

Borrego Water District Board of Directors
Special Meeting
January 8, 2019 @ 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. Comments from the Public & Requests for Future Agenda Items (may be limited to 3 min)
- F. Comments from Directors
- G. Correspondence Received from the Public
 - 1. Gary Haldeman (3-4)
 - 2. Rebecca Falk (5-6)

II. ITEMS FOR BOARD CONSIDERATION AND POSSIBLE ACTION

- A. Borrego Water District
 - 1. Election of Board Officers: President, Vice President, Secretary/Treasurer – G Poole, BWD (7)
 - 2. Capital Improvement Plan Update (8-173)
 - a. BWD Pipelines - Phase One: Rejection of Apparent Low Bidder and Award of Contract – C Beltran, Dynamic Engineering & C Hayes, BBK
 - b. Well Replacement #1 & #2 Bid Documents – K. Ilkhanipour, Dudek Engineering & C Hayes, BBK
 - 3. Grant Progress Report & Priorities – Rick Alexander, TRAC (174-176)
 - 4. FY 2019 Budget Development Process & Tie-In to Prop 218 Analysis – L Brecht, BWD (177-178)
 - 5. 2019 Town Hall Meeting Date Selection & Agenda – L Brecht, BWD (179-180)
 - 6. Nomination of Board Standing and Ad hoc Committee Selection – G Poole, BWD (181)
 - 7. Future Meeting Dates – G Poole, BWD (182-184)
 - a. Resolution to Change Date of Regular Meeting to January 29th
 - b. January 11th Special Meeting (9:15-9:45 AM) to receive and file FY 2018 Audit results
 - c. January 23rd Special Board Meeting for AB 1234 Ethics Training BB&K Webinar (9:00-11:00AM) – voluntary
 - d. February 2019 - Dolly Mack Associates Board Strategy Development Proposal
- B. GSA: Borrego Springs Sub Basin
 - 1. Facilitation Services for GSP Advisory Committee – G Poole (185-186)
 - 2. District Draft GSP Review Process – L Brecht, BWD (187-188)
 - 3. GSP Planning Process PPT – L Brecht, BWD (189-201)
 - 4. ENSI Takeaways PPT – L Brecht – BWD (202-223)

AGENDA: January 8, 2018

All Documents for public review on file with the District's secretary located at 806 Palm Canyon Drive, Borrego Springs CA 92004

Any public record provided to a majority of the Board of Directors less than 72 hours prior to the meeting, regarding any item on the open session portion of this agenda, is available for public inspection during normal business hours at the Office of the Board Secretary, located at 806 Palm Canyon Drive, Borrego Springs CA 92004.

The Borrego Springs Water District complies with the Americans with Disabilities Act. Persons with special needs should call Geoff Poole – Board Secretary at (760) 767 – 5806 at least 48 hours in advance of the start of this meeting, in order to enable the District to make reasonable arrangements to ensure accessibility.

If you challenge any action of the Board of Directors in court, you may be limited to raising only those issues you or someone else raised at the public hearing, or in written correspondence delivered to the Board of Directors (c/o the Board Secretary) at, or prior to, the public hearing.

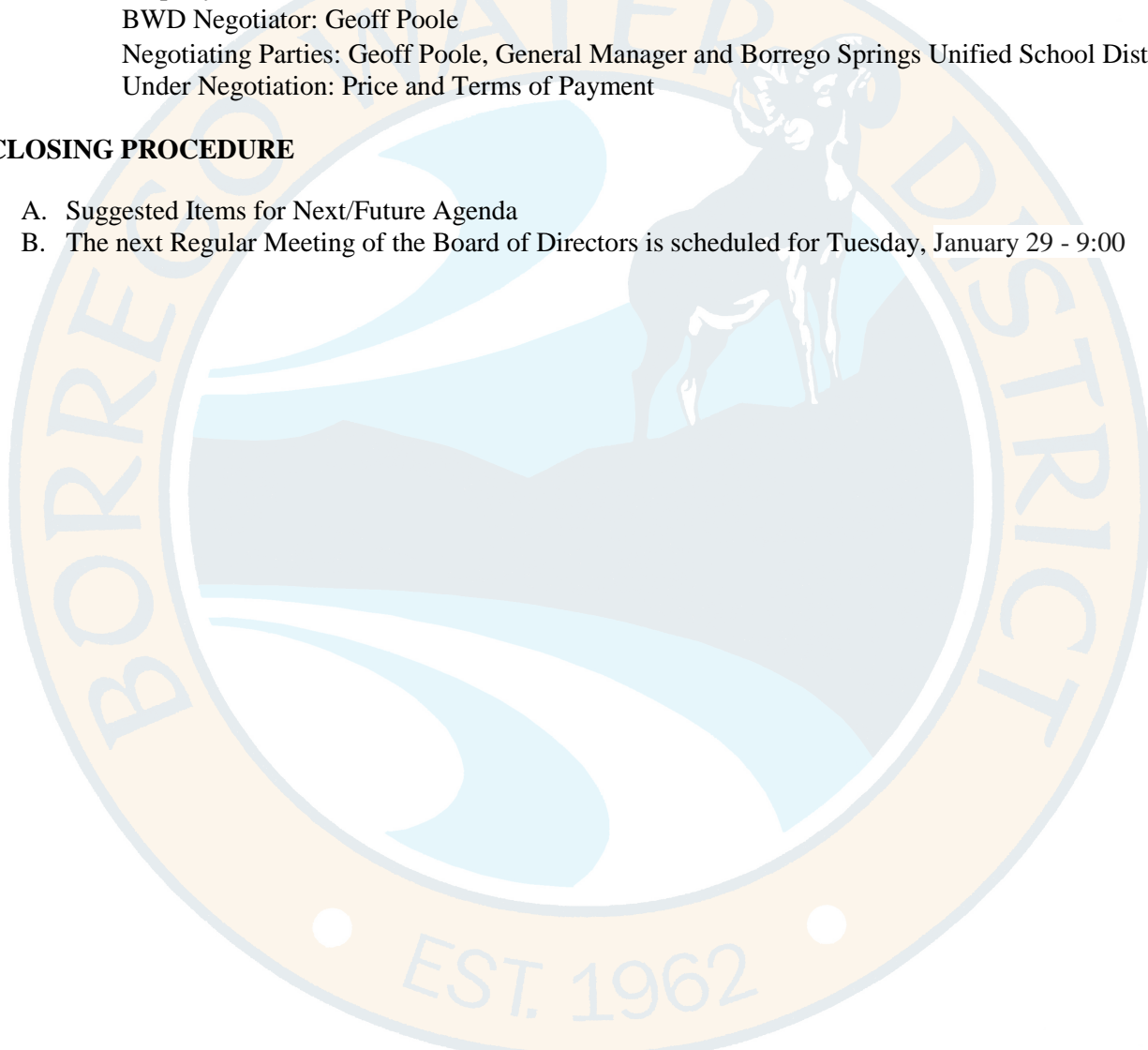
5. “Water Quality Review and Assessment: Borrego Water District (BWD) Water Supply Wells” (December 7, 2018) – Dr Jay Jones, ENSI (224-336)
6. Holly Doremus, Professor of Law, University of California, Berkeley, “Adaptive Management as an Information Problem” (2011) (337-378)

III. CLOSED SESSION:

- A. Conference with Legal Counsel - Significant exposure to litigation pursuant to paragraph (3) of subdivision (d) of Section 54956.9: (Three (3) potential cases)
- B. Conference with Real Property Negotiators (Gov. Code § Section 54956.8)
Property APN: 198-270-13: S8-11-6E (EX RDS) NEQ of the SEQ of Section 8
BWD Negotiator: Geoff Poole
Negotiating Parties: Geoff Poole, General Manager and Borrego Springs Unified School District
Under Negotiation: Price and Terms of Payment

IV. CLOSING PROCEDURE

- A. Suggested Items for Next/Future Agenda
- B. The next Regular Meeting of the Board of Directors is scheduled for Tuesday, January 29 - 9:00



AGENDA: January 8, 2018

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CORRESPONDENCE RECEIVED – GARY HALDEMAN

Fellow Borregans, I'm writing this letter to introduce myself as your Ratepayer Representative for the GSA (Groundwater Sustainability Agency), the agency responsible for the GSP (Groundwater Sustainability Plan) required under SGMA (Sustainable Groundwater Management Act,) legislation that became effective in 2016.

My hope is to represent all of us, the ratepayers, during the final crafting and implementation phases of the Plan.

The object of this plan is to regulate the consumption of water so that it will become a sustainable resource that will benefit all users.

The best available science informs us that we are removing more water from our aquifer than what is being restored. We know this has been going on for decades. We now also have a pretty clear idea that at this point in time, municipal use (residential, commercial and ABDSP) amounts to just over 10% (1,700 Acre Feet per Year [AFY]), recreational use is slightly less than 20%, and agriculture uses and has used the lion's share of just under 70%.

Under the law (SGMA,) as described in our Plan (GSP,) we must achieve a target pumping rate of 5,700 AFY, which translates to a 76% reduction in water use throughout the valley. But SGMA allows the GSA, through the Plan (GSP,) to assign the reductions as this Agency deems appropriate.

Allow me to make a few points about how the ratepayer, agriculture and other users have been consuming water over time in Borrego Springs:

- We, the ratepayers, at no point in history have been the cause of the overdraft
- We, by definition, pay for the resource
- BWD has increased its rates significantly in recent years
- Many of us struggle to pay for the ever-increasing cost of water
- We do not profit from the use of this common resource
- Agriculture makes a profit from a resource that we have to pay for
- Agriculture employs few people; most farm owners (if not all) do not live in Borrego Springs; both profits and crops leave the valley
- Agriculture does not pay for water
- Agricultural plantings have steadily increased over the years (we've all seen the two new ever-spreading herb farms)
- We have reduced our water consumption significantly in recent years

So, my plan is to hold a series of gatherings, not meetings, maybe open houses is a better term, at various locations around town and, with your help, coffees at your homes where you would invite some of your friends to learn about the issues, contribute their ideas and, I hope, to fine-tune a plan I've come up with after speaking to many of you already.

Under this plan, the ratepayer (all of us,) through BWD will be assigned a "**Minimum Water Allocation**" of 1,700 AFY (the amount we currently use, more than 30% less than what we were using just a few years ago, a good-faith reduction not undertaken by any other stakeholder.)

We would ask BWD to immediately begin searching for funding to purchase enough additional water to ensure the modest growth we hope for and expect of our town.

Agriculture is not a sustainable pursuit in our valley. It has never been. If agriculture had been undertaken sustainably, we would have no water issues now.

This is our time. We all want a viable community that continues to thrive, develop and grow. We want businesses and jobs that can succeed with our existing water resources. We want sustainable and affordable water and we want businesses in town to support our community.

We can do this together. Please look for these gatherings, bring your friends; let's put our heads and our hearts together to accomplish this fair, reasonable and straightforward goal.



Addressing Community Concerns, Agenda Item GSP AC

Rebecca Falk [REDACTED]

Fri, Dec 7, 2018 at 1:36 PM

To: Lyle Brecht [REDACTED] dave duncan [REDACTED] "Bennett, Jim"
[REDACTED], "Crow, Leanne" [REDACTED] "Wylie, Meagan D"
[REDACTED] Geoff Poole [REDACTED]

Dear Borrego GSP Core Team Members,

I think an agenda item addressing community concerns is very much needed, as I will explain below. I am requesting an agenda item at our next GSP AC Meeting addressing these concerns directly and in simple language most people can understand. In addition, I highly recommend finding a way to address these concerns before the January 31 meeting, perhaps via the local newspaper or a brief that gets posted at the County SGMA web page for Borrego so that it can be circulated.

The recent LA Times/SD Trib article ("Defeat of water bond measure bodes disaster for the desert community of Borrego

Springs") underlined and triggered alarm in the community about how municipal ratepayers and the town will survive the GSP outcome. The recent community outreach meeting did not clear up the concerns underlined by the article, and was the basis in major part for the article mentioned above. This alarm is being talked about fairly widely at this point, across sectors, and should not be ignored. The uncertainty about how municipal water and rates will be affected by the GSP is becoming a big problem.

Questions that need full and more clear answers that I believe do have available answers are:

1. Do ratepayers have to reduce 75% or 76% from current usage?
2. How much do ratepayers have to reduce their current water usage?
3. When will those reductions for municipal begin apart from calculations on paper, i.e. wet water reductions? How soon will BWD's water supply be affected?
4. How will BWD's proposed proportional reductions impact future water rates for municipal users? And to simplify: how much will our water bills rise because we have to purchase water under this plan?
5. What is going to keep other sectors from buying up available water, leaving municipal without enough water? And what is going to keep water being held hostage at prices BWD cannot afford to purchase without impacting ratepayers unfairly, since it seems BWD will have to purchase some water under the GSP?
6. Agricultural pumping accounts for the majority of water use that has overdrafted our basin. Where are assurances that this won't continue? How will reductions on the part of basin pumpers be enforced and how will not meeting annual pumping reductions be penalized?

7. If BWD customers have already reduced their water use by 50% per dwelling unit equivalent (EDU) since 2010, how is this being credited to BWD and ratepayers so ratepayers are not being penalized?

These ratepayer concerns have not been adequately addressed in AC meetings in the minds of community members and ratepayers who have spoken with me. Will the core team provide more detailed consideration of these ratepayer concerns?

Thank you,

Rebecca Falk

Member, Advisory Committee, GSP Borrego

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.1

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT: Election of Officers

RECOMMENDED ACTION:

Discuss, nominate and elect BWD Board Officers

ITEM EXPLANATION:

BWD Policy Manual requires election of officers at the first meeting in January following the election. The offices for the Board are:

President, Vice President, Secretary and Treasurer

Staff recommends the Board elect officers at the meeting.

FISCAL IMPACT:

N/A

ATTACHMENTS:

1. None

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.2.a

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT: Rejection of Apparent Low Bidder and Award of Contract – C Beltran, Dynamic Engineering & C Hayes, BBK

RECOMMENDED ACTION:

Reject apparent low bid from Aztec Construction as Non-Responsive and award Phase One Pipeline Contract to A and R Construction

ITEM EXPLANATION:

On December 11th bids were opened for Phase One of BWD Pipeline Projects and two bids were received:

BID RESULTS/FINANCIALS

1. AZTEC: Base = \$347,246	Water Service Alternate = \$52,754	Total = \$400,000
2. A and R: Base = \$435,083	Water Service Alternate = \$79,230	Total = \$514,313
Updated Engineer's Estimate		
Base = \$425,235	Water Service Alternate = \$61,750	Total = \$486,985
Bond Financing Estimate		
		Total = \$644,600

The Bond Financing amount would include engineering, construction management and related costs, typically in the 20% range, which on this project would be approximately \$102,000 for a total of \$588,000 (\$54,000 under Bond Financing budget). The actual costs will be known upon project completion.

LEGAL REVIEW

Following Legal review of the two bid packages, it was determined that the bid from AZTEC was not responsive for the following reasons:

Addendum No. 3 required pages 18 to 22 (bid schedule) to be replaced with the provided revised sheets. The major change was item number 21, the quantity was increased from 65 to 98 tons and from what I can tell, the work scope increased to include cold mill, additional asphalt, and emulsion/sand. Aztec did not use the revised bid schedule and as a result, the total amount should be \$16,985, not \$10,985.

This is not an inconsequential irregularity which would allow the District to waive Aztec's failure to include the updated bid sheets because this mistake could have had a material and significant impact on the bid price as both the quantity and scope of work increased. For comparison purposes, A&R's unit cost was \$591 per ton and Aztec's unit cost was \$164 per ton. This provides Aztec the ability to potentially withdraw its bid, thereby providing them with an unfair competitive advantage. As such, Aztec's bid is non-responsive.

Legal Counsel has created a letter that will be sent to Aztec explaining the situation and the Board's decision.

NEXT STEPS

Staff is recommending the Board reject Aztec's bid as non-responsive and award the contract to A & R.

Based on the fact that only two bids were received Staff will be re-evaluating the current proposed project phasing. In addition, Operations staff has identified a new waterline project with higher priority than those on the list and will be recommending a change to the project list. This action is allowed under the terms of our Bond Agreement as long as the appropriate notifications are made to the Bank, which will be done as soon as Staff has finalized the Project List including revised phasing. A meeting with staff and Dynamic Engineering is set for Jan 10th to discuss this topic and the results will be presented to the Board.

FISCAL IMPACT:

N/A

ATTACHMENTS:

1. None

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.2.b

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT Well Replacement #1 & #2 Bid Documents – K. Ilkhanipour, Dudek & C Hayes, BBK

RECOMMENDED ACTION:

Authorize staff and Dudek Engineering to bid Well Replacement #1 and #2

ITEM EXPLANATION:

As a follow up to the December 2018 Board Meeting, Staff, Legal Counsel and Dudek have performed another review of the bid documents under the concept that well #2 will be bid as an alternate with no obligation by BWD to accept the bid. The proposed documents are attached. Legal Counsel and Dynamic Engineering will be available to answer any questions at the meeting via phone.

FISCAL IMPACT:

The estimate for both wells is \$3 Million including well construction, pump/motor, design and related services

ATTACHMENTS:

1. Bid Documents for Replacement Well #1 and #2

BORREGO WATER DISTRICT



CONTRACT DOCUMENTS AND SPECIFICATIONS FOR

DRILLING AND CONSTRUCTION OF NEW EXTRACTION

WELL AT WELL #ID4-4 LOCATION

(BWD Capital Improvements Projects)

January 2019

**Borrego Water District
806 Palm Canyon Drive
Borrego Springs, California 92004**

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00 11 16 – NOTICE INVITING BIDS

NOTICE IS HEREBY GIVEN that the Borrego Water District (“DISTRICT”) invites and will receive sealed Bids up to but not later than **2:00 p.m. on Tuesday, January 29, 2019** at 806 Palm Canyon Drive, Borrego Springs, California 92004, for the furnishing to DISTRICT of all labor, equipment, materials, tools, services, transportation, permits, utilities, and all other items necessary for the **Installation of a New Extraction Well at the Well ID4-4 Location** (the “Project”). At said time, Bids will be publicly opened and read aloud at the DISTRICT Office. Bids received after said time shall be returned unopened. Bids shall be valid for a period of 60 calendar days after the Bid opening date.

The work shall include the drilling, constructing, developing, pump testing, and disinfecting of one extraction well. The extraction well is to be drilled into the unconsolidated deposits of the Borrego Springs Groundwater Subbasin (Subbasin) to a depth of approximately 1,000 feet using direct or reverse circulation mud-rotary drilling.

Bids must be submitted on the DISTRICT’s Bid Forms. Bidders may obtain a copy of the Contract Documents from the DISTRICT at: 806 Palm Canyon Dr, Borrego Springs CA or Geoff@BorregoWD.org or 760-767-5806 for \$30 (Thirty Dollars)**]. A non-refundable charge \$50 (Fifty) will be required of any bidder who requests that the Contract Documents be mailed within California (costs for out-of-state mailings will be higher). To the extent required by section 20103.7 of the Public Contract Code, upon request from a contractor plan room service, the DISTRICT shall provide an electronic copy of the Contract Documents at no charge to the

Bids must be submitted on the DISTRICT’s Bid Forms. Bidders may obtain a copy of the Contract Documents from the Borrego Water District Website (BorregoWD.org) on the BULLETIN BOARD located on the Home Page. To the extent required by section 20103.7 of the Public Contract Code, upon request from a contractor plan room service, the DISTRICT shall provide an electronic copy of the Contract Documents at no charge to the contractor plan room.

It is the responsibility of each prospective bidder to download and print all Bid Documents for review and to verify the completeness of Bid Documents before submitting a bid. Any Addenda will be posted on BorregoWD.org. It is the responsibility of each prospective bidder to check BorregoWD.org on a daily basis through the close of bids for any applicable addenda or updates. The DISTRICT does not assume any liability or responsibility based on any defective or incomplete copying, excerpting, scanning, faxing, downloading or printing of the Bid Documents. Information on BorregoWD.org may change without notice to prospective bidders. The Contract Documents shall supersede any information posted or transmitted by BorregoWD.org

Each Bid shall be accompanied by cash, a certified or cashier’s check, or Bid Bond secured from a surety company satisfactory to the General Manager, the amount of which shall not be less than ten percent (10%) of the submitted Total Bid Price, made payable to Borrego Water District as bid security. The bid security shall be provided as a guarantee that within five (5) working days after the DISTRICT provides the successful bidder the Notice of Award, the successful Bidder will enter into a contract and provide the necessary bonds and certificates of insurance. The bid security will be declared forfeited if the successful Bidder fails to comply within said time. No interest will be paid on funds deposited with DISTRICT.

A Pre-Bid Conference is scheduled for **January 22nd, 2019 at 1:30 PM** to review the Project’s existing conditions at BWD Office (806 Palm Canyon Dr.). Representatives of the DISTRICT and consulting engineers, if any, will be present or participate via webinar. Questions asked by

Bidders at the Pre-Bid Conference not specifically addressed within the Contract Documents shall be answered in writing, and shall be sent to all Bidders present at the Pre-Bid Conference. Bids will not be accepted from any bidder who did not attend the mandatory Pre-Bid Conference.

The successful Bidder will be required to furnish a Faithful Performance Bond and a Labor and Material Payment Bond each in an amount equal to one hundred percent (100%) of the Contract Price. Each bond shall be in the forms set forth herein, shall be secured from a surety company that meets all State of California bonding requirements, as defined in California Code of Civil Procedure Section 995.120, and that is a California admitted surety insurer.

Pursuant to Section 22300 of the Public Contract Code of the State of California, the successful Bidder may substitute certain securities for funds withheld by DISTRICT to ensure its performance under the contract.

Pursuant to Labor Code Section 1773, DISTRICT has obtained the prevailing rate of per diem wages and the prevailing wage rate for holiday and overtime work applicable in San Diego County from the Director of the Department of Industrial Relations for each craft, classification, or type of worker needed to execute this contract. A copy of these prevailing wage rates may be obtained via the internet at: www.dir.ca.gov/dlsr/

In addition, a copy of the prevailing rate of per diem wages is available at the DISTRICT's office and shall be made available to interested parties upon request. The successful bidder shall post a copy of the prevailing wage rates at each job site. It shall be mandatory upon the Bidder to whom the Contract is awarded, and upon any subcontractors, to comply with all Labor Code provisions, which include but are not limited to the payment of not less than the said specified prevailing wage rates to all workers employed by them in the execution of the Contract, employment of apprentices, hours of labor and debarment of contractors and subcontractors.

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. No Bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors' current registration with the Department of Industrial Relations to perform public work. If awarded a contract, the Bidder and its subcontractors, of any tier, shall maintain active registration with the Department of Industrial Relations for the duration of the Project. Notwithstanding the foregoing, the contractor registration requirements mandated by Labor Code Sections 1725.5 and 1771.1 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Sections 1725.5 and 1771.1.

This Project is subject to compliance monitoring and enforcement by the Department of Industrial Relations. In bidding on this Project, it shall be the Bidder's sole responsibility to evaluate and include the cost of complying with all labor compliance requirements under this contract and applicable law in its Bid.

Unless otherwise provided in the Instructions for Bidders, each Bidder shall be a licensed contractor pursuant to sections 7000 et seq. of the Business and Professions Code in the following classification(s) throughout the time it submits its Bid and for the duration of the contract:

Class A (General Engineering).

Substitution requests shall be made within 35 calendar days after the award of the contract. Pursuant to Public Contract Code Section 3400(b), the DISTRICT may make findings designating that certain additional materials, methods or services by specific brand or trade name other than those listed in the Standard Specifications be used for the Project. Such findings, if any, as well as the materials, methods or services and their specific brand or trade names that must be used for the Project may be found in the Special Conditions.

DISTRICT shall award the contract for the Project to the lowest responsive, responsible Bidder as determined by the DISTRICT from the **BASE BID ALONE**. DISTRICT reserves the right to reject any or all bids or to waive any irregularities or informalities in any bids or in the bidding process.

For further information, contact Geoff Poole, General Manager at Geoff@BorregoWD.Org or 760-767-5806.

END OF NOTICE INVITING BIDS

00 21 13 – INSTRUCTIONS TO BIDDERS

ARTICLE 1. SECURING DOCUMENTS

Bids must be submitted to the DISTRICT on the Bid Forms which are a part of the Bid Package for the Project. Bid and Contract Documents may be obtained from the DISTRICT at the location(s) and at the time(s) indicated in the Notice Inviting Bids. Prospective bidders are encouraged to telephone in advance to determine the availability of Contract Documents. Any charge for the Contract Documents is stated in the Notice Inviting Bids.

The DISTRICT may also make the Contract Documents available for review at one or more plan rooms, as indicated in the Notice Inviting Bids. Please Note: Prospective Bidders who choose to review the Contract Documents at a plan room must contact the DISTRICT to obtain the required Contract Documents if they decide to submit a bid for the Project.

Addenda, if any, issued during the bid period will be sent only to those contractors who have obtained documents from the DISTRICT.” Failure to acknowledge addenda may make a bid nonresponsive and not eligible for award of the contract.

ARTICLE 2. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

At its own expense and prior to submitting its Bid, each Bidder shall visit the site of the proposed work and fully acquaint itself with the conditions relating to the construction and labor required so that the Bidder may fully understand the work, including but not limited to difficulties and restrictions attending the execution of the work under the contract. Each Bidder shall carefully examine the Drawings, and shall read the Specifications, Contract, and all other documents referenced herein. Each Bidder shall also determine the local conditions which may in any way affect the performance of the work, including local tax structure, contractors’ licensing requirements, availability of required insurance, the prevailing wages and other relevant cost factors, shall familiarize itself with all federal, state and local laws, ordinances, rules, regulations and codes affecting the performance of the work, including the cost of permits and licenses required for the work, and shall make such surveys and investigations, including investigations of subsurface or latent physical conditions at the site or where work is to be performed as may be required. Bidders are responsible for consulting the standards referenced in the Contract. The failure or omission of any Bidder to receive or examine any contract documents, forms, instruments, addenda, or other documents, or to visit the site and acquaint itself with conditions there existing shall in no way relieve any Bidder from any obligation with respect to its Bid or to the contract and no relief for error or omission will be given except as required under State law. The submission of a Bid shall be taken as conclusive evidence of compliance with this Article.

ARTICLE 3. INTERPRETATION OF DRAWINGS AND DOCUMENTS

Prospective Bidders unclear as to the true meaning of any part of the Drawings, Specifications or other proposed contract documents may submit to the Engineer of the DISTRICT a written request for interpretation. The prospective Bidder submitting the request is responsible for prompt delivery. Interpretation of the Drawings, Specifications or other proposed contract documents will be made only by a written addendum duly issued and a copy of such addenda will be mailed or delivered to each prospective Bidder who has purchased a set of Drawings and Specifications. The DISTRICT will not be responsible for any other explanation or interpretations of the proposed documents. If a Prospective Bidders becomes aware of any errors or omissions in any part of the Contract Documents, it is the obligation of the Prospective Bidder to promptly bring it to the

attention of the DISTRICT.

ARTICLE 4. PRE-BID CONFERENCE

A Pre-Bid Conference is scheduled for **January 22, 2019** at 1:30 PM at 806 Palm Canyon Dr, Borrego Springs CA to review the Project's existing conditions. Representatives of the DISTRICT and consulting engineers, if any, will be present. Questions asked by Bidders at the Pre-Bid Conference not specifically addressed within the Contract Documents shall be answered in writing, and shall be sent to all Bidders present at the Pre-Bid Conference. Bids will not be accepted from any bidder who did not attend the mandatory Pre-Bid Conference.

ARTICLE 5. ADDENDA

The DISTRICT reserves the right to revise the Contract Documents prior to the Bid opening date. Revisions, if any, shall be made by written Addenda. All Addenda issued by the DISTRICT shall be included in the Bid and made part of the Contract Documents. Pursuant to Public Contract Code Section 4104.5, if the DISTRICT issues an Addendum which includes material changes to the Project less than 72 hours prior to the deadline for submission of Bids, the DISTRICT will extend the deadline for submission of Bids. The DISTRICT may determine, in its sole discretion, whether an Addendum warrants postponement of the Bid submission date. Each prospective Bidder shall provide DISTRICT a name, address, email address, and facsimile number to which Addenda may be sent, as well as a telephone number by which the DISTRICT can contact the Bidder. Copies of Addenda will be furnished by email, facsimile, first class mail, express mail or other proper means of delivery without charge to all parties who have obtained a copy of the Contract Documents and provided such current information. Please Note: Bidders are responsible for ensuring that they have received any and all Addenda. To this end, each Bidder should contact Geoff Poole to verify that it has received all Addenda issued, if any, prior to the Bid opening. The Bidder shall indicate the Addenda received prior to bidding in the space provided in the Bid Form. Failure to indicate all Addenda may be sufficient cause for rejecting the Bid.

ARTICLE 6. ALTERNATE BIDS

If alternate bid items are called for in the Contract Documents, the time required for completion of the alternate bid items has already been factored into the Contract duration and no additional Contract time will be awarded for any of the alternate bid items. The DISTRICT may elect to include one or more of the alternate bid items, or to otherwise remove certain work from the Project scope of work. Accordingly, each bidder must ensure that each bid item contains a proportionate share of profit, overhead, and other costs or expenses which will be incurred by the bidder.

ARTICLE 7. COMPLETION OF BID FORMS

Bids shall only be prepared using copies of the Bid Forms which are included in the Contract Documents. The use of substitute Bid Forms other than clear and correct photocopies of those provided by the DISTRICT will not be permitted. Bids shall be executed by an authorized signatory as described in these Instructions to Bidders. In addition, Bidders shall fill in all blank spaces (including inserting "N/A" where applicable), and initial all interlineations, alterations, or erasures to the Bid Forms. Bidders shall neither delete, modify, nor supplement the printed matter on the Bid Forms nor make substitutions thereon. **USE OF BLACK OR BLUE INK, INDELIBLE**

PENCIL, OR A TYPEWRITER IS REQUIRED. Deviations in the Bid Forms may result in the Bid being deemed non-responsive.

ARTICLE 8. MODIFICATIONS OF BIDS

Each Bidder shall submit its Bid in strict conformity with the requirements of the Contract Documents. Unauthorized additions, modifications, revisions, conditions, limitations, exclusions or provisions attached to a Bid may render it non-responsive and may cause its rejection. Bidders shall not delete, modify, or supplement the printed matter on the Bid Forms, or make substitutions thereon. Oral, telephonic and electronic modifications will not be considered.

ARTICLE 9. SUBCONTRACTORS

Bidder shall set forth the name, address of the place of business, and contractor license number of each subcontractor who will perform work, labor, furnish materials or render services to the bidder on said contract and each subcontractor licensed by the State of California who, under subcontract to bidder, specially fabricates and installs a portion of the Work described in the Drawings and Specifications in an amount in excess of one half of one percent (0.5%) of the total bid price, and shall indicate the portion of the work to be done by such subcontractor in accordance with Public Contract Code Section 4104.

ARTICLE 10. LICENSING REQUIREMENTS

Pursuant to Business and Professions Code Section 7028.15 and Public Contract Code Section 3300, all bidders must possess proper licenses for performance of this Contract. Subcontractors must possess the appropriate licenses for each specialty subcontracted. Pursuant to Business and Professions Code Section 7028.5, the DISTRICT shall consider any bid submitted by a contractor not currently licensed in accordance with state law and pursuant to the requirements found in the Contract Documents to be nonresponsive, and the DISTRICT shall reject the Bid. The DISTRICT shall have the right to request, and Bidders shall provide within ten (10) calendar days, evidence satisfactory to the DISTRICT of all valid license(s) currently held by that Bidder and each of the Bidder's subcontractors, before awarding the Contract.

Notwithstanding anything contained herein, if the Work involves federal funds, the Contractor shall be properly licensed by the time the Contract is awarded, pursuant to the provisions of Public Contract Code section 20103.5.

ARTICLE 11. BID GUARANTEE (BOND)

Each bid shall be accompanied by: (a) cash; (b) a certified or cashier's check made payable to Borrego Water District; or (c) a Bid Bond secured from a surety company satisfactory to the General Manager, the amount of which shall not be less than ten percent (10%) of the Total Bid Price, made payable to Borrego Water District as bid security. Personal sureties and unregistered surety companies are unacceptable. The surety insurer shall be California admitted surety insurer, as defined in Code of Civil Procedure Section 995.120. The bid security shall be provided as a guarantee that within ten (10) working days after the DISTRICT provides the successful bidder the Notice of Award, the successful bidder will enter into a contract and provide the necessary bonds and certificates of insurance. The bid security will be declared forfeited if the successful bidder fails to comply within said time, and DISTRICT may enter into a contract with the next lowest responsive responsible bidder, or may call for new bids. No interest shall be paid

on funds deposited with the DISTRICT. DISTRICT will return the security accompanying the bids of all unsuccessful bidders no later than 60 calendar days after award of the contract.

ARTICLE 12. IRAN CONTRACTING ACT OF 2010

In accordance with Public Contract Code Section 2200 *et seq.*, the DISTRICT requires that any person that submits a bid or proposal or otherwise proposes to enter into or renew a contract with the DISTRICT with respect to goods or services of one million dollars (\$1,000,000) or more, certify at the time the bid is submitted or the contract is renewed, that the person is not identified on a list created pursuant to subdivision (b) of Public Contract Code Section 2203 as a person engaging in investment activities in Iran described in subdivision (a) of Public Contract Code Section 2202.5, or as a person described in subdivision (b) of Public Contract Code Section 2202.5, as applicable.

The form of such Iran Contracting Certificate is included with the bid package and must be signed and dated under penalty of perjury.

ARTICLE 13. NONCOLLUSION DECLARATION

Bidders on all public works contracts are required to submit a declaration of noncollusion with their bid. This form is included with the bid package and must be signed and dated under penalty of perjury.

ARTICLE 14. PUBLIC WORKS CONTRACTOR REGISTRATION CERTIFICATION

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. No bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors' current registration with the Department of Industrial Relations to perform public work. If awarded a contract, the bidder and its subcontractors, of any tier, shall maintain active registration with the Department of Industrial Relations for the duration of the Project. To this end, Bidder shall sign and submit with its Bid the Public Works Contractor Registration Certification on the form provided, attesting to the facts contained therein. Failure to submit this form may render the bid non-responsive. In addition, each Bidder shall provide the registration number for each listed subcontractor in the space provided in the Designation of Subcontractors form.

ARTICLE 15. BIDDER INFORMATION AND EXPERIENCE FORM

Each Bidder shall complete the questionnaire provided herein and shall submit the questionnaire along with its Bid. Failure to provide all information requested within the questionnaire along with the Bid may cause the bid to be rejected as non-responsive. The DISTRICT reserves the right to reject any Bid if an investigation of the information submitted does not satisfy the Engineer that the Bidder is qualified to properly carry out the terms of the contract.

ARTICLE 16. WORKERS' COMPENSATION CERTIFICATION

In accordance with the provisions of Labor Code Section 3700, Contractor shall secure the payment of compensation to its employees. Contractor shall sign and file with the DISTRICT the following certificate prior to performing the work under this Contract:

I am aware of the provisions of Section 3700 of the Labor Code, which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this contract.

The form of such Workers' Compensation Certificate is included as part of this document.

ARTICLE 17. SIGNING OF BIDS

All Bids submitted shall be executed by the Bidder or its authorized representative. Bidders may be asked to provide evidence in the form of an authenticated resolution of its Board of Directors or a Power of Attorney evidencing the capacity of the person signing the Bid to bind the Bidder to each Bid and to any Contract arising therefrom.

If a Bidder is a joint venture or partnership, it may be asked to submit an authenticated Power of Attorney executed by each joint venturer or partner appointing and designating one of the joint venturers or partners as a management sponsor to execute the Bid on behalf of Bidder. Only that joint venturer or partner shall execute the Bid. The Power of Attorney shall also: (1) authorize that particular joint venturer or partner to act for and bind Bidder in all matters relating to the Bid; and (2) provide that each venturer or partner shall be jointly and severally liable for any and all of the duties and obligations of Bidder assumed under the Bid and under any Contract arising therefrom. The Bid shall be executed by the designated joint venturer or partner on behalf of the joint venture or partnership in its legal name.

ARTICLE 18. SUBMISSION OF SEALED BIDS

Once the Bid and supporting documents have been completed and signed as set forth herein, they shall be placed, along with the Bid Guarantee and other required materials, in a sealed envelope, addressed and delivered or mailed, postage prepaid, to the Engineering Department of the DISTRICT before the time and day set for the receipt of bids. The envelope shall bear the title of the work and the name of the bidder. No oral or telephonic bids will be considered. No forms transmitted via the internet, e-mail, facsimile, or any other electronic means will be considered unless specifically authorized by the DISTRICT as provided herein. Bids received after the time and day set for the receipt of bids shall be returned to the bidder unopened. The envelope shall also contain the following in the lower left-hand corner thereof:

**Bid of _____ (Bidder's Name)
for the Installation of New Extraction Well at the Well ID4-4 Location**

Only where expressly permitted in the Notice Inviting Bids may bidders submit their bids via electronic transmission pursuant to Public Contract Code sections 1600 and 1601. Any acceptable method(s) of electronic transmission shall be stated in the Notice Inviting Bids. DISTRICT may reject any bid not strictly complying with DISTRICT's designated methods for delivery.

ARTICLE 19. OPENING OF BIDS

At the time and place set for the opening and reading of bids, or any time thereafter, each and every bid received prior to the time and day set for the receipt of bids will be publicly opened and read. The DISTRICT will leave unopened any Bid received after the specified date and time, and any such unopened Bid will be returned to the bidder. It is the bidder's sole responsibility to

ensure that its Bid is received as specified. Bids may be submitted earlier than the date(s) and time(s) indicated.

The public reading of each bid will include the following information:

- A. The name and business location of the bidder.
- B. The nature and amount of the bid security furnished by bidder.
- C. The bid amount.

Bidders or their representatives and other interested persons may be present at the opening of the bids. The DISTRICT may, in its sole discretion, elect to postpone the opening of the submitted Bids. The DISTRICT reserves the right to reject any or all Bids and to waive any informality or irregularity in any Bid.

ARTICLE 20. WITHDRAWAL OF BID

Any bid may be withdrawn either personally or by written request, incurring no penalty, at any time prior to the scheduled closing time for receipt of bids. Requests to withdraw bids shall be worded so as not to reveal the amount of the original bid. Withdrawn bids may be resubmitted until the time and day set for the receipt of bids, provided that resubmitted bids are in conformance with the instructions herein.

Bids may be withdrawn after bid opening only by providing written notice to DISTRICT within five (5) working days of the bid opening and in compliance with Public Contract Code Section 5100 *et seq.*, or as otherwise may be allowed with the consent of the DISTRICT.

ARTICLE 21. BIDDERS INTERESTED IN MORE THAN ONE BID

No Bidder shall be allowed to make, file or be interested in more than one bid for the same work unless alternate bids are specifically called for. A person, firm or corporation that has submitted a sub-proposal to a Bidder, or that has quoted prices of materials to a Bidder, is not thereby disqualified from submitting a sub-proposal or quoting prices to other bidders. No person, firm, corporation, or other entity may submit a sub-proposal to a Bidder, or quote prices of materials to a Bidder, when also submitting a prime Bid on the same Project.

ARTICLE 22. SUBSTITUTION OF SECURITY

The Contract Documents call for monthly progress payments based upon the percentage of the Work completed. The DISTRICT will retain a percentage of each progress payment as provided by the Contract Documents. At the request and expense of the successful Bidder, the DISTRICT will substitute securities for the amount so retained in accordance with Public Contract Code Section 22300.

ARTICLE 23. PREVAILING WAGES

The DISTRICT has obtained from the Director of the Department of Industrial Relations the general prevailing rate of per diem wages in the locality in which this work is to be performed for each craft or type of worker needed to execute the Contract. These rates are available at the

DISTRICT or may be obtained online at <http://www.dir.ca.gov>. Bidders are advised that a copy of these rates must be posted by the successful Bidder at the job site(s).

ARTICLE 24. DEBARMENT OF CONTRACTORS AND SUBCONTRACTORS

In accordance with the provisions of the Labor Code, contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Labor Code Sections 1777.1 or 1777.7. Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid to a debarred subcontractor by the Contractor for the Project shall be returned to the DISTRICT. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the Project.

ARTICLE 25. INSURANCE REQUIREMENTS

Prior to commencing work, the successful bidder shall purchase and maintain insurance as set forth in the General Conditions.

ARTICLE 26. PERFORMANCE BOND AND PAYMENT BOND REQUIREMENTS

The successful bidder will be required to furnish a Labor and Material Payment Bond and a Faithful Performance Bond each in an amount equal to one hundred percent (100%) of the contract price. Each bond shall be secured from a surety company that meets all State of California bonding requirements, as defined in California Code of Civil Procedure Section 995.120 and is admitted by the State of California. Each bond shall be accompanied, upon the request of DISTRICT, with all documents required by California Code of Civil Procedure Section 995.660 to the extent required by law. All bonding and insurance requirements shall be completed and submitted to DISTRICT within ten (10) working days from the date the DISTRICT provides the successful bidder with the Notice of Award.

ARTICLE 27. SALES AND OTHER APPLICABLE TAXES, PERMITS, LICENSES AND FEES

Contractor and its subcontractors performing work under this Contract will be required to pay California sales tax and other applicable taxes, and to pay for permits, licenses and fees required by the agencies with authority in the jurisdiction in which the Work will be located, unless otherwise expressly provided by the Contract Documents.

ARTICLE 28. FILING OF BID PROTESTS

Bidders may file a "protest" of a Bid with the DISTRICT's General Manager. In order for a Bidder's protest to be considered valid, the protest must:

- A. Be filed in writing within five (5) calendar days after the bid opening date;
- B. Clearly identify the specific irregularity or accusation;

- C. Clearly identify the specific DISTRICT staff determination or recommendation being protested;
- D. Specify in detail the grounds for protest and the facts supporting the protest; and
- E. Include all relevant, supporting documentation with the protest at time of filing.

If the protest does not comply with each of these requirements, the DISTRICT may reject the protest without further review.

If the protest is timely and complies with the above requirements, the DISTRICT's General Manager, or other designated DISTRICT staff member, shall review the protest, any response from the challenged Bidder(s), and all other relevant information. The General Manager will provide a written decision to the protestor.

The procedure and time limits set forth in this Article are mandatory and are the sole and exclusive remedy in the event of a Bid protest. Failure to comply with these procedures shall constitute a failure to exhaust administrative remedies and a waiver of any right to further pursue the Bid protest, including filing a Government Code Claim or legal proceedings.

ARTICLE 29. BASIS OF AWARD; BALANCED BID

The DISTRICT shall award the Contract to the lowest responsible Bidder submitting a responsive Bid. The lowest Bid will be determined on the basis of the Total Bid Price. **AWARD WILL BE ON THE BASIS OF THE TOTAL BASE BID ALONE, NOT INCLUDING ALTERNATIVE BID ITEMS.**

The DISTRICT may reject any Bid which, in its opinion when compared to other Bids received or to the DISTRICT's internal estimates, does not accurately reflect the cost to perform the Work. The DISTRICT may reject as non-responsive any Bid which unevenly weights or allocates costs, including but not limited to overhead and profit to one or more particular bid items.

ARTICLE 30. AWARD PROCESS

Once all Bids are opened and reviewed to determine the lowest responsive and responsible Bidder, the DISTRICT may award the contract. The apparent successful Bidder should begin to prepare the following documents: (1) the Performance Bond; (2) the Payment Bond; and (3) the required insurance certificates and endorsements. Once the DISTRICT notifies the Bidder of the award, the Bidder will have ten (10) working days from the date of this notification to execute the Contract and supply the DISTRICT with all of the required documents and certifications. Once the DISTRICT receives all of the properly drafted and executed documents and certifications from the Bidder, the DISTRICT shall issue a Notice to Proceed to that Bidder. The Contractor shall begin work within ten (10) days after receiving the Notice to Proceed.

ARTICLE 31. EXECUTION OF CONTRACT

As required herein the Bidder to whom an award is made shall execute the Contract in the amount determined by the Contract Documents. The DISTRICT may require appropriate evidence that the persons executing the Contract are duly empowered to do so. The Contract and bond forms to be executed by the successful Bidder are included within these Specifications and shall not be

detached.

ARTICLE 32. QUESTIONS

Questions regarding this Notice Inviting Bids may be directed to the General Manager at 760-767-5806 or email at Geoff@BorregoWD.Org. No other members of the DISTRICT's staff or Board of Directors should be contacted about this procurement during the bidding process. Any and all inquiries and comments regarding this Bid must be communicated in writing, unless otherwise instructed by the DISTRICT. The DISTRICT may, in its sole discretion, disqualify any Bidder who engages in any prohibited communications.

00 41 43 – BID FORMS

1.1 Bid.

Bids will be received at the Office of the Borrego Water District, located at 806 Palm Canyon Drive, Borrego Springs, California 92004 until **2:00 p.m. on Tuesday, January 29, 2019.**

NAME OF BIDDER: _____

To the General Manager
of the Borrego Water District
806 Palm Canyon Drive
Borrego Springs, California 92004

The undersigned hereby declare that we have carefully examined the location of the proposed Work, and have read and examined the Contract Documents, including all plans, specifications, and all addenda, if any for the following Project:

New Extraction Well at the Well ID4-4 Location

We hereby propose to furnish all labor, materials, equipment, tools, transportation, and services, and to discharge all duties and obligations necessary and required to perform and complete the Project, as described and in strict conformity with the Drawings, and these Specifications for TOTAL BID PRICE indicated herein.

The undersigned acknowledges receipt, understanding, and full consideration of the following addenda to the Contract Documents:

Addenda No. _____

1. Attached is the required Bid Guarantee in the amount of not less than 10% of the Total Bid Price.
2. Attached is the completed Designation of Subcontractors form.
3. Attached is the fully executed Noncollusion Declaration form.
4. Attached is the completed Iran Contracting Act Certification form.
5. Attached is the completed Public Works Contractor Registration Certification form.
6. Attached is the completed Contractor's Certificate Regarding Workers' Compensation form.
7. Attached is the completed Bidder Information and Experience form.

A. BID SCHEDULE FOR EXTRACTION WELL AT WELL ID4-4 LOCATION

ITEM	QUANTITY	UNIT	ITEM	UNIT COST	AMOUNT
1	1	LS	Mobilization, demobilization, and site preparation including water pollution control compliance and site BMPs, obtain San Diego County well permit.	\$	\$
2	50	LF	Drill a 40-inch diameter conductor borehole, set 30-inch conductor casing, and sanitary seal to minimum 50 feet.	\$	\$
3	1,000	LF	Drill a 17.5-inch diameter test borehole.	\$	\$
4	1	LS	Run geophysical logs, including guard log.	\$	\$
5	3	LS	Perform zone testing (optional).	\$	\$
6	1,000	LF	Ream borehole to 26-inch diameter.	\$	\$
7	1	LS	Perform caliper survey.	\$	\$
8	500	LF	Furnish and install 16-inch diameter mild steel blank well casing and 3-inch gravel feed tube.	\$	\$
9	1	LS	Furnish and install a dielectric coupler (mechanical connector) between the mild steel and stainless steel casing.	\$	\$
10	500	LF	Furnish and install 16-inch diameter 304L stainless steel louver well screen with 0.060 slot and end cap at bottom of screen for sump.	\$	\$
11	700	LF	Furnish and install filter pack.	\$	\$
12	300	LF	Furnish and install cement annular seal.	\$	\$
13	24	HR	Develop well with air-lift swab and drill rig.	\$	\$
14	24	HR	Develop well with line swab and pump rig.	\$	\$
15	12	HR	Develop well with test pump.	\$	\$

then the amount set forth in the “Amount” column for the item shall prevail and shall be divided by the estimated quantity for the item and the price thus obtained shall be the Unit Cost.

For purposes of evaluating Bids, the DISTRICT will correct any apparent errors in the extension of unit prices and any apparent errors in the addition of lump sum and extended prices.

The estimated quantities for Unit Price items are for purposes of comparing Bids only and the DISTRICT makes no representation that the actual quantities of work performed will not vary from the estimates. Final payment shall be determined by the Engineer from measured quantities of work performed based upon the Unit Price.

Description of Payment Items

Payment for work satisfactorily completed as specified in these Contract Documents shall be made according to the Proposal as agreed upon by the DISTRICT and Contractor and as stated in the Agreement. The contract price for each item shall constitute full compensation for furnishing all labor, equipment, and supplies and for performing all operations for completion of the Work so specified in the Contract Documents or as directed by the District Representative. The following payment descriptions are applicable to and correlate with line items on the Cost Proposal form .

Cost Proposal Items – New Extraction Well

1. Mobilization, demobilization, and site preparation, including water pollution control compliance and site BMPs, obtain San Diego County well permit. Payment for this item shall include all materials, equipment, labor and transportation, necessary to perform the move-in, set-up for well drilling and construction of the well, tear-down and move-out of all well drilling and construction equipment, and installation and maintenance of water pollution control BMPs. Payment for this item shall also include well permit fees and all miscellaneous operations not included elsewhere for payment, such as, but not limited to, well disinfection, capping, and site clean-up. Payment shall be made at the lump sum price as stated in Item 1 of Cost Proposal form. No hourly rate shall be applicable during the performance of these operations.
2. Drill 40-inch diameter conductor borehole, set 30-inch conductor casing, set 50-foot sanitary seal. Payment for this item shall include the cost of all labor, equipment, materials, and all other costs incurred in drilling 30-inch diameter borehole, installing a 30-inch diameter steel conductor casing and 50-foot sanitary seal consisting of cement. Measurement for payment, estimated to the nearest foot by the District Representative, shall be made for the vertical distance to the bottom of the conductor casing. Payment shall be at the unit price per linear foot as stated under Item 2 of Cost Proposal form.
3. Drill 17.5-inch diameter test borehole. Payment for this item shall include the cost of all labor, equipment, materials, and all other costs incurred in drilling a 17.5-inch maximum diameter pilot hole to a depth of 1,000 feet and securing all required drill cuttings and grain size analysis samples. Measurement for payment, estimated to the nearest foot by the District Representative, shall be made for the vertical distance from the bottom of the conductor casing to the total depth of the pilot hole. Payment shall be at the unit price per linear foot as stated under Item 3 of Cost Proposal form.
4. Run geophysical logs including guard log. Payment for this item shall include the cost of an electric log (i.e., SP, 16- and 64-inch resistivity, guard log, deviation

survey, gamma), borehole conditioning, copies of the log, and time required for logging. A lump sum cost is stated in Item 4 of the Cost Proposal Form.

5. Perform zone testing (optional). Payment for this item shall include the cost of all labor, services, equipment, materials and all other costs incurred in zone testing of specific depth within the aquifer. Measurement of payment shall be made based on the number of zones tested and the unit price bid per zone as stated in Item 5 of the Cost Proposal Form.
6. Ream borehole to 26-inch diameter. Payment for this item shall include the cost of all labor, equipment, materials, and all other costs incurred in reaming borehole to 26-inch diameter. Measurement for payment, estimated to the nearest foot by the District Representative, shall be made for the vertical distance from the bottom of the conductor casing to the total depth of the reamed borehole. Payment shall be at the unit price per linear foot as stated under Item 6 of Cost Proposal form.
7. Perform caliper survey. Payment for the caliper survey will be based on the lump sum price of bid item 7. Payment shall include full compensation for fluid circulation, removal of the drill string, operation of the drilling rig and other equipment, furnishing and operating caliper survey equipment as specified, and providing whatever assistance may be required to complete the caliper survey.
8. Furnish and install blank well casing, and gravel feed tube. Payment for this item shall include the cost of all labor, services, equipment, materials and all other costs incurred in furnishing and installing the 16-inch diameter mild steel blank well casing, 3-inch diameter gravel feed tube, fittings and accessories. Measurement of payment shall be made for the actual number of feet of screen installed, measured to the nearest foot by the District Representative. Payment shall be made at the unit price per linear foot of screen installed as stated in Item 8 of the Cost Proposal Form. No hourly rate shall be applicable during the performance of these operations.
9. Furnish and install dielectric coupler (mechanical connector). Payment for this item shall include the cost of all labor, and materials and all other costs incurred in furnishing and installing a dielectric coupler between the mild steel and stainless steel casing. Measurement of payment shall be made for the actual number of couplers installed. Payment shall be made as stated in Item 9 of the Cost Proposal Form.
10. Furnish and install well screen. Payment for this item shall include the cost of all labor, services, equipment, materials and all other costs incurred in furnishing and installing the 16-inch diameter 304L stainless steel screened well casing with 0.060 slots, end cap at bottom, fittings and accessories. Measurement of payment shall be made for the actual number of feet of screen installed, measured to the nearest foot by the District Representative. Payment shall be made at the unit price per linear foot of screen installed as stated in Item 10 of the Cost Proposal Form. No hourly rate shall be applicable during the performance of these operations.
11. Furnish and install filter pack. Payment for this item shall include the cost of all labor, services, equipment, materials and all other costs incurred in furnishing and installing the filter (gravel) pack. Payment for the gravel pack will be based on measurement of the vertical feet of gravel installed in the annulus from the bottom of the borehole up and includes payment for any consolidation of the gravel pack which occurs during well development. Payment shall be made at the unit price per

linear foot of screen installed as stated in Item 11 of the Cost Proposal Form. No hourly rate shall be applicable during the performance of these operations.

12. Furnish and install cement annular seal. Payment for this item shall include the cost of all labor, services, equipment, materials and all other costs incurred in furnishing and installing the cement annular well seal. Payment for the annular well seal will be based on measurement of the vertical feet of sealing material installed in the annulus. Payment shall be made at the unit price per linear foot as stated in Item 12 of the Cost Proposal Form. No hourly rate shall be applicable during the performance of these operations..
13. Develop well with air-lift swab and drill rig. Payment for this item shall include only the time that dual swab and air-lift development of the well is actually in operation, as directed by the District Representative. Payment for actual operational time, estimated to the nearest one-half hour, shall be made at the unit price per hour as stated in Item 13 of the Cost Proposal Form. No payment shall be made under this item for servicing of equipment; for delays due to breakdown or inadequacy of plant, equipment, personnel or materials; for time spent in setting up, installing or removing equipment; for work not in accordance with specifications or directions of the District Representative; nor for failure to conduct the work in a workmanlike manner by which the desired result could ordinarily be expected. Payment for removal of accumulated mud, sand, or gravel to the full depth of the well using a bailer or other acceptable method, shall be at the unit price per hour stated for swab development.
14. Develop well with line swab and pump rig. Payment for this item shall include only the time when swab development of the well is actually in operation, as directed by the District Representative. Payment for actual operational time, estimated to the nearest one-half hour, shall be made at the unit price per hour as stated in Item 14 of the Cost Proposal Form. No payment shall be made under this item for servicing of equipment; for delays due to the breakdown or inadequacy of plant, equipment, personnel, or materials; for time spent in setting up, installing or removing equipment; for work not in accordance with the specifications or directions of the District Representative; nor for failure to conduct the work in a workmanlike manner by which the desired result could ordinarily be expected. Payment for removal of accumulated mud, sand, or gravel to the full depth of the well using a bailer or other acceptable method, shall be at the unit price per hour stated for swab development.
15. Develop well with test pump. Payment for this item shall include the time when the pumping equipment is actually in operation for development, as directed by the District Representative. Payment for actual operational time, estimated to the nearest one-half hour, shall be made at the unit price per hour as stated in Item 15 of the Cost Proposal Form. No payment shall be made under this item for servicing of equipment; for delays due to breakdown or inadequacy of plant, equipment, personnel or materials; for time spent in setting up, installing or removing equipment; for work not in accordance with specifications or directions of the District Representative; nor for failure to conduct the work in a workmanlike manner by which the desired result could ordinarily be expected
16. Test Pumping. Payment for this item shall include the time when the pumping equipment is actually in operation, as directed by the District Representative, such as during testing and development periods. Payment for actual operational time, estimated to the nearest one-half hour, shall be made at the unit price per hour as stated in Item 16 of the Cost Proposal Form. No payment shall be made under this

item for servicing of equipment; for delays due to breakdown or inadequacy of plant, equipment, personnel or materials; for time spent in setting up, installing or removing equipment; for work not in accordance with specifications or directions of the District Representative; nor for failure to conduct the work in a workmanlike manner by which the desired result could ordinarily be expected.

17. Video survey, spinner survey, and deviation tests. Payment for this item shall include the cost of all equipment, labor, materials and all other costs incurred in the lump sum price in Item 17 of the Cost Proposal Form.
18. Well Disinfection. Payment for this item shall include the cost of all equipment, labor, materials and all other costs incurred in the lump sum price in Item 18 of the Cost Proposal Form.
19. Standby time rate. Payment for this item (if accrued) shall include the cost as stated in Item 19 of the Cost Proposal Form.

No hourly rates shall be applicable without prior approval of the District Representative, nor shall they apply during the performance of any operation covered by either a lump sum or unit price. The performance of any operations noted in this section or similar operations conducted by the Contractor for his convenience in drilling, construction, development and testing of the wells shall not be included in hourly rate payment.

No separate payment will be made for work, equipment or materials necessary for keeping records and determining plumbness and alignment. The cost of all such work, equipment and materials shall be included in the proposal costs for applicable proposal items.

The hourly rates for the operation of swabbing, cleaning, and pumping equipment shall not become effective until the Contractor has installed all equipment and is ready to start operations. If during the development period, move-in and move-out, and the installation and removal of the equipment, the Contractor chooses not to work for a given period, he shall not be paid an hourly rate during the shutdown periods.

The Contractor shall be expected to anticipate material and equipment requirements to complete operations. Any delays in operation resulting from the lack of proper equipment and/or materials at the drill sites shall be at the Contractor's expense.

Non-Payment for Lost and Rejected Holes

The District shall not pay for lost or rejected holes, including but not limited to, holes which the Contractor is forced to abandon because of defective workmanship or faulty equipment, failure to properly protect the drill hole and drilling work from the natural elements, cave-in resulting from formational conditions and inability to drill the well to the depth specified in the Contract Documents or to such lesser depth as ordered by the District Representative. Any rejected hole shall be replaced by another adjacent hole at a location determined by the District Representative. Payment for labor and materials involved in the drilling and construction of the replacement hole(s) will be made on the same basis as the rejected hole(s) and as specified under these Specifications. All lost holes shall be backfilled in accordance with applicable law. No payment will be made for backfilled lost holes.

The District shall not pay for any work or materials involved in the drilling and/or construction of holes that fail after taking corrective measures to meet the alignment requirements as specified herein and as determined by the District Representative. Furthermore, the DISTRICT shall

recover from the Contractor all costs for work and material incurred by the DISTRICT on lost or rejected holes resulting from the Contractor's negligence.

B. TOTAL BID PRICE:

TOTAL BID PRICE BASED ON BID SCHEDULE TOTAL OF UNIT PRICES FOR: New Extraction Well at Well ID4-4 Location	
\$ _____	Total Bid Price in Numbers
\$ _____	Total Bid Price in Written Form
In case of discrepancy between the written price and the numerical price, the written price shall prevail.	

--

The undersigned agrees that this Bid Form constitutes a firm offer to the DISTRICT which cannot be withdrawn for the number of calendar days indicated in the Notice Inviting Bids from and after the Bid opening, or until a Contract for the Work is fully executed by the DISTRICT and a third party, whichever is earlier.

The DISTRICT can choose to include any, all, or none of the Alternate Bid items in the Work, in the DISTRICT's sole discretion.. If the DISTRICT selects any of the Alternate Bid items, the corresponding Alternate Bid prices shall be added to Base Bid Price for the Work. The DISTRICT can award/select Alternate Bid items at any time(s). All Alternate Bid items correspond to the second extraction well, at a location to be determined. The Description of Payment, including descriptions of the Cost Proposal Items and Non-Payment for Lost or Rejected Holes listed above for Well ID-4-4 apply to the Alternate Bid items.

ALTERNATE BID ITEMS FOR SECOND EXTRACTION WELL AT LOCATION TO BE DETERMINED

ITEM	QUANTITY	UNIT	ITEM	UNIT COST	AMOUNT
A-1	1	LS	Mobilization, demobilization, and site preparation including water pollution control compliance and site BMPs, obtain San Diego County well permit (Assumes mobilization from ID4-4 Well Location).	\$	\$
A-2	50	LF	Drill a 40-inch diameter conductor borehole, set 30-inch conductor casing, and sanitary seal to minimum 50 feet.	\$	\$
A-3	1,000	LF	Drill a 17.5-inch diameter test borehole.	\$	\$
A-4	1	LS	Run geophysical logs, including guard log.	\$	\$
A-5	3	LS	Perform zone testing (optional).	\$	\$
A-6	1,000	LF	Ream borehole to 26-inch diameter.	\$	\$
A-7	1	LS	Perform caliper survey.	\$	\$
A-8	500	LF	Furnish and install 16-inch diameter mild steel blank well casing and 3-inch gravel feed tube.	\$	\$
A-9	1	LS	Furnish and install a dielectric coupler (mechanical connector) between the mild steel and stainless steel casing.	\$	\$
A-10	500	LF	Furnish and install 16-inch diameter 304L stainless steel louver well screen with 0.060 slot and end cap at bottom of screen for sump.	\$	\$
A-11	700	LF	Furnish and install filter pack.	\$	\$

ALTERNATE BID ITEMS FOR SECOND EXTRACTION WELL AT LOCATION TO BE DETERMINED

ITEM	QUANTITY	UNIT	ITEM	UNIT COST	AMOUNT
A-12	300	LF	Furnish and install cement annular seal.	\$	\$
A-13	24	HR	Develop well with air-lift swab and drill rig.	\$	\$
A-14	24	HR	Develop well with line swab and pump rig.	\$	\$
A-15	12	HR	Develop well with test pump.	\$	\$
A-16	60	HR	Pumping Test (12-hour step test and 48-hour constant rate test).	\$	\$
A-17	1	LS	Video survey, spinner survey and deviation test.	\$	\$
A-18	1	LS	Well Disinfection.	\$	\$
A-19	1	HR	Standby time rate.	\$	\$
A-20	1	LS	Full Mobilization, demobilization, and site preparation including water pollution control compliance and site BMPs, if necessary. (This line item will only be necessary if not able to mobilize to alternate well location immediately upon completion of ID4-4 Well Location).	\$	\$

(

In case of discrepancy between the Unit Cost and the Amount set forth for a unit basis item, the unit cost shall prevail. However, if the amount set forth as a unit cost is ambiguous, unintelligible or uncertain for any cause, or is omitted, or is the same amount as the entry in the "Amount" column, then the amount set forth in the "Amount" column for the item shall prevail and shall be divided by the estimated quantity for the item and the price thus obtained shall be the Unit Cost.

The successful bidder hereby agrees to sign the contract and furnish the necessary bonds and certificates of insurance within ten (10) working days after the DISTRICT provides the successful bidder with the Notice of Award.

Upon receipt of the signed contract and other required documents, the contract will be executed by the DISTRICT, after which the DISTRICT will prepare a letter giving Contractor Notice to Proceed. The official starting date shall be the date of the Notice to Proceed, unless otherwise specified. The undersigned agrees to begin the Work within ten (10) working days of the date of the Notice to Proceed, unless otherwise specified.

The undersigned has examined the location of the proposed work and is familiar with the Drawings and Specifications and the local conditions at the place where work is to be done.

If awarded the contract, the undersigned agrees that there shall be paid by the undersigned and by all subcontractors to all laborers, workers and mechanics employed in the execution of such contract no less than the prevailing wage rate within San Diego County for each craft, classification, or type of worker needed to complete the Work contemplated by this contract as established by the Director of the Department of Industrial Relations. A copy of the prevailing rate of per diem wages are on file at the DISTRICT's Administration Office and shall be made available to interested parties upon request.

Enclosed find cash, bidder's bond, or cashier's or certified check No. _____ from the _____ Bank in the amount of _____, which is not less than ten percent (10%) of this bid, payable to Borrego Water District as bid security and which is given as a guarantee that the undersigned will enter into a contract and provide the necessary bonds and certificates of insurance if awarded the Work.

The bidder furthermore agrees that in case of bidder's default in executing said contract and furnishing required bonds and certificates of insurance, the cash, bidder's bond, or cashier's or certified check accompanying this proposal and the money payable thereon shall become and shall remain the property of the Borrego Water District.

Bidder is an individual _____, or corporation _____, or partnership _____, organized under the laws of the State of _____.

Bidder confirms license(s) required by California State Contractor's License Law for the performance of the subject project are in full effect and proper order. The following are the Bidder's applicable license number(s), with their expiration date(s) and class of license(s):

If the Bidder is a joint venture, each member of the joint venture must include the required licensing information.

Sureties that will furnish the Faithful Performance Bond and the Labor and Material Payment Bond, in the form specified herein, in an amount equal to one hundred percent (100%) of the contract price within ten (10) working days from the date the DISTRICT provides the successful bidder the Notice of Award. Sureties must meet all of the State of California bonding requirements, as defined in California Code of Civil Procedure Section 995.120 and must be authorized by the State of California.

The insurance company or companies to provide the insurance required in the contract documents must have a Financial Strength Rating of not less than "A-" and a Financial Size

Category of not less than “Class VII” according to the latest Best Key Rating Guide. At the sole discretion of the DISTRICT, the DISTRICT may waive the Financial Strength Rating and the Financial Size Category classifications for Workers’ Compensation insurance.

(signatures continued on next page)

I hereby certify under penalty of perjury under the laws of the State of California that all of the information submitted in connection with this Bid and all of the representations made herein are true and correct.

Executed at _____, on this ____ day of _____, _____.

(Bidders Name – Print or Type)

(Name and Title)

(Corporate Seal)

(Signature)

Names of individual members of firm or names and titles of all officers of corporation and their addresses are listed below:

Name _____ Title _____

Complete Address _____

Phone _____ FAX _____

Name _____ Title _____

Complete Address _____

Phone _____ FAX _____

Name _____ Title _____

Complete Address _____

Phone _____ FAX _____

Name _____ Title _____

Complete Address _____

Phone _____ FAX _____

1.2 Bid Bond

[Note: Not required when other form of Bidder's Security, e.g. cash, certified check or cashier's check, accompanies bid.]

The makers of this bond are, _____, as Principal, and _____, as Surety and are held and firmly bound unto the Borrego Water District, hereinafter called the DISTRICT, in the penal sum of TEN PERCENT (10%) OF THE TOTAL BID PRICE of the Principal submitted to DISTRICT for the work described below, for the payment of which sum in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted the accompanying bid dated _____, 20 ____, for New Extraction Well at Well ID4-4 Location.

If the Principal does not withdraw its Bid within the time specified in the Contract Documents; and if the Principal is awarded the Contract and provides all documents to the DISTRICT as required by the Contract Documents; then this obligation shall be null and void. Otherwise, this bond will remain in full force and effect.

Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Documents shall affect its obligation under this bond, and Surety does hereby waive notice of any such changes.

In the event a lawsuit is brought upon this bond by the DISTRICT and judgment is recovered, the Surety shall pay all litigation expenses incurred by the DISTRICT in such suit, including reasonable attorneys' fees, court costs, expert witness fees and expenses.

IN WITNESS WHEREOF, the above-bound parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporation.

(Corporate Seal)

Contractor/ Principal

By _____

Title _____

(Corporate Seal)

Surety

By _____
Attorney-in-Fact

(Attach Attorney-in-Fact Certificate)

Title _____

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

Name(s) of Signer(s)

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

Title(s)

Title or Type of Document

- Partner(s)
 - Limited
 - General

Number of Pages

- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

Date of Document

Signer is representing:
 Name Of Person(s) Or Entity(ies)

Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for Contractor/Principal.

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

_____ Title(s)

_____ Title or Type of Document

- Partner(s) Limited
- General

_____ Number of Pages

- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

_____ Date of Document

Signer is representing:
 Name Of Person(s) Or Entity(ies)

_____ Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for the Attorney-in-Fact. The Power-of-Attorney to local representatives of the bonding company must also be attached.

END OF BID BOND

1.3 List of Subcontractors

In compliance with the Subletting and Subcontracting Fair Practices Act Chapter 4 (commencing at Section 4100), Part 1, Division 2 of the Public Contract Code of the State of California and any amendments thereof, Bidder shall set forth below: (a) the name and the location of the place of business, (b) the California contractor license number, (c) the DIR public works contractor registration number unless exempt pursuant to Labor Code Sections 1725.5 and 1771.1, and (d) the portion of the work which will be done by each subcontractor who will perform work or labor or render service to the Bidder in or about the construction of the work or improvement to be performed under this Contract in an amount in excess of one-half of one percent (0.5%) of the Bidder's Total Bid Price. Notwithstanding the foregoing, if the work involves the construction of streets and highways, then the Bidder shall list each subcontractor who will perform work or labor or render service to the Bidder in or about the work in an amount in excess of one-half of one percent (0.5%) of the Bidder's Total Bid Price or \$10,000, whichever is greater. No additional time shall be granted to provide the below requested information.

If a Bidder fails to specify a subcontractor or if a contractor specifies more than one subcontractor for the same portion of work, then the Bidder shall be deemed to have agreed that it is fully qualified to perform that portion of work and that it shall perform that portion itself.

Work to be done by Subcontractor	Name of Subcontractor	Location of Business	CSLB Contractor License No.	DIR Registration Number	% of Work

Work to be done by Subcontractor	Name of Subcontractor	Location of Business	CSLB Contractor License No.	DIR Registration Number	% of Work

(Attach additional sheets if necessary)

Name of Bidder _____

Signature _____

Name and Title _____

Dated _____

1.4 Bidder Information and Experience Form

ARTICLE 1. INFORMATION ABOUT BIDDER

(Indicate not applicable (“N/A”) where appropriate.)

NOTE: Where Bidder is a joint venture, pages shall be duplicated and information provided for all parties to the joint venture.

1.0 Name of Bidder: _____

2.0 Type, if Entity: _____

3.0 Bidder Address: _____

Facsimile Number

Telephone Number

Email Address

4.0 How many years has Bidder’s organization been in business as a Contractor?

5.0 How many years has Bidder’s organization been in business under its present name? _____

5.1 Under what other or former names has Bidder’s organization operated? _____

6.0 If Bidder’s organization is a corporation, answer the following:

6.1 Date of Incorporation: _____

6.2 State of Incorporation: _____

6.3 President’s Name: _____

6.4 Vice-President’s Name(s): _____

6.5 Secretary’s Name: _____

6.6 Treasurer’s Name: _____

7.0 If an individual or a partnership, answer the following:

7.1 Date of Organization: _____

7.2 Name and address of all partners (state whether general or limited partnership):

8.0 If other than a corporation or partnership, describe organization and name principals:

9.0 List other states in which Bidder's organization is legally qualified to do business.

10.0 What type of work does the Bidder normally perform with its own forces?

11.0 Has Bidder ever failed to complete any work awarded to it? If so, note when, where, and why:

12.0 Within the last five years, has any officer or partner of Bidder's organization ever been an officer or partner of another organization when it failed to complete a contract? If so, attach a separate sheet of explanation:

13.0 List Trade References:

14.0 List Bank References (Bank and Branch Address):

15.0 Name of Bonding Company and Name and Address of Agent:

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ARTICLE 2. LIST OF CURRENT PROJECTS (BACKLOG)

[**Duplicate Page if needed for listing additional current projects.**]

Project	Description of Bidder's Work	Completion Date	Cost of Bidder's Work

ARTICLE 3. LIST OF COMPLETED PROJECTS – LAST THREE YEARS

[**Duplicate Page if needed for listing additional completed projects.**]

Please include only those projects which are similar enough to demonstrate Bidder’s ability to perform the required Work.

Project	Description of Bidder’s Work	Completion Date	Cost of Bidder’s Work

ARTICLE 4. EXPERIENCE AND TECHNICAL QUALIFICATIONS QUESTIONNAIRE

Personnel:

The Bidder shall identify the key personnel to be assigned to this project in a management, construction supervision or engineering capacity.

1. List each person's job title, name and percent of time to be allocated to this project:

2. Summarize each person's specialized education:

3. List each person's years of construction experience relevant to the project:

4. Summarize such experience:

Bidder agrees that personnel named in this Bid will remain on this Project until completion of all relevant Work, unless substituted by personnel of equivalent experience and qualifications approved in advance by the DISTRICT.

Changes Occuring Since Prequalification

If any substantive changes have occurred since Bidder submitted its prequalification package for this Project, Bidder shall list them below. If none are listed, Bidder certifies that no substantive changes have occurred.

Additional Bidder's Statements:

If the Bidder feels that there is additional information which has not been included in the questionnaire above, and which would contribute to the qualification review, it may add that information in a statement here or on an attached sheet, appropriately marked:

ARTICLE 5. VERIFICATION AND EXECUTION

These Bid Forms shall be executed only by a duly authorized official of the Bidder:

I declare under penalty of perjury under the laws of the State of California that the foregoing information is true and correct:

Name of Bidder_____

Signature_____

Name_____

Title_____

Date_____

1.5 Non-Collusion Declaration

The undersigned declares:

I am the _____ of _____, the party making the foregoing Bid.

The Bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The Bid is genuine and not collusive or sham. The Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid. The Bidder has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or to refrain from bidding. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the Bid Price of the Bidder or any other Bidder, or to fix any overhead, profit, or cost element of the Bid Price, or of that of any other Bidder. All statements contained in the Bid are true. The Bidder has not, directly or indirectly, submitted his or her Bid Price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a Bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the Bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____ [date], at _____ [city], _____ [state].

Name of Bidder _____

Signature _____

Name _____

Title _____

1.6 Iran Contracting Act Certification.
(Public Contract Code section 2200 et seq.)

As required by California Public Contract Code Section 2204, the Contractor certifies subject to penalty for perjury that the option checked below relating to the Contractor's status in regard to the Iran Contracting Act of 2010 (Public Contract Code Section 2200 *et seq.*) is true and correct:

The Contractor is not:

- (1) identified on the current list of person and entities engaged in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203; or
- (2) a financial instruction that extends, for 45 days or more, credit in the amount of \$20,000,000 or more to any other person or entity identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203, if that person or entity uses or will use the credit to provide goods or services in the energy sector in Iran.

The DISTRICT has exempted the Contractor from the requirements of the Iran Contracting Act of 2010 after making a public finding that, absent the exemption, the DISTRICT will be unable to obtain the goods and/or services to be provided pursuant to the Contract.

The amount of the Contract payable to the Contractor for the Project does not exceed \$1,000,000.

Signature: _____

Printed Name: _____

Title: _____

Firm Name: _____

Date: _____

Note: In accordance with Public Contract Code Section 2205, false certification of this form shall be reported to the California Attorney General and may result in civil penalties equal to the greater of \$250,000 or twice the Contract amount, termination of the Contract and/or ineligibility to bid on contracts for three years.

1.7 Public Works Contractor Registration Certification

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. See <http://www.dir.ca.gov/Public-Works/PublicWorks.html> for additional information.

No bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors' current registration with the Department of Industrial Relations to perform public work.

Bidder hereby certifies that it is aware of the registration requirements set forth in Labor Code sections 1725.5 and 1771.1 and is currently registered as a contractor with the Department of Industrial Relations.¹

Name of Bidder: _____

DIR Registration Number: _____

DIR Registration Expiration: _____

Small Project Exemption: _____ Yes or _____ No

Unless Bidder is exempt pursuant to the small project exemption, Bidder further acknowledges:

1. Bidder shall maintain a current DIR registration for the duration of the project.
2. Bidder shall include the requirements of Labor Code sections 1725.5 and 1771.1 in its contract with subcontractors and ensure that all subcontractors are registered at the time of bid opening and maintain registration status for the duration of the project.
3. Failure to submit this form or comply with any of the above requirements may result in a finding that the bid is non-responsive.

Name of Bidder _____

Signature _____

Name and Title _____

Dated _____

¹ If the Project is exempt from the contractor registration requirements pursuant to the small project exemption under Labor Code Sections 1725.5 and 1771.1, please mark "Yes" in response to "Small Project Exemption."

1.8 Contractor's Certificate Regarding Workers' Compensation.

I am aware of the provisions of section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.

Name of Bidder _____

Signature _____

Name _____

Title _____

Dated _____

00 52 13 – CONTRACT

This CONTRACT, No. _____ is made and entered into this ____ day of _____, _____, by and between Borrego Water District, sometimes hereinafter called "DISTRICT," and _____, sometimes hereinafter called "Contractor."

WITNESSETH: That the parties hereto have mutually covenanted and agreed, and by these presents do covenant and agree with each other as follows:

a. **SCOPE OF WORK.** The Contractor shall perform all Work within the time stipulated in the Contract, and shall provide all labor, materials, equipment, tools, utility services, and transportation to complete all of the Work required in strict compliance with the Contract Documents as specified in Article 5, below, for the following Project:

New Extraction Well at Well ID4-4 Location

The Contractor and its surety shall be liable to the DISTRICT for any damages arising as a result of the Contractor's failure to comply with this obligation.

b. **TIME FOR COMPLETION.** Time is of the essence in the performance of the Work. The Work shall be commenced on the date stated in the DISTRICT's Notice to Proceed. The Contractor shall complete all Work required by the Contract Documents within **ONE HUNDRED AND TWENTY (120) CALENDAR DAYS** from the commencement date stated in the Notice to Proceed. By its signature hereunder, Contractor agrees the time for completion set forth above is adequate and reasonable to complete the Work.

c. **CONTRACT PRICE.** The DISTRICT shall pay to the Contractor as full compensation for the performance of the Contract, subject to any additions or deductions as provided in the Contract Documents, and including all applicable taxes and costs, the sum of _____ Dollars (\$ _____). Payment shall be made as set forth in the General Conditions.

d. **LIQUIDATED DAMAGES.** In accordance with Government Code section 53069.85, it is agreed that the Contractor will pay the DISTRICT the sum set forth in Section 00 73 13, Article 1.11 for each and every calendar day of delay beyond the time prescribed in the Contract Documents for finishing the Work, as Liquidated Damages and not as a penalty or forfeiture. In the event this is not paid, the Contractor agrees the DISTRICT may deduct that amount from any money due or that may become due the Contractor under the Contract. This Article does not exclude recovery of other damages specified in the Contract Documents.

e. **COMPONENT PARTS OF THE CONTRACT.** The "Contract Documents" include the following:

- Notice Inviting Bids
- Instructions to Bidders
- Bid Form
- Bid Bond
- Designation of Subcontractors
- Information Required of Bidders

Non-Collusion Declaration Form
Iran Contracting Act Certification
Public Works Contractor Registration Certification
Performance Bond
Payment (Labor and Materials) Bond
General Conditions
Special Conditions
General Requirements
Technical Specifications
Addenda
Plans and Drawings
Standard Specifications for Public Works Construction “Greenbook”, latest edition, Except Sections 1-9
Applicable Local Agency Standards and Specifications, as last revised
Approved and fully executed change orders
Any other documents contained in or incorporated into the Contract

The Contractor shall complete the Work in strict accordance with all of the Contract Documents.

All of the Contract Documents are intended to be complementary. Work required by one of the Contract Documents and not by others shall be done as if required by all. This Contract shall supersede any prior agreement of the parties.

f. **PROVISIONS REQUIRED BY LAW AND CONTRACTOR COMPLIANCE.** Each and every provision of law required to be included in these Contract Documents shall be deemed to be included in these Contract Documents. The Contractor shall comply with all requirements of applicable federal, state and local laws, rules and regulations, including, but not limited to, the provisions of the California Labor Code and California Public Contract Code which are applicable to this Work.

g. **INDEMNIFICATION.** Contractor shall provide indemnification and defense as set forth in the General Conditions.

h. **PREVAILING WAGES.** Contractor shall be required to pay the prevailing rate of wages in accordance with the Labor Code which such rates shall be made available at the DISTRICT’s Administrative Office or may be obtained online at <http://www.dir.ca.gov> and which must be posted at the job site.

[REMAINDER OF PAGE LEFT INTENTIONALLY BLANK]

IN WITNESS WHEREOF, this Contract has been duly executed by the above-named parties, on the day and year above written.

Name of Contractor

BORREGO WATER DISTRICT

By _____

By _____
General Manager

Name and Title:

Date:

License No.

Date:

**(CONTRACTOR'S SIGNATURE MUST BE
NOTARIZED AND CORPORATE
SEAL AFFIXED, IF APPLICABLE)**

Approved as to form this _____ day of _____ 20____.

Attorney for Borrego Water District

END OF CONTRACT

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

- Individual
- Corporate Officer

_____ Title(s)

- Partner(s) Limited
- General
- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

Signer is representing:
 Name Of Person(s) Or Entity(ies)

DESCRIPTION OF ATTACHED DOCUMENT

_____ Title or Type of Document

_____ Number of Pages

_____ Date of Document

_____ Signer(s) Other Than Named Above

00 61 13 – BOND FORMS

1.1 Performance Bond.

KNOW ALL PERSONS BY THESE PRESENTS:

THAT WHEREAS, the Borrego Water District, (hereinafter referred to as “DISTRICT”) has awarded to _____, (hereinafter referred to as the “Contractor”) an agreement for **Contract No.** _____, (hereinafter referred to as the “Project”).

WHEREAS, the work to be performed by the Contractor is more particularly set forth in the Contract Documents for the Project dated _____, (hereinafter referred to as “Contract Documents”), the terms and conditions of which are expressly incorporated herein by reference; and

WHEREAS, the Contractor is required by said Contract Documents to perform the terms thereof and to furnish a bond for the faithful performance of said Contract Documents.

NOW, THEREFORE, we, _____, the undersigned Contractor and _____ as Surety, a corporation organized and duly authorized to transact business under the laws of the State of California, are held and firmly bound unto the DISTRICT in the sum of _____ DOLLARS, (\$ _____), said sum being not less than one hundred percent (100%) of the total amount of the Contract, for which amount well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that, if the Contractor, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in the Contract Documents and any alteration thereof made as therein provided, on its part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their intent and meaning; and shall faithfully fulfill all obligations including the one (1) year guarantee of all materials and workmanship; and shall indemnify and save harmless the DISTRICT, its officials, officers, employees, and authorized volunteers, as stipulated in said Contract Documents, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

As a part of the obligation secured hereby and in addition to the face amount specified therefore, there shall be included costs and reasonable expenses and fees including reasonable attorney’s fees, incurred by DISTRICT in enforcing such obligation.

As a condition precedent to the satisfactory completion of the Contract Documents, unless otherwise provided for in the Contract Documents, the above obligation shall hold good for a period of one (1) year after the acceptance of the work by DISTRICT, during which time if Contractor shall fail to make full, complete, and satisfactory repair and replacements and totally protect the DISTRICT from loss or damage resulting from or caused by defective materials or faulty workmanship. The obligations of Surety hereunder shall continue so long as any obligation of Contractor remains. Nothing herein shall limit the DISTRICT’s rights or the Contractor or Surety’s obligations under the Contract, law or equity, including, but not limited to, California Code of Civil Procedure Section 337.15.

Whenever Contractor shall be, and is declared by the DISTRICT to be, in default under the Contract Documents, the Surety shall remedy the default pursuant to the Contract Documents, or shall promptly, at the DISTRICT's option:

- i. Take over and complete the Project in accordance with all terms and conditions in the Contract Documents; or
- ii. Obtain a bid or bids for completing the Project in accordance with all terms and conditions in the Contract Documents and upon determination by Surety of the lowest responsive and responsible bidder, arrange for a Contract between such bidder, the Surety and the DISTRICT, and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the contract price, including other costs and damages for which Surety may be liable. The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor by the DISTRICT under the Contract and any modification thereto, less any amount previously paid by the DISTRICT to the Contractor and any other set offs pursuant to the Contract Documents.
- iii. Permit the DISTRICT to complete the Project in any manner consistent with California law and make available as work progresses sufficient funds to pay the cost of completion of the Project, less the balance of the contract price, including other costs and damages for which Surety may be liable. The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor by the DISTRICT under the Contract and any modification thereto, less any amount previously paid by the DISTRICT to the Contractor and any other set offs pursuant to the Contract Documents.

Surety expressly agrees that the DISTRICT may reject any contractor or subcontractor which may be proposed by Surety in fulfillment of its obligations in the event of default by the Contractor.

Surety shall not utilize Contractor in completing the Project nor shall Surety accept a bid from Contractor for completion of the Project if the DISTRICT, when declaring the Contractor in default, notifies Surety of the DISTRICT's objection to Contractor's further participation in the completion of the Project.

The Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project to be performed thereunder shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract Documents or to the Project.

[REMAINDER OF PAGE LEFT INTENTIONALLY BLANK]

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20__.

(Corporate Seal)

Contractor/ Principal

By _____

Title _____

(Corporate Seal)

Surety

By _____
Attorney-in-Fact

(Attach Attorney-in-Fact Certificate)

Title _____

The rate of premium on this bond is _____ per thousand. The total amount of premium charges is \$_____.
(The above must be filled in by corporate attorney.)

THIS IS A REQUIRED FORM

Any claims under this bond may be addressed to:

(Name and Address of Surety)

(Name and Address of Agent or Representative for service of process in California, if different from above)

(Telephone number of Surety and Agent or Representative for service of process in California)

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
 COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

 Title(s)

 Title or Type of Document

- Partner(s) Limited
- Attorney-In-Fact General

 Number of Pages

- Trustee(s)
- Guardian/Conservator
- Other:

 Date of Document

Signer is representing:
 Name Of Person(s) Or Entity(ies)

 Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for Contractor/Principal.

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public

OPTIONAL

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CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

_____ Title(s)

_____ Title or Type of Document

- Partner(s) Limited
- General

_____ Number of Pages

- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

_____ Date of Document

Signer is representing:
Name Of Person(s) Or Entity(ies)

_____ Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for the Attorney-in-Fact. The Power-of Attorney to local representatives of the bonding company must also be attached.

END OF PERFORMANCE BOND

1.2 Payment Bond (Labor and Materials).

KNOW ALL MEN BY THESE PRESENTS That

WHEREAS, the Borrego Water District (hereinafter designated as the "DISTRICT"), by action taken or a resolution passed _____, 20____, has awarded to _____ hereinafter designated as the "Principal," a contract for the work described as follows: **Contract No.** _____ (the "Project"); and

WHEREAS, said Principal is required to furnish a bond in connection with said contract; providing that if said Principal or any of its Subcontractors shall fail to pay for any materials, provisions, provender, equipment, or other supplies used in, upon, for or about the performance of the work contracted to be done, or for any work or labor done thereon of any kind, or for amounts due under the Unemployment Insurance Code or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of said Principal and its Subcontractors with respect to such work or labor the Surety on this bond will pay for the same to the extent hereinafter set forth.

NOW THEREFORE, we, the Principal and _____ as Surety, are held and firmly bound unto the DISTRICT in the penal sum of _____ Dollars (\$_____) lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Principal, his or its subcontractors, heirs, executors, administrators, successors or assigns, shall fail to pay any of the persons named in Civil Code Section 9100, fail to pay for any materials, provisions or other supplies, used in, upon, for or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld, and paid over to the Employment Development Department or Franchise Tax Board from the wages of employees of the contractor and his subcontractors pursuant to Revenue and Taxation Code Section 18663, with respect to such work and labor the Surety or Sureties will pay for the same, in an amount not exceeding the sum herein above specified, and also, in case suit is brought upon this bond, all litigation expenses incurred by the DISTRICT in such suit, including reasonable attorneys' fees, court costs, expert witness fees and investigation expenses.

This bond shall inure to the benefit of any of the persons named in Civil Code Section 9100 so as to give a right of action to such persons or their assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety on this bond shall not be exonerated or released from the obligation of this bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement herein above described, or pertaining or relating to the furnishing of labor, materials, or equipment therefore, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement herein above described, nor by any rescission or attempted rescission or attempted rescission of the contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that

this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the owner or DISTRICT and original contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Civil Code Section 9100, and has not been paid the full amount of his claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned, including but not limited to the provisions of sections 2819 and 2845 of the California Civil Code.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20__.

(Corporate Seal)

Contractor/ Principal

By _____

Title _____

(Corporate Seal)

Surety

By _____
Attorney-in-Fact

(Attach Attorney-in-Fact Certificate)

Title _____

Notary Acknowledgment

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA
COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

DESCRIPTION OF ATTACHED DOCUMENT

- Individual
- Corporate Officer

_____ Title(s)

_____ Title or Type of Document

- Partner(s) Limited
- General

_____ Number of Pages

- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

_____ Date of Document

Signer is representing:
Name Of Person(s) Or Entity(ies)

_____ Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for Contractor/Principal.

Notary Acknowledgment

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STATE OF CALIFORNIA
COUNTY OF _____

On _____, 20____, before me, _____, Notary Public, personally appeared _____, who proved to me on the basis of satisfactory

evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature of Notary Public _____

OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of this form to another document.

CAPACITY CLAIMED BY SIGNER

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- Corporate Officer

Title(s)

- Partner(s) Limited
- General

- Attorney-In-Fact
- Trustee(s)
- Guardian/Conservator
- Other:

Signer is representing:
Name Of Person(s) Or Entity(ies)

DESCRIPTION OF ATTACHED DOCUMENT

Title or Type of Document

Number of Pages

Date of Document

Signer(s) Other Than Named Above

NOTE: This acknowledgment is to be completed for the Attorney-in-Fact. The Power-of-Attorney to local representatives of the bonding company must also be attached.

END OF PAYMENT BOND

00 72 13 – GENERAL CONDITIONS

ARTICLE 1. DEFINED TERMS

Whenever used in the Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined below, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

- A. Act of God – An earthquake of magnitude of 3.5 or higher on the Richter scale or a tidal wave.
- B. Addenda -- Written or graphic instruments issued prior to the submission of Bids which clarify, correct, or change the Contract Documents.
- C. Additional Work -- New or unforeseen work will be classified as “Additional Work” when the DISTRICT’s Representative determines that it is not covered by the Contract.
- D. Applicable Laws -- The laws, statutes, ordinances, rules, codes, regulations, permits, and licenses of any kind, issued by local, state or federal governmental authorities or private authorities with jurisdiction (including utilities), to the extent they apply to the Work.
- E. Bid -- The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices and other terms for the Work to be performed.
- F. Bidder -- The individual or entity who submits a Bid directly to the DISTRICT.
- G. Board; Board of Directors – Borrego Water District Board of Directors.
- H. Change Order (“CO”) -- A document that authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Contract, in accordance with the Contract Documents and in the form contained in the Contract Documents.
- I. Change Order Request (“COR”) -- A request made by the Contractor for an adjustment in the Contract Price and/or Contract Times as the result of a Contractor-claimed change to the Work. This term may also be referred to as a Change Order Proposal (“COP”), or Request for Change (“RFC”).
- J. Claim -- A demand or assertion by the DISTRICT or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
- K. Contract -- The entire integrated written agreement between the DISTRICT and Contractor concerning the Work. “Contract” may be used interchangeably with “Agreement” in the Contract Documents. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral, and includes all Contract Documents.

- L. Contract Documents -- The documents listed in Section 00 52 13, Article 5. Some documents provided by the DISTRICT to the Bidders and Contractor, including but not limited to reports and drawings of subsurface and physical conditions are not Contract Documents.
- M. Contract Price -- Amount to be paid by the DISTRICT to the Contractor as full compensation for the performance of the Contract and completion of the Work, subject to any additions or deductions as provided in the Contract Documents, and including all applicable taxes and costs.
- N. Contract Times -- The number of days or the dates stated in the Contract Documents to: achieve defined Milestones, if any; and to complete the Work so that it is ready for final payment.
- O. Contractor -- The individual or entity with which the DISTRICT has contracted for performance of the Work.
- P. Contractor's Designated On-Site Representative -- The Contractor's Designated On-Site Representative will be as identified in Section 00 72 13, Article 3 and shall not be changed without prior written consent of the DISTRICT.
- Q. Daily Rate -- The Daily Rate stipulated in the Contract Documents as full compensation to the Contractor due to the DISTRICT's unreasonable delay to the Project that was not contemplated by the parties.
- R. Day -- A calendar day of 24 hours measured from midnight to the next midnight.
- S. Defective Work -- Work that is unsatisfactory, faulty, or deficient; or that does not conform to the Contract Documents; or that does not meet the requirements of any inspection, reference standard, test, or approval referenced in the Contract Documents.
- T. Demobilization -- The complete dismantling and removal by the Contractor of all of the Contractor's temporary facilities, equipment, and personnel at the Site.
- U. District -- Borrego Water District.
- V. District's Representative -- The individual or entity as identified in the Special Conditions to act as the DISTRICT's Representative.
- W. Drawings -- That part of the Contract Documents prepared by of the Engineer of Record which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
- X. Effective Date of the Contract -- The date indicated in the Contract on which it becomes effective, but if no such date is indicated, it means the date on which the Contract is signed and delivered by the last of the two parties to sign and deliver.
- Y. Engineer, whenever not qualified, shall mean the General Manger of the DISTRICT, acting either directly or through properly authorized agents, such agents acting

severally within the scope of the particular duties entrusted to them. On all questions concerning the acceptance of materials, machinery, the classifications of material, the execution of work, conflicting interest of the contractors performing related work and the determination of costs, the decision of the Engineer, duly authorized by the Board of Directors, shall be binding and final upon both parties.

Z. Engineer of Record -- The individual, partnership, corporation, joint venture, or other legal entity named as such in Section 00 73 13, Article 1.1. or any succeeding entity designated by the DISTRICT.

AA. General Manager – Borrego Water District’s General Manager/Engineer, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

BB. Green Book -- The current edition of the Standard Specifications for Public Works Construction promulgated by the Joint Cooperative Committee of the Southern California Chapter American Public Works Association and the Southern California Districts of the Associated General Contractors of California.

CC. Hazardous Waste -- The term “Hazardous Waste” shall have the meaning provided in Section 104 of the Solid Waste Disposal Act (42 U.S.C. § 6903) as amended from time to time or, as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a class I, class II, or class III disposal site in accordance with provisions of existing law, whichever is more restrictive.

DD. Holiday – The Holidays occur on:

- New Year’s Day - January 1
- President’s Day – Third Monday in February
- Memorial Day - Last Monday in May
- Independence Day - July 4
- Labor Day - First Monday in September
- Veteran’s Day - November 11
- Thanksgiving Day - Fourth Thursday in November
- Friday after Thanksgiving
- Christmas Eve – December 24
- Christmas Day - December 25
- Day After Christmas – December 26
- New Year’s Eve – December 31

If any Holiday listed above falls on a Saturday, Saturday and the preceding Friday are both Holidays. If the Holiday should fall on a Sunday, Sunday and the following Monday are both Holidays.

EE. Notice of Award -- The written notice by the DISTRICT to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, the DISTRICT will sign and deliver the Contract.

FF. Notice of Completion -- The form which may be executed by the DISTRICT and recorded by the county where the Project is located constituting final acceptance of the Project.

- GG. Notice to Proceed -- A written notice given by the DISTRICT to Contractor fixing the date on which the Contractor may proceed with the Work and when Contract Times will commence to run.
- HH. Project -- The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
- II. Recyclable Waste Materials -- Materials removed from the Site which are required to be diverted to a recycling center rather than an area landfill. Recyclable Waste Materials include asphalt, concrete, brick, concrete block, and rock.
- JJ. Schedule of Submittals -- A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to facilitate scheduled performance of related construction activities.
- KK. Shop Drawings -- All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
- LL. Specifications -- That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
- MM. Stop Payment Notice -- A written notice as defined in Civil Code section 8044.
- NN. Subcontractor -- An individual or entity other than a Contractor having a contract with any other entity than the DISTRICT for performance of any portion of the Work at the Site.
- OO. Submittal -- Written and graphic information and physical samples prepared and supplied by the Contractor demonstrating various portions of the Work.
- PP. Successful Bidder -- The Bidder submitting a responsive Bid to whom the DISTRICT makes an award.
- QQ. Supplier -- A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment used in the performance of the Work or to be incorporated in the Work.
- RR. Underground Facilities -- All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
- SS. Unit Price Work -- Work to be paid for on the basis of unit prices as provided by the Contractor in its bid or as adjusted in accordance with the Contract Documents.

TT. Warranty -- A written guarantee provided to the DISTRICT by the Contractor that the Work will remain free of defects and suitable for its intended use for the period required by the Contract Documents or the longest period permitted by the law of this State, whichever is longer.

UU. Work -- The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

ARTICLE 2. CONTRACT DOCUMENTS

A. **Contract Documents.** The Contract Documents are complementary, and what is called for by one shall be as binding as if called for by all.

B. **Interpretations.** The Contract Documents are intended to be fully cooperative and complementary. If the Contractor observes that any documents are in conflict, the Contractor shall promptly notify the Engineer in writing. In case of conflicts between the Contract Documents, the order of precedence shall be as follows:

1. Change Orders
2. Addenda
3. Special Conditions
4. Technical Specifications
5. General Requirements
6. Plans (Contract Drawings)
7. Contract
8. General Conditions
9. Instructions to Bidders
10. Notice Inviting Bids
11. Contractor's Bid Forms
12. Standard Specifications for Public Works Construction (Sections 1-9 Excluded), Latest Edition.
13. Applicable Local Agency Standards and Specifications
14. Standard Drawings
15. Reference Documents

With reference to the Drawings, the order of precedence shall be as follows:

1. Figures govern over scaled dimensions
2. Detail drawings govern over general drawings
3. Addenda or Change Order drawings govern over Contract Drawings
4. Contract Drawings govern over Standard Drawings
5. Contract Drawings govern over Shop Drawings

C. **Conflicts in Contract Documents.** Notwithstanding the orders of precedence established above, in the event of conflicts, the higher standard, higher quality, and most expensive shall always apply.

- D. **Organization of Contract Documents.** Organization of the Contract Documents into divisions, sections, and articles, and arrangement of drawings shall not control the Contractor in dividing Project Work among subcontractors or in establishing the extent of Work to be performed by any trade.

ARTICLE 3. PRECONSTRUCTION AND CONSTRUCTION COMMUNICATION

Before any Work at the site is started, a conference attended by the DISTRICT, Contractor, DISTRICT's Representative, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to herein, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

At this conference the DISTRICT and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

At the discretion of the Engineer, periodic meetings involving project personnel (the Contractor, utility and others) will be held for the purpose of coordinating project activities.

ARTICLE 4. CONTRACT DOCUMENTS: COPIES & MAINTENANCE

Contractor will be furnished, free of charge, **five (5)** copies of the Contract Documents. Additional copies may be obtained at cost of reproduction.

Contractor shall maintain a clean, undamaged set of Contract Documents, including submittals, at the Project site.

