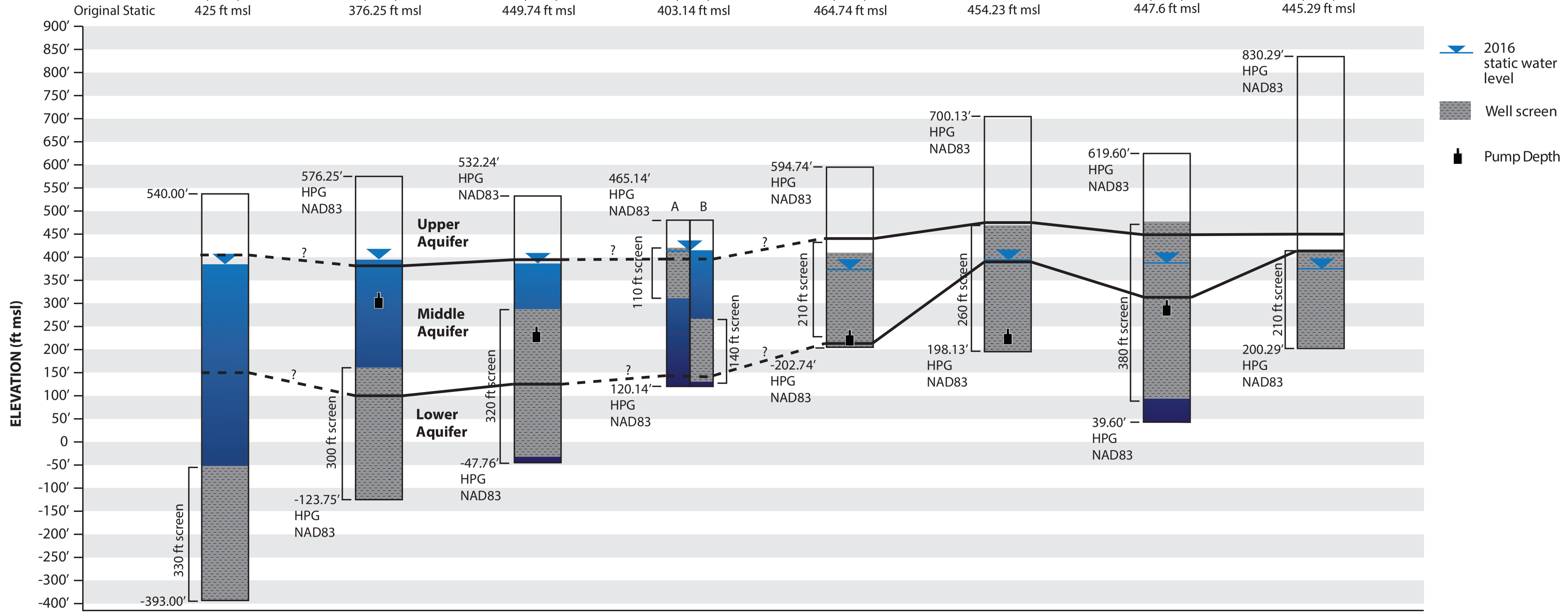
Borrego Valley Groundwater Basin - Groundwater Quality Risk Assessment

Figure 7 North Management Area Groundwater Quality



Notes: Water entering well ID4-4 near static groundwater level was found to be high in dissolved minerals and nitrate. This zone was sealed off by the Roscoe Moss Co. in 1972 and redilled in 1979.
Source: BWD 2016, USGS 1980, DDW 2017

Well ID	Cocopah	ID5-5	ID1-12	MW-5A/B	ID1-10	Wilcox	ID1-16	ID4-10
Current gpm	Q=1,166gpm	Q=1,000gpm	Q=965gpm	Monitoring Well	Q=500?gpm	Q=175gpm	Q=750gpm	Q=69gpm
Original gpm*	Q=2,000gpm*	Q=3,000gpm*	Q=2,000gpm*	N/A	Q=1,110gpm*	Q=900gpm*	Q=2,500gpm*	Q=69gpm*
Year Drilled	(2005)	(2000)	(1984)	(2006)	(1972)	(1981)	(1989)	(1989)
Original Static	425 ft msl	376.25 ft msl	449.74 ft msl	403.14 ft msl	464.74 ft msl	454.23 ft msl	447.6 ft msl	445.29 ft msl



	Cocopah	ID5-5	ID1-12	MW-5A/B	ID1-10	Wilcox	ID1-16	ID4-10
Casing Inside Diameter (in):	14″ ID	16″ ID	14.75″ ID	4″ ID	12.75″ ID	12.75″ ID	16″ ID	8″ ID
Well Depth (ft bls):	570′ bls	700′ bls	580′ bls	900′ bls	392′ bls	502′ bls	550′ bls	630′ bls
Borehole Depth (ft bls):	699′ bls	708′ bls	726′ bls (2004)	1,238′ bls (2004)	816′ bls	502′ bls	705′ bls	630′ bls
Pump Size (HP):	160 HP	200 HP	200 HP	N/A	150 HP	80 HP	200 HP	N/A
Pump Depth (ft msl):	N/A	316 ft msl	242 ft msl	N/A	204 ft msl	225 ft msl	219 ft msl	N/A
Specific Capacity (gpm/ft):	N/A	N/A	75.4 gpm/ft	N/A	20.3 gpm/ft	26.4 gpm/ft	31.0 gpm/ft	20 gpm/ft
Current Production Rate (gpm):	1,166 gpm	1,000 gpm	965 gpm	Monitoring Well	500? gpm	350? gpm	723 gpm	N/A
Casing Type:	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel
Drop Pipe:	N/A	10″	8″	N/A	8″	6″	8″	N/A

*Indicates original tested production rate when drilled.

DUDEK

SOURCE: DWD, Pump Check 2008, 2009, 2010, 2013, DWR Well Completion Reports '79/'95/'82/'04, USGS

FIGURE 8
DRAFT: Central Management Area Wells

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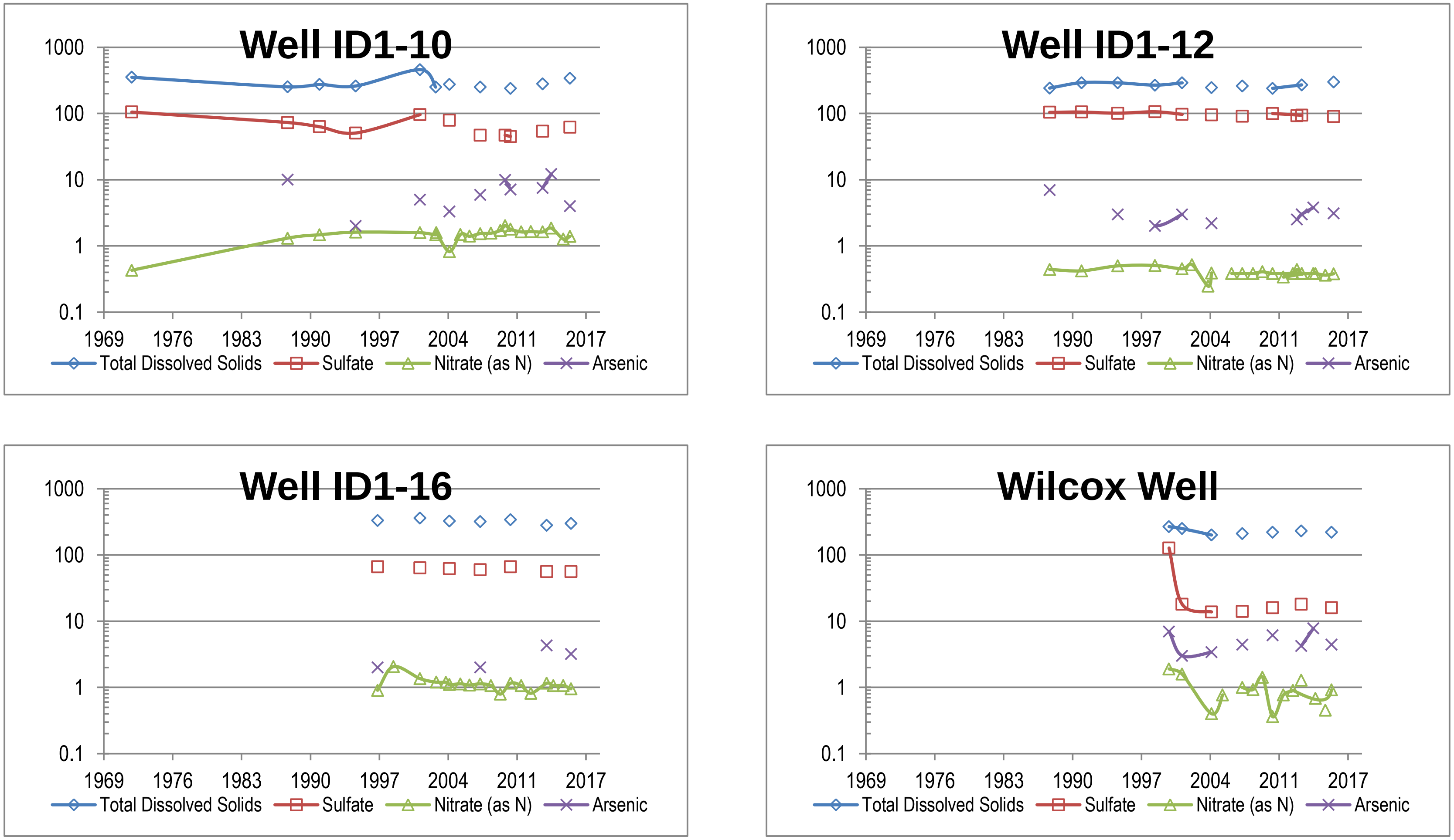
June 2017