ARTICLE 5. EXAMINATION OF DRAWINGS, SPECIFICATIONS AND SITE OF WORK

- A. **Examination of Contract Documents.** Before commencing any portion of the Work, Contractor shall again carefully examine all applicable Contract Documents, the Project site, and other information given to Contractor as to materials and methods of construction and other Project requirements. Contractor shall immediately notify the Engineer of any potential error, inconsistency, ambiguity, conflict, or lack of detail or explanation. If Contractor performs, permits, or causes the performance of any Work which is in error, inconsistent or ambiguous, or not sufficiently detailed or explained, Contractor shall bear any and all resulting costs, including, without limitation, the cost of correction. In no case shall the Contractor or any subcontractor proceed with Work if uncertain as to the applicable requirements.
- B. **Additional Instructions.** After notification of any error, inconsistency, ambiguity, conflict, or lack of detail or explanation, the Engineer will provide any required additional instructions, by means of drawings or other written direction, necessary for proper execution of Work.
- C. **Quality of Parts, Construction and Finish.** All parts of the Work shall be of the best quality of their respective kinds and the Contractor must use all diligence to inform itself fully as to the required construction and finish.

- D. **Contractor's Variation from Contract Document Requirements.** If it is found that the Contractor has varied from the requirements of the Contract Documents including the requirement to comply with all applicable laws, ordinances, rules and regulations, the Engineer may at any time, before or after completion of the Work, order the improper Work removed, remade or replaced by the Contractor at the Contractor's expense.

ARTICLE 6. MOBILIZATION

- A. When a bid item is included in the Bid Form for mobilization, the costs of Work in advance of construction operations and not directly attributable to any specific bid item will be included in the progress estimate ("Initial Mobilization"). When no bid item is provided for "Initial Mobilization," payment for such costs will be deemed to be included in the other items of the Work.
- B. Payment for Initial Mobilization based on the lump sum provided in the Bid Form, which shall constitute full compensation for all such Work. No payment for Initial Mobilization will be made until all of the listed items have been completed to the satisfaction of the Engineer. The scope of the Work included under Initial Mobilization shall include, but shall not be limited to, the following principal items:
1. Obtaining and paying for all bonds, insurance, and permits.
 2. Moving on to the Project site of all Contractor's plant and equipment required for the first month's operations.
 3. Installing temporary construction power, wiring, and lighting facilities, as applicable.
 4. Establishing fire protection system, as applicable.
 5. Developing and installing a construction water supply, if applicable.
 6. Providing and maintaining the field office trailers for the Contractor, if necessary, and the Engineer (if specified), complete, with all specified furnishings and utility services.
 7. Providing on-site sanitary facilities and potable water facilities as specified per Cal-OSHA and these Contract Documents.
 8. Furnishing, installing, and maintaining all storage buildings or sheds required for temporary storage of products, equipment, or materials that have not yet been installed in the Work. All such storage shall meet manufacturer's specified storage requirements, and the specific provisions of the specifications, including temperature and humidity control, if recommended by the manufacturer, and for all security.
 9. Arranging for and erection of Contractor's work and storage yard.
 10. Posting all OSHA required notices and establishment of safety programs per Cal-OSHA.

11. Full-time presence of Contractor's superintendent at the job site as required herein.
12. Providing on-site Contractor's sanitary facilities.
13. Install project sign, if required.
14. Submittal of Schedule of Values.
15. Submittal of Construction Schedule as required by the Contract Documents.

ARTICLE 7. EXISTENCE OF UTILITIES AT THE WORK SITE

- A. The DISTRICT has endeavored to determine the existence of utilities at the Project site from the records of the owners of known utilities in the vicinity of the Project. The positions of these utilities as derived from such records are shown on the Plans.
- B. Unless indicated otherwise on the Plans and Specifications, no excavations were made to verify the locations shown for underground utilities. The service connections to these utilities are not shown on the Plans. Water service connections may be shown on the Plans showing general locations of such connections. It shall be the responsibility of the Contractor to determine the exact location of all service connections. The Contractor shall make its own investigations, including exploratory excavations, to determine the locations and type of service connections, prior to commencing Work which could result in damage to such utilities. The Contractor shall immediately notify the DISTRICT in writing of any utility discovered in a different position than shown on the Plans or which is not shown on the Plans.
- C. If applicable, all water meters, water valves, fire hydrants, electrical utility vaults, telephone vaults, gas utility valves, and other subsurface structures shall be relocated or adjusted to final grade by the Contractor. Locations of existing utilities shown on the Plans are approximate and may not be complete. The Contractor shall be responsible for coordinating its Work with all utility companies during the construction of the Work.
- D. Notwithstanding the above, pursuant to section 4215 of the Government Code, the DISTRICT has the responsibility to identify, with reasonable accuracy, main or trunkline facilities on the plans and specifications. In the event that main or trunkline utility facilities are not identified with reasonable accuracy in the plans and specifications made a part of the invitation for Bids, the DISTRICT shall assume the responsibility for their timely removal, relocation, or protection.
- E. Contractor, except in an emergency, shall contact the appropriate regional notification center, Southern California Underground Service Alert at 811 or 1-800-227-2600 or on-line at www.digalert.org at least two working days prior to commencing any excavation if the excavation will be performed in an area which is known, or reasonably should be known, to contain subsurface installations other than the underground facilities owned or operated by the DISTRICT, and obtain an inquiry identification number from that notification center. No excavation shall be commenced or carried out by the Contractor unless such an inquiry identification number has been assigned to the Contractor or any subcontractor of the Contractor and the DISTRICT has been given the identification number by the Contractor.

ARTICLE 8. SOILS INVESTIGATIONS

- A. Reports and Drawings. The Special Conditions identify:
1. those reports known to the DISTRICT of explorations and tests of subsurface conditions at or contiguous to the site; and
 2. those drawings known to the DISTRICT of physical conditions relating to existing surface or subsurface structures at the site (except Underground Facilities).
- B. Limited Reliance by Contractor on Technical Data Authorized. Contractor may rely upon the accuracy of the “technical data” contained in such reports and drawings, which were expressly not created or obtained to evaluate or assist in the evaluation of constructability, and are not Contract Documents. Contractor shall make its own interpretation of the “technical data” and shall be solely responsible for any such interpretations. Except for reliance on the accuracy of such “technical data,” Contractor may not rely upon or make any claim against the DISTRICT, DISTRICT’s Representative, or Engineer of Record, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor’s purposes, including without limitation any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions, conclusions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions, or information.

ARTICLE 9. CONTRACTOR’S SUPERVISION

Contractor shall continuously keep at the Project site, a competent and experienced full-time Project superintendent acceptable to the DISTRICT. Superintendent must be able to proficiently speak, read and write in English and shall have the authority to make decisions on behalf of the Contractor. Contractor shall continuously provide efficient supervision of the Project.

ARTICLE 10. WORKERS

- A. Contractor shall at all times enforce strict discipline and good order among its employees. Contractor shall not employ on the Project any unfit person or any one not skilled in the Work assigned to him or her.
- B. Any person in the employ of the Contractor whom the DISTRICT may deem incompetent or unfit shall be dismissed from the Work and shall not be employed on this Project.

ARTICLE 11. INDEPENDENT CONTRACTORS

Contractor shall be an independent contractor for the DISTRICT and not an employee. Contractor understands and agrees that it and all of its employees shall not be considered officers, employees, or agents of DISTRICT and are not entitled to benefits of any kind normally provided employees of DISTRICT, including but not limited to, state unemployment compensation or workers' compensation. Contractor assumes full responsibility for the acts and omissions of its employees or agents related to the Work.

ARTICLE 12. SUBCONTRACTS

- A. Contractor agrees to bind every subcontractor to the terms of the Contract Documents as far as such terms are applicable to subcontractor's portion of the Work. Contractor shall be as fully responsible to the DISTRICT for the acts and omissions of its subcontractors and of persons either directly or indirectly employed by its subcontractors, as Contractor is for acts and omissions of persons directly employed by Contractor. Nothing contained in these Contract Documents shall create any contractual relationship between any subcontractor and the DISTRICT.
- B. The DISTRICT reserves the right to accept all subcontractors. The DISTRICT's acceptance of any subcontractor under this Contract shall not in any way relieve Contractor of its obligations in the Contract Documents.
- C. Prior to substituting any subcontractor listed in the Bid Forms, Contractor must comply with the requirements of the Subletting and Subcontracting Fair Practices Act pursuant to California Public Contract Code section 4100 et seq.

ARTICLE 13. VERIFICATION OF EMPLOYMENT ELIGIBILITY

By executing this Contract, Contractor verifies that it fully complies with all requirements and restrictions of state and federal law respecting the employment of undocumented aliens, including, but not limited to, the Immigration Reform and Control Act of 1986, as may be amended from time to time, and shall require all subcontractors, sub-subcontractors and consultants to comply with the same. Each person executing this Contract on behalf of Contractor verifies that he or she is a duly authorized officer of Contractor and that any of the following shall be grounds for the DISTRICT to terminate the Contract for cause: (1) failure of the Contractor or its subcontractors, sub-subcontractors or consultants to meet any of the requirements provided for in this Article; (2) any misrepresentation or material omission concerning compliance with such requirements; or (3) failure to immediately remove from the Work any person found not to be in compliance with such requirements.

ARTICLE 14. REQUESTS FOR SUBSTITUTION

- A. For the purposes of this provision, the term "substitution" shall mean the substitution of any material, method or service substantially equal to or better in every respect to that indicated in the Standard Specifications or otherwise referenced herein.
- B. Pursuant to Public Contract Code section 3400(b), the DISTRICT may make a finding that is described in the Notice Inviting Bids that designates certain products, things, or services by specific brand or trade name.

- C. Unless specifically designated in the Special Conditions, whenever any material, process, or article is indicated or specified by grade, patent, or proprietary name or by name of manufacturer, such specifications shall be deemed to be used for the purpose of facilitating the description of the material, process, or article desired and shall be deemed to be followed by the words "or equal." Contractor may, unless otherwise stated, offer for substitution any material, process, or article which may be substantially equal to or better in every respect to that so indicated or specified in the Contract Documents. However, the DISTRICT has adopted uniform standards for certain materials, processes, and articles.
- D. The Contractor shall submit substitution requests, together with substantiating data, for substitution of any "or equal" material, process, or article no later than thirty-five (35) calendar days after award of Contract. Provisions regarding submission of substitution requests shall not in any way authorize an extension of time for the performance of this Contract. If a substitution request is rejected by the DISTRICT, the Contractor shall provide the material, method or service specified herein. The DISTRICT shall not be responsible for any costs incurred by the Contractor associated with substitution requests. The burden of proof as to the equality of any material, process, or article shall rest with the Contractor. The Engineer has the complete and sole discretion to determine if a material, process, or article is substantially equal to or better than that specified and to approve or reject all substitution requests.
- E. Substantiating data as described above shall include, at a minimum, the following information:
1. A signed affidavit from the Contractor stating that the material, process, or article proposed as a substitution is substantially equal to or better than that specified in every way except as may be listed on the affidavit.
 2. Illustrations, specifications, catalog cut sheets, and any other relevant data required to prove that the material, process, or article is substantially equal to or better than that specified.
 3. A statement of the cost implications of the substitution being requested, indicating whether and why the proposed substitution will reduce or increase the amount of the contract.
 4. Information detailing the durability and lifecycle costs of the proposed substitution.
- F. Failure to submit all the required substantiating data detailed above in a timely manner so that the substitution request can be adequately reviewed may result in rejection of the substitution request. The Engineer is not obligated to review multiple submittals related the same substitution request resulting from the Contractor's failure to initially submit a complete package.
- G. Time limitations within this Article shall be strictly complied with and in no case will an extension of time for completion of the contract be granted because of Contractor's failure to provide substitution requests at the time and in the manner described herein.
- H. The Contractor shall bear the costs of all DISTRICT work associated with the review of substitution requests.

- I. If substitution requests approved by the Engineer require that Contractor furnish materials, methods or services more expensive than that specified, the increased costs shall be borne by Contractor.

ARTICLE 15. SHOP DRAWINGS

- A. Contractor shall check and verify all field measurements and shall submit with such promptness as to provide adequate time for review and cause no delay in its own Work or in that of any other contractor, subcontractor, or worker on the Project, six (6) copies of all shop drawings, calculations, schedules, and materials list, and all other provisions required by the Contract Documents. Contractor shall sign all submittals affirming that submittals have been reviewed and approved by Contractor prior to submission to Engineer. Each signed submittal shall affirm that the submittal meets all the requirements of the Contract Documents except as specifically and clearly noted and listed on the transmittal letter of the submittal.
- B. Contractor shall make any corrections required by the Engineer, and file with the Engineer six (6) corrected copies each, and furnish such other copies as may be needed for completion of the Work. Engineer's acceptance of shop drawings shall not relieve Contractor from responsibility for deviations from the Contract Documents unless Contractor has, in writing, called Engineer's attention to such deviations at time of submission and has secured the Engineer's written acceptance. Engineer's acceptance of shop drawings shall not relieve Contractor from responsibility for errors in shop drawings.

ARTICLE 16. SUBMITTALS

- A. Contractor shall furnish to the Engineer for approval, prior to purchasing or commencing any Work, a log of all samples, material lists and certifications, mix designs, schedules, and other submittals, as required in the Contract Documents. The log shall indicate whether samples will be provided in accordance with other provisions of this Contract.
- B. Contractor will provide samples and submittals, together with catalogs and supporting data required by the Engineer, to the Engineer within a reasonable time period to provide for adequate review and avoid delays in the Work.
- C. These requirements shall not authorize any extension of time for performance of this Contract. Engineer will check and approve such samples, but only for conformance with design concept of work and for compliance with information given in the Contract Documents. Work shall be in accordance with approved samples and submittals.

ARTICLE 17. MATERIALS

- A. Except as otherwise specifically stated in the Contract Documents, Contractor shall provide and pay for all materials, labor, tools, equipment, lights, power, transportation, superintendence, temporary constructions of every nature, and all other services and facilities of every nature whatsoever necessary to execute and complete this Contract within specified time.

- B. Unless otherwise specified, all materials shall be new and the best of their respective kinds and grades as noted and/or specified, and workmanship shall be of good quality.
- C. Materials shall be furnished in ample quantities and at such times as to ensure uninterrupted progress of the Work and shall be stored properly and protected as required by the Contract Documents. Contractor shall be entirely responsible for damage or loss by weather or other causes to materials or Work.
- D. No materials, supplies, or equipment for Work under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in the Work and agrees upon completion of all work to deliver the Project, to the DISTRICT free from any claims, liens, or charges.
- E. Materials shall be stored on the Project site in such manner so as not to interfere with any operations of the DISTRICT or any independent contractor.
- F. Contractor shall verify all measurements, dimensions, elevations, and quantities before ordering any materials or performing any Work, and the DISTRICT shall not be liable for Contractor's failure to do so. No additional compensation, over and above payment for the actual quantities at the prices set out in the Bid Form, will be allowed because of differences between actual measurements, dimension, elevations and quantities and those indicated on the Plans and in the Specifications. Any difference therein shall be submitted to the Engineer for consideration before proceeding with the Work.

ARTICLE 18. PERMITS AND LICENSES

Permits and licenses necessary for prosecution of the Work shall be secured and paid for by Contractor, unless otherwise specified in the Contract Documents.

- A. Contractor shall obtain and pay for all other permits and licenses required for the Work, including but not limited to, excavation permit and for plumbing, mechanical and electrical work and for operations in or over public streets or right of way under jurisdiction of public agencies other than the DISTRICT.
- B. The Contractor shall arrange and pay for all off-site inspection of the Work related to permits and licenses, including certification, required by the specifications, drawings, or by governing authorities, except for such off-site inspections delineated as the DISTRICT's responsibility pursuant to the Contract Documents.
- C. Before acceptance of the Work, the Contractor shall submit all licenses, permits, certificates of inspection and required approvals to the DISTRICT.

ARTICLE 19. TRENCHES

- A. **Trenches Five Feet or More in Depth.** Contractor shall submit to the Engineer at the preconstruction meeting, a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from hazards of caving ground during the excavation of any trench or trenches five feet or more in depth. If

such plan varies from shoring system standards established by the Construction Safety Orders of the California Code of Regulations, Department of Industrial Relations, the plan shall be prepared by a California registered civil or structural engineer. The plan shall not be less effective than the shoring, bracing, sloping, or other provisions of the Construction Safety Orders, as defined in the California Code of Regulations. The Contractor shall designate in writing the "competent person" as defined in Title 8, California Code of Regulations, who shall be present at the Work Site each day that trenching/excavation is in progress. The "competent person" shall prepare and provide daily trenching/excavation inspection reports to the Engineer. Contractor shall also submit a copy of its annual California Occupational Safety and Health Administration (Cal/OSHA) trench/excavation permit.

- B. Excavations Deeper than Four Feet.** If the Work involves excavating trenches or other excavations that extend deeper than four feet below the surface, Contractor shall promptly, and before the excavation is further disturbed, notify the DISTRICT in writing of any of the following conditions:
1. Material that the Contractor believes may be material that is hazardous waste, as defined in section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
 2. Subsurface or latent physical conditions at the site differing from those indicated.
 3. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract

The DISTRICT shall promptly investigate the conditions, and if it finds that the conditions do so materially differ, or do involve hazardous waste, and cause a decrease or increase in Contractor's cost of, or the time required for, performance of any part of the Work, shall issue a change order under the procedures described in the Contract Documents.

In the event that a dispute arises between the DISTRICT and the Contractor as to whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the Work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the parties.

ARTICLE 20. TRAFFIC CONTROL

- A.** Traffic control plan(s) for the Work may be required by the Agency(s) of Jurisdiction. Traffic control plans, if required, shall be prepared at Contractor's expense, and traffic control shall be performed at Contractor's expense in accordance with the requirements of the Agency(s) of Jurisdiction. Costs for traffic control plans, implementation of traffic control, or traffic signal services required by the Agency(s) of Jurisdiction shall be included in the Contractor's Bid.

- B. All warning signs and safety devices used by the Contractor to perform the Work shall conform to the requirements contained in the State of California, Department of Transportation's current edition of "Manual of Traffic Controls for Construction and Maintenance Work Zones" or to the requirements of the local agency. The Contractor shall also be responsible for all traffic control required by the agency having jurisdiction over the project on the intersecting streets. Contractor shall submit two (2) traffic control plans to the agency having jurisdiction over the project and the General Manager a minimum of forty-eight (48) hours prior to starting work for approval.
- C. The Contractor's representative on the site responsible for traffic control shall produce evidence that he/she has completed training acceptable to the California Department of Transportation for safety through construction zones. All of the streets in which the Work will occur shall remain open to traffic and one lane of traffic maintained at all times unless otherwise directed by the agency of jurisdiction. Businesses and residences adjacent to the Work shall be notified forty-eight (48) hours in advance of closing of driveways. The Contractor shall make every effort to minimize the amount of public parking temporarily eliminated due to construction in areas fronting businesses. No stockpiles of pipe or other material will be allowed in traveled right-of-ways after working hours unless otherwise approved by the Engineer.

ARTICLE 21. DIVERSION OF RECYCLABLE WASTE MATERIALS

In compliance with the applicable DISTRICT's waste reduction and recycling efforts, Contractor shall divert all Recyclable Waste Materials to appropriate recycling centers as required for compliance with the local jurisdiction's waste diversion ordinances. Contractor will be required to submit weight tickets and written proof of diversion with its monthly progress payment requests. Contractor shall complete and execute any certification forms required by DISTRICT or other applicable agencies to document Contractor's compliance with these diversion requirements. All costs incurred for these waste diversion efforts shall be the responsibility of the Contractor.

ARTICLE 22. REMOVAL OF HAZARDOUS MATERIALS

Should Contractor encounter material reasonably believed to be polychlorinated biphenyl (PCB) or other toxic wastes and hazardous materials which have not been rendered harmless at the Project site, the Contractor shall immediately stop work at the affected Project site and shall report the condition to the DISTRICT in writing. The DISTRICT shall contract for any services required to directly remove and/or abate PCBs and other toxic wastes and hazardous materials, if required by the Project site(s), and shall not require the Contractor to subcontract for such services. The Work in the affected area shall not thereafter be resumed except by written agreement of the DISTRICT and Contractor.

ARTICLE 23. SANITARY FACILITIES

Contractor shall provide sanitary temporary toilet buildings and hand washing facilities for the use of all workers. All toilets and hand washing facilities shall comply with local codes and ordinances. Toilets shall be kept supplied with toilet paper and shall have workable door fasteners. Toilets and hand washing facilities shall be serviced no less than once weekly and shall be present in a quantity of not less than 1 per 20 workers as required by Cal/OSHA regulations. The toilets and hand washing facilities shall be maintained in a sanitary condition at all times. Use of toilet and hand washing facilities in the Work under construction shall not be permitted. Any other Sanitary Facilities required by Cal/OSHA shall be the responsibility of the Contractor.

ARTICLE 24. AIR POLLUTION CONTROL

Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes, including, but not limited to, those required by the South Coast Air Quality Management District. All containers of paint, thinner, curing compound, solvent or liquid asphalt shall be labeled to indicate that the contents fully comply with the applicable material requirements.

ARTICLE 25. LAYOUT AND FIELD ENGINEERING

All field engineering required for laying out the Work and establishing grades for earthwork operations shall be furnished by the Contractor at its expense.

ARTICLE 26. TESTS AND INSPECTIONS

- A. If the Contract Documents, the Engineer, or any instructions, laws, ordinances, or public authority requires any part of the Work to be tested or Approved, Contractor shall provide the Engineer at least two (2) working days' notice of its readiness for observation or inspection. If inspection is by a public authority other than the DISTRICT, Contractor shall promptly inform the DISTRICT of the date fixed for such inspection. Required certificates of inspection (or similar) shall be secured by Contractor. Costs for DISTRICT testing and DISTRICT inspection shall be paid by the DISTRICT. Costs of tests for Work found not to be in compliance shall be paid by the Contractor.
- B. If any Work is done or covered up without the required testing or approval, the Contractor shall uncover or deconstruct the Work, and the Work shall be redone after completion of the testing at the Contractor's cost in compliance with the Contract Documents.
- C. Where inspection and testing are to be conducted by an independent laboratory or agency, materials or samples of materials to be inspected or tested shall be selected by such laboratory or agency, or by the DISTRICT, and not by Contractor. All tests or inspections of materials shall be made in accordance with the commonly recognized standards of national organizations.
- D. In advance of manufacture of materials to be supplied by Contractor which must be tested or inspected, Contractor shall notify the DISTRICT so that the DISTRICT may arrange for testing at the source of supply. Any materials which have not satisfactorily passed such testing and inspection shall not be incorporated into the Work.
- E. If the manufacture of materials to be inspected or tested will occur in a plant or location greater than sixty (60) miles from the DISTRICT, the Contractor shall pay for any excessive or unusual costs associated with such testing or inspection, including but not limited to excessive travel time, standby time and required lodging.
- F. Reexamination of Work may be ordered by the DISTRICT. If so ordered, Work must be uncovered or deconstructed by Contractor. If Work is found to be in accordance with the Contract Documents, the DISTRICT shall pay the costs of reexamination and reconstruction. If such work is found not to be in accordance with the Contract Documents, Contractor shall pay all costs.

ARTICLE 27. PROTECTION OF WORK AND PROPERTY

- A. The Contractor shall be responsible for all damages to persons or property that occurs as a result of the Work. Contractor shall be responsible for the proper care and protection of all materials delivered and Work performed until completion and final Acceptance by the DISTRICT. All Work shall be solely at the Contractor's risk. Contractor shall adequately protect adjacent property from settlement or loss of lateral support as necessary. Contractor shall comply with all applicable safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the Project site where Work is being performed. Contractor shall erect and properly maintain at all times, as required by field conditions and progress of work, all necessary safeguards, signs, barriers, lights, and watchmen for protection of workers and the public, and shall post danger signs warning against hazards created in the course of construction.
- B. In an emergency affecting safety of life or of work or of adjoining property, Contractor, without special instruction or authorization from the Engineer, is hereby permitted to act to prevent such threatened loss or injury; and Contractor shall so act, without appeal, if so authorized or instructed by the Engineer or the DISTRICT. Any compensation claimed by Contractor on account of emergency work shall be determined by and agreed upon by the DISTRICT and the Contractor.

ARTICLE 28. CONTRACTOR'S MEANS AND METHODS

Contractor is solely responsible for the means and methods utilized to perform the Work. In no case shall the Contractor's means and methods deviate from commonly used industry standards.

ARTICLE 29. AUTHORIZED REPRESENTATIVES

The DISTRICT shall designate representatives, who shall have the right to be present at the Project site at all times. The DISTRICT may designate an inspector who shall have the right to observe all of the Contractor's Work. The inspector shall not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. Contractor shall provide safe and proper facilities for such access.

ARTICLE 30. HOURS OF WORK

- A. As provided in Article 3 (commencing at section 1810), Chapter 1, Part 7, Division 2 of the Labor Code, Contractor stipulates that eight (8) hours of labor shall constitute a legal day's work. The time of service of any worker employed at any time by the Contractor or by any subcontractor on any subcontract under this Contract upon the Work or upon any part of the Work contemplated by this Contract is limited and restricted to eight (8) hours during any one calendar day and 40 hours during any one calendar week, except as hereinafter provided. Notwithstanding the provisions herein above set forth, work performed by employees of Contractor in excess of eight (8) hours per day, and 40 hours during any one week, shall be permitted upon this public work upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half times the basic rate of pay.
- B. The Contractor and every subcontractor shall keep an accurate record showing the name of and actual hours worked each calendar day and each calendar week by each

worker employed in connection with the Work or any part of the Work contemplated by this Contract. The record shall be kept open at all reasonable hours to the inspection of the DISTRICT and to the Division of Labor Law Enforcement, Department of Industrial Relations of the State of California.

- C. The Contractor shall pay to the DISTRICT a penalty of twenty-five dollars (\$25.00) for each worker employed in the execution of this Contract by the Contractor or by any subcontractor for each calendar day during which such worker is required or permitted to work more than eight (8) hours in any calendar day and 40 hours in any one calendar week in violation of the provisions of Article 3 (commencing at section 1810), Chapter 1, Part 7, Division 2 of the Labor Code.
- D. Any work necessary to be performed after regular working hours, or on Saturdays and Sundays or other holidays, shall be performed without additional expense to the DISTRICT.
- E. DISTRICT will provide inspection during normal working hours from 7:00 a.m. to 3:30 p.m. Monday through Friday. Inspection before or after this time will be charged to the Contractor as reimbursable inspection time. Inspections on weekends requires two days' notice for review and approval. Upon written request and approval the 8.5 hour working day may be changed to other limits subject to city/county ordinance.
- F. It shall be unlawful for any person to operate, permit, use, or cause to operate any of the following at the Project site, other than between the hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, with no Work allowed on the DISTRICT-observed holidays, unless otherwise approved by the DISTRICT:
 - 1. Powered Vehicles
 - 2. Construction Equipment
 - 3. Loading and Unloading Vehicles
 - 4. Domestic Power Tools

ARTICLE 31. PAYROLL RECORDS; LABOR COMPLIANCE

- A. Pursuant to Labor Code section 1776, Contractor and all subcontractors shall maintain weekly certified payroll records, showing the names, addresses, Social Security numbers, work classifications, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by them in connection with the Work under this Contract. Contractor shall certify under penalty of perjury that records maintained and submitted by Contractor are true and accurate. Contractor shall also require subcontractor(s) to certify weekly payroll records under penalty of perjury.
- B. In accordance with Labor Code section 1771.4, the Contractor and each subcontractor shall furnish the certified payroll records directly to the Department of Industrial Relations ("DIR") on the specified interval and format prescribed by the DIR, which may include electronic submission. Contractor shall comply with all requirements and regulations from the DIR relating to labor compliance monitoring and enforcement.

The requirement to submit certified payroll records directly to the Labor Commissioner under Labor Code section 1771.4 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Section 1771.4.

- C. Any stop orders issued by the Department of Industrial Relations against Contractor or any subcontractor that affect Contractor's performance of Work, including any delay, shall be Contractor's sole responsibility. Any delay arising out of or resulting from such stop orders shall be considered Contractor caused delay subject to any applicable liquidated damages and shall not be compensable by the DISTRICT. Contractor shall defend, indemnify and hold the DISTRICT, its officials, officers, employees and agents free and harmless from any claim or liability arising out of stop orders issued by the Department of Industrial Relations against Contractor or any subcontractor.
- D. The payroll records described herein shall be certified and submitted by the Contractor at a time designated by the DISTRICT. The Contractor shall also provide the following:
 - 1. A certified copy of the employee's payroll records shall be made available for inspection or furnished to such employee or his or her authorized representative on request.
 - 2. A certified copy of all payroll records described herein shall be made available for inspection or furnished upon request of the DIR.
- E. Unless submitted electronically, the certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement ("DLSE") of the DIR or shall contain the same information as the forms provided by the DLSE.
- F. Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency, the DISTRICT, the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social security number. The name and address of the Contractor awarded the Contract or performing the contract shall not be marked or obliterated.
- G. In the event of noncompliance with the requirements of this Article, the Contractor shall have ten (10) calendar days in which to comply subsequent to receipt of written notice specifying in what respects the Contractor must comply with this Article. Should noncompliance still be evident after such 10-day period, the Contractor shall pay a penalty of one hundred dollars (\$100.00) to the DISTRICT for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, such penalties shall be withheld from progress payment then due.
- H. The responsibility for compliance with this Article shall rest upon the Contractor.

ARTICLE 32. PREVAILING RATES OF WAGES

- A. The Contractor is aware of the requirements of Labor Code sections 1720 *et seq.* and 1770 *et seq.*, as well as California Code of Regulations, Title 8, Section 16000 *et seq.*

("Prevailing Wage Laws"), which require the payment of prevailing wage rates and the performance of other requirements on certain "public works" and "maintenance" projects. Since this Project involves an applicable "public works" or "maintenance" project, as defined by the Prevailing Wage Laws, and since the total compensation is \$1,000 or more, Contractor agrees to fully comply with such Prevailing Wage Laws. The Contractor shall obtain a copy of the prevailing rates of per diem wages at the commencement of this Contract from the website of the Division of Labor Statistics and Research of the Department of Industrial Relations located at www.dir.ca.gov. In the alternative, the Contractor may view a copy of the prevailing rate of per diem wages which are on file at the DISTRICT's Administration Office and shall be made available to interested parties upon request. Contractor shall make copies of the prevailing rates of per diem wages for each craft, classification, or type of worker needed to perform work on the Project available to interested parties upon request, and shall post copies at the Contractor's principal place of business and at the Project site. Contractor shall defend, indemnify and hold the DISTRICT, its officials, officers, employees and authorized volunteers free and harmless from any claims, liabilities, costs, penalties or interest arising out of any failure or alleged failure to comply with the Prevailing Wage Laws.

- B. The Contractor shall forfeit as a penalty to the DISTRICT not more than Two Hundred Dollars (\$200.00), pursuant to Labor Code section 1775, for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate as determined by the Director of the Department of Industrial Relations for such work or craft in which such worker is employed for any public work done under the Contract by it or by any subcontractor under it. The difference between such prevailing wage rate and the amount paid to each worker for each calendar day or portion thereof, for which each worker was paid less than the prevailing wage rate, shall be paid to each worker by the Contractor.
- C. Contractor shall post, at appropriate conspicuous points on the Project site, a schedule showing all determined general prevailing wage rates and all authorized deductions, if any, from unpaid wages actually earned.

ARTICLE 33. PUBLIC WORKS CONTRACTOR REGISTRATION

Pursuant to Labor Code sections 1725.5 and 1771.1, the Contractor and its subcontractors must be registered with the Department of Industrial Relations prior to the execution of a contract to perform public works. By entering into this Contract, Contractor represents that it is aware of the registration requirement and is currently registered with the DIR. Contractor shall maintain a current registration for the duration of the Project. Contractor shall further include the requirements of Labor Code sections 1725.5 and 1771.1 in any subcontract and ensure that all subcontractors are registered at the time this Contract is entered into and maintain registration for the duration of the Project. Notwithstanding the foregoing, the contractor registration requirements mandated by Labor Code Sections 1725.5 and 1771.1 shall not apply to work performed on a public works project that is exempt pursuant to the small project exemption specified in Labor Code Sections 1725.5 and 1771.1.

ARTICLE 34. EMPLOYMENT OF APPRENTICES

- A. Contractor and all subcontractors shall comply with the requirements of Labor Code sections 1777.5 and 1777.6 in the employment of apprentices.

- B. Information relative to apprenticeship standards, wage schedules, and other requirements may be obtained from the Director of Industrial Relations, ex officio the Administrator of Apprenticeship, San Francisco, California, or from the Division of Apprenticeship Standards and its branch offices.
- C. Knowing violations of Labor Code section 1777.5 will result in forfeiture not to exceed one hundred dollars (\$100.00) for each calendar day of non-compliance pursuant to Labor Code section 1777.7.
- D. The responsibility for compliance with this Article shall rest upon the Contractor.

ARTICLE 35. NONDISCRIMINATION/EQUAL EMPLOYMENT OPPORTUNITY

Pursuant to Labor Code section 1735 and other applicable provisions of law, the Contractor and its subcontractors shall not discriminate against any employee or applicant for employment because of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, marital status, sex, age, sexual orientation, or any other classifications protected by law on this Project. The Contractor will take affirmative action to insure that employees are treated during employment or training without regard to their race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, marital status, sex, age, sexual orientation, or any other classifications protected by law.

Employment Eligibility; Contractor. By executing this Contract, Contractor verifies that it fully complies with all requirements and restrictions of state and federal law respecting the employment of undocumented aliens, including, but not limited to, the Immigration Reform and Control Act of 1986, as may be amended from time to time. Such requirements and restrictions include, but are not limited to, examination and retention of documentation confirming the identity and immigration status of each employee of the Contractor. Contractor also verifies that it has not committed a violation of any such law within the five (5) years immediately preceding the date of execution of this Contract, and shall not violate any such law at any time during the term of the Contract. Contractor shall avoid any violation of any such law during the term of this Contract by participating in an electronic verification of work authorization program operated by the United States Department of Homeland Security, by participating in an equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, or by some other legally acceptable method. Contractor shall maintain records of each such verification, and shall make them available to the DISTRICT or its representatives for inspection and copy at any time during normal business hours. The DISTRICT shall not be responsible for any costs or expenses related to Contractor's compliance with the requirements provided for or referred to herein.

Employment Eligibility; Subcontractors, Sub-subcontractors and Consultants. To the same extent and under the same conditions as Contractor, Contractor shall require all of its subcontractors, sub-subcontractors and consultants performing any part of the Work or of this Contract to make the same verifications and comply with all requirements and restrictions provided for herein.

Employment Eligibility; Failure to Comply. Each person executing this Contract on behalf of Contractor verifies that he or she is a duly authorized officer of Contractor, and understands that any of the following shall be grounds for the DISTRICT to terminate the Contract for cause: (1) failure of Contractor or its subcontractors, sub-subcontractors or consultants to meet any of the requirements provided for herein; (2) any misrepresentation or material omission concerning

compliance with such requirements; or (3) failure to immediately remove from the Work any person found not to be in compliance with such requirements.

ARTICLE 36. DEBARMENT OF CONTRACTORS AND SUBCONTRACTORS

Contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Labor Code section 1777.1 or 1777.7. Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid, or may have been paid to a debarred subcontractor by a contractor on the project shall be returned to the DISTRICT. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the project.

ARTICLE 37. LABOR/EMPLOYMENT SAFETY

The Contractor shall comply with all applicable laws and regulations of the federal, state, and local government, including Cal/OSHA requirements and requirements for verification of employees' legal right to work in the United States.

The Contractor shall maintain emergency first aid treatment for his employees which complies with the Federal Occupational Safety and Health Act of 1970 (29 U.S.C. § 651 *et seq.*), and California Code of Regulations, Title 8, Industrial Relations Division 1, Department of Industrial Relations, Chapter 4. The Contractor shall ensure the availability of emergency medical services for its employees in accordance with California Code of Regulations, Title 8, Section 1512.

The Contractor shall submit the Illness and Injury Prevention Program and a Project site specific safety program to the DISTRICT prior to beginning Work at the Project site. Contractor shall maintain a confined space program that meets or exceeds the DISTRICT Standards. Contractor shall adhere to the DISTRICT's lock out tag out program.

ARTICLE 38. INSURANCE

The Contractor shall obtain, and at all times during performance of the Contract, maintain, and for five (5) years thereafter, insurance described in this Article against claims for injuries or death to persons or damages to property, which may arise from or in connection with the performance of the Work hereunder by the Contractor, his agents, representatives, employees, or subcontractors. Contractor shall not commence Work under this Contract until it has provided evidence satisfactory to the DISTRICT that it has secured all insurance required hereunder. Contractor shall not allow any subcontractor to commence work on any subcontract until it has provided evidence satisfactory to the DISTRICT that the subcontractor has secured all insurance required under this Article. Failure to provide and maintain all required insurance shall be grounds for the DISTRICT to terminate this Contract for cause. Contractor shall furnish DISTRICT with original certificates of insurance and endorsements effective coverage required by this Contract on forms satisfactory to the DISTRICT. The certificates and endorsements for each insurance policy shall be signed by a person authorized by that insurer to bind coverage on its behalf, and shall be on forms acceptable to the DISTRICT. All certificates and endorsements must be received and approved by the DISTRICT before Work commences.

- A. **Additional Insureds; Waiver of Subrogation.** The DISTRICT, its officials, officers, employees, agents and authorized volunteers shall be named as Additional Insureds

on Contractor's All Risk policy and on Contractor's and its subcontractors' policies of Commercial General Liability and Automobile Liability insurance using, for Contractor's policy/ies of Commercial General Liability insurance, ISO CG form 20 10 11 85 or if not available, through the addition of **both** CG 20 10 10 01 and 20 37 10 01 (or endorsements providing the exact same coverage, including completed operations), and, for subcontractors' policies of Commercial General Liability insurance, ISO CG form 20 38 (or endorsements providing the exact same coverage). Notwithstanding the minimum limits set forth in this Contract for any type of insurance coverage, all available insurance proceeds in excess of the specified minimum limits of coverage shall be available to the parties required to be named as Additional Insureds hereunder. Contractor and its insurance carriers shall provide a Waiver of Subrogation in favor of those parties.

- B. Workers' Compensation Insurance.** The Contractor shall provide workers' compensation insurance for all of the employees engaged in Work under this Contract, on or at the Site, and, in case of any sublet Work, the Contractor shall require the subcontractor similarly to provide workers' compensation insurance for all the latter's employees as prescribed by the state of California, with Statutory Limits. Any class of employee or employees not covered by a subcontractor's insurance shall be covered by the Contractor's insurance. In case any class of employees engaged in work under this Contract, on or at the Site, is not protected under the Workers' Compensation Statutes, the Contractor shall provide or shall cause a subcontractor to provide, adequate insurance coverage for the protection of such employees not otherwise protected. The Contractor is required to secure payment of compensation to his employees in accordance with the provisions of section 3700 of the Labor Code. The Contractor shall file with the DISTRICT certificates of his insurance protecting workers. Company or companies providing insurance coverage shall be acceptable to the DISTRICT, if in the form and coverage as set forth in the Contract Documents.
- C. Employer's Liability Insurance.** Contractor shall provide Employer's Liability Insurance, including Occupational Disease, in the amount of at least one million dollars (\$1,000,000.00) per person per accident. Contractor shall provide DISTRICT with a certificate of Employer's Liability Insurance. Such insurance shall comply with the provisions of the Contract Documents. The Contractor hereby agrees to waive rights of subrogation to obtain endorsement necessary to affect this waiver of subrogation in favor of the DISTRICT, its directors, officers, employees, and authorized volunteers, for losses paid under the terms of this coverage which arise from Work performed by the Named Insured for the DISTRICT; this provision applies regardless of whether or not the DISTRICT has received a waiver of subrogation from the insurer.
- D. Commercial General Liability Insurance.** Contractor shall provide "occurrence" form Commercial General Liability insurance coverage at least as broad as the most current ISO CGL Form 00 01, including but not limited to, premises liability, contractual liability, products/completed operations, personal and advertising injury which may arise from or out of Contractor's operations, use, and management of the Site, or the performance of its obligations hereunder. The policy shall not contain any exclusion contrary to this Contract including but not limited to endorsements or provisions limiting coverage for (1) contractual liability (including but not limited to ISO CG 24 26 or 21 39); or (2) cross-liability for claims or suits against one insured against another. Policy limits shall not be less than \$5,000,000 per occurrence for bodily injury, personal injury and property damage Commercial General Liability Insurance or other form with a

general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit. Defense costs shall be paid in addition to the limits.

1. Such policy shall comply with all the requirements of this Article. The limits set forth herein shall apply separately to each insured against whom claims are made or suits are brought, except with respect to the limits of liability. Further the limits set forth herein shall not be construed to relieve the Contractor from liability in excess of such coverage, nor shall it limit Contractor's indemnification obligations to the DISTRICT, and shall not preclude the DISTRICT from taking such other actions available to the DISTRICT under other provisions of the Contract Documents or law.
 2. All general liability policies provided pursuant to the provisions of this Article shall comply with the provisions of the Contract Documents.
 3. All general liability policies shall be written to apply to all bodily injury, including death, property damage, personal injury, owned and non-owned equipment, blanket contractual liability, completed operations liability, explosion, collapse, under-ground excavation, removal of lateral support, and other covered loss, however occasioned, occurring during the policy term, and shall specifically insure the performance by Contractor of that part of the indemnification contained in these General Conditions relating to liability for injury to or death of persons and damage to property.
 4. If the coverage contains one or more aggregate limits, a minimum of 50% of any such aggregate limit must remain available at all times; if over 50% of any aggregate limit has been paid or reserved, the DISTRICT may require additional coverage to be purchased by Contractor to restore the required limits. Contractor may combine primary, umbrella, and as broad as possible excess liability coverage to achieve the total limits indicated above. Any umbrella or excess liability policy shall include the additional insured endorsement described in the Contract Documents.
 5. All policies of general liability insurance shall permit and Contractor does hereby waive any right of subrogation which any insurer of Contractor may acquire from Contractor by virtue of the payment of any loss.
- E. **Automobile Liability Insurance.** Contractor shall provide "occurrence" form Automobile Liability Insurance at least as broad as ISO CA 00 01 (Any Auto) in the amount of, at least, one million dollars (\$1,000,000) per accident for bodily injury and property damage. Such insurance shall provide coverage with respect to the ownership, operation, maintenance, use, loading or unloading of any auto owned, leased, hired or borrowed by Contractor or for which Contractor is responsible, in a form and with insurance companies acceptable to the DISTRICT. All policies of automobile insurance shall permit and Contractor does hereby waive any right of subrogation which any insurer of Contractor may acquire from Contractor by virtue of the payment of any loss.

F. **Builder's Risk ["All Risk"]**

1. It is the Contractor's responsibility to maintain or cause to be maintained Builder's Risk ["All Risk"] or an installation floater (for materials and equipment) extended coverage insurance on all work, material, equipment, appliances, tools, and structures that are or will become part of the Work and subject to loss or damage by fire, vandalism and malicious mischief, and collapse, in an amount to cover 100% of the replacement cost. The DISTRICT accepts no responsibility for the Work until the Work is formally accepted by the DISTRICT. The Contractor shall provide a certificate evidencing this coverage before commencing performance of the Work.
 2. The Policy shall be endorsed with DISTRICT, its directors, officers, employees, and authorized volunteers named as loss payee, as their interest may appear.
 3. Policy shall be provided for replacement value on an "all risk" basis. There shall be no coinsurance penalty provision in any such policy. Policy must include: (1) coverage for any ensuing loss from faulty workmanship, nonconforming work, omission or deficiency in design or specifications; (2) coverage against machinery accidents and operational testing; (3) coverage for removal of debris, and insuring the buildings, structures, machinery, equipment, materials, facilities, fixtures and all other properties constituting a part of the Project; (4) transit coverage, including ocean marine coverage (unless insured by the supplier), with sub-limits sufficient to insure the full replacement value of any key equipment item; and (5) coverage with sub-limits sufficient to insure the full replacement value of any property or equipment stored either on or off the Site. Such insurance shall be on a form acceptable to DISTRICT to ensure adequacy and sublimit.
 4. In addition, the policy shall meet the following requirements:
 - a. Insurance policies shall be so conditioned as to cover the performance of any extra work performed under the Contract.
 - b. Coverage shall include all materials stored on site and in transit.
 - c. Coverage shall include Contractor's tools and equipment.
 - d. Insurance shall include boiler, machinery and material hoist coverage.
- G. Contractor shall require all tiers of sub-contractors working under this Contract to provide the insurance required under this Article unless otherwise agreed to in writing by DISTRICT. Contractor shall make certain that any and all subcontractors hired by Contractor are insured in accordance with this Contract. If any subcontractor's coverage does not comply with the foregoing provisions, Contractor shall indemnify and hold the DISTRICT harmless from any damage, loss, cost, or expense, including attorneys' fees, incurred by the DISTRICT as a result thereof.

ARTICLE 39. FORM AND PROOF OF CARRIAGE OF INSURANCE

- A. Any insurance carrier providing insurance coverage required by the Contract Documents shall be admitted to and authorized to do business in the State of California unless waived, in writing, by the DISTRICT's Risk Manager. Carrier(s) shall have an A.M. Best rating of not less than an A:VII. Insurance deductibles or self-insured

retentions must be declared by the Contractor. At the election of the DISTRICT the Contractor shall either 1) reduce or eliminate such deductibles or self-insured retentions, or 2) procure a bond which guarantees payment of losses and related investigations, claims administration, and defense costs and expenses. If umbrella or excess liability coverage is used to meet any required limit(s) specified herein, the Contractor shall provide a "follow form" endorsement satisfactory to the DISTRICT indicating that such coverage is subject to the same terms and conditions as the underlying liability policy.

- B. Each insurance policy required by this Contract shall be endorsed to state that: (1) coverage shall not be suspended, voided, reduced or cancelled except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the DISTRICT; and (2) any failure to comply with reporting or other provisions of the policies, including breaches of warranties, shall not affect coverage provided to the DISTRICT, its officials, officers, agents, employees, and volunteers. When any of the required coverages expire during the term of this agreement, the Contractor shall deliver the renewal certificate(s) including the general liability additional insured endorsement and evidence of waiver of rights of subrogation against Member Water Agency (if builder's risk insurance is applicable) to Member Water Agency at least ten (10) days prior to the expiration date.
- C. The Certificate(s) and policies of insurance shall contain or shall be endorsed to contain the covenant of the insurance carrier(s) that it shall provide no less than thirty (30) days written notice be given to the DISTRICT prior to any material modification or cancellation of such insurance. In the event of a material modification or cancellation of coverage, the DISTRICT may terminate the Contract or stop the Work in accordance with the Contract Documents, unless the DISTRICT receives, at least ten (10) days prior to such effective date, another properly executed original Certificate of Insurance and original copies of endorsements or certified original policies, including all endorsements and attachments thereto evidencing coverage's set forth herein and the insurance required herein is in full force and effect. Contractor shall not take possession, or use the Site, or commence operations under this Contract until the DISTRICT has been furnished original Certificate(s) of Insurance and certified original copies of endorsements or policies of insurance including all endorsements and any and all other attachments as required in this Article. The original endorsements for each policy and the Certificate of Insurance shall be signed by an individual authorized by the insurance carrier to do so on its behalf.
- D. For any claims related to this Project, the Contractor's insurance coverage shall be primary at least as broad as ISO CG 20 01 04 13 as respects to the DISTRICT, its directors, officers, employees, and authorized volunteers. Any insurance or self-insurance maintained by the DISTRICT, its directors, officers, employees, and authorized volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
- E. DISTRICT reserves the right to adjust the monetary limits of insurance coverages during the term of this Contract including any extension thereof if, in the DISTRICT's reasonable judgment, the amount or type of insurance carried by the Contractor becomes inadequate.

- F. Contractor shall report to the DISTRICT, in addition to the Contractor's insurer, any and all insurance claims submitted by the Contractor in connection with the Work under this Contract.

ARTICLE 40. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- A. **Time for Completion/Liquidated Damages.** Time is of the essence in the completion of the Work. Work shall be commenced within ten (10) Days of the date stated in the DISTRICT's Notice to Proceed and shall be completed by Contractor in the time specified in the Contract Documents. The DISTRICT is under no obligation to consider early completion of the Project; and the Contract completion date shall not be amended by the DISTRICT's receipt or acceptance of the Contractor's proposed earlier completion date. Furthermore, Contractor shall not, under any circumstances, receive additional compensation from the DISTRICT (including but not limited to indirect, general, administrative or other forms of overhead costs) for the period between the time of earlier completion proposed by the Contractor and the Contract completion date. If the Work is not completed as stated in the Contract Documents, it is understood that the DISTRICT will suffer damage. In accordance with Government Code section 53069.85, being impractical and infeasible to determine the amount of actual damage, it is agreed that Contractor shall pay to the DISTRICT as fixed and liquidated damages, and not as a penalty, the sum stipulated in the Contract for each calendar day of delay until the Work is fully completed. Contractor and its surety shall be liable for any liquidated damages. Any money due or to become due the Contractor may be retained to cover liquidated damages.
- B. **Inclement Weather.** Contractor shall abide by the Engineer's determination of what constitutes inclement weather. Time extensions for inclement weather shall only be granted when the Work stopped during inclement weather is on the critical path of the Project schedule.
- C. **Extension of Time.** Contractor shall not be charged liquidated damages because of any delays in completion of the Work due to unforeseeable causes beyond the control and without the fault or negligence of Contractor (or its subcontractors or suppliers). Contractor shall within five (5) Days of identifying any such delay notify the DISTRICT in writing of causes of delay. The DISTRICT shall ascertain the facts and extent of delay and grant extension of time for completing the Work when, in its judgment, the facts justify such an extension. Time extensions to the Project shall be requested by the Contractor as they occur and without delay. No delay claims shall be permitted unless the event or occurrence delays the completion of the Project beyond the Contract completion date.
- D. **No Damages for Reasonable Delay.** The DISTRICT's liability to Contractor for delays for which the DISTRICT is responsible shall be limited to only an extension of time unless such delays were unreasonable under the circumstances. In no case shall the DISTRICT be liable for any costs which are borne by the Contractor in the regular course of business, including, but not limited to, home office overhead and other ongoing costs. Damages caused by unreasonable DISTRICT delay, including delays caused by items that are the responsibility of the DISTRICT pursuant to Government Code section 4215, shall be based on actual costs only, no proportions or formulas shall be used to calculate any delay damages.

ARTICLE 41. COST BREAKDOWN AND PERIODIC ESTIMATES

Contractor shall furnish on forms Approved by the DISTRICT:

- A. Within ten (10) Days of Notice to Proceed with the Contract, a detailed estimate giving a complete breakdown of the Contract price, if the Contract amount is a lump sum.
- B. A monthly itemized estimate of Work done for the purpose of making progress payments. In order for the DISTRICT to consider and evaluate each progress payment application, the Contractor shall submit a detailed measurement of Work performed and a progress estimate of the value thereof before the tenth (10th) Day of the following month.
- C. Contractor shall submit, with each of its payment requests, an adjusted list of actual quantities, verified by the Engineer, for unit price items listed, if any, in the Bid Form.
- D. Following the DISTRICT's Acceptance of the Work, the Contractor shall submit to the DISTRICT a written statement of the final quantities of unit price items for inclusion in the final payment request.
- E. The DISTRICT shall have the right to adjust any estimate of quantity and to subsequently correct any error made in any estimate for payment.

Contractor shall certify under penalty of perjury, that all cost breakdowns and periodic estimates accurately reflect the Work on the Project.

ARTICLE 42. PROGRESS ESTIMATES AND PAYMENT

- A. By the tenth (10th) Day of the following calendar month, Contractor shall submit to Engineer a payment request which shall set forth in detail the value of the Work done for the period beginning with the date work was first commenced and ending on the end of the calendar month for which the payment request is prepared. Contractor shall include any amount earned for authorized extra work. From the total thus computed, a deduction shall be made in the amount of five percent (5%) for retention, except where the DISTRICT has adopted a finding that the Work done under the Contract is substantially complex, and then the amount withheld as retention shall be the percentage specified in the Notice Inviting Bids. From the remainder a further deduction may be made in accordance with Section B below. The amount computed, less the amount withheld for retention and any amounts withheld as set forth below, shall be the amount of the Contractor's payment request.
- B. The DISTRICT may withhold a sufficient amount or amounts of any payment or payments otherwise due to Contractor, as in his judgment may be necessary to cover:
 1. Payments which may be past due and payable for just claims against Contractor or any subcontractors for labor or materials furnished in and about the performance of work on the Project under this Contract.
 2. Defective work not remedied.

3. Failure of Contractor to make proper payments to his subcontractor or for material or labor.
 4. Completion of the Contract if there is a reasonable doubt that the Work can be completed for balance then unpaid.
 5. Damage to another contractor or a third party.
 6. Amounts which may be due the DISTRICT for claims against Contractor.
 7. Failure of Contractor to keep the record ("as-built") drawings up to date.
 8. Failure to provide update on construction schedule as required herein.
 9. Site cleanup.
 10. Failure to comply with Contract Documents.
 11. Liquidated damages.
 12. Legally permitted penalties.
- C. The DISTRICT may apply such withheld amount or amounts to payment of such claims or obligations at its discretion with the exception of subsections (B)(1), (3), and (5) of this Article, which must be retained or applied in accordance with applicable law. In so doing, the DISTRICT shall be deemed the agent of Contractor and any payment so made by the DISTRICT shall be considered as a payment made under contract by the DISTRICT to Contractor and the DISTRICT shall not be liable to Contractor for such payments made in good faith. Such payments may be made without prior judicial determination of claim or obligations. The DISTRICT will render Contractor a proper accounting of such funds disbursed on behalf of Contractor.
- D. Upon receipt, the Engineer shall review the payment request to determine whether it is undisputed and suitable for payment. If the payment request is determined to be unsuitable for payment, it shall be returned to Contractor as soon as practicable but not later than seven (7) Days after receipt, accompanied by a document setting forth in writing the reasons why the payment request is not proper. The DISTRICT shall make the progress payment within 30 calendar days after the receipt of an undisputed and properly submitted payment request from Contractor, provided that a release of liens and claims has been received from the Contractor pursuant to Civil Code section 8132. The number of days available to the DISTRICT to make a payment without incurring interest pursuant to this paragraph shall be reduced by the number of days by which the Engineer exceeds the seven (7) Day requirement.
- E. A payment request shall be considered properly executed if funds are available for payment of the payment request and payment is not delayed due to an audit inquiry by the financial officer of the DISTRICT.

ARTICLE 43. SECURITIES FOR MONEY WITHHELD

Pursuant to section 22300 of the Public Contract Code of the State of California, Contractor may

request the DISTRICT to make retention payments directly to an escrow agent or may substitute securities for any money withheld by the DISTRICT to ensure performance under the contract. At the request and expense of Contractor, securities equivalent to the amount withheld shall be deposited with the DISTRICT or with a state or federally chartered bank as the escrow agent who shall return such securities to Contractor upon satisfactory completion of the contract. Deposit of securities with an escrow agent shall be subject to a written agreement substantially in the form provided in section 22300 of the Public Contract Code.

ARTICLE 44. CHANGES AND EXTRA WORK.

A. Contract Change Orders.

1. The DISTRICT, without invalidating the Contract, may order changes in the Work consisting of additions, deletions or other revisions, and the Contract Price and Contract Time shall be adjusted accordingly. Except as otherwise provided herein, all such changes in the Work shall be authorized by Change Order, and shall be performed under the applicable conditions of the Contract Documents. A Change Order signed by the Contractor indicates the Contractor's agreement therewith, including any adjustment in the Contract Price or the Contract Time, and the full and final settlement of all costs (direct, indirect and overhead) related to the Work authorized by the Change Order.
2. Contractor shall promptly execute changes in the Work as directed in writing by the DISTRICT even when the parties have not reached agreement on whether the change increases the scope of Work or affects the Contract Price or Contract Time. All claims for additional compensation to the Contractor shall be presented in writing. No claim will be considered after the Work in question has been done unless a written Change Order has been issued or a timely written notice of claim has been made by Contractor.
3. Whenever any change is made as provided for herein, such change shall be considered and treated as though originally included in the Contract, and shall be subject to all terms, conditions, and provisions of the original Contract.
4. Contractor shall not be entitled to claim or bring suit for damages, whether for loss of profits or otherwise, on account of any decrease or omission of any item or portion of Work to be done.
5. No dispute, disagreement, or failure of the parties to reach agreement on the terms of the Change Order shall relieve the Contractor from the obligation to proceed with performance of the work, including Additional Work, promptly and expeditiously.
6. Contractor shall make available to the DISTRICT any of the Contractor's documents related to the Project immediately upon request of the DISTRICT, as set forth in Article 52.
7. Any alterations, extensions of time, Additional Work, or any other changes may be made without securing consent of the Contractor's surety or sureties.

B. Contract Price Change.

1. Process for Determining Adjustments in Contract Price.

- a. Owner Initiated Change. The Contractor must submit a complete cost proposal, including any change in the Contract Price or Contract Time, within seven (7) Days after receipt of a scope of a proposed change order initiated by the DISTRICT, unless the DISTRICT requests that proposals be submitted in less than seven (7) Days.
- b. Contractor Initiated Change. The Contractor must give written notice of a proposed change order required for compliance with the Contract Documents within seven (7) Days of discovery of the facts giving rise to the proposed change order.
- c. Whenever possible, any changes to the Contract amount shall be in a lump sum mutually agreed to by the Contractor and the DISTRICT.
- d. Price quotations from the Contractor shall be accompanied by sufficiently detailed supporting documentation to permit verification by the DISTRICT, including but not limited to estimates and quotations from subcontractors or material suppliers, as the DISTRICT may reasonably request. Contractor shall certify the accuracy of all Change Order Requests under penalty of perjury.
- e. If the Contractor fails to submit a complete cost proposal within the seven (7) Day period (or as requested), the DISTRICT has the right to order the Contractor in writing to commence the Work immediately on a time and materials basis and/or issue a lump sum change to the Contract Price and/or Contract Time in accordance with the DISTRICT's estimate. If the change is issued based on the DISTRICT's estimate, the Contractor will waive its right to dispute the action unless within fifteen (15) Days following completion of the added/deleted work, the Contractor presents written proof that the DISTRICT's estimate was in error.

2. Unit Price Change Orders.

- a. When the actual quantity of a Unit Price item varies from the Bid Form, compensation for the change in quantity will be calculated by multiplying the actual quantity by the Unit Price. This calculation may result in either an additive or deductive Final Change Order pursuant to the Contract Documents.
- b. No Mark up for Overhead and Profit. Because the Contract Unit Prices provided in the Bid Form include Overhead and Profit as determined by Contractor at the time of Bid submission, no mark up or deduction for Overhead and Profit will be included in Unit Price Change Orders.
- c. Bid items included on the Bid Form may be deducted from the Work in their entirety without any negotiated extra costs.
- d. Contractor acknowledges that unit quantities are estimates and agrees that the estimated unit quantities listed on the Bid Form will be adjusted to reflect the actual unit quantities which may result in an adjustment to the Contract Unit Prices. Such an adjustment will be made by execution of a final additive or

deductive Change Order following Contractor's completion of the Work. Upon notification, Contractor's failure to respond within seven (7) Days will result in DISTRICT's issuance of a unit quantity adjustment to the Contract Unit Prices and/or Contract Time in accordance with the Contract Documents.

- e. The DISTRICT or Contractor may make a Claim for an adjustment in the Unit Price in accordance with the Contract Documents if:
 - i. the quantity of any item of Unit Price Work performed by Contractor differs by twenty-five percent (25%) or more from the estimated quantity of such item indicated in the Contract; and
 - ii. there is no corresponding adjustment with respect to any other item of Work; and
 - iii. Contractor believes that Contractor is entitled to an increase in Unit Price as a result of having incurred additional expense or the DISTRICT believes that the DISTRICT is entitled to a decrease in Unit Price and the parties are unable to agree as to the amount of any such increase or decrease..
3. Lump Sum Change Orders. Contractor shall incorporate the provisions of this Section into all agreements with Subcontractors. Compensation for Lump Sum Change Orders shall be limited to expenditures necessitated specifically by the Additional Work, and shall be according to the following:
 - a. Overview. The Contractor will submit a properly itemized Lump Sum Change Order Proposal covering the Additional Work and/or the work to be deleted. This proposal will be itemized for the various components of the Additional Work and segregated by labor, material, and equipment in a detailed format satisfactory to the DISTRICT. The DISTRICT will require itemized change orders on all change order proposals from the Contractor, subcontractors, and sub-subcontractors regardless of tier. Details to be submitted will include detailed line item estimates showing detailed materials quantity take-offs, material prices by item and related labor hour pricing information and extensions (by line item or by drawing as applicable).
 - b. Labor. The costs of labor will be the actual cost for wages prevailing locally for each craft or type of worker at the time the Additional Work is done, plus employer payments of payroll taxes and insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State or local laws, as well as assessment or benefits required by lawful collective bargaining agreements. The use of a labor classification which would increase the Additional Work cost will not be permitted unless the Contractor establishes the necessity for such new classifications. Labor costs for equipment operators and helpers shall be reported only when such costs are not included in the invoice for equipment rental.

Estimated labor hours must only include hours for those workmen and working foremen directly involved in performing the change order work. Supervision above the level of working foremen (such as general foremen, superintendent, project manager, etc.) is considered to be included in the markup percentages

as outlined below. Note that no separate allowances for warranty expense will be allowed as a direct cost of a change order. Costs attributed to warranty expenses will be considered to be covered by the markup.

- c. Labor Burden. Labor burden allowable in change orders shall be defined as employer's net actual cost of payroll taxes (FICA, Medicare, SUTA, FUTA), net actual cost for employer's cost of union benefits (or other usual and customary fringe benefits if the employees are not union employees), and net actual cost to employer for worker's compensation insurance taking into consideration adjustments for experience modifiers, premium discounts, dividends, rebates, expense constants, assigned risk pool costs, net cost reductions due to policies with deductibles for self-insured losses, assigned risk rebates, etc. Contractor shall reduce their standard payroll tax percentages to properly reflect the effective cost reduction due to the estimated impact of the annual maximum wages subject to payroll taxes. An estimated percentage for labor burden may be used for pricing change orders. However, the percentage used for labor burden to price change orders will be examined at the conclusion of the Project and an adjustment to the approved change orders will be processed if it is determined that the actual labor burden percentage should have been more or less than the estimated percentage used.
- d. Materials. The cost of materials reported shall be at invoice or lowest current price at which such materials are locally available in the quantities involved, plus sales tax, freight, and delivery. Materials costs shall be based upon supplier or manufacturer's invoice. If invoices or other satisfactory evidence of cost are not furnished within fifteen (15) Days of delivery, then the DISTRICT shall determine the materials cost, at its sole discretion. Estimated material change order costs shall reflect the Contractor's reasonably anticipated net actual cost for the purchase of the material needed for the change order work. Estimated material costs shall reflect cost reductions available to the Contractor due to "non-cash" discounts, trade discounts, free material credits, and/or volume rebates. "Cash" discounts (i.e., prompt payment discounts of 2% or less) available on material purchased for change order work shall be credited to the DISTRICT if the Contractor is provided the DISTRICT funds in time for Contractor to take advantage of any such "cash" discounts. The portion of any "cash" discounts greater than 2% will not be considered "non-cash" discount for purposes of this provision. Price quotations from material suppliers must be itemized with unit prices for each specific item to be purchased. "Lot pricing" quotations will not be considered sufficient substantiating detail.
- e. Tool and Equipment Use. Costs for the use of small tools, which are tools that have a replacement value of \$1,000 or less, shall be considered included in the Overhead and Profit mark-ups established below. Allowable change order estimated costs may include appropriate amounts for rental of major equipment specifically needed to perform the change order work (defined as tools and equipment with an individual purchase cost of more than \$750). For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing change order proposals shall be 75% of the monthly rate listed in the most current publication of The AED Green Book divided by 176 to arrive at a maximum hourly rate to be applied to the hours the equipment is used

performing the change order work. Further, for Contractor owned equipment, the aggregate equipment rent charges for any single piece of equipment used in all change order work shall be limited to 50% of the fair market value of the piece of equipment when the first change order is priced involving usage of the piece of equipment. Fuel necessary to operate the equipment will be considered as a separate direct cost associated with the change order work.

- f. Maximum Markup Percentage Allowable on Self-Performed Work. With respect to pricing change orders, the maximum markup percentage to be paid to any Contractor or subcontractor (regardless of tier) on self-performed work shall be a single markup percentage not-to-exceed fifteen percent (15%) of the net direct cost of (1) direct labor and allowable labor burden costs applicable to the change in the Work; (2) the net cost of material and installed equipment incorporated into the change in the Work, and (3) net rental cost of major equipment and related fuel costs necessary to complete the change in the Work. The markup computed using the above formula shall be considered to be allocated 2/3 to cover applicable overhead costs directly attributable to the field overhead costs related to processing, supervising and performing, the change order work, and the remaining 1/3 to cover home office overhead costs and profit
- g. Maximum Markup Percentages Allowable on Work Performed by Lower Tier Subcontractors. With respect to pricing the portion of change order proposals involving Work performed by lower tier contractors, the maximum markup percentage allowable to the Contractor or subcontractor supervising the lower tier subcontractor's work shall not exceed five percent (5%) of the net of all approved change order work performed by all subcontractors combined for any particular change order proposal. The markup computed using the above formula shall be considered to be allocated 2/3 to cover applicable overhead costs directly attributable to the field overhead costs related to processing, supervising and performing the change order work, and the remaining 1/3 to cover home office overhead costs and profit.
- h. No Markup on Bonds and Liability Insurance Costs. Change order cost adjustments due to increases or decreases in bond or insurance costs (if applicable) shall not be subject to any markup.
- i. Direct and Indirect Costs Covered by Markup Percentages. As a further clarification, the agreed upon markup percentage set forth above is intended to cover the Contractor's profit and all indirect costs associated with the change order work. Items intended to be covered by the markup percentage include, but are not limited to: home office expenses, branch office and field office overhead expense of any kind, project management, superintendents, general foremen, estimating, engineering, coordinating, expediting, purchasing, detailing, legal, accounting, data processing or other administrative expenses, shop drawings, permits, auto insurance and umbrella insurance, pick-up truck costs, and warranty expense costs. The cost for the use of small tools is also to be considered covered by the markup percentage established above. Small tools shall be defined as tools and equipment (power or non-power) with an individual purchase cost of less than \$750.

- j. Deduct Change Orders and Net Deduct Changes. The application of the markup percentages referenced above will apply to both additive and deductive change orders. In the case of a deductive change order, the credit will be computed by applying the sliding scale percentages as outlined above so that a deductive change order would be computed in the same manner as an additive change order. In those instances where a change involves both additive and deductive work, the additions and deductions will be netted and the markup percentage adjustments will be applied to the net amount.
 - k. Contingency. In no event will any lump sum or percentage amounts for "contingency" be allowed to be added as a separate line item in change order estimates. Unknowns attributable to labor hours will be accounted for when estimating labor hours anticipated performing the work. Unknowns attributable to material scrap and waste will be estimated as part of material costs.
 - l. Insurance and Bonds. In the event the Contractor has been required to furnish insurance and/or bonds as part of the base contract price, a final contract change order will be processed to account for the Contractor's net increase or decrease in insurance costs and/or bond premium costs associated with change orders to Contractor's base Contract Price
4. Time and Materials Change Orders.
- a. General. The term Time and Materials means the sum of all costs reasonably and necessarily incurred and paid by Contractor for labor, materials, and equipment in the proper performance of Additional Work. Except as otherwise may be agreed to in writing by the DISTRICT, such costs shall be in amounts no higher than those prevailing in the locality of the Project, and shall include only the following items.
 - b. Timely and Final Documentation.
 - i. T&M Daily Sheets. Contractor must submit timesheets, materials invoices, records of equipment hours, and records of rental equipment hours to the DISTRICT's Representative for an approval signature **each day** Additional Work is performed. Failure to get the DISTRICT's Representative's approval signature each Day shall result in a waiver of Contractor's right to claim these costs. The DISTRICT's Representative's signature on time sheets only serves as verification that the Work was performed and is not indicative of DISTRICT's agreement to Contractor's entitlement to the cost.
 - ii. T&M Daily Summary Sheets. All documentation of incurred costs ("T&M Daily Summary Sheets") shall be submitted by Contractor within **three (3) Days** of incurring the cost for labor, material, equipment, and special services as Additional Work is performed. Contractor's actual costs shall be presented in a summary table in an electronic spreadsheet file by labor, material, equipment, and special services. Each T&M Daily Summary Sheet shall include Contractor's actual costs incurred for the Additional Work performed that day and a cumulative total of Contractor's actual costs incurred for the Additional Work. Contractor's failure to provide a T&M Daily Summary Sheet showing a total cost summary within three (3) Days

but within five (5) Days of performance of the Work will result in the Contractor's otherwise allowable overhead and profit being reduced by 50% for that portion of Additional Work which was not documented in a timely manner. Contractor's failure to submit the T&M Daily Summary Sheet within five (5) Days of performance of the Work will result in a total waiver of Contractor's right to claim these costs.

- iii. T&M Total Cost Summary Sheet. Contractor shall submit a T&M Total Cost Summary Sheet, which shall include total actual costs, within **seven (7) Days** following completion of DISTRICT approved Additional Work. Contractor's total actual cost shall be presented in a summary table in an electronic spreadsheet file by labor, material, equipment, and special services. Contractor's failure to submit the T&M Total Cost Summary Sheet within seven (7) Days of completion of the Additional Work will result in Contractor's waiver for any reimbursement of any costs associated with the T&M Summary Sheets or the performance of the Additional Work.
- c. Labor. The Contractor will be paid the cost of labor for the workers used in the actual and direct performance of the Work. The cost of labor will be the sum of the actual wages paid (which shall include any employer payments to or on behalf of the workers for health and welfare, pension, vacation, and similar purposes) substantiated by timesheets and certified payroll for wages prevailing for each craft or type of workers performing the Additional Work at the time the Additional Work is done, and the labor surcharge set forth in the Department of Transportation publication entitled *Labor Surcharge and Equipment Rental Rates*, which is in effect on the date upon which the Work is accomplished and which is a part of the Contract. The labor surcharge shall constitute full compensation for all payments imposed by Federal, State, or local laws and for all other payments made to, or on behalf of, the workers, other than actual wages.
 - i. Equipment Operator Exception. Labor costs for equipment operators and helpers shall be paid only when such costs are not included in the invoice for equipment rental.
 - ii. Foreman Exception. The labor costs for foremen shall be proportioned to all of their assigned work and only that applicable to the Additional Work shall be paid. Indirect labor costs, including, without limitation, the superintendent, project manager, and other labor identified in the Contract Documents will be considered Overhead.
- d. Materials. The cost of materials reported shall be itemized at invoice or lowest current price at which materials are locally available and delivered to the Project site in the quantities involved, plus the cost of sales tax, freight, delivery, and storage.
 - i. Trade discounts available to the purchaser shall be credited to the DISTRICT notwithstanding the fact that such discounts may not have been taken by Contractor.

- ii. For materials secured by other than a direct purchase and direct billing to the purchaser, the cost shall be deemed to be the price paid to the actual supplier as determined by the DISTRICT's Representative.
 - iii. Payment for materials from sources owned wholly or in part by the purchaser shall not exceed the price paid by the purchaser for similar materials from said sources on Additional Work items or the current wholesale price for such materials delivered to the Project site, whichever price is lower.
 - iv. If, in the opinion of the DISTRICT's Representative, the cost of materials is excessive, or Contractor does not furnish satisfactory evidence of the cost of such materials, then the cost shall be deemed to be the lowest current wholesale price for the total quantity concerned delivered to the Project site less trade discounts.
 - v. The DISTRICT reserves the right to furnish materials for the Additional Work and no Claim shall be allowed by Contractor for costs of such materials or Indirect Costs or profit on DISTRICT furnished materials.
- e. Equipment.
- i. Rental Time. The rental time to be paid for equipment on the Project site shall be the time the equipment is in productive operation on the Additional Work being performed and, in addition, shall include the time required to move the equipment to the location of the Additional Work and return it to the original location or to another location requiring no more time than that required to return it to its original location; except that moving time will not be paid if the equipment is used on other than the Additional Work, even though located at the site of the Additional Work.
 - (a) Rental Time Not Allowed. Rental time will not be allowed while equipment is inoperative due to breakdowns.
 - (b) Computation Method. The following shall be used in computing the rental time of equipment on the Project site.
 - (i) When hourly rates are paid, any part of an hour less than 30 minutes of operation shall be considered to be 1/2-hour of operation, and any part of an hour in excess of 30 minutes will be considered one hour of operation.
 - (ii) When daily rates are paid, any part of a day less than 4 hours operation shall be considered to be 1/2-day of operation, and any part of an hour in excess of 4 hours will be considered one day of operation.
 - ii. Rental Rates. Contractor will be paid for the use of equipment at the lesser of (i) the actual rental rate, or (ii) the rental rate listed for that equipment in the California Department of Transportation publication entitled *Labor Surcharge and Equipment Rental Rates*, which is in effect on the date upon

which the Contract was executed. Such rental rates will be used to compute payments for equipment whether the equipment is under Contractor's control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment shall be the rate (i.e., daily, monthly) resulting in the least total cost to the DISTRICT for the total period of use. If it is deemed necessary by Contractor to use equipment not listed in the publication, an equitable rental rate for the equipment will be established by the DISTRICT's Representative. Contractor may furnish cost data which might assist the DISTRICT's Representative in the establishment of the rental rate.

iii. Contractor-Owned Equipment.

(a) For Contractor-owned equipment, the allowed equipment rental rate will be limited to the monthly equipment rental rate using a utilization rate of 173 hours per month.

(b) For Contractor-owned equipment, the rental time to be paid for equipment on the Site shall be the time the equipment is in productive operation, unless, in the instance of standby time, the equipment could be actively used by Contractor on another project, then DISTRICT shall pay for the entirety of the time the equipment is on Site. It shall be Contractor's burden to demonstrate to the DISTRICT that the equipment could be actively used on another project.

iv. All equipment shall, in the opinion of the DISTRICT's Representative, be in good working condition and suitable for the purpose for which the equipment is to be used.

v. Before construction equipment is used on the Additional Work, Contractor shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the DISTRICT's Representative, in duplicate, a description of the equipment and its identifying number and the scheduled Additional Work activities planned.

vi. Unless otherwise specified, manufacturer's rating and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

f. Special Services. Special work or services are defined as that Additional Work characterized by extraordinary complexity, sophistication, or innovation or a combination of the foregoing attributes which are unique to the construction industry.

i. Invoices for Special Services. When the DISTRICT's Representative and Contractor determine that a special service is required which cannot be performed by the forces of Contractor or those of any of its Subcontractors, the special service may be performed by an entity especially skilled in the Additional Work. Invoices for special services based upon the current fair

market value thereof may be accepted without complete itemization of labor, material, and equipment rental costs, after validation of market values by the DISTRICT's Representative.

- ii. Discount and Allowance. All invoices for special services will be adjusted by deducting all trade discounts offered or available, whether the discounts were taken or not. In lieu of Overhead and Profit specified herein, a total allowance not to exceed fifteen percent (15%) for Overhead and Profit will be added to invoices for Special Services.
 - iii. When the DISTRICT determines, in its sole discretion, that competitive bidding is necessary for certain special services, Contractor shall solicit competitive bids for those special services.
- g. Excluded Costs. The term Time and Material shall not include any of the following costs or any other home or field office overhead costs, all of which are to be considered administrative costs covered by Contractor's allowance for Overhead and Profit.
- i. Overhead Cost. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, timekeepers, clerks, and other personnel employed by Contractor whether at the Site or in Contractor's principal office or any branch office, material yard, or shop for general administration of the Additional Work;
 - ii. Office Expenses. Expenses of Contractor's principal and branch offices;
 - iii. Capital Expenses. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Additional Work and charges against Contractor for delinquent payments;
 - iv. Negligence. Costs due to the negligence of Contractor or any Subcontractor or Supplier, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including without limitation the correction of Defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property;
 - v. Other. Other overhead or general expense costs of any kind and the cost of any item not specifically and expressly included in the Contract Documents;
 - vi. Small Tools. Cost of small tools valued at less than \$1,000 and that remain the property of Contractor;
 - vii. Administrative Costs. Costs associated with the preparation of Change Orders (whether or not ultimately authorized), cost estimates, or the preparation or filing of Claims;

- viii. Anticipated Lost Profits. Expenses of Contractor associated with anticipated lost profits or lost revenues, lost income or earnings, lost interest on earnings, or unpaid retention;
 - ix. Home Office Overhead. Costs derived from the computation of a “home office overhead” rate by application of the *Eichleay, Allegheny*, burden fluctuation, or other similar methods;
 - x. Special Consultants and Attorneys. Costs of special consultants or attorneys, whether or not in the direct employ of Contractor, employed for services specifically related to the resolution of a Claim, dispute, or other matter arising out of or relating to the performance of the Additional Work.
- h. Overhead, Profit and Other Charges. The mark-up for overhead (including supervision) and profit on work added to the Contract shall be according to the following:
- i. “Net Cost” is defined as consisting of costs of labor, materials, and tools and equipment only excluding overhead and profit. The costs of applicable insurance and bond premium will be reimbursed to the Contractor and subcontractors at cost only, without mark-up. Contractor shall provide DISTRICT with documentation of the costs, including, but not limited to, payroll records, invoices, and such other information as DISTRICT may reasonably request.
 - ii. For Work performed by the Contractor’s forces, the added cost for overhead and profit shall not exceed fifteen percent (15%) of the Net Cost of the Work.
 - iii. For Work performed by a subcontractor, the added cost for overhead and profit shall not exceed fifteen percent (15%) of the subcontractor’s Net Cost of the Work to which the Contractor may add five percent (5%) of the subcontractor’s Net Cost.
 - iv. For Work performed by a sub-subcontractor, the added cost for overhead and profit shall not exceed fifteen percent (15%) of the sub-subcontractor’s Net Cost for Work to which the subcontractor and general contractor may each add an additional five percent (5%) of the Net Cost of the lower tier subcontractor.
 - v. No additional mark-up will be allowed for lower tier subcontractors, and in no case shall the added cost for overhead and profit payable by DISTRICT exceed twenty-five percent (25%) of the Net Cost as defined herein, of the party that performs the Work.
5. All of the following costs are included in the markups for overhead and profit described above, and Contractor shall not receive any additional compensation for: Submittals, drawings, field drawings, Shop Drawings, including submissions of drawings; field inspection; General Superintendence; General administration and preparation of cost proposals, schedule analysis, Change Orders, and other supporting documentation; computer services; reproduction services; Salaries of

project engineer, superintendent, timekeeper, storekeeper, and secretaries; Janitorial services; Small tools, incidentals and consumables; Temporary On-Site facilities (Offices, Telephones, High Speed Internet Access, Plumbing, Electrical Power, Lighting; Platforms, Fencing, Water), Jobsite and Home office overhead or other expenses; vehicles and fuel used for work otherwise included in the Contract Documents; Surveying; Estimating; Protection of Work; Handling and disposal fees; Final Cleanup; Other Incidental Work; Related Warranties; insurance and bond premiums.

6. For added or deducted Work by subcontractors, the Contractor shall furnish to the DISTRICT the subcontractor's signed detailed record of the cost of labor, material and equipment, including the subcontractor markup for overhead and profit. The same requirement shall apply to sub-subcontractors
7. For added or deducted work furnished by a vendor or supplier, the Contractor shall furnish to the DISTRICT a detailed record of the cost to the Contractor, signed by such vendor or supplier.
8. Any change in the Work involving both additions and deletions shall indicate a net total cost, including subcontracts and materials. Allowance for overhead and profit, as specified herein, shall be applied if the net total cost is an increase in the Contract Price; overhead and profit allowances shall not be applied if the net total cost is a deduction to the Contract Price. The estimated cost of deductions shall be based on labor and material prices on the date the Contract was executed.
9. Contractor shall not reserve a right to assert impact costs, extended job site costs, extended overhead, constructive acceleration and/or actual acceleration beyond what is stated in the Change Order for Work. No claims shall be allowed for impact, extended overhead costs, constructive acceleration and/or actual acceleration due to a multiplicity of changes and/or clarifications. The Contractor may not change or modify the DISTRICT's change order form in an attempt to reserve additional rights.
10. If the DISTRICT disagrees with the proposal submitted by Contractor, it will notify the Contractor and the DISTRICT will provide its opinion of the appropriate price and/or time extension. If the Contractor agrees with the DISTRICT, a Change Order will be issued by the DISTRICT. If no agreement can be reached, the DISTRICT shall have the right to issue a unilateral Change Order setting forth its determination of the reasonable additions or savings in costs and time attributable to the extra or deleted work. Such determination shall become final and binding if the Contractor fails to submit a claim in writing to the DISTRICT within fifteen (15) Days of the issuance of the unilateral Change Order, disputing the terms of the unilateral Change Order, and providing such supporting documentation for its position as the DISTRICT may require.

C. Change of Contract Times.

1. The Contract Times may only be changed by a Change Order.
2. All changes in the Contract Price and/or adjustments to the Contract Times related to each change shall be included in Contractor's COR pursuant to this Article. No

cost or time will be allowed for cumulative effects of multiple changes. All Change Orders must state that the Contract Time is not changed or is either increased or decreased by a specific number of days. Failure to include a change to time shall waive any change to the time unless the parties mutually agree in writing to postpone a determination of the change to time resulting from the Change Order.

3. Notice of the amount of the request for adjustment in the Contract Times with supporting data shall be delivered within seven (7) Days after such start of occurrence, unless DISTRICT's Representative allows an additional period of time to ascertain more accurate data in support of the request. No extension of time or additional compensation shall be given for a delay if the Contractor failed to give notice in the manner and within the time prescribed.
4. DISTRICT may elect, at DISTRICT's sole discretion, to grant an extension in Contract Times, without Contractor's request, because of delays or other factors.
5. Use of Float and Critical Path.
 - a. Float is for the benefit of the Project. Float shall not be considered for the exclusive use or benefit of either the DISTRICT or the Contractor.
 - b. Contractor shall not be entitled to compensation, and DISTRICT will not compensate Contractor, for delays which impact early completion. Any difference in time between the Contractor's early completion and the Contract Time shall be considered a part of the Project float.
6. Contractor's entitlement to an extension of the Contract Times is limited to a DISTRICT-caused extension of the critical path, reduced by the Contractor's concurrent delays, and established by a proper time impact analysis. No time extension shall be allowed unless, and then only to the extent that, the DISTRICT-caused delay extends the critical path beyond the previously approved Contract Time. If approved, the increase in time required to complete the Work shall be added to the Contract Time.
 - a. Contractor shall not be entitled to an adjustment in the Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.
 - b. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions (as determined by the DISTRICT), Acts of God, acts or failures to act of utility owners not under the control of DISTRICT, or other causes not the fault of and beyond control of DISTRICT and Contractor, then Contractor shall be entitled to an time extension when the Work stopped is on the critical path. Such a non-compensable adjustment shall be Contractor's sole and exclusive remedy for such delays. Contractor must submit a timely request in accordance with the requirements of this Article.
 - c. Utility-Related Delays.

- i. Contractor shall immediately notify in writing the utility owner and DISTRICT's Representative of its construction schedule and any subsequent changes in the construction schedule which will affect the time available for protection, removal, or relocation of utilities. Requests for extensions of time arising out of utility relocation or repair delays shall be filed in accordance with this Article.
 - ii. Contractor shall not be entitled to damages or additional payment for delays attributable to utility relocations or alterations if correctly located, as noted in the Contract Documents or by the Underground Service Alert survey.
- 7. Content for Requests for Contract Extension. Contractor's justification for entitlement shall be clear and complete citing specific Contract Document references and reasons on which Contractor's entitlement is based. At a minimum, each request for a time extension must include:
 - a. Each request for an extension of Contract Time must identify the impacting event, in narrative form, providing a description of the delay event and sufficient justification as to why the Contractor is entitled to a time extension. Contractor must demonstrate that the delay arises from unforeseeable causes beyond the control and without the fault or negligence of both Contractor and any Subcontractors or Suppliers, or any other persons or organizations employed by any of them or for whose acts any of them may be liable, and that such causes in fact lead to performance or completion of the Work, or specified part in question, beyond the corresponding Contract Times, despite Contractor's reasonable and diligent actions to guard against those effects.
 - b. Each request for an extension of Contract Time must include a time impact analysis in CPM format, using the Contemporaneous Impacted As-Planned Schedule Analysis to calculate the impact of the delay event.
- 8. No Damages for Reasonable Delay.
 - a. DISTRICT's liability to Contractor for delays for which DISTRICT is responsible shall be limited to only an extension of time unless such delays were unreasonable under the circumstances. In no case shall DISTRICT be liable for any costs which are borne by the Contractor in the regular course of business, including, but not limited to, home office overhead and other ongoing costs.
 - b. Damages caused by unreasonable DISTRICT delay that impact the critical path, including delays caused by items that are the responsibility of the DISTRICT pursuant to Government Code section 4215, shall be compensated at the Daily Rate established in the Special Conditions. No other calculations, proportions or formulas shall be used to calculate any delay damages.
 - c. DISTRICT and DISTRICT's Representative, and the officers, members, partners, employees, agents, consultants, or subcontractors of each of them, shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects,

attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

9. Contractor's failure, neglect, or refusal to comply with the requirements of the Contract Documents, or any portion thereof, shall bar Contractor's request for extensions of the Contract Times. Such failure, neglect, or refusal prejudices DISTRICT's and DISTRICT's Representative's ability to recognize and mitigate delay, and such failure, neglect, or refusal prevent the timely analysis of requests for extensions of Contract Times, and whether such extensions may be warranted. Contractor hereby waives all rights to extensions of Contract Times due to delays or accelerations that result from or occur during periods of time for which Contractor fails, neglects, or refuses to fully comply with the requirements of this Article.

ARTICLE 45. FINAL ACCEPTANCE AND PAYMENT

- A. The acceptance of the Work on behalf of the DISTRICT will be made by the Engineer. Such acceptance by the DISTRICT shall not constitute a waiver of defects. When the Work has been accepted there shall be paid to Contractor a sum equal to the contract price less any amounts previously paid Contractor and less any amounts withheld by the DISTRICT from Contractor under the terms of the contract. The final five percent (5%), or the percentage specified in the notice inviting bids where the DISTRICT has adopted a finding of substantially complete, shall not become due and payable until five (5) calendar days shall have elapsed after the expiration of the period within which all claims may be filed under the provisions of Civil Code section 9356. If the Contractor has placed securities with the DISTRICT as described herein, the Contractor shall be paid a sum equal to one hundred percent (100%) of the contract price less any amounts due the DISTRICT under the terms of the Contract.
- B. Unless Contractor advises the DISTRICT in writing prior to acceptance of the final five percent (5%) or the percentage specified in the notice inviting bids where the DISTRICT has adopted a finding of substantially complete, or the return of securities held as described herein, said acceptance shall operate as a release to the DISTRICT of all claims and all liability to Contractor for all things done or furnished in connection with this work and for every act of negligence of the DISTRICT and for all other claims relating to or arising out of this work. If Contractor advises the DISTRICT in writing prior to acceptance of final payment or return of the securities that there is a dispute regarding the amount due the Contractor, the DISTRICT may pay the undisputed amount contingent upon the Contractor furnishing a release of all undisputed claims against the DISTRICT with the disputed claims in stated amounts being specifically excluded by Contractor from the operation of the release. No payments, however, final or otherwise, shall operate to release Contractor or its sureties from the Faithful Performance Bond, Labor and Material Payment Bond, or from any other obligation under this contract.
- C. In case of suspension of the contract any unpaid balance shall be and become the sole and absolute property of the DISTRICT to the extent necessary to repay the DISTRICT any excess in the cost of the Work above the contract price.

- D. Final payment shall be made no later than 60 days after the date of acceptance of the Work by the DISTRICT or the date of occupation, beneficial use and enjoyment of the Work by the DISTRICT including any operation only for testing, start-up or commissioning accompanied by cessation of labor on the Work, provided that a release of liens and claims has been received from the Contractor pursuant to Civil Code section 8136. In the event of a dispute between the DISTRICT and the Contractor, the DISTRICT may withhold from the final payment an amount not to exceed 150% of the disputed amount.
- E. Within ten (10) calendar days from the time that all or any portion of the retention proceeds are received by Contractor, Contractor shall pay each of its subcontractors from whom retention has been withheld each subcontractor's share of the retention received. However, if a retention payment received by Contractor is specifically designated for a particular subcontractor, payment of the retention shall be made to the designated subcontractor if the payment is consistent with the terms of the subcontract.

ARTICLE 46. OCCUPANCY

The DISTRICT reserves the right to occupy or utilize any portion of the Work at any time before completion, and such occupancy or use shall not constitute acceptance of any part of Work covered by this Contract. This use shall not relieve the Contractor of its responsibilities under the Contract.

ARTICLE 47. INDEMNIFICATION

To the fullest extent permitted by law, Contractor shall immediately defend (with counsel of the DISTRICT's choosing), indemnify and hold harmless the DISTRICT, officials, officers, agents, employees, and representatives, and each of them from and against:

- A. Any and all claims, demands, causes of action, costs, expenses, injuries, losses or liabilities, in law or in equity, of every kind or nature whatsoever, but not limited to, injury to or death, including wrongful death, of any person, and damages to or destruction of property of any person, arising out of, related to, or in any manner directly or indirectly connected with the Work or this Contract, including claims made by subcontractors for nonpayment, including without limitation the payment of all consequential damages and attorney's fees and other related costs and expenses, however caused, regardless of whether the allegations are false, fraudulent, or groundless, and regardless of any negligence of the DISTRICT or its officers, employees, or authorized volunteers (including passive negligence), except the sole negligence or willful misconduct or active negligence of the DISTRICT or its officials, officers, employees, or authorized volunteers.
- B. Contractor's defense and indemnity obligation herein includes, but is not limited to damages, fines, penalties, attorney's fees and costs arising from claims under the Americans with Disabilities Act (ADA) or other federal or state disability access or discrimination laws arising from Contractor's Work during the course of construction of the improvements or after the Work is complete, as the result of defects or negligence in Contractor's construction of the improvements.

- C. Any and all actions, proceedings, damages, costs, expenses, fines, penalties or liabilities, in law or equity, of every kind or nature whatsoever, arising out of, resulting from, or on account of the violation of any governmental law or regulation, compliance with which is the responsibility of Contractor;
- D. Any and all losses, expenses, damages (including damages to the Work itself), attorney's fees, and other costs, including all costs of defense which any of them may incur with respect to the failure, neglect, or refusal of Contractor to faithfully perform the Work and all of Contractor's obligations under the agreement. Such costs, expenses, and damages shall include all costs, including attorney's fees, incurred by the indemnified parties in any lawsuit to which they are a party.

Contractor shall immediately defend, at Contractor's own cost, expense and risk, with the DISTRICT Council's choosing, any and all such aforesaid suits, actions or other legal proceedings of every kind that may be brought or instituted against the DISTRICT, its officials, officers, agents, employees and representatives. Contractor shall pay and satisfy any judgment, award or decree that may be rendered against the DISTRICT, its officials, officers, employees, agents, employees and representatives, in any such suit, action or other legal proceeding. Contractor shall reimburse the DISTRICT, its officials, officers, agents, employees and representatives for any and all legal expenses and costs incurred by each of them in connection therewith or in enforcing the indemnity herein provided. The only limitations on this provision shall be those imposed by Civil Code section 2782.

ARTICLE 48. PROCEDURE FOR RESOLVING DISPUTES

Contractor shall timely comply with all notices and requests for changes to the Contract Time or Contract Price, including but not limited to all requirements of Article 44, Changes and Extra Work, as a prerequisite to filing any claim governed by this Article. The failure to timely submit a notice of delay or notice of change, or to timely request a change to the Contract Price or Contract Time, or to timely provide any other notice or request required herein shall constitute a waiver of the right to further pursue the claim under the Contract or at law.

- A. **Intent.** Effective January 1, 1991, Section 20104 et seq., of the California Public Contract Code prescribes a process utilizing informal conferences, non-binding judicial supervised mediation, and judicial arbitration to resolve disputes on construction claims of \$375,000 or less. Effective January 1, 2017, Section 9204 of the Public Contract Code prescribes a process for negotiation and mediation to resolve disputes on construction claims. The intent of this Article is to implement Sections 20104 et seq. and Section 9204 of the California Public Contract Code. This Article shall be construed to be consistent with said statutes.
- B. **Claims.** For purposes of this Article, "Claim" means a separate demand by the Contractor, after a change order duly requested in accordance with Article 44 "Changes and Extra Work" has been denied by the DISTRICT, for (A) a time extension, (B) payment of money or damages arising from Work done by or on behalf of the Contractor pursuant to the Contract, or (C) an amount the payment of which is disputed by the DISTRICT. Claims governed by this Article may not be filed unless and until the Contractor completes all procedures for giving notice of delay or change and for the requesting of a time extension or change order, including but not necessarily limited to the procedures contained in Article 44, Changes and Extra Work, and Contractor's request for a change has been denied in whole or in part. Claims

governed by this Article must be filed no later than the date of final payment. The claim shall be submitted in writing to the DISTRICT and shall include on its first page the following in 16 point capital font: "THIS IS A CLAIM." Furthermore, the claim shall include the documents necessary to substantiate the claim. Nothing herein is intended to extend the time limit or supersede notice requirements otherwise provided by contract for the filing of claims, including all requirements pertaining to compensation or payment for extra Work, disputed Work, and/or changed conditions. Failure to follow such contractual requirements shall bar any claims or subsequent lawsuits for compensation or payment thereon.

C. Supporting Documentation. The Contractor shall submit all claims in the following format:

1. Summary of claim merit and price, reference Contract Document provisions pursuant to which the claim is made
2. List of documents relating to claim:
 - a. Specifications
 - b. Drawings
 - c. Clarifications (Requests for Information)
 - d. Schedules
 - e. Other
3. Chronology of events and correspondence
4. Analysis of claim merit
5. Analysis of claim cost
6. Time impact analysis in CPM format

D. DISTRICT's Response. Upon receipt of a claim pursuant to this Article, DISTRICT shall conduct a reasonable review of the claim and, within a period not to exceed 45 Days, shall provide the Contractor a written statement identifying what portion of the claim is disputed and what portion is undisputed. Any payment due on an undisputed portion of the claim will be processed and made within 60 Days after the DISTRICT issues its written statement.

1. If the DISTRICT needs approval from its governing body to provide the Contractor a written statement identifying the disputed portion and the undisputed portion of the claim, and the DISTRICT's governing body does not meet within the 45 Days or within the mutually agreed to extension of time following receipt of a claim sent by registered mail or certified mail, return receipt requested, the DISTRICT shall have up to three Days following the next duly publicly noticed meeting of the DISTRICT's governing body after the 45-Day period, or extension, expires to

provide the Contractor a written statement identifying the disputed portion and the undisputed portion.

2. Within 30 Days of receipt of a claim, the DISTRICT may request in writing additional documentation supporting the claim or relating to defenses or claims the DISTRICT may have against the Contractor. If additional information is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of DISTRICT and the Contractor. The DISTRICT's written response to the claim, as further documented, shall be submitted to the Contractor within 30 Days (if the claim is less than \$15,000, within 15 Days) after receipt of the further documentation, or within a period of time no greater than that taken by the Contractor in producing the additional information or requested documentation, whichever is greater.
- E. **Meet and Confer.** If the Contractor disputes the DISTRICT's written response, or the DISTRICT fails to respond within the time prescribed, the Contractor may so notify the DISTRICT, in writing, either within 15 Days of receipt of the DISTRICT's response or within 15 Days of the DISTRICT's failure to respond within the time prescribed, respectively, and demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand, the DISTRICT shall schedule a meet and confer conference within 30 Days for settlement of the dispute.
- F. **Mediation.** Within 10 business Days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, the public entity shall provide the Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 Days after the public entity issues its written statement. Any disputed portion of the claim, as identified by the Contractor in writing, shall be submitted to nonbinding mediation, with the public entity and the Contractor sharing the associated costs equally. The public entity and Contractor shall mutually agree to a mediator within 10 business Days after the disputed portion of the claim has been identified in writing, unless the parties agree to select a mediator at a later time.
1. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator.
 2. For purposes of this section, mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this section.
 3. Unless otherwise agreed to by the public entity and the Contractor in writing, the mediation conducted pursuant to this section shall excuse any further obligation under Section 20104.4 to mediate after litigation has been commenced.

4. The mediation shall be held no earlier than the date the Contractor completes the Work or the date that the Contractor last performs Work, whichever is earlier. All unresolved claims shall be considered jointly in a single mediation, unless a new unrelated claim arises after mediation is completed.
- G. Procedures After Mediation.** If following the mediation, the claim or any portion remains in dispute, the Contractor must file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code prior to initiating litigation. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time the Contractor submits his or her written claim pursuant to subdivision (a) until the time the claim is denied, including any period of time utilized by the meet and confer conference.
- H. Civil Actions.** The following procedures are established for all civil actions filed to resolve claims of \$375,000 or less:
1. Within 60 Days, but no earlier than 30 Days, following the filing or responsive pleadings, the court shall submit the matter to non-binding mediation unless waived by mutual stipulation of both parties or unless mediation was held prior to commencement of the action in accordance with Public Contract Code section 9204 and the terms of this Agreement. The mediation process shall provide for the selection within 15 Days by both parties of a disinterested third person as mediator, shall be commenced within 30 Days of the submittal, and shall be concluded within 15 Days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court.
 2. If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1114.11 of that code. The Civil Discovery Act of 1986 (Article 3 (commencing with Section 2016) of Chapter 3 of Title 3 of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration. In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, (A) arbitrators shall, when possible, be experienced in construction law, and (B) any party appealing an arbitration award who does not obtain a more favorable judgment shall, in addition to payment of costs and fees under that chapter, also pay the attorney's fees on appeal of the other party.
- I. Government Code Claims.** In addition to any and all contract requirements pertaining to notices of and requests for compensation or payment for extra Work, disputed Work, construction claims and/or changed conditions, the Contractor must comply with the claim procedures set forth in Government Code Sections 900, et seq. prior to filing any lawsuit against the DISTRICT. Such Government Code claims and any subsequent lawsuit based upon the Government Code claims shall be limited to those matters that remain unresolved after all procedures pertaining to extra Work, disputed Work, construction claims, and/or changed conditions have been followed by Contractor. If no such Government Code claim is submitted, or if the prerequisite contractual requirements are not satisfied, no action against the DISTRICT may be filed. **A Government Code claim must be filed no earlier than the date the Work**

is completed or the date the Contractor last performs Work on the Project, whichever occurs first. A Government Code claim shall be inclusive of all unresolved claims unless a new unrelated claim arises after the Government Code claim is submitted.

- J. **Non-Waiver.** The DISTRICT's failure to respond to a claim from the Contractor within the time periods described in this Article or to otherwise meet the time requirements of this Article shall result in the claim being deemed rejected in its entirety.