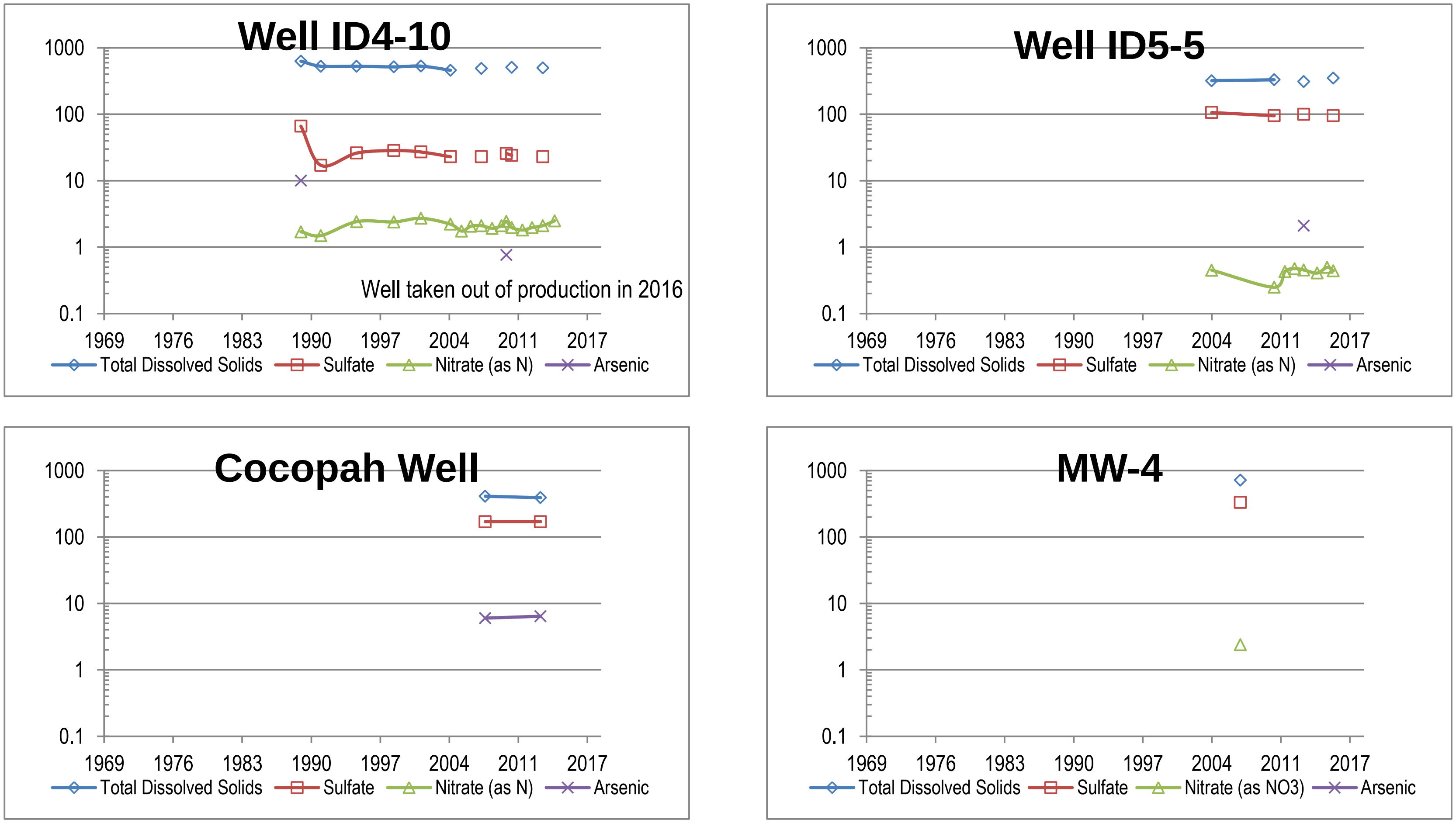
Borrego Valley Groundwater Basin - Groundwater Quality Risk Assessment

Figure 9 Central Management Area Groundwater Quality



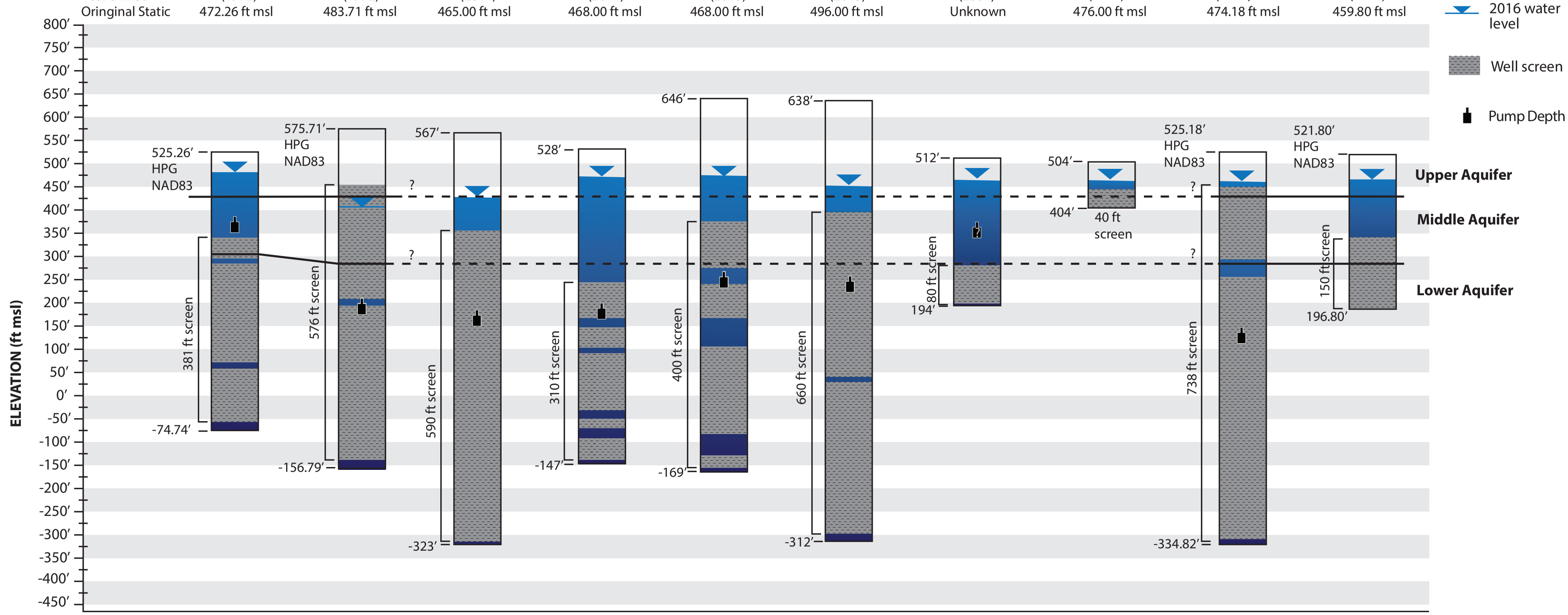
Source: BWD 2016, USGS 2009, 2012, Rezaie-Boroon et al. 2014

Figure 10 Central Management Area Groundwater Quality (Continued)



Source: BWD 2016, USGS 2009

Well ID	ID1-1	ID1-2	RH-3	RH-4	RH-5	RH-6	Jack Crosby Well	WWTP Well	ID1-8	MW-3
Current gpm	Q=200 gpm	Q=200 gpm	Q=230 gpm	Q=260 gpm	Q=350 gpm	Q=350 gpm	Q=10 gpm	Monitoring Well	Q=350 gpm (2013)	Monitoring Well
Original gpm*	Q=300 gpm*	Q=295 gpm*	Q=250 gpm*	Q=342 gpm*	Q=360 gpm*	Q=500 gpm*	Q=50 gpm*	N/A	Q=1,100 gpm*	N/A
Year Drilled	(1972)	(1972)	(2014)	(2014)	(2015)	(2015)	(2004)	(2009)	(1972)	(2005)
Oringinal Static	472.26 ft msl	483.71 ft msl	465.00 ft msl	468.00 ft msl	468.00 ft msl	496.00 ft msl	Unknown	476.00 ft msl	474.18 ft msl	459.80 ft msl



	ID1-1	ID1-2	RH-3	RH-4	RH-5	RH-6	Jack Crosby Well	WWTP Well	ID1-8	MW-3
Casing Inside Diameter (in):	12.75" ID	12.75" ID	12.75" ID	10.75" ID	10.75" ID	10.75" ID	4.5" ID	4.5" ID	12.75" ID	4" ID
Well Depth (ft bls):	600' bls	732' bls	890' bls	675 bls	815' bls	900' bls	318' bls	100' bls	850' bls	325' bls
Borehole Depth (ft bls):	609' bls	740 bls	998' bls	844' bls	830' bls	1,000' bls	318' bls	100' bls	938' bls	344' bls
Pump Size (HP):	40 HP	40 HP	40 HP	40 HP	40 HP	40 HP	unknown	N/A	100 HP	N/A
Pump Depth (ft msl):	357 ft msl	188 ft msl	187 ft msl	168 ft msl	246 ft msl	238 ft msl	N/A	N/A	135 ft msl	N/A
Specific Capacity (gpm/ft):	3.25 gpm/ft	1.45 gpm/ft	1.24 gpm/ft	1.69 gpm/ft	7.0 gpm/ft	5.9 gpm/ft	unknown	N/A	8.7 gpm/ft	N/A
Current Production Rate (gpm):	200 gpm	200 gpm	230 gpm	260 gpm	350 gpm	350 gpm	10 gpm	N/A	350 gpm (2013)	N/A
Casing Type:	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel	Mild Steel	PVC	PVC	Mild Steel	Mild Steel