ARTICLE 49. DISTRICT'S RIGHT TO TERMINATE CONTRACT

A. Termination for Cause by the DISTRICT:

1. In the sole estimation of the DISTRICT, if the Contractor refuses or fails to prosecute the Work or any separable part thereof with such diligence as will insure its completion within the time specified by the Contract Documents, or any extension thereof, or fails to complete such Work within such time, or if the Contractor should be adjudged a bankrupt, or if it should make a general assignment for the benefit of its creditors, or if a receiver should be appointed on account of its insolvency, or the Contractor or any of its subcontractors should violate any of the provisions of this Contract, the DISTRICT may serve written notice upon the Contractor and its Surety of the DISTRICT's intention to terminate this Contract. This notice of intent to terminate shall contain the reasons for such intention to terminate this Contract, and a statement to the effect that the Contractor's right to perform this Contract shall cease and terminate upon the expiration of ten (10) calendar days unless such violations have ceased and arrangements satisfactory to the DISTRICT have been made for correction of said violations.
2. In the event that the DISTRICT serves such written notice of termination upon the Contractor and the Surety, the Surety shall have the right to take over and perform the Contract. If the Surety does not: (1) give the DISTRICT written notice of Surety's intention to take over and commence performance of the Contract within 15 calendar days of the DISTRICT's service of said notice of intent to terminate upon Surety; and (2) actually commence performance of the Contract within 30 calendar days of the DISTRICT's service of said notice upon Surety; then the DISTRICT may take over the Work and prosecute the same to completion by separate contract or by any other method it may deem advisable for the account and at the expense of the Contractor.
3. In the event that the DISTRICT elects to obtain an alternative performance of the Contract as specified above: (1) the DISTRICT may, without liability for so doing, take possession of and utilize in completion of the Work such materials, appliances, plants and other property belonging to the Contractor that are on the site and reasonably necessary for such completion (A special lien to secure the claims of the DISTRICT in the event of such suspension is hereby created against any property of Contractor taken into the possession of the DISTRICT under the terms hereof and such lien may be enforced by sale of such property under the direction of the Board without notice to Contractor. The proceeds of the sale after deducting all expenses thereof and connected therewith shall be credited to Contractor. If the net credits shall be in excess of the claims of the DISTRICT

against Contractor, the balance will be paid to Contractor or Contractor's legal representatives.); and (2) Surety shall be liable to the DISTRICT for any cost or other damage to the DISTRICT necessitated by the DISTRICT securing an alternate performance pursuant to this Article.

B. Termination for Convenience by the DISTRICT:

1. The DISTRICT may terminate performance of the Work called for by the Contract Documents in whole or, from time to time, in part, if the DISTRICT determines that a termination is in the DISTRICT's interest.
2. The Contractor shall terminate all or any part of the Work upon delivery to the Contractor of a Notice of Termination specifying that the termination is for the convenience of the DISTRICT, the extent of termination, and the Effective Date of such termination.
3. After receipt of Notice of Termination, and except as directed by the DISTRICT's Representative, the Contractor shall, regardless of any delay in determining or adjusting any amounts due under this Termination for Convenience clause, immediately proceed with the following obligations:
 - a. Stop Work as specified in the Notice.
 - b. Complete any Work specified in the Notice of Termination in a least cost/shortest time manner while still maintaining the quality called for under the Contract Documents.
 - c. Leave the property upon which the Contractor was working and upon which the facility (or facilities) forming the basis of the Contract Document is situated in a safe and sanitary manner such that it does not pose any threat to the public health or safety.
 - d. Terminate all subcontracts to the extent that they relate to the portions of the Work terminated.
 - e. Place no further subcontracts or orders, except as necessary to complete the continued portion of the Contract.
 - f. Submit to the DISTRICT's Representative, within ten (10) calendar days from the Effective Date of the Notice of Termination, all of the usual documentation called for by the Contract Documents to substantiate all costs incurred by the Contractor for labor, materials and equipment through the Effective Date of the Notice of Termination. Any documentation substantiating costs incurred by the Contractor solely as a result of the DISTRICT's exercise of its right to terminate this Contract pursuant to this clause, which costs the contractor is authorized under the Contract documents to incur, shall: (1) be submitted to and received by the Engineer no later than 30 calendar days after the Effective Date of the Notice of Termination; (2) describe the costs incurred with particularity; and (3) be conspicuously identified as "Termination Costs occasioned by the DISTRICT's Termination for Convenience."

4. Termination of the Contract shall not relieve Surety of its obligation for any just claims arising out of or relating to the Work performed.
5. In the event that the DISTRICT exercises its right to terminate this Contract pursuant to this clause, the DISTRICT shall pay the Contractor, upon the Contractor's submission of the documentation required by this clause and other applicable provisions of the Contract Documents, the following amounts:
 - a. All actual reimbursable costs incurred according to the provisions of this Contract.
 - b. A reasonable allowance for profit on the cost of the Work performed, provided Contractor establishes to the satisfaction of the DISTRICT's Representative that it is reasonably probable that Contractor would have made a profit had the Contract been completed and provided further, that the profit allowed shall in no event exceed fifteen (15%) percent of the costs.
 - c. A reasonable allowance for Contractor's administrative costs in determining the amount payable due to termination of the Contract under this Article.
- C. Notwithstanding any other provision of this Article, when immediate action is necessary to protect life and safety or to reduce significant exposure or liability, the DISTRICT may immediately order Contractor to cease Work on the Project until such safety or liability issues are addressed to the satisfaction of the DISTRICT or the Contract is terminated.

ARTICLE 50. WARRANTY AND GUARANTEE OF WORK

- A. Contractor hereby warrants that materials and Work shall be completed in conformance with the Contract Documents and that the materials and Work provided will fulfill the requirements of this Warranty. Contractor hereby agrees to repair or replace, at the discretion of the DISTRICT, any or all Work that may prove to be defective in its workmanship, materials furnished, methods of installation or fail to conform to the Contract Document requirements together with any other Work which may be damaged or displaced by such defect(s) within a period of one (1) year from the date of the Notice of Completion of the Project without any expense whatever to the DISTRICT, ordinary wear and tear and unusual abuse and neglect excepted. The DISTRICT will perform an inspection before the warrant period expires. Contractor shall be required to promptly repair or replace defective equipment or materials, at Contractor's option. All costs associated with such corrective actions and testing, including the removal, replacement, and reinstatement of equipment and materials necessary to gain access, shall be the sole responsibility of the Contractor.
- B. For any Work so corrected, Contractor's obligation hereunder to correct defective Work shall be reinstated for an additional one (1) year period, commencing with the date of acceptance of such corrected Work. The reinstatement of the one (1) year warranty shall apply only to that portion of work that was corrected. Contractor shall perform such tests as DISTRICT may require to verify that any corrective actions, including, without limitation, redesign, repairs, and replacements comply with the requirements of the Contract. In the event of Contractor's failure to comply with the above-mentioned conditions within ten (10) calendar days after being notified in writing

of required repairs, to the reasonable satisfaction of the DISTRICT, the DISTRICT shall have the right to correct and replace any defective or non-conforming Work and any work damaged by such work or the replacement or correction thereof at Contractor's sole expense. Contractor shall be obligated to fully reimburse the DISTRICT for any expenses incurred hereunder immediately upon demand.

- C. In addition to the warranty set forth in this Article, Contractor shall obtain for DISTRICT all warranties that would be given in normal commercial practice and assign to DISTRICT any and all manufacturer's or installer's warranties for equipment or materials not manufactured by Contractor and provided as part of the Work, to the extent that such third-party warranties are assignable and extend beyond the warranty period set forth in this Article. Contractor shall furnish the DISTRICT with all warranty and guarantee documents prior to final Acceptance of the Project by the DISTRICT as required.
- D. When specifically indicated in the Contract Documents or when directed by the Engineer, the DISTRICT may furnish materials or products to the Contractor for installation. In the event any act or failure to act by Contractor shall cause a warranty applicable to any materials or products purchased by the DISTRICT for installation by the Contractor to be voided or reduced, Contractor shall indemnify DISTRICT from and against any cost, expense, or other liability arising therefrom, and shall be responsible to the DISTRICT for the cost of any repairs, replacement or other costs that would have been covered by the warranty but for such act or failure to act by Contractor.
- E. The Contractor shall remedy at its expense any damage to DISTRICT-owned or controlled real or personal property.
- F. The DISTRICT shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage. The Contractor shall within ten (10) calendar days after being notified commence and perform with due diligence all necessary Work. If the Contractor fails to promptly remedy any defect, or damage; the DISTRICT shall have the right to replace, repair or otherwise remedy the defect, or damage at the Contractor's expense.
- G. In the event of any emergency constituting an immediate hazard to health, safety, property, or licensees, when caused by Work of the Contractor not in accordance with the Contract requirements, the DISTRICT may undertake at Contractor's expense, and without prior notice, all Work necessary to correct such condition.
- H. Acceptance of Defective Work.
 - 1. If, instead of requiring correction or removal and replacement of Defective Work, the DISTRICT prefers to accept it, DISTRICT may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to DISTRICT's evaluation of and determination to accept such Defective Work and for the diminished value of the Work.

2. If any acceptance of defective work occurs prior to release of the Project Retention, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and DISTRICT shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work and all costs incurred by DISTRICT.
 3. If the Project Retention is held in an escrow account as permitted by the Contract Documents, Contractor will promptly alert the escrow holder, in writing, of the amount of Retention to be paid to DISTRICT.
 4. If the acceptance of Defective Work occurs after release of the Project Retention, an appropriate amount will be paid by Contractor to DISTRICT.
- I. DISTRICT May Correct Defective Work.
1. If Contractor fails within a reasonable time after written notice from DISTRICT's Representative to correct Defective Work, or to remove and replace rejected Work as required by DISTRICT, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, DISTRICT may, after seven (7) Days' written notice to Contractor, correct, or remedy any such deficiency.
 2. In connection with such corrective or remedial action, DISTRICT may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which DISTRICT has paid Contractor but which are stored elsewhere. Contractor shall allow DISTRICT and DISTRICT's Representative, and the agents, employees, other contractors, and consultants of each of them, access to the Site to enable DISTRICT to exercise the rights and remedies to correct the Defective Work.
 3. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by DISTRICT correcting the Defective Work will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions into the Contract Documents with respect to the Work; and DISTRICT shall be entitled to an appropriate decrease in the Contract Price.
 4. Such claims, costs, losses and damages will include, but not be limited to, all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Defective Work.
 5. If the Change Order is executed after all payments under the Contract have been paid by DISTRICT and the Project Retention is held in an escrow account as permitted by the Contract Documents, Contractor will promptly alert the escrow holder, in writing, of the amount of Retention to be paid to DISTRICT.
 6. If the Change Order is executed after release of the Project Retention, an appropriate amount will be paid by Contractor to DISTRICT.

7. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to DISTRICT correcting Defective work.
- J. Nothing in the Warranty or in the Contract Documents shall be construed to limit the rights and remedies available to DISTRICT at law or in equity, including, but not limited to, Code of Civil Procedure section 337.15.

ARTICLE 51. DOCUMENT RETENTION & EXAMINATION

- A. In accordance with Government Code section 8546.7, records of both the DISTRICT and the Contractor shall be subject to examination and audit by the State Auditor General for a period of three (3) years after final payment.
- B. Contractor shall make available to the DISTRICT any of the Contractor's other documents related to the Project immediately upon request of the DISTRICT.
- C. In addition to the State Auditor rights above, the DISTRICT shall have the right to examine and audit all books, estimates, records, contracts, documents, bid documents, subcontracts, and other data of the Contractor (including computations and projections) related to negotiating, pricing, or performing the modification in order to evaluate the accuracy and completeness of the cost or pricing data at no additional cost to the DISTRICT, for a period of four (4) years after final payment.

ARTICLE 52. SEPARATE CONTRACTS

- A. The DISTRICT reserves the right to let other contracts in connection with this Work or on the Project site. Contractor shall permit other contractors reasonable access and storage of their materials and execution of their work and shall properly connect and coordinate its Work with theirs.
- B. To ensure proper execution of its subsequent Work, Contractor shall immediately inspect work already in place and shall at once report to the Engineer any problems with the Work in place or discrepancies with the Contract Documents.
- C. Contractor shall ascertain to its own satisfaction the scope of the Project and nature of any other contracts that have been or may be awarded by the DISTRICT in prosecution of the Project to the end that Contractor may perform this Contract in the light of such other contracts, if any. Nothing herein contained shall be interpreted as granting to Contractor exclusive occupancy at site of the Project. Contractor shall not cause any unnecessary hindrance or delay to any other contractor working on the Project. If simultaneous execution of any contract for the Project is likely to cause interference with performance of some other contract or contracts, the Engineer shall decide which Contractor shall cease Work temporarily and which contractor shall continue or whether work can be coordinated so that contractors may proceed simultaneously. The DISTRICT shall not be responsible for any damages suffered or for extra costs incurred by Contractor resulting directly or indirectly from award, performance, or attempted performance of any other contract or contracts on the Project site.

ARTICLE 53. NOTICE AND SERVICE THEREOF

All notices shall be in writing and either served by personal delivery or mailed to the other party as designated in the Bid Forms. Written notice to the Contractor shall be addressed to Contractor's principal place of business unless Contractor designates another address in writing for service of notice. Notice to DISTRICT shall be addressed to the DISTRICT as designated in the Notice Inviting Bids unless DISTRICT designates another address in writing for service of notice. Notice shall be effective upon receipt or five (5) calendar days after being sent by first class mail, whichever is earlier. Notice given by facsimile shall not be effective unless acknowledged in writing by the receiving party.

ARTICLE 54. NOTICE OF THIRD PARTY CLAIMS

Pursuant to Public Contract Code section 9201, the DISTRICT shall provide the Contractor with timely notification of the receipt of any third-party claims relating to the Contract. The DISTRICT is entitled to recover reasonable costs incurred in providing such notification.

ARTICLE 55. STATE LICENSE BOARD NOTICE

Contractors are required by law to be licensed and regulated by the Contractors' State License Board which has jurisdiction to investigate complaints against contractors if a complaint regarding a patent act or omission is filed within four (4) years of the date of the alleged violation. A complaint regarding a latent act or omission pertaining to structural defects must be filed within ten (10) years of the date of the alleged violation. Any questions concerning a contractor may be referred to the Registrar, Contractors' State License Board, P.O. Box 26000, Sacramento, California 95826.

ARTICLE 56. INTEGRATION

- A. **Oral Modifications Ineffective.** No oral order, objection, direction, claim or notice by any party or person shall affect or modify any of the terms or obligations contained in the Contract Documents.
- B. **Contract Documents Represent Entire Contract.** The Contract Documents represent the entire agreement of the DISTRICT and Contractor.

ARTICLE 57. ASSIGNMENT OF CONTRACT

Contractor shall not assign, transfer, convey, sublet or otherwise dispose of the rights or title of interest of any or all of this contract without the prior written consent of the DISTRICT. Any assignment or change of Contractor's name of legal entity without the written consent of the DISTRICT shall be void. Any assignment of money due or to become due under this Contract shall be subject to a prior lien for services rendered or Material supplied for performance of Work called for under the Contract Documents in favor of all persons, firms, or corporations rendering such services or supplying such Materials to the extent that claims are filed pursuant to the Civil Code, the Code of Civil Procedure or the Government Code.

ARTICLE 58. CHANGE IN NAME AND NATURE OF CONTRACTOR'S LEGAL ENTITY

Should a change be contemplated in the name or nature of the Contractor's legal entity, the Contractor shall first notify the DISTRICT in order that proper steps may be taken to have the

change reflected on the Contract and all related documents. No change of Contractor's name or nature will affect DISTRICT's rights under the Contract, including but not limited to the bonds.

ARTICLE 59. ASSIGNMENT OF ANTITRUST ACTIONS

Pursuant to Public Contract Code section 7103.5, in entering into a public works contract or subcontract to supply goods, services, or materials pursuant to a public works contract, Contractor or subcontractor offers and agrees to assign to the DISTRICT all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 USC, Section 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from the purchase of goods, services, or materials pursuant to this contract or any subcontract. This assignment shall be made and become effective at the time the DISTRICT tenders final payment to the Contractor, without further acknowledgment by the parties.

ARTICLE 60. PROHIBITED INTERESTS

No DISTRICT official or representative who is authorized in such capacity and on behalf of the DISTRICT to negotiate, supervise, make, accept, or approve, or to take part in negotiating, supervising, making, accepting or approving any engineering, inspection, construction or material supply contract or any subcontract in connection with construction of the project, shall be or become directly or indirectly interested financially in the Contract.

ARTICLE 61. CONTROLLING LAW

Notwithstanding any subcontract or other contract with any subcontractor, supplier, or other person or organization performing any part of the Work, this Contract shall be governed by the law of the State of California excluding any choice of law provisions.

ARTICLE 62. JURISDICTION; VENUE

Contractor and any subcontractor, supplier, or other person or organization performing any part of the Work agrees that any action or suits at law or in equity arising out of or related to the bidding, award, or performance of the Work shall be maintained in the Superior Court of San Diego County, California, and expressly consent to the jurisdiction of said court, regardless of residence or domicile, and agree that said court shall be a proper venue for any such action.

ARTICLE 63. LAWS AND REGULATIONS

- A. Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on conduct of work as indicated and specified. If Contractor observes that drawings and specifications are at variance therewith, it shall promptly notify the Engineer in writing and any necessary changes shall be adjusted as provided for in this Contract for changes in work. If Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, it shall bear all costs arising therefrom.
- B. Contractor shall be responsible for familiarity with the Americans with Disabilities Act ("ADA") (42 U.S.C. § 12101 et seq.). The Work will be performed in compliance with ADA regulations.

ARTICLE 64. PATENTS

Contractor shall hold and save the DISTRICT, officials, officers, employees, and authorized volunteers harmless from liability of any nature or kind of claim therefrom including costs and expenses for or on account of any patented or unpatented invention, article or appliance manufactured, furnished or used by Contractor in the performance of this contract.

ARTICLE 65. OWNERSHIP OF CONTRACT DOCUMENTS

All Contract Documents furnished by the DISTRICT are DISTRICT property. They are not to be used by Contractor or any subcontractor on other work nor shall Contractor claim any right to such documents. With exception of one complete set of Contract Documents, all documents shall be returned to the DISTRICT on request at completion of the Work.

ARTICLE 66. NOTICE OF TAXABLE POSSESSORY INTEREST

In accordance with Revenue and Taxation Code section 107.6, the Contract Documents may create a possessory interest subject to personal property taxation for which Contractor will be responsible.

ARTICLE 67. SURVIVAL OF OBLIGATIONS

All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

00 73 13 – SPECIAL CONDITIONS

1.1 Engineer of Record.

- A. For purposes of this Project, the Engineer of Record or Engineer shall be: Derek Reed, PE, Dudek, and the Professional Geologist (PG) and Certified Hydrogeologist (CHG) of record shall be Trey Driscoll, PG, CHG.

1.2 Location of the Project.

- A. The Project is located at the existing Well ID4-4 location for the first well and a location to be determined by the District for the second well, if awarded as alternate bid items.

1.3 Construction Area Signs.

- A. The Contractor shall furnish, install, maintain and remove all construction area signs in conformance with the plans and Sections 12-3.06 of the State of California Department of Transportation (Caltrans) Standard Specifications, latest edition.

1.4 Dust Control

- A. Dust control shall be performed in accordance with Subsection 7-8.1, "Clean up and Dust Control," of the Standard Specifications, San Diego County Air Pollution Control District (APCD) Rules, the General Conditions and the following provision.

Dust resulting from the Contractor's performance of the work, either inside or outside, the right-of-way shall be controlled by the Contractor. Dust control includes the action necessary to prevent, reduce or control dust within the work area as required to complete the work. The Contractor shall carry out proper and efficient measures to prevent his operations from producing dust in amounts damaging to property or causing a nuisance or harm to persons living nearby or occupying buildings in the vicinity of the work. The Contractor shall control dust twenty-four (24) hours a day, seven (7) days a week. The methods to be used for controlling dust in the construction area and along haul roads shall be approved by the Engineer prior to starting any work.

Dust or dirt accumulations generated by the Contractor's operations shall be cleaned and removed by the Contractor from all areas as designated by the Engineer. The cost for cleaning and removal of dust or dirt shall be at the Contractor's expense and no additional compensation will be made therefore.

Water for use in dust control shall, at the option of the Contractor, be potable or non-potable. Non-potable water shall consist of reclaimed waste water or non-potable water developed from other sources.

If the Contractor uses reclaimed waste water in the work, the sources and discharge of reclaimed waste water shall meet the California Department of Health Services Water Reclamation Criteria and the Regional Water Quality Control Board requirements. The Contractor shall obtain either a waste water discharge permit or a

waiver from the Regional Water Quality Control Board. Copies of permits or waivers from the Regional Water Quality Control Board shall be delivered to the engineer before using reclaimed waste water in the work.

Water shall be applied in the amounts, at the locations, and for the purposes designated in the Special Provision and these Specifications, and as order by the Engineer.

Water for compacting embankment material, sub-base, base and surfacing material and for laying dust, shall be applied by means of pressure-type distributors or pipe lines equipped with a spray system or hoses with nozzles that will ensure a uniform application of water.

All equipment used for the application of water shall be equipped with a positive means of shut-off.

Unless otherwise permitted by the Engineer or unless all the water is applied by means of pipe lines, at least one mobile unit with a minimum capacity of 3700 L (1,000 gallons) shall be available for applying water on the project at all times.

Chemical additives or binder may be used in water for compaction or dust palliative. If such additives are used, furnishing and applying the additives shall be at the Contractor's expense.

The right is reserved by the Engineer to prohibit the use of a particular type of additive, to designate the locations where a particular type of additive may not be used, or to limit the amount of a particular type of additive to be used at certain locations, all if the Engineer has reasonable ground for believing that such use will in any way be detrimental.

The additive or binder shall be either miscible in water or be some form of material that is directly applied to the surface without mixing with water.

Additives or binders that are miscible in water shall be either a resin emulsion, an SS1 type asphaltic emulsion, materials composed essentially of lignin sulfonate or any other binder that is miscible in water in the proportions provided herein is non-corrosive, and is effective as a dust palliative.

Resin emulsion shall be composed of from fifty-seven percent (57%) to sixty-three percent (63%) of semi-liquid petroleum resin and the remainder water to which a suitable emulsifying agent has been added. The resin emulsion shall be readily miscible with water and when diluted with any hard water in the proportions of one (1) part of emulsion to ten (10) parts water shall show no signs of breakdown or separation of the petroleum resin base. Resin emulsion, which has been stored in closed containers at temperatures above freezing for a period up to three (3) months shall show no signs of separation. Any resin emulsion which has been stored for more than three (3) months shall not be used until tested and approved.

SS1 type asphaltic emulsion shall conform to the provisions in Subsection 203-3, "Emulsified Asphalt."

Additives or binders that are miscible in water shall be mixed with additional water at the rate of from four (4) to nineteen (19) parts of water to one (1) part of binder, the exact rate to be determined by the Engineer. Mixing shall be accomplished by placing the binder and water in the spreading equipment simultaneously or by some other mixing method that will produce equivalent results.

The resulting mixture shall be applied with pressure type water distributor trucks equipped with a spray system or pressure type asphalt distributors at an approximate rate of from 0.9- to 3.6 L/m². (0.2 to 0.8 gallon on per square yard)

Additives or binders that are directly applied to the surface without mixing with water shall be applied with equipment approved by the Engineer. The binder shall be applied at a rate of from 0.4- to 1.1L/m². (0.10 to 0.25 gallons per square yard)

The exact rate and number of applications of binders will be determined by the Engineer.

Dust control ordered by the Engineer to be applied on Saturdays, Sundays or holidays will be included in the Contract price for dust control and no additional compensation will be allowed therefore.

No adjustment of compensation will be made for any increase or decrease in the quantity of dust control required, regardless of the reason for such increase or decrease.

The full compensation for all direct and indirect costs incurred for work performed or materials used to control dust resulting from the Contractor's performance of the work and caused by public traffic, either inside or outside the right-of-way shall be considered as included in the Contract prices paid for the various items of work involved and no additional compensation will be allowed therefore.

1.5 Cooperation and Collateral Work

- A. The Contractor shall be responsible for ascertaining the nature and extent of any simultaneous, collateral and essential work by others and coordinating with the work by others. The DISTRICT, other contractors and utilities shall have the right to operate within or adjacent to the work site during the performance of such work.

Should construction be under way by other forces or by other contractors within or adjacent to the limits of the work specified or should work of any other nature be under way by other forces within or adjacent to those limits, the Contractor shall cooperate with all the other contractors or other forces to the end that any delay or hindrance to their work will be avoided. The right is reserved to perform other or additional work at or near the site (including material sources) at any time, by the use of other forces.

Each contractor shall be responsible to the other for all damage to work, to persons or property caused to the other by their operations, and for loss caused the other due to unnecessary delays or failure to finish the work within the time specified for completion.

The Contractor shall include in its proposal all costs involved as a result of coordinating its work with others. The Contractor will not be entitled to additional compensation from the DISTRICT for damages resulting from such simultaneous, collateral and essential work. If necessary to avoid or minimize such damage or delay, the Contractor shall re-deploy its work force to other parts of the work.

Should the Contractor be delayed by the DISTRICT, and such delay could not have been reasonably foreseen or prevented by the Contractor, the Engineer will determine the extent of the delay, the effect on the project and any extension of time. Should any agency or utility company's work result in delays to the Contractor's work schedule, the Contractor shall be entitled only to an equivalent extension of time for the completion of the contract, and shall not be entitled to damages due to downtime and idled equipment or additional payments over and above the agreed upon unit prices.

Compensation for compliance with all collateral work shall be considered as being included in the various Contract items in the proposal schedule and no additional compensation will be allowed therefore.

1.6 Existing Improvement

- A. The Contractor shall make every effort to protect all existing improvements and facilities from damage during the progress of his/her/its work. No trees, planters, walks, shrubs, signs, fences or other such facilities shall be removed except as shown or called for on the plans or unless specifically authorized in writing by the Engineer. The Contractor shall be held responsible for the care and preservation of the present premises and of adjacent premises and coterminous property. Any parts of them which are injured, damaged or disturbed because of his work shall be repaired, replaced or cleaned by him at his expense.

1.7 Existing Utilities

- A. The Contractor will be required to work around public utilities and other improvements that are to remain in place within the construction area. The Contractor will be held liable for any damage to existing improvements or interference with service resulting from his operations. The Contractor shall pothole and ascertain the exact location of all underground facilities and improvements within the construction area before using equipment that may damage such facilities.

1.8 Resident Access to Their Properties During Construction

- A. The Contractor shall provide access to local residents at all times. The contractor shall notify the residents of the construction schedule and when construction activities will take place in front of their properties. The Contractor shall install steel plates over open trench (for the width of a standard residential driveway) to provide vehicular access in

and out of local residences. The compensation for providing steel plates for resident vehicular access shall be included (factored) in the unit price (LF) of the 6 inch diameter PVC pipe installation. No additional cost shall be incurred.

1.9 Status of the Project Area and Rights-of-Way.

- A. DISTRICT, at its expense, will provide all rights-of-way or permits, or both, covering the crossing of private property and public and private rights-of-way necessary for the permanent Work; provided, however, Contractor shall, at its expense, obtain any bonds or insurance policies or pay any fees and enter into any agreements required by a controlling authority, e.g., Caltrans or Southern Pacific Railroad Company, before Contractor enters upon any property or right-of-way under the jurisdiction of any such controlling authority for the purpose of performing Work.
- B. DISTRICT has acquired or is negotiating to acquire any rights-of-way, or both, necessary for the permanent Work.
- C. If such permits are required, all operations of Contractor shall conform to the restrictions, regulations, and requirements set forth in said permits, copies of which will be included in the Contract Documents.
- D. Contractor may be required, as a condition for receiving final payment, to obtain, and provide DISTRICT's Representative with copies of, executed damage releases from the owners of public and private property whose property has been damaged by the Work. The damage releases will be on a form provided by DISTRICT.
- E. Contractor shall, also, as a condition for receiving final payment, obtain, and provide DISTRICT's Representative with copies of, executed damage releases from the owners of certain public and private property or areas which have been crossed by the Work or otherwise affected by the Work. The damage releases will be on a form provided by DISTRICT.

1.10 Site Data.

NOT USED.

1.11 Pre-Purchased or Pre-Negotiated Material.

NOT USED.

1.12 Designation of DISTRICT's Representative.

- A. Unless otherwise modified by DISTRICT, DISTRICT's Representative shall be its General Manager.

1.13 Project Retention

In accordance with Public Contract Code § 7201, DISTRICT will withhold 5% of each progress payment as retention on the Project.

1.14 Liquidated Damages Due to Contractor Delay.

- A. Time is of the essence. Should Contractor fail to complete all or any part of the Work within the time specified in the Contract Documents, DISTRICT will suffer damage, the amount of which is difficult, if not impossible, to ascertain and, pursuant to the authority of Government Code section 53069.85, DISTRICT shall therefore be entitled to **\$1,000.00 per Day** as liquidated damages for each Day or part thereof that actual completion extends beyond the time specified.
- B. Liquidated damages may be deducted from progress payments due Contractor, Project retention or may be collected directly from Contractor, or from Contractor's surety. These provisions for liquidated damages shall not prevent DISTRICT, in case of Contractor's default, from terminating the Contractor.

1.15 Utility Outages – Notices to Residents.

- A. Should Contractor's operations require interruption of any utility service, Contractor shall notify DISTRICT at least ten (10) Days prior to the scheduled outage. Contractor will notify all impacted residents on a form provided by DISTRICT at least seven (7) Days prior to the scheduled outage.
- B. Contractor shall be responsible for providing, at its cost, any temporary utility or facilities necessitated by the utility outage.

1.16 Schedule Constraints.

NOT USED.

1.17 Noise Restrictions

- A. Contractor shall use only such equipment on the Work and in such state of repair so that the emission of sound therefrom is within the noise tolerance level of that equipment as established by Cal/OSHA.

1.18 Safety Programs.

- A. DISTRICT has considered these Safety Programs when determining the Contract Times and no additional time or compensation will be added to the Contract due to these Programs.]

END OF SPECIAL CONDITIONS

01 00 00 – GENERAL REQUIREMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The work to be performed under this Contract shall consist of all plant, labor, equipment, materials, tools, transportation, and services required for the fulfillment of the Contract in strict accordance with the Contract Documents and Specifications. The work shall be complete, and all work, materials, and services not expressly shown or called for in the Contract Documents and Specifications which may be necessary for the complete and proper construction of the work in good faith shall be performed, furnished, and installed by the contractor as though originally so specified or shown, at no increasing cost to the District.
- B. The work of this Contract is comprised of drilling, constructing, developing, pump testing, and disinfecting one new extraction well. The well is to be located on DISTRICT-owned land, as detailed in the Bid Documents. Additionally, a second extraction well may be awarded as alternate bid items, at the sole discretion of the DISTRICT and the exact location of the second well will be determined at a later date, but will be located within 2 miles of the ID4-4 Well Location.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 LAYOUT OF WORK AND QUANTITY SURVEYS

- A. General. Construction staking will be provided by the DISTRICT.
- B. Quantity surveys. The Contractor shall perform such surveys and computations as are necessary to determine quantities of Work performed or placed during each progress payment period, and shall perform all surveys necessary for the DISTRICT Representative to determine final quantities of Work in place. The DISTRICT Representative will determine final quantities based upon the survey data provided by the Contractor, and the design lines and grades. If requested by the DISTRICT Representative, the Contractor shall provide an electronic copy of data used for quantity computations.
- C. All surveys performed for measurement of final quantities of Work and material shall be subject to approval of DISTRICT's Representative. Unless waived by DISTRICT's Representative in each specific case, quantity surveys made by the Contractor shall be made in the presence of DISTRICT's Representative.
- D. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required for quantity surveys shall be included in the Schedule of

Pay Items for items of work requiring the surveys. No additional compensation shall be made to the Contractor for this Work.

3.2 SCHEDULE

- A. Estimated Schedule. Within ten (10) Days after the issuance of the Notice to Proceed, Contractor shall prepare a Project schedule and shall submit this to the Engineer for Approval. The receipt or Approval of any schedules by the Engineer or the DISTRICT shall not in any way relieve the Contractor of its obligations under the Contract Documents. The Contractor is fully responsible to determine and provide for any and all staffing and resources at levels which allow for good quality and timely completion of the Project. Contractor's failure to incorporate all elements of Work required for the performance of the Contract or any inaccuracy in the schedule shall not excuse the Contractor from performing all Work required for a completed Project within the specified Contract time period. If the required schedule is not received by the time the first payment under the Contract is due, Contractor shall not be paid until the schedule is received, reviewed and accepted by the Engineer.
- B. Schedule Contents. The schedule shall indicate the beginning and completion dates of all phases of construction; critical path for all critical, sequential time related activities; and "float time" for all "slack" or "gaps" in the non-critical activities. The schedule shall clearly identify all staffing and other resources which in the Contractor's judgment are needed to complete the Project within the time specified for completion. The overall Project Schedule duration shall be within the Contract time.
- C. Schedule Updates. Contractor shall continuously update its construction schedule. Contractor shall submit an updated and accurate construction schedule to the Engineer monthly when requested to do so by Engineer. Contractor shall also submit schedules showing a three week detailed look-ahead at bi-weekly meetings conducted with the DISTRICT. The Engineer may withhold progress payments or other amounts due under the Contract Documents if Contractor fails to submit an updated and accurate construction schedule.

3.3 TEMPORARY FIELD OFFICE

NOT USED

3.4 PROTECTION OF WORK AND PROPERTY

- A. All traffic detector loops, fences, walls, culverts, property line monuments, or other obstructions (except property line monuments within five (5) feet of the centerline of the mains) which are removed, damaged, or destroyed in the course of the Work, shall be replaced or repaired to the original condition. If Contractor provides the DISTRICT with reasonable notice of the need for such repair or replacement, it shall be performed by the DISTRICT. If the Contractor fails to provide the DISTRICT with reasonable notice, the repair or replacement shall be performed by and at the expense of the Contractor to the satisfaction of the DISTRICT, whether or not those obstructions have been shown on the Plans, unless otherwise stated herein. It is then the Contractor's responsibility to employ at its expense a Licensed Land Surveyor to restore all property line monuments located more than five (5) feet from the centerline of the mains, which are destroyed or obliterated. Property line monuments located within five (5) feet of

the centerline of the mains will be replaced by the DISTRICT at no expense to the Contractor, provided the DISTRICT is notified at least 48 hours before the property line monuments are damaged.

- B. Contractor shall provide such heat, covering, and enclosures as are necessary to protect all Work, materials, equipment, appliances, and tools against damage by weather conditions.
- C. Contractor shall take adequate precautions to protect existing sidewalks, curbs, pavements, utilities, and other adjoining property and structures, and to avoid damage thereto, and Contractor shall repair any damage thereto caused by the Work operations. Contractor shall:
 - 1. Enclose the working area with a substantial barricade, and arrange work to cause minimum amount of inconvenience and danger to the public.
 - 2. Provide substantial barricades around any shrubs or trees indicated to be preserved.
 - 3. Deliver materials to the Project site over a route designated by the Engineer.
 - 4. Provide any and all dust control required and follow the Applicable air quality regulations as appropriate. If the Contractor does not comply, the DISTRICT shall have the immediate authority to provide dust control and deduct the cost from payments to the Contractor.
 - 5. Confine Contractor's apparatus, the storage of materials, and the operations of its workers to limits required by law, ordinances, permits, or directions of the Engineer. Contractor shall not unreasonably encumber the Project site with its materials.
 - 6. Take care to prevent disturbing or covering any survey markers, monuments, or other devices marking property boundaries or corners. If such markers are disturbed by accident, they shall be replaced by a civil engineer or land surveyor acceptable to the DISTRICT, at no cost to the DISTRICT.
 - 7. Ensure that existing facilities, fences and other structures are all adequately protected and that, upon completion of all Work, all facilities that may have been damaged are restored to a condition acceptable to the DISTRICT.
 - 8. Preserve and protect from injury all buildings, pole lines and all direction, warning and mileage signs that have been placed within the right-of-way.
 - 9. At the completion of work each day, leave the Project site in a clean, safe condition.
 - 10. Comply with any stage construction and traffic control plans. Access to residences and businesses shall be maintained at all times, unless otherwise permitted in writing by the DISTRICT.
- D. These precautionary measures will apply continuously and not be limited to normal working hours. Full compensation for the Work involved in the preservation of life,

safety and property as above specified shall be considered as included in the prices paid for the various contract items of Work, and no additional allowance will be made therefore.

- E. Should damage to persons or property occur as a result of the Work, Contractor shall be responsible for proper investigation, documentation, including video or photography, to adequately memorialize and make a record of what transpired. The DISTRICT shall be entitled to inspect and copy any such documentation, video, or photographs.

3.5 SITE CONDITIONS SURVEYS

A. Work Included.

Contractor shall conduct thorough pre-construction and post-construction site condition surveys of the entire project area. Site Conditions surveys shall include written documentation of the conditions found, as well as photographs and video recordings of the area within at least 80 feet of any construction area and staging area. The written notes, photographs, and video shall be suitable for forensic purposes to resolve any damage claims that may arise as a result of construction.

B. Submittals.

1. Written documentation of site condition survey at pre-construction and post-construction.
2. Photographs as described herein of pre-construction and post-construction conditions.
3. Video recordings as described herein of pre-construction and post-construction conditions.
4. Submittals shall be made within three days of the surveys. All post-construction data shall be submitted prior to the final project inspection.

C. Site Condition Written Documentation.

Written documentation shall include the time, date, and conditions under which the site survey was made. The documentation shall note the condition of structures, pavement, sidewalks, utilities, fences, and etc. within the work areas.

Photographs.

General – Contractor shall take enough photographs during each site survey to provide a record of conditions existing prior to construction and conditions after construction. Pre-construction photographs shall be taken prior to any construction or mobilization of equipment, but not more than one week prior to actual start of work. The pre-construction photographs may be staged at different times to match the progression of the Work.

The photographs shall document existing damage to public and private facilities, both prior to and after construction. Conditions to be documented include, but are not limited to: sidewalk cracks, broken curbs, separated property walls, improvements within public right-of-ways, access roads used, utility covers and markings, signs, pavement striping, pavement, unique or unusual conditions, adjacent driveways, landscaping, survey markers, and any feature directed by the Engineer. Private property that is adjacent to the public right-of-way shall be documented to the extent visible from the public right-of-way.

Photographs shall include items to indicate scale, as needed. In particular, scales or other items shall be laid next to close ups of structural cracks and other damaged areas being recorded. Scaling shall also be used to document elevation differences, as needed.

One set of color prints shall be submitted. Additional sets shall be available for reviewing in settling any construction disputes. A set of photos shall also be furnished in electronic format. The resolution shall be at least equal to 7 megapixels. All photos shall be documented as to time and date taken, photographer, project number, location, and orientation. Documentation shall include a brief description of objects photographed.

Video Recording.

Video recordings shall document the conditions of the entire area affected by construction, as well as nearby structures and facilities. The general documentation requirements for videos are the same as for photographs. Video recorders shall accurately and continuously record the time and date.

Video recordings shall include an audio portion made simultaneously during the videoing. The audio recording shall describe the location, time, orientation, and objects being recorded. Special commentary shall be provided for unusual conditions or damage noted.

Video equipment shall be capable of producing high resolution images and shall have zoom capabilities.

Video recordings shall provide an overall picture of the sites and shall provide detailed images of damaged areas. Video shall extend to the maximum height of structures.

The Engineer shall have the right to reject any audio video recordings submitted with unintelligible audio, uncontrolled pan or zoom, or of poor quality. Video recordings shall be repeated when rejected.

Video recordings shall be submitted with labels indicating the project, date, recorder, and other pertinent information. Recordings shall be submitted on standard DVDs in a standard format.

Timing.

Contractor shall provide written notice of the time scheduled for the site conditions survey and the place it is to begin. Contractor shall obtain the Engineer's concurrence prior to beginning the condition survey. The Engineer reserves the right to cancel the survey due to weather conditions or other problems. Videoing shall be done during times of good visibility and no videoing or photography shall be done during periods of visible precipitation or when standing water obscures pavement. Contractor shall provide the Engineer with an opportunity to have a representative present when taking the photos and provide guidance during photographing.

Site Surveyor.

The site condition surveyor(s) shall be experienced in construction and potential damage concerns. The site condition surveyor(s) shall be familiar with the photography and video equipment being used.

Field Quality Control.

Prior to submitting videos and photographs, the Contractor shall spot check the photos and videos in the field to insure they accurately reflect the actual conditions and to insure they are correctly labeled.

Soils Compaction Testing.

All soils compaction testing will be done by a licensed geotechnical engineer furnished by the Contractor.

3.6 SUBMITTAL REQUIREMENTS FOR MANUALS AND RECORD DRAWINGS

- A. General. The Contractor shall furnish all materials and perform all Work required for furnishing submittals to DISTRICT in accordance with Contract Documents.
- B. Technical Manuals.
 - 1. The Contractor shall submit technical operation and maintenance information for each item of mechanical, electrical and instrumentation equipment in an organized manner in the Technical Manual. It shall be written so that it can be used and understood by DISTRICT's operation and maintenance staff.
 - 2. The Technical Manual shall be subdivided first by specification section number; second, by equipment item; and last, by "Category." "Categories" shall conform to the following (as applicable):
 - (a) Category 1 - Equipment Summary:
 - (1) Summary: A summary table shall indicate the equipment name, equipment number, and process area in which the equipment is installed.
 - (b) Category 2 - Operational Procedures:
 - (1) Procedures: Manufacturer-recommended procedures on the following shall be included in Part 2:

- a. Installation
- b. Adjustment
- c. Startup
- d. Location of controls, special tools, equipment required, or related instrumentation needed for operation
- e. Operation procedures
- f. Load changes
- g. Calibration
- h. Shutdown
- i. Troubleshooting
- j. Disassembly
- k. Reassembly
- l. Realignment
- m. Testing to determine performance efficiency
- n. Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices
- o. List of all electrical relay settings including alarm and contact settings

(c) Category 3 - Preventive Maintenance Procedures:

- (1) Procedures: Preventive maintenance procedures shall include all manufacturer-recommended procedures to be performed on a periodic basis, both by removing and replacing the equipment or component, and by leaving the equipment in place.
- (2) Schedules: Recommended frequency of preventive maintenance procedures shall be included. Lubrication schedules, including lubricant SAE grade, type, and temperature ranges, shall be covered.

(d) Category 4 - Parts List:

- (1) Parts List: A complete parts list shall be furnished, including a generic description and manufacturer's identification number for each part. Addresses and telephone numbers of the nearest supplier and parts warehouse shall be included.
- (2) Drawings: Cross-sectional or exploded view drawings shall accompany the parts list.

(e) Category 5 - Wiring Diagrams:

- (1) Diagrams: Part 5 shall include complete internal and connection wiring diagrams for electrical equipment items.

(f) Category 6 - Shop Drawings:

- (1) Drawings: This part shall include approved shop or fabrication drawings, complete with dimensions.

(g) Category 7 - Safety:

- (1) Procedures: This part describes the safety precautions to be taken when operating and maintaining the equipment or working near it.

(h) Category 8 - Documentation:

- (1) All equipment warranties, affidavits, and certifications required by the Technical Specifications shall be placed in this part.

3. The Contractor shall furnish to DISTRICT six (6) identical Technical Manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard binder.

- C. Spare Parts List - The Contractor shall furnish to DISTRICT six (6) identical sets of spare parts information for all mechanical, electrical, and instrumentation equipment. The spare parts list shall include the current list price of each spare part. The spare parts list shall include those spare parts which each manufacturer recommends be maintained by DISTRICT in inventory. Each manufacturer or supplier shall indicate the name, address, and telephone number of its nearest outlet of spare parts to assist DISTRICT in ordering. The Contractor shall cross-reference all spare parts lists to the equipment numbers designated in the Contract Documents. The spare parts lists shall be bound in standard size, 3-ring binder.

D. Record Drawings

1. The Contractor shall maintain one record set of Drawings at the Site. On these, it shall mark all Project conditions, locations, configurations, and any other changes or deviations which may vary from the information represented in the original Contract Documents, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. Said record drawings shall be supplemented by any detailed sketches as necessary or directed to fully indicate the Work as actually constructed. These master record drawings of the as-built conditions, including all revisions made necessary by Addenda and Change Orders shall be maintained up-to-date during the progress of the Project. Red ink shall be used for alterations and notes. Notes shall identify relevant Change Orders by number and date.

2. For all Projects involving the installation of any pipeline, Contractor shall survey and record the top of the pipe at a minimum of every 100 linear feet, and at each bend, recording both the horizontal and vertical locations.
 3. Record drawings shall be accessible to DISTRICT's Representative at all times during the construction period. Failure on the Contractor's part to keep record drawings current could result in withholding partial payment.
 4. Upon Completion of the Project and as a condition of final acceptance, the Contractor shall finalize and deliver a complete set of Record Drawings to DISTRICT's Representative. The information submitted by the Contractor will be assumed to be correct, and the Contractor shall be responsible for, and liable to DISTRICT, for the accuracy of such information, and for any errors or omissions which may or may not appear on the Record Drawings.
- E. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to complete the Manuals and Record Drawings shall be included in Contractor's bid and distributed in the Schedule of Pay. No additional compensation shall be made to the Contractor for this Work.

3.7 MATERIALS

A. Materials to be Furnished by the Contractor

1. Inspection of Materials. Materials furnished by the Contractor which will become a part of the Project shall be subject to inspection at any one or more of the following locations, as determined by DISTRICT's Representative: at the place of production or manufacture, at the shipping point, or at the site of the Work. To allow sufficient time to provide for inspection, the Contractor shall submit to DISTRICT's Representative, at the time of issuance, copies of purchase orders or other written instrument confirming procurement of the materials, including drawings and other pertinent information, covering materials on which inspection will be made.
2. No later than fourteen (14) Days prior to manufacture of material, Contractor shall inform DISTRICT's Representative, in writing, the date the material is to be manufactured.
3. Contractors Obligations. The inspection of materials at any of the locations specified above or the waiving of the inspection thereof shall not impact whether the materials and equipment conform to the Contract Documents. Contractor will not be relieved from furnishing materials meeting the requirements of the Contract Documents due to DISTRICT's inspection or lack of inspection of the equipment or materials. Acceptance of any materials will be made only after materials are installed in the Project.
4. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to accommodate DISTRICT's testing efforts, including any travel required by Contractor's forces, shall be included in Contractor's bid and distributed in the Schedule of Pay Items related to the

materials requiring testing. No additional compensation shall be made to the Contractor for this Work.

3.8 LOCAL CONDITIONS AND REQUIREMENTS

A. Access to Work and Haul Routes

1. General. All work on the rights-of-way necessary for access to the Site shall be performed by the Contractor.
2. Access, Damage, Restoration. The Contractor shall make his own investigation of the condition of available public or private roads and of clearances, restrictions, bridge-load limits, permit or bond requirements, and other limitations that affect or may affect transportation and ingress or egress at the Site. Claims for changes in Contract Price or Contract Times arising out of the unavailability of transportation facilities or limitations thereon shall not be considered by DISTRICT.
3. The Contractor shall maintain and repair any damage arising out of Contractor's operations to all roads used during construction of the Project, and upon completion of all Work, but prior to final acceptance, the roads shall be restored to their original condition. Prior to using any road for access to the Site, the Contractor shall conduct a photograph and/or video survey of the roadway with a copy submitted to DISTRICT's Representative.
4. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to complete this Work, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

B. Power. Contractor shall provide at its own expense all necessary power required for operations under the contract. The Contractor shall provide and maintain in good order such modern equipment and installations as shall be adequate in the opinion of the Engineer to perform in a safe and satisfactory manner the Work required by the contract.

C. Construction Water.

1. Construction water shall not be used for purposes other than those required to satisfactorily complete the contract.
2. All connections to the DISTRICT's water system used for the purposes of obtaining construction water shall utilize a temporary construction meter and backflow prevention device supplied by the DISTRICT. The DISTRICT-furnished backflow prevention device shall be tested immediately after installation and the construction meter and backflow prevention device shall not be placed into service until the backflow prevention device passes such tests. Backflow prevention device testing shall be performed in accordance with the most recent edition of the Manual of Cross-Connection Control as published by the University of Southern California by a person selected from Borrego Water District's "DISTRICT-Approved Certified Backflow Assembly Testers" list, and test results shall be provided to the Engineer. If the temporary construction meter and backflow prevention device are moved to

alternate location(s) during construction, the backflow prevention device shall again be tested as described above immediately after re-installation.

3. For each temporary construction meter requested by the Contractor for the performance of work under this contract, an amount equivalent to the deposit requirement for temporary construction meters listed in the current approved version of the DISTRICT's Policies and Procedures Manual shall be withheld from the final contract payment until the temporary construction meters are returned.

D. Operation of Existing Water Facilities

1. The Contractor shall not operate any of the existing water systems, including pumps, motors, and hydrants, but shall contact the DISTRICT two (2) working days in advance with a list and location of the water system facilities that will require operating, opening, stopping, or closure by the DISTRICT.
2. At the option of the Engineer, the Contractor may be permitted to operate valves for the purpose of making connections to existing mains. The DISTRICT will perform all notification to existing customers regarding temporary loss of service.
3. Contractor shall submit a request on DISTRICT's standard form for any shut-down of existing water facilities.

E. Construction at Existing Utilities

1. General. Where the Work to be performed crosses or otherwise interferes with water, sewer, gas, or oil pipelines; buried cable; or other public or private utilities, the Contractor shall perform construction in such a manner so that no damage will result to either public or private utilities. It shall be the responsibility of the Contractor to determine the actual locations of, and make accommodations to maintain, all utilities.
2. Permission, Notice and Liability. Before any utility is taken out of service, permission shall be obtained by the Contractor from the owner. The owner, any impacted resident or business owner and the DISTRICT Representative will be advised of the nature and duration of the utility outage as well as the Contractor's plan for providing temporary utilities if required by the owner. The Contractor shall be liable for all damage which may result from its failure to maintain utilities during the progress of the Work, and the Contractor shall indemnify DISTRICT as required by the Contract Documents from all claims arising out of or connected with damage to utilities encountered during construction; damages resulting from disruption of service; and injury to persons or damage to property resulting from the negligent, accidental, or intentional breaching of utilities.
3. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to complete this Work, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

F. Traffic Control

1. General. Contractor shall abide by traffic control plans approved by the appropriate jurisdiction.
2. Protections. Roads subject to interference by the Work shall be kept open or suitable temporary passages through the Work shall be provided and maintained by the Contractor. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient flasher lights, flag persons, danger signals, and signs, and shall take all necessary precautions for the protection of the Work and the safety of the public. No construction work along public or private roads may proceed until the Contractor has proper barricades, flasher lights, flag persons, signals, and signs in place at the construction site.
3. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to complete this Work, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

G. Cleaning Up

1. Contractor at all times shall keep premises free from debris such as waste, rubbish, and excess materials and equipment. Contractor shall not store debris under, in, or about the premises. Contractor shall also clean all asphalt and concrete areas to the degree necessary to remove oil, grease, fuel, or other stains caused by Contractor operations or equipment. The use of water, resulting in mud on streets, will not be permitted as substitute for sweeping or other methods. Dust control may require having a water truck onsite for the duration of the project, and/or use of temporary hoses and pipelines to convey water.
2. Contractor shall fully clean up the site at the completion of the Work. If the Contractor fails to immediately clean up at the completion of the Work, the DISTRICT may do so and the cost of such clean up shall be charged back to the Contractor.

3.9 ENVIRONMENTAL QUALITY PROTECTION

A. Environmental Conditions

NOT USED.

B. Landscape and Vegetation Preservation

1. General. The Contractor shall exercise care to preserve the natural landscape and vegetation, and shall conduct operations so as to prevent unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the Work.
2. Damage and Restoration. Movement of crews and equipment within the rights-of-way and over routes provided for access to the Work shall be performed in a manner to prevent damage to property. When no longer required, construction roads shall be restored to original contours.

3. Upon completion of the Work, and following removal of construction facilities and required cleanup, land used for construction purposes and not required for the completed installation shall be scarified and regraded, as required, so that all surfaces are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.
4. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to complete this Work, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

C. Protected Species

1. General. If, in the performance of the Work, evidence of the possible occurrence of any Federally listed threatened or endangered plant or animal is discovered, the Contractor shall notify the DISTRICT Representative immediately, giving the location and nature of the findings. Written confirmation of the evidence, location and nature of the findings shall be forwarded to DISTRICT within 2 Days.
2. Procedures. The Contractor shall immediately cease all construction activities in the immediate area of the discovery to the extent necessary to protect the endangered plant or animal.

If directed by the DISTRICT Representative, Contractor will refrain from working in the immediate area, suspend the Work in its entirety, or alter its performance to ensure full compliance with all applicable permits, laws and regulations. Any DISTRICT directed changes to the Work as a result of a siting will be pursuant to the Contract Documents.

3. False Siting. Any costs or delays incurred by DISTRICT or the Contractor due to unreasonable or false notification of an endangered plant or animal will be borne by the Contractor.
4. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to comply with this paragraph, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

D. Preservation of Historical and Archeological Resources

1. General. If, in the performance of the Work, Contractor should unearth cultural resources (for example, human remains, animal bones, stone tools, artifacts and/or midden deposits) through excavation, grading, watering or other means, the Contractor notify the Construction/Archeological Monitor and/or the DISTRICT Representative immediately, giving the location and nature of the findings. Written confirmation of the evidence, location and nature of the findings shall be forwarded to the Construction/Archeological Monitor and/or DISTRICT within 2 Days.

2. Procedures. The Contractor shall immediately cease all construction activities in the immediate area of the discovery to the extent necessary to protect the cultural resource.

If directed by the DISTRICT Representative, Contractor will refrain from working in the immediate area, suspend the Work in its entirety, or re-sequence and/or alter its performance to ensure full compliance with all applicable permits, laws and regulations. Should the presence of cultural resources be confirmed, the Contractor will assist the DISTRICT Representative and the Construction/Archeological Monitor in the preparation and implementation of a data recovery plan. The Contractor shall provide such cooperation and assistance as may be necessary to preserve the cultural resources for removal or other disposition. Any DISTRICT directed changes to the Work as a result of the cultural resource will be pursuant to the Contract Documents.

3. Contractor's Liability. Should Contractor, without permission, injure, destroy, excavate, appropriate, or remove any cultural resource on or adjacent to the Site, it will be subject to disciplinary action, arrest and penalty under applicable law. The Contractor shall be principally responsible for all costs of mitigation and/or restoration of cultural resources related to the unauthorized actions identified above. Contractor shall be required to pay for unauthorized damage and mitigation costs to cultural resources (historical and archeological resources) as a result of unauthorized activities that damage cultural resources and shall indemnify DISTRICT pursuant to the Contract Documents.
4. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to comply with this paragraph, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

E. Dust and Pollution Control

1. Contractor shall provide all necessary material, equipment and labor to prevent and control the emission of dust and any other potential pollutant on site.
2. Contractor shall not discharge into the atmosphere from any source smoke, dust or other air contaminants in violation of the law, rules, and regulations of the governing agency.
3. Cost. Unless otherwise called for by the Contract Documents, the cost of all material, equipment, and labor required to comply with this paragraph, shall be included in Contractor's bid and distributed in the Schedule of Pay Items. No additional compensation shall be made to the Contractor for this Work.

F. Fugitive Dust

NOT USED.

G. Management of Storm, Surface and Other Waters

1. Storm water, surface water, groundwater, and nuisance, or other waters may be encountered at various times during construction of the Project. Federal and State laws require the DISTRICT and its contractors to manage such waters pursuant to the requirements of California State Water Resources Control Board Order Number 2009-0009-DWQ, the Federal Clean Water Act, and the California Porter Cologne Water Quality Control Act. Contractor acknowledges that it has investigated the risk arising from such waters in conjunction with the Project, and assumes any and all risks and liabilities arising therefrom.
2. The Contractor shall perform all construction operations in such a manner as to comply, and ensure all subcontractors to comply, with all applicable Federal, State, and local laws, orders, and regulations concerning the control and abatement of water pollution; and all terms and conditions of any applicable permits issued for the Project. In the event there is a conflict between Federal, State, and local laws, regulations, and requirements, the most stringent shall apply.
3. Contractor violations. If noncompliance should occur, the Contractor shall report this to the DISTRICT Representative immediately, with the specific information submitted in writing within 2 Days. Consistent violations of applicable Federal, State, or local laws, orders, regulations, or Water Quality Standards may result in DISTRICT stopping all site activity until compliance is ensured. The Contractor shall not be entitled to any change in Contract Price or Contract Times, claim for damage, or additional compensation by reason of such a work stoppage. Corrective measures required to bring activities into compliance shall be at the Contractor's expense.
4. Compliance with Construction General Storm water Permit. Contractor shall be required to comply with all aspects of the State Water Resources Control Board (State Board) Water Quality Order No. 2009-0009-DWQ, National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction Activity (Permit) for all projects that involve construction on or disturbance of one acre or more of land or which are part of a larger common area of development.
 - (a) Contractor shall prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) for the Project site based on the appropriate Risk Level requirements, and draft and coordinate submittal of all Permit related documents with DISTRICT's Legally Responsible Person and/or Authorized Signatory as those terms are defined in the Permit. The Contractor shall submit the SWPPP to the DISTRICT Representative for review not less than fifteen (15) Days prior to the start of on- site construction work. DISTRICT will file the Notice of Intent and pay the filing fee.
 - (b) The SWPPP shall be developed by a Qualified SWPPP Developer and implemented by a Qualified SWPPP Practitioner as those terms are defined in the Permit and shall include industry standard requirements for water quality control including but not be limited to the following:
 - (1) Sediment and erosion control measures to manage sediment and erosion including vegetative practices, structural control, silt fences, straw dikes, sediment controls or operator controls as appropriate. Storm water management measures shall be instituted as required,

including velocity dissipaters, and solid waste controls shall address controls for building materials and offsite tracking of sediment.

- (2) Wastewater and storm water management controls to divert offsite surface flows around the Project site and to divert surface flows within the Project area away from areas of open earth or stockpiles of building and other materials. Wastewater from general construction activities, such as drain water collection, aggregate processing, concrete batching, drilling, grouting, or other construction operations, shall not enter flowing or dry watercourses without having met the authorized non-storm water discharge requirements listed in State Board Water Quality Order No. 2009-0009-DWQ, Section III.C., including proper notification to the Regional Water Board.
- (3) Pollution prevention measures including methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials which include prevention measures to control silting and erosion, and which will intercept and settle any runoff of sediment-laden waters.
- (4) Turbidity prevention measures for prevention of excess turbidity including, but are not restricted to, intercepting ditches, settling ponds, gravel filter entrapment dikes, flocculating processes, recirculation, combinations thereof, or other approved methods that are not harmful to aquatic life. All such wastewaters discharged into surface waters, shall contain the least concentration of settleable material possible, and shall meet all conditions of section 402, the National Pollutant Discharge Elimination System (NPDES) permit.
- (5) Overall construction site management measures to address changes at the Project site as the Project moves through different phases and changes that account for rainy and dry season management practices.
- (6) Pollution control measures and construction activity methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes, into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources. Such pollutants and wastes include, but are not restricted to: refuse, garbage, cement, sanitary waste, industrial waste, hazardous materials, radioactive substances, oil and other petroleum products, aggregate processing, tailings, mineral salts, and thermal pollution.
- (7) Control measures for stockpiled or deposited materials prohibiting the stockpile or deposit of excavated materials, or other construction materials, near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can, in any way, encroach upon the watercourse.
- (8) Develop and implement a Rain Event Action Plan (REAP), if required, that must be designed and implemented to protect all exposed portions of the site 48 hours prior to any likely precipitation event.
- (9) Monitoring, reporting and record keeping, as necessary to achieve compliance with applicable Permit requirements, including but not limited to annual reports and rain event reports.

- (c) Before any Permit related documents, including the SWPPP, rain event reports, or annual reports may be submitted to the State Board or implemented on the Project site, they must first be reviewed and approved by DISTRICT.
 - (d) DISTRICT retains the right to procure and maintain coverage under the Permit for the Project site if the Contractor fails to draft a SWPPP or other Permit related document, or fails to proceed in a manner that is satisfactory to DISTRICT. DISTRICT reserves the right to implement its own SWPPP at the Project site, and hire additional contractors to maintain compliance. Whether Contractor has adequately maintained compliance with the Permit shall be DISTRICT's sole determination. In the event that Contractor has failed or is unable to maintain compliance with the Permit, any costs or fines incurred by DISTRICT in implementing a SWPPP, or otherwise maintaining compliance with the Construction General Permit shall be paid by the Contractor.
5. Failure to implement the SWPPP or otherwise comply with the Permit is a violation of federal and state law. Contractor hereby agrees to indemnify DISTRICT as required by the Contract Documents for any noncompliance or alleged noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the sole established negligence, willful misconduct or active negligence of DISTRICT. DISTRICT may seek damages from Contractor for delay in completing the Contract in accordance with the Contract Documents, caused by Contractor's failure to comply with the Permit. In addition to compliance with the Permit, Contractor shall comply with the lawful requirements of any applicable municipality, district, drainage district, flood control district, and other local agencies regarding discharges of storm water, surface water, groundwater or other nuisance waters off of the Project site.
6. Oil storage tanks management.
- (a) Storage tank placement. All oil or other petroleum product (hereinafter referred to collectively as oil) storage tanks shall be placed at least 20 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source.
 - (b) Storage area dikes. Storage areas shall be diked at least 12 inches high or graded and sloped to permit safe containment of leaks and spills equal to the capacity of all tanks and/or containers located within each area, plus a sufficient amount of freeboard to contain the 25-year rainstorm.
 - (c) Diked area barriers. Diked areas shall have an impermeable barrier at least 10 mils thick. Areas used for refueling operations shall have an impermeable liner at least 10 mils thick buried under 2 to 4 inches of soil.
 - (d) Spill Prevention Control and Countermeasure Plan (SPCC). Where the location of a construction site is such that oil from an accidental spillage could reasonably be expected to enter into or upon the navigable waters of the United States or adjoining shorelines, and the aggregate storage of oil at the site is over 1,320 gallons or a single container has a capacity in excess of 660 gallons, the Contractor shall prepare an SPCC Plan. The Contractor shall submit the SPCC Plan to the Engineer at least 30 days prior to delivery or

storage of oil at the site. The Plan must have been reviewed and certified by a registered professional engineer in accordance with 40 C.F.R., part 112

7. Underground tank prohibition. The Contractor shall not use underground storage tanks.
8. Construction safety standards. The Contractor shall comply with the sanitation and potable water requirements of Section 7 of United States Bureau of Reclamation's publication "Reclamation Safety And Health Standards."
9. Other Permits.
 - (a) Other permits applicable to the Project are listed in the Special Conditions. The Contractor shall obtain all other necessary licenses and permits.
 - (b) Monitoring. The Contractor is required to conduct monitoring in order to meet the requirements of the permits, which may include sampling, testing and inspections.
 - (c) Recordkeeping. The Contractor shall retain all records and data required by the permits for the time specified in the contract.
10. Cost. Except as specified herein, the cost of complying with this section shall be included in the Schedule of Pay Items for work which necessitate the water pollution prevention measures required by this paragraph.

END OF GENERAL REQUIREMENTS

TECHNICAL SPECIFICATIONS

1.1. WELL CONSTRUCTION:

All technical specifications included in this section apply to the construction of the new extraction well and are to be implemented during construction of Well ID-4-4. If the alternate bid items to construct the second extraction well are awarded by the DISTRICT, these technical specifications shall also apply and be implemented during construction of the second extraction well.

1.1.1. Operating Requirements for Water Well Drilling and Construction

The Contractor shall provide, in addition to the proposed construction schedule following the District's acceptance of the Proposal, a description of the proposed drilling program including method, on-site equipment, fluids, and additives to be used. The proposed drilling program must include information regarding the types of fluid to be used, intended drilling fluid weights, viscosities, sand and solids contents, water loss control, **and the specification of all additives** to be used.

Excavated pits for drilling fluid circulation will be prohibited. Contractor shall furnish a mud pump, shaker, desander and drilling fluids storage system capable of circulating at a minimum 500 gallons per minute. The solids (sand) content of the drilling fluids re-circulated to the borehole shall not exceed 2% at any time during drilling operations. These "heavy" drilling fluids shall be containerized on site and allowed to dry. All fluids generated during initial well development and pumping shall be conveyed through the series of tanks described above prior to disposal.

The drill cuttings can be stockpiled on site to dry and the final disposition of cuttings will be the responsibility of the District.

All clean development and test water will be discharged to land surface.

Delays during the drilling operation caused by the inadequacy of the drilling equipment shall be the responsibility of the Contractor. Owner will require replacement of such inadequate equipment by the Contractor. This does not include the mechanical failure of equipment normally considered capable of performing the required work. The Contractor shall be held responsible for, and payment may be withheld for, damages done to the well from faulty operation due to negligence or any other cause.

The equipment to be furnished for the specified well drilling and construction shall comply with all State and local safety regulations, shall be subject to the inspection and approval of the Owner, and shall meet the minimum requirements and include the equipment listed below:

- a. **Direct or Reverse circulation rotary drilling equipment**, including mast, substructure, draw works and prime mover with sufficient capacity to drill and ream the required diameter borehole through the formations encountered in the area of drilling to a depth of 1,000 feet.
- b. All of the accessory equipment necessary for the completion of the work including an approved circulating cleaner system, equipment for measuring drilling fluid properties, sluce box or other equipment capable of separating cutting samples from drilling fluid, settlement system (tanks), groundwater level measuring instrument(s), bottom sounding device, and approved drill cutting sample bags.
- c. An auxiliary power plant (if needed, see II.2 below), sufficient in size to provide for all electrical power required during the entire operation of drilling and construction.
- d. Welding equipment and material, as needed.
- e. Portable sanitation facilities, including hand washing accommodations.
- f. Air compressor with adequate capacity for drilling and/or well development.
- g. Submersible and/or turbine well pump to perform zone testing, well development and pump testing.
- h. All other equipment necessary to complete work described herein including earthmoving equipment, and water trucks, as necessary.

The omission of listing equipment necessary to satisfactorily complete the work specified does not relieve the Contractor from providing necessary equipment. All equipment necessary to complete the work shall be determined by the Contractor and described to the District in the proposed drilling program within ten (10) working days of the District's acceptance of the Proposal.

1.1.2. **Equipment and Operating Requirements for Development and Pump Testing**

The Contractor shall furnish, install, operate and remove all equipment and tools, including a rig and appurtenances capable of setting and properly operating the pumping equipment, swabs and bailers to meet the requirements of the Contract for pump testing, development and cleaning of the well. All fuel, lubricating oil and other necessary materials shall be provided by the Contractor.

The pumping equipment shall be capable of pumping at a variable rate from 500 to 2,500 gallons per minute at a maximum pumping level of 700 feet below ground surface. The expected static groundwater level at the well site is approximately 293 feet bgs. The

pumping unit shall be complete with a variable frequency drive, controls and appurtenances, and shall be capable of being operated without interruptions for a period of 48 hours.

The Contractor shall furnish all necessary discharge assemblage which shall be of sufficient size and length to allow the proper functioning of the discharge meter. The Contractor shall furnish, install and maintain a discharge meter capable of directly and accurately reading instantaneous flow in gallons per minute and total pumpage, a gate valve on the discharge line, and a pressure gage.

One 2-inch diameter PVC pipe and one 1.0-inch diameter PVC pipe shall be installed from each well head to a depth below the pump intake, to remain in place for the duration of the pump testing period as a conduit for measuring depth to groundwater, using an electrode type water-level indicator, and for sounding the accumulation of sediment at the bottom of the well during development. The bottom two feet of the 1.0-inch PVC pipe shall be perforated. The top of the pipe at the well head shall be installed in such a way as to allow easy access for groundwater level and well bottom measurements. The 2-inch diameter PVC pipe shall be open-ended and extend to a depth below the pump intake to allow for a spinner survey with a Titan Spinner/Flowmeter that has a tool diameter of 1.6875 inches or similar tooling approved by the District Representative. Should the PVC pipe break, become obstructed, or be rendered unusable for any reason during development and test pumping, the Contractor shall immediately reinstall the pipe at no additional cost to the District.

The Contractor shall provide two, probe-type water level measuring devices (primary and back-up) capable of measuring groundwater level to a depth of 700 feet bgs, as well as any additional equipment necessary for development and testing, including replacement equipment, unless otherwise noted herein.

1.1.3. Records and Samples

During the drilling of the pilot hole, the Contractor shall maintain careful and accurate real-time logging of each formation encountered a description of the materials at each change in formation, and the penetration rate of the drilling per drill stem. Additionally, the driller shall measure and record the weight, viscosity, and sand content of the drilling fluid, at periodic intervals as determined by the District Representative, to assure consistency with the Contractor's proposed drilling program (see II.1 above). Drilling fluid characteristics including viscosity, weight, sand content, water loss, and wall cake thickness shall be determined not less than every four hours by the Contractor and reported to the District Representative. At any time, the District Representative may request additional tests to be run or repeated. A record shall be maintained indicating the addition and amount of approved chemical products or water required during drilling. The depths at which such changes are required shall also be including in the fluids log.

During all drilling and construction phases, the Contractor shall also record the work done during each day including the items of work accomplished, including but not limited to the following: 1) depth drilled; 2) properties of drilling fluid and amount of additives used; 3) casing set, including the number, size and length of individual pipe installed in the well; 4) volume and specifications of filter pack used; 5) volume and specifications for concrete used in the annular seal and all other pertinent data requested by the District Representative.

The above required data shall be recorded at the time of occurrences or observation. Records shall be legibly written and each recorded item or event shall include the date and the time of day. A copy of daily reports shall be submitted to the District Representative each day for the prior day's completed work. The State-required (i.e., Department of Water Resources) drilling report, shall be submitted to the District Representative upon completion of the project and before final payment is made. A consulting geologist or District staff will be on site to monitor activities and gather data on behalf of the District during drilling all or a portion of the pilot hole, reaming, well construction, and during development activities. This does not relieve the Contractor of his requirement to provide a driller's log of formations encountered for inclusion on the well completion report for each well.

During the drilling of the pilot hole, the Contractor shall carefully collect samples from the depth of the conductor casing to the total depth of the well at 10-foot intervals and at each change of formation. These samples shall be collected during the drilling and placed in bags with labels that indicate the depth from which each sample was obtained. The Contractor shall accurately account for the time required for cuttings to rise to the surface based on the volumetric flow of the drilling fluid from the hole. Samples collected shall be representative of the samples taken from the designated depth. Occasionally, extra samples will be sent for grain size analysis as directed by the District Representative. The method of collecting samples shall be subject to the approval of the District Representative. The Owner shall retain all samples.

Following the installation of the filter pack and throughout the development period, the Contractor shall maintain a written record that includes date, static groundwater level, time, pumping rate in gallons per minute and corresponding operating or pumping groundwater level. The Contractor's records throughout the development and test pumping activities shall include a **daily measurement of the static groundwater level at the beginning and ending of each work day, before commencement of any pumping or other development activities and at the end of all such activities, respectively**. All groundwater level data shall be recorded to the nearest tenth of a foot (0.1 ft). Entries shall be made for each change of pumping and when comment is desirable. During periods of constant pumping, entries shall be made at intervals of not more than one hour. Upon completion and before final payment, the Contractor shall provide the District Representative with a copy of the development records. The District Representative shall maintain pump test records and shall request assistance, as needed, to obtain the necessary measurements. The Contractor shall have a worker available to

assist the District Representative in taking measurements and to operate and service the pumping equipment.

1.1.4. Move-In and Site Preparation Work

Prior to move-in, the Contractor will be required to obtain a San Diego County well drilling permit. The Contractor shall perform all necessary move-in and set-up, of all rigs, equipment and materials and all other miscellaneous work associated with drilling, well construction, development and testing at the well site. If additional temporary construction fencing is required to adequately enclose the work site, it shall be included as part of the site preparation work, and will be the responsibility of the Contractor.

The Contractor must satisfy as to the adequacy of the well site for drill rig set-up. Any earthwork necessary (e.g., compaction) to accommodate the drill rig or appurtenant drilling equipment and machinery (circulation system, mud tanks, etc.) shall be the responsibility of the Contractor. Any grading deemed necessary by the Contractor in preparation for site work shall be determined in advance and agreed to by the District Representative. Any excavated top soil shall be stockpiled on site for replacement at the completion of the project.

In the event of a spill or leakage of fuels, lubricants, or other hazardous materials during site move-in/move-out, drilling, development, or pumping operations, the Contractor shall take immediate steps to contain the spill. Clean-up and disposition of any hazardous materials released by Contractor during the conduct of the described work shall be completed to the satisfaction of the District Representative and shall be the responsibility of the Contractor.

1.1.5. Conductor Borehole, Casing and Sanitary Seal

This item includes drilling a conductor borehole, installation of conductor casing and installation of a cement grout sanitary seal in the annulus between the borehole and conductor casing to the minimum depth of 50 feet. The sanitary seal installed shall meet the requirements of California Department of Water Resources Bulletins 74-81 and 74-90, and all requirements of the County of San Diego Department of Environmental Health Services. Continuous (24-hour/day) operations will be allowed during borehole drilling. The conductor casing diameter, wall thickness and material shall have the following specifications:

- a. 40-inch diameter conductor borehole
- b. Minimum 50 feet depth
- c. 30-inch O.D., minimum 3/8-inch wall thickness
- d. Mild steel, ASTM A53, Grade B or approved equal

During drilling, the Contractor shall collect and preserve representative samples of formation materials at 10-foot intervals and each major change in formation. Upon completion of drilling, the Contractor shall condition the borehole and take whatever steps are necessary to maintain and prevent collapse of the borehole prior to and during placement of the conductor casing and cement grout sanitary seal. All field joints shall be properly butt-welded to assure complete penetration during welding with a minimum of two passes. All joints shall be watertight. Special care shall be exercised to ensure that the casing is straight. All field welding shall be performed in accordance with American Welding Society Standards by a certified welder. Welder Certifications shall be specific to the metal type (i.e. stainless steel)

After the conductor casing is installed and aligned, the annular space between the conductor casing and the conductor casing borehole shall be filled with cement grout from the bottom of the borehole to the ground surface. The MINIMUM depth of the grout seal shall be 50 feet. The grout shall be pumped into the annular space through a tremie pipe installed to the bottom of the borehole. The bottom of the tremie pipe shall remain submerged in the grout throughout the placement of the grout. The placement procedure shall be approved by the District prior to installation of the grout seal. The Contractor shall take all precautions to prevent the collapse of the conductor casing and borehole during placement of the grout. The grout seal shall be placed in one continuous pour. The contractor shall not operate any equipment on-site during the 24-hour period immediately after the sanitary seal has been placed.

In the event the borehole or part of the borehole collapses prior to completion of grouting, the Contractor shall take whatever steps are necessary to reopen the borehole, reset the casing and place the grout as required. Any such remedial action shall be conducted at the Contractor's expense.

Potable water for use by the Contractor will be available from nearby fire hydrant. Any hard-plumbed connection must be protected by an air gap or approved by the District Representative. Water used by the Contractor will be metered by the District but will be provided at no charge.

Recirculation of drill cuttings with the drilling fluid shall be kept to a practical minimum.

1.1.6. Borehole

The Contractor shall drill a 17.5-inch diameter pilot borehole to a depth of 1,000 feet. Continuous (24-hour/day) operations will be allowed during pilot borehole drilling. The diameter shall not exceed 17.5 inches without the approval of the District Representative. The borehole shall be drilled to a depth of approximately 1,000 feet below the existing ground surface at the well location. The exact total depth shall be as directed by the District Representative, and will be determined by the nature of the materials encountered.

The drilling fluid shall possess such characteristics as are required to (a) adequately maintain the walls of the borehole to prevent caving, (b) permit recovery of representative samples of drill cuttings, (c) prevent the swelling of clay zones, (d) prevent loss of shear strength or other borehole stability problems, and (e) allow the fluid and mud cake to be readily removed from the borehole and borehole wall during placement of the gravel pack and development of the well. It shall be the responsibility of the Contractor to collect, measure, and record drilling fluid samples. Unless otherwise approved by the District's Representative, only fresh water with Baroid Poly-Bore shall be used as the circulating medium for reverse circulation method. Any other method must be disclosed for approval by the District Representative. If 'lost circulation' or other drilling problems require the addition of bentonite gel or other materials, such materials may be added only with the prior approval of the District Representative.

For direct mud rotary method only high-grade approved products such as Baroid Aqua-Gel or Quick-Gel, or other product pre-approved by the District Representative shall be used in the make-up of the drilling fluid. Drilling with a mixture of water and unprocessed mud, clay, or other material will not be permitted.

Potable water for use by the Contractor will be available from nearby fire hydrant. Any hard-plumbed connection must be protected by an air gap or approved by the District Representative. Water used by the Contractor will be metered by the District but will be provided at no charge.

As described in II.3 above, the Contractor shall periodically collect samples, representative of the strata penetrated, for lithological description and grain size analysis. Recirculation of drill cuttings with the drilling fluid shall be kept to a practical minimum.

1.1.7. Borehole Deviation

At the discretion of the District Representative, evaluation of borehole deviation may be requested, to be performed by a professional logging service, following the drilling of the hole, as a component of the geophysical logging (see item II.7 below). The subcontractor(s) proposed to complete the geophysical logging shall be submitted to the Owner and District Representative for review and approval prior to Contractor mobilization. The maximum allowable horizontal deviation (drift) of the borehole from the vertical shall not exceed one diameter of the borehole per 200 feet of depth.

1.1.8. Electric Log of Borehole

Upon completion of the borehole, the Contractor shall condition the hole and drilling fluid for geophysical logging (electric log) of the hole. The electric logging of the hole shall consist of spontaneous potential, 16- and 64-inch resistivity surveys, a guard log, a borehole deviation survey, and a natural gamma survey, all in API format. Six (6) copies of the various logging runs shall be delivered to the District Representative on site

immediately following the logging of the hole, **at a vertical scale of 2 inches equals 100 feet.**

1.1.9. Isolated Aquifer Zone Testing (optional)

This optional line item includes installation of sampling equipment in the pilot borehole, development pumping, water quality sampling and analyses, and groundwater level monitoring to be completed at the option of the District in isolated aquifer zones selected by the District. Upon completion of the downhole geophysical surveys, the District will prepare a schedule of testing and sampling for specific isolated aquifer zones. The schedule will specify the number and depth of individual zones to be tested, depth intervals for gravel pack and seals, specific sampling requirements and method of pumping for sample collection (air-lift and/or submersible pump).

The Contractor shall be responsible for the collection, storage, transport and analysis of groundwater samples during isolated aquifer zone testing. Laboratory analyses of water samples shall include the chemicals listed and be completed within 48 hours after submittal to the laboratory. Laboratory results shall be provided to the District in paper copy and District approved digital formats on compact disk.

1.1.10. Final Reamed Borehole and Caliper Survey

This item includes reaming the pilot borehole to the final borehole diameter(s) and depth(s) specified by the District in the final well design. Upon receipt of a written final well design from the District, the Contractor shall ream the pilot borehole to a diameter of 26 inches and to a depth to be specified upon completion of the pilot borehole and zone testing.

A record shall be kept by the Contractor showing any variation in the addition and amount of drilling fluid or water required during the drilling operation. The depths at which such changes are required shall be shown in the daily reports.

Upon completion of the reaming operations, a caliper survey and deviation survey shall be run to verify the alignment, final diameters and depths reamed. If the caliper survey shows the reamed borehole to be less than the specified diameter(s) at any point or the final borehole is less than the specified depth, the borehole shall be re-reamed or re-drilled and re-surveyed at the Contractor's expense.

1.1.11. Installation of Well Casing and Screen

The Contractor shall, upon completion of reaming and caliper survey, install a string of casing and screen as directed by the District Representative in the approved final well design. The casing shall extend 12 inches above the existing ground surface. The entire well casing string (i.e., blank casing, well screen, final blank section, and bottom plate) shall be suspended in tension from the surface by means of an appropriate hanger or

clamp prior to placement of the filter pack so that the casing is not supported from the bottom of the hole.

The blank casing shall be 16-inch diameter mild steel well casing. The Contractor shall install a dielectric coupler (mechanical connector) anywhere mild steel and stainless steel casing connected to minimize potential for corrosion between dissimilar metals. The mechanical connector shall be manufactured by Roscoe Moss or other approved manufacturer.

The well screen shall be manufactured in accordance with the aforementioned casing requirements for blank casing. The screened well casing shall be 16-inch diameter 304L stainless steel, louvered type Roscoe Moss Ful Flo Shutter Screen with machine made openings that are horizontal to the axis of the casing with an aperture facing downward. For bidding purposes only, the aperture size shall be 0.060 inches. Actual specifications for the screened casing will be determined by the District following interpretation of grain size analyses and electrical logging results and will be specified in the final well design prepared by the District. The blank well casing shall have the same I.D., thickness as the screened well casing.

The blank casing and screen shall be plumb and centered in the hole. Centralizers with 120 degree spacing shall be installed to blank casing sections, as specified in this section unless otherwise directed by the District Representative, to hold the casing in the proper position for placement of the filter pack. Three centralizers shall be placed as follows: 1) five feet from the bottom of the casing; 2) five feet above the uppermost screen; and 3) sixty feet from the ground surface. The guides shall be placed in the blank casing sections only. No centralizers shall be attached adjacent to screened casing.

All field joints shall be properly lap or butt-welded during installation with a minimum of two continuous passes per circumference. All field welding shall be performed in accordance with American Welding Society Standards by a certified welder. Welder Certifications shall be specific to metal type (i.e. stainless steel certification).

A 3-inch diameter permanent gravel feed tube shall be installed in the reamed borehole prior to installation of the well casing. The gravel feed tube shall consist of 3.5-inch outside diameter mild steel flush treaded to Schedule 80 PVC for the section of tube adjacent to any stainless steel well casing. The bottom of the tube shall be placed below the planned top of the gravel pack as specified in the final well design. The top of the gravel feed tube shall extend above the ground surface.

A temporary construction tremie pipe shall be installed in the reamed borehole prior to installation of well casing. The tremie pipe shall be used to install gravel pack, annular seal and sanitary seal materials in the annulus between the well casing and borehole. The tremie pipe shall be completely removed after placement of the upper annular seal.

Sounding tubes shall be installed as specified in the final well design. Sounding tubes shall enter the well casing at the depths specified in the final well design. At the point of entry, a sounding tube shall be securely welded to the casing in a manner and at an angle approved by the District. All rough cut edges shall be ground smooth prior to completing the splice.

1.1.12. Installation of Filter Pack

Upon completion of the installation of the well casing string, the Contractor shall circulate the drilling fluid and any chemical additives in order to remove all solids from the completion fluid in preparation for the installation of the filter pack.

The filter pack material shall be natural, hard, water worn, well rounded and washed clean of all clay, silt and foreign material. Mechanically crushed rock will not be acceptable. For bidding purposes only, the required filter pack material shall be NSF 61 approved by SRI Supreme with U.S. Standard Sieve Size 8X16, or equivalent approved by the District Representative. Filter pack material shall be delivered to the site in “super sacks”, weighed by a certified weigh master prior to delivery. Accurate volume measurement may substitute for weighing certification.

Actual filter pack specifications shall be determined by the District following interpretation of grain size analyses and geophysical logging (i.e., e-log) results and will be specified in the final well design prepared by the District. A certificate of quality and gradation of the filter pack material from an approved testing laboratory shall be submitted to the District Representative for every 40 sacks delivered to the site, before the filter pack material is delivered to the site.

Prior to placement of the filter pack in the well, the drilling fluid shall be thinned with clean water to reduce weight and viscosity. Disinfection of the filter pack shall follow the guidelines contained in Section 3.1, AWWA 654-03 and shall include the following: 1) sodium hypochlorite solution or calcium hypochlorite shall be added to the circulating fluid until a concentration of 50 mg/l is achieved in the entire volume of fluid within the well hole; 2) calcium hypochlorite powder or tablets (5 gram size max) shall be uniformly mixed with the filter pack at a rate of ¼ pound per ton of filter pack prior to placement in the well. Chlorinated water shall be circulated while installing the filter pack. The filter pack shall be placed by pumping through a tremie pipe extending to the bottom of the casing-hole annulus. The tremie pipe shall gradually be withdrawn as the filter pack is placed. Circulating shall be continued during placement until the filter pack is completely in place. Before the filter pack installation begins, the Contractor shall make adequate preparations to insure that circulation will be continuous.

The gravel pack shall be installed in the annular space between the reamed borehole and well casing through a construction tremie pipe from the bottom of the borehole. A circulating system with one or more positive displacement pumps utilizing fresh water shall be used for the purpose of introducing the gravel into the annulus. Under no circumstances

will the gravel pack be allowed to “free-fall” down into the annular space. The Contractor shall be responsible for any damage to the well resulting from the filter pack installation process.

The Contractor shall provide to the District an estimate of the volume of annular space between the casing and borehole wall prior to installing the gravel pack. The Contractor shall also record the volume of gravel installed. The volume shall not be less than the calculated volume of the annular space between the casing and the borehole wall based on the caliper survey. A significant discrepancy may be grounds for rejection of the well by the District.

1.1.13. Development

Prior to any development activity, the Contractor is required to sound and record the depth to the bottom of the well. This can be accomplished by a weighted wireline or other equivalent means.

The Contractor shall initially develop the well by line swabbing with a bailer or swab opposite the perforations to stabilize and settle the gravel pack. The gravel pack will be topped off during swabbing operations, as necessary. After initial swabbing has been completed, the Contractor shall remove all accumulations of mud, sand, or gravel to the full depth of the well using a bailer. The total number of feet of material swabbed into the well shall be recorded in the driller’s log.

Following initial swabbing and removal of accumulated debris, development will continue using air-lift pumping in conjunction with a dual swab development tool. The tool will consist of a 10-foot length of perforated pipe with flexible rubber swabs attached to each end. The tool shall be mounted on an eductor pipe and raised and lowered for a minimum of 15 minutes for every 20-foot screened section while water is simultaneously pumped through the eductor by air lifting. Dual swab airlifting development shall proceed from top to bottom of the screen in 20-foot sections until complete to the satisfaction of the District Representative. The Contractor shall provide sufficient airline diameter, airline submergence, eductor pipe diameter, and air compressor capacity in combination to produce a flow rate of at least 300 gallons per minute from the swab development tool. The Contractor shall bail or air lift sediment from the bottom of the well periodically during and at the end of well swab development activities as directed by the District Representative.

Upon completion of development and removal of collected debris, the Contractor shall install the test pump and discharge to land surface in accordance with the District’s NPDES Permit. All drilling fluid will be retained on site. Discharge of the chlorinated well water shall be treated with sodium thiosulfate to remove chlorine residual. The use of temporary storage tanks (e.g., Baker tanks), of sufficient size to allow for the adequate settlement of solids (as described above), shall be required to assure compliance with discharge requirements.

The initial pumping rate shall be restricted and, as the water clears, shall be gradually increased until a maximum rate is reached. The maximum rate will be determined by the District Representative, after consideration of the well's drawdown and discharge characteristics but will not exceed 2,500 gpm. At proper intervals, the pump shall be stopped and the water in the pump column shall be allowed to surge back through the pump bowls and through the screened portion of the well.

The Contractor shall continue development as directed by the District Representative. During development, sand production will be measured using centrifugal sand separating device (i.e., Rossum sampler) supplied by the Contractor and installed on the discharge piping, if necessary.

1.1.14. Pumping Test

Following development operations and at least a twenty-four (24) hour groundwater level recovery period, well testing shall begin under the direction of the District Representative. The Contractor shall pump the well at three (3) or four (4) constant discharge rates as designated by the District Representative. The pumping rates shall be uniformly increased until the final pumping rate is near the maximum pump-well capacity. It is estimated that the total "step" pump test shall require a pumping period of at least twelve (12) hours.

Upon completion of the "step" pump test, the groundwater level shall be allowed to recover for at least twenty-four (24) hours. Following the groundwater level recovery, the Contractor shall be prepared to conduct a "constant rate" pump test under the direction of the District Representative. If deemed necessary, the "constant rate" pump test would require a continuous pumping period of at least 48 hours at a rate to be determined by the District Representative.

The District Representative shall measure the groundwater level recovery for twelve (12) hours after completion of test pumping. At the end of the test pumping, the Contractor shall sound the depth to the bottom of the well to measure any accumulation of sediment. The Contractor shall not be required to have personnel at the well during the recovery periods.

Should a breakdown of the equipment occur prior to the completion of the pumping test period that renders the test results invalid, the Contractor, at his expense, must then proceed, after a sufficient recovery period, with a new test period. The District Representative shall determine if the test results are invalid and length of the recovery period. Time stated for the duration of the test period is an estimate only and the District Representative reserves the right to require the Contractor to reduce such period of test, change the discharge rate, or change the test procedure.

Prior to commencing the constant-rate discharge test, the District and Contractor shall set a start time for the flow meter survey. The flow meter survey shall be run at the rate of discharge selected for the constant rate discharge test.

1.1.15. Video Survey, and Alignment/Deviation Tests

A color video survey shall be conducted after removal of the test pump and before final disinfection of the well. The survey shall be conducted (1) after all sediment accumulating in the well from test pumping has been removed, (2) after fresh water has been introduced from the surface to clarify water standing in the well, and (3) before final disinfection of the well. Video survey results will serve as a final inspection document for the well.

The Contractor shall conduct alignment/deviation tests, using a gyroscopic tool, to determine the plumbness and straightness of the well casing. The alignment/deviation test shall be conducted throughout the entire length of casing and screen. Alignment tests shall be conducted upon completion of the downhole color video survey.

1.1.16. Disinfection

Prior to removal of the test pump from the well and final well cleaning, the Contractor shall sterilize the well in accordance with Section 5.1, AWWA C654-03, Standard for Disinfection of Wells, and as directed by the District Representative. After disinfection and flushing of the well, the District Representative shall sample the well water for coliform bacteria. If testing indicates the presence of coliform bacteria, Contractor shall repeat the disinfection and flushing procedure at no additional cost to the District until satisfactory results (i.e., no coliform bacteria detected) are achieved. "Pool" chlorine will not be acceptable for well disinfection. Chlorine products used for disinfection of the well shall be designed for potable water use (i.e., NSF 61 certified), delivered to the site in original closed containers, and bear the original label, indicating the percentage of available chlorine.

Chlorinated well water shall be treated with sodium thiosulfate or equivalent, as directed by the District Representative, to remove residual chlorine from the discharge water.

1.1.17. Well Capping

At times during the progress and at completion of the work, the Contractor shall protect the well in such manner as will effectively prevent either tampering with the well or entrance of foreign matter into it, and. Upon completion of well disinfection, the well casing and all accessory tubing shall be capped with welded steel plates.

1.1.18. Move-Out, Clean-up and Miscellaneous Work at Well

Following completion of all well pumping and clean-up work to the satisfaction of the District Representative, the Contractor will move all equipment (including sanitation facilities) off the site. Final disposition of cuttings will be the District's responsibility. Final site restoration following completion of the work will be the responsibility of the District.

PROJECT PLANS AND TECHNICAL SPECIFICATIONS - ATTACHED

New Extraction Well at Well ID4-4 Location

157

project plans AND TECHNICAL SPECIFICATIONS -
ATTACHED

PROJECT VICINITY MAP
 Borrego Springs, California

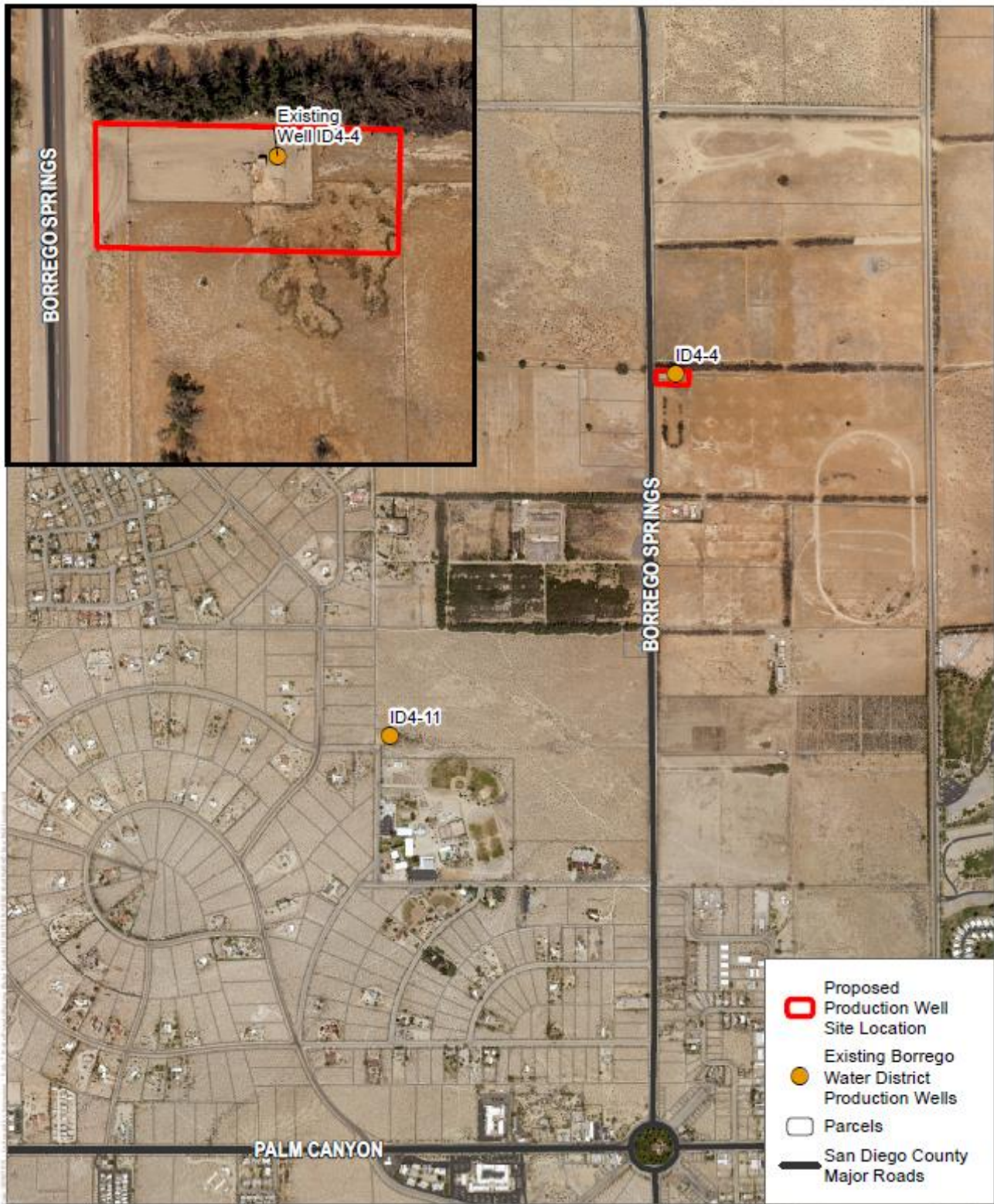


FIGURE 1

Proposed Production Well Site Location Map
 Borrego Water District New Production Well



New Extraction Well at Well ID4-4 Location

159

project plans AND TECHNICAL SPECIFICATIONS -
ATTACHED

New Extraction Well at Well ID4-4 Location

160

project plans AND TECHNICAL SPECIFICATIONS -
ATTACHED

**EXHIBIT "A"
CHANGE ORDER FORM**

Borrego Water District

*806 Palm Canyon Drive
Borrego Springs, CA 92204*

Contract Change Order #

Project:	Change Order No.:		
	Orig. Contract Amt.: \$		Days
Contract No.:			
Contractor:	Prev. Appvd. Changes: \$		Days
Owner: Borrego Water District	This Change: \$		Days
	Revised Contract Amt.: \$		Days

This Change Order covers changes to the subject contract as described herein. The Contractor shall construct, furnish equipment and materials, and perform all work as necessary or required to complete the Change Order items for a lump sum price agreed upon between the Contractor and Borrego Water District, otherwise referred to as Owner.

Item No.	Description of Changes	Increase/ (Decrease) in Contract Amount	Contract Time Extension, Days
1			
2			
	Totals	\$	

This Contract Change Order consists of **2 pages** and any exhibits attached to this Contract Change Order shall not be part of the Contract Change Order unless specifically initialed by or on behalf of both the Contractor and the Borrego Water District.

Contract Change Order # _____ Page 1 of 2

The amount of the contract will be increased by the sum of \$_____ and the contract time shall be extended by working days. The undersigned Contractor approves the foregoing Change Order # as to the changes, if any, in the contract price specified for each item including any and all supervision costs and other miscellaneous costs relating to the change in work, and as to the extension of time allowed, if any, for completion of the entire work on account of said Change Order #. The Contractor agrees to furnish all labor and materials and perform all other necessary work, inclusive of the directly or indirectly related to the approved time extension, required to complete the Change order items. This document will become a supplement of the contract and all provisions will apply hereto. It is understood that the Change Order shall be effective when approved by the Owner.

Contractor accepts the terms and conditions stated above as full and final settlement of any and all claims arising out of or related to the subject of this Change Order and acknowledges that the compensation (time and cost) set forth herein comprises the total compensation due for the work or change defined in the Change Order, including all impact on any unchanged work. By signing this Change Order, the Contractor acknowledges and agrees that the stipulated compensation includes payment for all Work contained in the Change Order, plus all payment for any acceleration or interruption of schedules, extended overhead costs, delay, and all impact or cumulative impact on all Work under this Contract. The signing of this Change Order acknowledges full mutual accord and satisfaction for the change and that the stated time and/or cost constitute the total equitable adjustment owed the Contractor as a result of the change. The Contractor hereby releases and agrees to waive all rights, without exception or reservation of any kind whatsoever, to file any further claim or request for equitable adjustment of any type, for any reasonably foreseeable cause that shall arise out of, or as a result of, this Change Order and/or its impact on the remainder of the Work under the Contract.

Accepted:

 (Signature) Contractor's Authorized Representative _____
Date

Recommended:

 (Signature) Carlos Beltran, District Engineer _____
Date

Approved:

 (Signature) Geoff Poole, Borrego Water District _____
Date

Item No.	Justification for Change(s)
1	
2	

This Contract Change Order consists of **2 pages** and any exhibits attached to this Contract Change Order shall not be part of the Contract Change Order unless specifically initialed by or on behalf of both the Contractor and the Borrego Water District.

Contract Change Order #

Page 2 of 2

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.3

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT Grant Progress Report & Priorities – Rick Alexander

RECOMMENDED ACTION:

Review report and recommendations from Consultant and direct staff accordingly

ITEM EXPLANATION:

As a follow up to the December 2018 Board Meeting, Staff, Rick Alexander and various other parties have been working on current Prop One Grant Application requirements as well as new projects such as Local Government Commission and other grant/loan opportunities. Attached is Rick’s monthly update for Board review. Rick is planning to attend the Board Meeting.