* Indicates original tested production rate when drilled

DUDEK

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June 2017

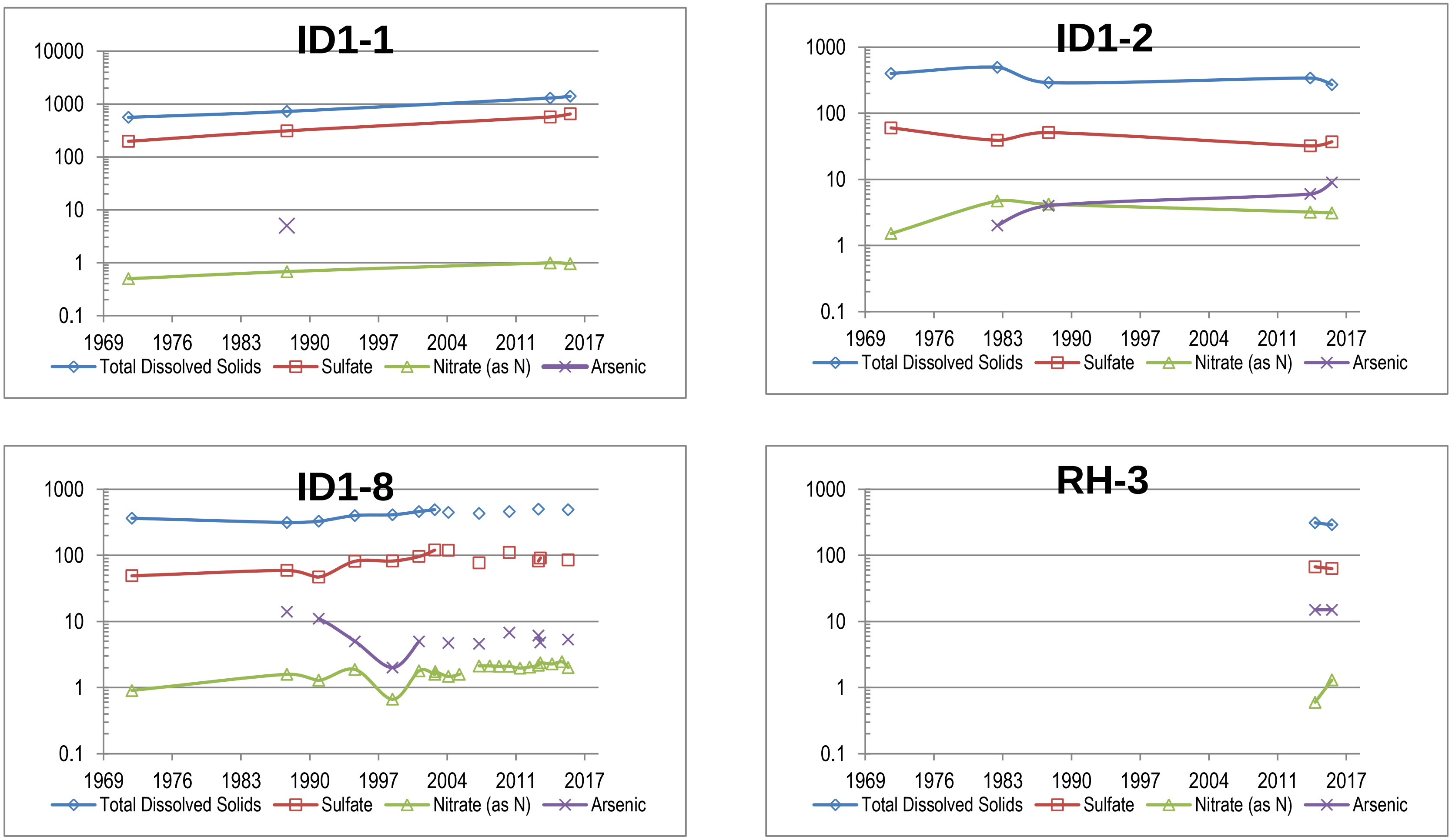
SOURCE: DWD, Pump Check 2008, 2009, 2010, 2013, DWR Well Completion Reports '79/'95/'82/'04, USGS (ID1-1, ID1-2, ID1-8, MW-3 elevation data source), other elevation data from Google Earth

FIGURE 11

DRAFT: Southern Management Area Wells

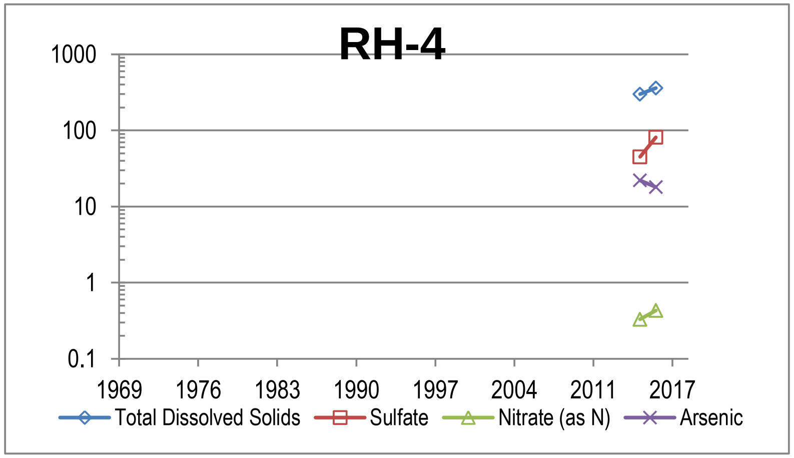
Borrego Valley Groundwater Basin - Groundwater Quality Risk Assessment

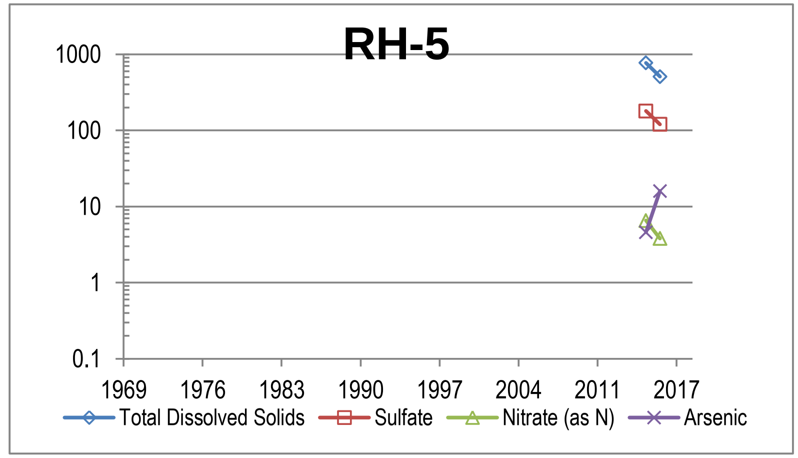
Figure 12 South Management Area Groundwater Quality

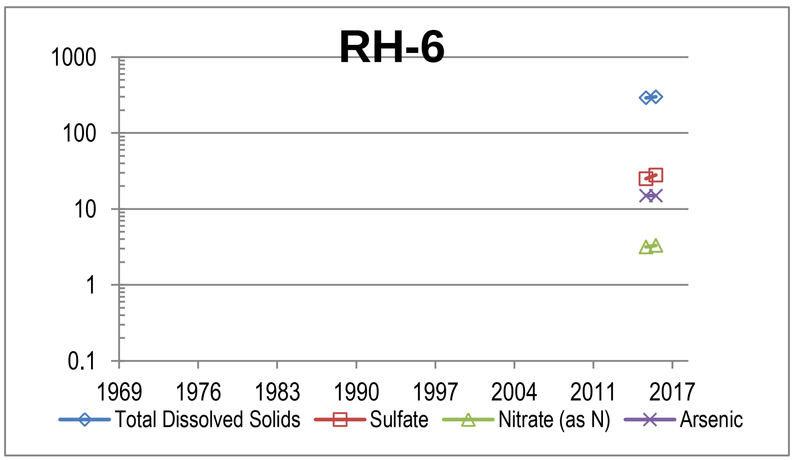


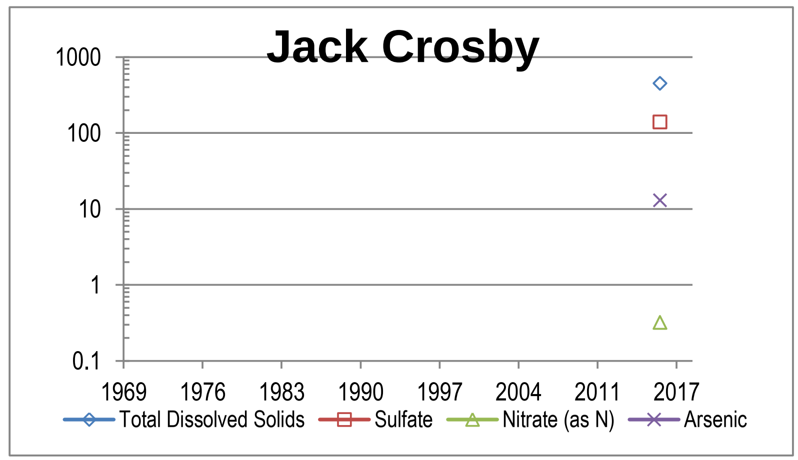
Source: BWD 2016, USGS 2013

Figure 13 South Management Area Groundwater Quality (Continued)



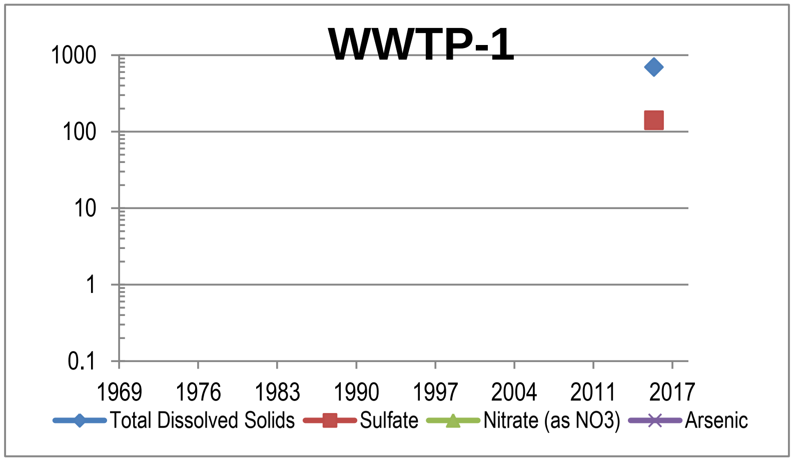






Source: Dudek 2016

Figure 14 South Management Area Groundwater Quality (Continued)



Source: BWD 2016

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL II.B

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Discussion of Prop 1 grant applications

RECOMMENDED ACTION:

Receive staff report on status of Prop 1 grant applications

ITEM EXPLANATION:

Following is a summary of the current Prop One Grant Applications:

Wastewater Tertiary Plant Upgrade - $75,000 GRANTED: The grant has been approved by SWRCB for this project. Dudek is in the process of developing an assessment of the feasibility of upgrading the plant treatment to tertiary levels and reusing the water for irrigation uses, percolating into the Basin or a no project alternative. Satellite, package plants will also be evaluated.

WasteWater Rehabilitation - $280,000 IN PROCESS: This project involves rehabilitating various components of the existing wastewater treatment plant that have exceeded the useful life. SWRCB grant requirements are evolving and new requirements pertaining to Debt Management have popped up. The good news is BWD approved the Policy last month which is now a requirement as part of the application process. I was also required to go through a webinar held by the California Debt and Investment Advisory Commission on the basics of issuing debt. At this point the only remaining items on the Application is a Financial Sustainability Study (due by 7-31) and the Plans and Specifications. I am waiting to get the green light from SWRCB staff that all other requirements have been met and it is now OK to develop the Plans and Specs. David Dale is providing BWD with an estimate for development of the P and S for this project so we are ready once we get the green light. Funding of selected projects is expected to occur in last 3rd Quarter or early 4th quarter of 2017 according to SWRCB Staff.

Water System Improvements - $1,122,500 IN PROCESS: This project involves replacement and rehabilitation of existing BWD reservoirs and replacement of the diesel motor at Wilcox. The nature of this application changed in the past few months and instead of repairing three reservoirs, two of the three will be replaced. The only remaining item for this project is the development of Plans and Specifications and as with the other WWTP Application above, David Dale is providing us with an estimate for completion of the necessary documents. Funding of selected projects is expected to occur in last 3rd Quarter or early 4th quarter of 2017 according to SWRCB Staff.