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Report from Rick Alexander

Board of Directors
BORREGO WATER DISTRICT
806 Palm Canyon Drive
Borrego Springs, CA 92004

TRAC Project Update:

At the December 11 Board of Directors meeting, staff reported on the status of the California Water Board's funding for the Wastewater Treatment Plant Upgrade (Project 34661) and the Water Distribution System Project (Project 34239).

Please recall that the next step in that process was to conduct Archaeological and Biological surveys of the project sites as a requirement for federal funding participation.

- Spindrift Archaeology; Staff furnished additional detailed project descriptions, and a summary of funding requirements to Spindrift on December 21. They will finish a draft report for staff review this month. They continue to be on time, and slightly under budget.
- Rocks Biology: Following resolution of contract questions, an agreement with Rocks was finalized on November 30. We are now scheduling a field/site tour and briefing for their Principal Biologist in the next two weeks. Staff has furnished complete project documentation to them.
- Response from Water Boards staff:

On November 21, in response to our inquiry, Project Manager Joseph Quilatan reported that they had undertaken review of our application for the Water Distribution System Project, and that it should be completed in the "first week of December." Their comments have not been received (holidays?) and staff contacted Mr. Quilatan on January 3.

We have recent experience with developing responses since the Wastewater Treatment Plant application response was very similar. We were able to complete that response in less than ten days.

- Identifying funding sources for BWD Priorities:

Staff has identified wastewater collection/treatment, agricultural land fallowing, maintaining and enhancing water quantity at all levels, and assuring water quantity as the priority areas to seek funding opportunities.

- TRAC and BWD -GM intend to make a trip to Sacramento in January/February to:

Workshop with ACWA staff on recommended sources of funding in these areas.

We have contacted staff of State Senator Brian Jones (CA38), and Assembly member Randy Voepel (CA71), to select meeting dates, and to assure that they have a clear understanding of the water issues and planning in the Borrego Valley. We will also solicit their support for current and future applications for funding.

Meet with staff of California Senate President Pro Tempore Toni Atkins (CA39) with the same goal of providing clear information and discussing future assistance at all levels.

Estimated travel cost including an overnight stay in February for two travelers;

Air Fare:	\$500
Lodging	\$280
Meals (4x1 traveler)	\$100*
<u>Shuttle/taxi/incidentals</u>	<u>\$100</u>

Estimated Total Cost \$980

*TRAC does not bill for travel meals

- Local Government Commission/Proposition 68 Funding Project.

LGC staff sent comments on BWD's proposed contract on December 28. Staff responded to the requested changes on January 2 and LGC staff has agreed to the final language which is being circulated for signature.

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.4

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT: FY 2019 Budget Development Process & Tie-In to Prop 218 Analysis – L Brecht

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Information from Director Brecht

Timelines	Cash Flow Impact	Financial Risk	Financial Management Task Description
Jan 8, 2019			Revise FY2019 budget so as risk not meeting debt coverage covenant w/ banks
Jan 8, 2019			Review CIP debt & grant build plans to make certain the District is on time, on budget w/ plans submitted to banks
Jan 31, 2019	200,000		T2 Spare Capacity Lease Agreement obligation agreed to
Mar 1, 2019	500,000		written agreement when District GSP development costs will be reimbursed at what %. This is required for FY 2020 budget documents
Mar 15 2019		4,000,000	bring RHD flood control facilities up to standard w/ repairs
Mar 15, 2019			CIP input to FY 2020 budget due
Apr 15, 2019			GSP-related expenses input to FY 2020 budget due
June 30, 2019	500,000		Prop 1 SDAC Reimbursal for full \$500,000 if received before this date to be credited to FY 2019 cash flow
June 30, 2019		1,500,000	difference in interest cost for tax-free vs. taxable bonds. A CIP progress update is required for FY 2020 budget documents
June 30, 2019		400,000	Cyber security risk cost estimate. Addressing cyber security must be described in FY 2020 budget documents
June 30, 2019		1,000,000	\$1,000,000 is estimated cost estimate required for Project & Management Actions (PMAs) development costs to complete GSP
June 30, 2019	(1,000,000)		potential District cost for stipulation (need plan & budget)
June 30, 2019	(1,250,000)		whether low interest debt source for FY2022 CIP \$5.6M takedown is identified and developed as a source for funds
June 30, 2019	(200,000)		decision on contribution of Legislative-sponsored bond offering for \$35M Borrego appropriation
June 30, 2019	(300,000)		\$16,000,000 is the estimate for required 20-Year GSP implementation costs (essentially the administrative and “adaptive management” costs of the GSP. \$300,000 is the PV annual costs the District is expected to cover, or ~\$6,000,000+ over 20-years.

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019

AGENDA ITEM 2.A.5

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT: 2019 Town Hall Meeting Date Selection & Agenda – L Brecht, BWD

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Information from Director Brecht

2019 BWD TOWN HALL AGENDA - DRAFT

On January 1, 2015, the Sustainable Groundwater Management Act (SGMA) went into effect. This law requires all groundwater basins in the State to be brought into sustainable use. That means no more overdraft (using more water than is replaced by rainfall or imported water each year). Under SGMA rules, Borrego must reach sustainable use of the Borrego Springs Subbasin (the groundwater basin where we get all our water) no later than January 2040. This basin has been designated by the California Department of Water Resources (DWR) as critically over-drafted. This does not mean that we are of immediate danger of running out of water. What critically over-drafted means is that adverse economic, social and/or environmental impacts are likely if we do not eliminate the overdraft in a timely fashion.

Please join us for this important meeting to discuss issues that will impact our entire community.

Town Hall Agenda

Welcome and Introductions: BWD Board President

Planning Overview - Board President, BWD (10 minutes)

Dudek PPT, Chapters 1-3 Draft Groundwater Sustainability Plan Key Concept Slides -
Trey Driscoll (20 minutes)

Dudek PPT, Chapters 4-5 Draft Groundwater Sustainability Plan Key Concept Slides -
Trey Driscoll (20 minutes)

Models, Uncertainty, and Some Overdraft Economics - Director Brecht (15 minutes)

How Ratepayers Can Be Heard - Gary Haldeman, BWD Ratepayer

Representative to GSP Advisory Committee (5 minutes)

Q&A: Verbal and written questions (remaining time)

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.6

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT: Nomination of Board Standing and Ad hoc Committee Selection – G Poole, BWD

RECOMMENDED ACTION:

Discuss, nominate and elect BWD Standing and Ad Hoc Committees

ITEM EXPLANATION:

In the past the BWD Board has maintained one Standing Committee and a series of Ad-hoc Committees based on specific need. A Standing Committee has continuing jurisdiction over issues and meet on a regular basis. Those meetings are required to comply with the Brown Act. Ad hoc Committees are created for a specific purpose and not subject to the Brown Act.

In the past, the only standing Committee is Operations and Infrastructure, and Ad-hoc Committees were created for GSP development, Annual Audit, Risk, Rams Hill Long Term Cooperation Agreement and Association of California Water Agencies Joint Powers Insurance Authority. The Board has full discretion to create the Committees needed.

FISCAL IMPACT:

N/A

ATTACHMENTS:

1. None

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.A.7

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT Future Meeting Dates – G Poole, BWD

- a. Resolution to Change Date of Regular Meeting to January 29th
- b. January 11th Special Meeting (9:15-9:45 AM) to receive and file FY 2018 Audit results
- c. January 23rd Special Board Meeting for AB 1234 Ethics Training BB&K Webinar (9:00-11:00AM) – voluntary
- d. February 2019 - Dolly Mack Associates Board Strategy Development Proposal – G Poole

RECOMMENDED ACTION:

Discuss upcoming Board Meeting dates and direct staff accordingly

ITEM EXPLANATION:

A series of meetings are proposed above and Staff would like to confirm availability.

FISCAL IMPACT:

N/A

ATTACHMENTS:

1. Resolution 2019-01-01

RESOLUTION NO. 2019-01-01

RESOLUTION OF THE BOARD OF DIRECTORS OF THE
BORREGO WATER DISTRICT
REVISING THE SCHEDULE OF REGULAR MEETINGS

WHEREAS, on June 14, 1983, this Board of Directors adopted Ordinance No. 83-1 establishing the Administrative Code of the Borrego Water District (“Administrative Code”) pursuant to the specific and implied grants of authority in Division 13, commencing with Section 34000, of the Water Code of the State of California to serve in part as the Bylaws of the Borrego Water District as required by Section 35300 et seq. of the Water Code; and

WHEREAS, Section 4.1.1 of the Administrative Code as adopted by Ordinance No. 83-1 established a schedule of the regular meetings of the Board of Directors; and

WHEREAS, on February 28, 2007 the Board of Directors adopted Ordinance No. 07-1 amending Section 4.1.1 of the Administrative Code governing the date and time of regular meetings of the Board of Directors to read: “4.1.1 Regular Meetings. Regular meetings of the Board shall be held pursuant to such schedule as the Board may adopt by Resolution from time to time. In the event the regular meeting date falls on a holiday designated in Section 6700 of the Government Code, a regular meeting of the Board of the cancellation of a regular meeting or meetings may be made by a majority vote of the members of the Board at least fifteen (15) days prior to the change or cancellation. A determination to change or cancel a regular meeting must be made at a regular or special meeting of the Board;” and

WHEREAS, the Board of Directors adopted Resolution 2007-2-1 on February 28, 2007 setting its regular board meetings at 9:00 a.m. on the second and fourth Wednesday of each month.

WHEREAS, the Board of Directors Adopted Resolution 2008-9-03 on September 24, 2008 setting its regular board meetings at 9:15 a.m. on the fourth Wednesday of every month.

WHEREAS, the Board of Directors adopted Resolution 2011-02-01 on February 15, 2011 setting its regular meetings at 9:00 a.m. on the fourth Wednesday of the month.

WHEREAS, pursuant to Ordinance 07-1, the Board of Directors desires to revise the schedule for its regular meetings.

NOW, THEREFORE,

the Board of Directors of the Borrego Water District does hereby resolve, determine and order as follows:

Section 1.

The Board of Directors of the Borrego Water District shall hold its regular meetings at 9:00 a.m. on the fourth Wednesday of each month.

Section 2.

Notwithstanding Section 1, above, the regular meetings of the Board of Directors of the Borrego Water District for the month of January 2018 shall be held on the fifth Tuesday, January 29th, 2019.

ADOPTED, SIGNED AND APPROVED this 8th day of January, 2019.

President of the Board of Directors of Borrego Water District

ATTEST:

Secretary of the Board of Directors of Borrego Water District

STATE OF CALIFORNIA

)

) ss.

COUNTY OF SAN DIEGO)

I, TBD, Secretary of the Board of Directors of the Borrego Water District, do hereby certify that the foregoing resolution was duly adopted by the Board of Directors of said District at a regular meeting held on the 8th day of January, 2019, and that it was so adopted by the following vote:

AYES, DIRECTORS:

NOES, DIRECTORS:

ABSENT, DIRECTORS:

ABSTAIN, DIRECTORS:

Secretary of the Board of Directors of Borrego Water District

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.1

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT Facilitation Services for GSP Advisory Committee – G Poole

RECOMMENDED ACTION:

Authorize Staff to enter into contract with CCP for continued Facilitation services and add the expense to the future BWD reimbursement request submitted to the GSA.

ITEM EXPLANATION:

The County of SD was informed today that funding for Facilitation Services for the GSP Advisory Committee and Core Teams thru the Center for Collaborative Policy has been discontinued. Meagan Wylie has been assigned to this project since shortly after the start of the AC process and done an admirable job. Staff is recommending BWD continue funding Meagan’s work for the next 4 months and submit these expenses for future reimbursement by the GSA.

FISCAL IMPACT:

N/A

ATTACHMENTS:

1. CCP Proposal and Budget

CCP Facilitation
DRAFT Engagement Letter

January 4, 2019

Dave Ceppos, Associate Director
College of Continuing Education | Consensus and Collaboration Program
Sacramento State Downtown
304 S Street, 3rd Floor
Sacramento, CA 95811
RE: Letter of Authorization

Dear Mr. Ceppos,

In connection with California State University, Sacramento, Consensus and Collaboration Program's (CCP) (formerly Center for Collaborative Policy), authorized work for the Borrego Valley Groundwater Sustainability Plan Advisory Committee (AC), the Borrego Water District (BWD) authorizes CCP to perform work as follows:

1. Facilitation of Borrego AC Meeting #17, scheduled for January 31, 2019.
2. Facilitation of Borrego AC Meeting #18, to be held during the summer of 2019 following the public review period of the draft Groundwater Sustainability Plan (GSP).
3. Pre-meeting planning and preparatory activities and conversations (phone and email as required) between the CCP facilitator and Borrego Core Team (CT) members.
4. Completion of post-meeting follow up activities such as: development of Action Items list; review of meeting minutes prepared by BWD staff; distribution of meeting materials to AC members, etc.
5. As-needed support of CT related to the release of the of the draft GSP for the non-mandatory 60-day public review and comment period, expected for February 2019.
6. As-needed support of CT related to the GSA's development of responses to public comments, and preparation of the Final GSP, expected April through June/July 2019.
7. As-needed communications with Borrego AC members and Borrego CT members.

The period of performance is anticipated to be **January 7, 2019 through August 31, 2019** for a cost not to exceed **\$8,000**.

Sincerely,

Geoffrey Poole, General Manager
Borrego Water District

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.2

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT District Draft GSP Review Process – L Brecht, BWD

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

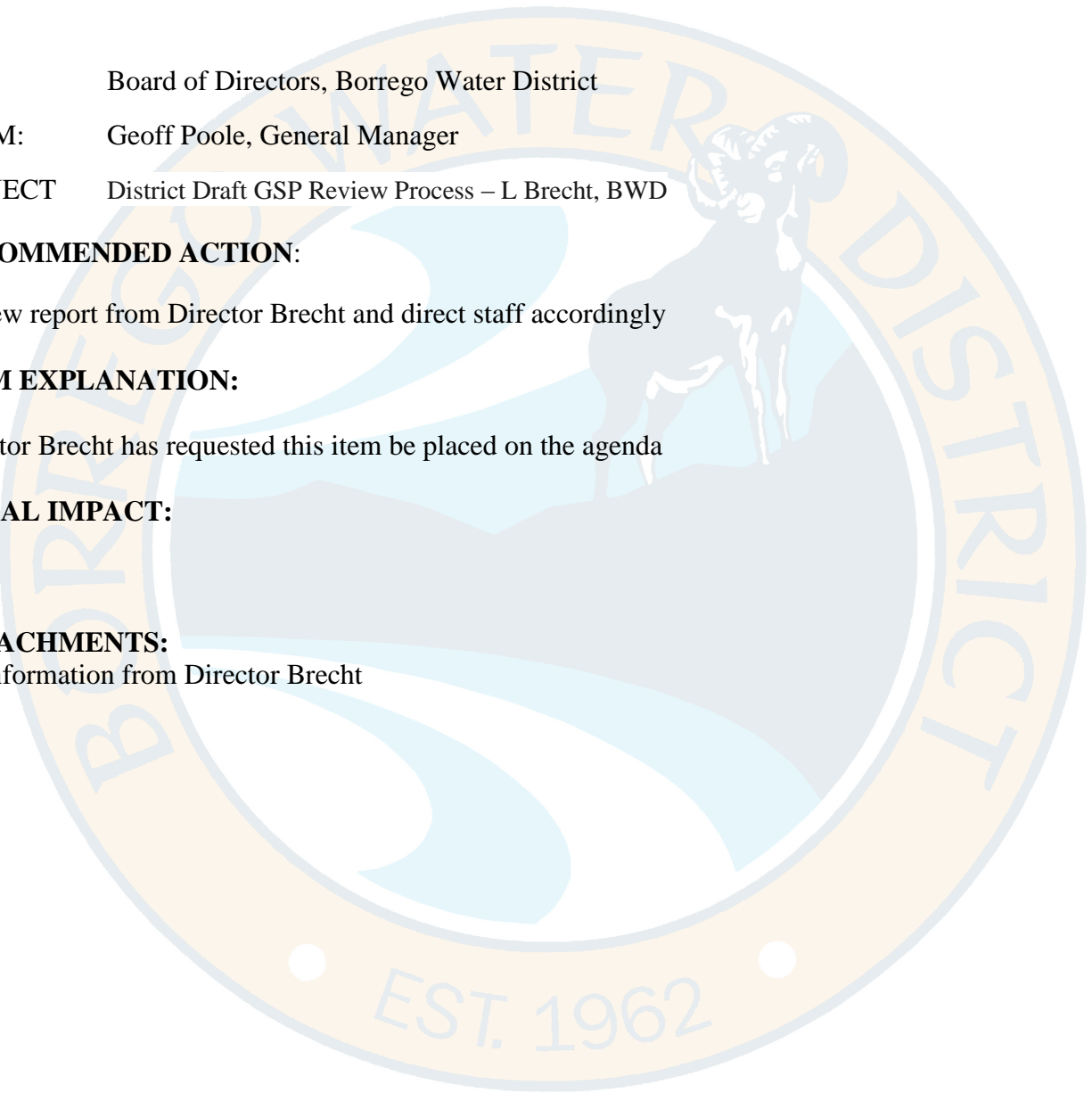
Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Information from Director Brecht



DISTRICT DRAFT GSP REVIEW PROCESS

Perspectives

- Legal - is probably defensible in face of disputes
- Technical - analytically solid in large and small matters
- Economic - results in probable affordable water rates

Criteria

- Avoids CEQA pre-approval
- Meets DWR GSP acceptance criteria
- Able to Achieve a Defensible Validation by Courts
- Receives Adequate Community Support
- Can be Approved by District Board

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.3

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT GSP Planning Process PPT – L Brecht, BWD

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

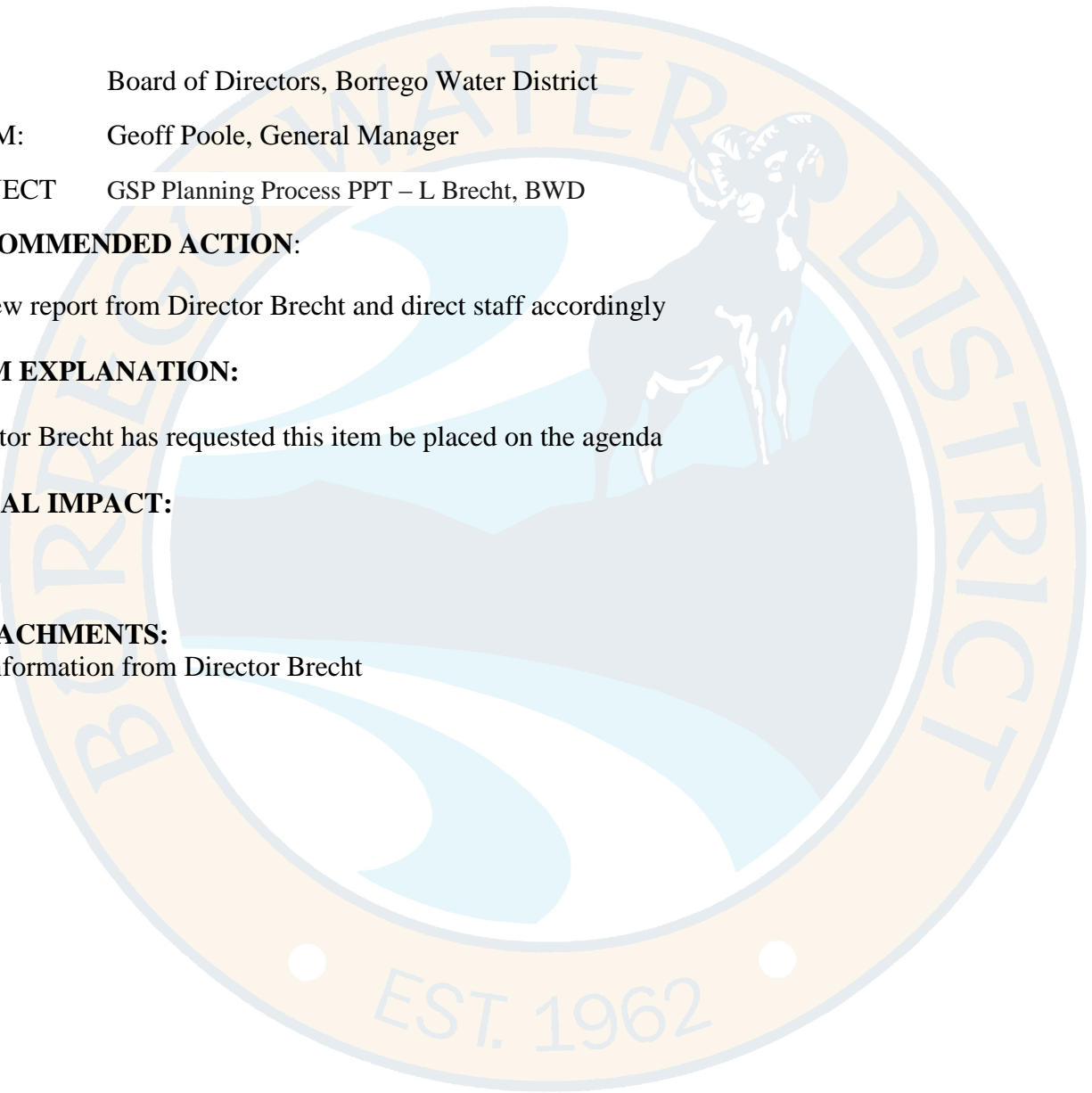
Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

2. Information from Director Brecht





PLANNING PROCESS

BRECHT Draft 1.2

HISTORY

- In 1982, the USGS study, funded by San Diego County, identified a ~6,000 AF overdraft of the Borrego Springs Subbasin
- At that time, given that the USGS estimated ~3M AF of water left in the basin, the mistaken belief was that “the overdraft did not matter because there was ~500-years of water left in the basin”
- thus, the 1980s ‘plan’ was to “let the free market do its thing” and all the farms would be gone from the Valley by around the year 2000

RESULTS OF A NON-PLAN 'PLAN'

- by 2010, the overdraft had more than doubled
- as the water table continued to drop in the basin (on average ~2/feet/year), wells went dry, water quality degraded, and groundwater dependent ecosystems were seriously impacted
- what did not happen was subsidence of the aquifers due to compaction, and reduction of agricultural pumping
- in essence, by shoving the problem of overdraft under the rug for 30+ years, the overdraft became a much more expensive problem to address (overdraft is not and has never been for free)

SGMA

- SGMA sets a date of January 2040 for a critically overdrafted basin, like the Borrego Springs Subbasin, to be brought into sustainable use
- this is an arbitrary drop dead date established for regulatory clarity
- this end date does not limit or mandate the reduction period by which one attempts to reach sustainable use of the basin, nor the reduction velocity as to how fast one attempts to ramp down pumping

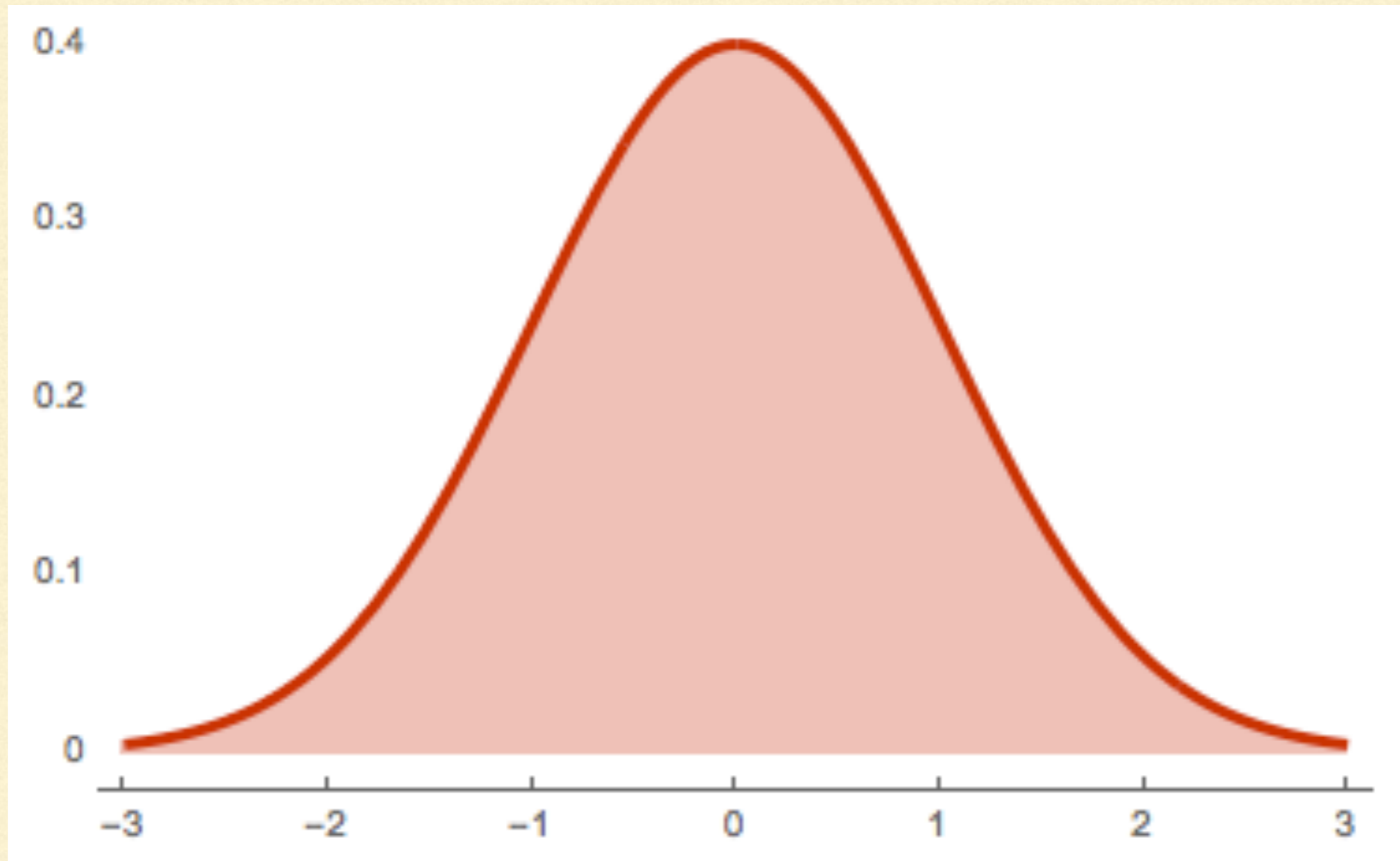
PLANNING OPTIONS

- a minimalist view of SGMA is that it requires a technical, hydrology-based; check the regulatory boxes approach
- however, there is nothing in SGMA that prevents a risk management approach — building in a ‘factor of safety’
- e.g. how does the plan address financial and economic impacts of the overdraft? — to assure one does not reach sustainability, but there is no water district or community left to benefit from a sustainable use of the basin
- a viable, useful Plan needs to do both of the above

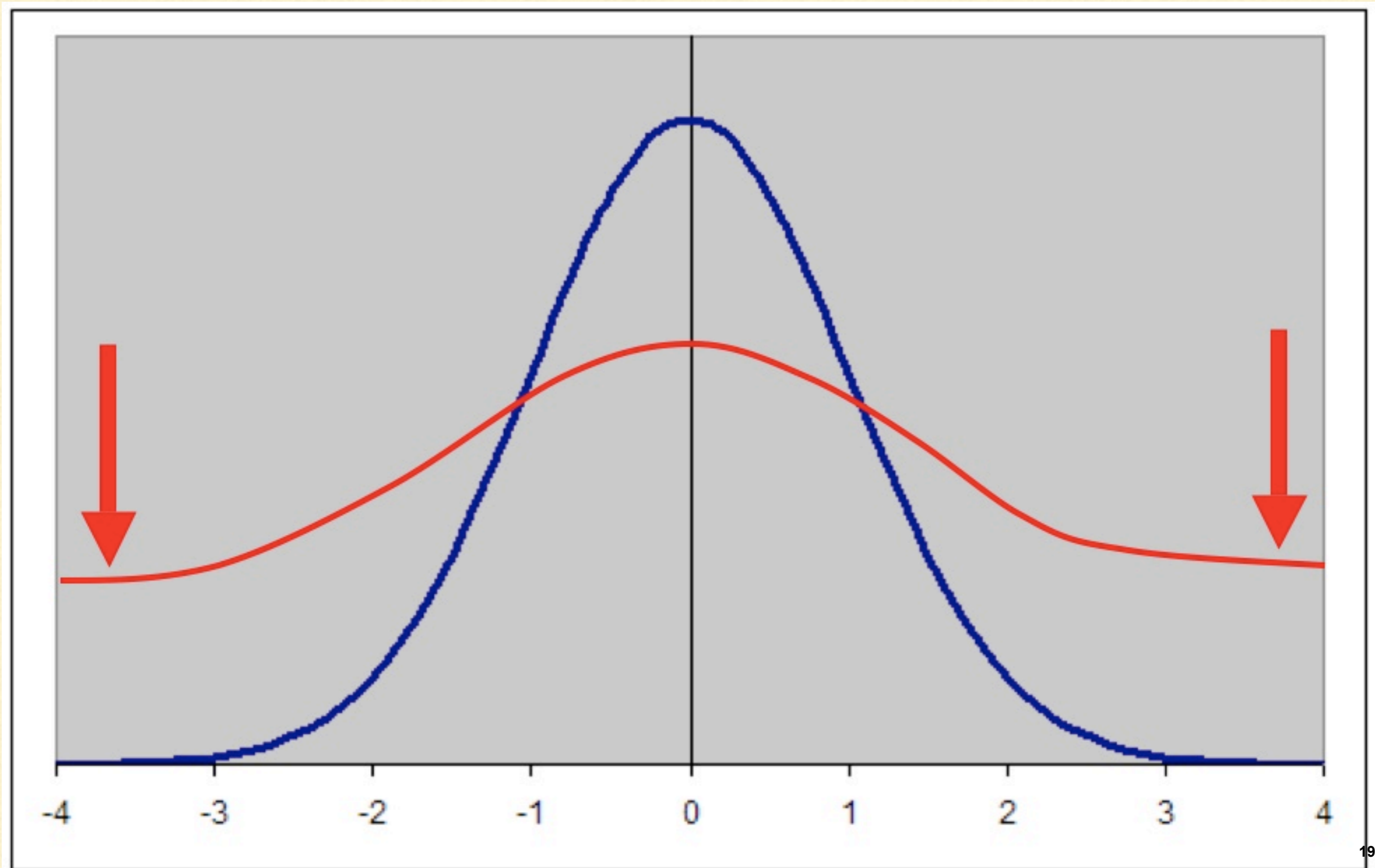
COMMON PLANNING MISTAKES

- Planning Mistake #1: assuming uncertainty is bounded by a normal distribution. For non-linear, complex systems, uncertainty is often more accurately described by a non-normal distribution
- Planning Mistake #2: assuming lack of data means lack of risk
- Planning Mistake #3: assuming stationarity is an uncertainty-free means for forecasting potential future histories
- Planning Mistake #4: assuming 'adaptive management' can correct for all the above planning mistakes

GAUSSIAN DISTRIBUTION

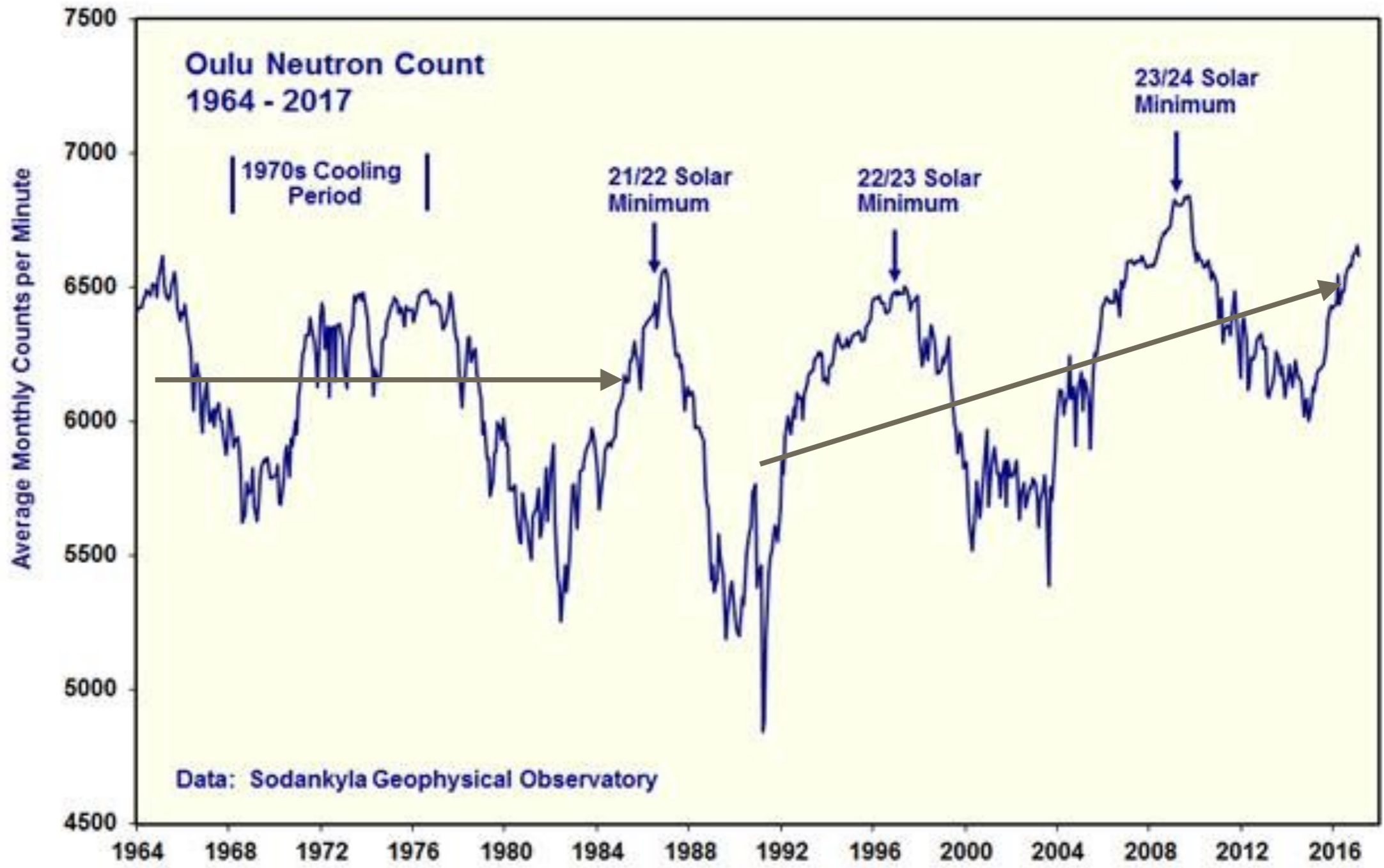


FAT-TAILED DISTRIBUTION



FOOLED BY THE DATA





ADAPTIVE MANAGEMENT

- adaptive management is a no-brainer. It essentially means changing the plan based on pertinent new data, which is common sense
- the planning mistake it to assume that adaptive management is a panacea for correcting all initial planning decisions. Some initial decisions may not be correctable in an economically viable fashion
- extending data sets for all arbitrarily chosen periods may not be useful. Certain planning variables may be on a timeframe that is non-arbitrary. Changing the plan based on new data gathered over an arbitrary timeframe may actually decrease one's probability of meeting a target sustainable yield by a specific date
- decision-making to change a plan may be friction-prone. Thus, useful new data may exist, but not lead to required timely changes in the plan
- 'adaptive management' may be an expensive means to manage all forms of risk. It may not be economically justified in all circumstances

RISK MANAGEMENT FAILURES

- failure to use proper mathematics to forecast risk
- assuming low risk probabilities equals small consequences
- failure to assess real world consequences attached to risk probabilities
- failure to plan for Black Swans
- mistaking Motivated Thinking for real risk assessment



BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.4

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT ENSI Takeaways PPT – L Brecht - BWD

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Information from Director Brecht

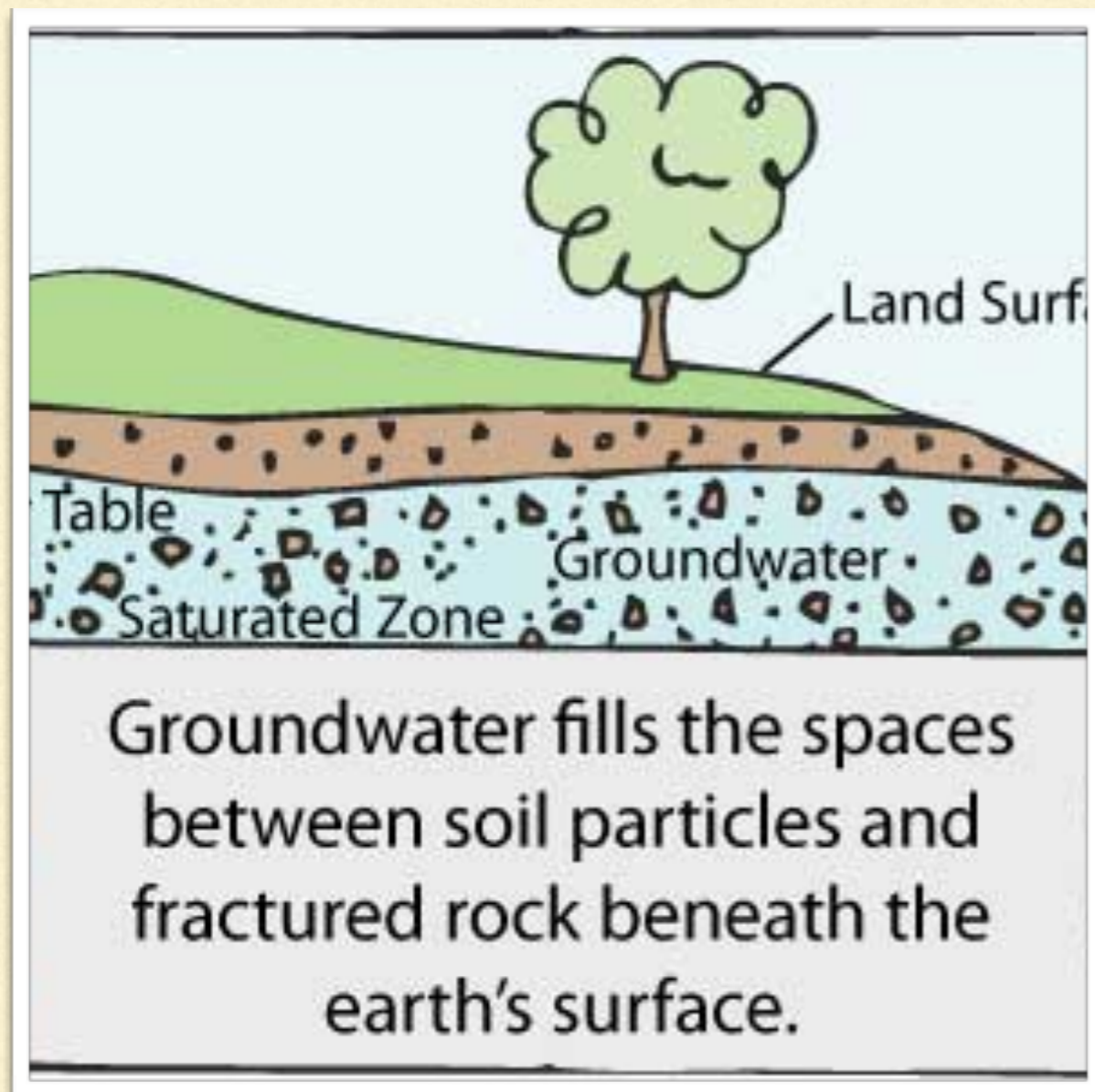
Groundwater

ENSI TAKEAWAYS

BRECHT - DRAFT 1.2

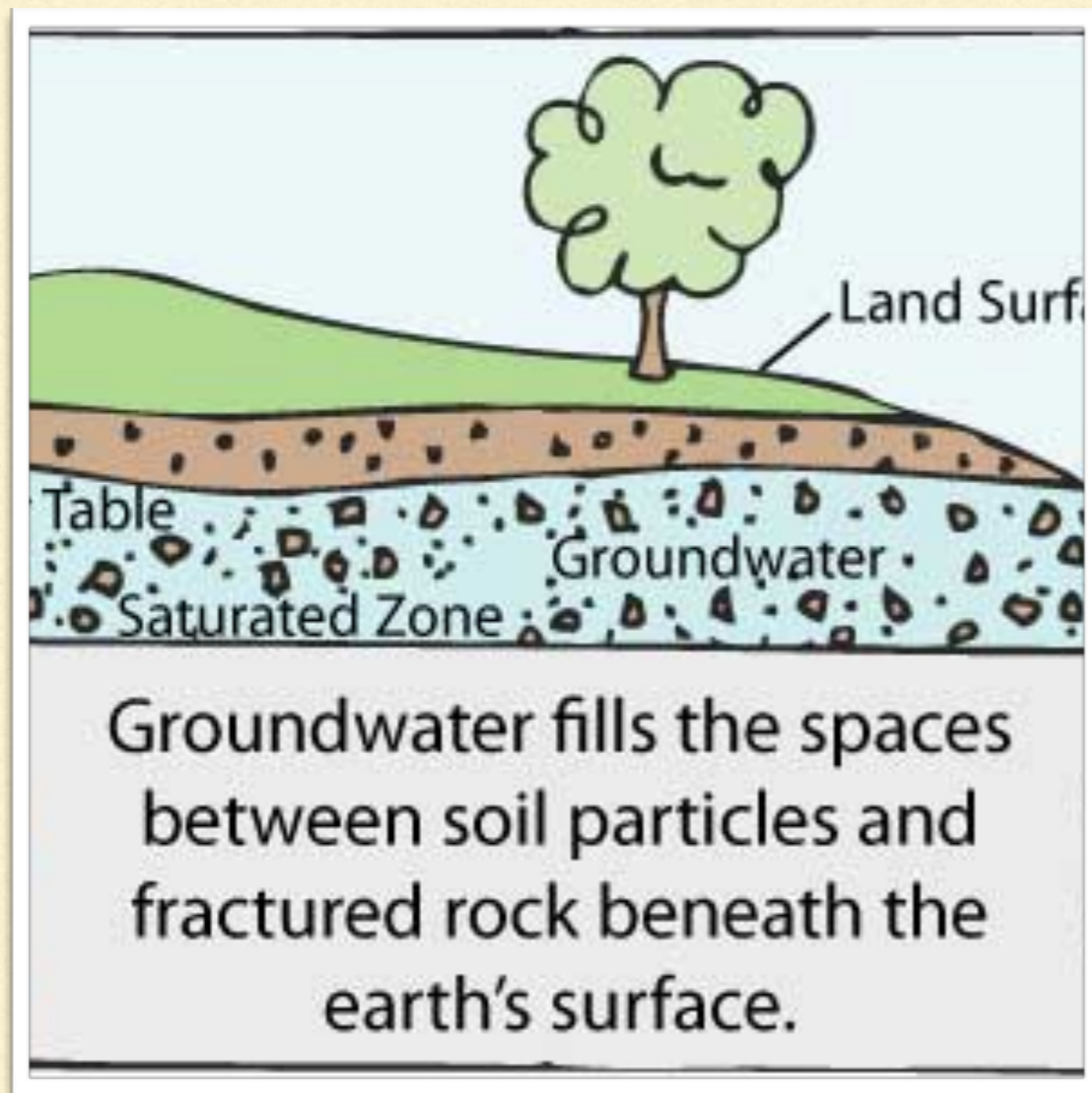
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- *ENSI, Methodology to Examine Future Groundwater Overdraft In Terms Of The Overall Hydrologic Water Balance Considering Recharge Variability And Parameter Uncertainty (September 12, 2018)*
 - *ENSI, Water Quality Review and Assessment: Borrego Water District (BWD) Water Supply Wells (December 7, 2018)*
 - *ENSI, Assessment of Hydrogeological Conditions, Groundwater Model Predictions, and Overdraft Impacts for Active BWD Water Supply Wells (December 20, 2018)*

PHYSICAL GW BASIN I



- three aquifers: upper, middle and lower
- the upper aquifer ranges in thickness from 0 to 643 ft and is thickest at the north end of the valley where Coyote Creek enters the basin. It thins to the southeast and is only about 50 ft thick near the Borrego Sink
- the middle aquifer is as much as 908 ft thick in the northern part of the valley, but it thins substantially in a southeasterly direction
- on the basis of the most recent interpretations of gravity data, the lower aquifer is as thick as 3,831 ft and is thickest in the eastern part of the valley

PHYSICAL GW BASIN 2



- each aquifer differs in *storativity* (the amount of water that will be produced from the aquifer in response to a change in water level)
- each aquifer differs in *hydraulic conductivity* (the relative rates of flow to a well for a given amount of drawdown)
- productivity of the aquifer system decreases with depth from both declines in *storativity* and *hydraulic conductivity*

-
- due to differences in specific yield (Sy) of the three aquifers, water levels are likely to decline faster as the water levels in the upper and middle aquifers are drawn down
 - i.e. Sy: Upper Aquifer 0.13; Middle Aquifer 0.11; Lower Aquifer 0.04
 - water supply well production rates are expected to decrease as a result of ongoing water level decline
 - the greatest impact occurs when the upper aquifer is dewatered as indicated by the four wells (ID4-4, ID4-11, ID5-5, and ID1-8) where the upper aquifer is projected to become dewatered
 - changes in water levels is important for managing District wells and avoiding expensive CIP costs

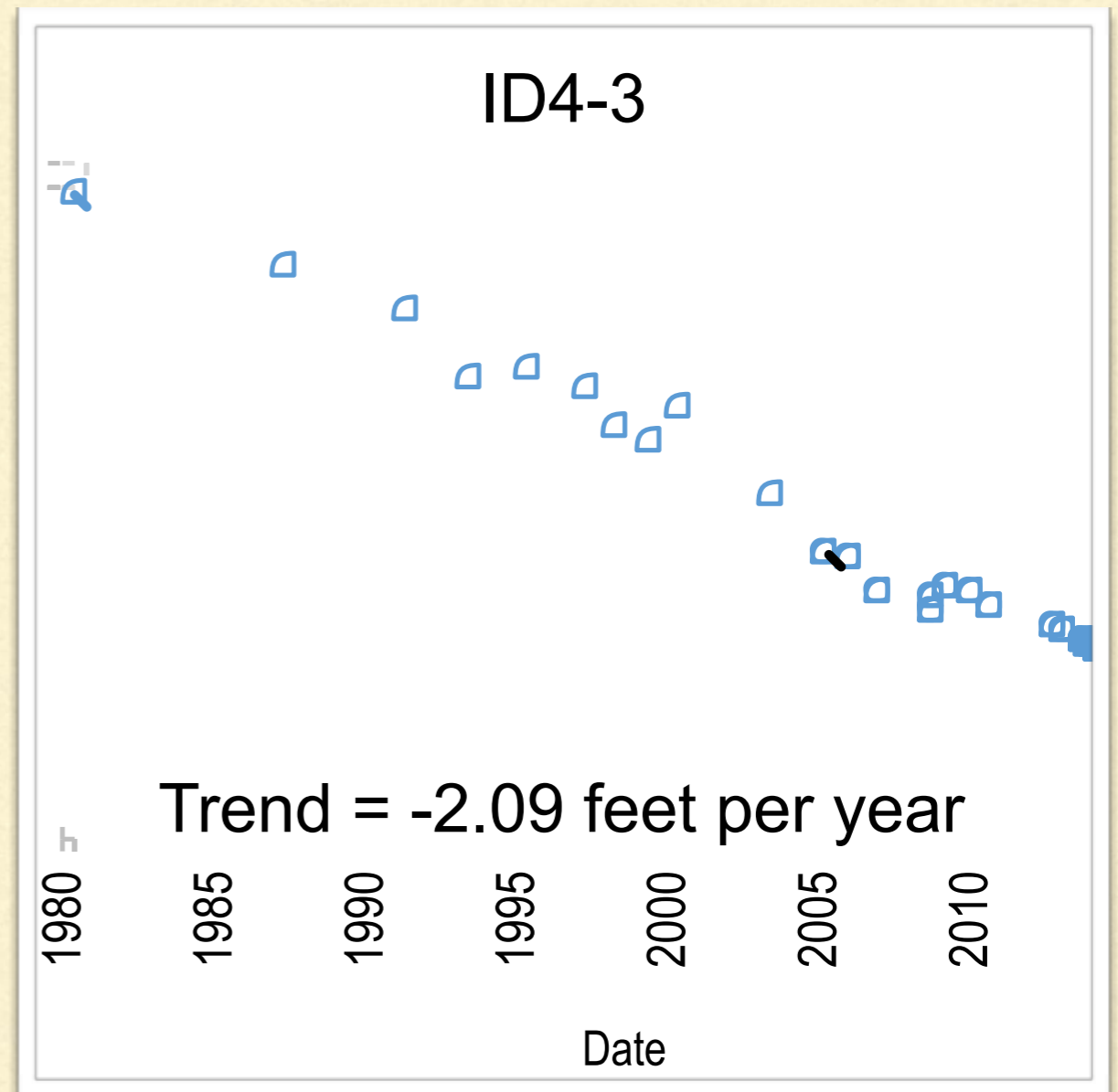
PHYSICAL GW BASIN 3



- the Subbasin receives recharge waters from the adjacent watersheds that include Coyote Creek, watersheds along the northwestern edge of the valley such as Borrego Palm Canyon, and San Felipe Creek that enters the south side of the valley
- surface water inflows that enter the along the edges of the valley are the primary source of recharge. The highest quality groundwater generally occurs near recharge areas
- the rate of pumping has greatly exceeded groundwater recharge rates and water levels have dropped well over 100 feet in some areas
- because the current rate of groundwater use continues to cause significant water level decline and loss of water from subsurface storage the Subbasin is now classified as being in *critical* overdraft

OVERDRAFT

- long-term physical data verifies the *critical* nature of the overdraft
- water production rates and the amount of groundwater in storage decreases with depth
- having a USGS-level model provides for more reliability relative to understanding the hydrology, not less, compared to a situation where a quality model did not exist



CRITICAL OVERDRAFT

- Per SGMA: “A basin is subject to critical overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.”

PHYSICAL GW BASIN 4

CHEMICALS OF CONCERN (COCs)

- groundwater quality provided by BWD water supply wells is currently good and meets California drinking water maximum contaminant levels (MCLs) without treatment
- arsenic concentrations were increasing in multiple District water supply wells until 2014 and have since decreased
- historically there have been significant nitrate-related water quality problems encountered in District wells that led to well reconstruction, abandonment, and replacement
- TDS and sulfate are presently “the only constituents that show increasing concentrations with simultaneous declines in groundwater levels”
- overall, the overdraft has resulted in changes of water quality in the basin over time

PRESENT SITUATION

- the upper aquifer in the vicinity of District water supply wells has been extensively dewatered as a result of ongoing overdraft
- future water production will increasingly need to rely on the middle and lower aquifers
- the sharp drop in *hydraulic conductivity* with depth means that the wells, as simulated in the model, will have decreasing production rates with depth

DISTRICT WELLS

- groundwater elevation decline obtained by measurements at District wells has ranged from 20 to 89 feet for each of the wells
- water level elevation decline rates observed in eight of the nine wells over the past decade range from 0.6 to 4.5 feet/year based on linear trends fitted to the water level data
- water level elevations calculated by the USGS model can be higher or lower than those observed by water level elevations obtained by measurements at the wells
- if the model-calculated water levels are lower than observed, the model overestimates water level declines and thus overestimates overdraft. From a District perspective, overestimated water level decline is preferred as it provides a factor of safety for water supply management
- if the model-calculated water levels are higher than those observed at a well, the model is said to underestimate water level decline and overdraft

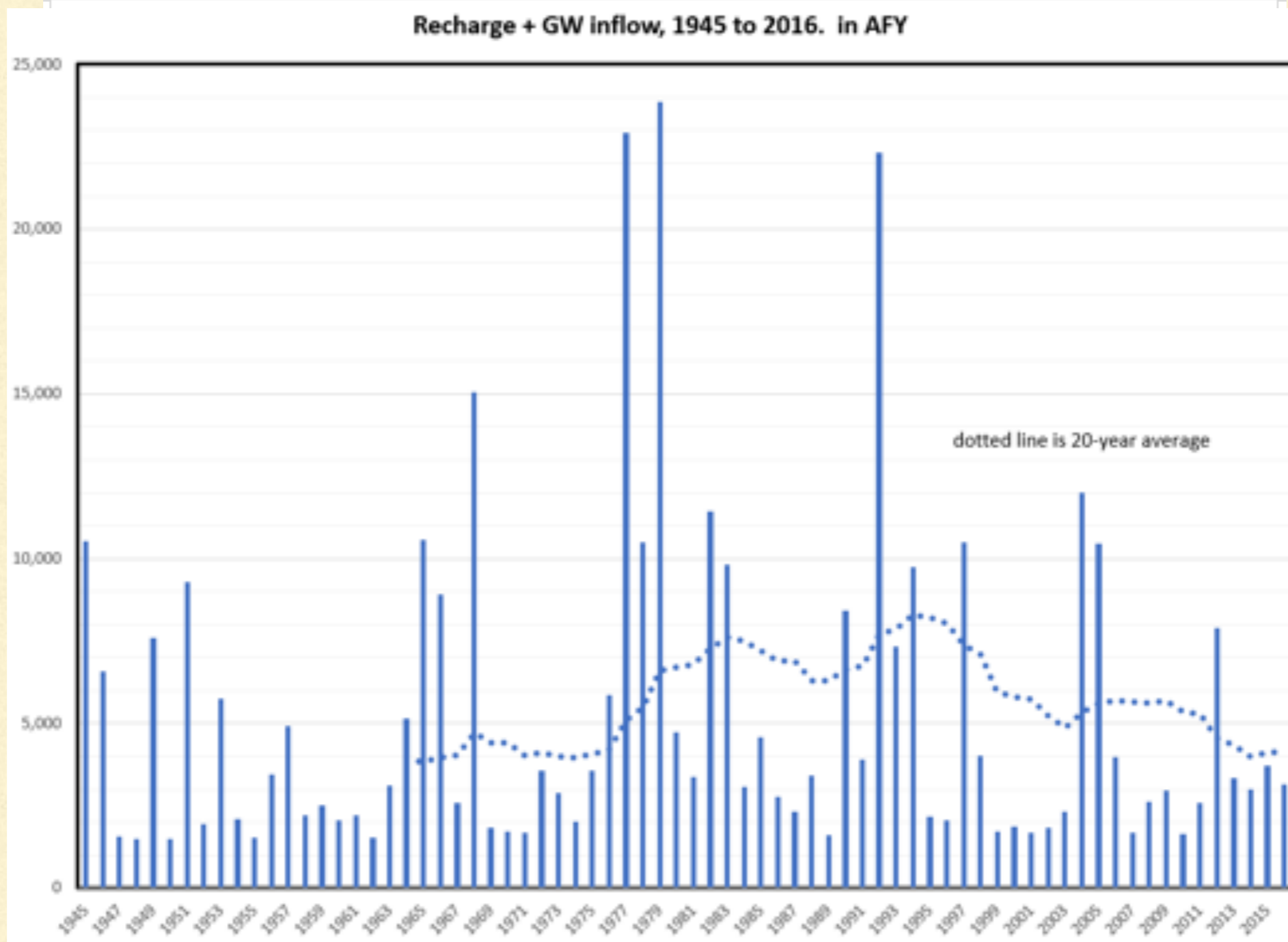
MODEL PREDICTIONS

- the USGS model overestimates water decline when compared to water level elevation measurements at five wells listed in the order of increasing magnitude of model error: ID1-5, ID4-4, ID4-18, ID4-11, and ID1-8. Increasing error trends were observed in four of these five wells. The exception is ID4-4 where the difference between modeled and measured groundwater elevations started decreasing in 2014 and becoming more accurate over time
- the model matches observed water level elevations reasonably well at ID1-12
- the model underestimates water level decline over time at two wells; ID1-16 and Wilcox. Increasing error trends over time were observed at these wells
- model-predicted and observed groundwater elevations have dissimilar trends at ID1-10, and the differences between observed and predicted groundwater elevations are at times greater than 50 feet. This well has increasing water levels

SUMMARY CONCLUSIONS

- long-term overdraft has affected all of the District water supply wells and water level decline is ongoing
- long-term groundwater overdraft has led to the need for District water supply wells to produce water from deeper, less productive sediments
- much of the upper aquifer has been dewatered and the District's water supply is increasingly dependent on the middle and lower aquifers
- of concern is the impact of continued overdraft to the District's ability to reliably produce drinking water without expensive treatment

VARIABILITY OF RECHARGE



-
- over the USGS model 66-year calibration period, variability and periodicity of ‘wet periods’ occurred on a decadal time frame.
 - statistically these ‘wet periods’ that produce most of the recharge have a high degree of variability, are poorly represented by averages, and have trends that are likely to vary over time (not be stationary)
 - a 20 year planning period is used in the GSP. It is extremely unlikely that any of the 20 year model periods will be duplicative in future periods
 - Monte Carlo Simulations (MCS) were used to assess this variability in future periods. MCS is very likely to provide a better idea of potential mass storage changes in the basin than the use of a long-term average recharge rate

-
- total loss of mass storage (overdraft) is ~115,000 AF over 20-years if an average of 5,700 AFY of annual pumping is assumed under MCS and the starting BPA is 22,044 AFY
 - by lowering the reduction period to 15 years, the overdraft declines to 86,000 AF under MCS and the starting BPA is 22,044 AF
 - a shorter reduction period provides for less uncertainty because overdraft and its associated uncertainty increase cumulatively over the reduction period

-
- drivers of uncertainty in the USGS model are: variability of natural recharge (primary) and measurement of annual withdrawals (secondary)
 - return flows for agricultural and golf course irrigation have much less impact over time when irrigation rates are reduced to attain sustainability.
 - municipal landscape irrigation and septic tank return flows are not material to the water balance over the 66-year calibrating period

-
- the USGS model assumes irrigation return flows of 10% of total annual withdrawals under current conditions
 - for valid technical reasons, this assumption of a 10% return flow of total annual withdrawals is just as likely as not to be too large as too low
 - the argument that agricultural irrigation return flows must be much higher is not technically defensible

-
- spending more money on a numerical basin dynamics model to reduce its uncertainty or believing the model will become more *precise* or *accurate* over a short period (e.g 5-years) with slightly more recharge data, is extremely unlikely
 - def: **precision** refers to a state of strict exactness — how consistently something is strictly exact
 - def: **accuracy** refers to the degree of conformity and correctness of something when compared to a true or absolute value

-
- the USGS model's estimated sustainable yield of 5,700 AF is currently proposed as the target pumping rate in the GSP
 - this target pumping rate does not account for groundwater use by Groundwater Dependent Ecosystems (GDEs) – a use that is effectively the same as pumping

-
- monthly water quality testing for baseline water chemistry parameters from municipal wells (such as pH and electrical conductivity) has the potential to provide more timely information on water quality changes from overdraft
 - monthly water quality testing for baseline water chemistry parameters can augment the semi-annual testing for Title 22 pollutants and use of Mann Kendall Trend Analysis metrics

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.5

January 2, 2019

TO: Board of Directors, Borrego Water District
FROM: Geoff Poole, General Manager
SUBJECT “Water Quality Review and Assessment: Borrego Water District (BWD) Water Supply Wells”
(December 7, 2018) – Dr Jay Jones, ENSI

RECOMMENDED ACTION:

Review report from Dr Jay Jones and direct staff accordingly

ITEM EXPLANATION:

Dr Jones has created additional information on the potential impacts of GSP implementation. This work will be funded by Prop One funds from DWR.

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Report from Jay Jones

December 7, 2018

Mr. Geoff Poole
General Manager, Borrego Water District
806 Palm Canyon Drive,
Borrego Springs, CA 92004

RE: Water Quality Review and Assessment:
Borrego Water District (BWD) Water Supply Wells

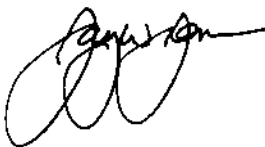
Dear Geoff,

The following draft Report was produced under our existing contract to provide technical support to BWD for to the Borrego Valley Groundwater Basin Groundwater Sustainability Plan Proposition 1 Grant Project. It addresses portions of Tasks 2.1 and 2.2, and will support Tasks 3.1 and 3.2 specific to water quality changes related to groundwater overdraft.

Subsequent analyses are in process that will build from this Report to examine the effect of overdraft on BWD's long-term water supply.

Thank you for your time and attention.

Sincerely,

A handwritten signature in black ink, appearing to read "Jay W. Jones", with a stylized, cursive flourish at the end.

Jay W. Jones
CA PG#4106
Environmental Navigation Services Inc.

WATER QUALITY REVIEW AND ASSESSMENT: BORREGO WATER DISTRICT (BWD) WATER SUPPLY WELLS

OVERVIEW

The purpose of this Report is to review water quality data for active Borrego Water District (BWD) water supply production wells to

- 1) Provide an overview of water quality conditions among the wells and assess spatial variations;
- 2) Examine how water quality has changed over time due to overdraft;
- 3) Evaluate the potential relationships among multiple water quality parameters as a means to support trend analyses for the five primary chemicals of concern (COCs) that include arsenic, total dissolved solids (TDS), nitrate, sulfate, and fluoride (As, TDS, NO₃, SO₄, and F);
- 4) Determine how well water quality trends may (or may not) be able to be identified among BWD water supply wells; and,

The Borrego Springs Subbasin (Subbasin) of the Borrego Valley Groundwater Basin is in a state of critical overdraft and subject to the Sustainable Groundwater Management Act (SGMA). As defined under SGMA¹ “A basin is subject to critical overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.”

Pursuant to SGMA a Groundwater Sustainability Plan (GSP) is currently under development for the Subbasin. This work updates and extends beyond prior work done by Dudek to assess water quality trends for BWD wells as described in the Draft Borrego Springs Subbasin Groundwater Quality Risk Assessment presented to the BWD Board on 6/28/2017.²

The analyses included herein will be used in subsequent ENSI reports to examine potential BWD water supply impacts and costs associated with current and future water quality conditions.

¹ See: <https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118/Critically-Overdrafted-Basins>

² The data used in the Report were located and compiled by Dudek staff as part of the GSP preparation process. The analyses presented in this Report would not have been possible without their support.

Preparation of the GSP is underway and it is understood that the draft GSP will be available for public review by January 2019³. The GSP will include a range of potential options for Projects and Managements Actions (PMAs), including PMAs to address water quality and water quality optimization. Among the direct impacts of degraded groundwater quality to BWD include:

- Need for Water Treatment to achieve drinking water standards (on a per well basis)
- Impact of water quality on the choice and design of replacement wells at existing well locations
- Potential need for Intra-Subbasin Transfer of Potable water from new or existing wells due to degraded water quality due to natural or anthropogenic sources

Groundwater quality data also have a role in the assessment of potential water management options that include but are not limited to:

- Options for Enhanced Natural Recharge (understood to be limited)⁴
- Artificial Recharge using Treated Wastewater

Of primary concern to BWD is the ability of historical data combined with ongoing water quality monitoring program to assess water quality trends. The data are needed to support management of their water system, for example to assess the probability of MCL (maximum contaminant level) exceedances and to plan for water treatment, if needed.

³ The GSP is being developed by the Groundwater Sustainability Agency (GSA) that consists of the County of San Diego and the Borrego Water District. See overview at: <https://www.sandiegocounty.gov/pds/SGMA.html>

⁴ It is understood that that recharge basins within the floodplains where much of Borrego Springs' residential population is located are likely not permissible due to County Flood Control Management concerns. Similarly managed artificial recharge areas located along mountain fronts within or nearby to the Anza Borrego State Park are also not likely permissible given their potential impact on the State Park.

This report includes the following sections:

- 1.0 HYDROLOGIC CONDITIONS
 - 1.1 Basin Location and Setting: Contributory Watersheds
 - 1.2 Historical Groundwater Conditions
 - 1.3 Stratigraphy and Aquifer Conceptual Model
 - 2.0 WELLS AND DATA USED IN THIS ANALYSIS
 - 3.0 SUBBASIN-WIDE WATER QUALITY: GENERAL MINERALS, ARSENIC, AND NITRATE
 - 3.1 Spatial Overview (DWR, 2014; Stiff Diagrams)
 - 3.2 General Minerals: Spatial Variability Based on Piper Diagrams
 - 3.2.1 Data Quality Review: General Minerals
 - 3.3 General Minerals: Variations Over Time at Wells, Piper Trilinear Diagrams
 - 3.4 TDS with Depth
 - 3.5 Nitrate
 - 3.5.1 Supporting Information Regarding Nitrate
 - 3.6 Arsenic
 - 3.6.1 Supporting Information Regarding Arsenic
 - 3.7 Correlations Among Water Quality Parameters (Combined Data Assessment)
 - 3.7.1 Water Quality Data Correlations
 - 3.8 General Minerals: Summary of Observations
 - 4.0 COCS AT BWD WATER SUPPLY WELLS
 - 4.1 North Management Area (3 Wells: ID4-4, ID4-11, and ID4-18)
 - 4.2 Central Management Area (5 Wells: ID1-10, ID1-12, ID1-16, ID5-5, and Wilcox)
 - 4.3 South Management Area (1 Well: ID1-8)
 - 5.0 SUMMARY
 - 5.1 Other Potential COCs
 - 5.2 Recommendations
- Appendix A
Appendix B

1.0 HYDROLOGIC CONDITIONS

A brief summary of the hydrologic conditions of the Subbasin is provided here to support review of the water chemistry data. Included is a description of groundwater recharge, pre- and post-development groundwater levels, and aquifer conditions. Many of the figures and much of the discussion included in this section was derived from the USGS Model Report prepared in 2015 entitled *Hydrogeology, hydrologic effects of development, and simulation of groundwater flow in the Borrego Valley, San Diego County, California*: U.S. Geological Survey Scientific Investigations Report 2015–5150⁵. For reference the *simulation of groundwater flow* refers to the use of a numerical model (in this case the USGS Modflow Model as described in the 2015 report) to examine the groundwater levels, recharge, and overall hydrologic conditions for the period of 1945 to 2010. The GSP contains additional detailed hydrologic information, and updates the USGS modeling work.

1.1 Basin Location and Setting: Contributory Watersheds

The Borrego Springs Subbasin (Subbasin) of the Borrego Valley Groundwater Basin is located at the western-most extent of the Sonoran Desert. The primary source of water to the Subbasin is surface water (storm water and ephemeral stream flow) that flows into the valley from adjacent mountain watersheds and infiltrates within the valley. The contributory watersheds are approximately 400 square miles (mi²) and much larger in area than the approximately 98mi² Subbasin as illustrated in **Figure 1**.

Direct recharge by rainfall within the valley is very low compared to surface water inflows as the annual rainfall averages 5.8 inches per year (in/yr.) [USGS Model Report, page 43]. Stream and flood flows from the adjacent watersheds provide the bulk of the water that enters the Subbasin.

⁵ Referenced herein as the “USGS Model Report”: Faunt, C.C., Stamos, C.L., Flint, L.E., Wright, M.T., Burgess, M.K., Sneed, Michelle, Brandt, Justin, Martin, Peter, and Coes, A.L., 2015, *Hydrogeology, hydrologic effects of development, and simulation of groundwater flow in the Borrego Valley, San Diego County, California*: U.S. Geological Survey Scientific Investigations Report 2015–5150, 135 p.
See: <http://dx.doi.org/10.3133/sir20155150>

FIGURE 1 (from USGS Model Report)

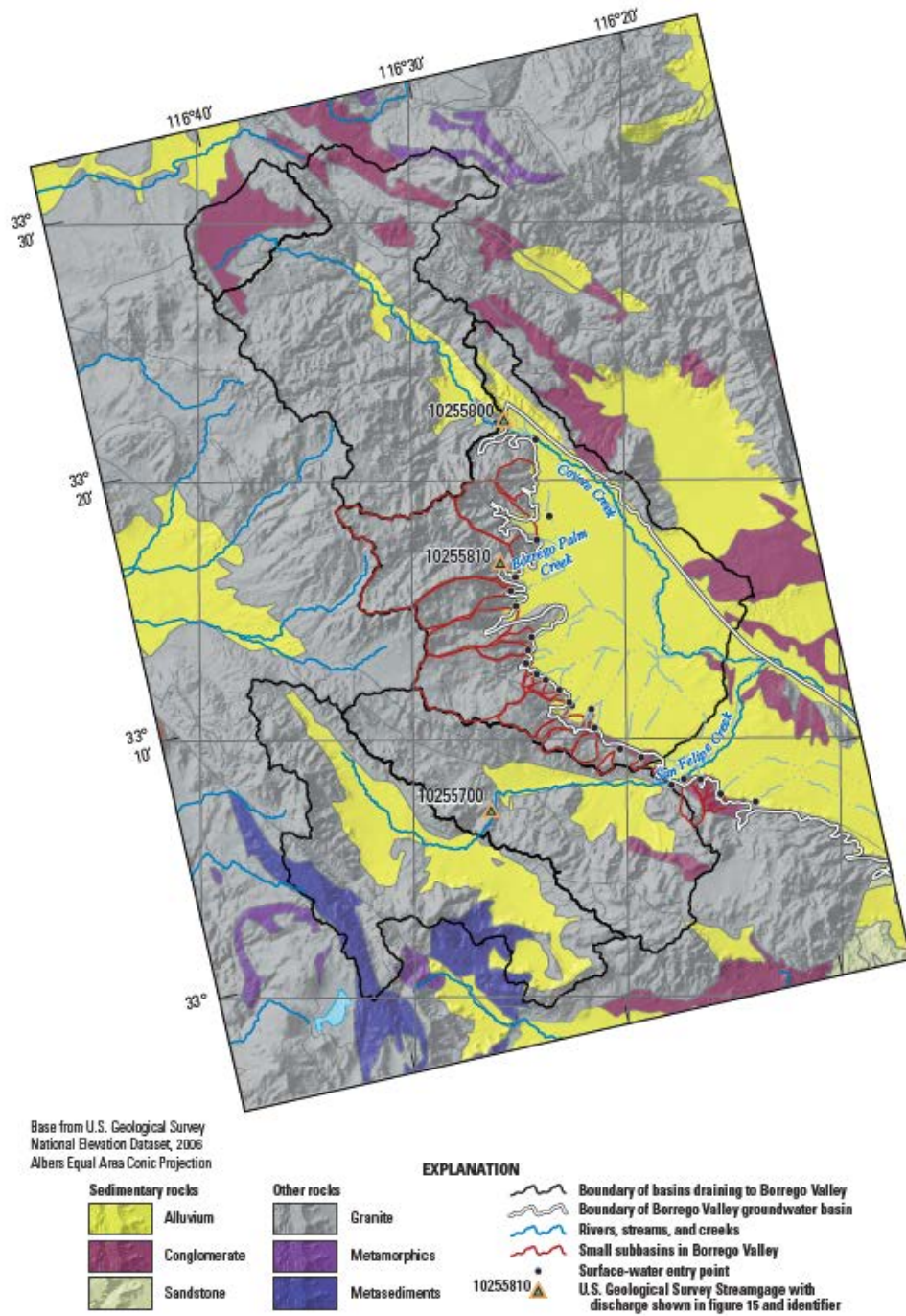


Figure 16. Drainage basin boundaries and geology used in the Basin Characterization Model to estimate climate-driven natural recharge in the Borrego Valley, California.

Note: The Subbasin lies within the area defined by alluvium. The tributary watersheds (e.g. that support Coyote Creek, Borrego Palm Creek, and San Felipe Creek) are outside of the Subbasin.

1.2 Historical Groundwater Conditions

The Subbasin receives recharge waters from the adjacent watersheds that include Coyote Creek, watersheds along the northwestern edge of the valley such as Borrego Palm Canyon, and San Felipe Creek that enters the south side of the valley (**Figure 1**).

Two water level maps from the USGS Model Report are included in **Figures 2A** and **2B** that depict pre- and post- development water levels (1945 and 2010). In both cases the Subbasin can be generally described as “closed” where surface water flows typically do not discharge from the valley but instead, if sufficient flows occur, terminate at the Borrego Sink.

Prior to development (**Figure 2A**) groundwater flow within the northern and central portions of the valley can generally be described as moving from northwest to southeast towards the Borrego Sink. Flow in the southern portion of the Subbasin is directed northeast towards the Borrego Sink. Pumping since 1945 has lowered groundwater levels and led the development of significant depressions of the water table associated with ‘pumping centers’ (see **Figure 2B**). From a groundwater perspective the overall flow patterns in the northern and central areas of the valley have changed from a roughly uniform flow (generally towards the Borrego Sink) to a condition where groundwater flow is reversed in some areas and now flows toward the pumping centers. The rate of pumping has greatly exceeded groundwater recharge rates and water levels have dropped well over 100 feet in some areas. Because the current rate of groundwater use continues to cause significant water level decline and loss of water from subsurface storage the Subbasin is now classified as being in critical overdraft.

Further description of historical and current groundwater conditions is included in the GSP.

FIGURE 2A (from USGS Model Report)

44 Hydrogeology, Hydrologic Effects of Development, and Simulation of Groundwater Flow in the Borrego Valley

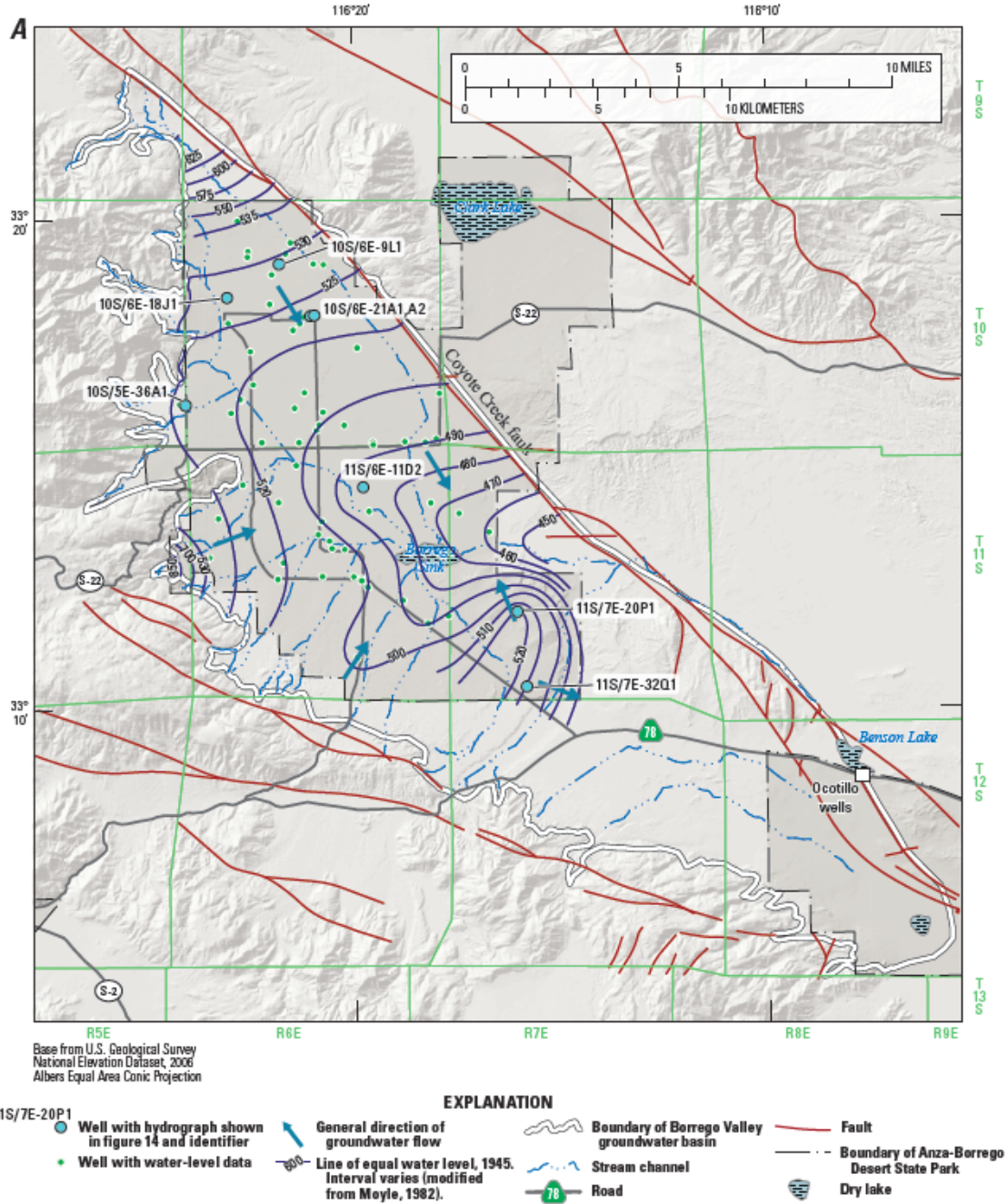


Figure 13. Water-level elevations and direction of groundwater flow in Borrego Valley, California, for A, 1945, approximately predevelopment, and B, 2010. (2010 data are modified from http://www.dpla.water.ca.gov/sd/groundwater/basin_assessment/basin_assment.html).

Note: The arrows indicating groundwater flow are roughly coincident with intermittent surface water channels (dashed blue lines) that enter from adjacent watersheds and flow towards the Borrego Sink.

FIGURE 2B (from USGS Model Report)

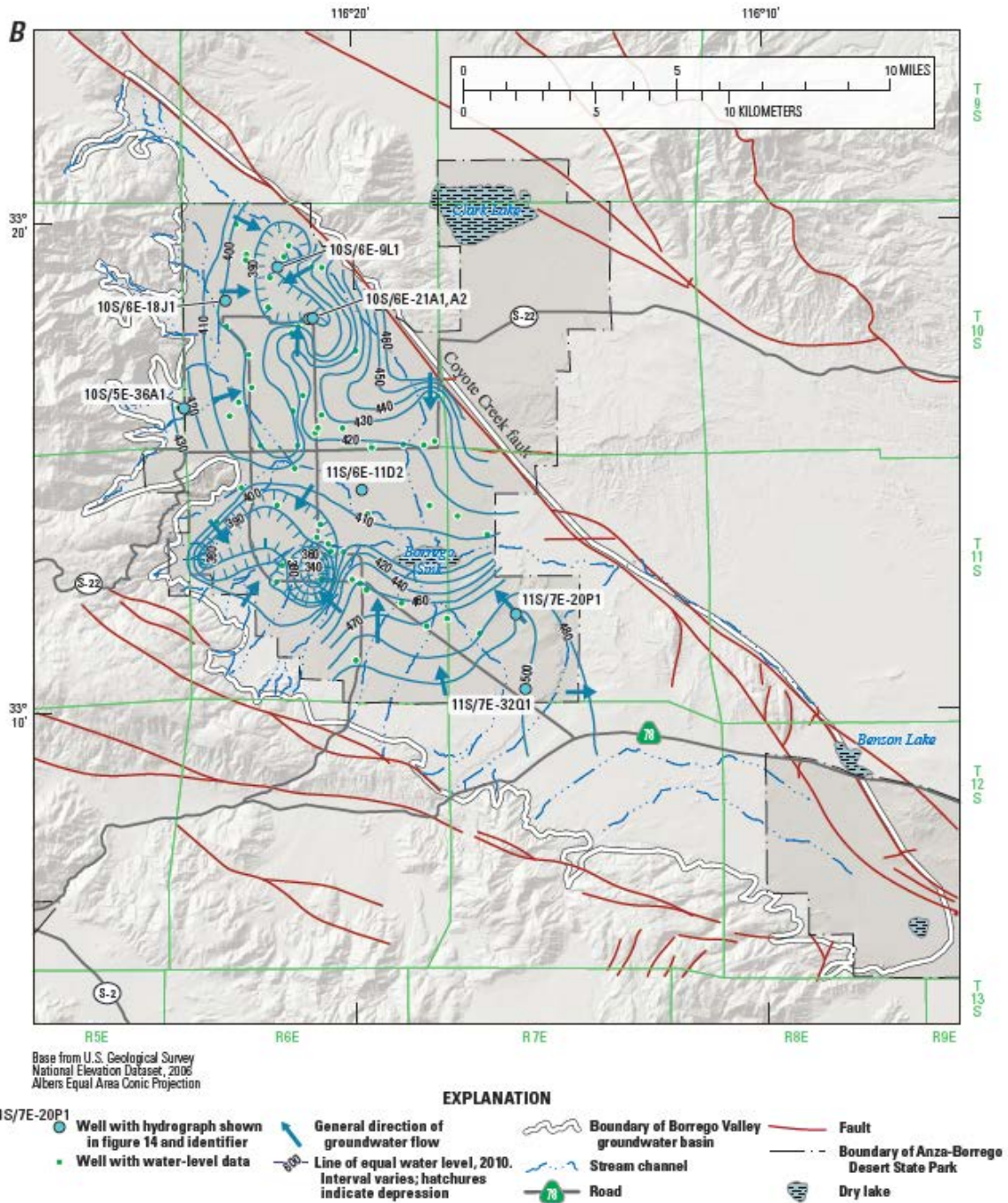


Figure 13. —Continued

NOTE: Hachured areas show the two major pumping centers in the Subbasin. The influence of northern pumping center has caused groundwater to reverse flow direction (see arrow at well 10S/6E-21A1). The central pumping center captures groundwater that was previously flowing south and southeastward towards the Borrego Sink.

1.3 Stratigraphy and Aquifer Conceptual Model

The current conceptual model for the aquifer system as incorporated in the USGS Model is that it consists of three unconfined aquifers named the upper, middle and lower aquifers. The upper and middle aquifers are the primary sources of water currently and are typically comprised of unconsolidated sediments. However, with time, the upper aquifer has become or is expected to become dewatered and the lower aquifer will become a more important source of water as overdraft continues.

The lower aquifer sediments become consolidated with depth and have been subject to folding and faulting. The lower aquifer provides water supply for some pumpers, especially in the southern area of the Subbasin. **Figure 3** (Figure 7 of the USGS Model Report) depicts the Borrego Valley Groundwater Basin as described by Moyle, 1982.⁶ Additional work has been done by Mitten et al (1989),⁷ and by Netto (2001).⁸ Of these, Netto (2001) provides the most detailed analysis of basin stratigraphy based on well log review and interpretation. Review of their work supports that locally confined aquifer conditions are expected to occur.

In brief there are a number of geologic features relevant to groundwater conditions and water quality:

- The Subbasin, as exemplified by the flow of water and sediment toward the current-day Borrego Sink, has historically been the locus of sediment deposition. Sedimentation initially occurred in a marine environment (with sediment sources located to the east) and transitioned to terrestrial environments as seen today.⁹
- The Borrego Sink, similar to dry lake beds that occur in the desert, is a location where water evaporates and minerals will accumulate and can form evaporite deposits. Historically similar conditions occurred as sediments were deposited. Thus, the middle and upper aquifers have the potential to include evaporite deposits that can re-dissolve and lead to elevated concentrations of sulfates and carbonates that result in corresponding increase in TDS.

⁶ Moyle, W. R., 1982, Water resources of Borrego Valley and vicinity, California; Phase 1, Definition of geologic and hydrologic characteristics of basin: U.S. Geological Survey Open-File Report 82-855, 39 p.

⁷ Mitten, H.T., Lines, G.C., Berenbrock, Charles., and Durbin, T.J., 1988, Water resources of Borrego Valley and vicinity, California, San Diego County, California; Phase 2, Development of a groundwater flow model: U.S. Geological Survey Water-Resources Investigation Report 87-4199, 27 p.

⁸ Netto, S.P., 2001, Water Resources of Borrego Valley San Diego County, California: Master's Thesis, San Diego State University, 143 p.

⁹ See GSP. For general reference see: Dorsey, R.J., 2005. Stratigraphy, Tectonics, and Basin Evolution in the Anza-Borrego Desert Region. In "Fossil Treasures of the Anza-Borrego Desert", George T. Jefferson and Lowell Lindsay, editors, Sunbelt Publications, San Diego California, 2006

<https://pages.uoregon.edu/rdorsey/Downloads/DorseyChaperNov05.pdf>

- Structural features such as the Coyote Creek Fault, the Desert Lodge anticline, and the effect of basement uplift and exposure of lower aquifer sediments along the southeastern portion of the Subbasin (cross-section A-A' in **Figure 3**) limit groundwater flow within and out of the basin. The Coyote Creek Fault is assumed to be a 'no flow' boundary condition in the USGS Groundwater Model and as such serves to contain groundwater within the basin and direct flow to the southeast towards the Borrego Sink. The current-day topography combined with the geologic structure creates a 'closed' groundwater condition where ongoing evaporation of water will lead to the long-term accumulation of minerals (often referred to as 'salts') in soil and groundwater.
- While the lower aquifer is quite deep and contains a significant volume of groundwater, the sediments have less storage capacity than the upper and middle aquifers as quantified in the USGS Model by lower specific storage and specific yield. The lower aquifer is also expected to have poor water quality with depth.
- Waters that flow into the Subbasin from the adjacent watersheds will have varying chemistry depending on the geologic and hydrologic conditions encountered in the watersheds. For example, water that flows in Borrego Palm Creek from nearby crystalline rock of the San Ysidro Mountains (see **Figure 1**) will be different than the waters of San Felipe Creek that drain from an alluvial desert valley and more likely to accumulate dissolved minerals.

Please refer to the GSP for additional details.

FIGURE 3

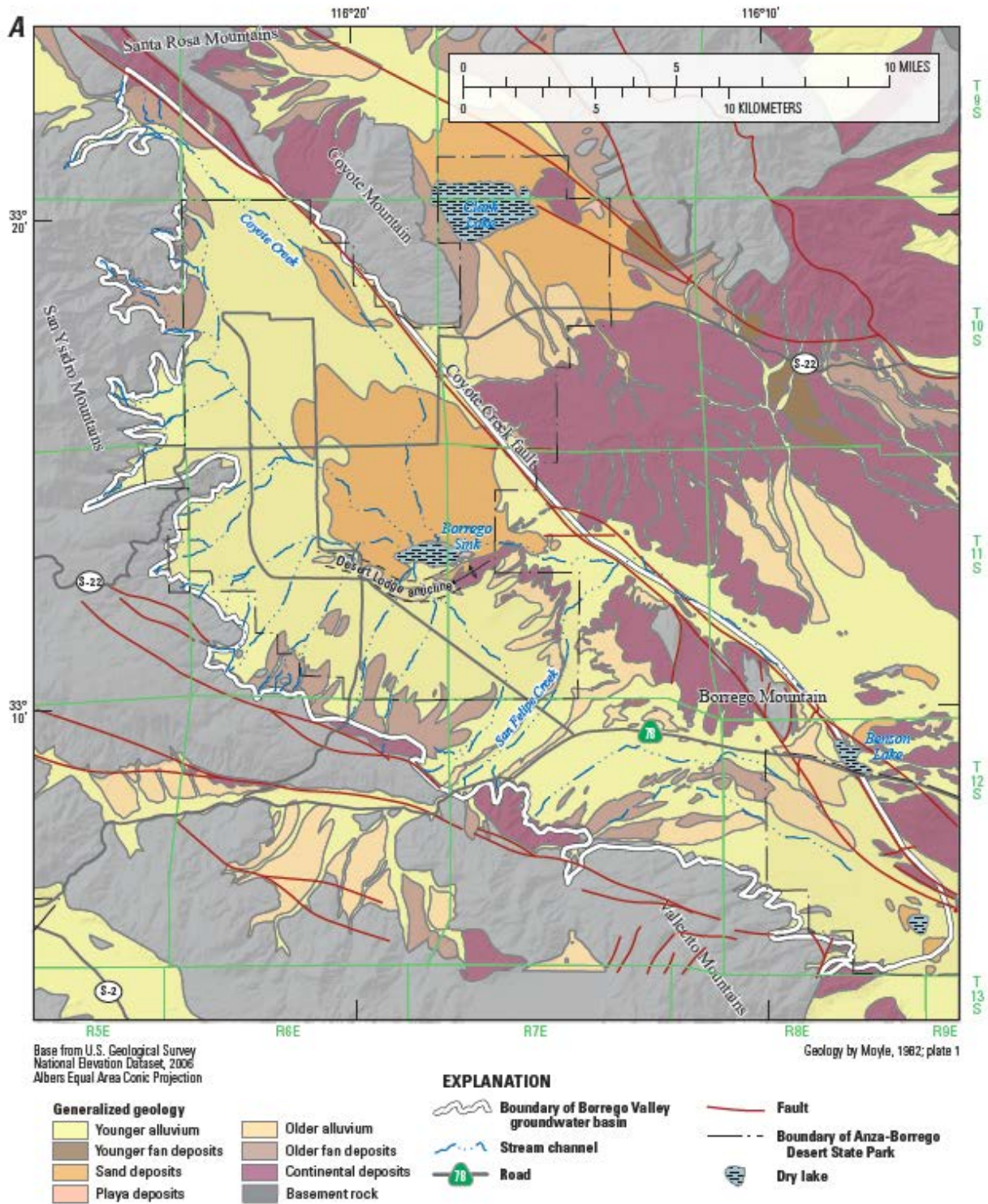


Figure 7. Maps showing Borrego Valley, California, showing A, geology; B, hydrogeology; and C, generalized hydrogeologic cross sections A-A' and B-B'. (Lines of section are shown in figure 7B.)

FIGURE 3, continued

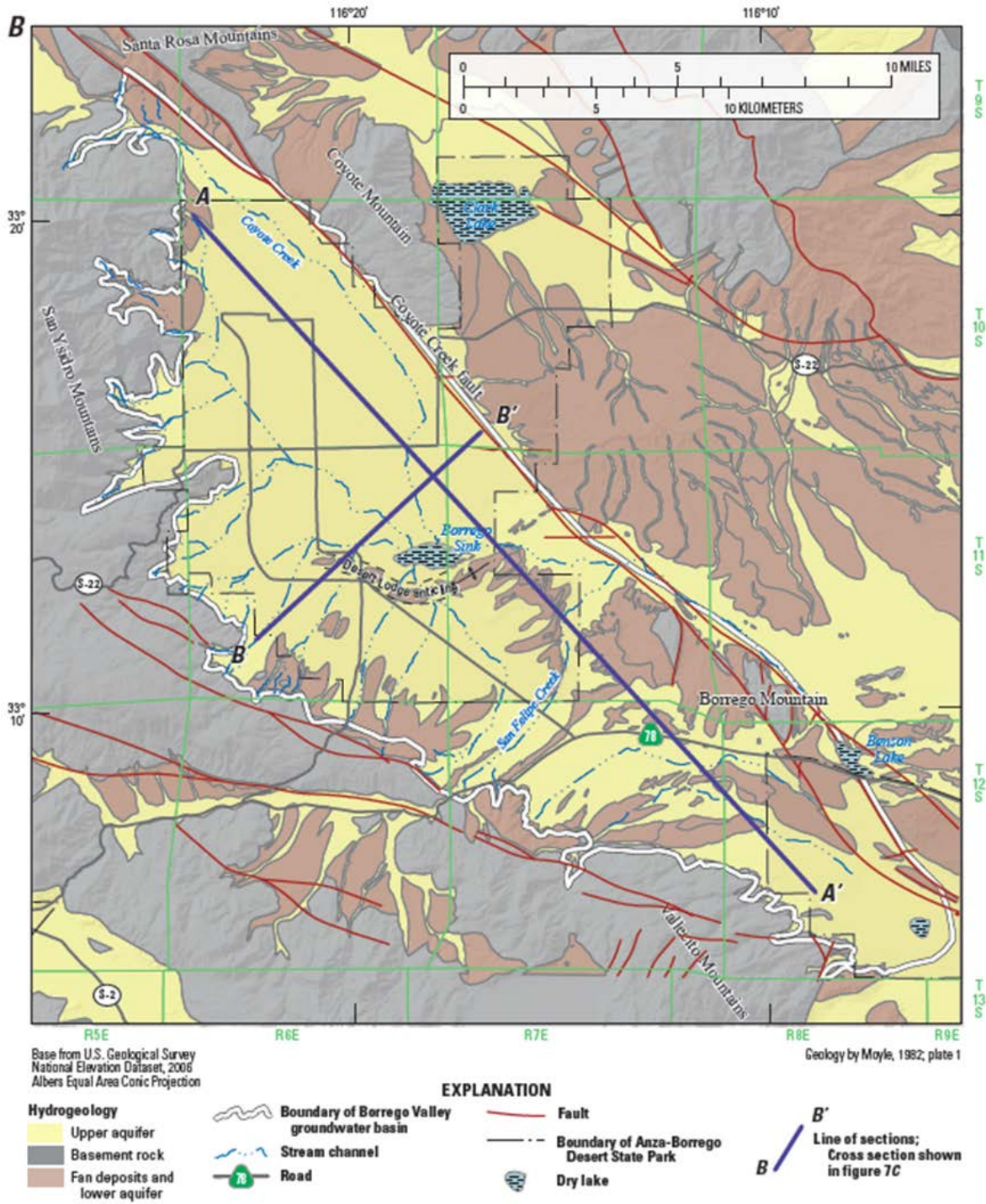
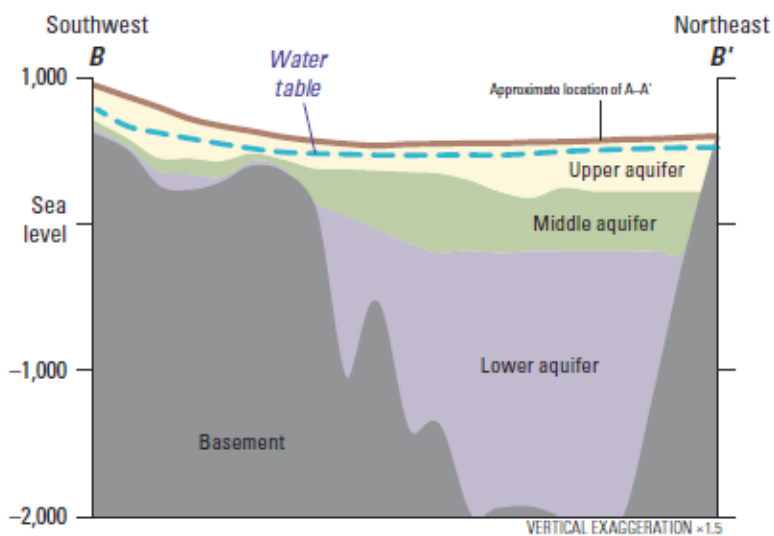
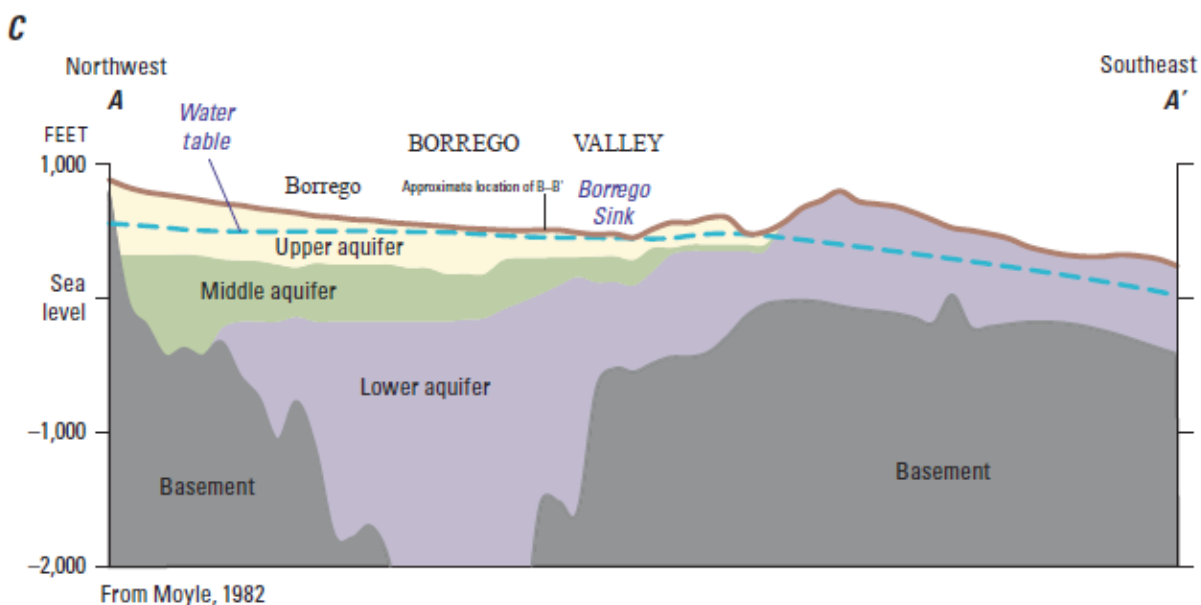


Figure 7. —Continued

FIGURE 3, continued



2.0 WELLS AND DATA USED IN THIS ANALYSIS

A total of 23 wells were included in this water quality analysis. Of these eight are active BWD supply wells and a ninth is used for emergency supply. The data for the wells were compiled and tabulated by Dudek staff as part of the GSP preparation process.

It is important to note that the wells were typically completed with long screened sections and can be open to flow from the upper, middle, and/or lower aquifers depending on the well construction, current groundwater levels, and well hydraulics. As a result, the data were not segregated by aquifer or depth.

Table 1A lists the active BWD wells and indicates the time periods when general minerals data were obtained. The wells have been segregated into three management areas (North, Central, and South) as established in prior work by Dudek.

TABLE 1A: BWD Water Supply Wells

Plot ID	Area	Well Name	GSA GWM Well	Year Inst.	gpm	Static Water Level (ft)	Draw Down (ft)	gpm/ft ***	Plant Eff. ****	Well Depth (ft)	Sampling Period	
											start	end
4	<u>North</u>	ID4-4*	Yes	1979**	365	205.4	63.5	6	71	802	1954**	2017
5		ID4-11	Yes	1995	620	223.2	5.8	107	73	770	1995	2017
2		ID4-18*	Yes	1982	130	311.2	7.6	17	50	570	1984	2017
14	<u>Central</u>	ID1-10*	Yes	1972	317	213.9	11.5	28	54	392	1972	2017
9		ID1-12	No	1984	890	145.5	10.4	86	72	580	1988	2018
12		ID1-16	Yes	1989	848	230.9	24.3	35	71	550	1993	2016
8		ID5-5	Yes	2000	542	182.1	16.1	34	62	700	2004	2016
13		Wilcox	Yes	1981	205	305.2	5.8	35	NA	502	2000	2017
15	<u>South</u>	ID1-8	Yes	1972	448	71.2	47.7	9	51	830	1972	2018
<p>Notes: Data from 2018 Pump Check Results (in Dudek New Wellsite Feasibility Report, in process)</p> <p>*, wells being considered for replacement (3)</p> <p>** , ID4-4 was redrilled in 1979.</p> <p>***, gpm/ft calculated from Pump Check data</p> <p>****, Plant Efficiency from Pump Check, in percent. Values less than 60% are viewed to be of concern.</p>												

The ‘plot ID’ listed in **Tables 1A and 1B** supports the map-based location of the wells and roughly proceeds from north to south.