FISCAL IMPACT

The total of the 3 grant applications is $1,342,500.

ATTACHMENTS

None

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL II.C

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Final Engineering on Prop One Grant Application – G Poole

RECOMMENDED ACTION:

Authorize staff to enter into contract with David Dale for completion of the Plans and Specifications on Prop One Grant Applications

ITEM EXPLANATION

One of the last stages in the Prop One Grant Application Process is development of the Plans and Specifications. As previously reported, on the two unfunded applications, all other required components have been submitted and at this point, Plans and Specs is the last step in the process. David has estimated the cost to produce Plans and Specifications at not to exceed cost of $20,000, and staff is requesting authorization for this expenditure.

FISCAL IMPACT:

Prop One Grant funding is possible with completion of the Plans and Specifications.

ATTACHMENTS:

None

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL II.D

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Temporary funding of Groundwater Sustainability Plan Facilitation by Center for Collaborative Policy (CCP) – G Poole

RECOMMENDED ACTION:

Authorize staff to enter into contract with CCP for interim funding of facilitation services to support the GSP Advisory Committee activities

ITEM EXPLANATION

Meghan Wiley from CCP has been assigned to facilitate the GSP Advisory Committee in Borrego through a grant from the State and she has done an excellent job. Funding of her activities will be discontinued in July and not started again until the next round of Prop One grants are funded which is planned for September/October of this year. The purpose of this item is to provide the interim funding needed to continue Meghan's services. Staff is working with the State to see if these expenses can be reimbursed from future Grant proceeds. The scope of work is to continue to support the AC.

The budget for Facilitation services during the interim period is $3,000 per month and funding is expected to be needed or up to 3 months until Prop One grants are determined. The final budget numbers will be included in the Final Draft of the Agenda tomorrow.

FISCAL IMPACT:

The cost for continued facilitation services is $3,000/month for up to 3 months = $9,000 total

ATTACHMENTS:

None

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL II.E

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: SGMA-related land use economic considerations proposal from Le Sar Development Consultants – L Brecht

RECOMMENDED ACTION:

Discuss LeSar proposal and direct staff accordingly

ITEM EXPLANATION

At the June 20th meeting the Board, the need for land use based analyses in Borrego Springs was discussed. Specifically, LeSar Consultants are proposing to assist BWD in the development of a Prop One Grant Application for a land use based model and related activities.

The Board felt more information was needed before a decision could be made. Staff and Directors Brecht and Ehrlich are scheduled to talk to LeSar on June 23rd at 4:30 to ask the questions that need to be answered. The current plan is to allow LeSar a few days to respond to the questions and share that information at the June 28th Board Meeting.

FISCAL IMPACT:

To be determined

ATTACHMENTS:

None

III

AD-HOC BOARD COMMITTEES

A. Executive – Hart & Brecht

B. Finance – Brecht & Tatusko

C. Operations and Infrastructure – Delahay & Tatusko

D. Personnel – Hart & Ehrlich

E. Public Outreach – Delahay & Ehrlich

F. Legislative – Brecht & Ehrlich

G. Risk Management – Tatusko & Ehrlich

IVA FINANACIALS REPORT

	C	CH	CJ	CK	CL
1	**BWD**	06/09/16			
2	**CASH FLOW**	ADOPTED	Actual	Projected	Actual
3	**2016-2017**	BUDGET	May	May	YTD
4		2016-2017	2017	2017	2016-2017
5					
6	REVENUE				
7	WATER REVENUE				
8	Residential Water Sales	1,149,431	73,536	65,000	844,264
9	Commercial Water Sales	160,956	36,353	33,421	259,708
10	Irrigation Water Sales	176,219	27,586	15,174	195,265
11	GWM Surcharge	145,959	14,847	14,155	139,124
12	Water Sales Power Portion	463,059	41,878	41,265	389,925
13	TOTAL WATER COMMODITY REVENUE:	2,095,624	194,200	169,014	1,828,285
14					
15	Readiness Water Charge	997,818	85,566	85,163	969,401
18	Meter Install/Reconnect Fees	2,380	0	340	680
19	Backflow Testing/installation	6,500	0	0	-
20	Bulk Water Sales	0	0	0	673
21	Penalty & Interest Water Collection	10,000	4,057	830	30,202
22	TOTAL WATER REVENUE:	3,112,323	283,823	255,347	2,829,240
23					
24	PROPERTY ASSESSMENTS/AVAILABILITY CHARGES				
25	641500 1% Property Assessments	65,000	8,593	9,622	65,169
26	641502 Property Assess wtr/swr/fld	106,212	46,639	46,262	105,646
28	641501 Water avail Standby	82,467	17,385	14,821	80,528
30	641504 ID 3 Water Standby (La Casa)	33,722	13,207	12,527	33,588
31	641503 Pest standby	17,885	5,825	5,498	17,114
32	TOTAL PROPERTY ASSES/AVAIL CHARGES:	305,286	91,648	88,729	302,045
33					
34	SEWER SERVICE CHARGES				
35	Town Center Sewer Holder fees	393,398	18,199	18,199	196,322
36	Town Center Sewer User Fees	103,158	6,834	6,773	79,673
37	Sewer user Fees	256,294	22,138	20,000	244,692
39	Penalty Interest-Sewer		0	0	2,985
41	TOTAL SEWER SERVICE CHARGES:	752,850	47,171	44,972	523,673
42					
43	OTHER INCOME				
48	Water Credits income/Gain on Asset Sold		0	0	1,000
52	Interest Income	49	1,263	0	4,134
53	TOTAL OTHER INCOME:	49	1,263	0	10,518
54					
55	TOTAL INCOME:	4,170,507	423,905	389,048	3,665,477
56					
57	CASH BASIS ADJUSTMENTS				
58	Decrease (Increase) in Accounts Receivable		(23,541)		(23,541)
60	Deposits				-
61	Other Cash Basis Adjustments				-
62	TOTAL CASH BASIS ADJUSTMENTS:		(23,541)		(13,426)
63					
64	TOTAL INCOME RECEIVED:	4,170,507	400,364	389,048	3,652,050

	C	CH	CJ	CK	CL
1	**BWD**	06/09/16			
2	**CASH FLOW**	ADOPTED	Actual	Projected	Actual
3	**2016-2017**	BUDGET	May	May	YTD
4		2016-2017	2017	2017	2016-2017
65	EXPENSES				
66					
67	MAINTENANCE EXPENSE				
68	R & M Buildings & Equipment	185,000	7,628	15,500	140,635
69	R & M - WWTP	150,000	2,155	12,500	48,536
70	Telemetry	10,000	2,611	840	11,019
71	Trash Removal	4,000	298	360	3,756
72	Vehicle Expense	18,000	401	1,500	13,242
73	Fuel & Oil	25,000	1,400	2,100	16,538
74	TOTAL MAINTENANCE EXPENSE:	392,000	14,493	32,800	233,725
75					
76	PROFESSIONAL SERVICES EXPENSE				
77	Tax Accounting (Taussig)	3,000	0	0	2,596
78	Administrative Services (ADP/Bank Fees)	3,500	207	250	5,693
79	Audit Fees (Squarmilner)	14,995	0	0	14,439
80	Computer billing (Accela/Parker)	12,000	10,451	0	12,710
81	Financial/Technical Consulting (Raftelis) (Municipal Advisor)	1,200	0	100	8,350
82	Engineering (Dale/Dudek)	35,000	22,810	3,000	72,230
83	District Legal Services (Downey Brand/McDougal)	30,000	165	2,500	8,025
84	Testing/lab work (Babcock Lab)	12,000	420	1,000	10,598
85	Regulatory Permit Fees (SWRB/DEH/Dig alerts/APCD)	46,000	3,955	900	38,101
86	TOTAL PROFESSIONAL SERVICES EXPENSE:	157,695	38,007	7,750	172,742
87					
88	INSURANCE EXPENSE				
89	ACWA/JPIA Program Insurance	60,000	0	0	55,478
90	ACWA/JPIA Workers Comp	16,800	0	0	11,508
91	TOTAL INSURANCE EXPENSE:	76,800	0	0	66,986
92					
93	DEBT EXPENSE				
94	Citizens Bank-COP 2008 Debt Payment	253,113	0	0	253,113
95	BBVA-Viking Ranch Debt Payment	143,312	35,839	35,828	152,721
96	TOTAL DEBT EXPENSE:	396,425	35,839	35,828	405,834
97					
98	PERSONNEL EXPENSE				
99	Board Meeting Expense (board stipend/board secretary)	18,500	3,730	1,680	16,866
100	Salaries & Wages (gross)	791,000	60,155	67,476	742,893
101	Salaries & Wages offset account (board stipends/staff project salaries)	(18,500)	(5,743)	(1,680)	(15,553)
102	Consulting services/Contract Labor				
103	Taxes on Payroll	21,300	1,264	2,200	17,355
104	Medical Insurance Benefits	210,400	16,727	18,000	204,653
105	Calpers Retirement Benefits	171,000	6,388	8,100	144,141
106	Conference/Conventions/Training/Seminars	7,000	405	600	4,769
107	TOTAL PERSONNEL EXPENSE:	1,200,700	82,925	96,376	1,115,124
108					
109	OFFICE EXPENSE				
110	Office Supplies	18,000	658	1,500	17,240
111	Office Equipment/ Rental/Maintenance Agreements	40,000	6,360	1,500	39,653
112	Postage & Freight	15,000	0	2,000	8,757
113	Taxes on Property	2,400	0	0	2,331
114	Telephone/Answering Service/Cell	8,600	1,535	1,342	14,574
115	Dues & Subscriptions (ACWA/CSDA)	3,600	196	50	1,596
116	Printing, Publications & Notices	3,000	56	150	1,068
117	Uniforms	5,400	553	450	4,367
118	OSHA Requirements/Emergency preparedness	4,000	1,358	300	3,047
119	TOTAL OFFICE EXPENSE:	100,000	10,715	7,292	92,634
120					
121	UTILITIES EXPENSE				
122	Pumping-Electricity	350,000	25,466	27,000	272,319
123	Office/Shop Utilities	25,000	1,042	2,200	15,503
125	TOTAL UTILITIES EXPENSE:	382,500	26,509	29,200	287,822
126					
133	TOTAL EXPENSES:	2,706,119	208,489	209,246	2,374,866
134					
135	CASH BASIS ADJUSTMENTS				
136	Decrease (Increase) in Accounts Payable		46,347		20,911
137	Increase (Decrease) in Inventory		3,224		5,980
138	Other Cash Basis Adjustments				-
139	TOTAL CASH BASIS ADJUSTMENTS:		49,572		
140					
141	TOTAL EXPENSES PAID:	2,706,119	258,060	209,246	2,348,648

	C	CH	CJ	CK	CL
1	**BWD**	06/09/16			
2	**CASH FLOW**	ADOPTED	Actual	Projected	Actual
3	**2016-2017**	BUDGET	May	May	YTD
4		2016-2017	2017	2017	2016-2017
144	**CIP PROJECTS**				
145	**Water**				
146	Pickup	35,000			42,607
148	Pump and Cleaning Well ID4-4-Wells-ID1-12/ID4-4	150,000			140,447
149	Booster Station 1 Rehab	40,000			-
150	New 900 Reservoir	500,000	1,553		3,240
151	Transmission mains for new 900 Reservoir	100,000		50,000	-
152	Environmental review for water storage infrastructure	50,000		10,000	-
153	Engineering analysis for water storage infrastructure	75,000		10,000	30,128
154	Replace Twin Tanks-(prop 1 grant)	125,000			-
162	Weathervane Dr., Frying Pan Road to Double O Road (Pipeline7)	30,000		2,500	10,895
172					-
173	**TOTAL WATER CIP:**	1,105,000	1,553	72,500	227,317
174	**Sewer**				
175	WWTP-Skid Steer				-
176	WWTP-Back up Generator/Portable engine driven trash pump	26,000			29,773
177	Transfer Switch	20,000			10,037
178	Return Pump	8,500			15,437
179	Fence at ponds WWTP	15,000		0	9,200
196	**TOTAL SEWER CIP:**	69,500	0	0	64,447
197	**NON-CIP**				
198	USGS Basin study				-
199	GWM -legal/Misc.-prop 1 grant/USGS	60,000	6,353	6,000	25,233
201	District portion of GSP	204,000		12,000	64,527
212	**TOTAL GWM NON O&M**	264,000	6,353	18,000	89,760
213	**OTHER**				
227	Solar-Shop		54,722		83,332
228	Springbrook software purchase-final payment				21,450
229	Country Club pipeline project		2,202		24,619
230		10,000	56,924		129,401
231	**TOTAL CIP EXPENSES:**	1,448,500	64,829	90,500	510,925
232					
233	**CASH RECAP**				
234	Cash beginning of period	3,257,872	3,972,874	3,995,776	3,257,872
235	Net Cash Flow (O&M)	1,464,388	142,304	179,802	1,303,402
236	Total Non O&M Expenses	(1,448,500)	(64,829)	(90,500)	(510,925)
237	**CASH AT END OF PERIOD**	3,273,759	4,050,349	4,085,078	4,050,349
238					
239	**RESERVES**				
241	Working Capital-Water (4 months)	(600,000)	(600,000)	(600,000)	(600,000)
245	R & R Reserves				
246	Contingency Reserves (8 % O&M)	(270,000)	(270,000)	(270,000)	(270,000)
247	Rate Stabilization Reserves	(480,000)	(480,000)	(480,000)	(480,000)
248	Available for Emergency Reserves	928,759	2,300,349	1,740,078	2,300,349
249	**Target Emergency Reserves**	2,000,000	2,000,000	2,000,000	2,000,000
250	**Emergency Reserves Deficit**	(1,071,241)	300,349	(259,922)	300,349
251					
252	**EXPLANATION**				
253	Computer billing (Accela/Parker)		10,451	0	Projected in June
254	Irrigation Water Sales		27,586	15,174	Cust not billed in April
255	Engineering		22,810	3,000	$12,000 reimb RH
256	Regulatory Permit Fees (SWRB/DEH/Dig alerts/APCD)		3,955	900	CC break SDC inspect $2,800
257	Office Equipment/ Rental/Maintenance Agreements		6,360	1,500	Projected (4,000) in June

	G	H	J	K	L
119			BALANCE SHEET	BALANCE SHEET	MONTHLY
120			May 31, 2017	April 30, 2017	CHANGE
121			(unaudited)	(unaudited)	(unaudited)
122		ASSETS			
123					
124	*CURRENT ASSETS*				
125	Cash and cash equivalents		$ 4,050,348.91	$ 3,972,874.38	$ 77,474.53
126	Accounts receivable from water sales and sewer charges		$ 392,206.00	$ 368,665.13	$ 23,540.87
128	Inventory		$ 133,899.89	$ 130,675.41	$ 3,224.48
132	Prepaid expenses		$ 31,969.89	$ 31,969.89	$ -
134					
135		**TOTAL CURRENT ASSETS**	**$ 4,608,424.69**	**$ 4,504,184.81**	$ 104,239.88
136					
137	*RESTRICTED ASSETS*				
138	Debt Service				
139	Deferred amount of COP Refunding		$ 112,546.17	$ 112,546.17	$ -
142	Deferred Outflow of Resources-calPERS		$ 244,883.00	$ 244,883.00	$ -
143	Total Debt service		$ 357,429.17	$ 357,429.17	$ -
144					
145	Trust fund				
146	Investments with fiscal agent -CFD 2007-1		$ 26,212.17	$ 31,523.00	$ (5,310.83)
147	Total Trust fund		$ 26,212.17	$ 31,523.00	$ (5,310.83)
148					
149		**TOTAL RESTRICTED ASSETS**	**$ 383,641.34**	**$ 388,952.17**	
150					
151	*UTILITY PLANT IN SERVICE*				
152	Land		$ 2,328,663.65	$ 2,328,663.65	$ -
153	Flood Control Facilities		$ 4,319,603.58	$ 4,319,603.58	$ -
154	Capital Improvement Projects		$ 435,697.48	$ 377,221.34	$ 58,476.14
155	Sewer Facilities		$ 5,907,917.14	$ 5,907,917.14	$ -
156	Water facilities		$ 10,901,938.65	$ 10,901,938.65	$ -
157	General facilities		$ 1,006,881.07	$ 1,006,881.07	$ -
158	Equipment and furniture		$ 454,833.77	$ 454,833.77	$ -
159	Vehicles		$ 582,802.28	$ 582,802.28	$ -
160	Accumulated depreciation		$ (12,137,990.70)	$ (12,137,990.70)	$ -
161					$ -
162		**NET UTILITY PLANT IN SERVICE**	**$ 13,800,346.92**	**$ 13,741,870.78**	$ 58,476.14
163					
164	*OTHER ASSETS*				
165	Water rights -ID4		$ 185,000.00	$ 185,000.00	$ -
166					
167		**TOTAL OTHER ASSETS**	**$ 185,000.00**	**$ 185,000.00**	
168					
169		**TOTAL ASSETS**	**$ 18,977,412.95**	**$ 18,820,007.76**	$ 157,405.19
170					
171					

	G	H	J	K	L
172					
173					
174					
175					
176					
177					
178					
179					
180	Balance sheet continued				
181			**BALANCE SHEET**	**BALANCE SHEET**	**MONTHLY**
182			**May 31, 2017**	**April 30, 2017**	**CHANGE**
183			(unaudited)	(unaudited)	(unaudited)
184		**LIABILITIES**			
185					
186					
187	***CURRENT LIABILITIES PAYABLE FROM CURRENT ASSETS***				
188	Accounts Payable		$ 83,520.25	$ 129,867.31	$ (46,347.06)
189	Accrued expenses		$ 154,788.17	$ 154,788.17	$ -
191	Deposits		$ 5,000.00	$ 5,000.00	$ -
192					
193		**TOTAL CURRENT LIABILITIES PAYABLE**			
194		**FROM CURRENT ASSETS**	**$ 243,308.42**	**$ 289,655.48**	$ (46,347.06)
195					
196	***CURRENT LIABILITIES PAYABLE FOM RESTRICTED ASSETS***				
197	Debt Service:				
198	Accounts Payable to CFD 2007-1		$ 26,212.17	$ 31,523.00	$ (5,310.83)
200					
201		**TOTAL CURRENT LIABILITIES PAYABLE**			
202		**FROM RESTRICTED ASSETS**	**$ 26,212.17**	**$ 31,523.00**	$ (5,310.83)
203					
204	***LONG TERM LIABILITIES***				
205	2008 Certificates of participation		$ 2,330,000.00	$ 2,330,000.00	$ -
206	BBVA Compass Bank Loan		$ 943,120.61	$ 967,025.53	$ (23,904.92)
207	Net Pension Liability-calPERS		$ 693,352.00	$ 693,352.00	$ -
208	Deferred Inflow of Resources-calPERS		$ 246,389.00	$ 246,389.00	
209					
210		**TOTAL LONG TERM LIABILITIES**	**$ 4,212,861.61**	**$ 4,236,766.53**	$ (23,904.92)
211					
212		**TOTAL LIABILITIES**	**$ 4,482,382.20**	**$ 4,557,945.01**	$ (75,562.81)
213					
214	***FUND EQUITY***				
215	Contributed equity		$ 9,611,814.35	$ 9,611,814.35	$ -
216					
217	Retained Earnings:				
218	Unrestricted Reserves/Retained Earnings		$ 4,883,216.40	$ 4,650,248.40	$ 232,968.00
219					
220	Total retained earnings		$ 4,883,216.40	$ 4,650,248.40	$ 232,968.00
221					
222	**TOTAL FUND EQUITY**		**$ 14,495,030.75**	**$ 14,262,062.75**	$ 232,968.00
223					
224		**TOTAL LIABILITIES AND FUND EQUITY**	**$ 18,977,412.95**	**$ 18,820,007.76**	$ 157,405.19

TREASURER'S REPORT
May, 2017

	Bank Balance	Carrying Value	Fair Value	% of Portfolio Current Actual	Rate of Interest	Maturity	Valuation Source
Cash and Cash Equivalents:							
Demand Accounts at UB/LAIF							
General Account/Petty Cash	$ 1,315,138	$ 1,233,025	$ 1,233,025	30.44%	0.00%	N/A	UB
Payroll Account	$ 78,331	$ 71,296	$ 71,296	1.76%	0.00%	N/A	UB
MMA-Sweep	$ 2,724,838	$ 2,724,848	$ 2,724,848	67.27%	0.55%	N/A	UB
LAIF	$ 21,179	$ 21,179	$ 21,179	0.52%	0.78%	N/A	LAIF
Total Cash and Cash Equivalents	**$ 4,139,487**	**$ 4,050,349**	**$ 4,050,349**	**100.00%**			
Facilities District No. 2007-1							
Special Tax Bond- Rams Hill -US BANK	$ 26,212	$ 26,212	$ 26,212				
Total Cash,Cash Equivalents & Investments	**$ 4,165,699**	**$ 4,076,561**	**$ 4,076,561**				

Cash and investments conform to the District's Investment Policy statement filed with the Board of Directors on July 19, 2016

Cash, investments and future cash flows are sufficient to meet the needs of the District for the next six months.