TABLE 1B

Plot ID (Figure 7)	Management Area	Water Quality: 2Q 2018 (MCL as indicated)						Well Name	gpm	TD (msl)	Year Inst.	notes	anion/cation trend over time (see Piper Diagram)
		in GWM program?	TDS (500/1000 mg/L)	F (2 mg/L)	NO3 (as N, 10 mg/L)	SO4 (250/500 mg/L)	As (10 ug/L)						
3	North	.					<2	ID4-3	IA	no data		last tested 2007	Percent Sulfate Increased, may be stable; Calcium has been variable
4		yes	330	0.16	0.5	110	2.2	ID4-4	A*	365	-204	1979	(redrilled 1979) Fairly stable (new well),
1		.					0	ID4-7/ Anza#4	IA	no data		last tested 1983	Percent Sulfate Increased (1973 to 1983)
5		yes	380	0.23	0.56	90	1.2J	ID4-11	A	620	-156	1995	Fairly stable
2		yes	630	0.87	0.54	270	<1.2	ID4-18	A*	130	-121	1982	Percent Sulfate Increasing
14	Central	yes	340	0.48	1.3	67	2.8	ID1-10	A*	317	-203	1972	Variable over time, no clear trend
9		yes	300	0.35	0.34	95	2.5	ID1-12	A	890	-48	1984	Fairly stable
12		yes	300	0.44	1	58	2.0	ID1-16	A	848	40	1989	Fairly stable
7A		.					<3	ID4-1	IA	no data		last tested 1980	Becoming more Calcium dominant (last gen min data 1980)
10		.					2.3	ID4-2	IA	no data		last tested 2010	Large change in 2010 (dec Sodium), no recent data to assess trend
7		.					2	ID4-5	IA	no data		last tested 1994	Limited data to assess trend
11		.					<2	ID4-10	IA	69?	200	1989	last tested 2012 Fairly stable
8		yes	330	0.8	0.39	100	2.1	ID5-5	A	542	-124	2000	Percent Sulfate Increased (2001 to 2013), may now be stable
6		.					6.4	Cocopah	A	1166	-393	2005	last tested 2013 Limited data to assess trend
13		yes	230	0.64	1.00	19	3.8	Wilcox	(A)	205	198	1981	Increasing bicarbonate, decreasing Calcium
20	South	yes	1600	0.18	0.76	700	<1.2	ID1-1	IA	200	-75	1972	Major changes 1972 to 2017: Increasing sulfate and Calcium; dec bicarbonate
21		yes	320	0.49	2.9	36	5.5	ID1-2	IA	200	-157	1972	Major changes 1972 to 2017: Increasing bicarbonate
15		yes	490	0.62	1.6	86	4	ID1-8	A	448	-335	1972	Increasing Sulfate and Chloride, Increasing Calcium
22		yes	830	0.56	0.5	350	15	Jack Crosby	(A)	10	194	2004	Limited data to assess trend
-		yes	640	0.37	20	100	2.5	WWTP	mw	mw	404	2009	Gen min data failed QA/ not assessed
16		yes	nm	nm	nm	nm	15	RH-3 (2017 data)	A	230	-323	2014	Limited data to assess trend
17		yes	400	1	0.49	110	6.3	RH-4	A	260	-147	2014	Limited data to assess trend
18		yes	480	1.3	3.6	100	15	RH-5	A	350	-169	2015	Increasing Bicarbonate
19		yes	330	1.2	3.3	31	13	RH-6	A	350	-312	2015	Limited data to assess trend
-		yes	450	0.51	1.2	76	2.8	MW-3	mw	mw	197	2005	Limited data to assess trend
xx		exceeds the MCL							A*	active BWD Production Well, * indicates wells currently slated for replacement due to condition			
		note: Secondary MCLs apply to TDS and Sulfate							A	active non-BWD Production Well			
		Recommended and maximum values							IA	Inactive BWD Well			
		are listed for TDS and Sulfate							mw	Monitoring Well			

Figure 4 shows the well locations and names used in this Report. Review of **Figure 4** shows that the well locations are spatially biased along the western portion of the valley and the Subbasin. This is because the BWD wells are located in populated areas within their historical service areas (or Improvement Districts [ID] as indicated by the well names).

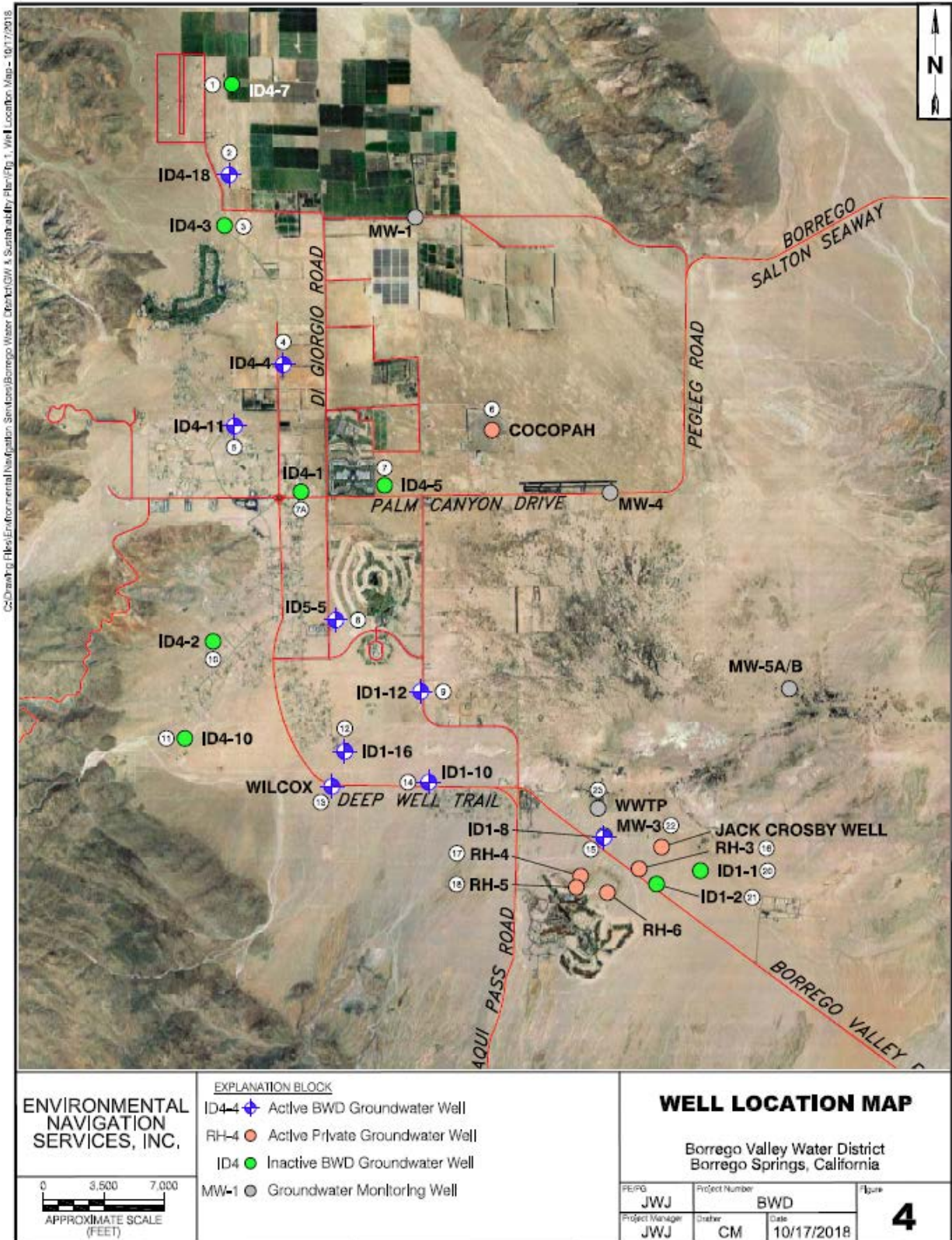
The analytical data used in the Report were located and compiled by Dudek staff from multiple sources as part of the GSP preparation process. The data base used here is from July 2018- the GSP data base is updated and revised on an ongoing basis. This Report focuses on:

- Chemicals of Concern (COCs) that include arsenic, TDS, nitrate, sulfate, and fluoride (As, TDS, NO₃, SO₄, and F).
- General Minerals: comprised of four cations- calcium (Ca⁺²), sodium (Na⁺), magnesium (Mg⁺²), and potassium (K⁺); and four anions- sulfate (SO₄⁻² [also a COC]), chloride (Cl⁻), carbonate (CO₃⁻²) and bicarbonate (HCO₃⁻).
- Hardness and pH.

The overall intent of this Report is to assess the use of multiple water quality parameters to examine how the primary COCs at BWD wells vary over time and to examine the likelihood that drinking water quality criteria will be exceeded. Of primary concern are arsenic and nitrate. Sulfate is also of concern.

Other COCs not examined in this Report include pesticides, herbicides, naturally-occurring radionuclides, and unregulated contaminants for which monitoring is required. Per State Law the Borrego Water District tests their water supply wells in accordance with California Code of Regulations Title 22 for a wide variety of potential contaminants because they operate a publicly-regulated water system. For additional information refer to their Consumer Confidence Report (CCR, available at <http://www.bvgsp.org/sgma-blank.html>).

FIGURE 4



3.0 SUBBASIN-WIDE WATER QUALITY: GENERAL MINERALS, ARSENIC, AND NITRATE

The term “general minerals” is a descriptor that includes the eight anions and cations that typically comprise most of the minerals, by mass, dissolved in groundwater. Anions are negatively charged and cations are positively charged. The eight dominant ions include four cations- calcium (Ca^{+2}), sodium (Na^{+}), magnesium (Mg^{+2}), and potassium (K^{+}); and four anions- sulfate (SO_4^{-2}), chloride (Cl^{-}), carbonate (CO_3^{-2}) and bicarbonate (HCO_3^{-}). Of these, sulfate is a COC. TDS is also a COC and represents the sum all of the anions and cations in solution.

Table 2. Common Cations and Anions Analyzed in the Subbasin

Common Cations	Common Anions
calcium (Ca^{+2})	sulfate (SO_4^{-2})
sodium (Na^{+})	chloride (Cl^{-})
magnesium (Mg^{+2})	carbonate (CO_3^{-2})
potassium (K^{+})	bicarbonate (HCO_3^{-})

The dominant anions and cations can be used to examine how the chemistry of groundwater varies in time at a well, or spatially among wells. Because they occur as a result of rock and mineral dissolution, they can also be diagnostic of minerals such as sulfates and carbonates that occur in the subsurface, or that occur in water being recharged to the aquifer system.

Graphical methods used to depict multiple anions and cations include Stiff Diagrams and Trilinear or Piper Diagrams.¹⁰ Both are used in this Report and will be explained in more detail in Sections 3.1 and 3.2, respectively.

3.1 Spatial Overview (DWR, 2014; Stiff Diagrams)

Stiff diagrams graphically depict the relative concentrations of three dominant anions (Cl, HCO_3 , and SO_4) together with three dominant cations (Na, Ca, and Mg) determined from water samples.¹¹ A 2014 groundwater quality study was conducted by the California Department of Water Resources (DWR)¹² based on the compilation of DWR, BWD, and USGS water quality data generally obtained between 1950 and 2014. A map depicting Stiff Diagrams of water quality is depicted in **Figure 5**.

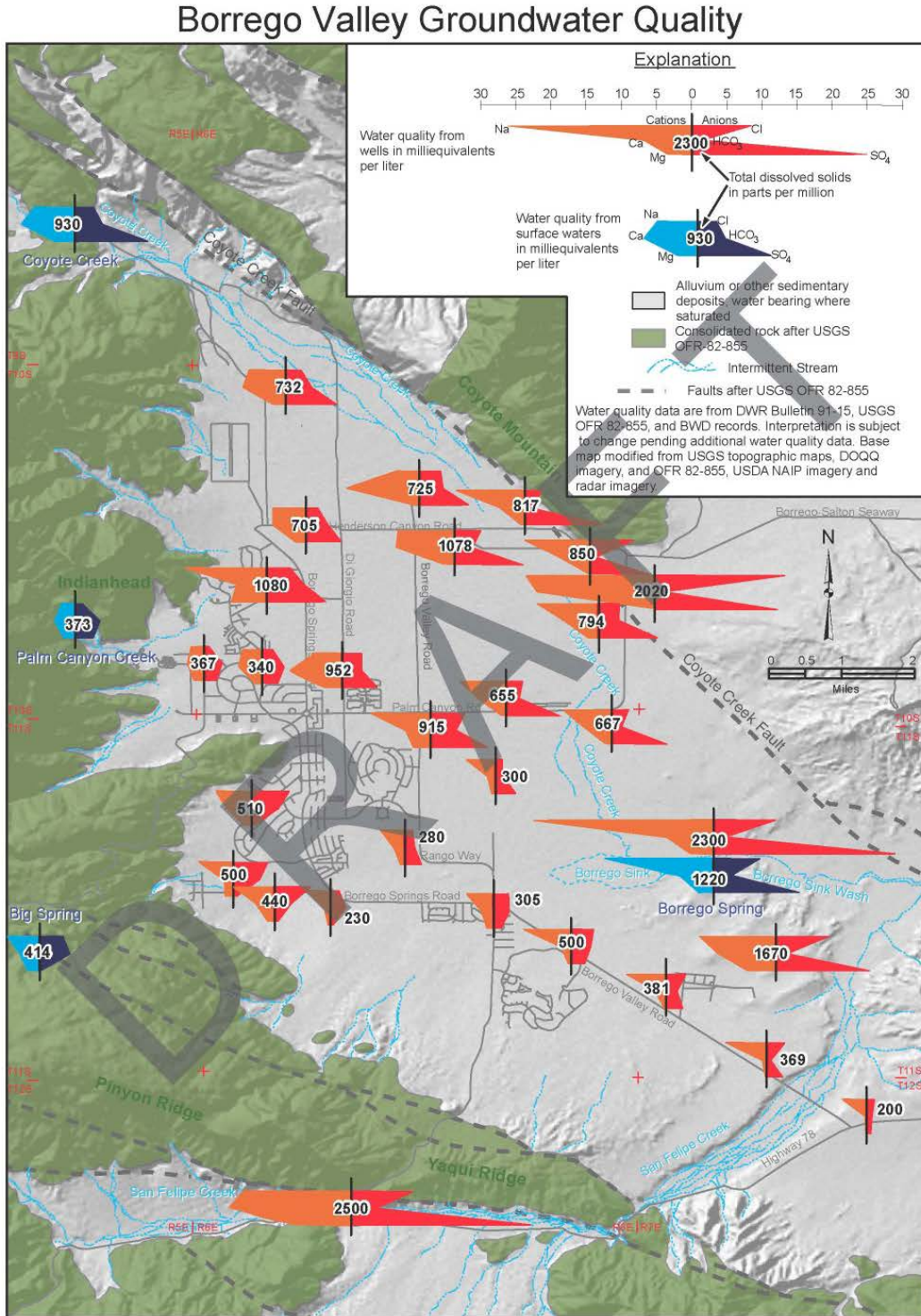
¹⁰ An overview summary is provided by: Hem, J.D., 1989, Study and interpretation of the chemical characteristics of natural water: U.S.

Geological Survey Water-Supply Paper 2254, 3rd edition, Washington D.C., 263 p.

¹¹ Stiff, H.A., Jr., 1951, The interpretation of chemical water analysis by means of patterns: Journal of Petroleum Technology, v. 3, no. 10, p. 15-17.

¹² DWR, 2014. Powerpoint presentation by Dr. Tim Ross dated May 2014. A copy is included for reference in **Appendix A**.

FIGURE 5



An explanation of how the analytes are depicted using Stiff Diagrams is also included in **Figure 5**. The 'legs' and overall size of the diagrams increase as the analytes increase in concentration and allow visual comparison of each of the sample results. Also included in the diagrams is the TDS in milligrams per liter. For reference the TDS of drinking water should be no more than 1,000 mg/L and ideally less than 500 mg/L (the recommended and maximum secondary MCLs, respectively).

DWR noted based on comparison of surface water and groundwater chemistry that *"The high proportion of Sulfate in the surface water of Coyote Creek appears to dominate the character of groundwater in the northern and eastern parts of the basin. The more Bicarbonate waters of Borrego Palm Canyon and Big Spring influence the groundwater along the western and southern parts of the basin."* For reference, the surface water watersheds are shown in **Figure 1**.

Additional observations that can be made from the Stiff Diagrams include:

- Surface water inflows that enter the along the edges of the valley are the primary source of recharge. The highest quality groundwater (TDS < 500 mg/L) generally occurs near recharge areas.
- Groundwater quality tends to increase in TDS towards the Borrego Sink with distance from the recharge areas. Ongoing evaporation and accumulation of minerals is occurring within the Subbasin. The Subbasin is effectively a closed basin and has been a closed basin during much of the time that alluvial sediments have been deposited from current watersheds. (Please refer to the GSP for a detailed description of the Subbasin geology and sedimentology.)
- Elevated concentrations of sulfate in surface waters are of concern from a water quality standpoint. Groundwater within the San Felipe Creek watershed that potentially recharges the South Management Area contains relatively high concentrations of sulfate, calcium and sodium.
- The Stiff Diagrams highlight the dominance of sulfate in groundwater (lower right portion of the diagrams). Sodium and chloride (upper right and upper left 'legs') also occur at significant concentrations in many samples.

The DWR presentation also reviewed TDS trends with time and depth at selected wells. No consistent trends were identified. The data were not evaluated in terms of the upper, middle, or lower aquifer.

DWR also assessed nitrate. Review of their results is included in **Section 3.5**.

3.2 General Minerals: Spatial Variability Based on Piper Diagrams

The eight dominant anions and cations can also be analyzed using Piper trilinear diagrams (Piper, 1944).¹³ In brief, the Piper plot is a visualization technique for groundwater chemistry data. It is based on a combination of ternary diagrams for the major anions and cations that are then projected onto a central diamond. The concentration data on (milligrams/liter) are converted to milliequivalent (meq/L), a measure of the number of electrochemically active ions in the solution.¹⁴ The analytes are plotted as relative proportions in order to examine the relative percentages of each of the dissolved minerals, primarily to show clustering or patterns of samples. The diagrams also support interpretation of trends and potential mixing of waters that have different chemistry.

Figure 6A provides a brief explanation of the Piper diagram. The methodology is explained in more detail in **Appendix B**, together with the Piper trilinear diagrams for all of the wells as noted in **Table 1B**. Ternary diagrams present a combination of three values that add up to 100 percent. The three values are ‘picked off of’ the sides of triangle by projection along a triangular grid. Please refer to **Appendix B** as needed for additional explanation.

Recent general minerals data, dating from 2004 to present, were used to represent the water chemistry at each of the wells. Review of the data supported the use of two data subsets. The North and Central Management Area wells have been combined and the South Management Area wells are presented as a second set. **Figure 6** depicts the data. Each of the wells are numbered per **Figure 4** and **Table 1** to simplify the data presentation. The numbering generally follows from north to south along the axis of the valley.

3.2.1 Data Quality Review: General Minerals

The data presented in the Piper diagrams underwent a data quality review based on the ion chemistry. Groundwater under natural conditions should be at or near electrochemical equilibrium. Here the sum of the negatively charged anions (in meq/L) was checked versus the sum of the positively charged cations. The sums should be similar (within ~5%) for a solution that is in equilibrium. Not all of the data were used because in some cases not all of the eight general minerals data were analyzed and in other cases the anion/cation balance test failed. As explained above, the anion/cation balance test may fail as a result of less common anions or cations being present within the water quality sample that were not analyzed. Charge imbalance may also indicate laboratory error.

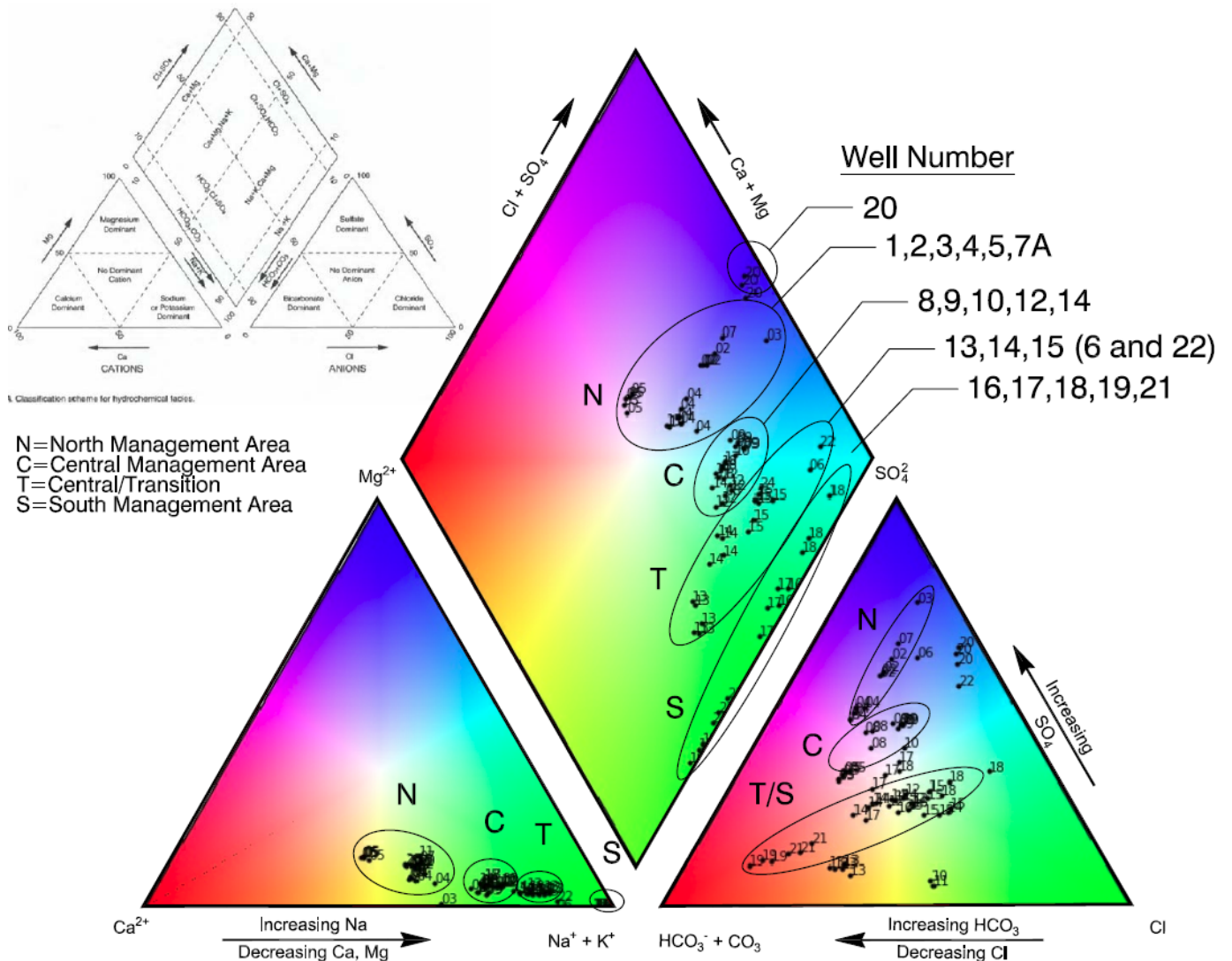
¹³ Piper, A.M. 1944. A graphic procedure in the geochemical interpretation of water-analyses. Transactions-American Geophysical Union 25, no. 6: 914–923

¹⁴ The number of ions in a solution is expressed in terms of moles, a unit widely used in chemistry as a convenient way to express amounts of reactants and products of chemical reactions. An equivalent is the number of moles of an ion in a solution, multiplied by the valence of that ion. For example, if 1 mole of NaCl and 1 mole of CaCl₂ are dissolved in a solution, there is 1 equivalent of Na, 2 equivalents of Ca, and 3 equivalents of Cl in that solution. The calculation is based on: $\text{mEq/L} = (\text{mg/L} \times \text{valence}) \div \text{molecular weight}$.

The eight anions and cations generally comprise the bulk of the minerals that comprise TDS. Sodium and calcium are the dominant cations; bicarbonate, sulfate, and chloride are the dominant anions. The long-term average concentrations, in mg/L, for the nine BWD wells were TDS (378), calcium (39), sodium (82), magnesium (5.4), and potassium (5), sulfate (112), chloride (56), carbonate (0.6) and bicarbonate (124). Nitrate averaged 1.8 mg/L.

A calculation of TDS was made by summing the concentrations of the eight anions and cations and comparing it to the TDS for all samples that met a 5% or less charge imbalance criteria. On average the sum was less than the TDS by 40 mg/L, where the mass of cations exceeded the mass of anions. Other anionic COCs not included in the calculation include fluoride and nitrate, but when these were added into the calculations the mass of anions remained lower than the mass of cations. While the mass balances remained within tolerance, the results suggest that additional anions occur in groundwater that have not been tested. Phosphates are one type of anion that may occur but have not been included in the analytical program.

FIGURE 6: Piper Diagram, recent data for all wells (2004 to 2018)

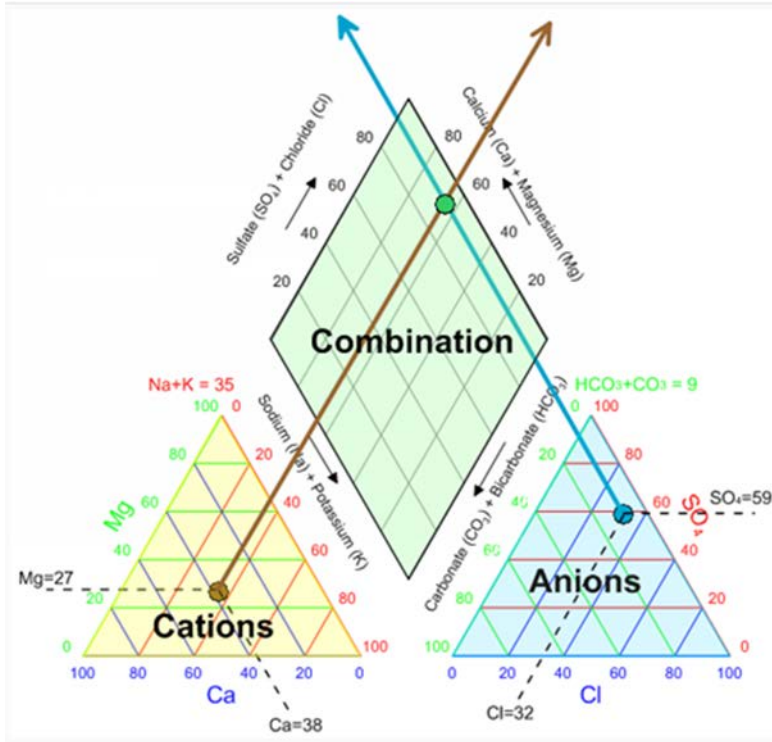


Notes:

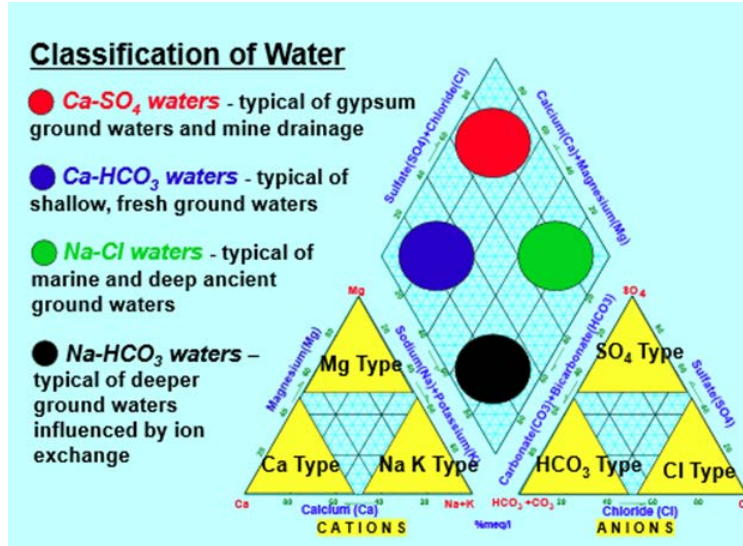
1. Numbers correspond to IDs shown in Figure 4. These generally increase from north to south.
2. The wells by management area include:
 - North Management Area: Wells # 1 to 5, #7, and #11
 - Central Management Area: Wells #8, #9, #10, and #12
 - “Transitional”: Wells #6, #13, #15, #16, #22
 - South Management Area: Wells #17 to 21, #23

FIGURE 6A

The Piper diagram is used to plot the 8 general minerals based on two ternary diagrams (triangles, at the base) that are projected onto a central diamond area. From (www.goldensoftware.com)



Where the subregions generally depict the chemical characteristics of the water (from <http://inside.mines.edu/~epoeter/GW/18WaterChem2/WaterChem2pdf.pdf>)



Here colors are used to show subareas following a methodology presented by Peeters, 2014. (A Background Color Scheme for Piper Plots to Spatially Visualize Hydrochemical Patterns by Luk Peeters, Vol. 52, No. 1–Groundwater–January-February 2014). Also see **Appendix B**.

No distinction was made regarding well completion by aquifer because of a lack of water quality data as a function of depth. However, while the wells include a range of well completions, the data do not indicate that any differentiation can be made among wells based on recent data (2004 to present). Review of the Piper Diagrams indicates that a systematic variation of water quality can be observed from north to south, and that the water quality in the South Management Area is sufficiently different to support segregation of the data into two data sets. Inorganic water quality depicted in the central Piper diagrams (**Figure 7**) indicates the data generally group by management area (MA): North MA (Wells # 1 to 7, and 11), Central MA (Wells #8, #9, #10, and 12), “Transitional” between the Central and South MAs (#13, #15, #16, #22), and South MA (#17 to 21, #23). Data from sets of wells align on the Piper diagram (**Figure 6**) indicative of waters that are mixing. Some general observations follow:

North and Central Management Areas

- A subset of the wells in the northern part of the basin (#1, #2, #3, and #4) occur along a line of anion data where high sulfate occurs.
- The North and Central Management Areas subdivide into two groups within the Piper diagram. With distance towards the south a general trend occurs where chloride decreases, bicarbonate increases, and sulfate decreases. Two mixing lines may occur where the waters go from sulfate dominant to a mixed condition (no dominant anion).

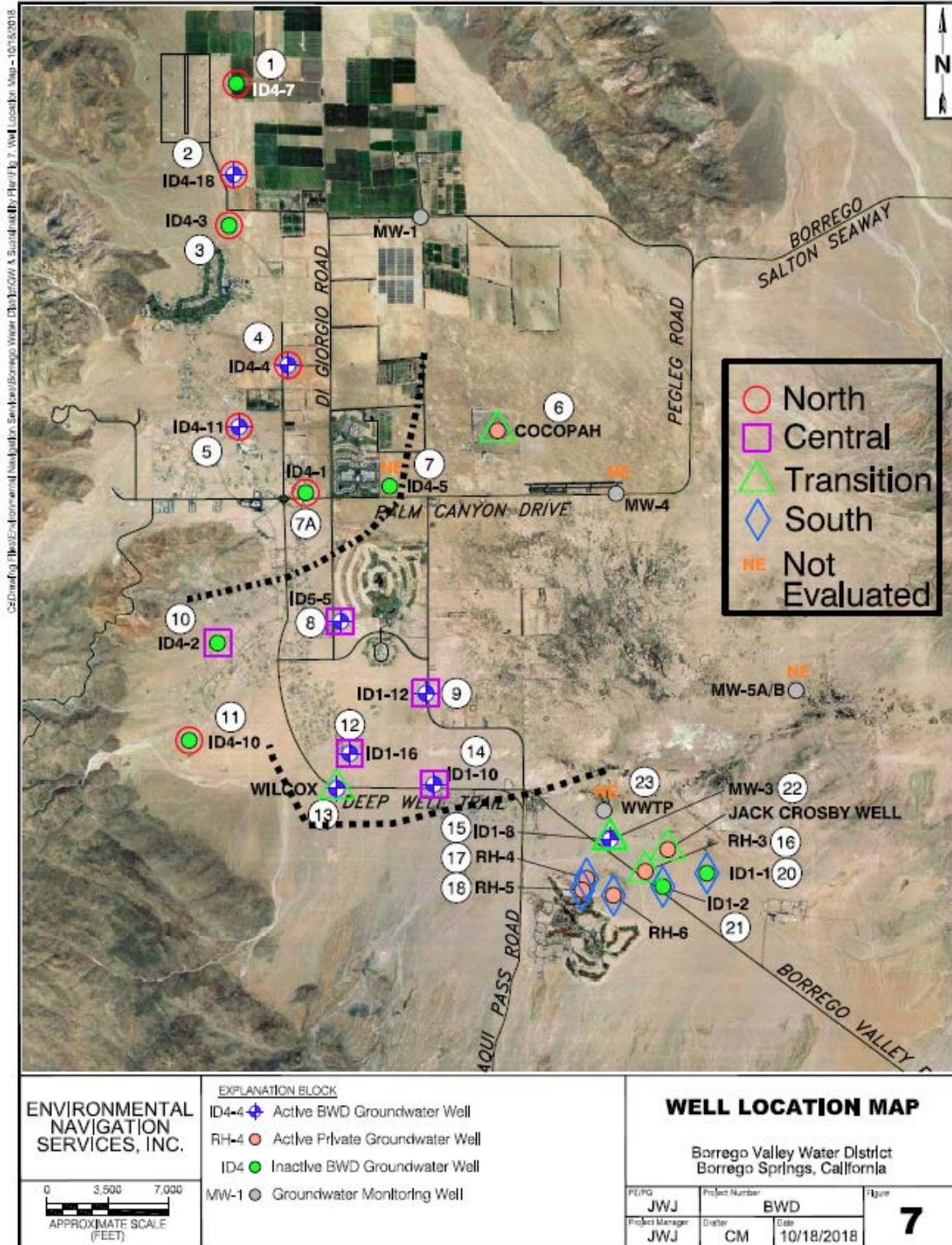
South Management Area

- A transitional zone occurs roughly coincident with the location of the Desert Lodge anticline (as depicted in **Figure 3**). The anticline is regarded as a structure that influences groundwater flow (refer to the GSP for further details).
- Mixing lines are observed for both cations and anions. For anions: as chloride decreases, bicarbonate increases, and sulfate decreases. For cations: as calcium decreases, sodium and magnesium increase.
- As also noted by the Stiff diagrams, the North Management Area has high sulfate as indicated by points that occur in the upper part of the cation ternary diagram. In contrast the South Management Area wells either have no dominant anion or become bicarbonate dominant (the lower left portion of the ternary diagram for anions).

Overall the Piper diagrams support that the inorganic water chemistry systematically varies across the Subbasin. The primary observations are summarized in **Figure 7**:

- Water quality gradually changes from north to south within the North and Central Management Areas, consistent with pre-development groundwater flow patterns.
- For both areas the cation relationships (calcium, magnesium, and sodium) are similar and are generally sodium dominant. In both cases the water quality is characterized by decreasing calcium and increasing percentages of sodium and magnesium.
- The South Management Area anionic water chemistry is different than the North and Central Management Areas, likely due to the difference in the San Felipe Creek recharge water and potential differences in aquifer mineralogy.

FIGURE 7
Shows water chemistry classified into the three Management Areas North, Central, and South. Also notes Transition (between central and south)



3.3 General Minerals: Variations Over Time at Wells, Piper Trilinear Diagrams

Of central concern to BWD and all other users of groundwater within the Subbasin is water quality degradation over time due to ongoing overdraft, irrigation and septic-related return flows, and loss of higher quality water due to dewatering of the upper aquifer. Piper trilinear diagrams were constructed for each of the wells using available historical data (compiled in **Appendix B**). Two examples are included as **Figures 8** and **9** where one well has had significant changes in water quality over time versus another that has been relatively stable.

The Piper diagrams depict relative ratios of the anions and cations, not the total concentrations. Also included in the figures are graphs of the anions and cations that present the measured concentrations (in mg/L).

ID1-8 (South Management Area, Well#15 on Figure 7)

Water chemistry has significantly changed over time at ID1-8. This well is in the South Management Area as depicted as Well #15 on **Figure 7**. It has been sampled since 1972. **Figure 8** includes a Piper Diagram and charts depicting TDS, cations, and anion concentrations over time.

Observed is historically decreasing bicarbonate, increasing chloride, and increasing calcium. Recent data indicates that water quality may be stabilizing.

In terms of overall chemistry (see **Figure 6A**) the water in this well is now described as sodium chloride dominant, typical of marine and deep ancient groundwater.

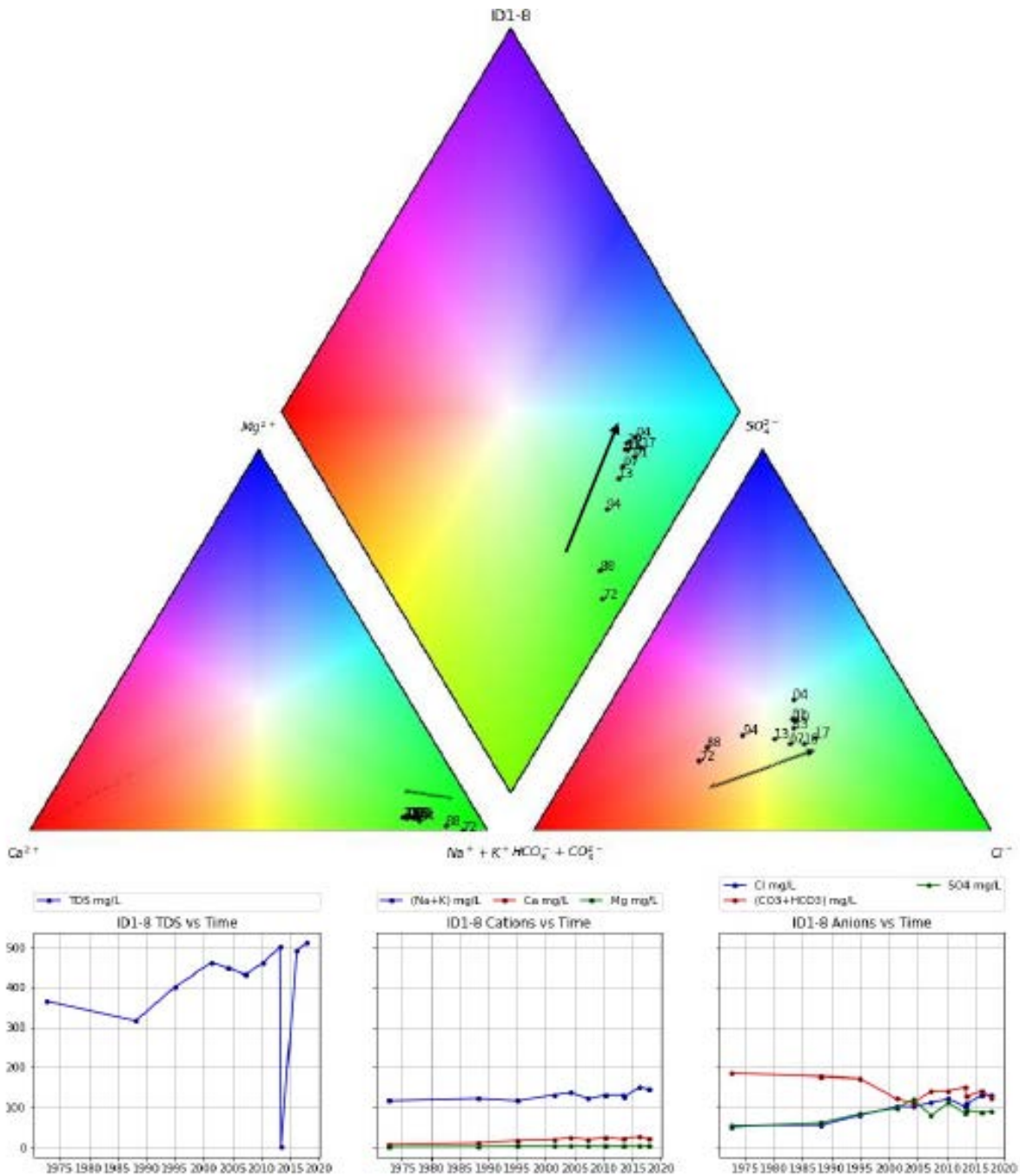
ID4-18 (North Management Area, Well #2 on Figure 7)

This well is in the North Management Area as depicted as Well #2 on **Figure 7**. It also has been sampled since 1972. **Figure 9** includes a Piper Diagram and charts depicting TDS, cations, and anion concentrations over time.

There is much less overall change with time compared to ID1-8, but the sampling data do show sulfate is increasing. The change is subtle change but significant since concentrations are above the recommended secondary MCL of 250 mg/L, but do remain below the upper MCL of 500 mg/L. Sulfate is increasing as bicarbonate decreases over time. The points in the anion portion of the diagram (lower right triangle) occur along a line indicative of increasing sulfate.

In terms of anion chemistry (see **Figure 6A**) the water in this well is now described as sulfate dominant. Sulfate is a COC.

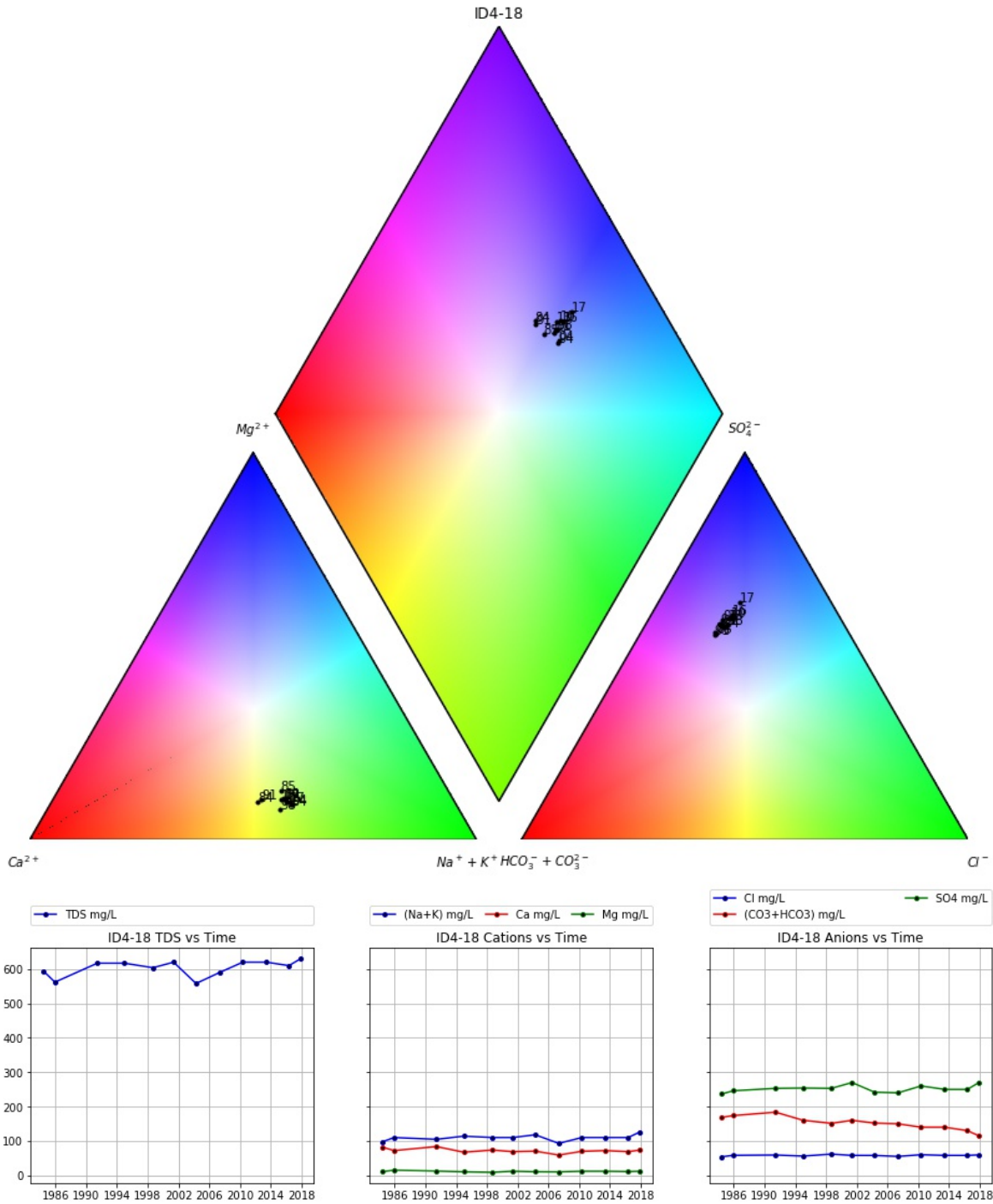
FIGURE 8: ID1-8 (see Figure 8A for explanation of the diagram and axes)



Notes:

1. The last two digits of the year the samples were taken are shown in the Piper diagram.
2. Chemistry has changed due to increases in sulfate, chloride, and sodium; and decreased bicarbonate. The change from 1970s to the 2000s is evident. TDS is also increasing.

FIGURE 9: ID4-18



Note:

1. The last two digits of the year the samples were taken are shown in the Piper diagram.
2. Water chemistry is fairly stable with a slow increase in sulfate and decrease in bicarbonate.

3.4 TDS with Depth

Well profiles based on TDS and temperature were presented by the DWR in a 2014 presentation (as referenced in footnote #11, a copy is included in **Appendix A**). **Figure 10** presents the profile data obtained from eleven wells that ranged in depth from 280 to 900 feet. For reference BWD water supply wells currently range in depth from 392 to 830 feet (Table 1).

Review of **Figure 10** supports the following:

- TDS varied by well, with linear increase with depth at each well. The exception is well ID4-3 where a step-wise increase in TDS was observed at a depth of approximately 350 feet.
- Groundwater temperature was relatively warm, ranging from approximately 80 to 90 °F. All wells exhibited increasing temperature with depth.

Geologic conditions and lithologies do change with depth, and it is generally expected that water quality change will decrease with depth. While quite important towards understanding the effect of overdraft on water quality, relatively few depth-specific groundwater chemistry data have been obtained in the Subbasin. The data presented in **Figure 10** are obtained by lowering measurement probes into the wells and are relatively inexpensive to collect provided there are no obstructions in the well. Additional discussion of well profiling methods is included in the report recommendations.

FIGURE 10

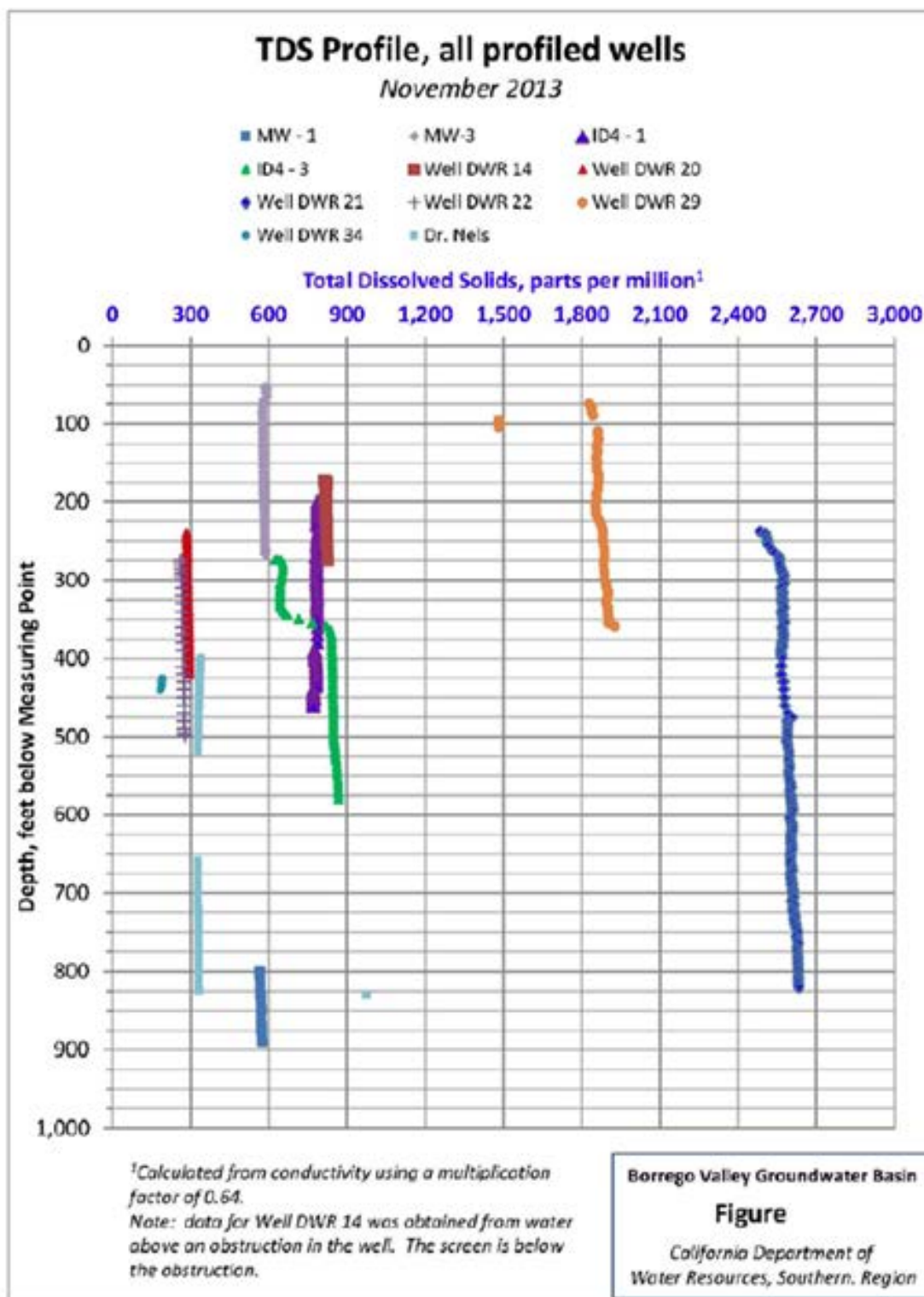
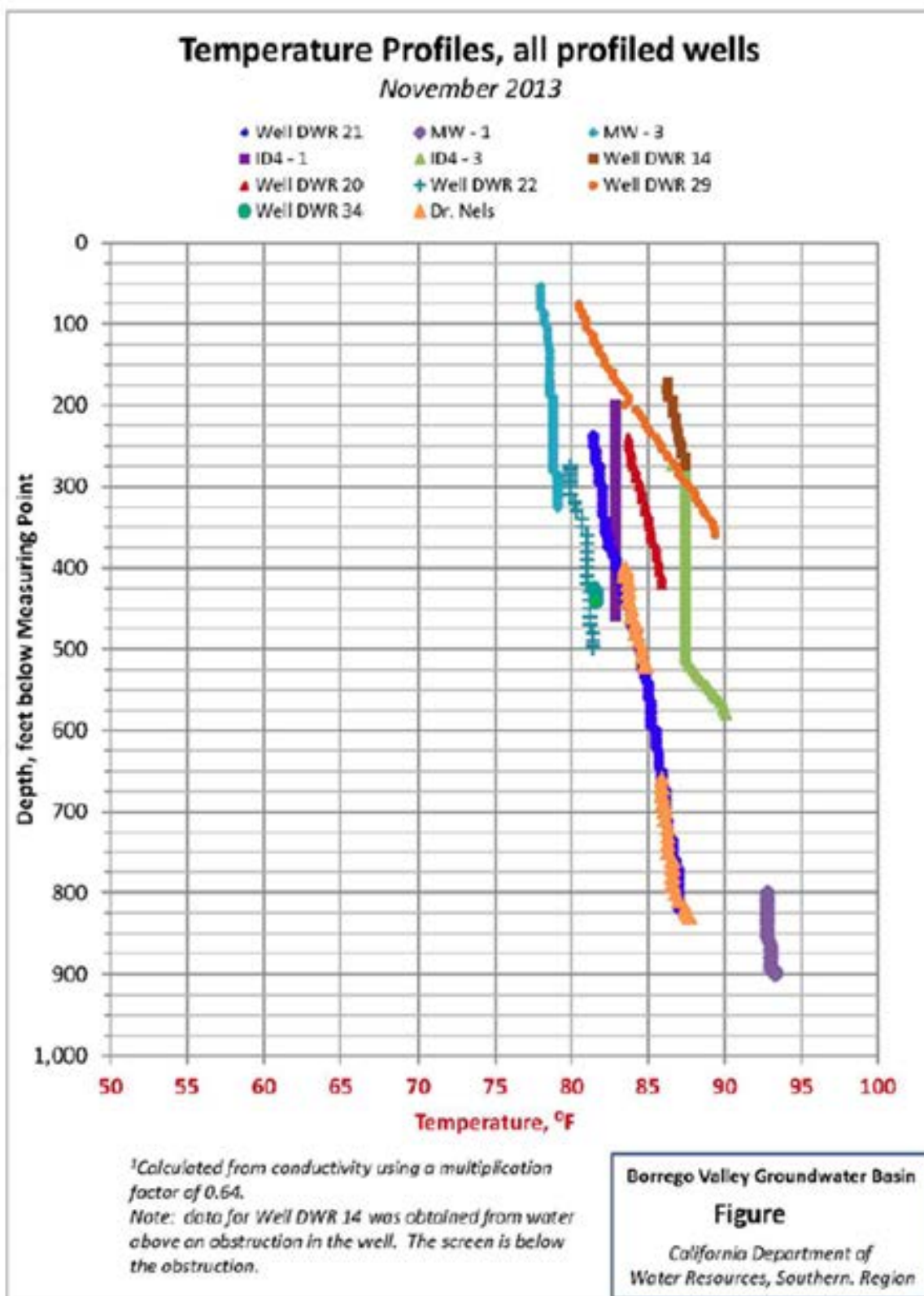


FIGURE 10, continued



3.5 Nitrate

Nitrate (NO₃) is a groundwater contaminant that is commonly detected in drinking water supplies obtained from alluvial basins throughout the southwestern US (see, for example, USGS NAWQA¹⁵, CA SWRCB GAMA¹⁶, and others). Nitrate in groundwater has many natural sources, but nitrate concentrations in groundwater underlying agricultural and urban areas are commonly higher than in other areas. The primary sources of nitrate in the Subbasin include fertilizers associated with agriculture and turf grasses (golf courses), and septic systems.

The relationship between groundwater quality and overlying land uses was examined by DWR (DWR, 2014; in **Appendix A**). **Figure 11** shows *“the distribution of nitrate analyses for the Borrego Basin. Maximum content is shown per section and sections are colored according to the number of analyses in the section. Sections where the maximum contaminant level (MCL) are exceeded are shown in hatched patterns.”* The DWR analysis shows that nitrates occur above MCLs in multiple wells.

The USGS reviewed nitrate data and stated that *“TDS and nitrate concentrations were generally highest in the upper aquifer and in the northern part of the Borrego Valley where agricultural activities are primarily concentrated.”* (USGS Model Report, p.2) ... *“Water-quality samples from wells distributed throughout the valley show that NO₃-N concentrations ranged from less than 1 mg/L to almost 67 mg/L. NO₃-N concentrations were highest in the shallow aquifer and exceeded the CA-MCL of 10 mg/L in some samples from the shallow and middle aquifers in the northwestern part of the basin (fig. 26). NO₃-N concentrations in samples from the lower aquifer did not exceed 6.7 mg/L.”* (USGS Model Report p.64)

Further spatial analysis of the occurrence of nitrate relative to land use is not included in this report. Additional review of nitrate data is included in **Section 3.7**, and in the GSP.

¹⁵ Thiros, S.A., Paul, A.P., Bexfield, L.M., and Anning, D.W., 2014, The quality of our Nation’s waters—Water quality in basin-fill aquifers of the southwestern United States: Arizona, California, Colorado, Nevada, New Mexico, and Utah, 1993–2009: U.S. Geological Survey Circular 1358, 113 p., <http://dx.doi.org/10.3133/cir1358>. National Ambient Water Quality Assessment (NAWQA)

¹⁶ Groundwater Ambient Monitoring and Assessment Program (GAMA
See:)<https://www.waterboards.ca.gov/gama/>

3.5.1 Supporting Information Regarding Nitrate

Historical groundwater quality impairment for nitrates is noted in the GSP to predominantly occur in the upper aquifer of the North Management Area underlying the agricultural areas, and near areas with a high density of septic point sources. The primary source of nitrates is likely associated with either fertilizer applications.

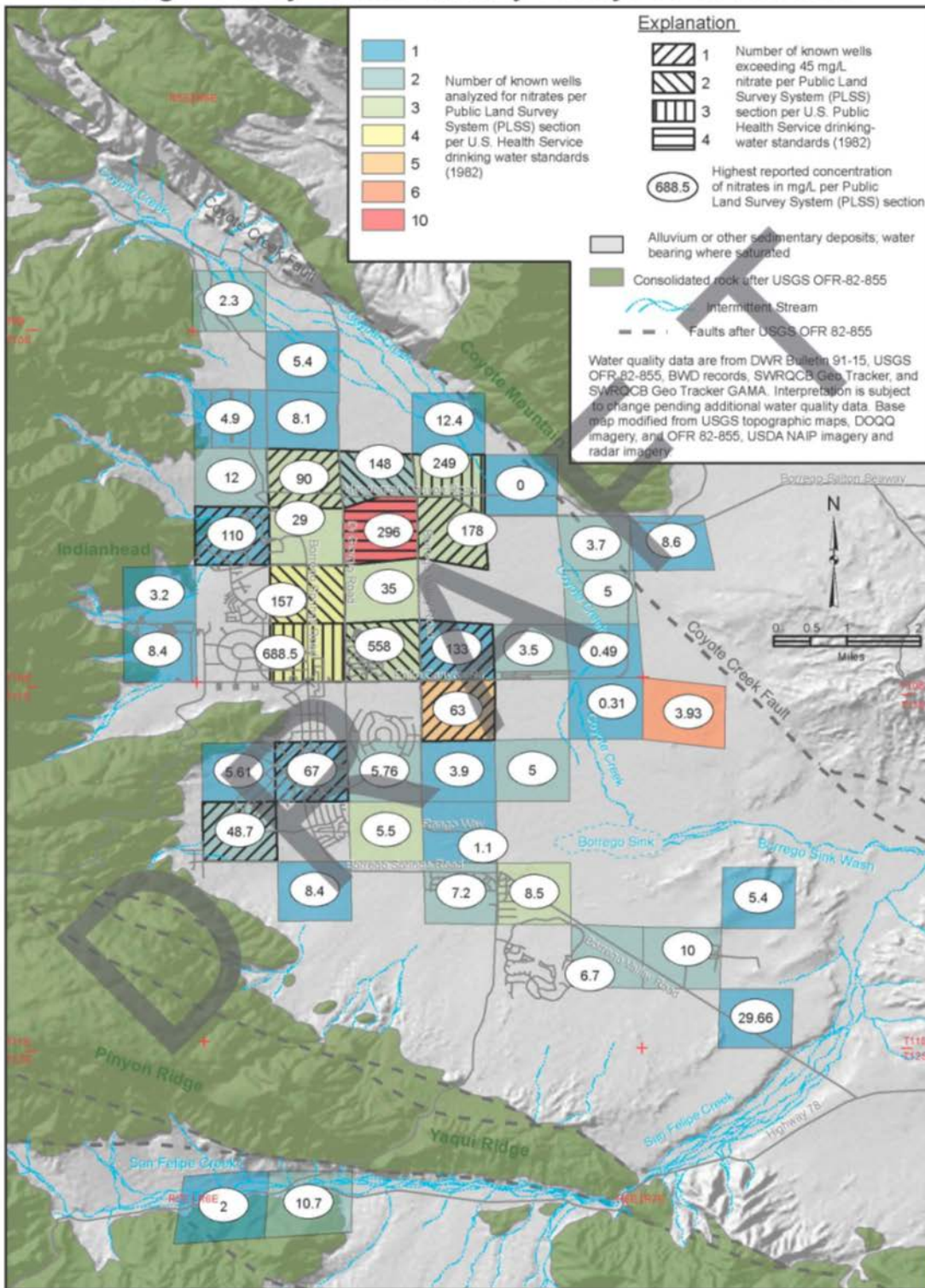
Information provided by Dudek in the GSP supports that nitrates have historically impacted multiple wells as follows. It is understood that the BWD Improvement District 4 (ID4) well 1 and 4, Borrego Springs Water Company Well No. 1 (located at the BWD office), the Roadrunner Mobile Home Park, and Santiago Estates wells were all taken out of potable service due to elevated nitrate. The latter two developments were connected to municipal wells operated by the BWD as an alternative source of supply. Well ID4-4 was re-drilled and screened deeper at the same location and successfully accessed good water quality not impacted by nitrates. The DiGiorgio wells 11, 14 and 15 located north of Henderson Road have historical detections of nitrate and TDS above drinking water standards. The existing groundwater network indicates elevated nitrate currently occurs at the Fortiner well No.1 in the North Management Area and at the BWD's WWTP monitoring well (see map, **Figure 4**).

Nitrate contamination enters the unconfined aquifer system via irrigation return flows and septic system discharge. An unconfined aquifer is directly open to the downward percolation of water. Thus, the uppermost portion of the aquifer is the most susceptible to nitrate impacts. However, as noted in **Table 1B**, nitrate impacts have been observed at low concentrations in all of the active BWD water supply wells.

There are two factors that can facilitate the downward migration of nitrates within the aquifer system- both caused by wells. The first is that ongoing pumping from deeper portions of the aquifer can actively draw shallow groundwater deeper into the aquifer system. The second is that inactive wells can act as conduits for groundwater flow and facilitate the drainage of water from the upper aquifer into deeper aquifers because of downward hydraulic gradients induced by ongoing pumping and overdraft (see Recommendations, Section 5.2, for additional discussion).

FIGURE 11

Borrego Valley Water Quality Analyses of Nitrates



3.6 Arsenic

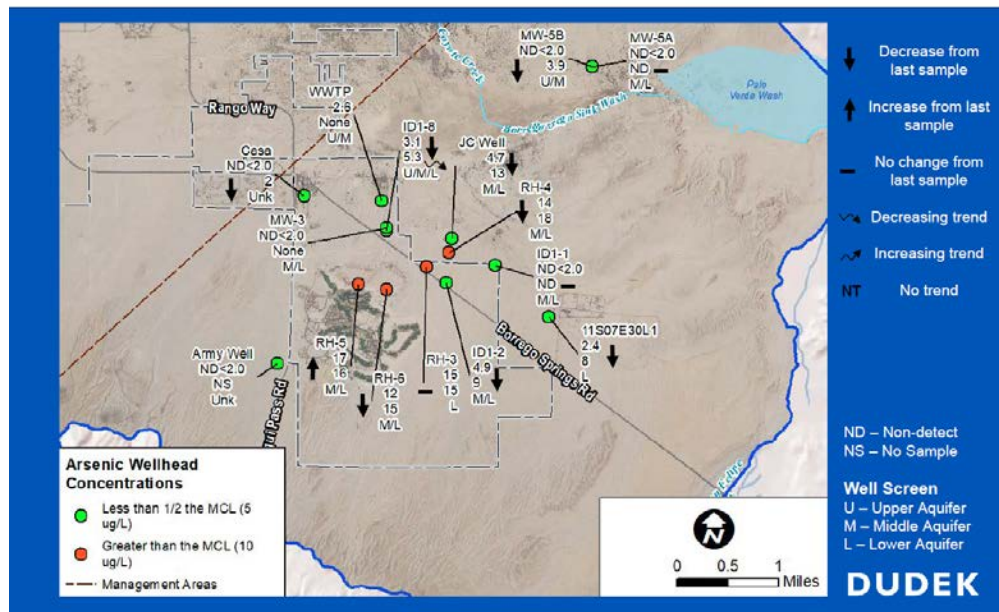
Arsenic is the primary drinking water COC identified throughout alluvial basins across the desert southwest (see, for example, previously cited USGS NWQA Report, 2014). The fate and transport of arsenic highly depends on the hadrochemical environment. Chemical conditions control the chemical state (valence) of the ion in solution- here arsenic can occur as either arsenate (As^{+3}) or arsenate (As^{+5}). The chemical behavior of arsenic in groundwater depends on multiple factors including the pH and the relative state of oxidation (i.e., chemically oxidizing or reducing, or 'redox' state). Arsenate (As^{+5}) for example, tends to become more soluble as pH increases. Microbial processes are also known to be involved in the oxidation and mobility of arsenic.¹⁷

Arsenic concentrations above MCLs currently occur in groundwater in the South Management Area, primarily in wells installed for the Ram's Hill Golf Course. **Figure 12**, from BWD Board presentation by Dudek dated 1/25/2018, shows prior sampling results. Sampling results for the remainder of the Subbasin indicate arsenic to occur at less than half the MCL (5 micrograms per liter [$\mu\text{g/L}$]). The sampling results for active BWD wells are summarized in **Section 4**.

FIGURE 12

10

South Management Area: Arsenic



¹⁷ Sun 2010. The Role of Denitrification on Arsenite Oxidation and Arsenic Mobility in An Anoxic Sediment Column Model with Activated Alumina. In Bioengineering and Biotechnology. <https://onlinelibrary.wiley.com/doi/abs/10.1002/bit.22883> This work is cited because it supports that Nitrate, an alternative electron acceptor, can support oxidation of As^{+3} to As^{+5} (arsenate) by denitrifying bacteria in the absence of oxygen. Arsenate is generally considered to be mobile in groundwater at pH levels greater than 8.

3.6.1 Supporting Information Regarding Arsenic

To date all water quality testing has reported ‘total arsenic’. While this is consistent with the reporting requirements for drinking water testing, the current monitoring program does not speciate arsenic by valence. The species that occur in groundwater can generally be inferred based on knowledge of water conditions- specifically the pH and Eh (or redox state).

A study of arsenic and nitrate in the Subbasin done in cooperation with the BWD was published by Rezaie-Boroon et al, in 2014.¹⁸ The study was based on data from six BWD wells (ID4-18, ID4-11, ID1-12, ID4-10, ID1-10, and Wilcox) for the period of 2006 to 2014. Their trend analyses are not summarized here because four more years of data have since been collected and the trends have changed. Their work emphasized the following:

- The chemical environment as determined by pH and Eh is important. Both pH and Eh conditions control how dissolved arsenic occurs in aqueous environment (see reference).¹⁹ Arsenic is more soluble in an alkaline (high pH) and anoxic environments. The relative mobility of arsenic depends on its valence, typically occurring as either arsenite (As^{+3}) or arsenate (As^{+5}). As^{+3} is typically more mobile than As^{+5} in anoxic groundwater.
- The presence of iron oxide coatings on soil and sediment particles supports arsenic adsorption and can cause the concentration of arsenic in solution to decrease. This will typically occur under oxidizing conditions where As^{+5} will generally occur versus As^{+3} , and where iron oxides will occur.
- *“The most common forms of arsenic in groundwater are their oxy-anions, arsenite (As^{+3}) and arsenate (As^{+5}). Both cations are capable of adsorbing to various subsurface materials, such as iron oxides and clay particles. Iron oxides are particularly important to arsenate fate and transport” because...“arsenate [ed: As^{+5}] strongly adsorbs to these surfaces in acidic to neutral waters.”* Thus, increases in pH will support the desorption or release of arsenate into groundwater.

The interaction of arsenic with soil and aquifer material containing iron oxide is summarized in a 2015 report by the Water Research Foundation.²⁰ This study is potentially relevant to the use of arsenic-bearing irrigation water, because it shows that arsenic can be removed from water when passed through soil. The Water Research Foundation report concluded that “Results of this study provide an inexpensive arsenic treatment method for water utilities”, while

¹⁸ Rezaie-Boroon et al, 2014. The Source of Arsenic and Nitrate in Borrego Valley Groundwater Aquifer. Journal of Water Resource and Protection, 5, p1589-1602.

<https://www.scirp.org/journal/PaperInformation.aspx?PaperID=51944>

¹⁹ Stein, C.L., Brandon, W.C. and McTigue, D.F. (2005) Arsenic Behavior under Sulfate-Reducing Conditions: Beware of the “Danger Zone”. EPA Science Forum 2005: Collaborative Science for Environmental Solutions, 16-18 May 2005, Washington DC.

²⁰ Water Research Foundation, 2015. In-situ Arsenic Removal During Groundwater Recharge Through Unsaturated Alluvium. Web Report #4299.

recognizing that the work was a pilot study and that a good understanding of site conditions is necessary to achieve similar results.

Arsenic may also be released from the dewatering or release of water in from clays. A recent study published in 2018 for the San Joaquin Valley of California examined the potential release of arsenic from the Corcoran Clay, a regionally extensive clay deposit that is being compressed as a result of land subsidence due to groundwater overdraft.²¹ Their results “support the premise that arsenic can reside within pore water of clay strata within aquifers and is released due to overpumping”.

Four factors were seen to contribute to the occurrence of arsenic in groundwater that included clay thickness, dissolved manganese (Mn) concentrations, elevation (depth), and recent subsidence. As stated in their report “We highlighted four of the most important variables describing arsenic concentration within the Tulare Basin in the recent model, shown in Fig. 2a-d [of their report]. Of these, the thickness of the Corcoran Clay (a confining unit that overlies a lower aquifer) shows a positive correlation with arsenic concentrations due to increased clay content. Elevation has a negative correlation, as lower areas are more likely to have been water-saturated and thus anaerobic. A positive correlation was found between $\log_{10}(\text{Mn})$ and arsenic concentrations, as the presence of manganese indicates an anoxic environment, in which arsenic tends to be more soluble. Significantly, recent subsidence from InSAR²² [ed: land surface elevation data] showed a positive correlation, as over-pumping leads to increased pore water drainage from clays. The first three variables are well-known from the literature and not related to human activity. The quantitative link between pumping-induced subsidence and arsenic concentrations has not been shown before, and is directly related to human activity.”

Their analysis supports that geochemical data that include measurements of oxidation-reduction potential (redox) and oxygen content, and testing for minerals that are indicative of geochemical conditions (such as ferrous and ferric iron, and manganese) can support assessment of the potential for arsenic to become mobile in the aquifer system. A recent USGS publication provides further explanation of the role of iron oxides under varying pH and redox conditions (USGS Scientific Investigations Report 2012–5065²³). A key point made by the USGS is that arsenic becomes mobile at a pH greater than 8 under oxidizing and neutral/transitional

²¹ Overpumping leads to California groundwater arsenic threat. By Ryan Smith, Rosemary Knight, and Scott Fendorf. June 2018. In *Nature Communications* (2018) 9:2089, DOI: 10.1038/s41467-018-04475, www.nature.com/naturecommunications. or at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5988660/pdf/41467_2018_Article_4475.pdf

²² “InSAR (Interferometric Synthetic Aperture Radar) is a technique for mapping ground deformation using radar images of the Earth's surface that are collected from orbiting satellites”. see <https://volcanoes.usgs.gov/vhp/insar.html>

²³ Predicted Nitrate and Arsenic Concentrations in Basin-Fill Aquifers of the Southwestern United States, by David W. Anning, Angela P. Paul, Tim S. McKinney, Jena M. Huntington, Laura M. Bexfield, and Susan A. Thiros; <https://pubs.usgs.gov/sir/2012/5065/pdf/sir20125065.pdf>

redox conditions, and is potentially mobile under strongly reducing conditions where both arsenite and iron can be in solution.

The USGS Model Report evaluated land subsidence in the Subbasin for the period of the 1960s to 2010 (page 70 of their report) and concluded that "...land subsidence attributed to aquifer-system compaction is not currently a problem in the Borrego Valley and is unlikely to be a significant problem in the future". However, this does not preclude the potential release or extraction of arsenic from clay-rich portions of the aquifer system that may occur under current or future pumping absent subsidence, or as a result of changes in geochemical conditions that could mobilize arsenic from clay-rich sediments that may contain arsenic.

Overall the occurrence, nature, and extent of arsenic in the Subbasin is not well understood. It is more prevalent in South Management Area wells. While currently water quality conditions are good relative to arsenic, it was observed to be at or near drinking water MCLs in multiple BWD water supply wells during the last decade and could affect BWD's water supply in the future.

3.7 Correlations Among Water Quality Parameters (Combined Data Assessment)

One of the goals of this Report is to evaluate whether multiple chemical parameters can be used to better define and predict COC trends at BWD water supply wells. Piper diagrams presented in **Section 3.2** were used to examine spatial trends and also illustrate that there are definable relationships among the general minerals seen in the trilinear diagrams. In this section the water chemistry data are combined for all wells to examine general relationships and correlations. The data set also includes pH, hardness. Other potentially important geochemical parameters such as iron and manganese were not included because they were not uniformly obtained for the water quality samples historically collected.

3.7.1 Water Quality Data Correlations

Water quality data obtained since 2004 were used to examine potential correlations and relationships. The recent data were selected to represent current conditions as water quality has changed over time in many wells. Among the parameters that were tested include anions (HCO_3 , Cl , SO_4), cations (Ca , Mg , and Na [potassium was not included as less data were collected]), pH, TDS, $\text{Ca} + \text{Na}$, $\text{Cl} + \text{HCO}_3$, As , F , and NO_3 . Also included in the correlation analysis were two parameters named Midst and Low Sat that represented the percentage of well screen open to flow per aquifer unit as described in each of the wells (for example if a well is completed with the same amount of screen length per aquifer then both values would be 50 percent).

Correlations greater than 0.5 or less than -0.5 are highlighted in **Table 3**. Values between 0.5 and 0.7 are underlined, and values greater than 0.7 are in bold. The South Management Area data have been separated from the North and Central Management Areas.

Selected data are shown in graphical form in this section. The data set used in the correlations was limited to those samples where the general minerals charge balance was within 10 percent. The graphs further restrict the data to only include higher quality data with a +/- 5 % charge balance. Hem (1985) considers data with 5% charge balance to be of good quality²⁴.

²⁴ John Hem, 1985. Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water-Supply Paper 2254. From page 163: "Under optimum conditions, the analytical results for major constituents of water have an accuracy of +/- 2 - +/- 10 percent. That is, the difference between the reported result and the actual concentration in the sample at the time of analysis should be between 2 and 10 percent of the actual value. Solutes present in concentrations above 100 mg/L generally can be determined with an accuracy of better than +/- 5 percent. Limits of precision (reproducibility) are similar."

Table 3

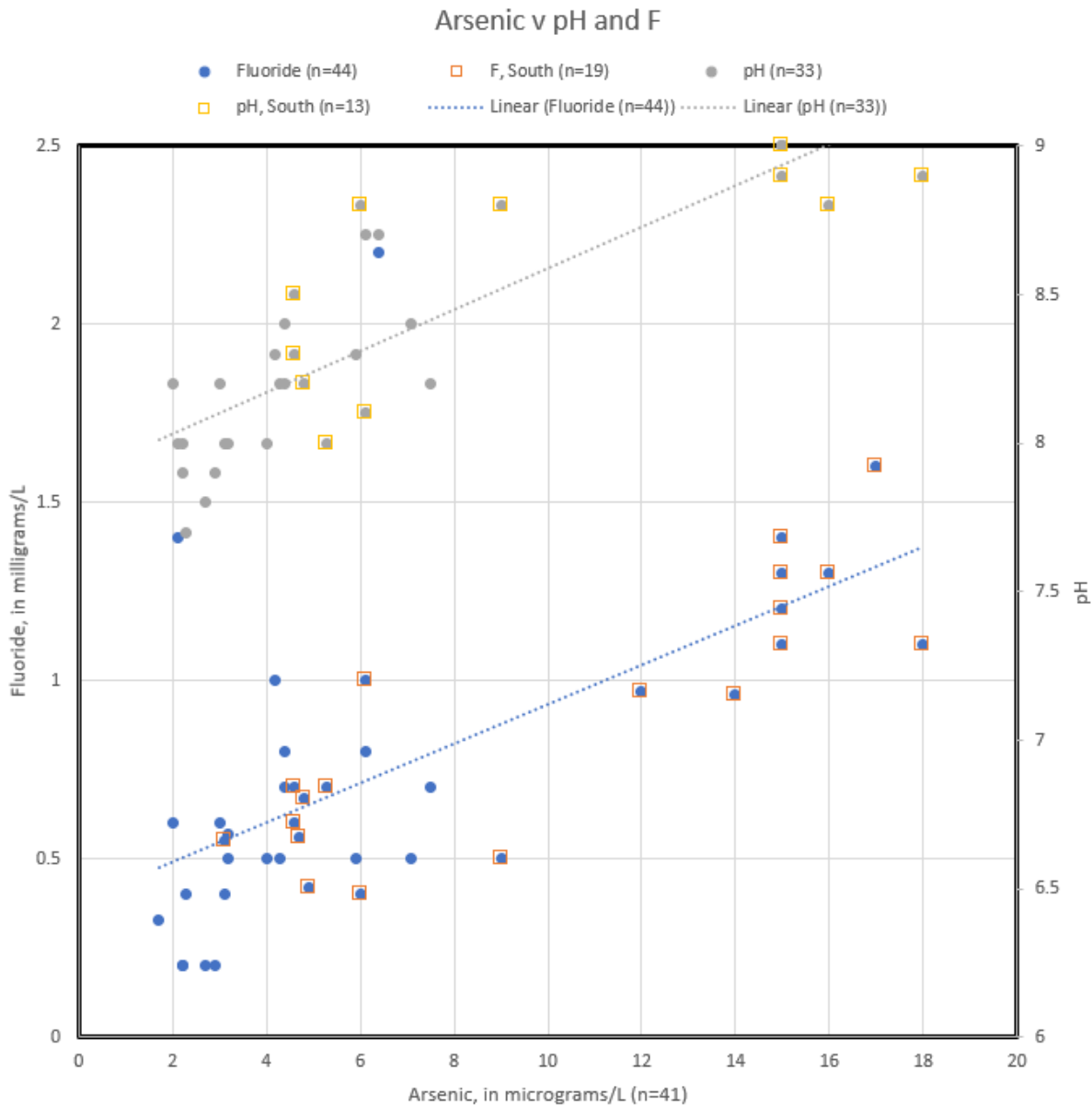
NORTH and CENTRAL																
	Bicarbonate	Chloride	Sulfate	Fluoride	Calcium	Magnesium	Sodium				cation	anion	pct middle	pct lower	Arsenic	Nitrate
	HCO3	Cl	SO4	F	Ca	Mg	Na	pH	TDS	Ca+Na	Cl+HCO3	MidSat	LowSat	As	NO3	
HCO3	1.00	0.73	-0.38	-0.30	0.46	0.76	-0.10	-0.69	0.27	0.18	0.94	-0.48	0.30	-0.28	0.49	
Cl		1.00	-0.26	-0.09	0.28	0.54	0.31	-0.53	0.43	0.36	0.92	-0.40	0.15	-0.13	0.72	
SO4			1.00	0.26	0.46	0.07	0.67	0.16	0.70	0.70	-0.35	0.01	0.09	0.23	-0.43	
F				1.00	-0.30	-0.23	0.54	0.48	0.15	0.21	-0.21	-0.43	0.47	0.66	-0.14	
Ca					1.00	0.79	0.34	-0.60	0.72	0.77	0.40	-0.31	0.25	-0.32	0.14	
Mg						1.00	0.23	-0.75	0.57	0.58	0.70	-0.48	0.40	-0.33	0.37	
Na							1.00	0.03	0.83	0.86	0.10	-0.39	0.38	0.31	0.22	
pH								1.00	-0.31	-0.30	-0.65	0.24	-0.12	0.68	-0.46	
TDS									1.00	0.95	0.37	-0.41	0.33	0.04	0.21	
Ca+Na										1.00	0.28	-0.43	0.39	0.04	0.23	
Cl+HCO3											1.00	-0.47	0.24	-0.23	0.65	
MidSat												1.00	-0.86	-0.30	-0.43	
LowSat													1.00	0.30	0.22	
As														1.00	-0.18	
NO3															1.00	
SOUTH																
	Bicarbonate	Chloride	Sulfate	Fluoride	Calcium	Magnesium	Sodium					pct middle	pct lower	Arsenic	Nitrate	
	HCO3	Cl	SO4	F	Ca	Mg	Na	pH	TDS	Ca+Na	Cl+HCO3	MidSat	LowSat	As	NO3	
HCO3	1.00	-0.45	-0.44	0.14	-0.37	-0.31	-0.16	0.27	-0.33	-0.25	0.14	0.31	-0.33	0.10	0.19	
Cl		1.00	0.87	-0.31	0.80	0.36	0.83	-0.34	0.92	0.84	0.47	0.17	-0.19	-0.08	0.11	
SO4			1.00	-0.37	0.95	0.46	0.73	-0.31	0.96	0.86	0.37	-0.03	0.04	-0.01	0.01	
F				1.00	-0.48	-0.16	-0.14	0.56	-0.40	-0.41	-0.33	-0.23	0.23	0.73	-0.22	
Ca					1.00	0.42	0.60	-0.46	0.92	0.78	0.29	0.05	-0.05	-0.13	0.08	
Mg						1.00	-0.03	-0.13	0.42	0.16	0.07	-0.11	0.11	0.06	-0.05	
Na							1.00	-0.10	0.81	0.86	0.49	0.24	-0.24	0.09	0.19	
pH								1.00	-0.35	-0.25	-0.13	-0.18	0.19	0.55	-0.30	
TDS									1.00	0.89	0.44	0.14	-0.14	-0.03	0.18	
Ca+Na										1.00	0.70	0.18	-0.19	-0.06	0.15	
Cl+HCO3											1.00	0.27	-0.30	-0.14	0.05	
MidSat												1.00	-1.00	-0.15	0.46	
LowSat													1.00	0.17	-0.45	
As														1.00	-0.06	
NO3															1.00	

COC	North and Central	South
Arsenic	pH (.68), F (.66)	F (.73), pH (.55)
Nitrate	Cl (.72)	-none-
Sulfate	TDS (.70), Na (.67)	TDS (.96), Ca (.95), Cl (.87), Na (.73)
Fluoride	As (.66), Na (.54)	As (.73), pH (.56)
TDS	Na (.83), Ca (.72), SO ₄ (.70), Mg (.57)	SO ₄ (.96), Cl (.92), Ca (.92), Na (.81)

Arsenic and Fluoride

Arsenic and fluoride concentrations are correlated and both increase with pH. **Figure 13** depicts arsenic versus fluoride and pH. (pH versus As is in the upper portion of the graph and the y-axis label is to the right; fluoride versus As is in the lower portion and the y-axis is to the left). In both cases the correlations are influenced by the higher arsenic concentrations observed in the South Management Area (as noted by squares drawn around the data points). Every occurrence of arsenic above the MCL of 10 µg/L is associated with pH values greater than 8.5 (upper portion of the graph).

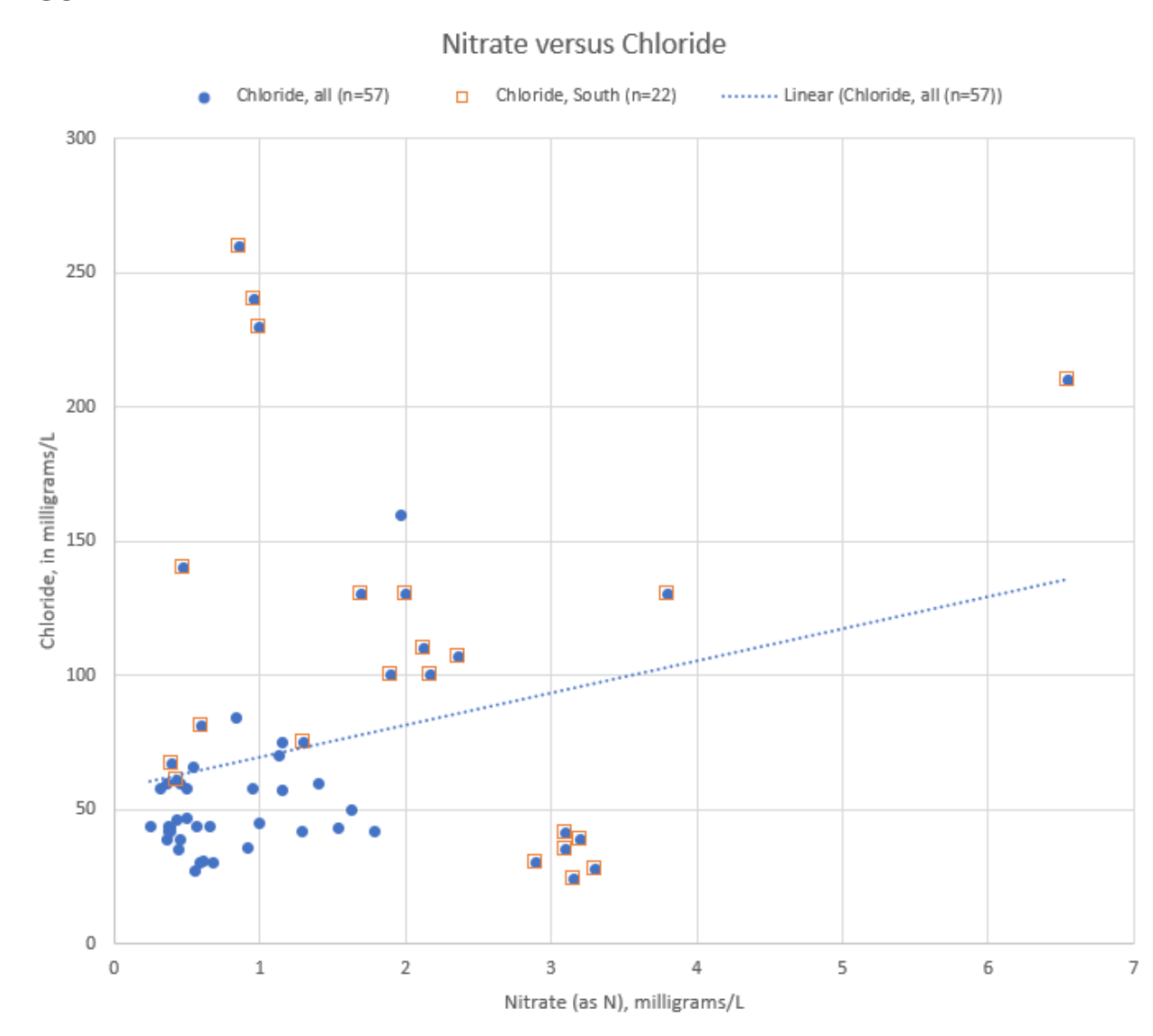
FIGURE 13



Nitrate

Nitrate had few water quality parameter correlations. Nitrate versus chloride is depicted in **Figure 14**. While there was a statistically-indicated correlation in **Table 3** for the North and Central Management Areas, chloride does not appear to be a globally useful predictor of nitrate.

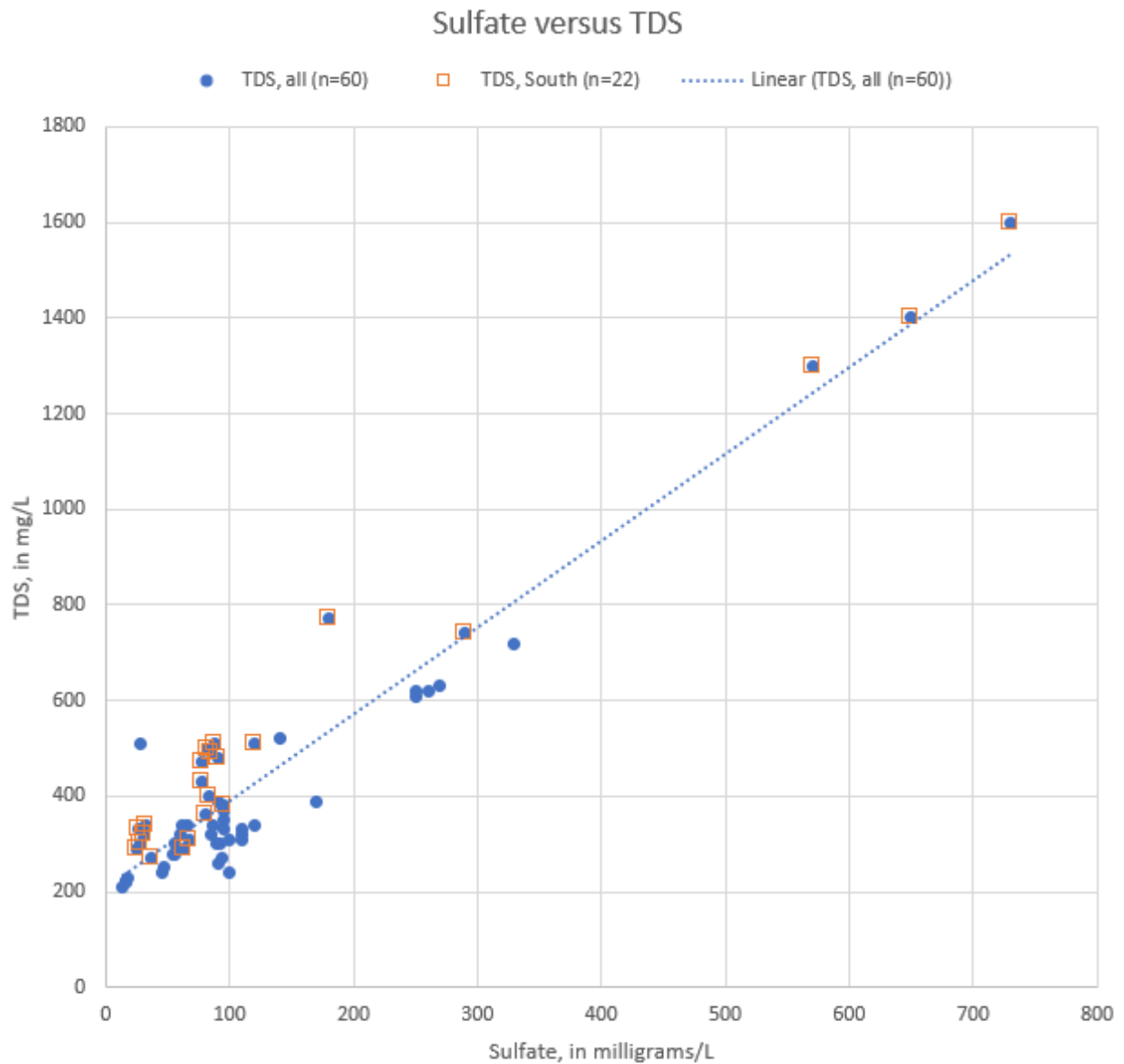
FIGURE 14



Sulfate

The correlation of sulfate with TDS is depicted in **Figure 15**. The three high sulfate values (> 500 mg/L) from the South Management Area strongly influence the correlation.

FIGURE 15

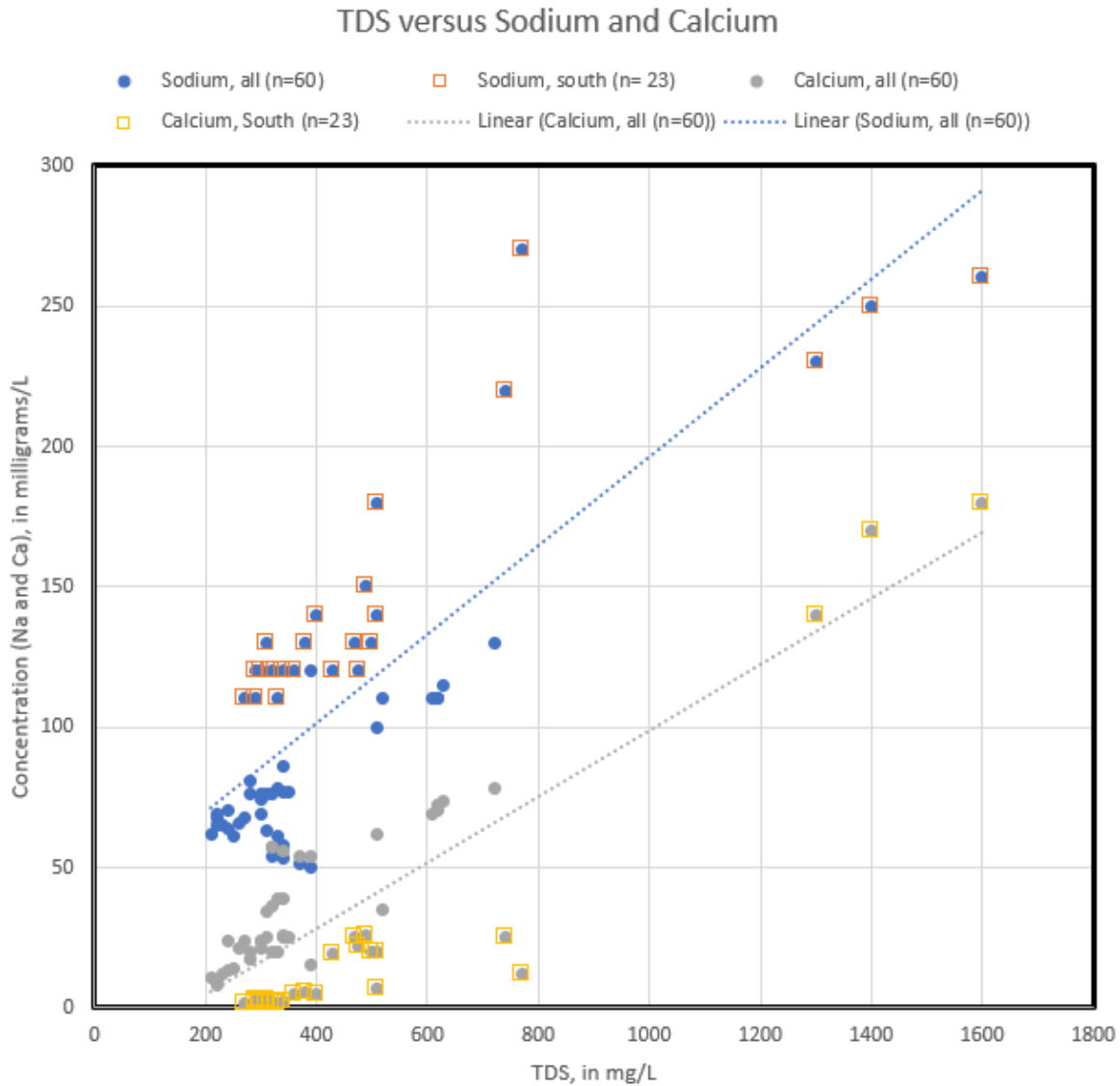


TDS

Multiple analytes correlated with TDS. Sulfate is shown in the previous figure. Sodium and calcium are shown versus TDS in **Figure 16**, and chloride versus TDS is shown in **Figure 17**. Both figures show that the South Management Area water chemistry is different than that observed to the north. The regression lines in **Figure 16** effectively split the two sets of data by management area.

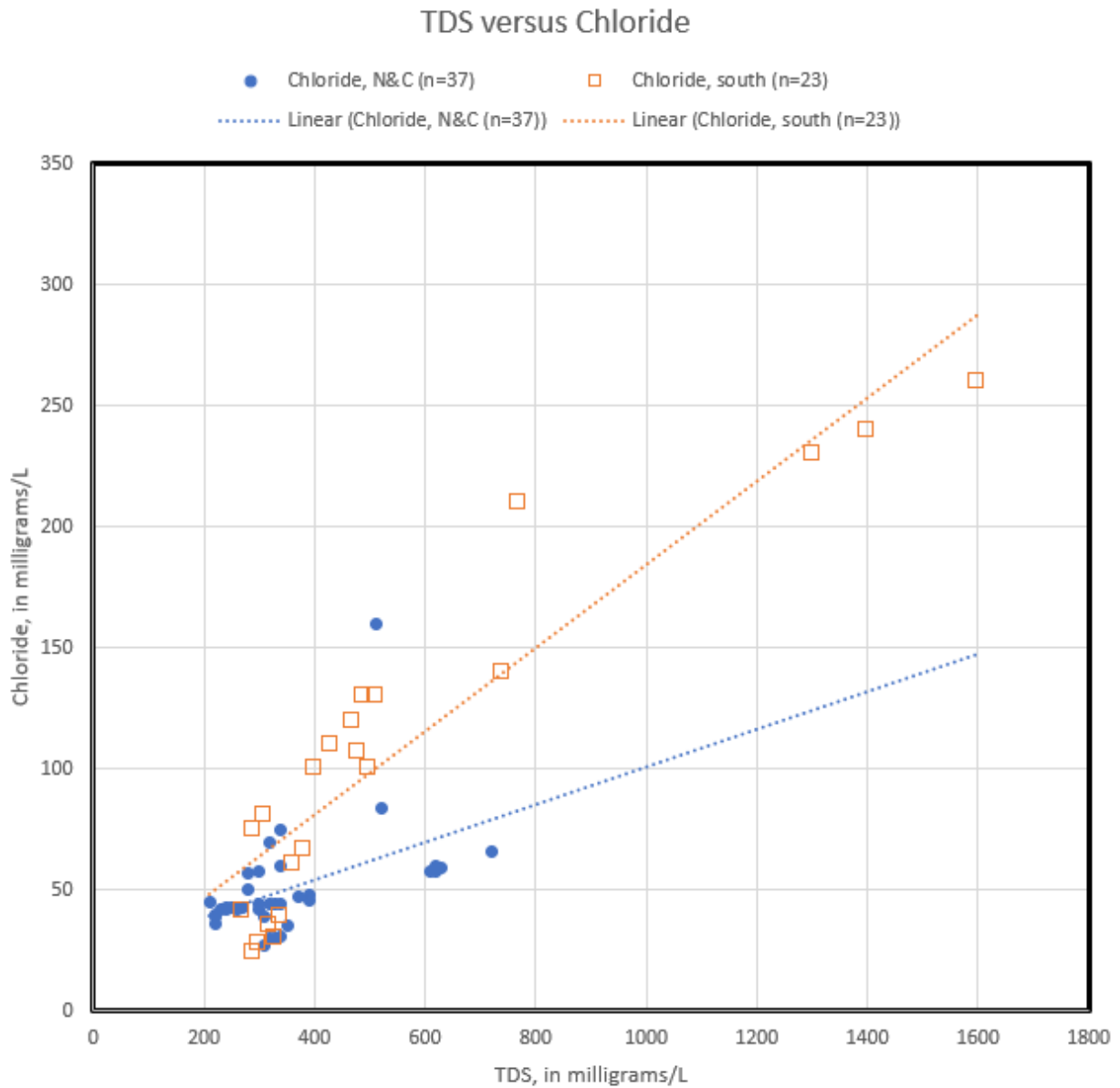
While correlations exist for all three analytes, sodium and chloride represents a higher percentage of TDS and calcium represents a smaller percentage of TDS in the South Management Area.