Sources of valuations are Umpqua Bank, LAIF and US Trust Bank.

Kim Pitman

Kim Pitman, Administration Manager

To:	BWD Board of Directors
From:	Kim Pitman
Subject:	Consideration of the Disbursements and Claims Paid Month Ending May, 2017

Vendor disbursements paid during this period:		**$**	**223,478.89**
Significant items:			
San Diego Gas & Electric		$	26,508.87
CalPERS Payments		$	6,387.97
Medical Health Benefits		$	20,331.72
Accella-Annual Maintenance Fee FY 2017		$	10,395.00
BBVA Compass Bank-Debt Expense		$	35,839.39
Capital Projects/Fixed Asset Outlays:			
Integrity Solar-Solar for shop		$	54,721.50
Total Professional Services for this Period:			
McDougal, Love, Eckis, Attorneys	Legal-general	$	165.00
One Eleven Water Services-Jerry Rolwing	GWM Support	$	3,449.79
Dudek Professional Services	Odor Control Study	$	5,713.27
(reimbursed)	RHGC Prepare Grants	$	14,561.93
David Dale-Engineering	Survey 900 Tank	$	1,552.50
	General Engineering	$	3,577.50
Payroll for this Period:			
Gross Payroll		$	60,155.08
Employer Payroll Taxes and ADP Fee		$	1,513.91
Total		**$**	**61,668.99**

Accounts Payable

Checks by Date - Summary by Vendor Number

User: ezmeralda

Printed: 6/22/2017 6:10 AM

9492	3E COMPANY ENVIRONMENTAL ECOLOGICAL & ENGINEERING	632.50
10867	ABETTER VENT CLEANING	2,445.00
1109	ABILITY ANSWERING/PAGING SER	529.51
90	ACCELA, INC. #774375	10,395.00
3035	ACWA/JPIA PROGRAM INSURANCE	20,331.72
1266	AFLAC	919.32
9524	AIR POLLUTION CONTROL DISTRICT	1,154.00
9338	AMERICAN BACKFLOW SPECIALTIES	334.89
1001	AMERICAN LINEN INC.	553.41
61	AT&T MOBILITY	722.18
9529	AT&T-CALNET 3	363.45
9450	AWWA CALIF-NEVADA SECTION	885.00
9255	BABCOCK LABRATORIES	360.00
91	BBVA COMPASS	35,839.39
9679	BIG J FENCING, INC.	1,400.00
88	BORREGO AUTO PARTS, INC.	366.72
10864	BORREGO COMMUNITY HEALTH FOUNDATION	81.00
1003	BORREGO SPRINGS BOTTLED WATER	49.02
1037	BORREGO SUN	55.50
56	CMS BUSINESS FORMS, INC.	337.36
48	COUNTY OF SAN DIEGO DEPT OF PUBLIC WORKS	2,800.70
10856	DAVID DALE, PE	5,130.00
1222	DEBBIE MORETTI	122.00
96	DISH	85.72
9640	DUDEK	20,275.20
9544	FIREFORCE INC.	1,276.73
UB*00011	Fred Roy	34.78
9579	GREEN DESERT LANDSCAPE	4,770.00
10854	HARRY EHRLICH	1,719.95
UB*00009	Holly Light	16.98
1136	HOME DEPOT CREDIT SERVICES	461.53
10865	INTEGRITY SOLAR	54,721.50
1022	JAMES HORMUTH DE ANZA TRUE VALUE	36.92
65	JC LABS & MONITORING SERVICE	1,500.00
UB*00010	JOHN DOHRENDORF	16.84
1067	KENNY STRICKLAND, INC.	1,399.80
9378	LANDMARK	582.00
1216	McCALLS METERS,INC	4,008.30
9549	McDOUGAL LOVE ECKIS	165.00
1016	NAPA AUTO PARTS INC	34.57
10852	ONE ELEVEN WATER SERVICES, LLC.	2,185.00
1208	PACIFIC PIPELINE SUPPLY INC	3,449.79
3015	PITNEY BOWES INC	137.49
10866	PUMP CHECK	1,750.00
1033	QUILL CORPORATION	295.75
9633	RAMONA DISPOSAL SERVICE	3,311.88

9481	RS INSTRUMENTS & SERVICES	592.00
1065	SAN DIEGO GAS & ELECTRIC	26,508.87
1059	STAPLES CREDIT PLAN	562.19
1233	SUNSET ELECTRIC POWER	1,279.17
9581	TRAVIS PARKER	630.50
3000	U.S.BANK CORPORATE PAYMENT SYS	1,547.18
1023	UNDERGROUND SERVICE ALERT	9.00
10847	USA COMMUNICATIONS	99.94
9439	USABLUEBOOK	416.86
1027	VICTOR VALENTI CONTRON SCADA SYSTEMS	2,610.78
1623	WENDY QUINN	425.00
92	XEROX FINANCIAL SERVICES	754.00
	Report Total (65 checks):	223,478.89

GROUNDWATER MANAGEMENT
ACCOUNTING
FY 2017
Acct #10154800

Month	McDougal/ Downey Brand	Dudek	Town Hall/ Advertising	One Eleven Water Services	Desert Club	Staff Allocation	Water Advisory Committee-Lunches Recording/Minutes	Monthly Total	FYE 2017 Total
Jul-16								-	-
Aug-16	190.00	39,583.64						39,773.64	39,773.64
Sep-16								-	-
Oct-16		7,650.00						7,650.00	47,423.64
Nov-16			111.00	4,005.00				4,116.00	51,539.64
Dec-16	1,925.00	10,695.76		285.00				12,905.76	64,445.40
Jan-17			55.50		500.00			555.50	65,000.90
Feb-17	1,945.00							1,945.00	66,945.90
Mar-17	323.50		20.00				498.12	841.62	67,787.52
Apr-17	901.89	13,140.22					635.62	14,677.73	82,465.25
May-17				2,185.00		3,968.19	200.00	6,353.19	88,818.44
Total	5,285.39	71,069.62	186.50	6,475.00	500.00	3,968.19	1,333.74		88,818.44

IVB

WATER & WASTE WATER OPERATIONS REPORT

May 2017

WATER OPERATIONS REPORT

WELL	TYPE	FLOW RATE	STATUS	COMMENT
ID1-8	Production	350	In Use	
ID1-10	Production	300	In Use	
ID1-12	Production	900	In Use	
ID1-16	Production	750	In Use	
Wilcox	Production	80	In Use	Diesel backup well for ID-4
ID4-4	Production	400	In Use	
ID4-11	Production	900	In Use	Diesel engine drive exercised monthly
ID4-18	Production	150	In Use	
ID5-5	Production	850	In Use	

System Problems: All production wells are in service. All reservoirs are in operating condition.

WASTEWATER OPERATIONS REPORT

Rams Hill Water Reclamation Plant serving ID-1, ID-2 and ID-5 Total Cap. 0.25 MGD (million gallons per day):

Average flow: 50,345 (gallons per day)
Peak flow: 85,150 gpd Sunday May 28, 2017

IVC

WATER PRODUCTION/ USE RECORDS

BORREGO WATER DISTRICT

WATER PRODUCTION SUMMARY

MAY 2017

DATE	WATER USE	WATER PROD	WATER %UNACC	ID4 USE	ID4 PROD	ID4 %UNACC	TOTAL USE	TOTAL PROD
May-15	34.25	22.72	-50.75	87.10	95.47	8.77	121.35	118.19
Jun-15	39.49	41.09	3.89	99.06	85.48	-15.89	138.55	126.57
Jul-15	37.46	36.53	-2.55	94.21	86.06	-9.47	131.67	122.59
Aug-15	33.06	41.46	20.26	96.54	86.54	-11.56	129.60	128.00
Sep-15	35.46	39.98	11.31	108.92	129.76	16.06	144.38	169.74
Oct-15	39.19	36.70	-6.78	117.32	104.29	-12.49	156.51	140.99
Nov-15	31.25	38.80	19.46	94.66	116.67	18.87	125.91	155.47
Dec-15	22.37	24.64	9.23	83.23	99.01	15.94	105.60	123.66
Jan-16	18.80	20.96	10.29	58.73	72.07	18.51	77.53	93.03
Feb-16	19.61	20.00	1.94	74.06	91.40	18.97	93.67	111.40
Mar-16	18.98	20.38	6.86	73.79	86.65	14.84	92.77	107.03
Apr-16	23.53	25.03	5.98	78.79	94.30	16.45	102.32	119.33
May-16	22.54	22.99	1.96	78.02	92.54	15.69	100.56	115.53
Jun-16	30.90	33.34	7.31	96.77	114.10	15.19	127.67	147.44
Jul-16	35.02	35.74	2.01	97.17	115.18	15.63	132.19	150.91
Aug-16	41.77	43.61	4.21	115.77	141.88	18.40	157.54	185.48
Sep-16	43.67	46.58	6.25	119.76	118.50	-1.06	163.43	165.09
Oct-16	34.51	37.64	8.31	102.51	122.73	16.48	137.02	160.37
Nov-16	31.55	31.58	0.10	102.59	112.11	8.50	134.14	143.70
Dec-16	27.15	27.95	2.87	73.25	82.85	11.59	100.40	110.81
Jan-17	17.49	16.18	-8.10	51.59	59.32	13.02	69.08	75.50
Feb-17	11.72	14.64	19.93	63.23	73.40	13.85	74.95	88.04
Mar-17	17.15	18.48	7.17	63.65	68.34	6.86	80.81	86.82
Apr-17	25.02	26.02	3.83	90.17	99.02	8.94	115.18	125.03
May-17	28.18	29.45	4.30	98.06	113.48	13.58	126.25	142.93
12 Mo. TOTAL	344.14	361.20	4.85	1074.53	1220.91	11.75	1418.66	1582.11

Totals reflect Water (ID1 & ID3) and ID4 (ID4 & ID5) . Interties to SA3 are no longer needs to be separated. ID4 and SA5 are combined because all water production is pumped from ID4.
All figures are in Acre Feet of water pumped.

WATER LOSS SUMMARY (%)

PROGRAM DID NOT CALCULATE WATER LOSS FOR JANUARY IN TIME FOR THIS REPORT

DATE	WATER	ID-4	ID-5	DISTRICT-WIDE AVERAGE
May-17	4.30	13.58	N/A	8.94
12 Mo. Average	4.85	11.75	N/A	8.30

IVD

GENERAL MANAGER REPORT

ITEM V
INFORMATIONAL ITEMS

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL V.A

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Setting the Proper Reduction Period for SGMA Compliance – L. Brecht

RECOMMENDED ACTION:

Receive report from Director Brecht

ITEM EXPLANATION:

Director Brecht requested this item be placed on the Agenda and the attachment shared with the Board.

ATTACHMENTS:

Information on setting proper reduction period for SGMA

SETTING THE PROPER SGMA REDUCTION PERIOD

The SGMA legislation requires a reduction period no longer than 20 years for an adopted GSP, or no longer than the year 2040.

The assumption is that no *undesirable results*, as defined by SGMA, will occur if 2040 is used as a date by which the basin is brought into balance. However, this is not necessarily so. Potential declining water quality is a case in point:

- If WQ standards change e.g. in year 12 from now assuming water quality for municipal water supply from the basin was already near the present maximum safe drinking water standards or trending in that direction, there would likely not be adequate time to adjust a reduction plan to achieve sustainable use of the basin for *no undesirable results* by 2040;[1]
- therefore, in planning a reduction period to prevent undesirable results under SGMA, a forecast of future changes in WQ is necessary;[2]
- this forecast requires a target WQ standard. However if a current target WQ standard is used, it will be out of date in 12 years (under the above scenario);[3]
- the financial consequences are large. In our case a PV cost of as much as ~$40M for advanced treatment;[4]

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[1] Section 10726.8(c) of the Water Code clarifies that SGMA requirements do not limit the requirements of other State Water Board or Department of Public Health programs. This is important, because if a federal or state drinking water standard is set below the one used at the time a GSP was developed, drinking water providers will be required to comply with the new standard based on the State Water Board's timeline, not the GSP timeline.

[2] Section 356.4 of the groundwater sustainability plan (GSP) regulations requires GSAs to perform a periodic assessment of their plan at least every five years and provide the assessment to the Department of Water Resources. Subdivisions (d) and (f) require the GSA to consider significant new information that has been made available since the GSP was adopted; this is in order to support adaptive management. A change in a drinking water standard would be new information that would need to be addressed in the assessment.

[3] The Sustainable Groundwater Management Act is intended to be a planning process for local agencies to set objectives and achieve sustainability over a 20-year timeline. Planning for uncertainty and adaptive management will likely be a part of this process. Water Quality standards will need to be considered when defining undesirable results and minimum thresholds, and it will be up to local managers to evaluate current water quality standards and decide how to incorporate potential and future changes in those standards in a sustainability plan.

[4] See Dudek, "Water Replacement and Treatment Cost Analysis for the Borrego Valley Groundwater Basin" (November 24, 2015) located at http://borregowd.org/uploads/2016.01.19_BWD_Board_Package.pdf (pp. 22 - 32).

- therefore, both a forecast of target WQ standard in the year 2040, as well as a forecast of probabilistic water quality changes over time are necessary to set a proper reduction period at the outset for the basin rather than using an arbitrary 20-year reduction period in SGMA that has nothing whatsoever to do with the characteristics, potential *undesirable results* (such as declining water quality), and/or likely costs associated with our specific basin (the Borrego Springs Subbasin of the Borrego Valley Groundwater Basin).[5]

Thus, the issue on the table is defensibility. How does one pick a defensible target standard for arsenic in 2040, for example, that takes into account future WQ standards uncertainty?

In my thinking, assuming arsenic will stay at 10 ppb through 2040 seems like a risky assumption, given the grave financial costs to the community of getting the time to tipping point wrong where expensive advanced treatment would be necessary to meet safe drinking water standards for municipal water supply, as well as known changes in arsenic standards.[6]

Likewise, the issue on the table for forecasting future water quality degradation that may require advanced treatment to meet safe drinking water standards is really about what level of financial risk the community willing to bear? That is because any Bayesian probabilistic forecast of declining water quality must result in a non-zero probability of not meeting safe drinking water standards sometime during the reduction period. In other words, any forecast cannot, no matter what data is collected or available, provide 100% assurance that water quality will not be affected during a reduction period as long as 20-years. Planning that MCLs will be reduced in the future is likely a good idea.

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[5] California's MCLs are adopted by the State Water Resources Control Board pursuant to the California Safe Drinking Water Act. California MCLs may be found in Title 22 of the California Code of Regulations (CCR), Division 4, Chapter 15, Domestic Water Quality and Monitoring. Health and Safety Code section 116365 imposes requirements on the State Water Board for adoption of primary drinking water standards for the protection of public health. One of those requirements is that the State Water Board set an adopted MCL as close to the contaminant's public health goal (PHG) as is technologically and economically feasible at the time of adoption, while placing primary emphasis on protection of public health. Public health goals are established by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment.

[6] State drinking water standards are required to be at least as stringent as those adopted by the USEPA. If USEPA adopts a federal MCL that is lower than the corresponding state MCL, the state is required by statute to revise its MCL to at least as low as the federal MCL. Some California MCLs are more stringent than federal MCLs. A good example is Benzene. The USEPA MCL for benzene is 5 ppb and California's MCL is 1 ppb.

Since getting these interacting forecasts wrong could potentially put the community out of business, as many ratepayers might be unable to afford rapidly increasing municipal water costs caused by a sudden need for advanced treatment, it behoves us to think deeply and proactively about these issues now, before any normative reduction period is assumed based on the arbitrary SGMA legislation timeline.

Other Basin Dynamics Uncertainties that Impact Choice of Reduction Period Length to Avoid Undesirable Results from Declining Water Quality

SGMA's choice of a not to exceed 20-year reduction period to reach sustainable yield may be arbitrary with respect to the proper reduction period for a specific basin, but the period is not arbitrary with respect to managing basin dynamics uncertainties. The architects of SGMA believed that 20-years was a reasonable time period within which uncertainties could be addressed and planned for, given SGMA's intent to arrive at a *physical solution* (as opposed to an *accounting solution*) for a basin in overdraft.

Uncertainties in Sustainable Yield. The mathematics to arrive at a sustainable yield that relies on stationarity (historical averages based on variable recharge through time) has two fundamental weaknesses: (1) under a climate regime of Anthropogenic Climate Disruption (ACD), stationarity is no longer a reliable predictor for future climate; and (2) in a desert clime with variability of annual recharge ranging from 1,000 AFY to 25,000 AFY over 66-years, it is questionable that a singular number is reliable, as opposed to a range of acceptable values.

Uncertainties in Precipitation. Mathematically, the issue is change in the trend of variability over time, not low or high precipitation in any one year. Based on trend analysis for Southern California, some professional research hydrologists suggest that historical recharge should be reduced by as much as 7%, based on trends in annual precipitation under ACD.

Changes in Transmissivity as Pumping Declines. Presently, the basin is divided into 3 Management Areas based on transmissivity (speed of movement of water from one management area to the next). As pumping declines, it is likely that transmissivity will also change. If this occurs, contaminants concentrations at specific wellheads may change from historical levels.

Uncertainties in 5-year Reduction Targets. Relying on simple arithmetic to determine 5-year targets to a sustainable yield goal is not necessarily mathematically defensible as such arithmetic targets do not take into account slippage.[7] That is, it is unlikely that a *physical*

[7] For an explanation of slippage see Dudek, "Market Evaluation of Water Credits and Production Credits for the Borrego Valley Groundwater Basin Sustainability Plan" (February 24, 2016).

solution may be arrived at using simple arithmetic targets. Of equal or greater concern is using an arithmetically derived target as somehow a "defensible" (when it may not be) target instead of a duly arrived at greater target reduction from 2+ years of negotiations with pumpers who represent ~80% of annual withdrawals from the basin. Dishonoring their hard work to arrive at a mutually-agreed reduction target over an arithmetically-derived lower target is hardly a "defensible" approach, but denigrates work that has already ensued — as if it never occurred.

Another subtlety is how reductions occur during the 5-year target reduction period. If reductions occur all in year 5 rather than incrementally each year during a 5-year reduction period, there is a risk that actual *physical* reductions by the end of year 5 will not amount to the required reductions to meet SGMA *physical* targets for sustainable use of the basin with *no undesirable results*. Mathematically, some penalty would be due whether the reductions physically happen all at once in arrears, or in advance of 5-year reduction targets.

Thinking Through Adaptive Management Strategies. Is the objective of SGMA to arrive at a *physical sustainable use* of the basin by 2040 with *no undesirable results*, or an *accounting* basis sustainable use of the basin?

If the objective is physical, my back of the envelope is that there is only ~80% probability, at best, of reaching this objective by 2040, IF various basin dynamics uncertainties are taken into account. If basin dynamics uncertainties are not taken into account in the choice of reduction period, target MCL standards, and a forecast of water quality changes over time, my best guess at this juncture is that there is only about a 50% probability for reaching a *physical sustainable use* of the basin by 2040 with *no undesirable results*.

These dynamics uncertainties issues are likely to impact water credits policy, choice of reduction period, and reduction targets pre and post 2040. Thus, adaptive management strategies both pre-SGMA reduction period and post-SGMA reduction period will need to be applied IF the objective is actually to arrive at a perpetual physical sustainable use of the basin with *no undesirable results*.

BORREGO WATER DISTRICT

BOARD OF DIRECTORS MEETING – JUNE 28, 2017

AGENDA BILL V.B

June 21, 2017

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT: Economics of Sustainable Water Supply – L. Brecht

RECOMMENDED ACTION:

Receive report from Director Brecht

ITEM EXPLANATION:

Director Brecht requested this item be placed on the Agenda and the attachment shared with the Board.

ATTACHMENTS:

Info on Sustainable Water Supply

Nothing is more useful than water;
but it will purchase scarce anything;
scarce anything can be had in exchange for it."[1]

DEFINITIONS

Acre-feet/year (af/y): a unit of measuring water usage over time corresponding to covering one acre of land with one foot of water over the course of one year. An acre-foot of water equals 43,560 cubic-feet of water or 325,851.4 U.S. gallons. A football field is about 1.1 acres. One cubic-foot contains 7.48 gallons of water.

Appropriator: the pumpers of the groundwater basin that resell water for use by other parties.

Aquifer: the underground geologic formation where water is stored within the groundwater basin. The Valley's groundwater basin is comprised of three aquifers: upper, middle, and lower aquifers. The upper aquifer of the basin contains high quality, potable water. The middle and lower aquifers contain water of lesser quality that would require in some cases tertiary water treatment to render this water potable or suitable for irrigation.

Conjunctive Use: the storage of water in a groundwater basin for use at a later time.

Dewatering: the extraction of water from one or more aquifers that comprise the groundwater basin. As an aquifer is dewatered, pore space in a deep aquifer can collapse, rendering the aquifer no longer useful for storing water. Thus, if the aquifer becomes dewatered to the extent that pore space collapses, "even if pumping stopped, such fossil water cannot be replaced" (*American West at Risk*, 236).

Groundwater: water beneath the surface of the ground below the water table in which soil is saturated with water.

Groundwater Basin: an area underlain by one or more permeable formations capable of furnishing water supply.