FIGURE 16



Chloride data segregated by management area are depicted in **Figure 17**. The highest chloride concentrations typically occur in the South Management Area.

FIGURE 17



3.8 General Minerals: Summary of Observations

A summary of the Piper diagram analyses for the 23 wells used in this Report is included in **Table 1B**.

- Water quality has clearly changed over time. Of the 23 wells, six had insufficient general minerals data to assess trends. Of the 17 wells with sufficient temporal data, approximately 70 percent showed a change in natural water chemistry over time.
- Sulfate is the general mineral most commonly observed to be increasing in groundwater (as a relative percentage per the Piper diagrams).
- Groundwater quality systematically varies with distance along the valley, with water in the South Management Area being noticeably different. Here the well data were not differentiated by aquifer or relative depth

Five COCs are included in this Report. Nitrate and arsenic are currently the chemical of highest concern specific to BWD drinking water quality. Fluoride, sulfate, and TDS are other three COCs. The data were collected over varying time periods and not all sampling events included a complete set of the eight general minerals. A review of the COCs for all of the active BWD wells is provided in **Section 4**.

Limited depth-specific hydraulic and contaminant data are available to assess the nature and extent of COCs in groundwater. As a result, the analyses among wells is limited to spatial comparisons. The lack of depth-specific data is a data gap that affects the assessment of all water quality parameters. The primary impact of this data gap is that the depth-dependent data will provide a good indication of how water quality will change over time as water levels decline. If specific zones are contributing poor water quality, then the data can be used to selectively complete future water wells to reduce the impact of the inflow of poor water quality.

4.0 CHEMICALS OF CONCERN (COCs) AT BWD WATER SUPPLY WELLS

The five chemicals of concern (COCs) include arsenic, total dissolved solids, nitrate, sulfate, and fluoride (As, TDS, NO₃, SO₄, and F). There are nine BWD water supply wells reviewed here. The COC and Piper diagram data for these wells is depicted in the following Figures that follow this subsection:

Figure 18 ID4-4 (Well #4, as depicted in Figure 4)
Figure 19 ID4-11 (Well #5, as depicted in Figure 4)
Figure 20 ID4-18 (Well #2, as depicted in Figure 4)
Figure 21 ID1-10 (Well #14, as depicted in Figure 4)
Figure 22 ID1-12 (Well #9, as depicted in Figure 4)
Figure 23 ID1-16 (Well #12, as depicted in Figure 4)
Figure 24 ID5-5 (Well #8, as depicted in Figure 4)
Figure 25 Wilcox (Well #13, as depicted in Figure 4)
Figure 26 ID1-8 (Well #15, as depicted in Figure 4)

Of these, three wells are being considered for replacement- ID4-4, ID4-18, and ID1-10. **Table 4** summarizes the review of **Figures 18 through 26**.

Water quality trends, if identified, are based on visual description of the various data. The GSP describes the use of Mann-Kendall statistical trend analyses, a non-parametric way to detect a monotonic trend (up or down), to assess individual water quality parameters. The work here is focused on identifying correlations among parameters.

NOTE: Well ID4-4 was redrilled in 1979. Water chemistry changed.

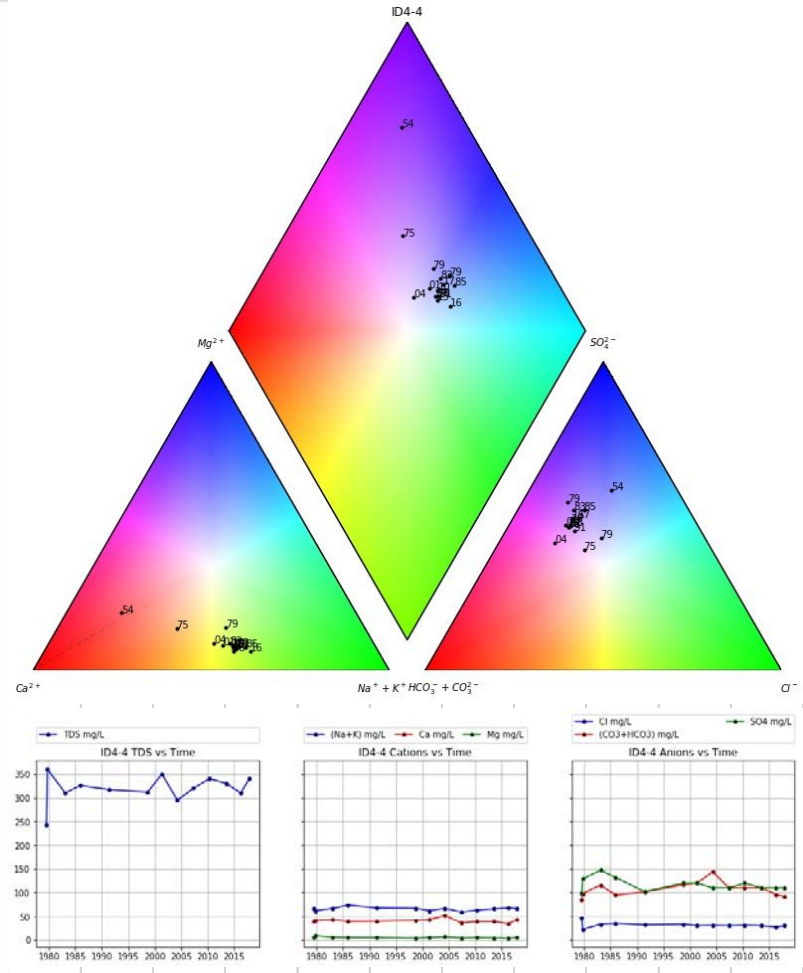
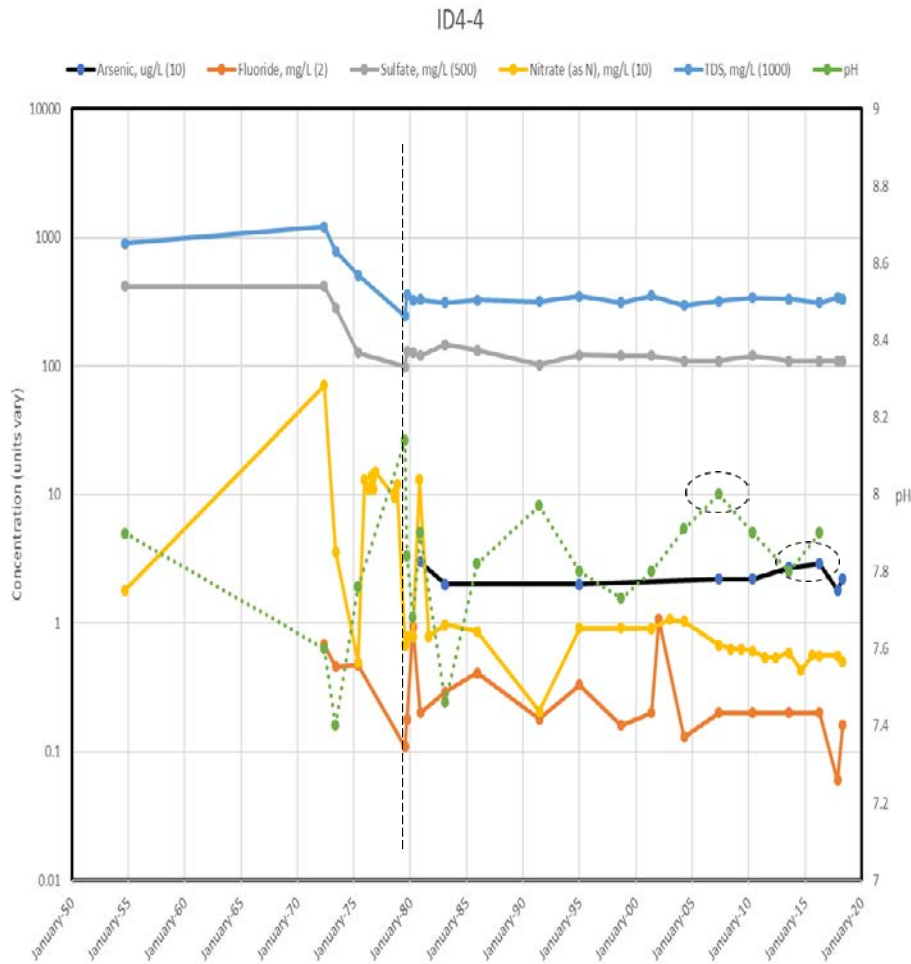


FIGURE 18. BWD Well ID4-4

Notes: pH and COC concentrations versus time shown left panel.
 Piper trilinear diagram depicts change over time- the labels indicate the last two digits of the year when sampled (e.g. 72 = 1972)

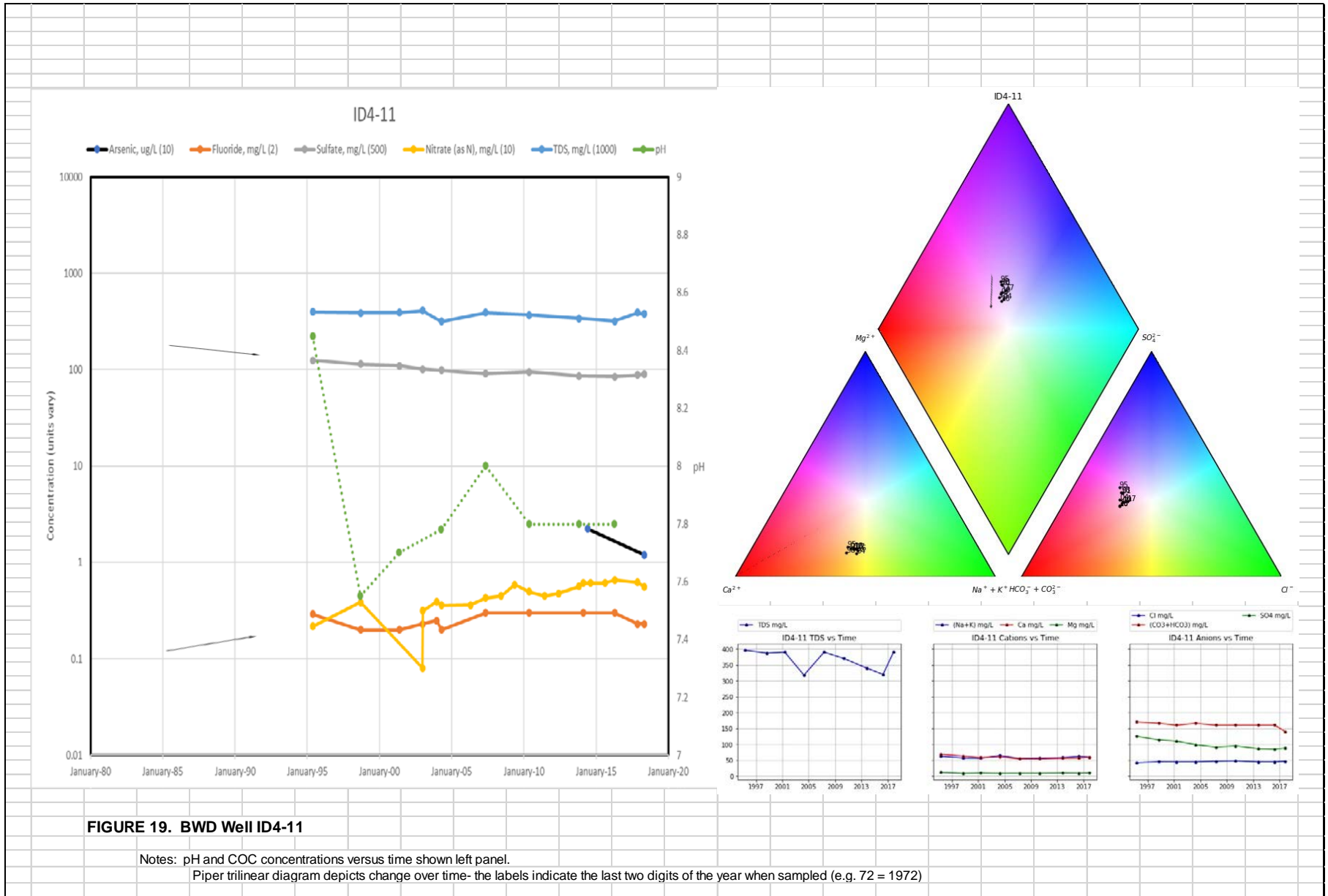
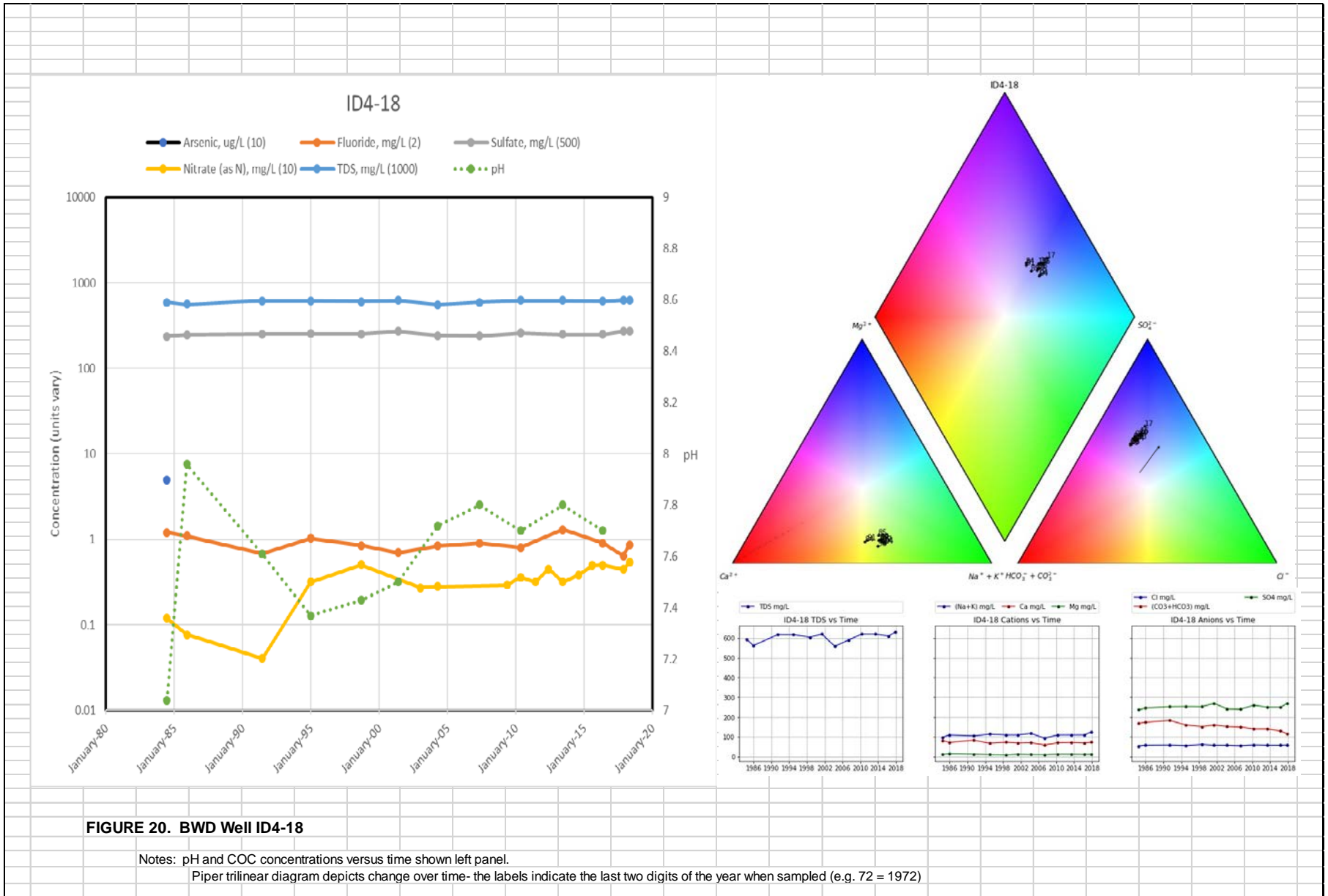
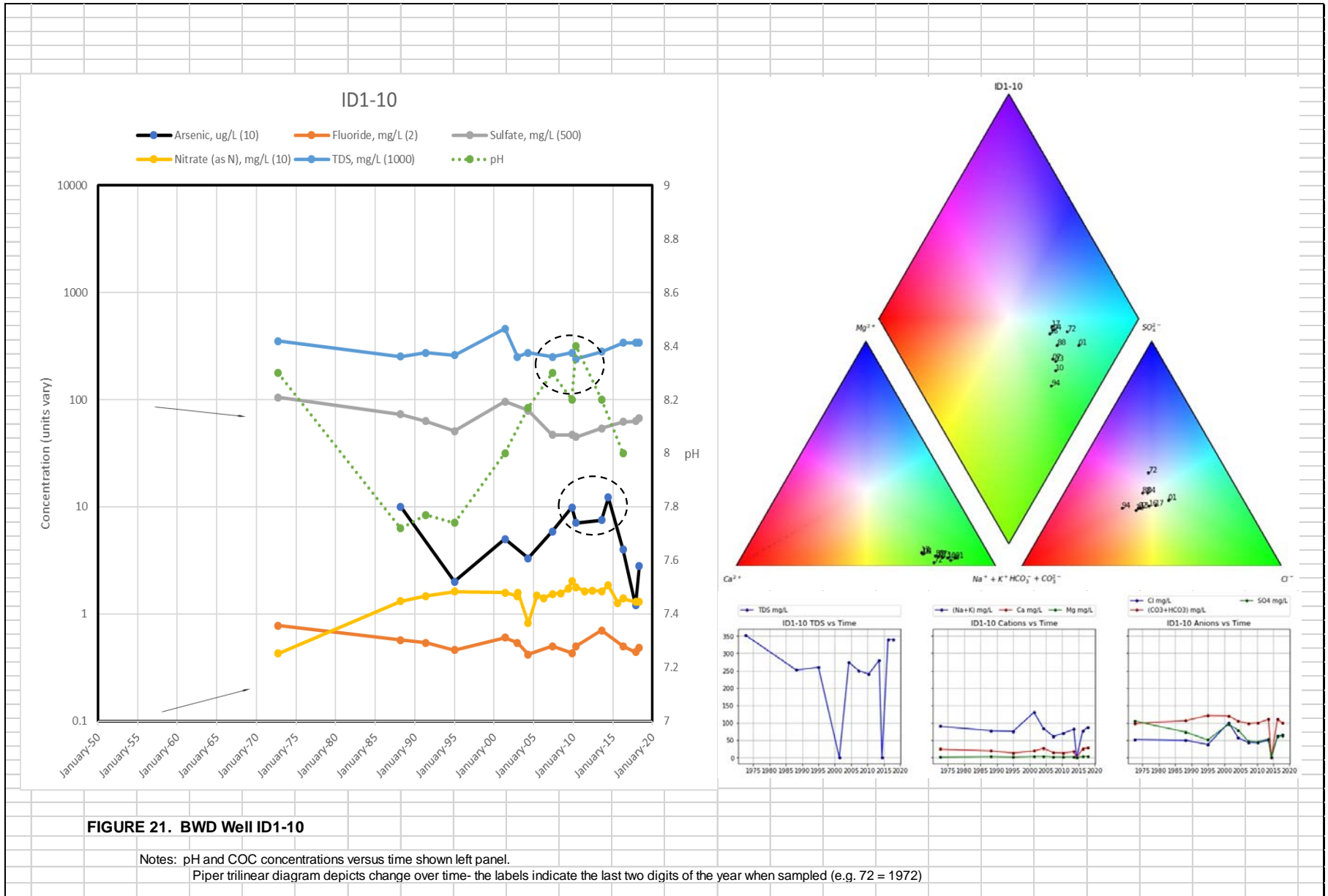


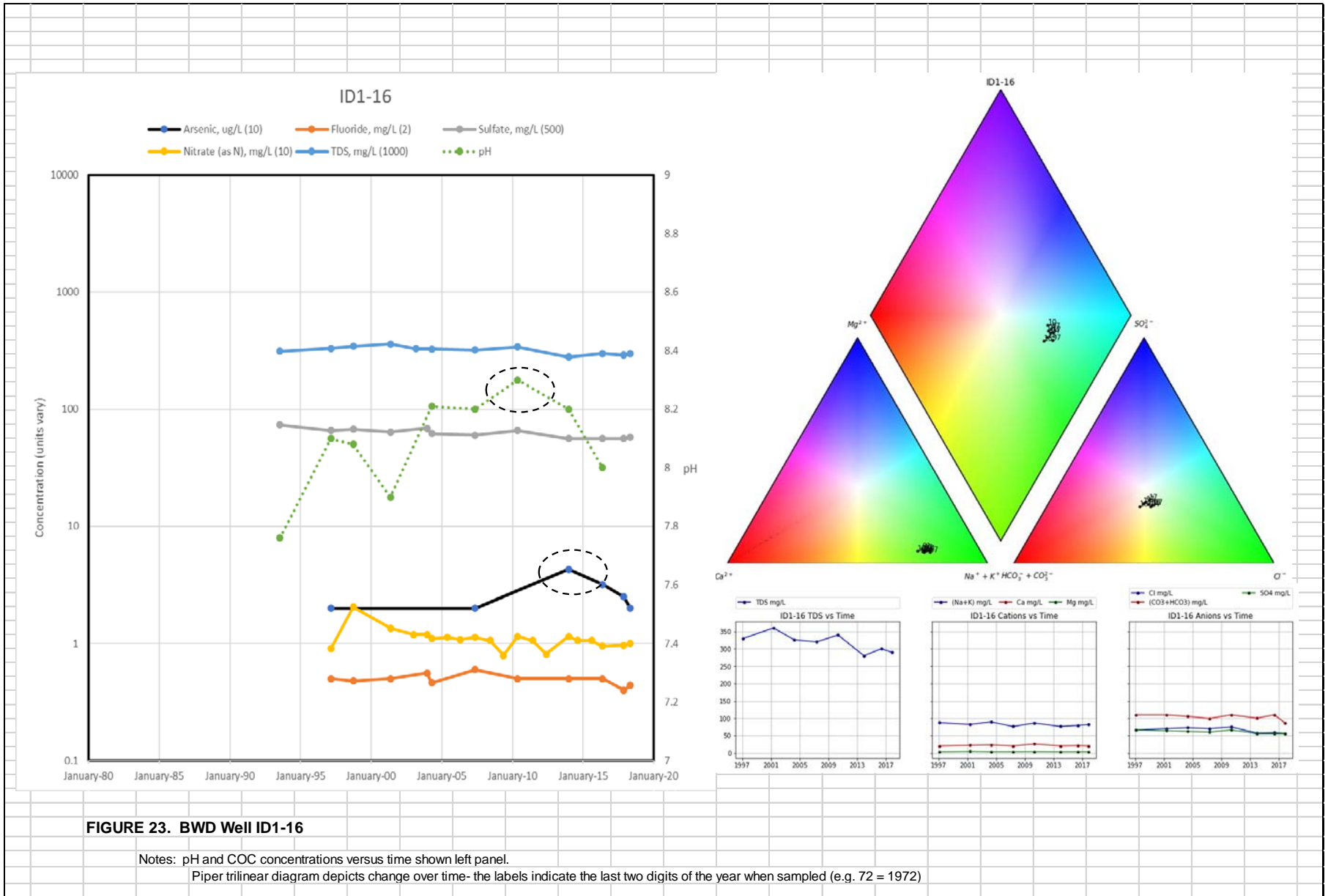
FIGURE 19. BWD Well ID4-11

Notes: pH and COC concentrations versus time shown left panel.
 Piper trilinear diagram depicts change over time- the labels indicate the last two digits of the year when sampled (e.g. 72 = 1972)









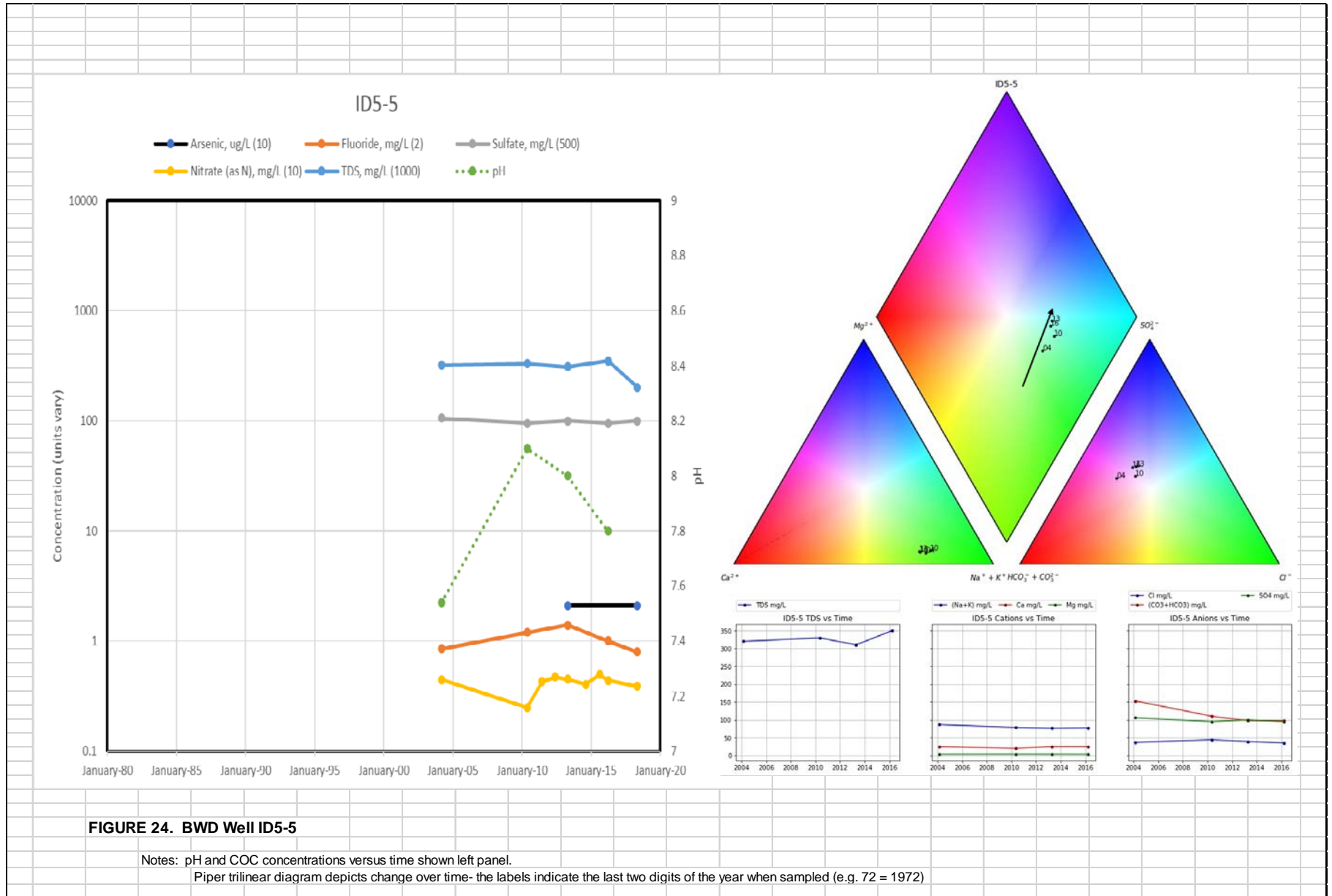


FIGURE 24. BWD Well ID5-5

Notes: pH and COC concentrations versus time shown left panel.
 Piper trilinear diagram depicts change over time- the labels indicate the last two digits of the year when sampled (e.g. 72 = 1972)

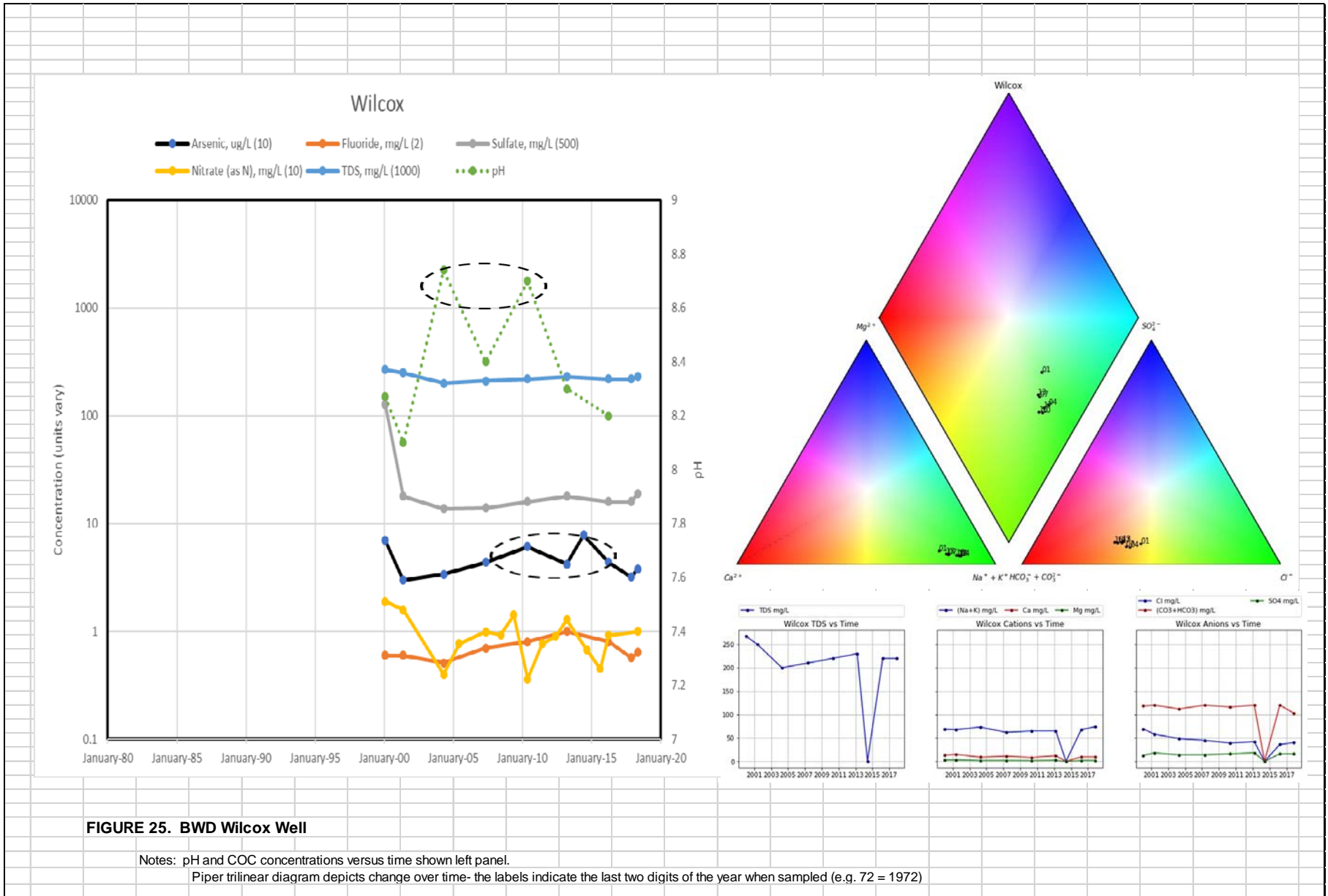


FIGURE 25. BWD Wilcox Well

Notes: pH and COC concentrations versus time shown left panel.
 Piper trilinear diagram depicts change over time- the labels indicate the last two digits of the year when sampled (e.g. 72 = 1972)

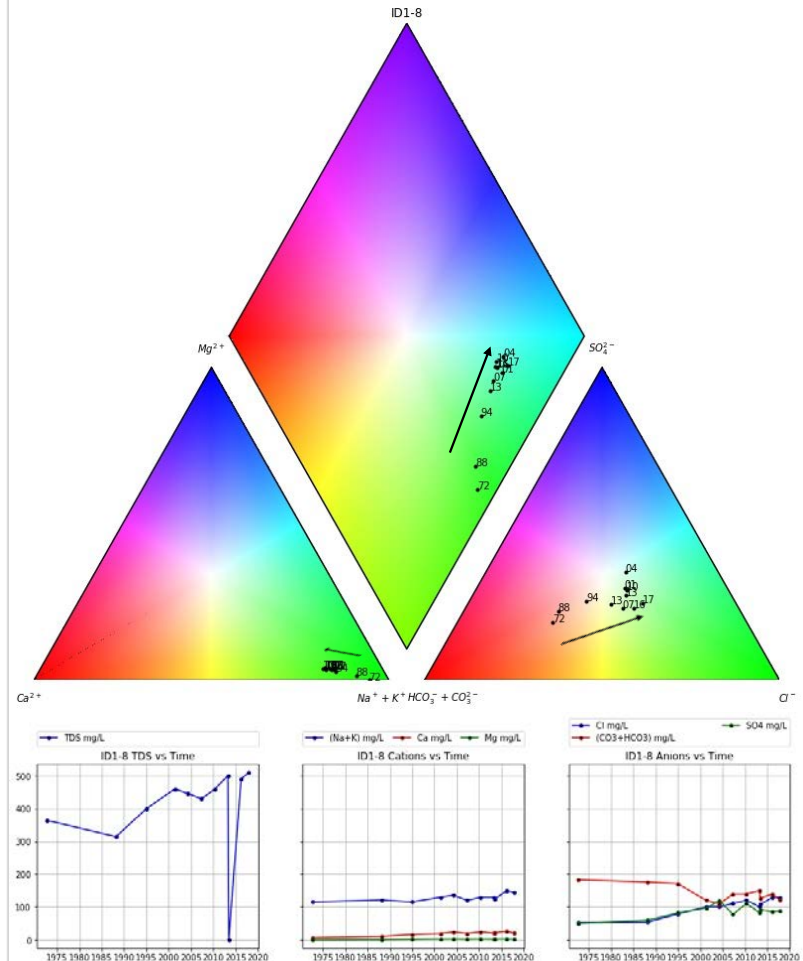
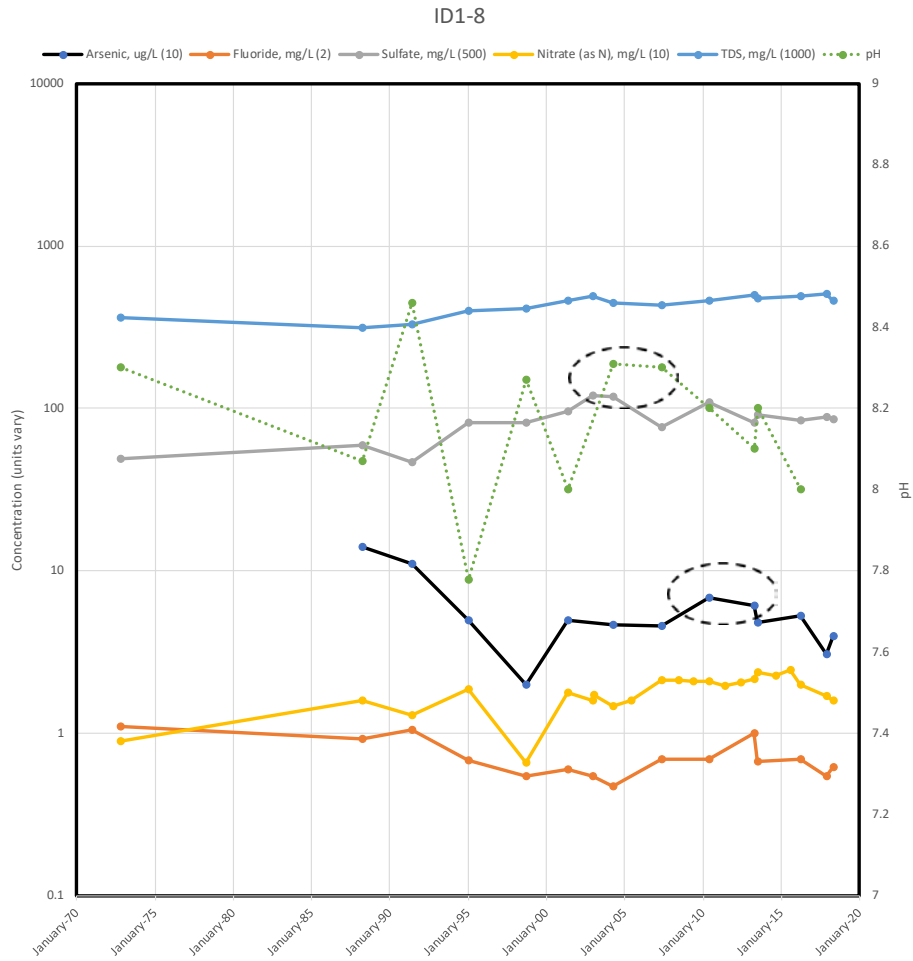


FIGURE 26. BWD Well ID1-8

Notes: pH and COC concentrations versus time shown left panel.

Piper trilinear diagram depicts change over time- the labels indicate the last two digits of the year when sampled (e.g. 72 = 1972)

TABLE 4

WELL	TDS/ Gen Min (MCL: 500 rec /1000 max, mg/L)	Sulfate (MCL: 250 rec /500 max, mg/L)	Arsenic (MCL: 10 ug/L)	pH	Nitrate (MCL: 10 mg/L as N)	Fluoride (MCL: 2 mg/L)
ID4-4 (#4)**	Stable (330) TDS: 320 to 340 GenMins*: Vble, cation trend may develop	Stable (110) SO4: 110 to 120	In Range (2.2) As: 1.8 to 2.9	Stable Range pH*: 7.8 to 8	Decreasing (0.5) NO3: 1.0 to 0.43	In Range (0.16) 0.6 to 0.2
ID4-11 (#5)	Stable (380) TDS: 320 to 390 GenMins*: Vble, anion trend may develop	Stable SO4: 91 to 95 Was decreasing prior to 2005	Insuff. Data (2.1) As: 1.2 to 2.2 Two recent detects	Stable Range pH*: 7.8 to 8	Increasing (0.56) NO3: 0.36 to 0.66	In Range (0.23) 0.23 to 0.3
ID4-18 (#2)**	Possibly Increasing (630) TDS: 590 to 630 GenMins: inc SO4, dec HCO3	Increasing (270) SO4: 240 to 270 Slowly changing	Non-Detect	Stable Range pH*: 7.7 to 7.8	Increasing (0.54) NO3: 0.29 to 0.54	In Range (0.87) 0.54 to 1.3
ID1-10 (#14)**	Possibly Increasing (340) TDS: 250 to 340 GenMins: inc SO4, dec HCO3 (major changes since 1972)	Increasing (67) SO4: 45 to 67 Slowly changing	In Wide Range (2.8) As: 1.2 to 12.2 Maximum 6/2014	In Wide Range pH*: 8.0 to 8.4 Maximum 5/2010 (~2 yr ahead of As)	In Range (1.3) NO3: 1.27 to 2.02	In Range (0.48) 0.43 to 0.7
ID1-12 (#9)	Stable (300) TDS: 260 to 300 GenMins: Stable	Stable (95) SO4: 91 to 95	In Range (2.5) As: 2.5 to 3.79	In Range pH*: 8.2 to 8.4	In Range (0.34) NO3: 0.34 to 0.44	In Range (0.34) 0.38 to 0.6
ID1-16 (#12)	Possibly Decreasing (340) TDS: 280 to 340 GenMins: SO4 slowly decreasing	Decreasing (58) SO4: 56 to 66 Slowly changing	In Range (2.0) As: 2.0 to 4.3 Maximum 12/2013	In Range pH*: 8.0 to 8.3 Maximum 5/2010 (~3 yr ahead of As)	In Range (1.3) NO3: 1.27 to 2.02	In Range (0.48) 0.43 to 0.7
ID5-5 (#8)	Stable (350) TDS: 202 to 350 GenMins*: Vble, anion trend may develop (inc SO4)	Stable (100) SO4: 95 to 106	Insuff. Data (2.1) As: 2.1 (twice) Two recent detects	In Wide Range pH*: 7.54 to 8.1	In Range (0.39) NO3: 0.25 to 0.50	In Range (0.8) 0.85 to 1.4
Wilcox (#13)	Stable (230) TDS: 210 to 230 GenMins: SO4 slowly increasing	Increasing (19) SO4: 14 to 19 Slowly changing	In Range (3.8) As: 3.2 to 7.8 Maximum 6/2014	In Range pH*: 8.2 to 8.7 Maximum 5/2010 (~4 yr ahead of As)	In Range (1.0) NO3: 0.36 to 1.42	In Range (0.64) 0.57 to 0.87
ID1-8 (#15)	Possibly Increasing (460) TDS: 430 to 510 GenMins: long-term inc SO4 & Cl & Ca, dec HCO3 (major changes since 1972)	Stable (86) SO4: 82 to 110	In Range (4.0) As: 3.1 to 6.8 Maximum 5/2010	In Range pH*: 8.0 to 8.4 Maximum during 2004 to 2007 (~3 to 6 yr ahead of As)	In Range (1.6) NO3: 1.6 to 2.46 (long-term inc)	In Range (0.62) 0.55 to 1.0

Notes:

- Most recent general minerals and pH analyses done in 2016
- ** Wells expected to be replaced or re-drilled in short-term

Explanation:

Trends noted as Stable, Increasing, Decreasing, Possibly Increasing/Decreasing, or In a Range
 Number after descriptor – e.g. Stable (330), is the most recent sampling result from Spring 2018
 Next line is the range of values observed since 2005
 GenMins refers to the set of general minerals data- eight major anions and cations
 xx, a value that is highlighted occurs at a concentration greater than 50% of the MCL
 xx, a value that is highlighted and bold occurs at a concentration greater than the MCL

4.1 North Management Area (3 Wells: ID4-4, ID4-11, and ID4-18)

The North Management Area wells are generally located to the west and upgradient of the irrigated agricultural areas visible in **Figures 4 and 7**. COC-specific observations are included in **Table 4**.

ID4-4

ID4-4 was re-drilled in 1979 due to high nitrate concentrations related to the upper aquifer. Nitrate remains detectable but at low concentrations. Water quality is good and reasonably stable. The District is currently planning to re-drill this well at the same site as a result of poor well conditions that resulted in sanding and the installation of a well liner that limits the depth to which the pump can be installed in the well.

Additional information regarding the well replacement can be found in a 8/30/2018 Dudek presentation entitled "Water Vulnerability & New Extraction Well Site Feasibility Analysis" posted at the County SGMA website:

<https://www.sandiegocounty.gov/content/dam/sdc/pds/SGMA/Prop-1-SDAC-Grant-Task-5-New-Extraction-Well-Site-Feasibility-Analysis.pdf>

ID4-11

Water quality in ID4-11 is good and reasonably stable.

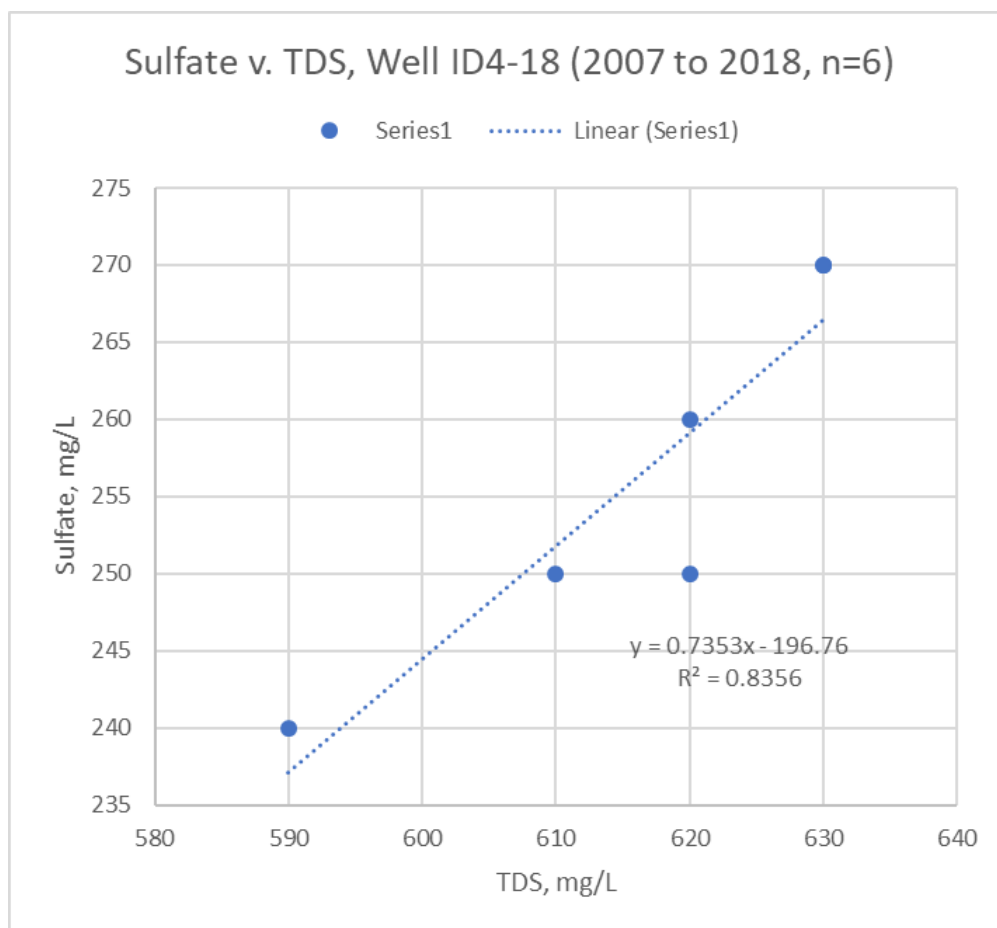
ID4-18

TDS is between the recommended and upper secondary MCL (currently at 630 mg/L). Sulfate is slowly increasing and is above the recommended secondary MCL of 250 mg/L. Arsenic has not been detected in this well (last reported as ND < 1.2 µg/L).

Figure 27 shows how TDS and sulfate are correlated and is presented as an example of how TDS measurements based on electrical conductivity testing may be able to be used to assess sulfate.

FIGURE 27

Date	TDS	Sulfate
5/8/2007	590	240
5/11/2010	620	260
6/10/2013	620	250
5/16/2016	610	250
11/17/2017	630	270
4/30/2018	630	270



4.2 Central Management Area (5: ID1-10, ID1-12, ID1-16, ID5-5, and Wilcox)

The Central Management Area is associated with both the “central” and “transitional” water quality type as indicated in **Figure 6** and COC-specific observations included in Table 4.

ID1-10

Water quality in ID1-10 is currently good and reasonably stable.

Elevated arsenic concentrations (a maximum of 12.2 µg/L that exceeded the MCL of 10 µg/L) were observed in 2014 that were preceded by elevated pHs of 8.2 to 8.4 (see **Figure 21**). Arsenic concentrations and elevated pH conditions have since declined.

ID1-12

Water quality in ID1-12 is currently good and reasonably stable.

ID1-16

Water quality in ID1-12 is currently good and reasonably stable.

Elevated arsenic concentrations (a maximum of 4.3 µg/L) were observed in 2014 that were preceded by and elevated pH of 8.3 (see **Figure 23**). Arsenic concentrations and elevated pH conditions have since declined.

ID5-5

Water quality in ID5-5 is currently good and reasonably stable.

Wilcox

Water quality in the Wilcox well is currently good and reasonably stable.

Elevated arsenic concentrations (a maximum of 7.8 µg/L) were observed in 2010 and 2014 that were preceded by elevated pH of greater than 8.6 (see **Figure 25**). Arsenic concentrations and elevated pH conditions have since declined.

4.3 South Management Area (1: ID1-8)

As previously discussed, the water chemistry observed in the South Management Area is distinctly different than that observed to the north. COC-specific observations are included in Table 4.

ID1-8

Water chemistry at ID1-8 has significantly changed over time, but now appears to be stabilizing. Water quality in ID1-8 is currently good.

Arsenic is of concern due to MCL exceedances consistently observed in nearby Ram's Hill wells.

Elevated arsenic concentrations (a maximum of 6.8 µg/L) were observed in 2010 that were preceded by an elevated pH of 8.3 (see **Figure 26**). Arsenic concentrations and elevated pH conditions have since declined.

5.0 SUMMARY

The multi-parameter assessment of water quality and COC trends provides additional insight compared to single parameter assessments.

Natural Water Chemistry (anions and cations)

- Natural water chemistry as determined by the eight dominant anions and cation systematically varies across the Subbasin (these include calcium [Ca], magnesium [Mg], sodium [Na], potassium [K], chloride [Cl], sulfate [SO₄], bicarbonate [HCO₃], and carbonate [CO₃]).

The observed variations generally correlate with the previously established management areas that are further discussed in the GSP. Overall trends generally correlate with the well location relative to the pre-development groundwater flow paths and distance from where recharge waters enter the Subbasin,

- Water samples from BWD water supply wells show that the dominant cations and anions are sodium and calcium; and bicarbonate, sulfate, and chloride, respectively.
- The water type transitions from a calcium sulfate to a sodium chloride in the Northern Management Area wells.
- Sodium bicarbonate type water generally occurs in the South Management Area as tested. The groundwater analysis further supports that the South Management Area has distinctly different water quality than observed in the north and central groundwater management areas.
- The primary causes for the difference in water quality within the Subbasin include variations in the water being recharged (e.g. Coyote Creek versus San Felipe Creek), proximity of irrigated lands (e.g. nitrate impacts due to fertilizer application), aquifer lithology (local deposits of evaporites and potential arsenic-bearing clays), aquifer depth (related to increase in TDS), and location within the Subbasin with respect to the Borrego Sink where enhanced evaporation of ephemeral surface water occurs.
- Due to the location of the BWD wells this analysis does not fully represent the water quality distribution in the Subbasin. Refer to **Figures 4 and 7** for the well locations. As result the spatial trends identified among the wells are limited to examining variations along the western side of the Subbasin.
- Water quality as a function of depth has not been assessed in the BWD water supply wells, for example by the use of depth-specific water sampling. Well profiling data obtained by the DWR (**Figure 10**, for example) indicate that TDS linearly increases with

depth. Given the high correlation with sulfate, the increase in TDS implies that sulfate will also increase with depth.

- Multiple aquifers are represented in the water chemistry data because of the construction of the 23 wells used in this report. As a result, water quality could not be differentiated in terms of the three-layer aquifer system (upper/middle/lower) used by the USGS and others (for example in the USGS Model Report).
- Temporal trends are more readily identified when multiple general mineral analyses are considered for each of the wells. Here Piper trilinear diagrams were used to assess the eight dominant anions and cations.
- 17 of the 23 wells had sufficient anion and cation data for temporal analysis and in some cases, well over 40 years data are available. Of these approximately 70 percent have experienced changes in water chemistry over time. The changes are generally attributed to long-term overdraft.

Chemicals of Concern (COCs)

- Five COCs were examined: arsenic, nitrate, TDS, sulfate, and fluoride. The overall analyses are improved when all five parameters are considered together and geochemical factors such as pH are included. The five COCs are depicted together with pH for each of the nine active BWD water supply wells in **Section 4**.
- Single parameter trend assessments, for example using Mann-Kendall trend analyses included in previous studies, are not repeated here.
- The COC analysis is based on a comparison of concentrations with current MCLs. Down-revision of the criteria, especially for arsenic, could have a large impact on BWD operations should water treatment be required. The State of California MCL for arsenic was last revised (from 50 to 10 ug/L) on 1/28/2008²⁵. As of February 2017, there is no indication that the State Water Resources Control Board is planning to revise the arsenic MCL²⁶.
- Overall the water quality is currently good and water can be delivered without the need for advanced treatment. However, short-term water quality trends have been of concern, especially for arsenic. The following summarizes the analysis per COC.

²⁵ See: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Arsenic.html

²⁶ Per a state review from 2017: "We are not aware of changes in treatment that would permit materially greater protection of public health, nor of new scientific evidence of a materially different public health risk than was previously determined. Thus, we do not plan on further review of the arsenic MCL." See: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/reviewofmaximumcontaminantlevels-2017.pdf

Arsenic and Fluoride

Arsenic concentrations were increasing in multiple BWD water supply wells until 2014 and have since decreased. The potential for MCLs to be exceeded is of high concern to BWD due to the potential cost of water treatment and/or well replacement. The MCL was temporarily exceeded in one well, ID1-10. Review of the data shows that there is a relationship between pH and arsenic where elevated arsenic concentrations occur under alkaline conditions with pH levels of approximately 8 and greater. Especially noteworthy is that peak arsenic concentrations can be observed to occur after the peak pH was observed in multiple wells (ID1-10, ID1-16, Wilcox, and ID1-8). The lag time is approximately 2 to 4 years. While additional data and observations are required to further assess the connection between arsenic and pH, this relationship could prove important toward the monitoring and management of BWD's water supply.

Fluoride is discussed with arsenic because it has been observed to correlate with arsenic. While fluoride occurs at detectable concentrations in all of the active BWD wells, it has not been of concern as concentrations have typically been well less than 1.0 mg/L, less than half the MCL. Given the correlation it may prove useful towards future trend analyses for arsenic.

TDS and Sulfate

TDS represents the sum of all anions and cations that occur in the water. Here a number of these anions and cations have been observed to correlate with TDS. **Figures 15 through 17** show the correlation with TDS for sulfate, sodium, calcium, and chloride. A specific example is shown for well ID4-18 in **Figure 27** where TDS and sulfate are well correlated.

The USGS Model Report (p. 2) identified TDS and sulfate as “the only constituents that show increasing concentrations with simultaneous declines in groundwater levels”.

Electrical conductivity measurements are commonly used to assess TDS. In this case they can be used as a field-based monitoring tool for TDS, and in turn support tracking of sulfate. The TDS profiles presented by DWR (**Figure 10**) are examples of electrical conductivity measurements used to evaluate TDS.

Nitrate

Historically there have been significant nitrate-related water quality problems encountered in BWD wells that led to well reconstruction, abandonment, and replacement. These wells were typically producing water from the uppermost portion of the aquifer system. As noted in **Table 4**, nitrate occurs in all of the active BWD wells at varying concentrations well below the MCL. Nitrate predominantly occurs as a result of fertilizers contained in irrigation return flow, and from septic systems. Historically, because the upper portion of the aquifer system is unconfined, nitrate has primarily affected wells that were completed (open to flow) at the water table.

The USGS Model Report (p.2) noted that “TDS and nitrate concentrations were generally highest in the upper aquifer and in the northern part of the Borrego Valley where agricultural activities are primarily concentrated”.

Nitrate concentrations are primarily related to land-based activities and do not correlate with inorganic water quality data. Overall determination of historical impacts and ongoing susceptibility of the aquifer to nitrate contamination will require review of prior, current, and future land use placed in a spatial context. Work done by DWR (for example as illustrated in **Figure 11**) is an example of how land use information can be used. Among the land use parameters that would go into a nitrate source analysis would be the location and types of septic and sewer systems, current and historical agricultural activities, and current and historical irrigated turf/golf courses.

5.1 Other Potential COCs

This report focused on the dominant anions and cations, and the five primary COCs. Other potential COCs include naturally-occurring uranium and radionuclides. Anthropogenic COCs include herbicides, pesticides, and similar chemicals used for agriculture and turf management. Microbial contamination, typically associated with animal wastes and sewage/septic, is also of potential concern.

Groundwater quality provided by BWD water supply wells is currently good and meets California drinking water maximum contaminant levels (MCLs). To date the current wells are producing water without the need for treatment. The BWD public water supply monitoring program is conducted in compliance with the State of California’s requirements as administered by the State Water Resources Control Board Division of Drinking Water (DDW) and includes a wide range of analytes.

BWD provides all sampling data to the DDW, and is listed as public water supply CA3710036. A summary of BWD’s sampling program for other COCs can be reviewed in the annual consumer confidence report, available online at <http://nebula.wsimg.com/c30a61991a5160ddf5e577fe9f7b3c01?AccessKeyId=D2148395D6E5B38D600&disposition=0&alloworigin=1>. The BWD is also sampling all of its water supply well semi-annually as part of the GSA monitoring network rather than the minimum 3-year timeframe currently required by DDW.

5.2 Recommendations

- The COC analysis supports expansion of groundwater monitoring and testing program to include field-based water quality measurements of water being produced by BWD. Monthly wellhead measurements are recommended for electrical conductivity (EC), pH, and oxidation-reduction (redox) potential. These could be conducted at the same time BWD personnel collect monthly bacteria samples. EC can be used to calculate TDS, and by correlation estimate sulfate in some wells. Redox and pH are key geochemical parameters that can readily be measured at the wellhead by BWD personnel.
- Conduct vertical profiling and depth-specific sampling of water supply wells when the wells become accessible, for example during pump removal for maintenance. The primary goals of the testing are to identify potential zones where water quality may be poor and to examine the relative rate of flow of water into the well with depth. Both types of information will support assessment of well performance as overdraft continues.

Long-term the vertical profiling will provide data to better understand the water quality trends and support BWD water management planning. For example, the data will support assessment of sulfate trends by understanding how concentrations may or may not be increasing with depth and support projections of how water quality will change as overdraft while pumping reductions occur over the 20-year GSP planning period.

- Use the groundwater model to assess pre- and post-SGMA groundwater flow conditions and potential changes in water chemistry. Current pumping conditions have changed groundwater flow patterns within the North and Central Management Area due to the establishment of two pumping centers. Future pumping reductions will likely alter groundwater flow patterns. The model can be used to support calculations of groundwater flow rates and directions using ‘particle tracking’, a methodology that looks at how water flows over time. The modeling software (USGS Modflow model) includes Modpath, a post-processing software that works with the model output.
- Use the groundwater model water balance to develop a ‘mixing cell’ calculation of salt balance to assess the potential rate of accumulation of dissolved minerals associated with water use. The Subbasin is effectively a closed system where dissolved minerals and other solutes have will continue to accumulate over time. The primary purpose of the calculations is to assess long-term TDS changes that result from irrigation and septic return flows as overdraft continues. The calculations will also support examination of areas where BWD water production may need to be established using new or existing water wells.

- Investigate the potential causes of the temporary increases in arsenic concentrations and pH observed in BWD wells as a means of predicting future arsenic concentrations. A lag time of 2 to 4 years is observed in multiple BWD wells where elevated pH preceded the increase in arsenic concentrations that could prove to be important towards BWD’s water supply and risk management.
- Expand on the analysis of nitrate in groundwater relative to land use as described by the DWR (e.g. **Figure 11**). Additional discussion of the occurrence of nitrate in groundwater is included in the GSP that describes land uses within the Subbasin.
- Expand the water chemistry and water quality evaluation to areas within and downgradient of the agricultural areas in the North and Central Management Areas.
- Continue to collect the full suite of general minerals (8 anions and cations) together with pH and redox measurements. Water chemistry parameters should be collected using ‘flow cells’ where the chemistry of the water is tested before it is exposed to the atmosphere.²⁷
- Conduct selective sampling for phosphate and review the overall electrochemical balance for all potential anions and cations to determine why the current data have excess cations relative anions (see **Section 3.2.1**).
- Further assess lithologic and geochemical conditions associated with the occurrence of arsenic. For example, work done in the San Joaquin valley (discussed in **Section 3.6.1**) linked the release of water from clay to increased arsenic concentrations in groundwater. Further review of Subbasin stratigraphy work done by Netto (2001) is warranted. Re-analysis of the geostatistical work done by the USGS to evaluate sediment lithologies may also prove useful towards understanding the nature and extent of sediments potentially associated with arsenic. Lithologic sampling and

²⁷ An example is shown below. Water flows directly from the well into a chamber where measurements are made. From: http://www.geotechenv.com/flowcell_sampling_systems.html. It is understood that Dudek staff are using flow cells during sampling of Rams Hill wells to measure pH, specific conductance, temperature, turbidity, dissolved oxygen, oxygen-reduction potential, and color. Their Sampling and Analysis Plan could be used for the remaining wells within the GSP monitoring program.



geochemical testing for arsenic and related minerals is recommended during the installation of new wells.

- Investigate the potential interaction of microbially-mediated oxidation and reduction processes (e.g. denitrification and sulfate reduction) specific to arsenic mobility.
- Examine the potential application of recharge basins to facilitate arsenic removal as a result of geochemical processes in the vadose zone (see discussions in Section 3.6.1).
- Develop an inventory of abandoned wells, including well completion information and potential condition. Abandoned wells have the potential to act as conduits for the downward flow of shallow groundwater contaminants such as surface applied fertilizers, agricultural chemicals, and turf management chemicals. Abandoned wells may need to be properly destroyed per California Well Standards (See information available from the County of San Diego https://www.sandiegocounty.gov/content/sdc/deh/lwqd/lu_water_wells.html)
- Continue to track changes in groundwater quality as a function of water level to assess trends relative to the potential for water quality degradation and the likelihood of the need for water treatment. Use the data to assess potential cost and water system reliability risks to BWD.
- Continue to track water treatment technologies and costs for arsenic as the potential for revision of the arsenic MCL is, in part, dependent on cost-benefit analyses for water treatment (see COC discussion in Section 5).

6.0 REFERENCES

All references are cited within the text using footnotes.

APPENDIX A

DWR, 2014

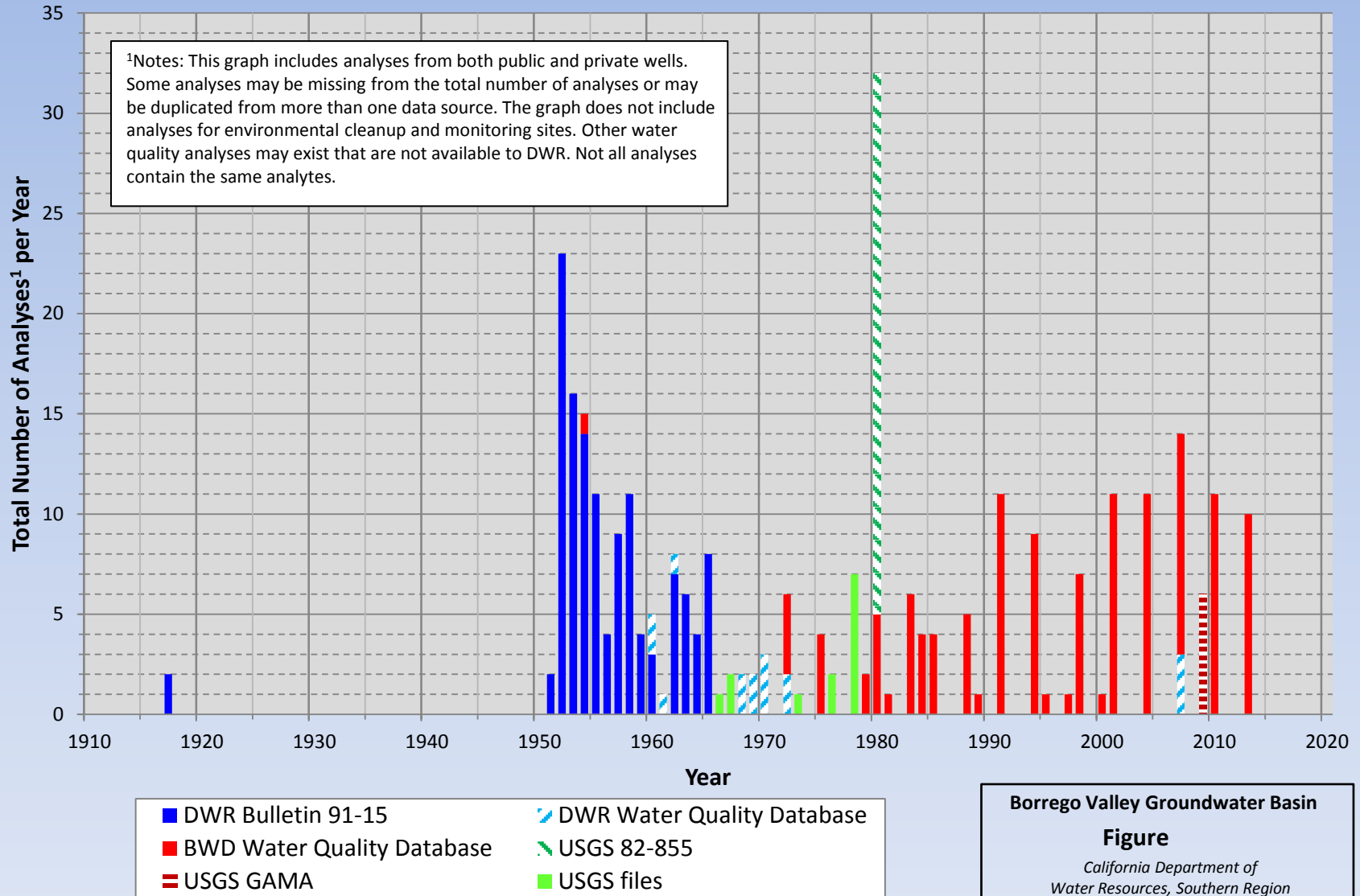
Groundwater Quality Information
for
Borrego Valley



Groundwater Quality Information
for
Borrego Valley



Water Quality Analyses by Year and Source



More than 300 water quality analyses have been identified.

Borrego Valley Groundwater Quality

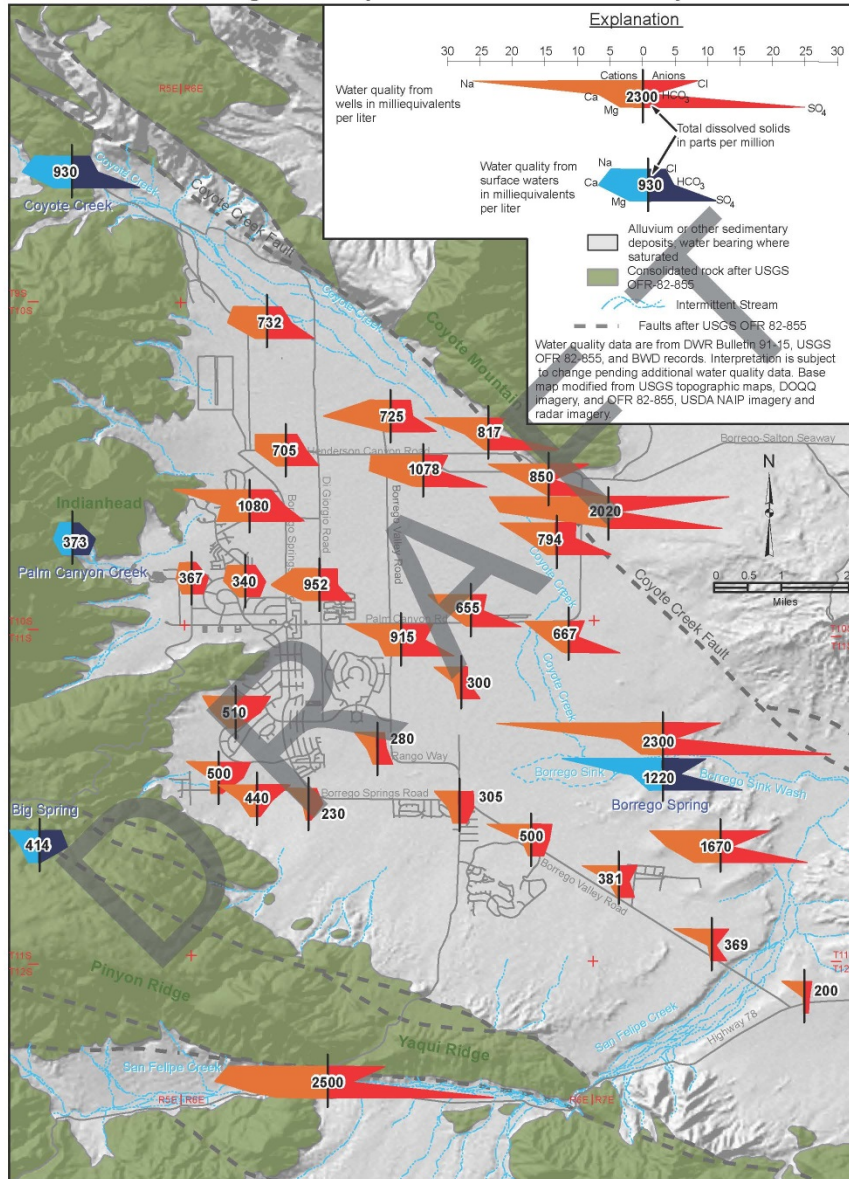


Figure showing major water quality constituents in groundwater and surface water in Borrego Valley. The high proportion of Sulfate in the surface water of Coyote Creek appears to dominate the character of groundwater in the northern and eastern parts of the basin. The more Bicarbonate waters of Borrego Palm Canyon and Big Spring influence the groundwater along the western and southern parts of the basin.

Borrego Valley Water Quality Analyses of Nitrates

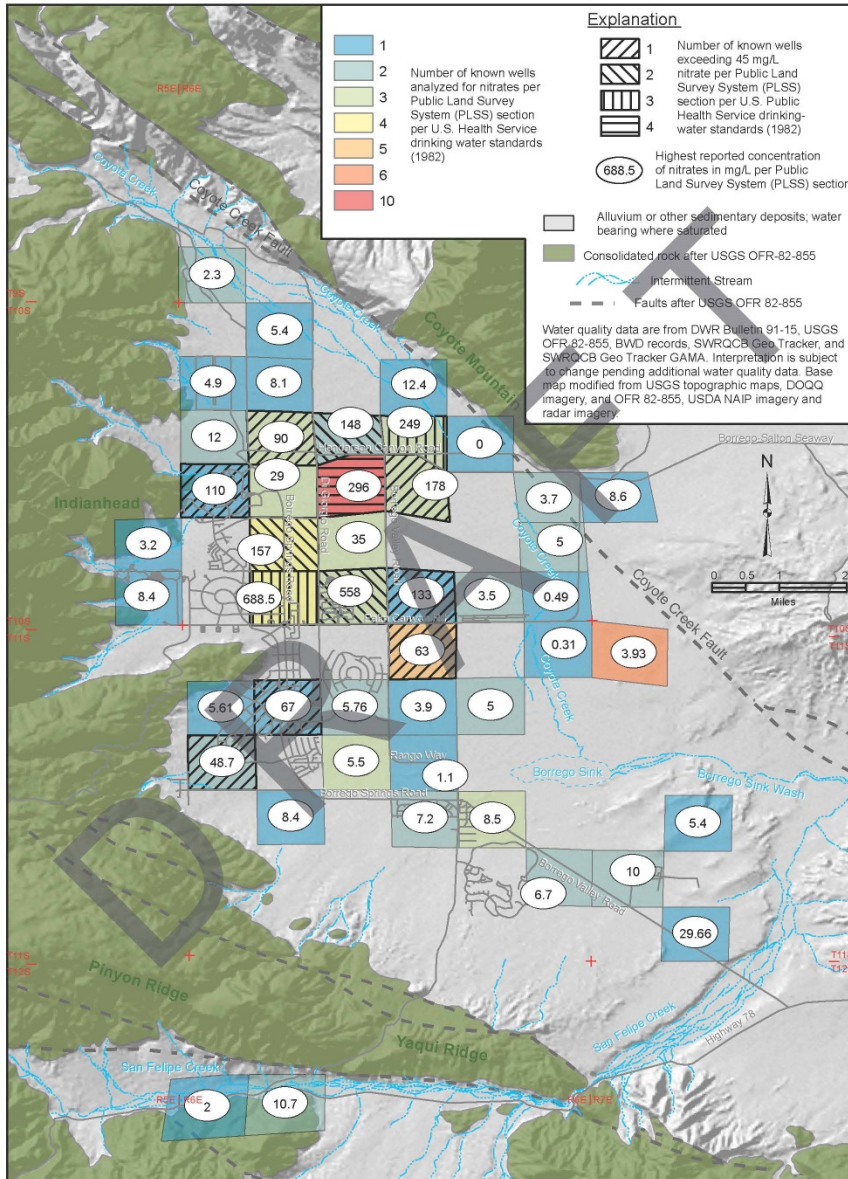
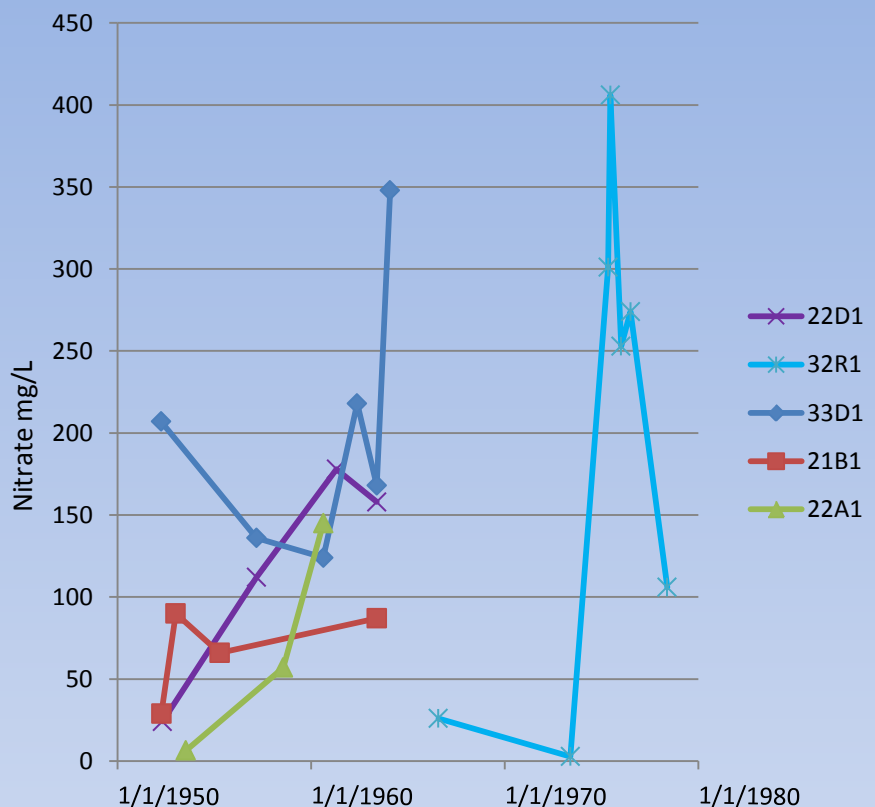
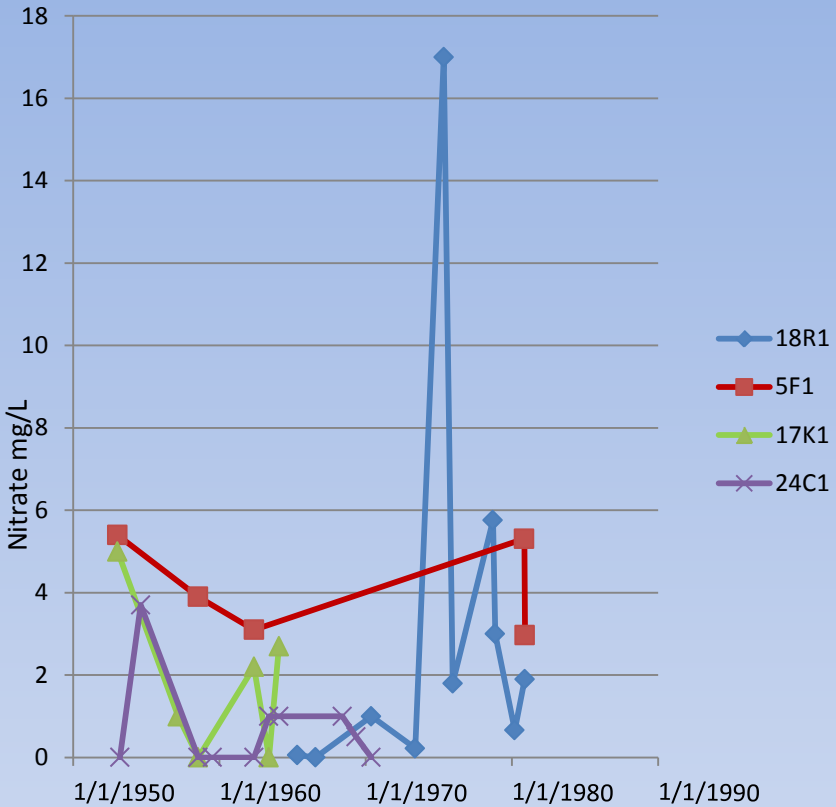
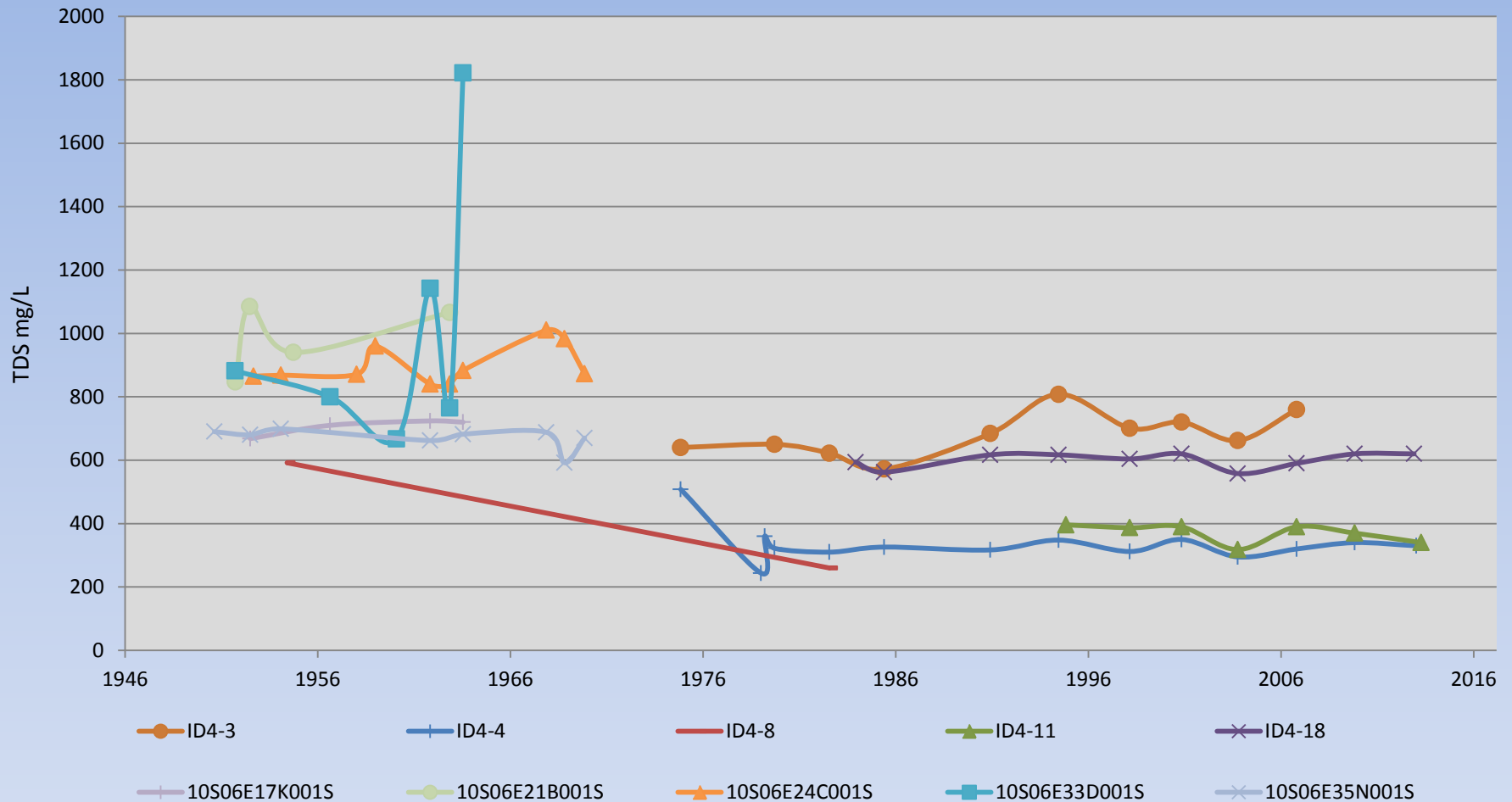


Figure showing the distribution of Nitrate analyses for the Borrego Basin. Maximum content is shown per section and sections are colored according to the number of analyses in the section. Sections where the maximum contaminant level (MCL) are exceeded are shown in hatched patterns.



Nitrate content is graphed through time for several wells in the Borrego Basin. No obvious trend is apparent. (MCL is 45 mg/L)

North Borrego Valley



Graph showing change in TDS content through time for several wells in the northern part of the basin. No clear increase in TDS is observed.

South Borrego Valley

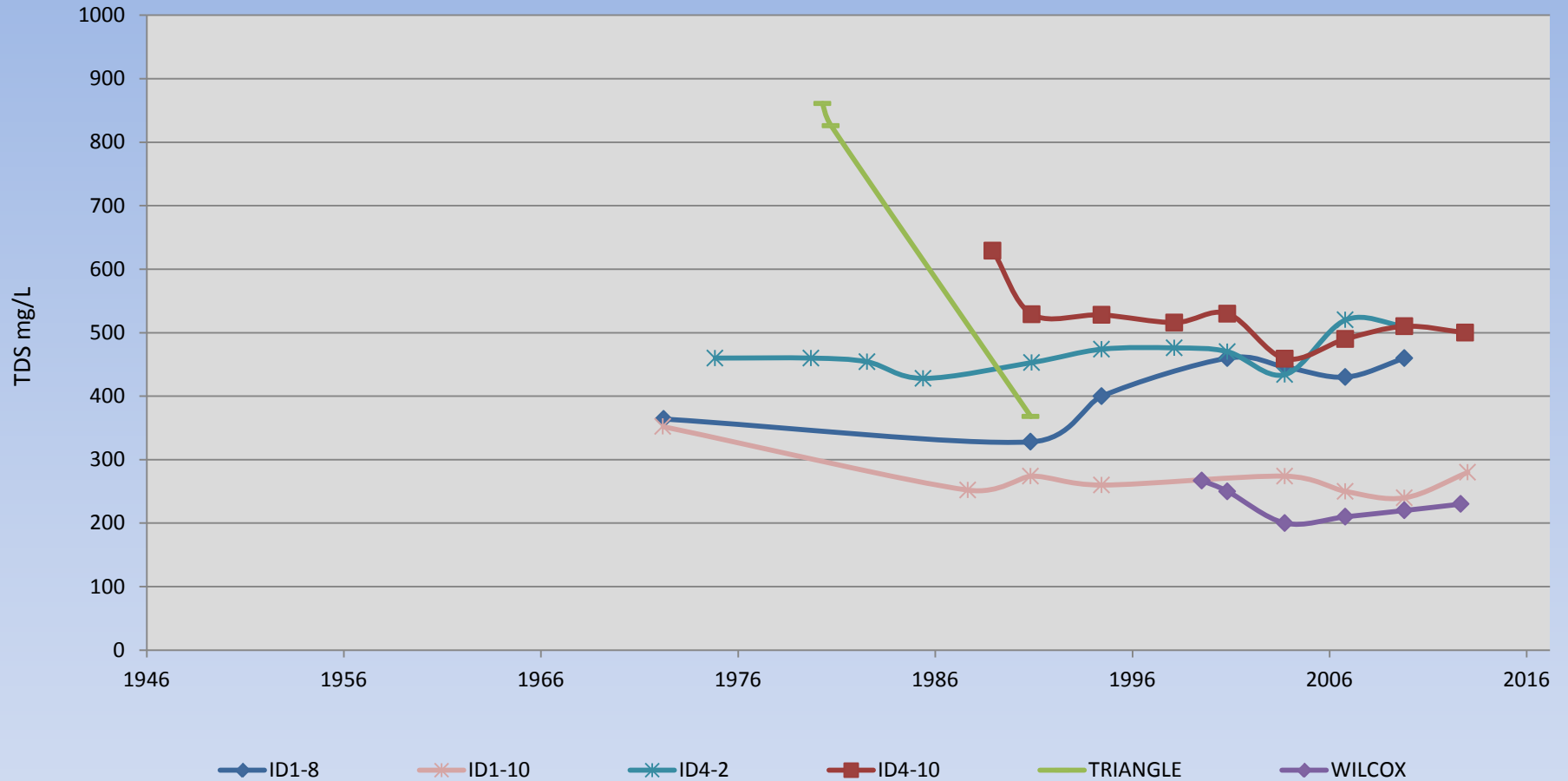
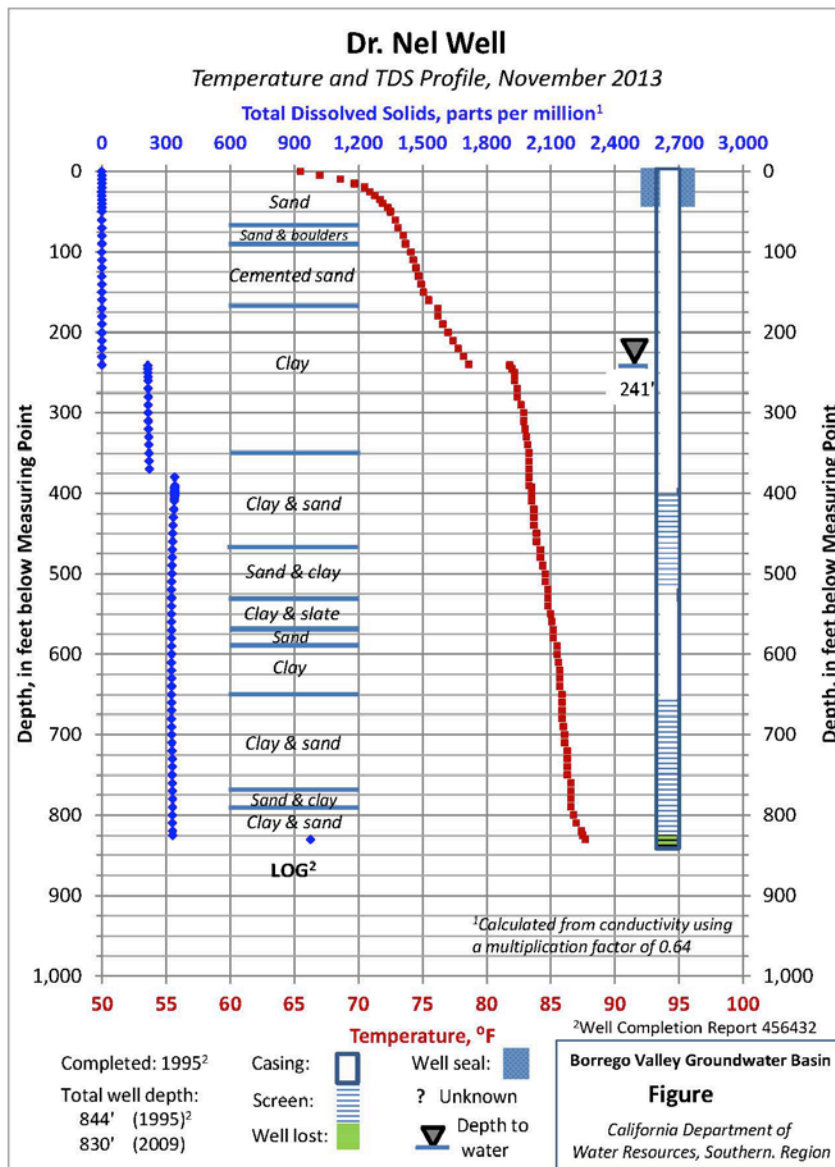
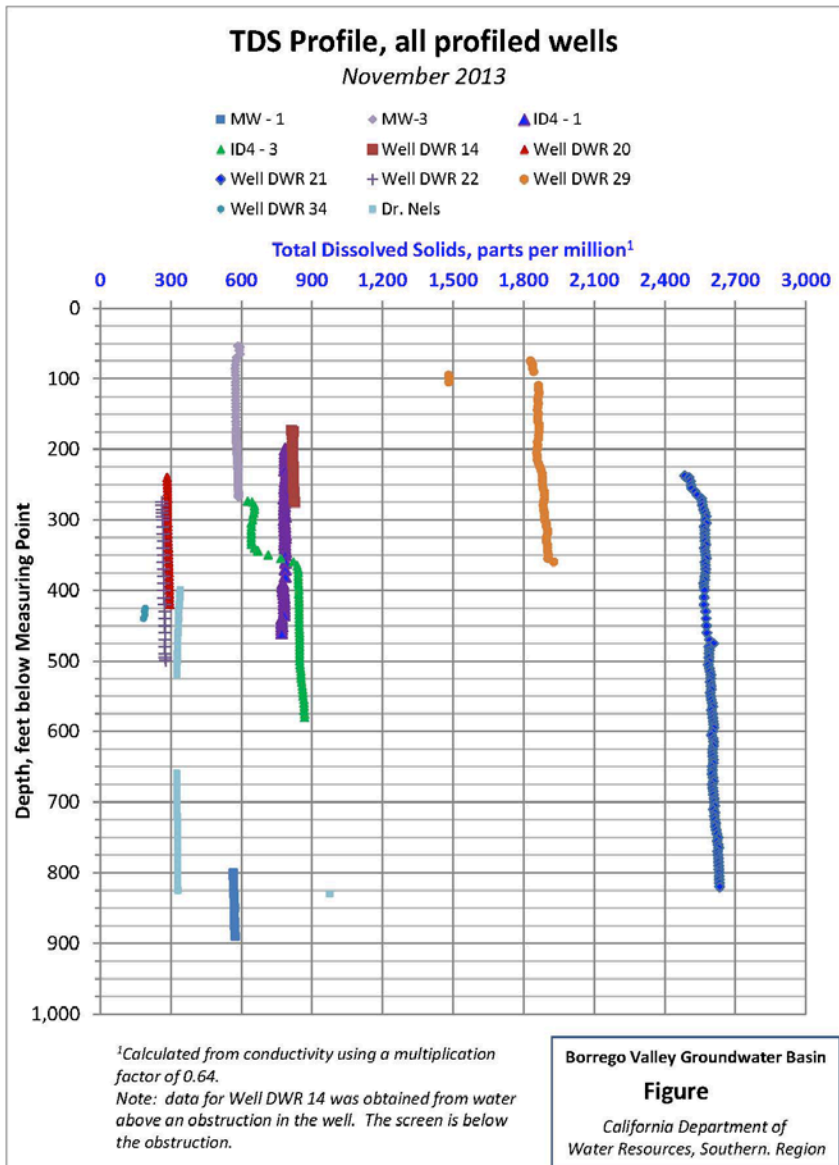


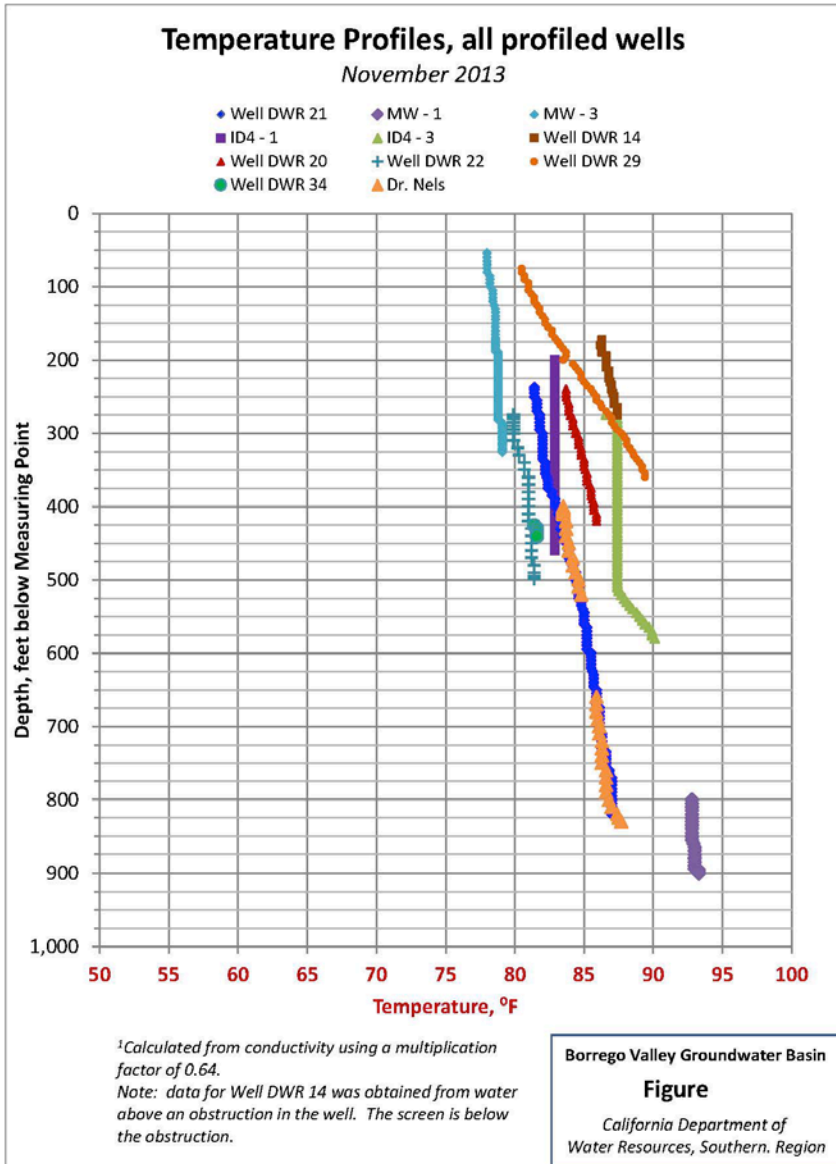
Figure showing TDS content through time for several wells in the southern portion of the basin. Most show decrease in TDS through time.



A profile of TDS content and temperature for Dr. Nel's Well. Changes in TDS appear to occur at the well screen. TDS does not change appreciably with depth through the screened interval. Temperature rises steadily with depth.



Profiles of TDS with respect to depth for wells in Borrego Valley. Most show slight increase in TDS with depth



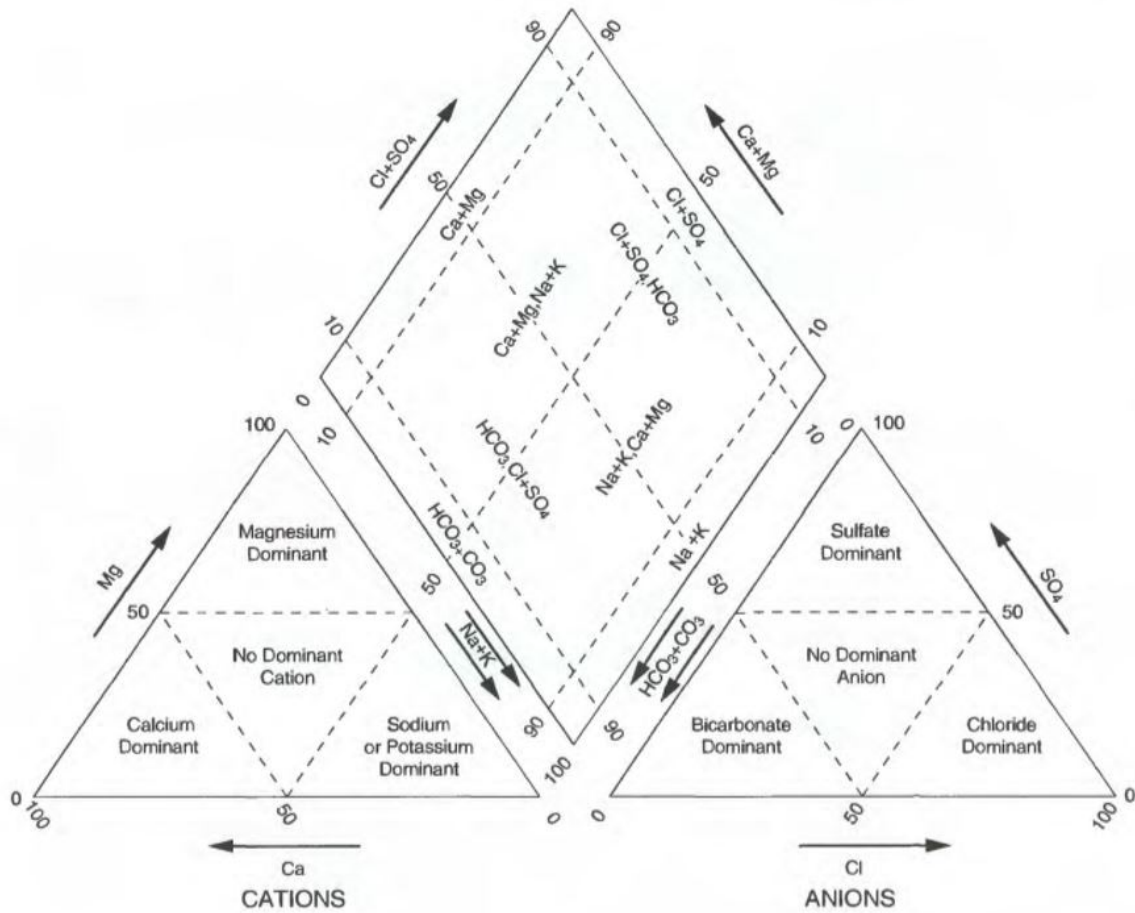
Profiles of Temperature with respect to depth. Most wells show increase in temperature with depth.

Summary

- More than 300 analyses identified
- Water character reflects recharge source
- More than 100 Nitrate analyses, widespread
- No apparent trend through time for Nitrate or TDS
- 11 Wells profiled for Temperature and TDS
- No consistent trend for TDS with depth in well.