Overdraft: a condition wherein the total annual production from a groundwater basin exceeds the safe yield thereof. In the long run, rates of ground water extraction cannot exceed rates of recharge.

Overlying Parties: owners of land that overlies the groundwater basin and who have exercised overlying water rights to pump wherefrom.

Overlying Water Rights: the rights, limitations, and responsibilities of overlying parties to the groundwater in the groundwater basin.

Recharge: the amount of water falling on the land from all sources that reaches the aquifer. Typically, the maximum safe yield is equal to no more than the annual recharge rate. Recharge is slow. Deeper aquifers take hundreds to thousands of years

to recharge. "Withdrawing excessive groundwater amounts (i.e. over-drafting) from deep aquifers is the same as mining a nonrenewable resource, like petroleum" (*American West at Risk*, 236).

Safe Yield: the maximum quantity of water that can be produced annually from a groundwater basin under a given set of conditions without causing a gradual lowering of the groundwater level leading eventually to depletion of supply.

Sustainable Yield: the maximum quantity of water that can be produced annually from a groundwater basin under a given set of conditions without causing damage to existing ecosystems within the basin. The sustainable yield is almost always lower than the safe yield.[2]

Sustainability (broad definition): Sustainability, as used here is the re-engineering of complex economic support systems that enable these existing systems to transition from high Energy Return on Energy Invested (EROEI) sources to systems capable of operating at lower thermodynamic states without experiencing disruptive non-linearities or collapse.[3]

Sustainability (water definition): the maximum economically extractable withdrawals from the basin during any defined period that does not exceed the sustainable yield of the basin. The permeability of the aquifer, water quality in the aquifer, and the cost of energy for withdrawals primarily determine whether the water is economically extractible for use.[4]

Water Budget Deficit: the amount of water on an annual basis withdrawn that exceeds the safe yield. This total equals the *overdraft*.

Withdrawals: the amount of extraction of groundwater from the groundwater basin.

CONSTRAINTS:

The primary and overdetermining causal claim of basin overdraft is based on ignoring and distorting the value of groundwater. This has resulted in groundwater being overused, degraded, and misallocated. Without price signals or other indicators of value to help guide policy, too little attention and funding for resource management and protection of ground water has occurred.[5]

Essentially, in California the state *owns* the water, which is assumed to have no market value (water in the basin is a *commons*). The overlyers and appropriators may have *claims* to withdraw water from the basin for beneficial use (*rights* must be established by court adjudication) for the cost of pumping, treating, and transporting this withdrawn water for beneficial use. But, the water itself is *free*.

This colossal underpricing of water's full economic and environmental worth unfortunately sends perverse, insidious, and often illusory economic signals "that water

supply is endlessly plentiful, prompting wasteful use on wasteful purposes" with dis-economic (wealth-destroying) returns. The Twentieth Century's most egregious example of discounting the full economic and environmental worth of water is the former Soviet Union's destruction of central Asia's Aral Sea to irrigate cotton fields that resulted in a hydrologic Chernobyl.[6] The failure to place an economic and environmental value on freshwater has created a situation of groundwater overdraft and freshwater shortage not only in the state and the nation, but globally that is "no longer a philosophical threat, no longer a future threat, *no longer a threat at all*. It's our reality."[7]

The *purpose of economic analysis* in this context is to understand the consequential risk of decisions in the absence of accurate market pricing for water resources.[8]

FALLACIES:

Anchoring, Adjustment and Contamination: Specific knowledge may *anchor* one's perception of risk by *contaminating* one's analysis of new data that is *adjusted* to fit one's cognitive map. The most common result is the logical *fallacy of generalization from fictional evidence*. One example is the common refrain that "if 70% of the overdraft is due to overlyer's withdrawals for agricultural purposes, then what value is there in encouraging conservation by end-users of appropriator withdrawals who account for less than 10% of the basin's overdraft?" The reality is that efficiency measures taken by end-users produce economic value primarily by the avoidance of expensive water treatment, supply augmentation, and distribution infrastructure expenditures. This economic value has absolutely nothing to do with the 70% of overdraft produced by overlyer withdrawals. For example, typically, water efficiency can deliver another unit of water for a fraction of the cost of a supply augmentation project's total cost.

Availability Fallacy: the risk of overdraft is discounted because the dewatering of the aquifer or reaching point beyond economically extractable water has never occurred in the experience of the observer. The tendency is to take no action against the larger potential risk of actually running out of water and to imagine the risk of this occurring at much less than it actually is in reality.

Confirmation Bias: Often with information that is difficult or that rubs against one's heuristic sensibilities, we look for evidence to refute a reasonable analysis. This, biased reasoning looks for data that *fits* one's preconceived notion of the solution set. Unfortunately, this approach to framing problems almost always gets economic risk very wrong. Oftentimes the more sophisticated the person's experience or training, the more confirmation bias is in play. Experts regularly do a poorer job of assessing risk in some cases than a naive observer.

Conjunction Fallacy: Studying the problem reduces the risk of occurrence of running out of water. That is, by adding detail, we sometimes get the risk vastly wrong because we are overconfident. For example, many people who have heard the USGS Town Hall presentation believe that dewatering of the upper aquifer will occur in 50-years because that is what the model predicts. But, the model is not reality. In reality, there is risk that the aquifer can become dewatered less than 50-years.

Preferential Use Fallacy: My use is preferred to your use sets overlyers against appropriators. "It cannot be said, for example, that the residential use of water is always more desirable (or more valuable) than irrigation, or visa versa. Protagonists in public debates about water may sponsor the idea that water is universally more desirable in one sector than another, but economic evidence does not support such thinking."[9] The logical outcome of this fallacy is that a *CocaCola* bottling plant whose economic return of more than $300,000/af should be preferred over all other uses. This argument was actually used in a few towns in India who saw their aquifers dry-up and the town destroyed by this economic fallacy (of course, the bottling plant actually withdrew the water at no fee to the town).

Overconfidence Fallacy: This is a form of *calibration error* that occurs oftentimes where planning assumes *Technological Optimism*, the misbelief that some future technology can fix any water problem. Not only has this belief not been borne out historically, technological fixes are typically expensive and ultimately uncertain. The overconfidence engendered by this misbelief then leads to assuming that the uncertainties in a risk situation allows one to construct a relatively benign future. This *calibration error* provides for ignoring futures in which water supply runs out. The doubters are right that uncertainties are rife. They are wrong when they present that as a reason for inaction.[10]

Scope Neglect: A person's stated willingness to pay (SWTP) is not recalibrated when the scope is magnitudes different between two risk scenarios. Essentially, the analyst is unable to imagine the relative magnitudes of consequences from the associated risk of the solution set, as the consequences lie too far outside his/her life experience. For example, few people, unless they have experienced this for themselves first hand, have a clear picture of what the consequences would be for the Borrego Valley to dewater its basin and the magnitude of economic risk as the final dewatering grows closer in time.

ENDNOTES:

[1] Adam Smith, *The Wealth of Nations* quoted in Steven Solomon, *Water: The Epic Struggle for Wealth, Power, and Civilization* (New York: HarperCollins Publishers, 2010), 379. Adam Smith was musing about the "diamond-water paradox." "Why was water, despite being invaluable to life, so cheap, while diamonds, though relatively useless, so expensive?"

[2] Surface waters and groundwater are interconnected. They may be thought of as a single resource. Over-pumping groundwater can impact surface flows, reducing the water available to support the fauna and flora of the Park's desert ecosystem. T.C. Winter et. al. *Ground Water and Surface Water, a Single Resource* (U.S. Geological Survey Circular 1139, 1999) in Howard G. Wilshire, Jane E. Nielson, and Richard W. Hazlett, *The American West at Risk: Science, Myths, and Politics of Land Abuse and Recovery* (Oxford & New York: Oxford University Press, 2008), 231, 236, 534 footnote #17.

[3] In 1930, EROEI of oil, natural gas and coal was 100:1; today EROEI of oil, gas, wind is 15:1; large hydropower 11:1; conventional coal 10:1; newly found oil, photovoltaic solar 8:1; *clean* coal 5:1 (better carbon emissions control through carbon capture and sequestration but coal ash and heavy metals pollution); fuel cell, geothermal, nuclear 4:1 (nuclear's carbon footprint is ~ 66 gCO2e/kWh, less than 960 gCO2e/kWh for conventional coal but for every dollar spent on nuclear, 5X-6X more carbon could be reduced with end-use efficiency, or renewables); oil shale and Alberta tar sands 3:1 (Athabasca Valley tar sands have largest carbon footprint of any oil production); LNG 2:1; ethanol (from corn) 1.3:1; hydrogen 0.8:1; nuclear fusion (unknown). See, Charlie Hall, "Balloon Graph;" The Oil Drum (www.theoildrum.com); Thomas Homer-Dixon, *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization* (Washington, DC, Island Press, 2006).

[4] Water systems are the largest single category user of electricity in the world, accounting for between two and ten percent of electricity use in a country. In the U.S., water systems account for about three percent of electricity consumed annually (about 75 billion kWh). About 39% of freshwater use in the U.S. is used for thermal electric energy production. See AWWA Water Loss Control Committee, "Applying Worldwide BMPs in Water Loss Control," *AWWA Journal* 95:8 (August 2003), 75 and U.S. Department of the Interior, U.S. Geological Survey, http://ga.water.usgs.gov/edu /wupt.html (accessed 5/1/08).

California's water infrastructure uses electricity to collect, move, and treat water; dispose of wastewater; and power the large pumps that move water throughout the state. California consumers also use electricity to heat, cool, and pressurize the water they use in their homes and businesses. Total water related electrical consumption for the state amounts to ~52,000 Gigawatthours (GWh). Electricity to pump water by the water purveyors in the state amounts to 20,278 GWh, which is approximately 8% of the statewide total annual electrical use. 32,000 GWh represent electricity used on the customer side of the meter, that is, electricity that customers use to move, heat, pressurize, filter, and cool water. See Lon W. House, "Water Supply Related Electricity Demand in California," *Demand Response Research Center* (December 2006), 1.

[5] Committee on Valuing Groundwater, *Valuing Ground Water: Economic Concepts and Approaches*, National Research Council Press, 1997.

[6] Solomon, 377.

[7] Bill McKibben, *Eaarth: Making a Life on a Tough New Planet* (New York: Times Books, Henry Holt and Company, 2010), xiii.

[8] Systemic risk is often discounted. See http://www.scribd.com/doc/22163392/.

[9] See Ronald C. Griffin, *Water Resource Economics: The Analysis of Scarcity, Policies, and Projects* (Cambridge, MA. & London, The MIT Press, 2006), 12.

[10] See *The American West at Risk*, 5, 8, 365, 367