APPENDIX B

PIPER DIAGRAMS, ALL WELLS

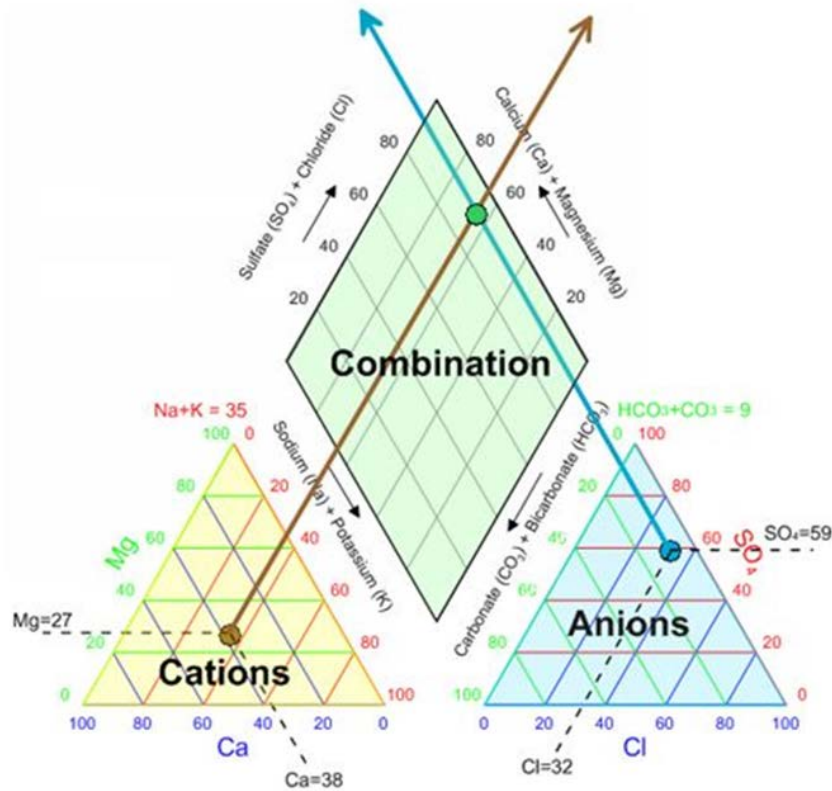


A. Classification scheme for hydrochemical facies.

APPENDIX B: PIPER DIAGRAMS

B.1 EXPLANATION OF PIPER DIAGRAMS

The eight dominant anions and cations that occur in groundwater can be used to describe of the type of water. A Piper trilinear diagram¹ combines sodium and potassium (cations), and carbonate and bicarbonate (anions) to reduce the total number of anions and cations from eight to six, with 3 values for each. This allows the anions and cations to be depicted using ternary diagrams. The values are then then projected onto a central diamond. An example of the projection follows:



From: <https://support.goldensoftware.com/hc/en-us/articles/115003101648-What-is-a-piper-plot-trilinear-diagram->

The values used for the anions and cations are converted from mass/liter to milliequivalents/liter, a measure of the relative number of anions and cations in the solution. For example, if NaCl is dissolved into pure water there are an equal number of sodium cations (Na^+) and chloride anions (Cl^-). An analysis by weight will show that there is more chloride because chloride has a larger molecular weight (MW) - the MW of Na is 22.9 grams/mole versus Cl that has a MW of 35.45 grams/mole. 'Equivalents' are derived by dividing the reported mass by the MW so that the relative number of ions (in moles) is calculated.

¹ Piper, A.M. 1944. A graphic procedure in the geochemical interpretation of water-analyses. Transactions-American Geophysical Union 25, no. 6: 914–923

APPENDIX B: PIPER DIAGRAMS

The overall intent of the diagram is to support grouping and classification of water types, also termed hydrochemical facies. An example follows from <https://www.hatarilabs.com/ih-en/what-is-a-piper-diagram-and-how-to-create-one>

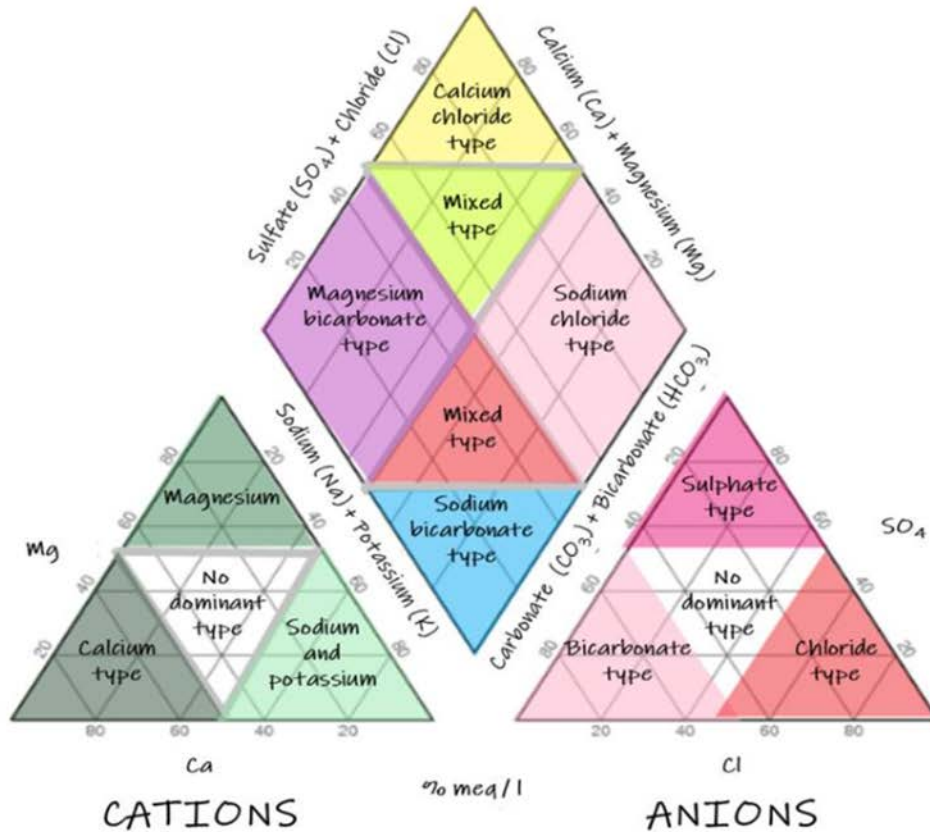


FIGURE 1A: HYDROCHEMICAL FACIES IN THE CATION AND ANION TRIANGLES AND IN THE DIAMOND.

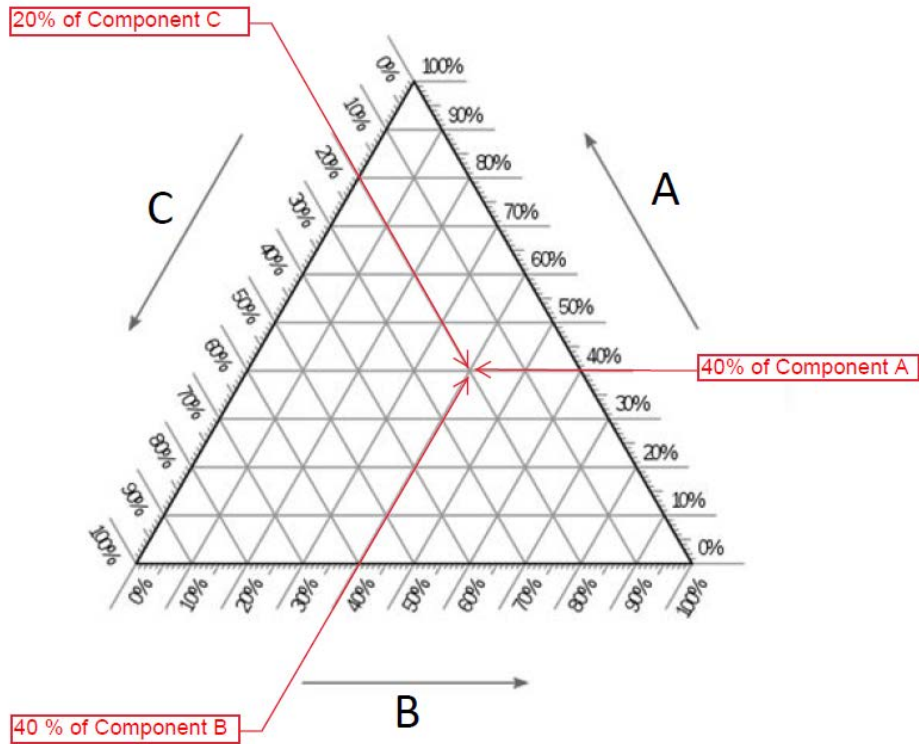
The lower triangles are ternary diagrams that represent the relative proportion of anions or cations. The various types of water, or facies, are shown in the middle diamond.

Piper diagrams depicted in this report use a colored field scheme implemented in the Python programming language as published by Peeters, 2014². Rather than drawing an underlying grid, the colored fields are used to help the visual interpretation of the data. The computations and graphics were developed using open source program code published by Peeters.

² Peeters, L., 2014. A Background Color Scheme for Piper Plots to Spatially Visualize Hydrochemical Patterns. Vol. 52, No. 1—Groundwater—January-February 2014

APPENDIX B: PIPER DIAGRAMS

The following is an example of the ternary grid and how data are plotted:



All values equal 100% on the triangular grid. The highest percentage of each of the components occurs in the extreme corners of the triangle.

Values increase as indicated by the arrows.

Source:

https://upload.wikimedia.org/wikipedia/commons/thumb/a/ac/Blank_ternary_plot.svg/486px-Blank_ternary_plot.svg.png

APPENDIX B: PIPER DIAGRAMS

APPENDIX B.2 PIPER DIAGRAMS USED IN THE REPORT

The following diagram are presented in the following order:

- 1: ID4-7 (not included due to insufficient data)
- 2: ID4-18
- 3: ID4-3
- 4: ID4-4
- 5: ID4-11
- 6: Cocopah
- 7: ID4-5
- 7A: ID4-1
- 8: ID5-5
- 9: ID1-12
- 10: ID4-2
- 11: ID4-10
- 12: ID1-16
- 13: Wilcox
- 14: ID1-10
- 15: ID1-8
- 16: RH-3
- 17: RH-4
- 18: RH-5
- 19: RH-6
- 20: ID1-1
- 21: ID1-2
- 22: Jack Crosby
- 23: WWTP (insufficient data)
- 24: MW-3 (insufficient data)

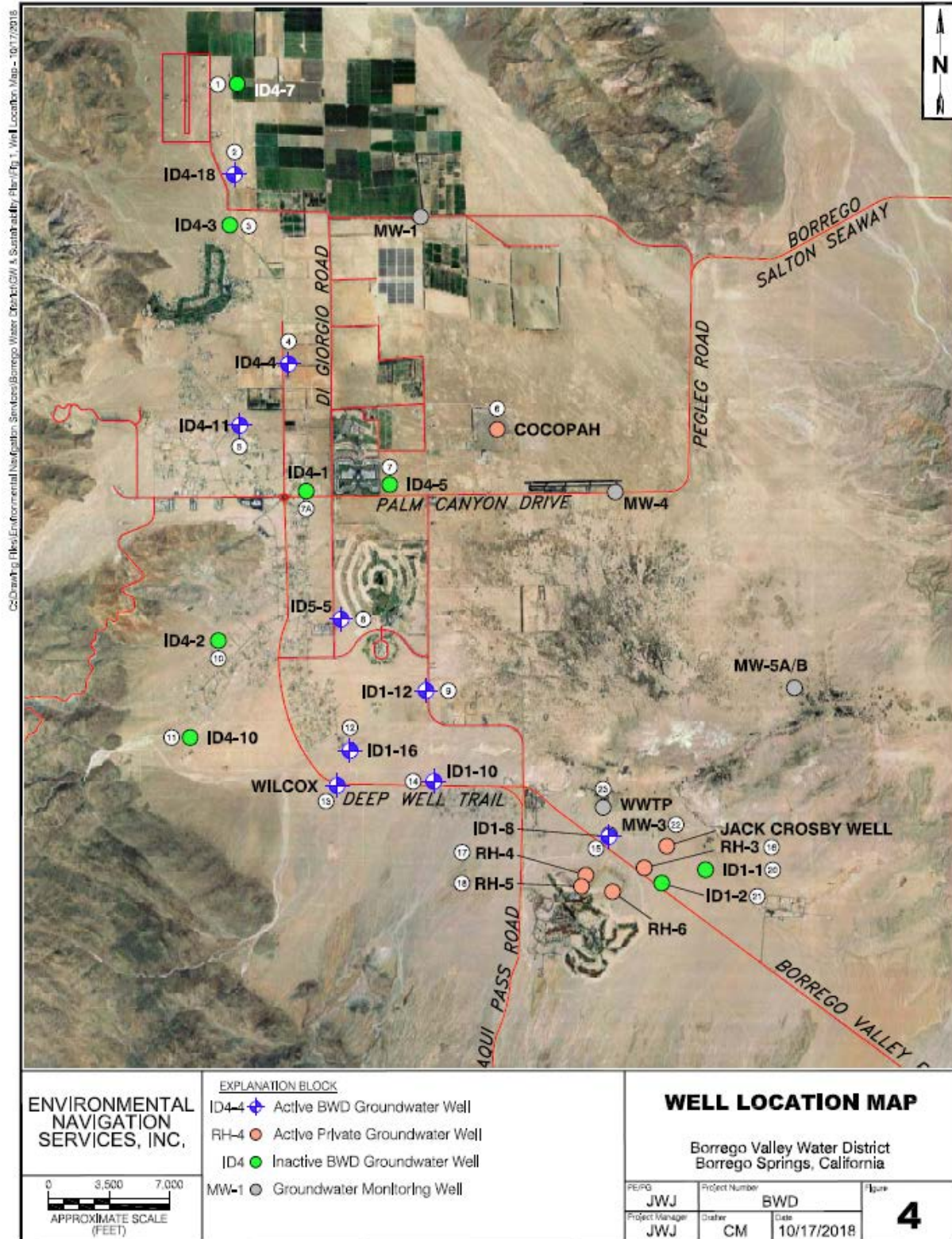
Recent Data: All (Piper only)

Recent Data: North and Central (Piper only)

Recent Data: South (Piper only)

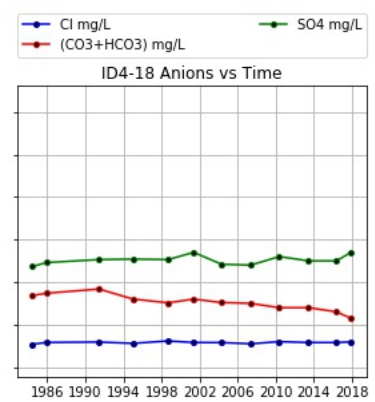
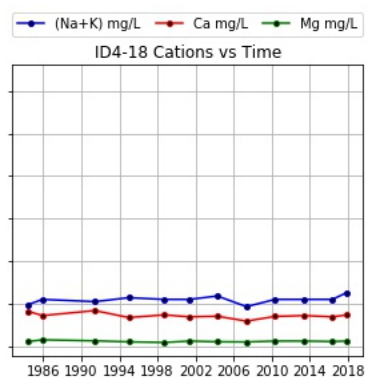
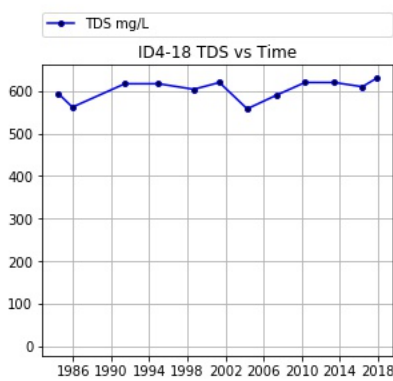
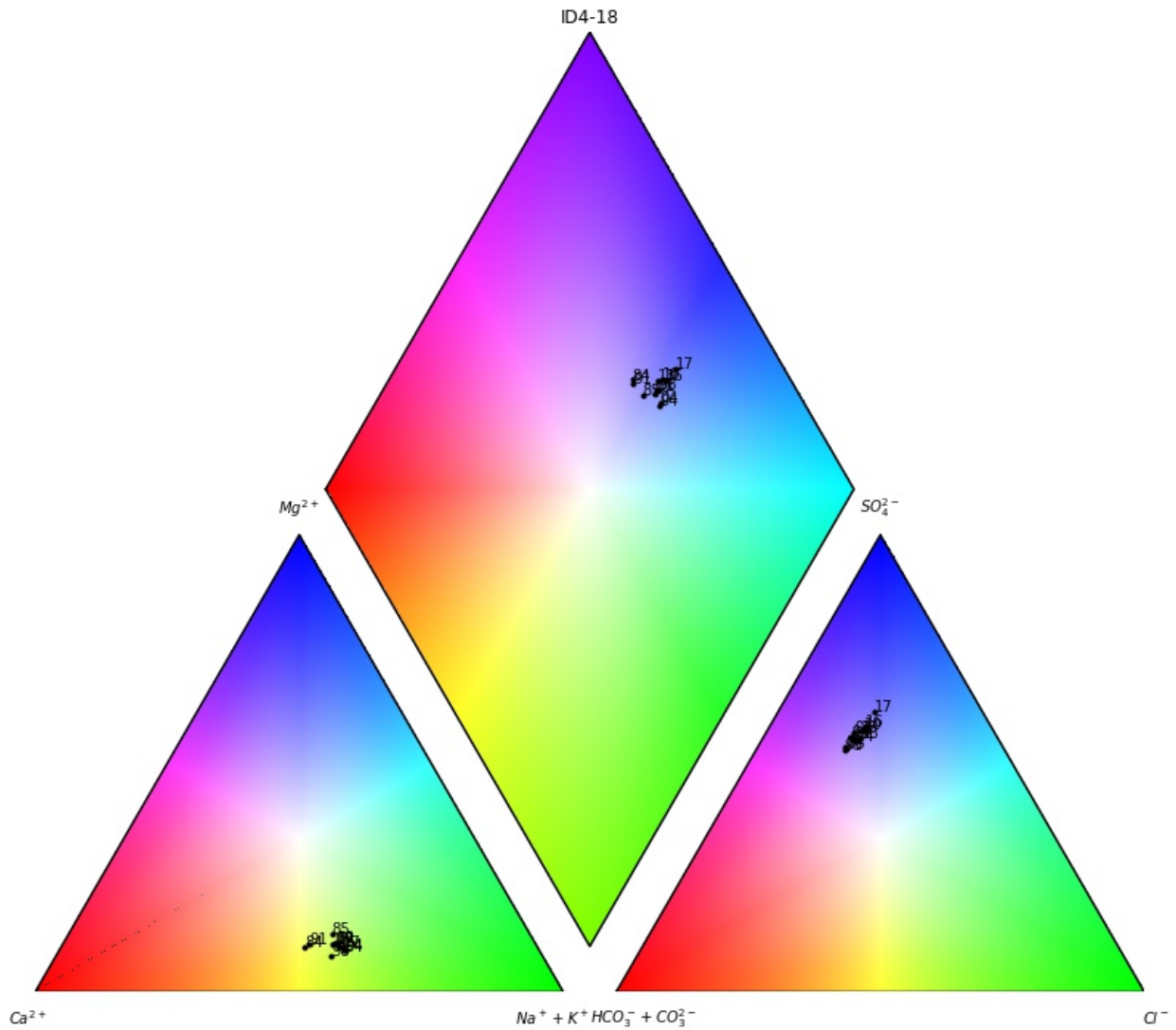
A copy of the map follows (**Figure 4**, from main body of report)

APPENDIX B: PIPER DIAGRAMS



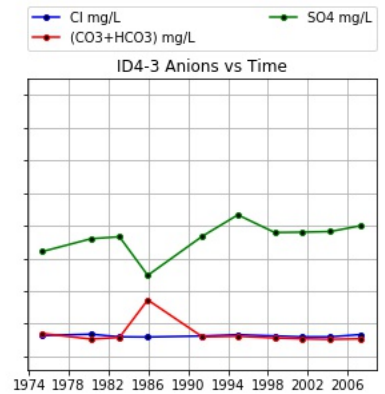
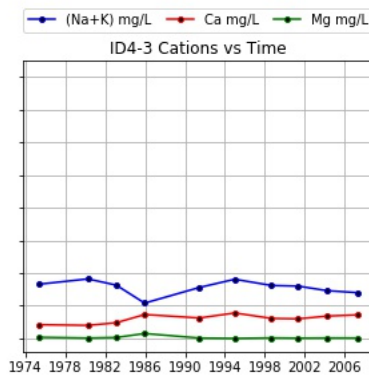
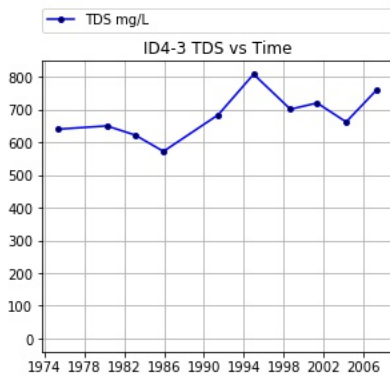
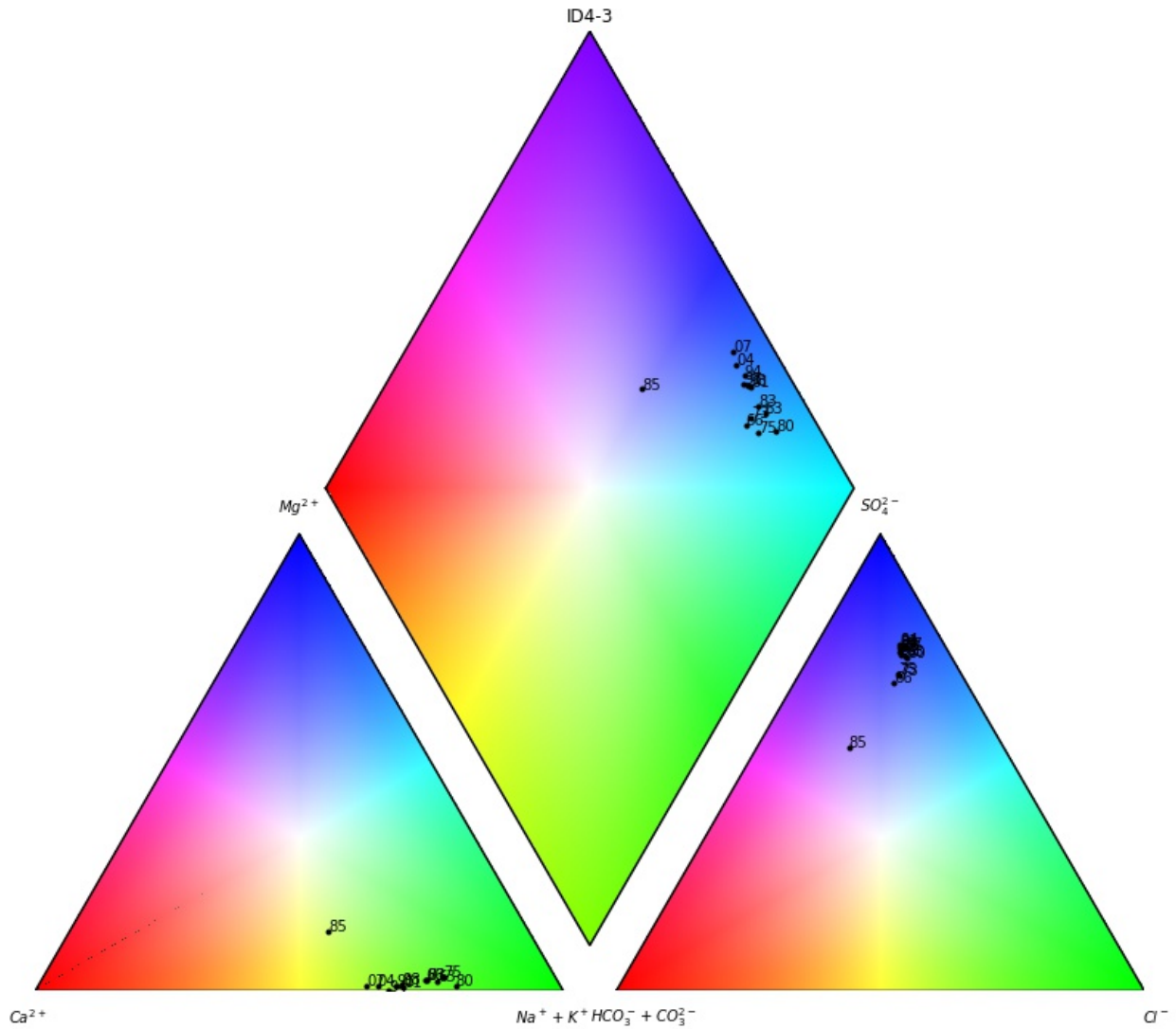
APPENDIX B: PIPER DIAGRAMS

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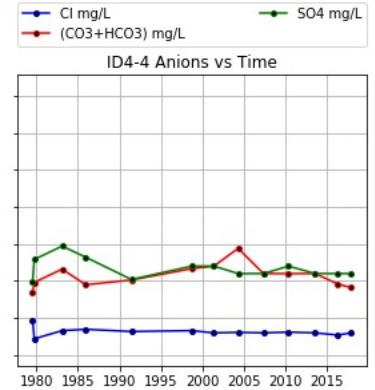
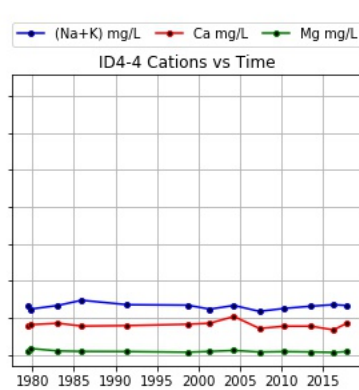
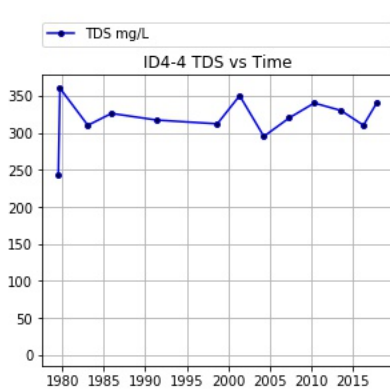
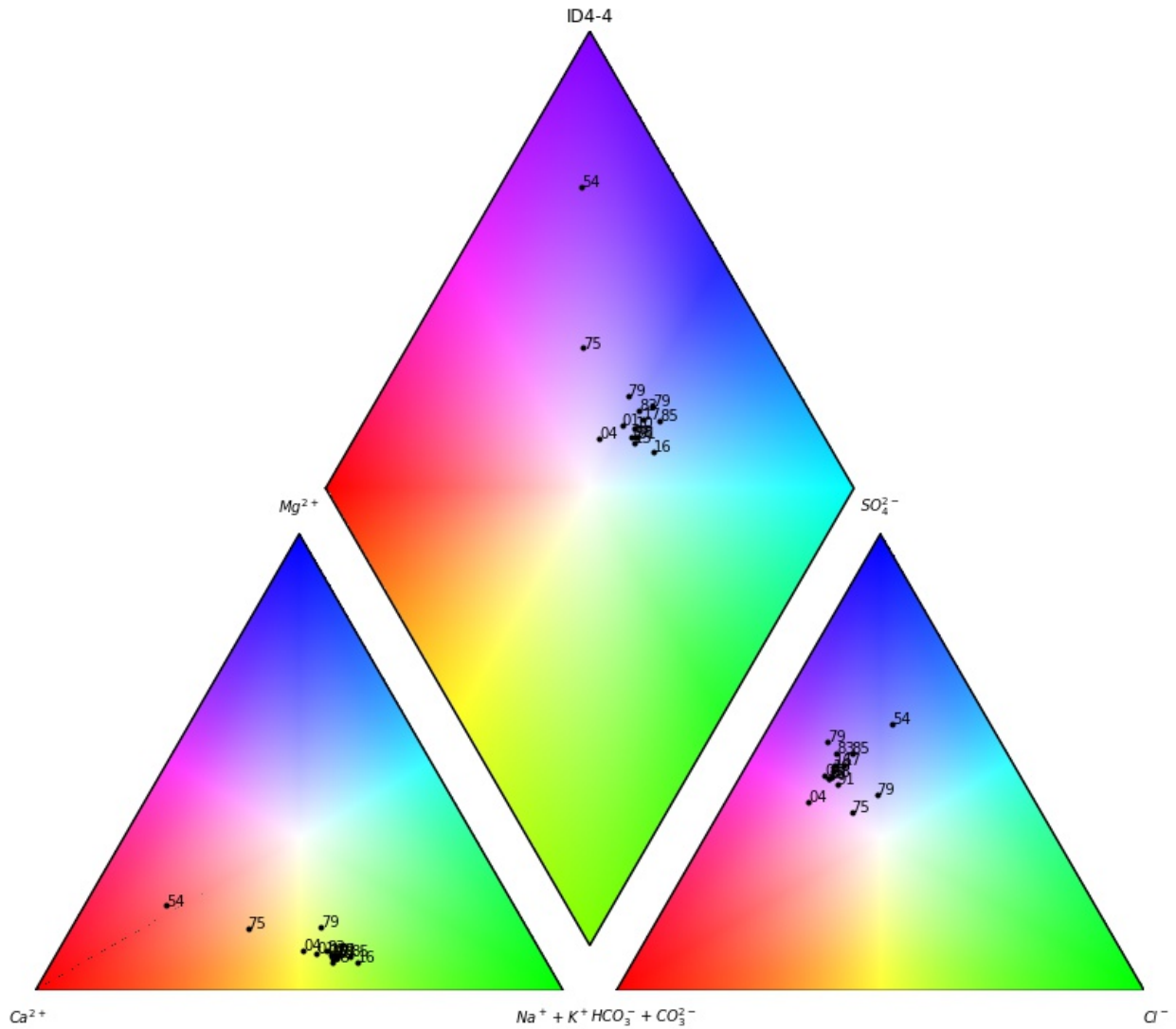
APPENDIX B: PIPER DIAGRAMS

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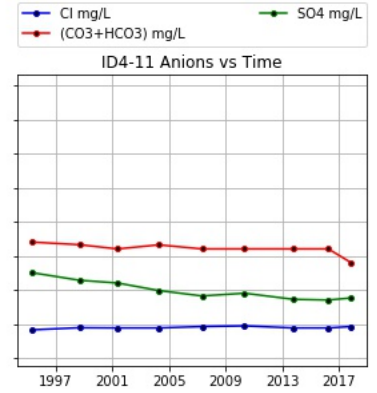
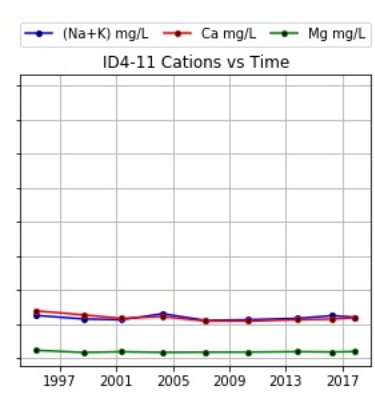
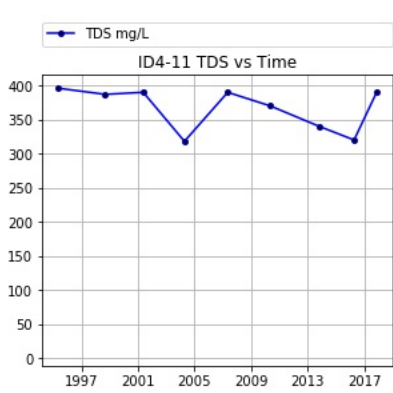
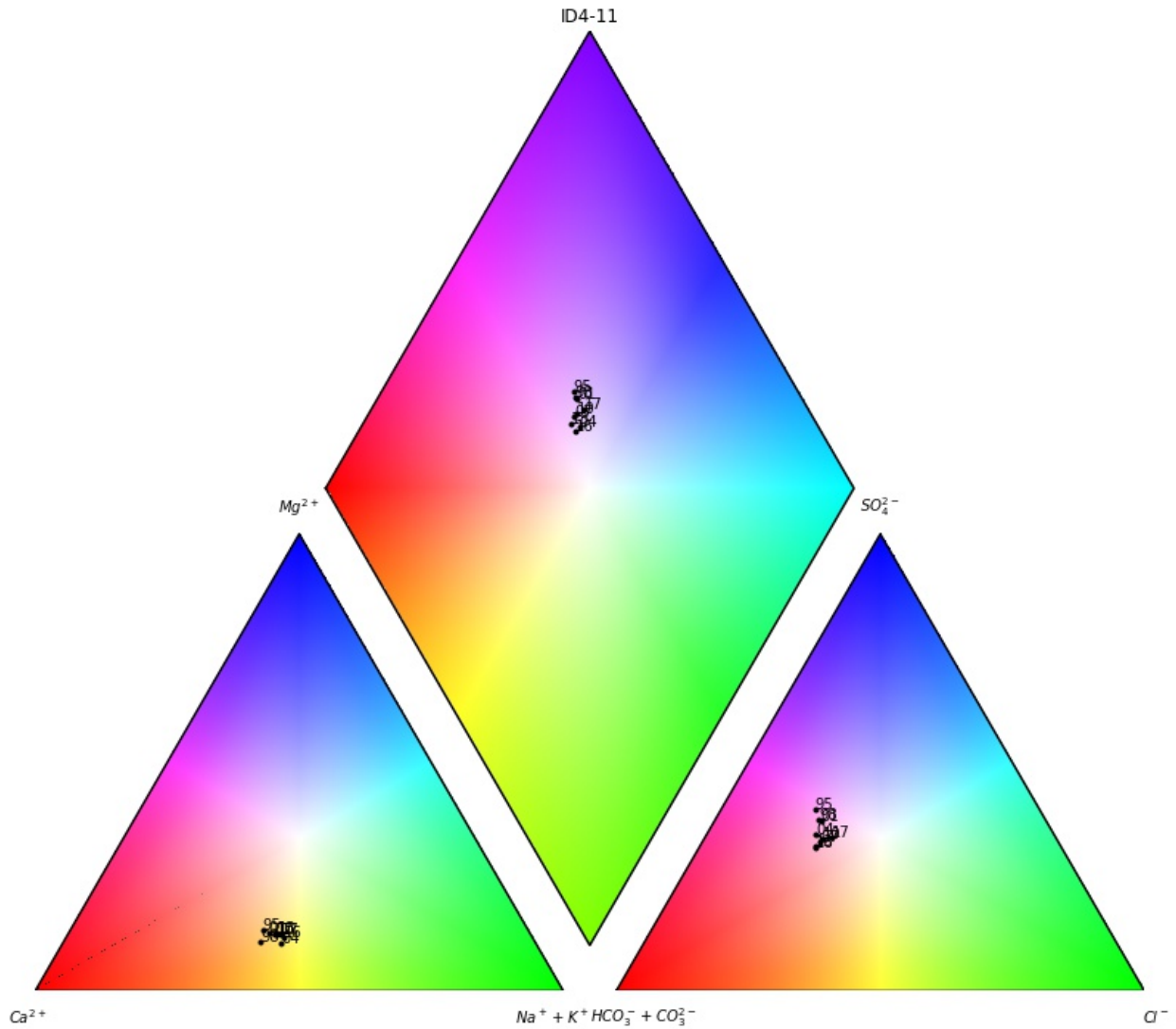
APPENDIX B: PIPER DIAGRAMS

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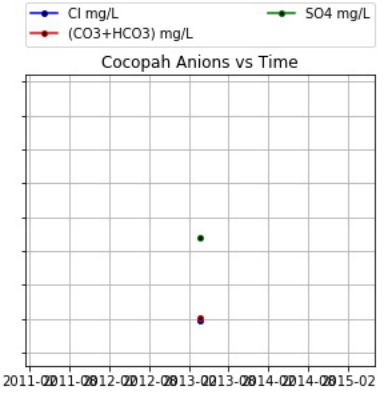
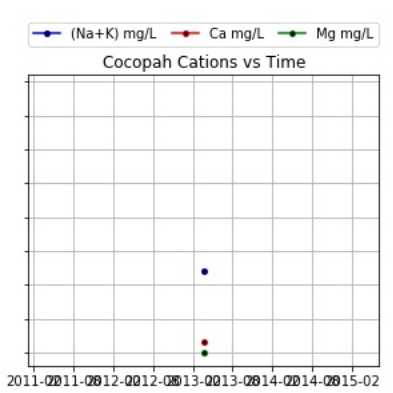
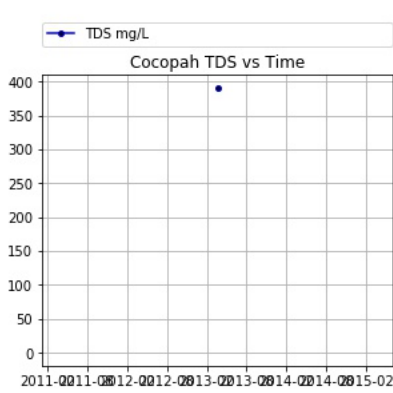
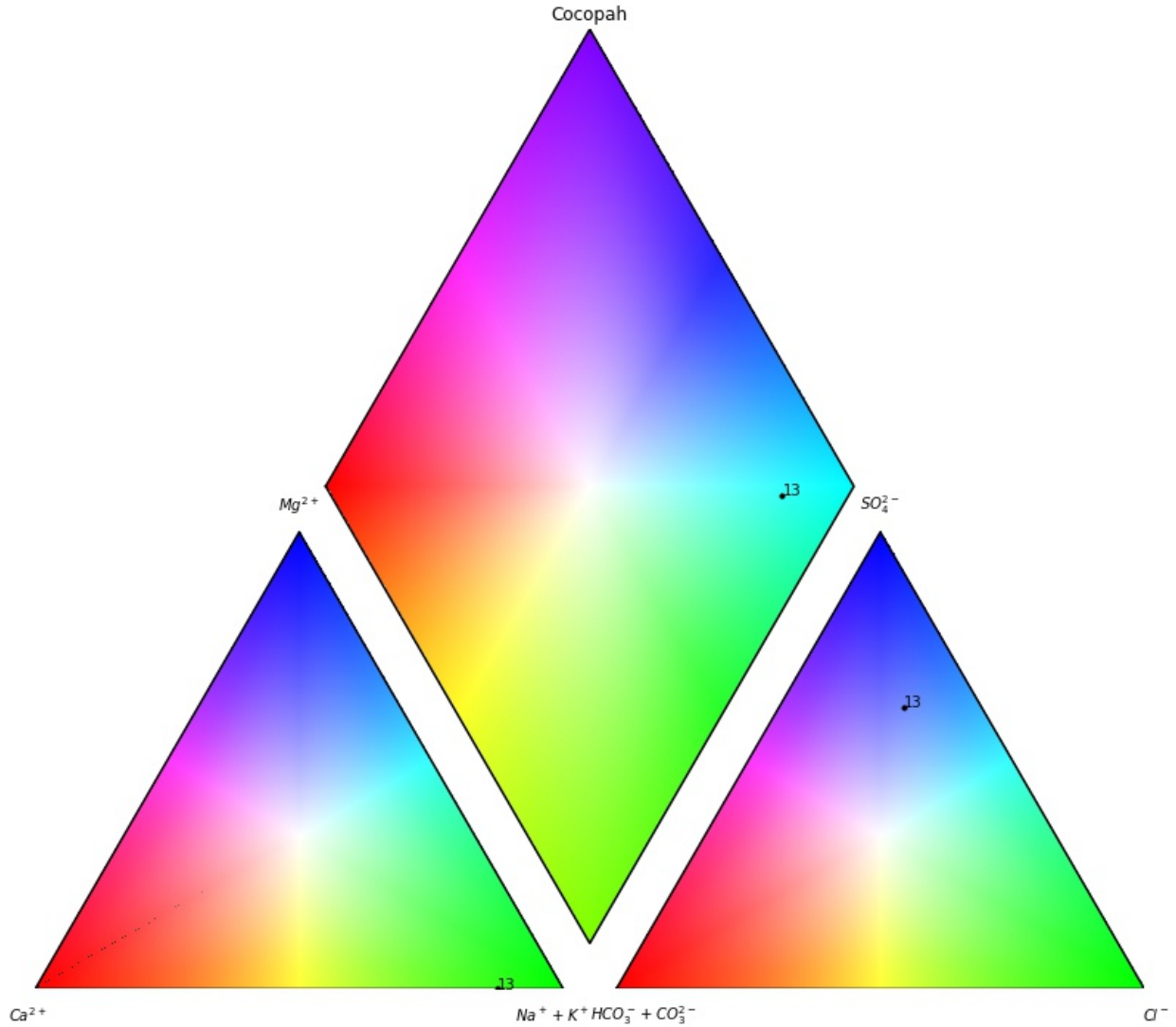
APPENDIX B: PIPER DIAGRAMS

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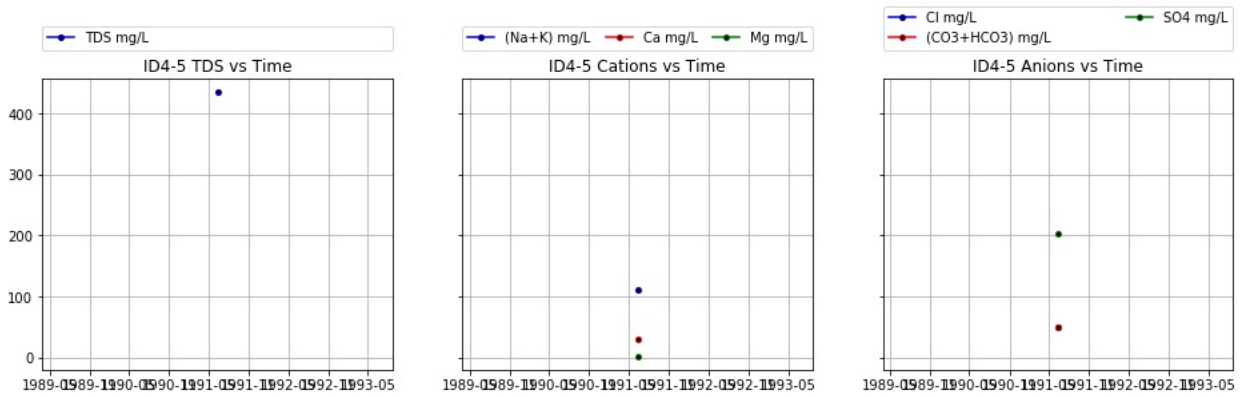
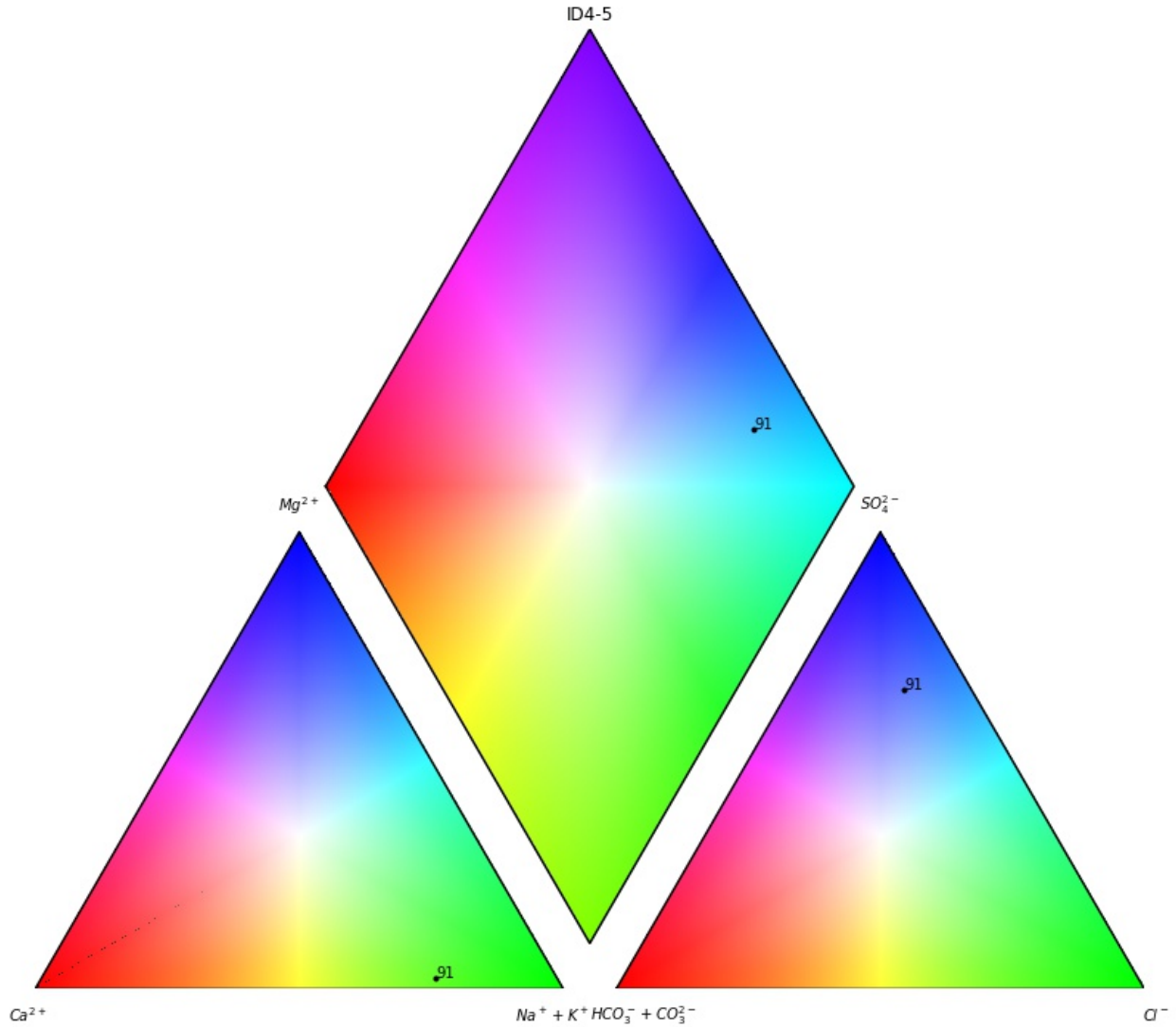
APPENDIX B: PIPER DIAGRAMS

6: Cocopah



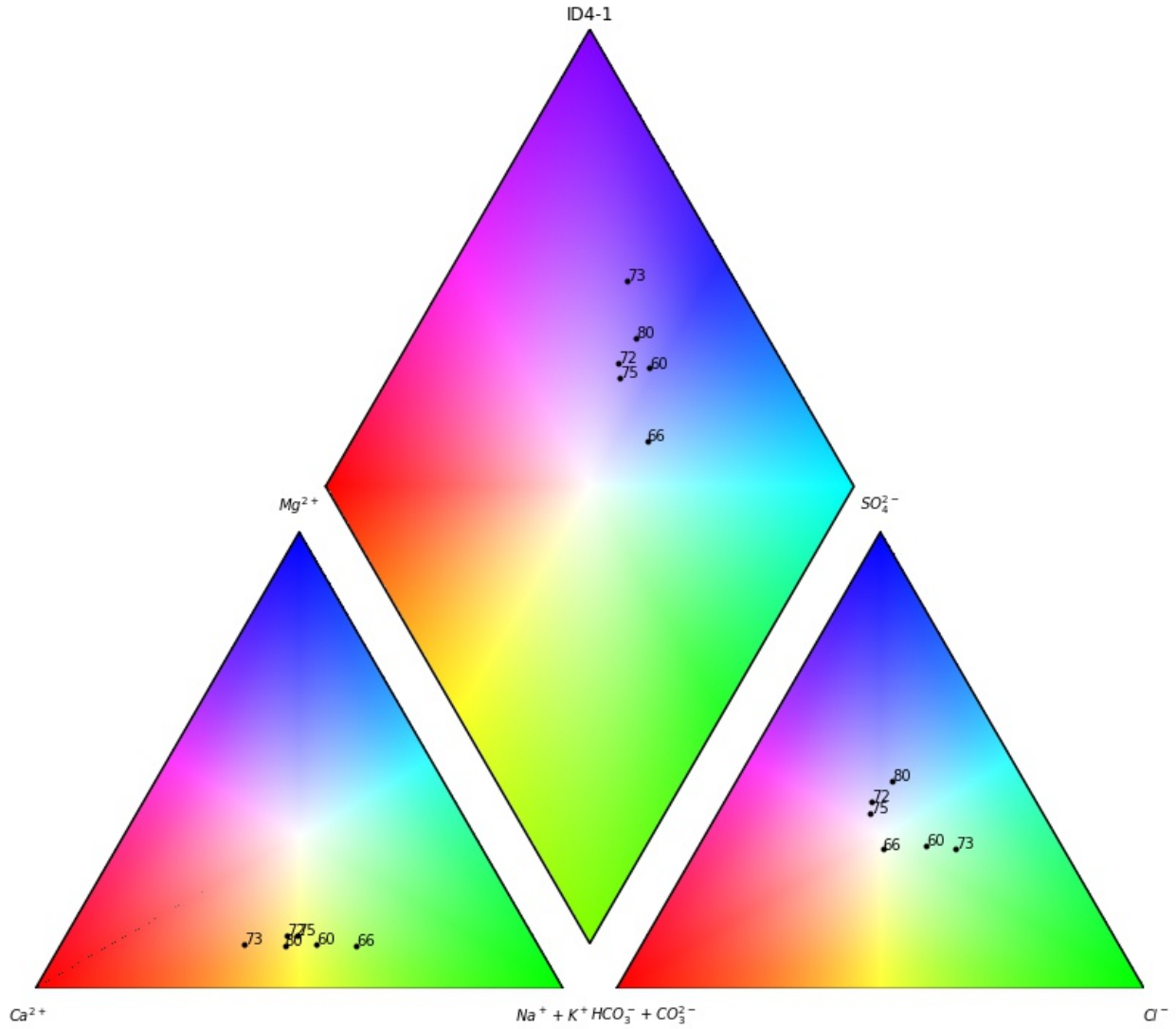
APPENDIX B: PIPER DIAGRAMS

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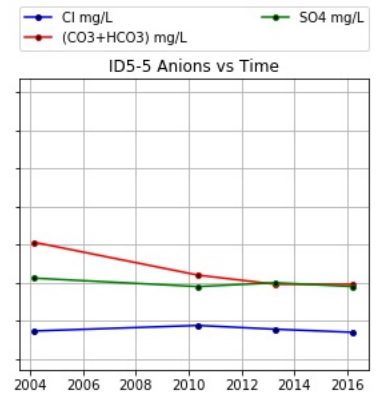
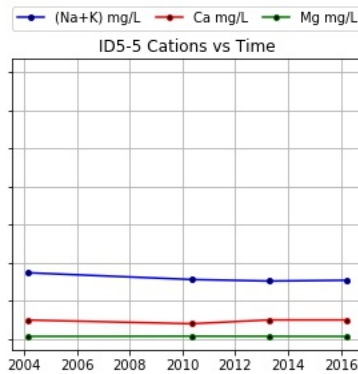
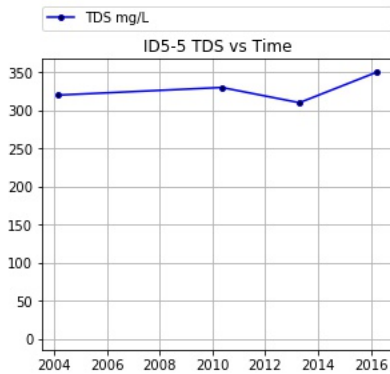
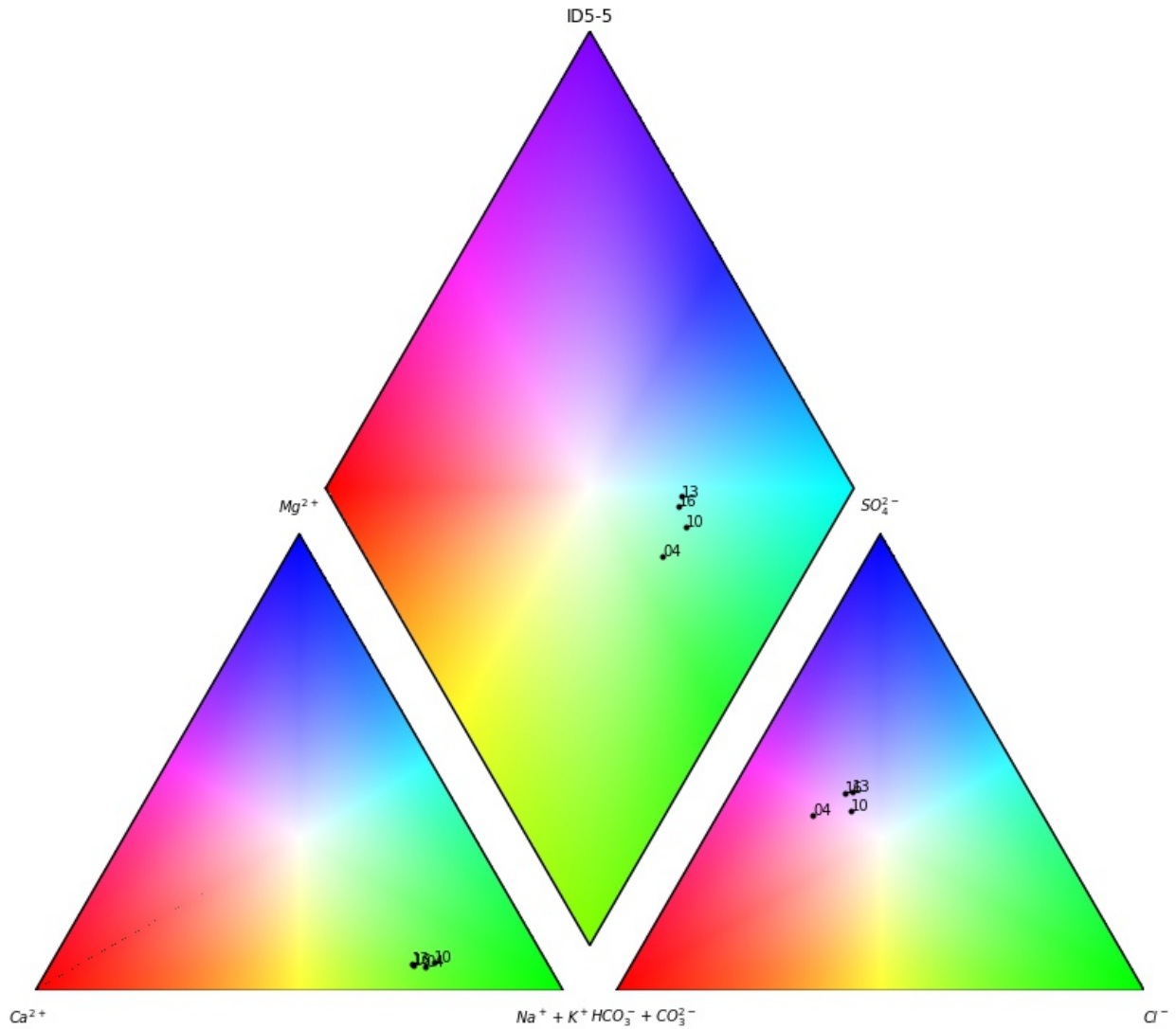
APPENDIX B: PIPER DIAGRAMS

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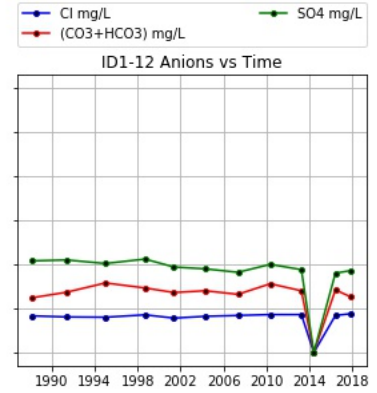
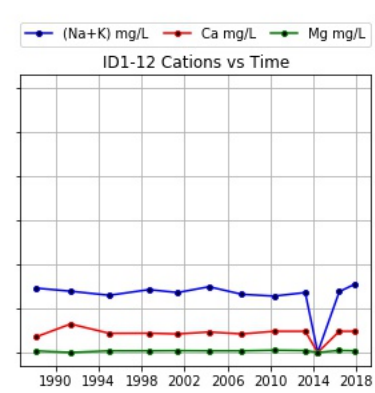
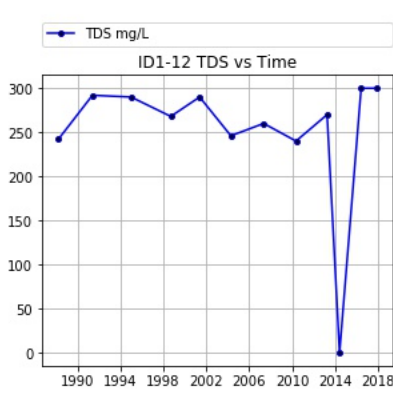
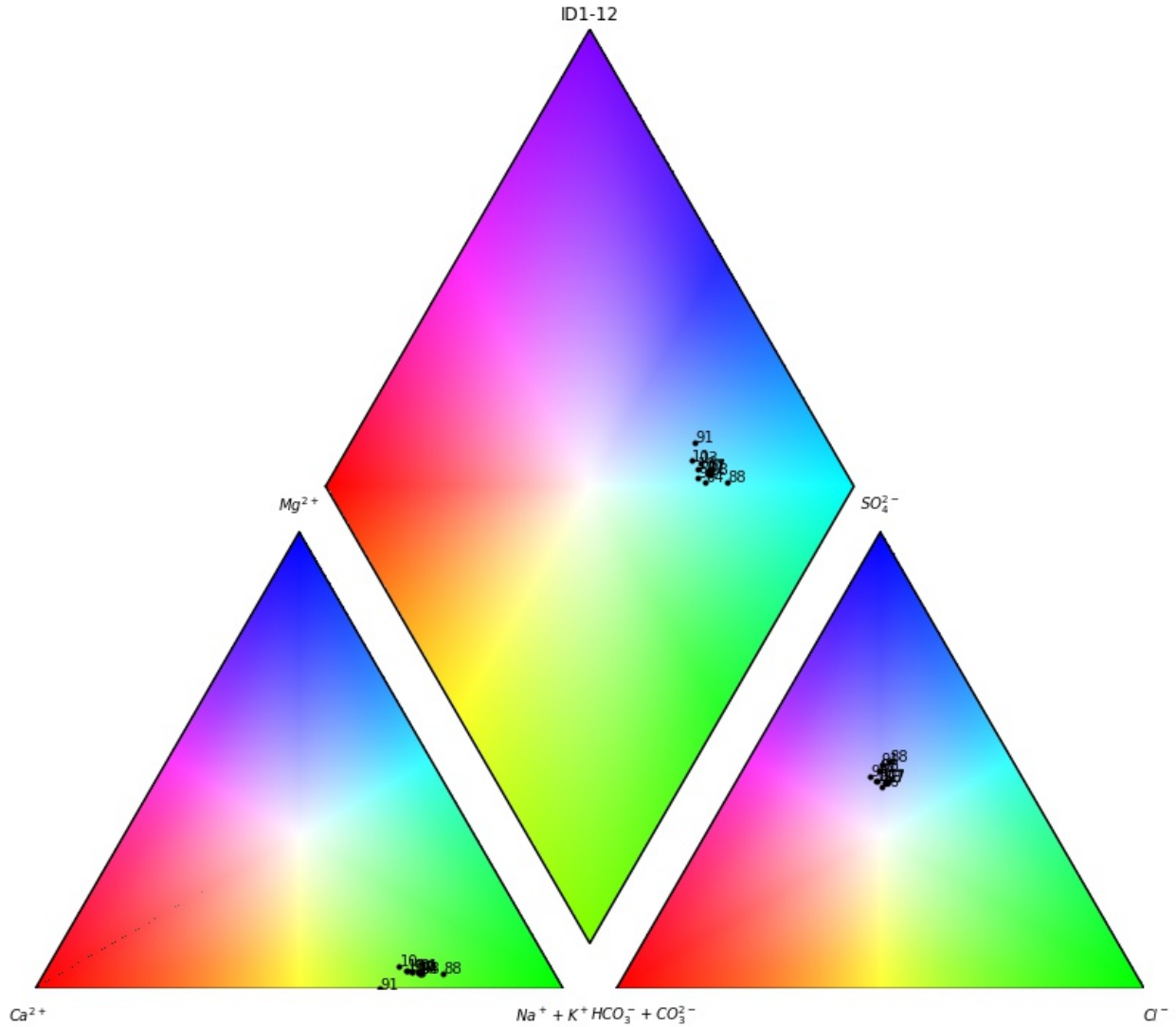
APPENDIX B: PIPER DIAGRAMS

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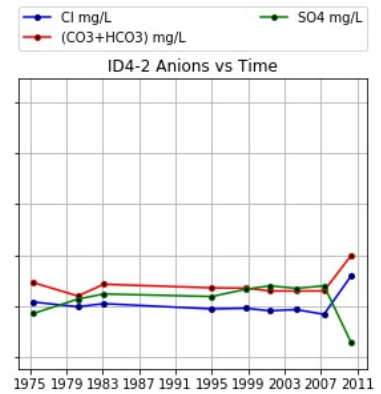
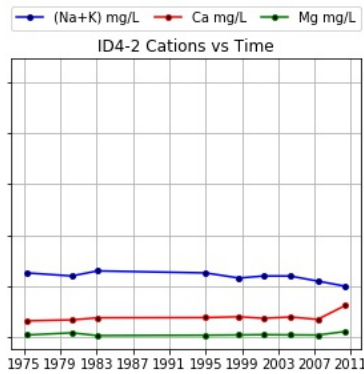
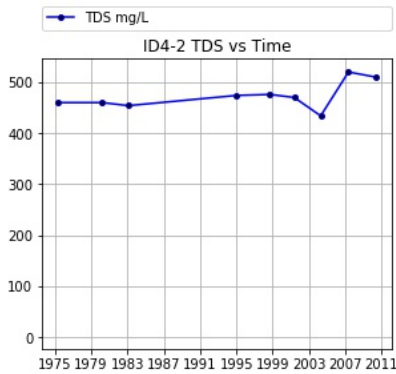
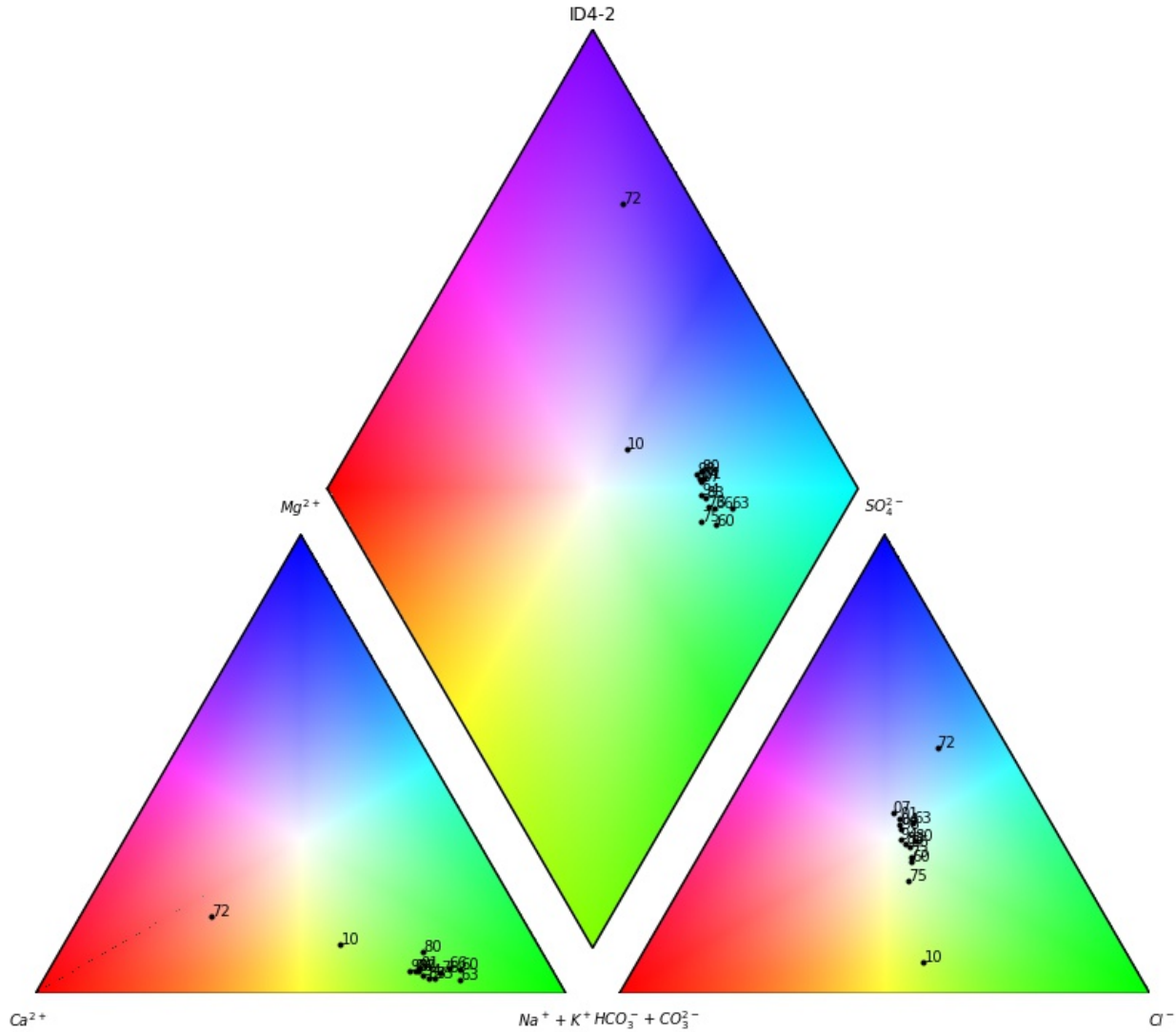
APPENDIX B: PIPER DIAGRAMS

9: ID1-12



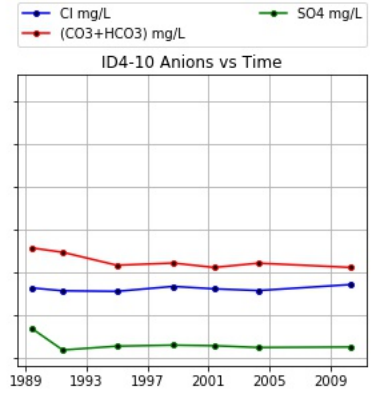
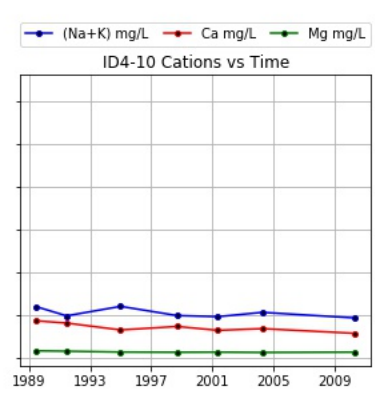
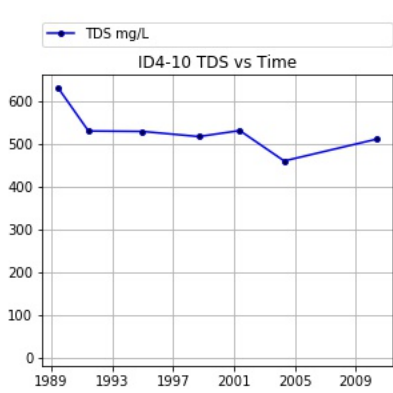
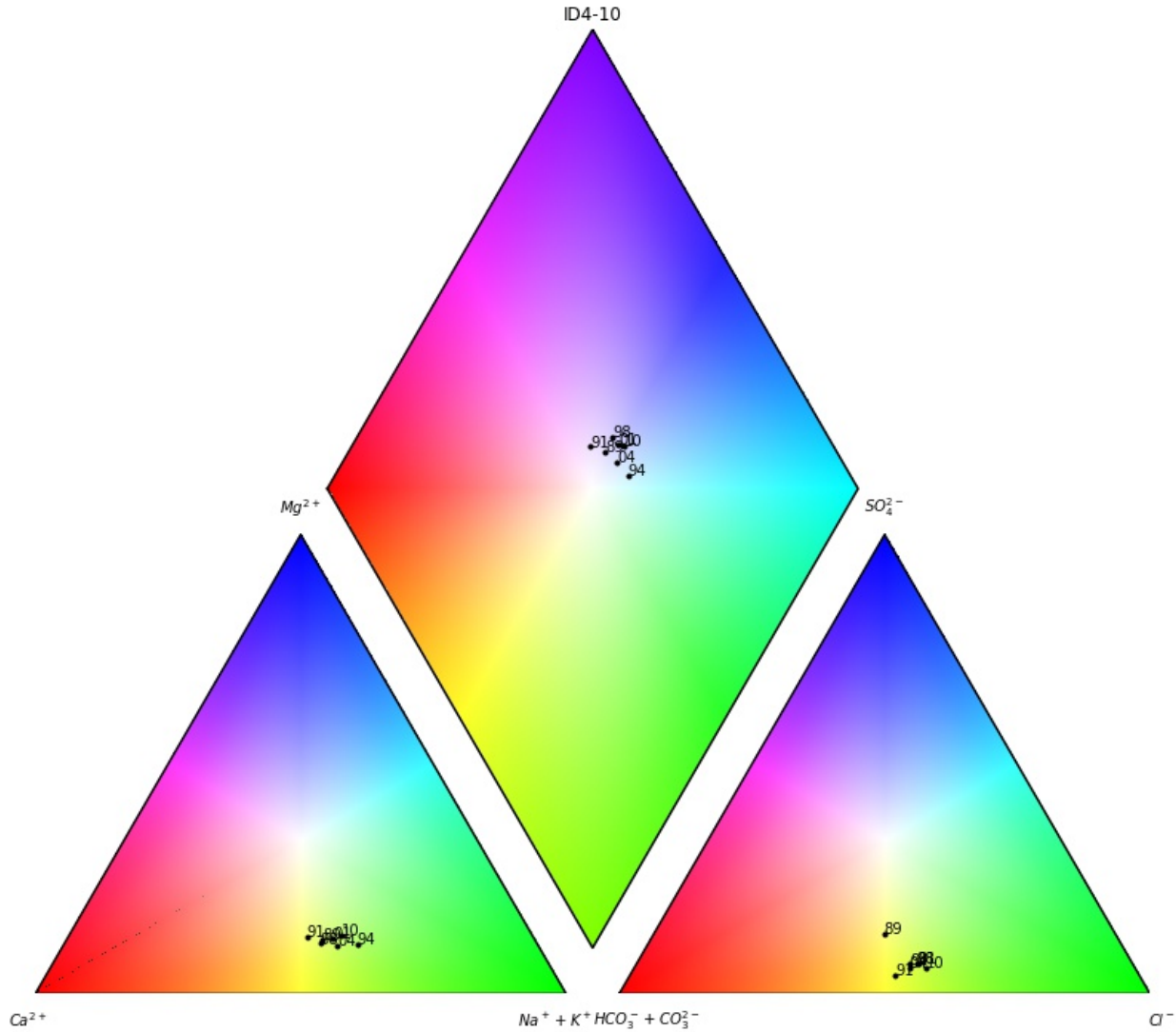
APPENDIX B: PIPER DIAGRAMS

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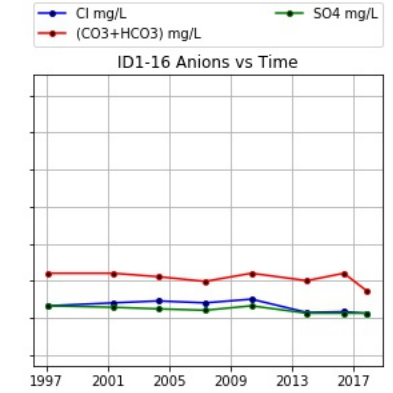
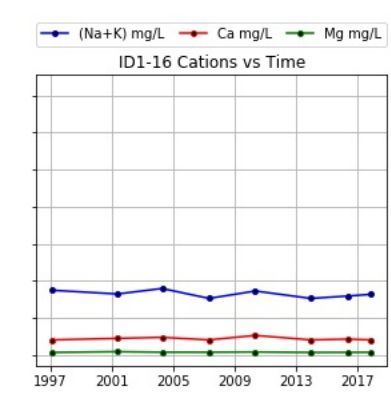
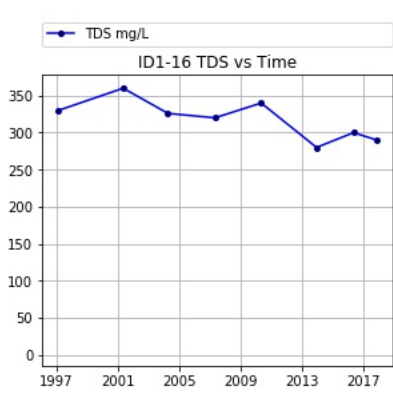
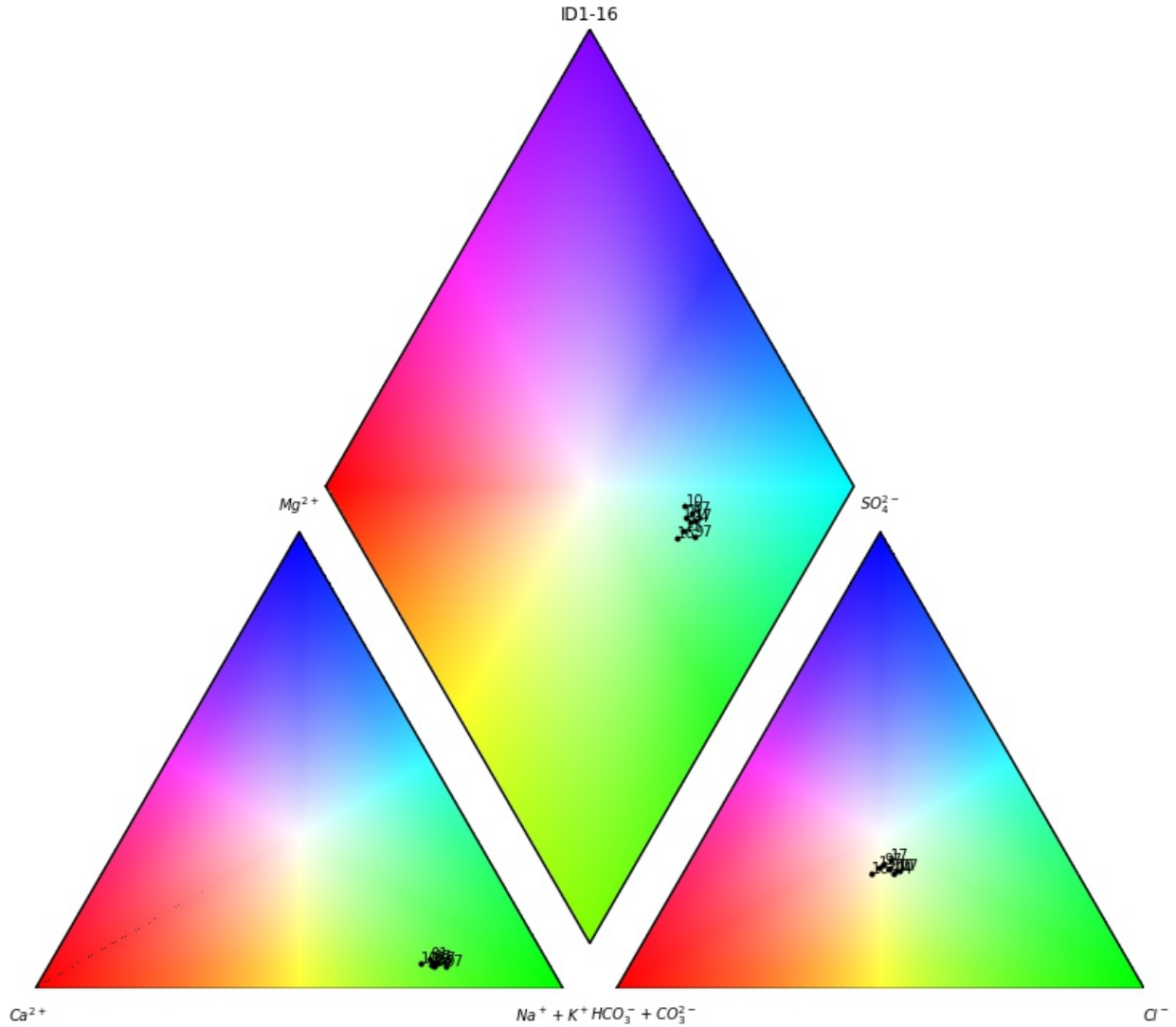
APPENDIX B: PIPER DIAGRAMS

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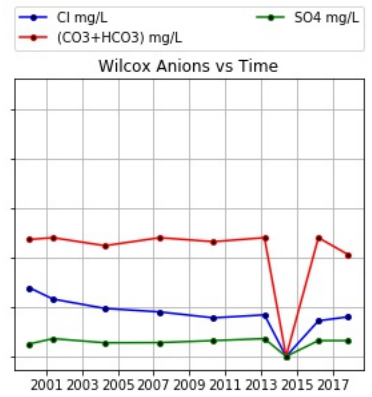
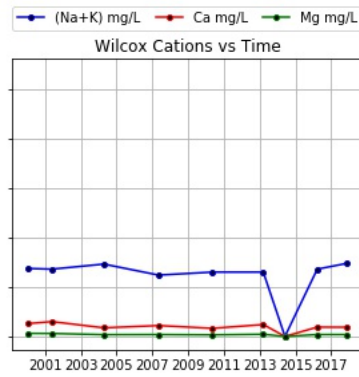
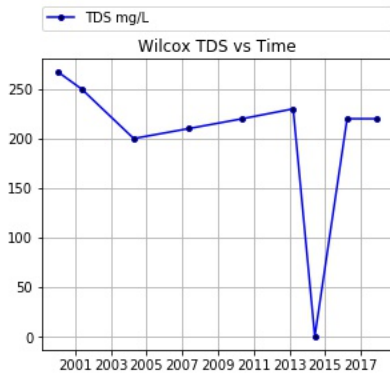
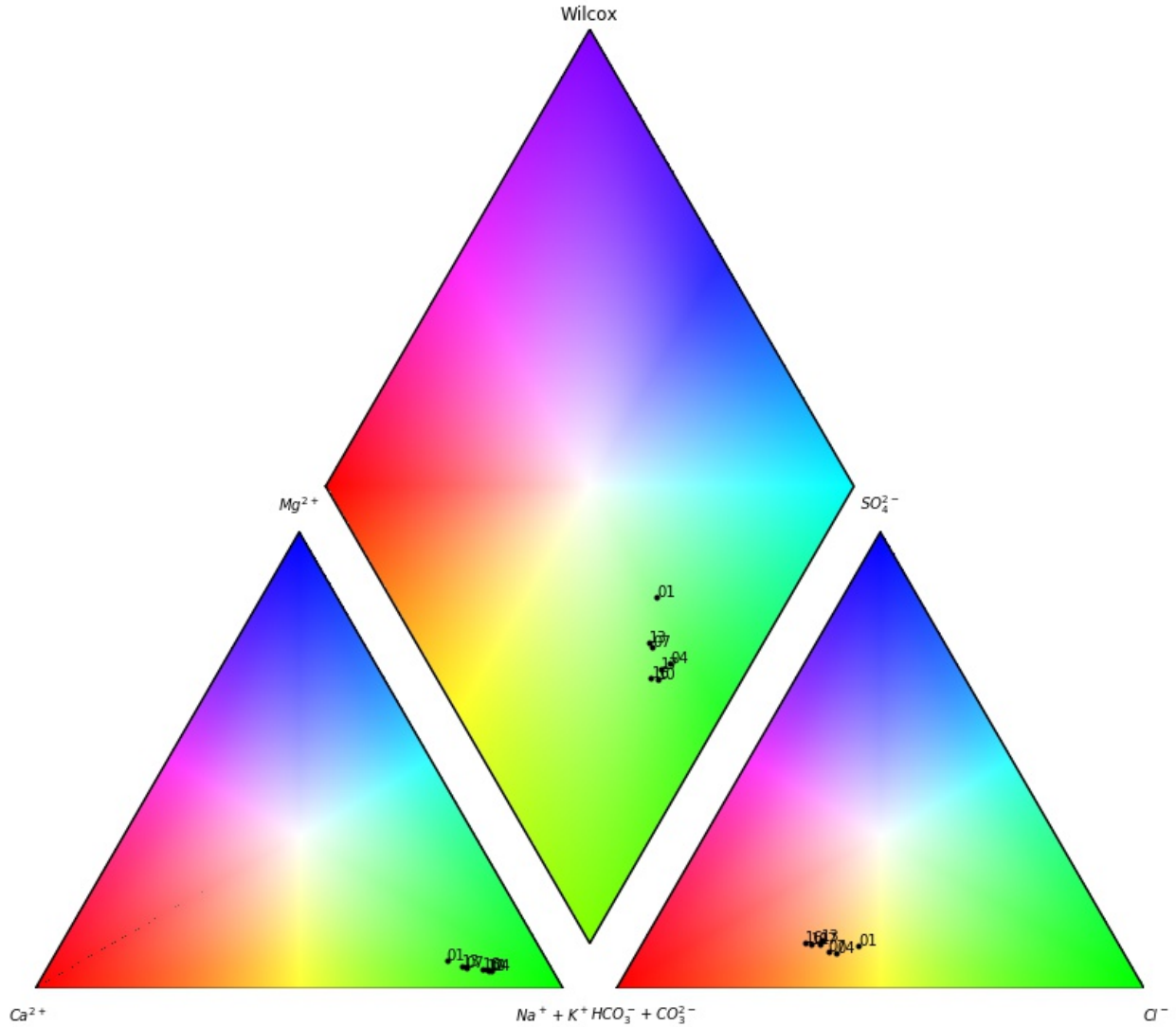
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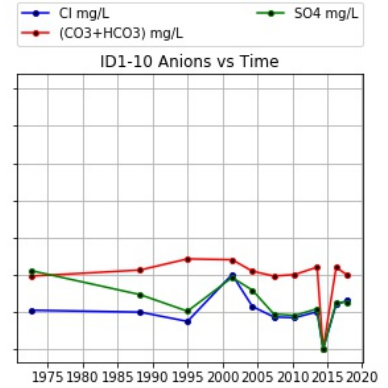
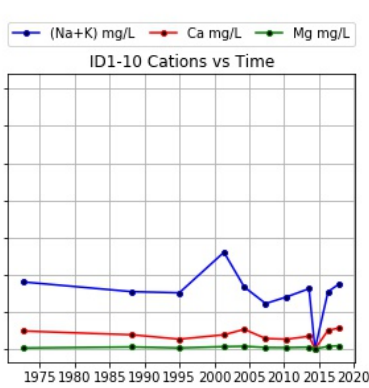
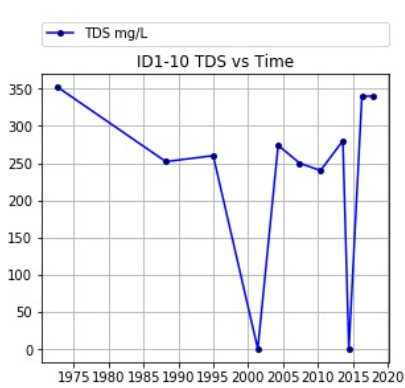
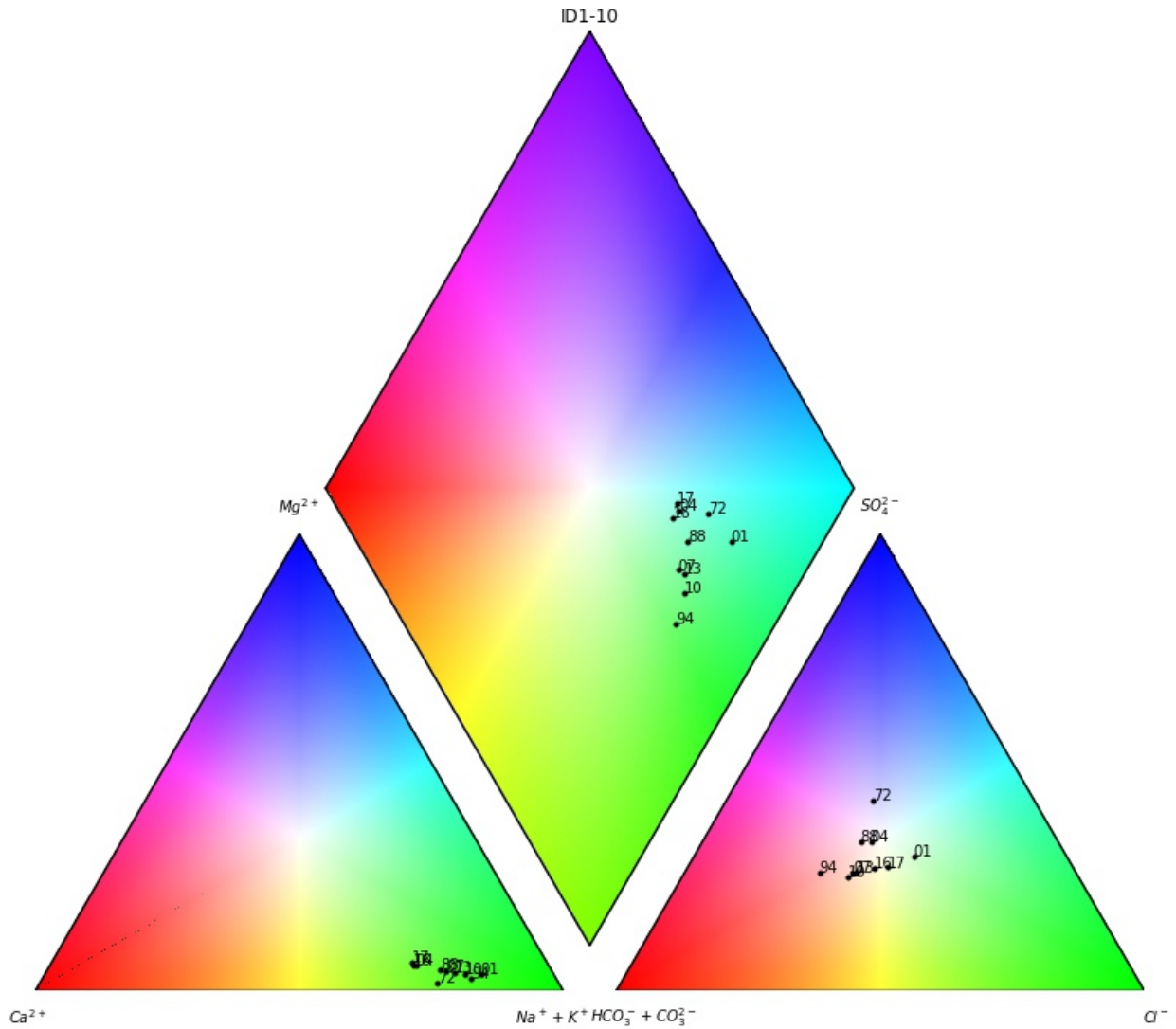
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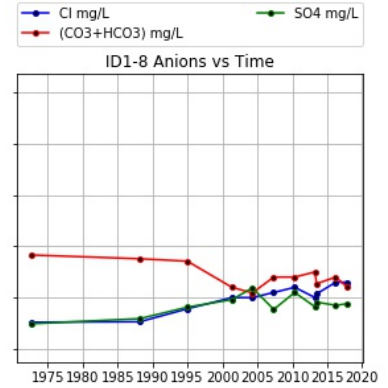
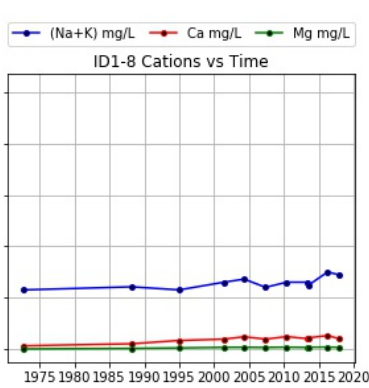
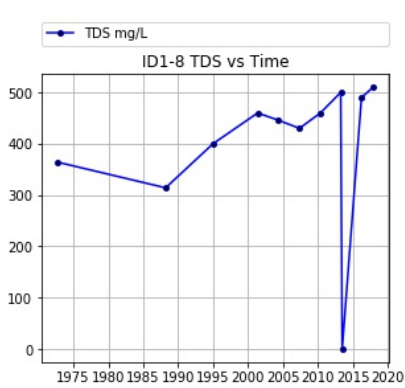
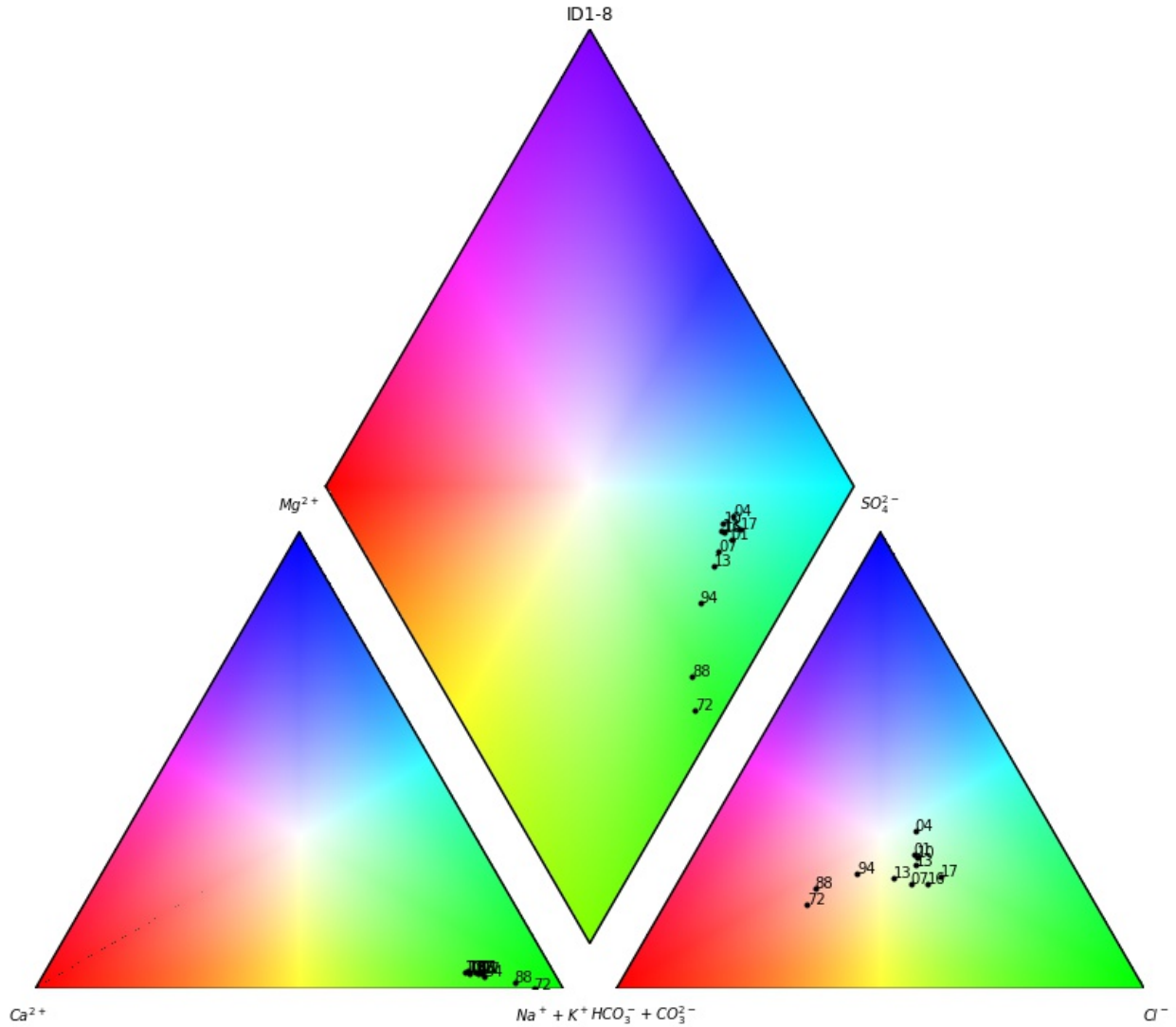
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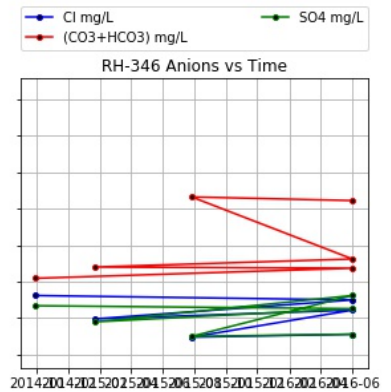
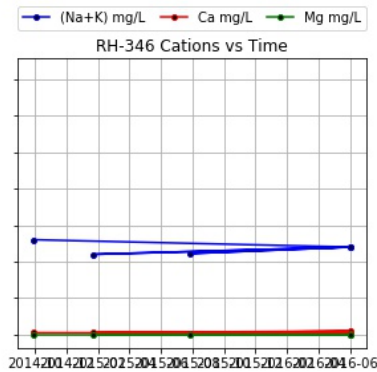
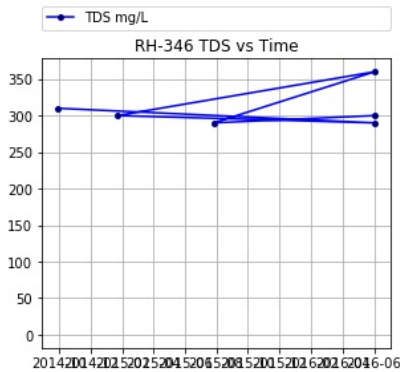
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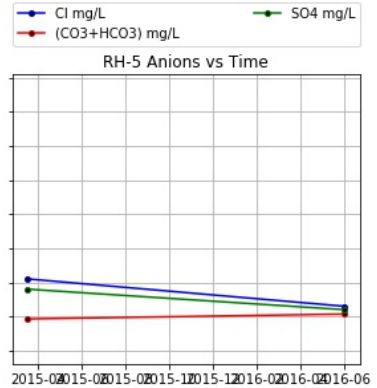
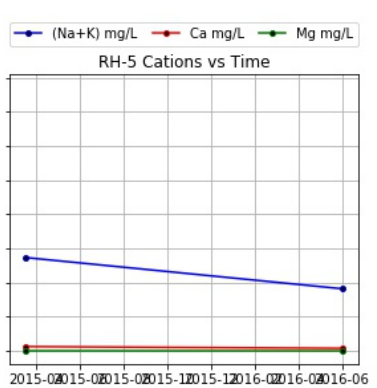
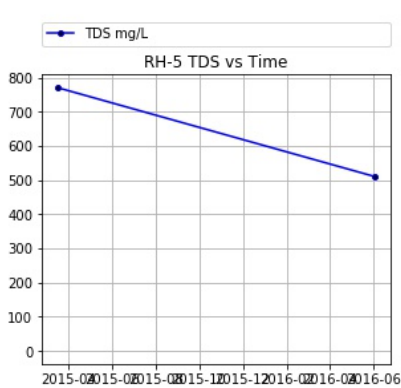
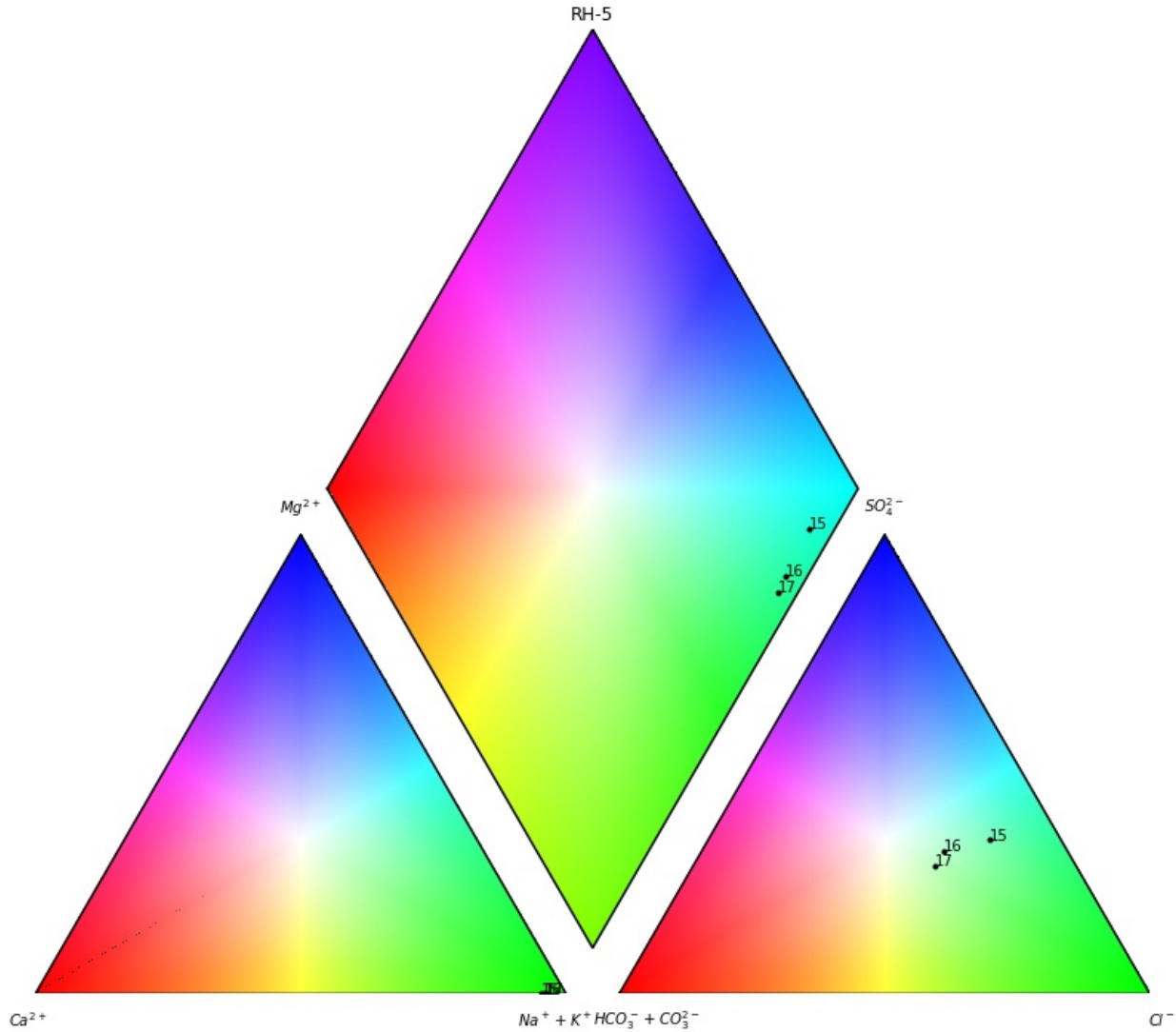
APPENDIX B: PIPER DIAGRAMS

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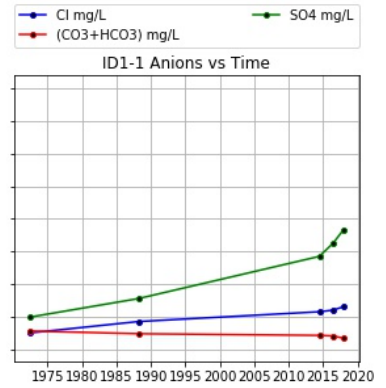
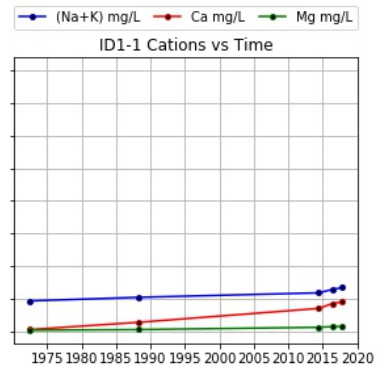
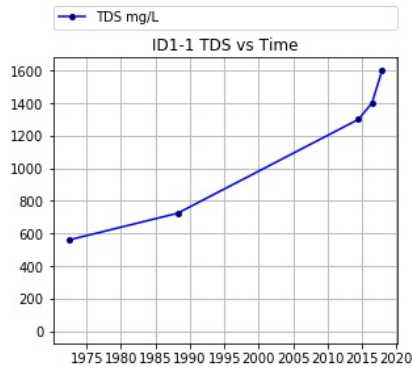
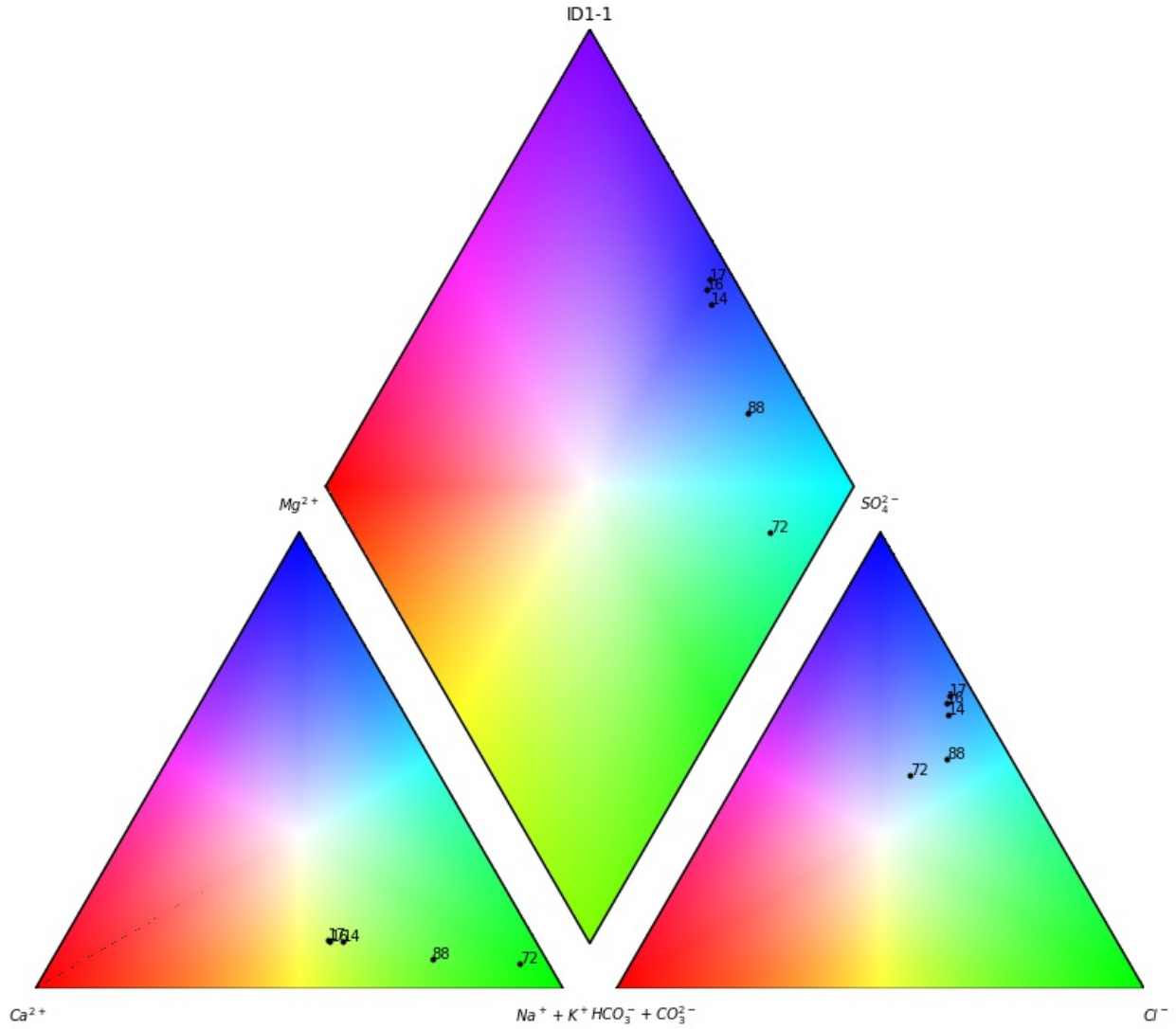
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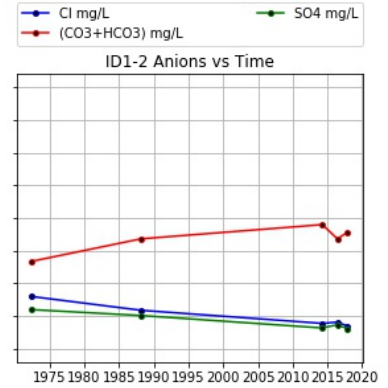
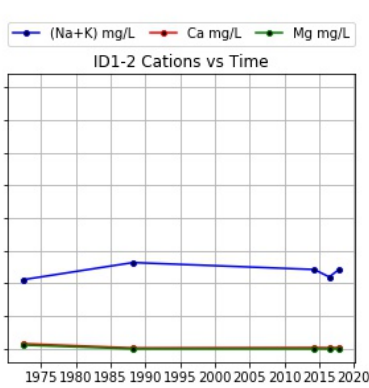
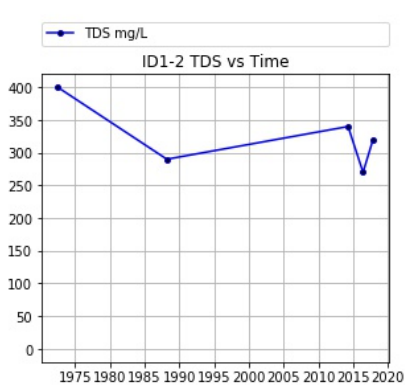
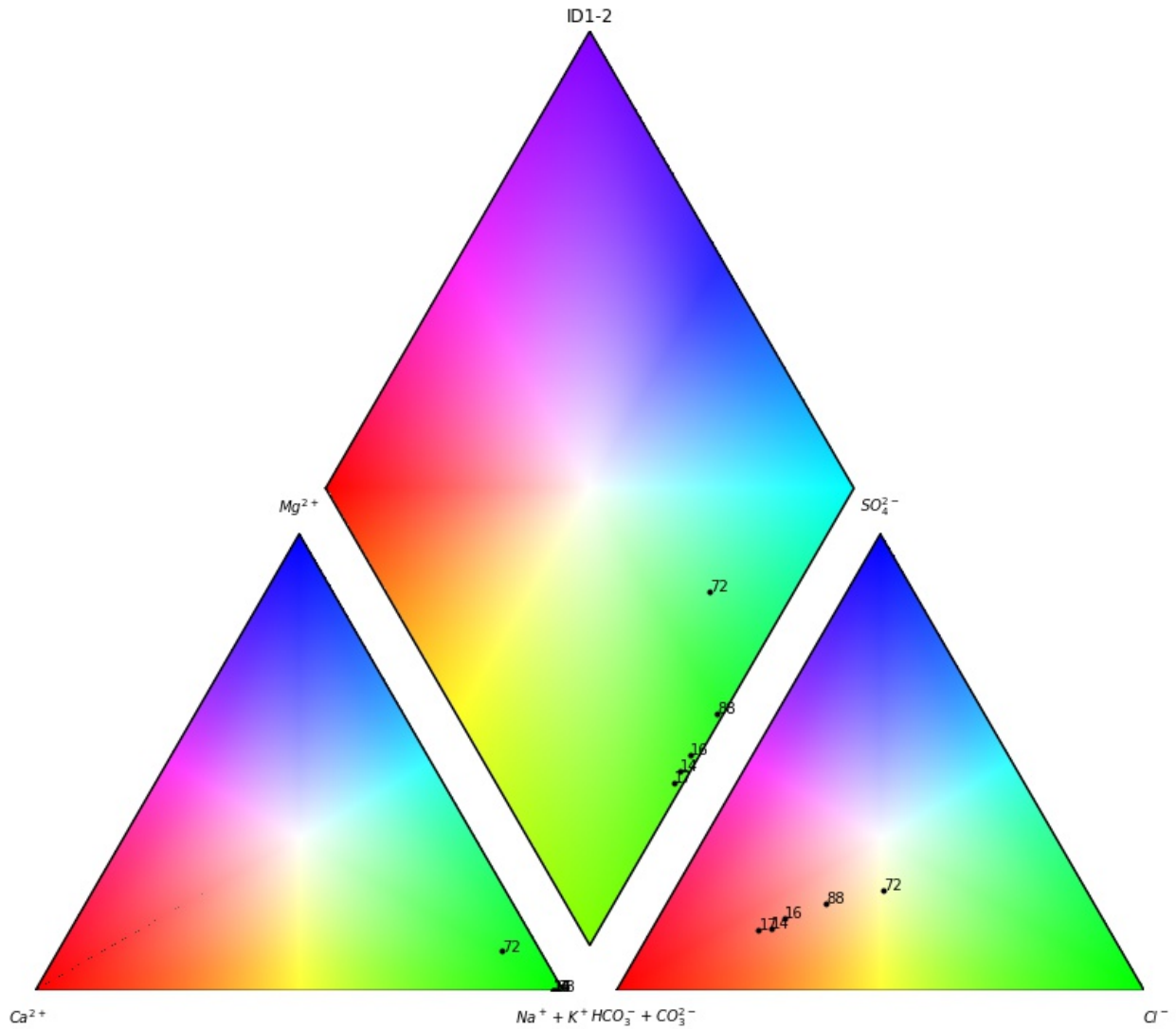
APPENDIX B: PIPER DIAGRAMS

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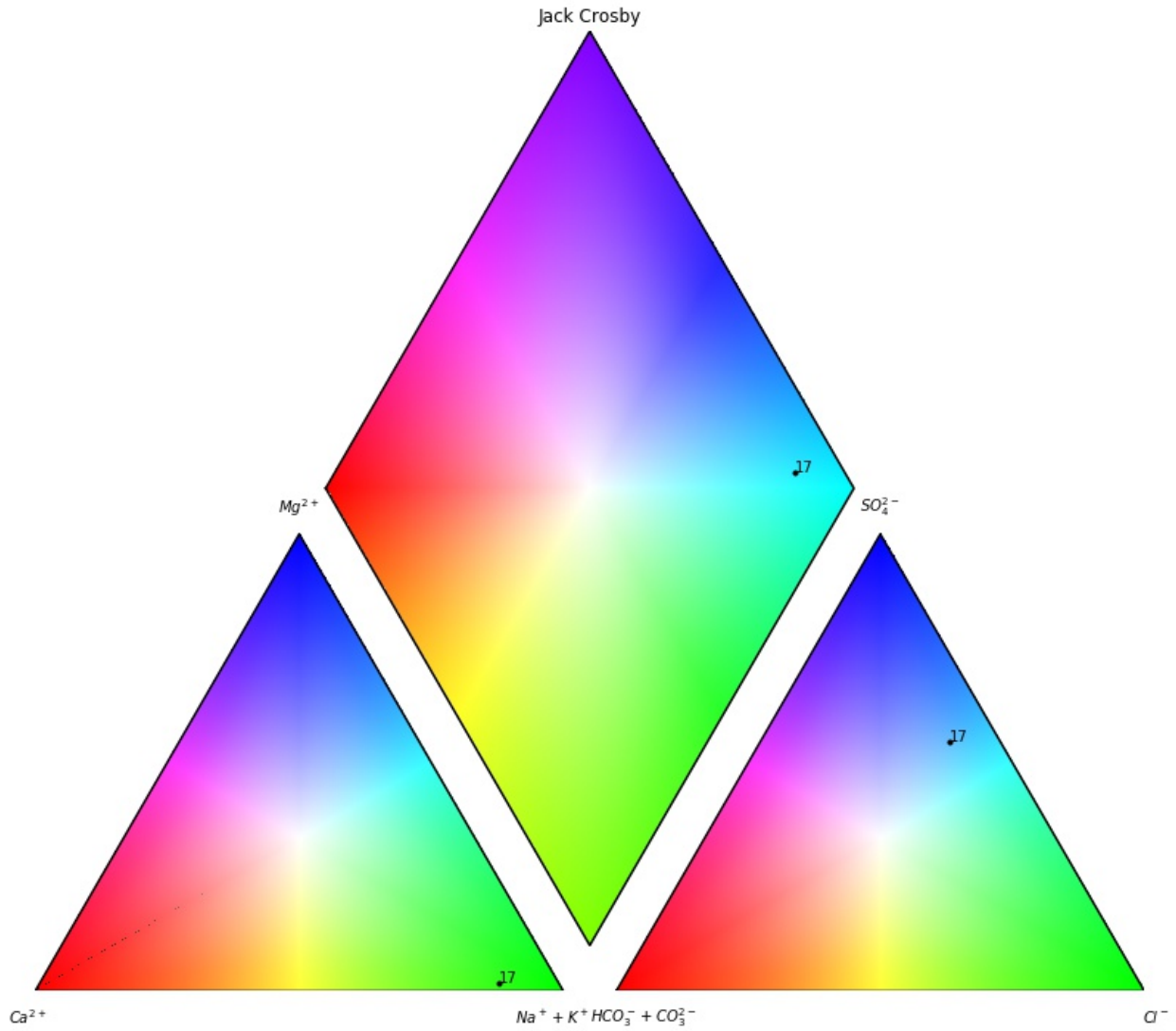
APPENDIX B: PIPER DIAGRAMS

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APPENDIX B: PIPER DIAGRAMS

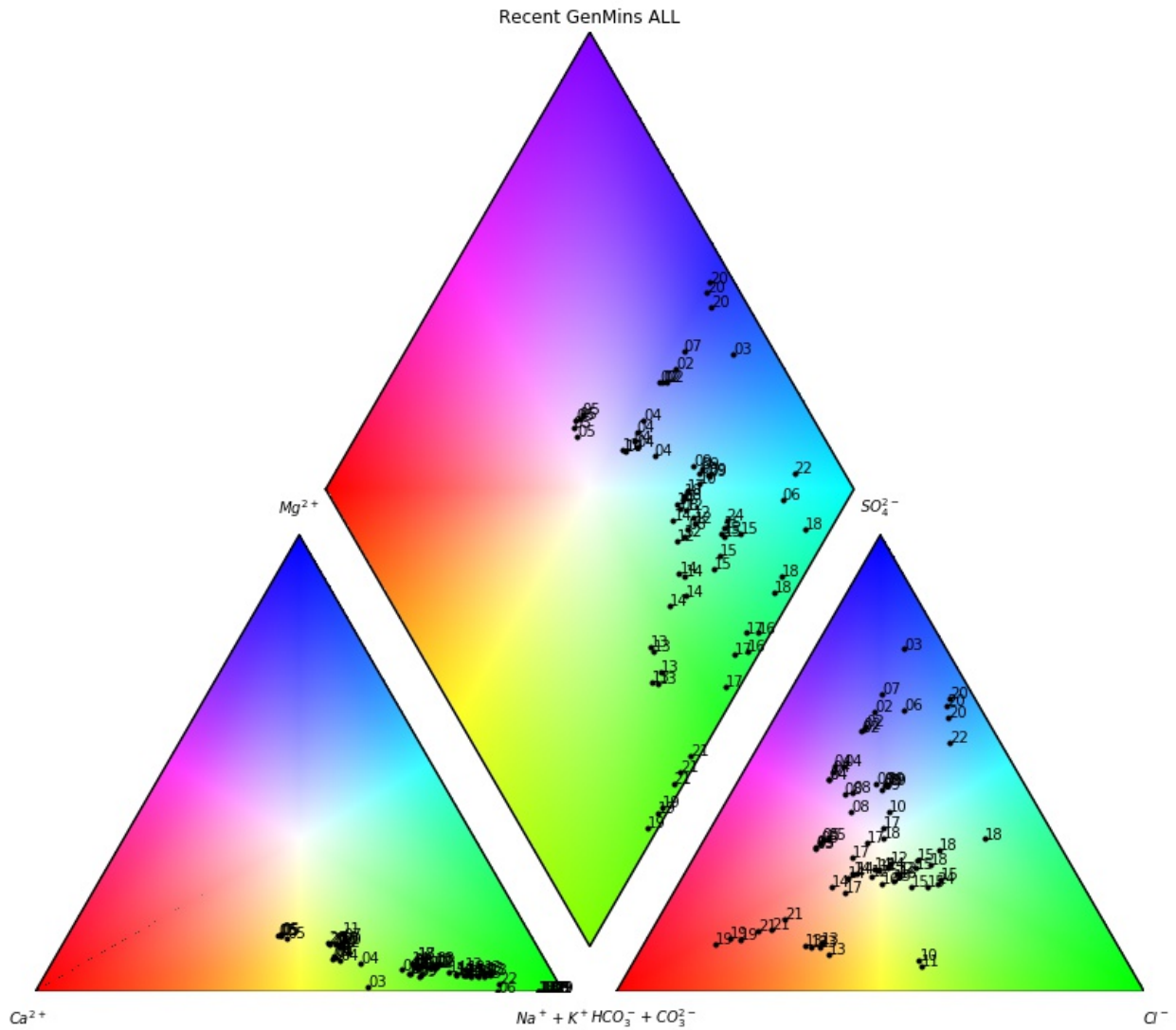
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APPENDIX B: PIPER DIAGRAMS

Recent Data: All (Piper only)



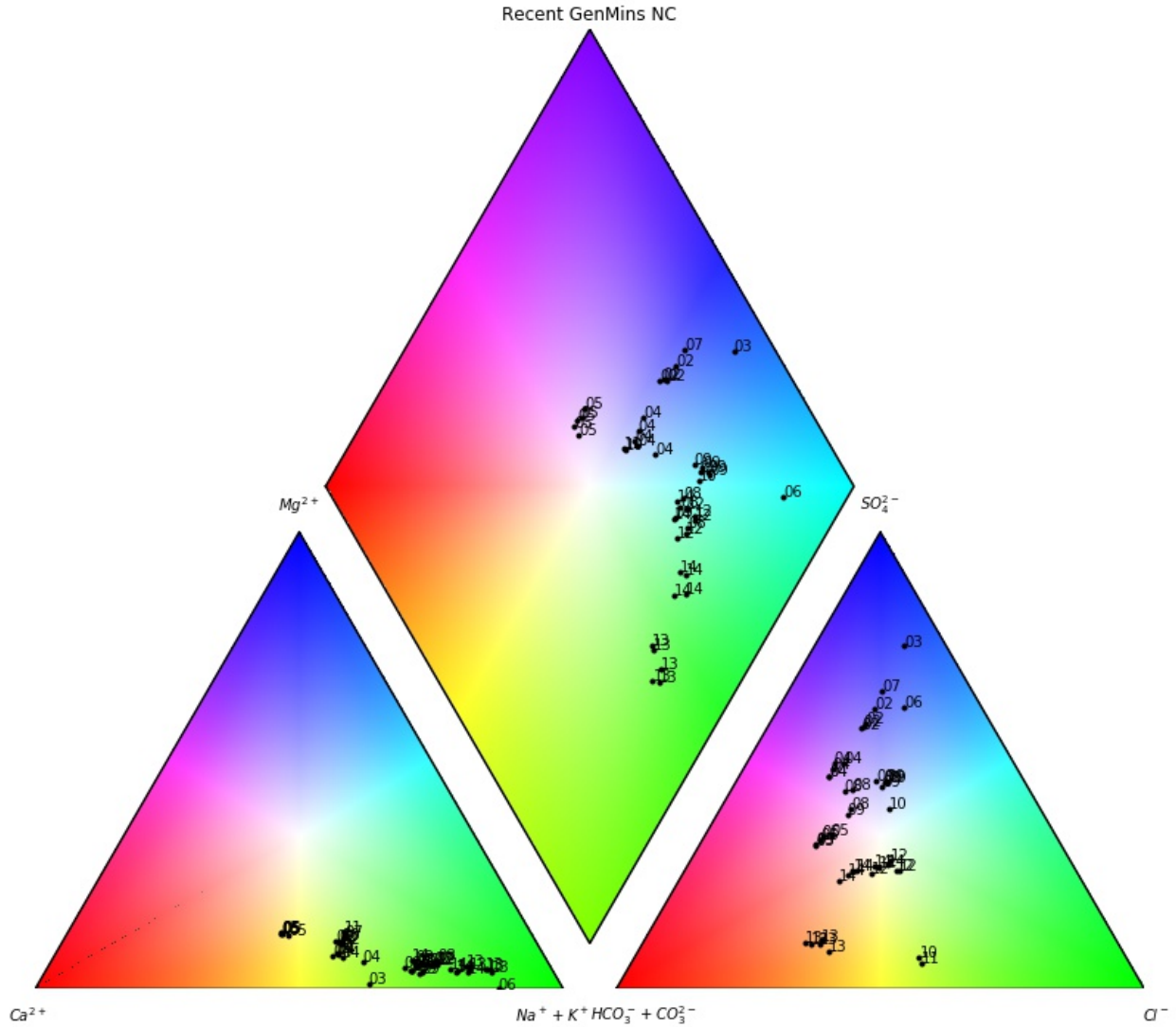
Notes:

The number on the diagrams correspond to sequential well numbers assigned to each of the wells as explained in the text. Data are for the period of 2005 to 2018.

This Piper diagram is further explained in **Figure 6**.

APPENDIX B: PIPER DIAGRAMS

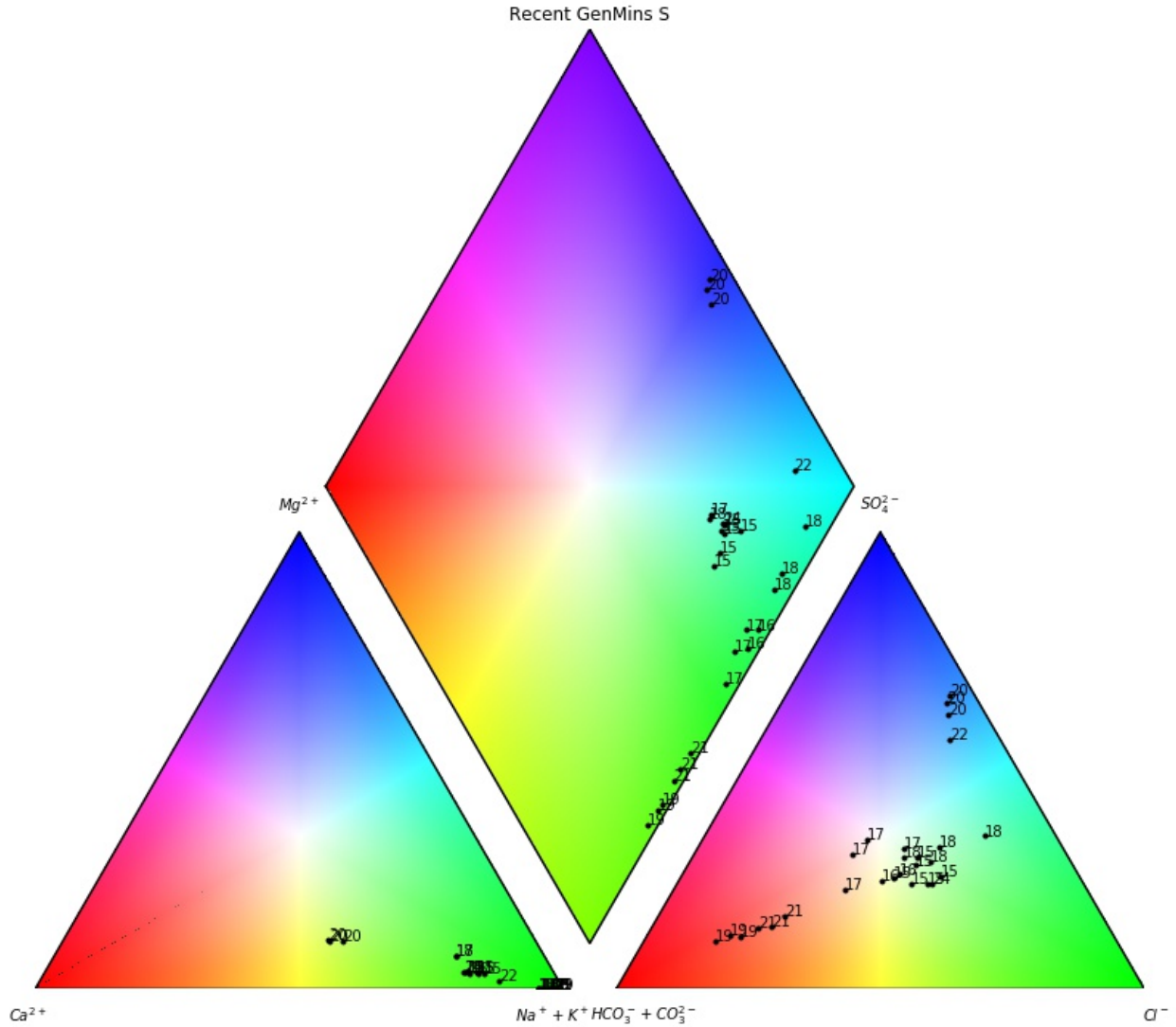
Recent Data: North and Central (Piper only)



Note: The number on the diagrams correspond to sequential well numbers assigned to each of the wells as explained in the text. Data are for the period of 2005 to 2018.

APPENDIX B: PIPER DIAGRAMS

Recent Data: South (Piper only)



Note: The number on the diagrams correspond to sequential well numbers assigned to each of the wells as explained in the text. Data are for the period of 2005 to 2018.

BORREGO WATER DISTRICT
BOARD OF DIRECTORS MEETING – JANUARY 8, 2019
AGENDA ITEM 2.B.6

January 2, 2019

TO: Board of Directors, Borrego Water District

FROM: Geoff Poole, General Manager

SUBJECT Holly Doremus, Professor of Law, University of California, Berkeley, “Adaptive Management as an Information Problem” (2011)

RECOMMENDED ACTION:

Review report from Director Brecht and direct staff accordingly

ITEM EXPLANATION:

Director Brecht has requested this item be placed on the agenda

FISCAL IMPACT:

TBD

ATTACHMENTS:

1. Information from Professor Doremus

ADAPTIVE MANAGEMENT AS AN INFORMATION PROBLEM*

HOLLY DOREMUS**

Enthusiasm for adaptive management has outrun evaluation of its usefulness as a natural resource management tool. Policymakers routinely endorse, and frequently require, it. Managers and academic observers alike have tended to assume that adaptive management is uniformly the best strategy. Little has been said, particularly in the policy literature, about how to decide whether an adaptive management approach makes sense. Looking at adaptive management as an information problem, this Article argues that adaptive management should be used only when it promises to improve management outcomes sufficiently to justify the additional costs it imposes. An explicit formal analysis of the prospects for learning and the value of learning for management should precede any decision to engage in adaptive management. For large-scale, long-term, or high-profile adaptive management programs, that analysis should be reviewed by outside experts and periodically reexamined. The type of analysis recommended here would help limit the use of adaptive management to appropriate circumstances, improve implementation when adaptive management is adopted, and enhance accountability. It would also highlight situations in which learning would be valuable for managers but appears too costly or difficult. The analysis should highlight barriers to learning. Many will be context specific, but others are systematic. This Article offers suggestions for addressing some of the most common systematic impediments to learning.

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* © 2011 Holly Doremus.

** Professor of Law, University of California, Berkeley. I am grateful to Eric Biber, Meg Caldwell, Alex Camacho, Victor Flatt, Yee Huang, Rebecca Shaw, Debbie Sivas, Rena Steinzor, Buzz Thompson, and participants at the North Carolina Law Review symposium *Adaptation and Resiliency in Legal Systems* and the Stanford Law School Environment and Energy Workshop for comments and discussions that helped clarify my thinking on this topic. Of course all remaining shortcomings are mine alone.

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INTRODUCTION

This symposium broadly considers the ability of law to change in response to changing circumstances and knowledge (adaptive capacity), and to retain its fundamental form in the face of exogenous challenges (resilience).¹ In the natural resource management context, the current interest in resilience and adaptability is largely driven by climate change, which raises questions about whether law can keep up with an environment whose rate of change exceeds that for which human institutions were designed, and whether existing law can withstand the new stresses it is beginning to encounter.² This Article approaches those questions through the lens of adaptive management, a strategy that theoretically promotes both adaptation and resilience. I argue that, despite its theoretical appeal, adaptive management is not useful for all management problems and should not be adopted without an explicit evaluation of its benefits and costs.

Adaptive management arouses both much enthusiasm and much skepticism.³ The theory is an attractive one, promising a way to make decisions in the face of current uncertainty while also reducing uncertainty over time.⁴ The core concept of adaptive management is that the

1. For definitions of both resilience and adaptive capacity, see J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems — with Applications to Climate Change Adaptation*, 89 N.C. L. REV. 1373, 1375–76, 1388 (2011).

2. See generally Alejandro E. Camacho, *Transforming the Means and Ends of Natural Resources Management*, 89 N.C. L. REV. 1405 (2011) (discussing the extent to which climate change exacerbates existing resource management challenges and introduces new ones).

3. The literature “tells a conflicting story; one could conclude that adaptive management should either be relied upon heavily or criticized sharply when considering solutions to challenging resource management problems.” R. Gregory et al., *Deconstructing Adaptive Management: Criteria for Applications to Environmental Management*, 16 ECOLOGICAL APPLICATIONS 2411, 2411 (2006).

4. See, e.g., James E. Lyons et al., *Monitoring in the Context of Structured Decision-Making and Adaptive Management*, 72 J. WILDLIFE MGMT. 1683, 1691 (2008) (“Adaptive management has been widely recognized as having tremendous potential to solve problems in

management process should incorporate, rather than follow, learning about the managed system. An adaptive management framework explicitly builds in opportunities for learning and adjustment.⁵ Ideally, that creates a resilient institutional structure for adapting to change.

Enthusiasm has spilled over to the policy arena, where adaptive management is now routinely endorsed, and even mandated.⁶ When it comes to implementation, however, skepticism becomes the rule. Documented instances of successful adaptive management are rare,⁷ and many touted examples diverge significantly from the theoretical ideal.⁸ Furthermore, adaptive management can create a new type of accountability problem, providing cover that allows resource management agencies to put off imposing politically controversial limits on economic activity.⁹

I share the skepticism about the politics of adaptive management, but I also share the sense that it is both inevitable and in some contexts desirable. That makes it important to examine and deal with its challenges. And that, in turn, is a tall order. Adaptive management is like the elephant being examined by the blind men in the well-known tale: every different aspect explored reveals a new challenge.

Several of the challenges have been recognized and are being addressed from both scientific and policy perspectives. Without denigrating their importance, therefore, I set them aside here. There is no question that

natural resource management, and calls for implementation of adaptive management are becoming more common . . .”).

5. See discussion *infra* Part I.A.2–3.

6. See, e.g., CAL. WATER CODE § 85308(f) (Deering 2010) (mandating that a management plan, to be prepared by the newly established Delta Stewardship Council, include “a science-based, transparent, and formal adaptive management strategy for ongoing ecosystem restoration and water management decisions”); Chesapeake Bay Protection and Restoration, Exec. Order No. 13,508, § 203(e), 74 Fed. Reg. 23,099, 23,100 (May 12, 2009) (requiring that federal agencies develop a Chesapeake Bay strategy that, among other things, “describe[s] a process for the implementation of adaptive management principles, including a periodic evaluation of protection and restoration activities”); Eric Biber, *The Problem of Environmental Monitoring Problem*, 83 U. COLO. L. REV. (forthcoming 2011) (manuscript at 4), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1680000 (noting that agencies have embraced adaptive management); J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424, 424 (2010) (explaining that adaptive management “has become infused into the natural resources policy world to the point of ubiquity”).

7. See, e.g., Catherine Allan & Allan Curtis, *Nipped in the Bud: Why Regional Scale Adaptive Management Is Not Blooming*, 36 ENVTL. MGMT. 414, 417 (2005); Beth C. Bryant, *Adapting to Uncertainty: Law, Science, and Management in the Steller Sea Lion Controversy*, 28 STAN. ENVTL. L.J. 171, 209 (2009) (noting that large-scale adaptive management experimentation “presently suffers from a sorry success rate”).

8. Gregory et al., *supra* note 3, at 2411.

9. Holly Doremus, *Adaptive Management, the Endangered Species Act, and the Institutional Challenges of “New Age” Environmental Protection*, 41 WASHBURN L.J. 50, 52 (2001); Gregory et al., *supra* note 3, at 2411.

adaptive management poses incentives problems, accountability problems, and flexibility problems.¹⁰ In this Article, however, I choose to focus on a different part of the elephant, one that has been less explored by policy wonks. Adaptive management is, in important ways, an information problem. It depends on the ability to fill information gaps over time under challenging conditions. It cannot be used appropriately or effectively without confronting that piece of the puzzle. I make no claim that information is the entire elephant—of course it is not. What I do claim, though, is that information is an important part of the elephant, one that deserves more of our attention.

I focus on information for three reasons. First, the information problem inherent in adaptive management is logically prior to the incentives, accountability, and flexibility problems when deciding whether to use adaptive management in a specific context. Only if learning is feasible does it make sense to worry about whether managers want to learn, can be forced to learn, or can use knowledge they acquire. Asking the information question is therefore a way of asking whether adaptive management can succeed under a best-case scenario. If the answer is yes, additional questions must still be asked about how close we can come to that best case. But if the answer is no, those other problems are irrelevant; adaptive management simply is not a useful choice.

Second, there is good reason to think that the information problem will frequently be a difficult one. Adaptive management poses an underappreciated information conundrum.¹¹ It is needed only when lack of information undermines confidence in management decisions. It is substantively (as opposed to politically) useful, however, only if that inadequate information base can and will be supplemented over time in a way that increases confidence in future decisions. The learning needed to make adaptive management successful will often be difficult, even with the right motivation. It will typically be costly, requiring added modeling, monitoring, and data evaluation. The extra resources adaptive management requires will not be well spent unless they produce useful information.

Finally, the information problem represents a gap in the literature. Although some ecologists and economists have recognized the information

10. A number of authors have discussed these problems. Examples include Alejandro E. Camacho, *Can Regulation Evolve? Lessons from a Study in Maladaptive Management*, 55 UCLA L. REV. 293, 323–35 (2007); Doremus, *supra* note 9, at 52–56; Ruhl & Fischman, *supra* note 6, at 476; J.B. Ruhl, *Regulation by Adaptive Management: Is It Possible?*, 7 MINN. J. L. SCI. & TECH. 21, 53 (2005); John M. Volkman & Willis E. McConnaha, *Through a Glass Darkly: Columbia River Salmon, the Endangered Species Act, and Adaptive Management*, 23 ENVTL. L. 1249, 1256–63 (1993).

11. See discussion *infra* Part I.A.1.

problem and begun to develop decision support tools to address it,¹² other thoughtful commentators still leave it out of their descriptions of the prerequisites for adaptive management,¹³ and policy scholars seem not yet to have given it much thought. Perhaps that is because solutions to the information problem seem, at least at first glance, to lie peculiarly within the expertise of natural scientists. Certainly natural science has a crucial role to play, providing tools and techniques for undertaking and interpreting experiments or other information-gathering efforts. But factors within the realm of law and policy are also important because they can facilitate or complicate data generation, sharing, interpretation, and use.

This Article explores the policy and institutional context for the acquisition and use of information in the course of adaptive management. The analysis builds on my earlier work on the “information supply pipeline,” the sequence of steps needed to take information from the discovery phase to use in decisionmaking.¹⁴ I assume for purposes of this analysis that managers are making good faith efforts to achieve the goals set out by their governing statutes and regulations.¹⁵ I am under no illusion that this assumption is always (or even generally) correct. Indeed, the conviction that managers cannot be trusted surely motivates much of the work on the need to build accountability into adaptive management efforts.¹⁶ But making this assumption allows me to highlight challenges

12. See, e.g., Eli P. Fenichel & Gretchen J.A. Hansen, *The Opportunity Cost of Information: An Economic Framework for Understanding the Balance Between Assessment and Control in Sea Lamprey (*Petromyzon marinus*) Management*, 67 CANADIAN J. FISHERIES & AQUATIC SCI. 209, 210 (2010); Gregory et al., *supra* note 3, at 2412; Julien Martin et al., *Structured Decision Making as a Conceptual Framework to Identify Thresholds for Conservation and Management*, 19 ECOLOGICAL APPLICATIONS 1079, 1089 (2009); Tracy M. Rout et al., *Optimal Adaptive Management for the Translocation of a Threatened Species*, 19 ECOLOGICAL APPLICATIONS 515, 515 (2009); Michael C. Runge et al., *Which Uncertainty? Using Expert Elicitation and Expected Value of Information to Design an Adaptive Program*, 144 BIOLOGICAL CONSERVATION 1214, 1214–16 (2011).

13. See, e.g., Lyons et al., *supra* note 4, at 1691 (describing adaptive management as “the most effective and efficient way to achieve management objectives” when the basic conditions of a series of sequential decisions, uncertainty, and the ability to adjust are met, with no mention of the ability to learn).

14. See generally Holly Doremus, *Data Gaps in Natural Resource Management: Sniffing for Leaks Along the Information Pipeline*, 83 IND. L.J. 407 (2008).

15. I also assume that managers have as much access to information as the regulated community. Because my focus here is on public resource management, that is often, although not always, a good assumption. To the extent that actions affecting managed resources require government approval, it will generally be legally possible to require that those seeking approval provide needed information.

16. See, e.g., Bruce Pardy, *The Pardy-Ruhl Dialogue on Ecosystem Management Part V: Discretion, Complex Adaptive Problem Solving and the Rule of Law*, 25 PACE ENVTL. L. REV. 341, 347 (2008) (decrying the degree of administrative discretion in natural resource management). On the prevalence of the principal-agent problem in natural resource management

distinct from the motivations of resource managers, challenges which must be dealt with even if the incentives and accountability problems are solved.

Analyzing adaptive management as an information problem produces two pragmatically useful results. First, and perhaps most important, it encourages recognition that adaptive management is not always a desirable strategy and points to ways to determine whether adaptive management will be helpful in specific contexts. The current enthusiasm for adaptive management in the policy sector seems to ignore this step. There is debate about how to do adaptive management and a fair amount of handwringing about why it is not more fully pursued,¹⁷ but not enough discussion about whether it ought to be used.¹⁸

That needs to change. Adaptive management is not an end in itself, nor is it always useful. It is a tool that can improve management outcomes over time in some contexts. It does not come free, however. Both the decision to employ adaptive management and decisions about how to implement it involve tradeoffs. Adaptive management increases the costs of management, complicates oversight, imposes added institutional demands, and is subject to misuse for political ends.¹⁹ It requires striking a balance between short-term management objectives and long-term learning, between devoting resources to management and to monitoring,²⁰ and between finality and endless political squabbling.²¹ It should only be used when the benefits of learning exceed those costs over the relevant time frame.

In order to make sure that adaptive management is employed only where it should be, and before deciding to implement it, resource managers should undertake, and policymakers should require, an explicit, formalized analysis of the prospects for learning and its expected value for management. That analysis, which ideally should be reviewed by leading technical experts outside the management agency and periodically

and the need for accountability mechanisms to hold agencies to their statutorily assigned tasks, see Holly Doremus, *Using Science in a Political World: The Importance of Transparency in Natural Resource Regulation*, in *RESCUING SCIENCE FROM POLITICS* 143, 144–45 (Wendy Wagner & Rena Steinzor eds., 2006).

17. See, e.g., Carl Walters, *Challenges in Adaptive Management of Riparian and Coastal Ecosystems*, *CONSERVATION ECOLOGY* (June 1997), <http://www.ecologyandsociety.org/vol1/iss2/art1/> (evaluating the “low success rates in implementing adaptive management”).

18. For an exception, see Gregory et al., *supra* note 3, at 2414 (offering four criteria for deciding whether the use of adaptive management is appropriate). Their analysis, however, ends up focusing as much on the details of implementing adaptive management as on the choice of whether to implement it.

19. See *infra* text accompanying notes 91–95.

20. See *infra* text accompanying note 95.

21. See *infra* text accompanying note 94.

reexamined, can serve valuable internal and external ends. Internally, it can force managers to confront their assumptions about the system and their information needs, providing a kind of intellectual discipline that prepares the groundwork for learning. A thorough pre-adoption review of the prospects for adaptive management improves any adaptive management program ultimately adopted. Externally, it can provide a different kind of discipline, enhancing accountability to management goals by forcing managers to explain how they expect adaptive management to help them achieve those goals.

Second, approaching adaptive management as an information problem highlights systematic barriers to learning which can be reduced by changes in law, policy, or institutional structure. While a formal evaluation of the tradeoffs should be a prerequisite to adaptive management, it is important to recognize that the calculus of learning is not fixed. If the evaluation suggests that learning will be difficult or costly, that need not be the end of the matter. Recognizing barriers to gathering, exchanging, or using information is the first step in reducing those barriers. It may turn out that some are illusory, or at least not as high as they appear, while others can be reduced through targeted or general policy choices.

Of course, many information challenges are context-specific and cannot be resolved or even recognized outside that context. There are some, however, which occur across a range of management contexts. At least some of these systematic challenges can be proactively addressed. Rapid diffusion of data, analytic tools, and theoretical insights is one recurring problem.²² There are relatively straightforward (though not necessarily easy) ways to encourage better movement of information through the system. Other recurring challenges may require deeper policy and institutional changes that are not likely to occur unless their potential to improve management outcomes is recognized. Information generation can be promoted by designating areas for experimentation and crafting general rules specifying the conditions under which management experiments can be conducted. Information utilization can be promoted through employee selection and training, institutional design, and building more effective connections between academic and applied scientists.

The argument proceeds in two major Parts. The first sets out a framework for evaluating the usefulness of adaptive management. It begins by reviewing the elements that must be present before adaptive management should even be considered. It then considers in more detail how the most challenging of those elements, the costs and benefits (broadly defined) of learning, should be evaluated and proposes a formal analytic

22. Doremus, *supra* note 14, at 434–39.

approach. The second Part takes up the question of what to do when the benefits of learning appear high but are matched or exceeded by the costs. It contends that some systematic barriers to learning can be addressed through policy measures and offers recommendations. Finally, the Conclusion briefly recaps the argument and key recommendations.

I. EVALUATING ADAPTIVE MANAGEMENT IN CONTEXT

It is common ground at this point that natural resource management²³ decisions must typically be made in the face of incomplete knowledge about the systems being managed.²⁴ Knowledge gaps impede management success in a variety of ways. Most obviously, they undermine confidence in management decisions, because actions taken under uncertainty might move the system away from rather than toward the desired outcome. In addition to raising the risk of management failure, knowledge gaps can be paralyzing if managers are risk averse, preferring passivity to taking the chance that their actions will make the situation worse.²⁵ That sort of passivity might be desirable from a conservation perspective where the relevant decision is whether or not to permit new environmental impacts,

23. I use the terms “natural resource management” and “natural resource managers” in this Article inclusively, to refer to those responsible for managing public natural resources, such as the U.S. Forest Service (“USFS”) and National Park Service, to those responsible for managing built systems that use or impinge on public resources, such as officials at the Bureau of Reclamation and U.S. Army Corps of Engineers, and also to regulators responsible for setting limits on resource extraction and use, such as the U.S. Fish and Wildlife Service (“FWS”) and National Marine Fisheries Service (“NMFS”).

24. See, e.g., Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 WASH. L. REV. 547, 548 (2007) (“Uncertainty is the unifying hallmark of environmental and natural resource regulation.”).

25. My view that many managers are risk averse in precisely this way may require some explanation. While I agree that resource management agencies often seem to bow to political pressures in ways that put the resources under their supervision at risk, that’s a different problem. Recall that for purposes of this Article I assume that managers are pursuing applicable statutory and regulatory goals in good faith. That assumption is, at a minimum, not universally false; although their urge to act protectively surely can be overcome by political pressures, often managers do try to protect the resources they are charged with overseeing. In that context, I think there is good evidence that at least some managers show risk aversion with respect to the tradeoffs between learning and risks to the resource, and there is little evidence that any are prone to risk-taking. Examples of risk aversion potentially inhibiting learning come from the reluctance of FWS to authorize experimental high flows on the Colorado River because of possible impacts on the Kanab ambersnail, Doremus, *supra* note 9, at 78–79, and the reluctance of water managers to expend the resources of the Environmental Water Account created by the federal-state CalFed program lest they be caught without water later when the fish could need it more, ENVTL. WATER ACCOUNT REVIEW PANEL, FIRST ANNUAL REVIEW OF THE ENVIRONMENTAL WATER ACCOUNT FOR THE CALFED BAY-DELTA PROGRAM 16 (2001), available at http://www.science.calwater.ca.gov/pdf/2001_EWA_Science_Review_Workshop.pdf.

but it is problematic where the status quo itself is harmful to the environment, as is often the case for managed natural systems.²⁶

Knowledge gaps also can interfere with political and judicial accountability. Uncertainty leaves managers free to make interpretive judgments. They can often conceal those judgments, and the reasons for the specific choices made, from public oversight with claims that they are simply following the science.²⁷ Uncertainty therefore makes it difficult for the public to discern whether managers are doing their best to follow legislative direction or instead bowing to political pressure. It also complicates judicial oversight. Federal courts must be at their “most deferential” when reviewing scientific determinations.²⁸ They generally will not disturb an agency’s interpretation of limited or conflicting data.²⁹ Uncertainty may, therefore, in effect, maximize management discretion.³⁰

Adaptive management has been touted as a way to deal with the information deficit, allowing action in the face of uncertainty in the short run while information gaps are filled in over the longer term.³¹ The concept was developed before large-scale anthropogenic climate disruption was widely recognized as a problem,³² but climate change makes it seem even more vital to effective resource management.³³

There is no universal definition of the term “adaptive management.” It has been used to describe a range of management strategies, but fundamentally any adaptive strategy must include at least two key features:

26. Doremus, *supra* note 24, at 555.

27. See Doremus, *supra* note 16, at 145–47.

28. *Balt. Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 103 (1983).

29. See Holly Doremus, *The Purposes, Effects, and Future of the Endangered Species Act’s Best Available Science Mandate*, 34 ENVTL. L. 397, 429–30 (2004) (explaining how courts approach reviews of technical decisions).

30. Biber, *supra* note 6, at 46–47; Doremus, *supra* note 24, at 574–77.

31. See, e.g., Robert W. Adler, *Restoring the Environment and Restoring Democracy: Lessons from the Colorado River*, 25 VA. ENVTL. L.J. 55, 102 (2007) (“The science community first embraced adaptive management as a way to address the immense gaps in our scientific knowledge and understanding of how ecosystems might respond to various changes in conditions, whether natural or artificial.”); A. Dan Tarlock, *Is There a There There in Environmental Law?*, 19 J. LAND USE & ENVTL. L. 213, 249 (2004) (“Adaptive management is designed to close the gap between the available information and the information needed to make sound environmental decisions.”).

32. The foundational works on adaptive management are ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT (C.S. Holling ed., 1978) and CARL WALTERS, ADAPTIVE MANAGEMENT OF RENEWABLE RESOURCES (1986).

33. See, e.g., Joshua J. Lawler, *Climate Change Adaptation Strategies for Resource Management and Conservation Planning*, 1162 ANNALS N.Y. ACAD. SCI. 79, 86 (2009) (noting that for all its challenges, adaptive management “is still likely to be one of the best tools managers and scientists have to address climate change and to learn about its effects”).

iterative decisionmaking and a commitment to learning over time.³⁴ As originally envisioned by its primary architects, adaptive management was a reaction to the perceived inadequacies of management based on pre-decision comprehensive analysis.³⁵

In fact, many natural resource decisions need not be made once and for all at the “front end.” For large managed systems, like the Florida Everglades, Chesapeake Bay, California Bay-Delta, national forests, and national parks, decision points recur over time, providing repeated opportunities for reconsideration and adjustment. In other contexts, such as permits to fill wetlands or even permits to bury streams with the waste from mountaintop removal mining, individual decisions are made only once but the same type of decision is confronted repeatedly. Although individual decisions cannot be reversed, the effects of those decisions can inform later ones. Where either direct or indirect opportunities exist for “back end”³⁶ adjustment, management can be designed as a learning strategy.

Early proponents of adaptive management suggested that the most efficient path to increased knowledge would be to design management actions as deliberate and, to the extent possible, controlled experiments to test explicit hypotheses about the system. That strategy has come to be known as “active adaptive management.”³⁷ Another version, known as

34. See, e.g., NAT'L RESEARCH COUNCIL, ADAPTIVE MANAGEMENT FOR WATER RESOURCES PLANNING 2 (2004) (“There are multiple views and definitions regarding adaptive management, but elements that have been identified in theory and in practice are: management objectives that are regularly revisited and accordingly revised, a model(s) of the system being managed, a range of management options, monitoring and evaluating outcomes of management actions, mechanisms for incorporating learning into future decisions, and a collaborative structure for stakeholder participation and learning.”). Unlike some adaptive management proponents, I do not include collaborative decisionmaking as a fundamental element. Adaptive management is a learning approach to management. Collaboration is one possible method for making management decisions, but it is not essential to learning, and in some circumstances might even be an impediment. Whether and in what circumstances collaborative management might be appropriate is a distinct question from whether adaptive management is appropriate, and the two are best addressed separately.

35. Brad Karkkainen traces the roots of adaptive management much further back than the work of Walters and Holling, locating them in the pragmatism of John Dewey. Bradley C. Karkkainen, *Adaptive Ecosystem Management and Regulatory Penalty Defaults: Toward a Bounded Pragmatism*, 87 MINN. L. REV. 943, 957–59 (2003). Others have made the same connection. See, e.g., KAI N. LEE, COMPASS AND GYROSCOPE—INTEGRATING SCIENCE AND POLITICS FOR THE ENVIRONMENT 91–92, 100–01 (1993); BRYAN G. NORTON, SUSTAINABILITY: A PHILOSOPHY OF ADAPTIVE ECOSYSTEM MANAGEMENT 78–82 (2005).

36. On the “front end/back end” distinction and the need to be able to adjust policies based on new information, see SIDNEY A. SHAPIRO & ROBERT L. GLICKSMAN, RISK REGULATION AT RISK: RESTORING A PRAGMATIC APPROACH 177 (2003).

37. WALTERS, *supra* note 32, at 232. For a concise explanation of the distinction between active and passive adaptive management, see Julie Thrower, *Adaptive Management and NEPA: How a Nonequilibrium View of Ecosystems Mandates Flexible Regulation*, 33 ECOLOGY L.Q. 871, 884–85 (2006).

“passive adaptive management,” however, has been more commonly implemented.³⁸ Passive adaptive management involves structured learning in the absence of deliberate management experimentation.³⁹ It relies on monitoring the outcomes of management and using the information gained to update beliefs about how the system operates. In either form, adaptive management implies a humble attitude,⁴⁰ anticipating the possibility of surprise and being prepared to detect and correct management shortfalls.

Currently, policymakers seem uniformly excited about adaptive management. It has been mandated by federal and state legislation, adopted by regulation, and applied through guidance and informal mechanisms.⁴¹ Scholars are less sanguine. There is much enthusiasm for the concept; indeed, given the shortage of front-end knowledge about ecosystems and species, most observers agree that some form of adaptive management is a necessity in many systems.⁴² Nonetheless, questions remain about both its feasibility and its potential political pitfalls. On the feasibility side, it is not clear that the law always does, or even should, offer enough flexibility to make adaptive management possible.⁴³ On the political side, claims of adaptive management have been criticized as a false front, allowing

38. Allan & Curtis, *supra* note 7, at 415.

39. WALTERS, *supra* note 32, at 248–52. Brad Karkkainen has provided an excellent, concise explanation of the difference between active and passive adaptive management. Karkkainen, *supra* note 35, at 950.

40. Virginie Maris & Arnaud Béchet, *From Adaptive Management to Adjustive Management: A Pragmatic Account of Biodiversity Values*, 24 CONSERVATION BIOLOGY 966, 967 (2010).

41. In addition to the sources cited *supra* note 6, a few examples include 32 C.F.R. § 651.4(f)(3) (2010) (requiring that the Army’s director of environmental programs “[m]onitor proposed Army policy and program documents that have environmental implications to determine compliance with National Environmental Policy Act (“NEPA”) requirements and ensure integration of environmental considerations into decision-making and adaptive management processes”); 33 C.F.R. § 332.4(c)(12) (2010) (requiring that mitigation plan employ adaptive management to “guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success”); and 36 C.F.R. § 219.3(d)(8) (2010) (including “[m]onitoring and evaluation for adaptive management” among the key elements of USFS planning). As Professors Ruhl and Fischman explain, “With its core idea of ‘learning while doing,’ adaptive management ‘has become infused into the natural resources policy world to the point of ubiquity, surfacing in everything from mundane agency permits to grand presidential proclamations. Indeed, it is no exaggeration to suggest that these days adaptive management is natural resources policy.” Ruhl & Fischman, *supra* note 6, at 424–25 (citation omitted).

42. As J.B. Ruhl has pointed out, for example, “No serious assessment of the [Endangered Species Act] fails to conclude that adaptive management . . . is the preferred method of implementation.” J.B. Ruhl, *Taking Adaptive Management Seriously: A Case Study of the Endangered Species Act*, 52 U. KAN. L. REV. 1249, 1284 (2004).

43. Ruhl, *supra* note 10, at 31.

agencies to authorize environmental harm when it is uncertain whether the extent of harm will exceed applicable legal limits.⁴⁴

Neither of those challenges are my concern here. Instead, I start at the logical beginning. The first question to be asked is what advantages, if any, adaptive management offers in any particular natural resource management context. As explained in the next section, adaptive management should be considered only if, at a minimum, three conditions are met: there must be information gaps; learning must be feasible; and there must be opportunities for adjustment. Any decision to employ adaptive management should be supported by an explicit analysis of all three questions. Although that analysis need not be precise or quantitative, it should be sufficiently detailed to support the conclusion that the learning adaptive management is expected to generate will justify its costs. Requiring such an analysis at the outset would reduce the ability of policymakers or managers to use adaptive management as a tool for delaying or avoiding difficult decisions, counter temptations to convert management into a research exercise in which learning is pursued for its own sake or uncertainty becomes an endless excuse for inaction,⁴⁵ and improve the effectiveness of adaptive management when its use is appropriate.

A. *Prerequisites for Successful Adaptive Management*

Adaptive management is premised on the assumption that learning is both plausible and valuable. It makes logical sense only if three conditions are satisfied. First, there must be an information gap that is important to management choices. Second, it must seem possible to fill that gap on a management-relevant time scale. Third, it must seem possible to adjust the initial decision over time in response to new information.

1. Information Gaps

Adaptive resource management necessarily begins with an information problem. The very premise of adaptive management is that it will promote learning.⁴⁶ It is only useful if learning is needed, that is, if information gaps limit resource managers' ability to evaluate, at the initial time point, the likelihood that their choices will achieve management

44. Doremus, *supra* note 9, at 52.

45. See Fred A. Johnson et al., *Conditions and Limitations on Learning in the Adaptive Management of Mallard Harvests*, 30 WILDLIFE SOC'Y BULL. 176, 182 (2002) ("[M]anagers must be careful not to turn large-scale management into a research endeavor.").

46. See, e.g., Gregory et al., *supra* note 3, at 2412 ("The generally stated goal of [adaptive management] is to improve managers' knowledge . . .").

goals.⁴⁷ Absent such uncertainties, managers could confidently act on the basis of front-end knowledge. They would not need adaptive management to facilitate later adjustment.

Because there is so much we don't know about the systems we try to manage, uncertainty is nearly always great enough to justify invoking adaptive management. Natural systems are not static; they change over time in ways that are difficult to predict.⁴⁸ Climate change exacerbates the prediction challenge, increasing the probability that managed systems will change rapidly, in unexpected ways, and outside known historical boundaries.⁴⁹ But the move toward adaptive management predates widespread concern about climate change because there is more to the information challenge than instability. The complex connections among biotic and abiotic elements of ecosystems are often poorly understood, as are responses to management actions.⁵⁰ Even far less esoteric knowledge,

47. I am concerned here only with technical uncertainties, primarily natural science uncertainties about the functioning of a species or ecological system and social science uncertainties about changes in human pressures on systems. For purposes of this Article, I put aside issues of "normative uncertainty," lack of knowledge about the values people place on managed resources, and the potential for changes in those values. *See* Maris & Béchet, *supra* note 40, at 966. I recognize the importance of that type of uncertainty and unpredictability, particularly in the context of the massive reshuffling of the earth's systems that greenhouse gas accumulation is causing. Certainly we need measures for exploring societal conservation values and for adjusting management efforts in response to durable value changes. But that is a set of issues for another article. Here I follow the lead of early scientific advocates of adaptive management, who assumed that management goals are exogenously fixed. *See, e.g.,* Byron K. Williams et al., *Uncertainty and the Adaptive Management of Waterfowl Harvests*, 60 J. WILDLIFE MGMT. 223, 224 (1996) (describing adaptive management as "the ability to make optimal decisions over time pursuant to stated objectives, in the face of uncertainty and recognizing some constraints").

48. *See, e.g.,* Gordon H. Reeves & Sally L. Duncan, *Ecological History vs. Social Expectations: Managing Aquatic Ecosystems*, ECOLOGY & SOC'Y (Dec. 2009), <http://www.ecologyandsociety.org/vol14/iss2/art8/>.

49. Climate disruption is rapidly disassembling today's climate envelopes and biotic communities and reassembling them in ways that have no current analog. *See* Robert L. Glicksman, *Ecosystem Resilience to Disruptions Linked to Global Climate Change: An Adaptive Approach to Federal Land Management*, 87 NEB. L. REV. 833, 844-49 (2009); J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 17-26 (2008); John W. Williams et al., *Projected Distributions of Novel and Disappearing Climates by 2100 AD*, 104 PROC. NAT'L ACAD. SCI. 5738, 5738 (2007). Although natural resource management has long been plagued by uncertainty, climate change "raise[s] uncertainty to a level humans have never encountered and governments have never attempted to manage." Alejandro E. Camacho, *Adapting Governance to Climate Change: Managing Uncertainty Through a Learning Infrastructure*, 59 EMORY L.J. 1, 15 (2009).

50. On the complexity of environmental systems and the difficulties that complexity poses, *see* Bryant, *supra* note 7, at 175-76 (explaining that at least nine theories have been offered to explain the decline of the Stellar sea lion); Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145, 148-55 (2003); Stephanie Tai, *When Natural Science Meets the Dismal Science*, 42 ARIZ. ST. L.J. 949, 958-59 (2010). Lack of knowledge about underlying biological mechanisms, and the corresponding lack of ability to predict responses to management, has been called "structural uncertainty." Williams

such as population sizes and trends, habitat requirements, and basic life history information is frequently lacking. Finally, the control of managed systems is always less than perfect. Rules do not automatically generate absolute compliance,⁵¹ tracking of resource use may be poor,⁵² and it may not be possible to keep the system within desired management parameters. Under the circumstances, the only real surprise for managers would be if they weren't surprised by the way the system reacts to their efforts and outside events over the course of time.

Although this requirement will rarely turn us away from adaptive management, directly confronting it is an important prerequisite to undertaking effective adaptive management. For one thing, it emphasizes the need for clear goals set exogenously to the adaptive management process. Without identified management goals, it is impossible to understand what relevant information is missing. Looking for information gaps, therefore, necessarily forces managers to identify their goals and to seek clarification if those goals are inadequately defined.

Surprisingly, a substantial portion of the adaptive management literature rejects the idea that goals are exogenous to the adaptive management process. Although there are those who contend that clear goals are a necessary starting point for adaptive management,⁵³ others, including some leading adaptive management theorists, argue that management goals themselves should be evaluated and reconsidered as part of the adaptive management cycle.⁵⁴ That view is mistaken; it seeks to sweep too much into a process with important limitations. Management

et al., *supra* note 47, at 225. Structural uncertainty may be rampant even in systems with a long history of management. *See id.* As an example, although migratory waterfowl harvest has long been regulated, the relationship between harvest levels and population changes has been obscured by uncertainty about whether harvest adds another source of mortality or simply replaces other causes of death. *Id.* at 225–26.

51. Williams et al., *supra* note 47, at 225.

52. In California, for example, where limited water resources are the subject of constant conflict, many diversions are still not directly monitored. Elliot Rector, *From Paper to the Real World: Stopping Illegal Water Diversions in California*, ENVTL. DEF. FUND (Aug. 4, 2010), <http://blogs.edf.org/waterfront/2010/08/04/from-paper-to-the-real-world-stopping-illegal-water-diversions-in-california/>. Although diverters are required to file statements of diversion, enforcement has been weak. *Id.* Last year a bill that would have strengthened enforcement and monitoring measures stalled because of opposition from water users. S.B. 565, 2009–2010 Leg., Reg. Sess. (Cal. 2010), available at http://www.leginfo.ca.gov/pub/09-10/bill/sen/sb_05510600/sb_565_bill_20100816_amended_asm_v92.pdf; Dan Bacher, *Delta Advocates Oppose Fran Pavley's SB 565*, INDYBAY (Aug. 25, 2010), <http://www.indybay.org/newsitems/2010/08/25/18656797.php>; Rector, *supra*.

53. *See, e.g.*, Lyons et al., *supra* note 4, at 1684 (“A clear statement of objectives is essential.”).

54. *See, e.g.*, LEE, *supra* note 35, at 62–63; NAT'L RESEARCH COUNCIL, *supra* note 34, at 24.

goals for public and quasi-public natural resources are, and should be, politically determined. What resources society should protect, and what tradeoffs it should make between conservation and other values are not scientific questions. The answers are a function of social values rather than of technical understanding. Surely those values shift over time, and goals must periodically be reexamined and adjusted. But adaptive management as it is conventionally practiced does not provide the right forum for making such adjustments.

Adaptive management structures typically require periodic meetings of a select group to review data and technical documents.⁵⁵ Those meetings are effectively inaccessible to most members of the public. Only those with enough of a stake in the outcome to devote large amounts of time to it will even bother, and only technical experts or those who can afford to hire experts will be comfortable with the discussion.⁵⁶ Furthermore, management quickly becomes unwieldy as the size of the group increases; as a practical matter, adaptive management is incompatible with a large-scale, generalized, open-invitation political process. It is not, therefore, the right place to make decisions which should take account of all views.

A second benefit of explicitly identifying information gaps is that it would focus the attention of managers on areas where learning would be most helpful and encourage them to identify uncertainties that may be hidden within their assumptions. Forcing people to explain and justify their understanding of a system sometimes leads to the discovery that they do not understand parts of it as well as they thought. Simply going through the exercise of drafting a model of the system and thinking through the various factors that might affect the ability to achieve management goals can help raise awareness of possibilities that might otherwise not be considered until much later.

Finally, an explicit information gap analysis is the first step in identifying why information is missing and how it might be obtained. As discussed in more detail below, there are many potential sources of uncertainty, and distinguishing between them is crucial to understanding how likely it is that learning will occur, at what cost, and by what pathways.

55. See, e.g., Lawrence Susskind et al., *Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale*, 35 COLUM. J. ENVTL. L. 1, 21–24 (2010) (describing the structure of the adaptive management program for Glen Canyon).

56. See Joseph M. Feller, *Collaborative Management of Glen Canyon Dam: The Elevation of Social Engineering over Law*, 8 NEV. L.J. 896, 931–33 (2008) (describing dominance of economic interests in Glen Canyon adaptive management program).

2. Good Prospects for Learning

The second requirement for successful adaptive management is the ability to learn. Adaptive management will not improve management outcomes unless important information gaps are narrowed over time. But therein lies a conundrum. If we know so little at the outset that we feel the need for adaptive management, why should we believe that we can learn rapidly enough to be able to correct management mistakes? The answer turns on the sources of initial uncertainty and the relevant management timeframe.

If the source of key information gaps is simply that it is difficult to predict exogenous future changes to a managed system, then opportunities for learning should be plentiful and relatively inexpensive. As the future unfolds, some things will become apparent. For example, there is currently considerable uncertainty about how global warming will affect precipitation in California.⁵⁷ That makes it difficult for those who manage the state's water system to plan for the future, and in turn for those responsible for the conservation of aquatic ecosystems to evaluate the effects of water management on their charges. There is nothing conceptually difficult, however, about learning over time how precipitation patterns are changing. It requires only regular observation coupled with regular updating of the climate models. That sort of learning does not seem to require any special efforts, and we can have high confidence that it will occur.

That does not automatically mean that adaptive management will always be useful where uncertainty is primarily a matter of seeing how the future develops. That depends not only on the ability to fill information gaps but on the speed with which learning will occur. Although we can be confident that we will learn over time about altered precipitation regimes, we cannot be as confident that we will learn quickly. Because California's annual rainfall is already highly variable, and it is expected to become more so,⁵⁸ it may take many years before the new regime is well enough understood to support confident management decisions. Furthermore,

57. For the Sacramento region, for example, six global climate models project that precipitation may decrease by nearly twenty percent or increase slightly by the end of this century. CAL. DEP'T OF WATER RES., USING FUTURE CLIMATE PROJECTIONS TO SUPPORT WATER RESOURCES DECISION MAKING IN CALIFORNIA 8 (2009), available at <http://www.energy.ca.gov/2009publications/CEC-500-2009-052/CEC-500-2009-052-F.PDF>.

58. See Bohumil M. Svoma & Robert C. Balling, Jr., *United States Interannual Precipitation Variability over the Past Century: Is Variability Increasing As Predicted by Models?*, 31 PHYSICAL GEOGRAPHY 307, 307-08 (2010).

because change will continue for decades or centuries,⁵⁹ the process of updating our understanding will have to continue as well.

Another common source of uncertainty is lack of knowledge about how potential management actions will change the system. Like uncertainty about the future, this type of uncertainty will sometimes be conceptually easy to address. Trial and observation may be all we need to reduce it. But observation is sometimes difficult, and again this sort of learning may take a long time by management standards. The Chesapeake Bay, for example, is impacted by nutrient pollution from many sources, including runoff from agricultural lands.⁶⁰ Although it is widely agreed that dealing with the Bay's pollution problem will require some changes to management of those lands, the learning curve will not be rapid.⁶¹ Scientists working on water quality in the region believe it will take at least nine years to recognize how changes in agricultural practices affect water quality in the Bay.⁶² Nutrient pollution from farming practices also affects the Gulf of Mexico; runoff conveyed via the Mississippi River system is believed to be largely responsible for the low-oxygen "dead zone" which develops in the Gulf every summer.⁶³ Given the larger size of the watershed and greater distance from the estuary, connecting changes in agricultural practices to water quality in the Gulf with any degree of confidence could take decades.⁶⁴

Other uncertainties carry a time lag for institutional rather than scientific reasons. In the Gulf of Mexico, for example, nutrient loading does not come entirely from nonpoint sources. The precise contribution of point sources such as wastewater treatment plants is not known, however, because few sources directly monitor their effluent for nutrients.⁶⁵ In theory, monitoring could be instituted immediately and would immediately provide useful information. There is even a ready-made institutional hook

59. See, e.g., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP 1 TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 1–18 (Susan Solomon et al. eds., 2007); Susan Solomon et al., *Persistence of Climate Changes Due to a Range of Greenhouse Gases*, 107 PROC. NAT'L ACAD. SCI. 18,354, 18,354–55 (2010).

60. U.S. ENVTL. PROT. AGENCY, CHESAPEAKE BAY TMDL EXECUTIVE SUMMARY, at ES-3 (2010), http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/BayTMDLExecutiveSummaryFINAL122910_final.pdf.

61. See COMM. ON THE MISS. RIVER & THE CLEAN WATER ACT, NAT'L RESEARCH COUNCIL, NUTRIENT CONTROL ACTIONS FOR IMPROVING WATER QUALITY IN THE MISSISSIPPI RIVER BASIN AND NORTHERN GULF OF MEXICO 21 (2009) [hereinafter NUTRIENT CONTROL ACTIONS].

62. *Id.*

63. *Id.* at 18, 21.

64. *Id.* at 21.

65. *Id.* at 15.

for imposing nutrient monitoring requirements: point sources must have discharge permits,⁶⁶ and those permits must require monitoring and reporting of discharges.⁶⁷ Regulators can require point sources which discharge nutrients into impaired waterways to monitor and report the nutrient content of their effluent. But that can't be done overnight. Regulators must wait until permits are renewed to impose new conditions. That should not introduce a lengthy lag; under the federal Clean Water Act, discharge permits have a nominal five-year life span.⁶⁸ In practice, however, many permits are allowed to run much longer than five years.⁶⁹ Regulatory agencies simply do not have the resources to review and revise each of the hundreds of thousands of discharge permits nationwide⁷⁰ every five years.

Learning about changes wrought by management actions is also conceptually straightforward, but the practical challenges quickly become steep. At the outset, we may have little confidence in our predictions about, for example, how restoring a seasonal floodplain will affect the population of an endangered fish that used to spawn on the site.⁷¹ Monitoring population size and breeding success following restoration efforts should help us figure out how the fish have responded. The data are not likely to be as clearcut or easy to acquire as temperature and precipitation data,

66. See 33 U.S.C. §§ 1311, 1342, 1362(6), 1362(7), 1362(12) (2006).

67. 40 C.F.R. § 122.41 (2010).

68. 33 U.S.C. § 1342(b)(1)(B).

69. Permits are administratively continued if the permittee timely files for renewal. Permits which are continued pending renewal are described as "backlogged." *NPDES Permit Program Basics*, U.S. ENVTL. PROT. AGENCY, http://cfpub.epa.gov/npdes/home.cfm?program_id=45 (last visited Apr. 13, 2011). The Environmental Protection Agency's ("EPA") most recent backlog report shows that between ten and twenty percent of permits (depending on the region) are backlogged. U.S. ENVTL. PROT. AGENCY, PERMIT STATUS REPORT FOR NON-TRIBAL MAJOR INDIVIDUAL, MINOR INDIVIDUAL, AND NON-STORMWATER GENERAL PERMIT COVERED FACILITIES—DECEMBER 2009 (1), at 1–2, available at http://www.epa.gov/npdes/pubs/grade_all.pdf.

70. As of 2001, EPA reported that more than 400,000 facilities nationwide were required to have National Pollutant Discharge Elimination System ("NPDES") permits, and that number was growing. OFFICE OF WATER, U.S. ENVTL. PROT. AGENCY, PROTECTING THE NATION'S WATERS THROUGH EFFECTIVE NPDES PERMITS: A STRATEGIC PLAN, FY 2001 AND BEYOND 1 (2001), available at <http://www.epa.gov/npdes/pubs/strategicplan.pdf>. There are over 33,000 point source permits in the Mississippi watershed alone. NUTRIENT CONTROL ACTIONS, *supra* note 61, at 15.

71. The efficacy of flood plain restoration for Delta smelt is one of many questions dogging efforts to improve the ecological health of California's Bay-Delta. A recent National Research Council report concluded that the relationship is still poorly understood and there is scant scientific justification for a regulatory requirement to create or restore habitat. COMM. ON SUSTAINABLE WATER & ENVTL. MGMT. IN THE CAL. BAY-DELTA, NAT'L RESEARCH COUNCIL, A SCIENTIFIC ASSESSMENT OF ALTERNATIVES FOR REDUCING WATER MANAGEMENT EFFECTS ON THREATENED AND ENDANGERED FISHES IN CALIFORNIA'S BAY-DELTA 54–55 (2010).

however. Many species are difficult to census accurately, even with considerable effort.⁷² Furthermore, trends may be difficult to interpret. Natural variability in population size, breeding success, habitat usage, and other factors may be so high that it masks changes, positive or negative, caused by management actions.⁷³

Confounding environmental variables add yet another layer of complexity. Pacific salmon offer a familiar example. Seeking to reverse the salmon's decline, resource managers have ordered reductions in irrigation deliveries and changes in the operation of hydropower dams.⁷⁴ But shifts in ocean conditions can mask the effect of those steps, so that managers may not be able to tell whether their efforts are helping or not.⁷⁵ Another example comes from the Colorado River system, where experimental releases from Glen Canyon Dam were instituted in the 1990s in the hope of promoting recovery of downstream aquatic ecosystems.⁷⁶ Populations of the native humpback chub rebounded somewhat after the experimental releases, but given the wealth of other factors, managers could not say with

72. Again the Delta smelt, which is notoriously difficult to census, provides an example. *See, e.g., Nat'l Res. Def. Council v. Kempthorne*, No. 1:05-cv-1207 OWW GSA, 2007 WL 4462395, at *5 (E.D. Cal. Dec. 14, 2007) ("All parties agree that there is no firm and reliable total population estimate for the Delta smelt and there never has been. . . . No scientist was able to explain how, despite the marshaling of federal, state and private resources, over ten testifying experts presented in this case, and over ten years of study, what is necessary and how long it will take to produce a reliable total population estimate for Delta smelt."); WIM KIMMERER & RANDY BROWN, CALFED BAY-DELTA PROGRAM ENVIRONMENTAL WATER ACCOUNT: SUMMARY OF THE ANNUAL DELTA SMELT TECHNICAL WORKSHOP (2003), available at http://www.science.calwater.ca.gov/pdf/EWA_Delta_Smelt_Workshop.pdf (noting disagreement over population estimates).

73. *See, e.g., Biber, supra* note 6, at 23–24 (noting the difficulty of distinguishing natural variability from anthropogenic impacts); Helen M. Regan et al., *A Taxonomy and Treatment of Uncertainty for Ecology and Conservation Biology*, 12 *ECOLOGICAL APPLICATIONS* 618, 620 (2002) (explaining the role of natural variation in creating uncertainty).

74. *See, e.g., NAT'L MARINE FISHERIES SERV., SW. REGION, ENDANGERED SPECIES ACT SECTION 7 CONSULTATION, BIOLOGICAL OPINION AND CONFERENCE OPINION ON THE LONG-TERM OPERATIONS OF THE CENTRAL VALLEY PROJECT AND STATE WATER PROJECT* 574–80 (2009) (detailing changes to water project operations needed to comply with Endangered Species Act); Michael C. Blumm et al., *Practiced at the Art of Deception: The Failure of Columbia Basin Salmon Recovery Under the Endangered Species Act*, 36 *ENVTL. L.* 709, 734–63 (2006) (detailing terms of biological opinions governing Columbia River hydropower operations).

75. *See COMM. ON PROT. & MGMT. OF PAC. NW. ANADROMOUS SALMONIDS, NAT'L RESEARCH COUNCIL, UPSTREAM: SALMON AND SOCIETY IN THE PACIFIC NORTHWEST* 39–74 (1996) (detailing the effects of changing ocean conditions and a variety of human activities on salmon). How little is still known about the dynamics of salmon populations was brought home in the summer of 2010 when a record sockeye run, more than twenty times as large as the previous year, in British Columbia took fisheries scientists and regulators by surprise. Kate Larkin, *Canada Sees Shock Salmon Glut*, *NATURE* (Sept. 3, 2010), <http://www.nature.com/news/2010/100903/full/news.2010.449.html>.

76. Sandra Zellmer, *Floods, Famines, or Feasts: Too Much, Too Little, or Just Right*, *NAT. RESOURCES & ENV'T*, Winter 2010, at 20, 24.

confidence that the rebound was directly linked to the releases, or determine exactly what their influence was.⁷⁷

Controlled experiments potentially offer one way out of this type of indeterminacy. Indeed, the purpose of controlled experimentation is to sort among possible causes of an effect, distinguishing the most important factors from others or identifying the roles of multiple factors.⁷⁸ The potential informational power of experiments explains the emphasis of early adaptive management theorists on management experiments. But the ability to experiment may be, or at least appears to be, limited in managed systems. The potential for and limits of experimentation are considered in more detail in the next Part.

Two other sets of information gaps are more difficult to recognize and very challenging to fill. First, there is often a dearth of background information about managed systems. For many species and ecosystems it is literally true, as Joni Mitchell sang, that “you don’t know what you’ve got till it’s gone.”⁷⁹ Research science is skewed toward subjects that are charismatic, economically valuable, or easy to study.⁸⁰ Often we don’t realize how much we don’t know about a system and its components until it hits a crisis point.⁸¹ At that point, it is too late to go back and generate historic data. The lack of such baseline information can pose a serious problem for adaptive management because some types of learning cannot be rushed. Years of data are required to understand the extent of natural variability in some populations and habitat conditions, for example, and that understanding in turn may be crucial to interpreting population fluctuations.

Finally, there are what Donald Rumsfeld famously called the “unknown unknowns,” the things we don’t even realize that we don’t

77. Susskind et al., *supra* note 55, at 28–29.

78. Holly Doremus, *Listing Decisions Under the Endangered Species Act: Why Better Science Isn’t Always Better Policy*, 75 WASH. U. L.Q. 1029, 1059–60 (1997) (explaining the power of experiments).

79. JONI MITCHELL, *BIG YELLOW TAXI* (A&M Studios 1970).

80. See, e.g., Berta Martín-López et al., *What Drives Policy Decision-Making Related to Species Conservation?*, 142 BIOLOGICAL CONSERVATION 1370, 1379 (2009) (“Research goals, therefore, tend to focus on those species that have direct economic impacts or are considered ‘cute’ or ‘charismatic’ by society . . .”); John R.U. Wilson et al., *The (Bio)Diversity of Science Reflects the Interests of Society*, 5 FRONTIERS ECOLOGY & ENV’T 409, 411 (2007) (finding that invasive vertebrates are more studied than invertebrates or plants).

81. In many cases, for example, little is known about an endangered species before it is proposed for protected status. Holly Doremus, *Science Plays Defense: Natural Resource Management in the Bush Administration*, 32 ECOLOGY L.Q. 249, 297–98 (2005); Dale D. Goble, *The Endangered Species Act: What We Talk About When We Talk About Recovery*, 49 NAT. RESOURCES J. 1, 16 (2009).

know.⁸² They include facts or behaviors we could have discovered but hadn't thought to look for because we were focused on other aspects of the system. For example, protection of the marbled murrelet, a small Pacific coast bird listed as threatened under the Endangered Species Act, has focused on restricting timber harvests in the bird's nesting areas.⁸³ That is necessary, but it turns out that it may not be sufficient to protect the bird. Several years ago, a university research group decided to investigate whether changes in foraging conditions might also be contributing to the species' decline.⁸⁴ They found that the amount of krill and small prey species in murrelet diets had increased over the past century relative to sardines and other larger predatory fish.⁸⁵ This avian version of "fishing down the food web," they speculated, might be reducing the energy gain per amount of fishing effort, contributing to reduced reproductive success.⁸⁶ That discovery has led to increased attention to the potential effects of commercial and recreational fishing on murrelets.⁸⁷

82. Rumsfeld tied himself in verbal knots trying to explain to the press the various kinds of uncertainty. See Donald H. Rumsfeld, Sec'y of Defense, U.S. Dep't of Def., Department of Defense News Briefing—Secretary Rumsfeld and Gen. Myers (Feb. 12, 2002), *available at* <http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=2636> (“[A]s we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones.”). Although his syntax was inelegant, the point is a good one; if you don't know what to look for, you are not likely to find it.

83. REGION 1, U.S. FISH & WILDLIFE SERV., RECOVERY PLAN FOR THE MARBLED MURRELET (WASHINGTON, OREGON, AND CALIFORNIA POPULATIONS) 79–111 (1997) (detailing regulatory protections implemented for the murrelet, almost entirely focused on protecting forest nesting habitat).

84. Benjamin H. Becker & Steven R. Beissinger, *Centennial Decline in the Trophic Level of an Endangered Seabird After Fisheries Decline*, 20 CONSERVATION BIOLOGY 470, 476–77 (2006).

85. *Id.*

86. *Id.*

87. Other “unknown unknowns” may include surprises in the form of unanticipated changes in the system, like the encroachment of the barred owl into the range of the threatened spotted owl, a stress which has interacted with others, including logging, to contribute to the owl's decline. The relative contributions of logging and invasive species became a topic of controversy in 2008, when the FWS issued a revised recovery plan for the threatened northern spotted owl which emphasized the contribution of the barred owl to the spotted owl's woes. U.S. FISH & WILDLIFE SERV., RECOVERY PLAN FOR THE NORTHERN SPOTTED OWL (*STRIX OCCIDENTALIS CAURINA*), at viii (2008), *available at* http://www.fws.gov/ecos/ajax/docs/recovery_plan/NSO%20Final%20Rec%20Plan%20051408_1.pdf. Faced with highly critical peer reviews and litigation, the FWS voluntarily withdrew the 2008 plan; a new draft version has recently been issued. U.S. FISH & WILDLIFE SERV., DRAFT REVISED RECOVERY PLAN FOR THE NORTHERN SPOTTED OWL (*STRIX OCCIDENTALIS CAURINA*) (2010), *available at* <http://www.fws.gov/OREGONFWO/Species/Data/NorthernSpottedOwl/Recovery/Library/Documents/2010NSODraftRe>

We cannot specifically identify unknown unknowns at the outset of a management program. As discussed in the next Part, however, it is possible to structure management and monitoring efforts, and to coordinate them with outside research, in ways that enhance the likelihood that unknown unknowns will be sought and found.

3. Opportunities for Adjustment

The third prerequisite for adaptive management to be useful is that there must be opportunities to adjust management efforts over time. That means that initial management steps must not become immediately locked in, either formally by law or informally by reason of their practical effect. Adaptive management cannot help when there is no way to correct an initial mistake, as for example when the decision in question is to allow irreversible alteration of the environment. Even in that context, however, a form of adaptive management or progressive “learning while doing” can be helpful when managers face many similar decisions over time, such as evaluating permits to fill wetlands or take endangered species.⁸⁸

It also means that managers must periodically reconsider and reevaluate their management decisions in light of their improved or revised understanding of the system. New institutional structures and legal mandates may be needed to make reconsideration both mandatory and transparent enough to allow effective public oversight, because management revisions are a notorious point of slippage between the theory and practice of adaptive management.⁸⁹

Finally, it means that there must actually be alternative policy choices. Carl Walters, one of the fathers of the concept of adaptive resource

visedRecPlan.pdf. Mistakes about parameters we think we understand also fall in this category. In the Chesapeake Bay, for example, EPA’s Draft Total Maximum Daily Load (“TMDL”) specifies the total nutrient loading the agency believes the Bay ecosystem can tolerate while meeting the goal of preserving all its uses. U.S. ENVTL. PROT. AGENCY, DRAFT CHESAPEAKE BAY TMDL, at 1-1, 2-7 (2010), available at <http://executiveorder.chesapeakebay.net/post/TMDL-appendices.aspx>. If that target turns out to be wrong (at least if it turns out to be wrong in the direction of allowing too much pollution), it will need to be adjusted if the management objective is to be met.

88. Doremus, *supra* note 24, at 557.

89. See, e.g., April Reese, *Colorado River Adaptive Management Program Needs Overhaul, Critics Say*, LAND LETTER (May 7, 2009), <http://www.eenews.net/public/Landletter/2009/05/07/01> (noting that despite thirteen years of evidence gathering, “the Glen Canyon Dam Adaptive Management Work Group, or AMWG, has never reached sufficient consensus to execute its primary charge—recommending a new dam operations policy to the Department of Interior”).

management, once described a rich set of policy alternatives as the critical factor in the success of adaptive management.⁹⁰

B. *Doing the Math*

Even if all of the required elements are in place, adaptive management is not necessarily the right strategy. A rough calculation is needed to determine if its benefits justify its costs. Adaptive management should not be undertaken lightly. It requires more resources than conventional management⁹¹ because doing it right requires taking the time to carefully analyze the system at the outset, monitoring the results, and periodically reassessing and revising.⁹² It imposes unfamiliar demands on management institutions for long-term commitment of human and financial resources.⁹³ In addition to using government resources, adaptive management may impose greater demands on stakeholders, who must monitor decisions and the decisionmaking process not just at one point in time but continually. Because it implies that decisions are always tentative, it may also increase or extend controversy and conflict,⁹⁴ despite claims to the contrary. Finally, it may require trading the anticipated best outcome in the short-term for long-term learning and improvement.⁹⁵ Adaptive management should be used only if the tradeoffs appear to offer a net benefit, measured in terms of improved likelihood of meeting management goals.

90. CARL WALTERS, SRP REVIEW OF PATH PRELIMINARY DECISION ANALYSIS REPORT ON SNAKE RIVER SPRING/SUMMER CHINOOK I (1998), *available at* <http://efw.bpa.gov/Environment/PATH/reports/pdar/index.html>. Noting the tendency for scientists charged with developing adaptive management programs to develop multiple hypotheses but gloss over policy alternatives, Walters pointed out that “the few adaptive management success stories have involved the opposite: relatively few response hypotheses, but a very rich set of policy alternatives.” *Id.*

91. Carolyn Brickey et al., *How to Take Climate Change into Account: A Guidance Document for Judges Adjudicating Water Disputes*, 40 ENVTL. L. REP. 11,215, 11,227 (2010).

92. *See, e.g.*, Biber, *supra* note 6, at 29 (noting costs of monitoring); Walters, *supra* note 17 (noting that costs of modeling, monitoring, and experimentation often stand in the way of implementing adaptive management).

93. *See* Camacho, *supra* note 49, at 74 (noting the importance of sustained funding for successful adaptive management); Holly Doremus et al., *Making Good Use of Adaptive Management* 13 (Ctr. for Progressive Reform, White Paper No. 1104, 2011), *available at* http://www.progressivereform.org/articles/Adaptive_Management_1104.pdf (“[A]daptive management cannot succeed without funding that is both stable and sufficient.”).

94. Doremus, *supra* note 9, at 55; Sandra Zellmer & Lance Gunderson, *Why Resilience May Not Always Be a Good Thing: Lessons in Ecosystem Restoration from Glen Canyon and the Everglades*, 87 NEB. L. REV. 893, 945 (2009).

95. *See* Lyons et al., *supra* note 4, at 1691; *see, e.g.*, Gretchen J. A. Hansen & Michael L. Jones, *The Value of Information in Fishery Management*, 33 FISHERIES 340, 340 (2008); Michael A. McCarthy & Hugh P. Possingham, *Active Adaptive Management for Conservation*, 21 CONSERVATION BIOLOGY 956, 963 (2007).

Unless the three factors discussed above—significant information gaps, opportunities for learning, and opportunities for adjustment—are all present to some degree, adaptive management is a nonstarter. But the analysis is more nuanced than that, particularly with respect to the prospects for learning, which is never a simple yes or no question. What is needed is a kind of broad-brush cost-benefit analysis evaluating the tradeoffs inherent in choosing an adaptive approach. In most cases, that will boil down to estimating the expected value of learning for achieving management objectives, and comparing that added value to the costs and complications it will impose. That is not an easy task, and we should not expect anything like precise quantification. The analysis itself will, of course, consume agency resources. But I am convinced it will be worth it, leading to more self-conscious management even if the choice is not to undertake an adaptive approach. And although it imposes significant costs at the beginning of a management program, it could save resources down the line by making it clearer what needs to be periodically evaluated and how that evaluation should be done.

The analysis I envision begins by setting out the applicable management goals. As discussed above, management goals should be exogenous to the adaptive management process. To the extent that statutory goals are, as is so often the case, vague or conflicting, they should be clarified at the outset. In other words, an agency planning to undertake adaptive management (or considering whether to undertake it) should identify what it views as its management goals as well as metrics believed to indicate achievement of those goals.⁹⁶

The next step is articulation of a model of the managed system. An explicit model is generally recognized as a core element of adaptive management.⁹⁷ It is also essential to making an informed decision on whether or not to undertake adaptive management. The model need not be elaborate. Depending upon the management goals and level of knowledge at the start, it can be as simple as a schematic diagram or brief narrative, or as elaborate as a detailed computer model. Its function is both to discipline managers' thinking and to make that thinking accessible to stakeholders. It should highlight key elements of the system for management purposes, their interconnections, their relationship to the management goals, and their expected response to management alternatives. It should explicitly acknowledge uncertainty and competing hypotheses.

96. The metrics, unlike the goals, are appropriately, even necessarily, subject to reevaluation within the adaptive management process. Technical experts must periodically reevaluate whether the selected metrics accurately represent achievement of the relevant management goals.

97. See, e.g., NAT'L RESEARCH COUNCIL, *supra* note 34, at 24–25.

Comparing the model to management objectives should highlight what managers hope to learn through adaptive management. In particular, it should make apparent the “known unknowns,” areas of uncertainty or competing hypotheses that are important to achieving the desired management outcomes. The regulation of duck hunting in the United States, a longstanding and relatively successful example of adaptive management,⁹⁸ provides a good example. The management goal is sustainable harvest; therefore, the key management question is how hunting mortality will affect population abundance and productivity.⁹⁹ The key uncertainties are whether most of the birds killed by hunters would have died from other causes anyway or whether instead their deaths must be added on to natural mortality,¹⁰⁰ and the extent to which reproduction declines with increasing population density.¹⁰¹

Using mathematical models grounded by comparison to monitoring data, researchers showed in 1996 that harvest levels could be deliberately varied to distinguish between the two possibilities, accelerating learning.¹⁰² There are often tradeoffs between learning and resource protection, however; in the waterfowl example, the authors noted that “the most informative harvest strategy is also the most extreme.”¹⁰³ Those tradeoffs must be evaluated in context; the more irreplaceable the managed resources, the more conservative we may want to be in pursuing learning. On the other hand, the greater the economic consequences of the decision, that is, the greater the economic value of resource exploitation, the more important learning may become.

Economic analysis,¹⁰⁴ structured decisionmaking,¹⁰⁵ and other tools¹⁰⁶ have been proposed for evaluating the tradeoffs. Notably, in some cases, running the analysis reveals that learning overall is less valuable than managers had expected,¹⁰⁷ or that “active” adaptive management, involving

98. The FWS, which regulates hunting of migratory waterfowl, has used a strategy it calls adaptive harvest management since 1995. See Johnson et al., *supra* note 45, at 176. That strategy has produced significant learning in the form of updated probabilities assigned to the four competing models employed. *Id.* at 180.

99. *Id.*

100. The competing mortality models are generally referred to as additive or compensatory mortality, respectively. See, e.g., *id.* at 177.

101. *Id.* at 177–78.

102. Williams et al., *supra* note 47, at 228–29, 231.

103. *Id.* at 230.

104. See, e.g., Fenichel & Hansen, *supra* note 12, at 209.

105. Martin et al., *supra* note 12, at 1079.

106. Rout et al., *supra* note 12, at 515.

107. RAY HILBORN & CARL G. WALTERS, QUANTITATIVE FISHERIES STOCK ASSESSMENT: CHOICE, DYNAMICS AND UNCERTAINTY 494 (1992) (“Often this step in the analysis reveals that

deliberate management experiments, adds little to simple observation of the results of more conventional management choices.¹⁰⁸ For our purposes, the precise tool employed is not crucial. What is important is that the analysis be done explicitly and transparently, that it consider the available avenues for investigation, observation, and hypothesis testing, and that managers explain and justify their choice of analytic tools. Undertaking this analysis will also require managers to reveal the extent to which they believe their mandated goals require or permit discounting of future benefits. The value of learning in relation to its costs will depend critically on the extent to which long-term conservation is valued over the short-term economic consequences of experimentation or intervention.¹⁰⁹

In cases of very high value resources, very high uncertainty, or very sharp political conflict over management choices, it may be useful to invoke peer review of the model and the prospects for learning.¹¹⁰ This is the sort of setting in which peer review can be most helpful, sharpening the agency's attention to gaps in its knowledge, unrecognized assumptions, and new or emerging methodologies.¹¹¹ Peer review at this stage is less likely to become a political football or to be perceived as a threat to agency autonomy or authority than review of individual regulatory decisions. Peer review of this sort is likely to be most effective if it is conducted by outsiders with strong inside support and a medium- to long-term commitment.¹¹² Outsiders should have independence from the agency's mission, culture, and process, so that they are able to take a fresh look and to demand a clear explanation. Inside support, from the head of the agency or equivalent, can ensure that agency personnel take the peer review process and resulting critiques seriously, but can also provide a check on unrealistic reviewer assumptions. A long- or at least medium-term commitment means that the review process, like the management process, is ongoing. Managers who must report every year to the same review

there is a 'robust' policy that should do very well, no matter which model is correct, so that only minor gains would be expected from having better information.").

108. Johnson et al., *supra* note 45, at 182.

109. If an aggressive discount rate is applied, management as a learning exercise will rarely appear economically justified. Carl J. Walters & Roger Green, *Valuation of Experimental Management Options for Ecological Systems*, 61 J. WILDLIFE MGMT. 987, 996 (1997).

110. Because it carries its own significant costs, peer review should not be applied to all management decisions. See J.B. Ruhl, *Prescribing the Right Dose of Peer Review for the Endangered Species Act*, 83 NEB. L. REV. 398, 422-25 (2004) (noting that peer review mandates might do more to smother than to improve agency decisions).

111. For contrasting views on the role of peer review, see Holly Doremus & A. Dan Tarlock, *Science, Judgment, and Controversy in Natural Resource Regulation*, 26 PUB. LAND & RESOURCES L. REV. 1, 32-35 (2005); J.B. Ruhl & James Salzman, *In Defense of Regulatory Peer Review*, 84 WASH. U. L. REV. 1, 43-54 (2006).

112. See Doremus & Tarlock, *supra* note 111, at 33.

committee are more likely to seriously address that committee's concerns than those who receive a one-time report but will never be faced with tough follow-up questions.

In sum, resource managers and policymakers should not blindly assume that adaptive management is the best strategy. Before committing to it, they should undertake an explicit, structured analysis of its benefits and costs. That analysis should clearly set out management goals, articulate an initial model of the system, identify important data gaps, and evaluate the prospects of filling those gaps. Such a structured analysis is essential for making a reasoned decision to use or eschew adaptive management, but it will be useful beyond that gateway decision. It will provide a starting point for choosing initial management actions and drawing up a monitoring strategy.¹¹³ It should also set the stage for periodic reevaluation by clearly setting out the assumptions to be tested and reconsidered.

One shortcoming of this sort of analysis, however, is that it invites a static approach, taking as given the perceived limits on learning, such as restrictions on experimentation. It ought to highlight those constraints, but it is not likely to question them. Nor is it likely to address overarching features of a learning-friendly environment. In other words, by its very nature this sort of individual, project-specific approach is likely to treat the learning equation as fixed.

The costs of learning, however, are not necessarily fixed. They can be altered by a variety of policy measures independent of any individual management effort. So while this sort of specific analysis is needed to make informed choices about specific uses of adaptive management, it is not the end of the story. At a broader level, we need to look at and address how learning occurs in natural resource management agencies and why it does not, with the aim of reducing the costs of learning and the time it takes.

II. REWRITING THE LEARNING EQUATION

The structured analysis recommended above may conclude, for a particular resource problem, that learning would improve management but also that learning will be costly and challenging. That result, when it occurs, presents a dilemma: will it be worth investing in adaptive management or not? Managers could try to duck that question by adopting a less information-intensive strategy, such as technology-based or best-

113. Although detailed monitoring is often assumed to be a necessary component of adaptive management, it is not always the best use of limited resources. Alana L. Moore & Michael A. McCarthy, *On Valuing Information in Adaptive-Management Models*, 24 CONSERVATION BIOLOGY 984, 991 (2010).

management-practices mandates, or a precautionary approach. For reasons I have previously articulated,¹¹⁴ I believe reducing information demands will often not be practical or politically palatable. It therefore becomes important not only to evaluate the relative costs and benefits of information, but to shift that equation where feasible by increasing the availability of useful information.

Whether, to what extent, and how the costs of learning can be reduced of course varies with the specific context. But there are some general policy steps that can improve the prospects for learning by natural resource managers. They fall in two categories: improving information production and improving information diffusion.

A. *Facilitating Information Production*

Often, management-relevant learning requires the generation of new information. In some cases, that may mean that new tools for inquiry or methods for interpreting existing data need to be developed. Those are matters for the natural scientists to tackle. But in other cases, there are policy barriers, or at least apparent policy barriers, to inquiry or learning. Those are for the policy wonks to deal with. Policy barriers may be context-specific, but some, such as impediments to experimentation and funding challenges, are general and can be addressed by general policy steps.

1. Experiments and Experiment Substitutes

There are often serious barriers to conducting experiments in managed natural systems. Some of the limits are technical; for example there may be so many confounding, uncontrollable factors that experiments would not generate useful information. Others are practical; for example, the value of infrastructure like large dams to human populations, coupled with the expense and time needed to rebuild them, precludes taking one out even if we thought we could thereby gain useful information about threats to imperiled salmon populations. Still others are policy-mediated; for example, laws like the Endangered Species Act impose substantive limits on the risks to which some managed resources can be subjected,¹¹⁵ and environmental analysis and planning laws may require that the impacts of management be articulated in advance and in detail.¹¹⁶

All of these barriers to effective experimentation, even those which do not originate from the legal or institutional regime, can be addressed to

114. See Doremus, *supra* note 14, at 410–11.

115. On the ESA and experimentation, see Doremus, *supra* note 9, at 79–80.

116. On the NEPA as a barrier to experimentation, see Doremus, *supra* note 14, at 454–55.

some extent by policy and institutional changes. Requiring the explicit analysis of the prospects for and costs of learning advocated above would improve information production. Where learning is necessary and likely, but experiments seem too risky or impractical, managers can look for substitutes for direct, controlled experimentation. Model runs can sometimes stand in for active manipulation, although it may be difficult to gain enough confidence in the model without the ability to perform on-the-ground experiments, and modeling can itself become an excuse for an infinite search for perfect understanding prior to taking action.¹¹⁷

Models can serve another function, though, helping managers evaluate and limit the potential negative impacts of experiments. Simulating an experiment before actually attempting it, using a range of inputs reflecting the competing hypotheses, should signal the extent to which the experiment poses risks of disastrous impacts. Managers can then plan for those risks, developing monitoring plans to detect adverse effects and planning to end the experiment if the effects exceed predetermined acceptable levels. Medical trials offer a useful analogy. The medical community understands the value of such trials, but is also sensitive to the twin risks that the experimental treatment may prove harmful or that it may prove so much more effective that the placebo or control treatment appears harmful by comparison.¹¹⁸ Ethical considerations require that the perils such trials pose be justified at the outset by the learning they promise, that outcomes be monitored on an ongoing basis, and that they be halted if new information shows that the risk-benefit balance is outside the acceptable range.¹¹⁹

Of course those decisions are not easy, and they depend on the relative value decision makers assign to learning and protecting resources.¹²⁰ But articulating and justifying sideboards in advance would allow stakeholders to have their say about the value of learning and acceptability of risk. It

117. Walters, *supra* note 17.

118. See Paul S. Mueller et al., *Ethical Issues in Stopping Randomized Trials Early Because of Apparent Benefit*, 146 ANNALS INTERNAL MED. 878, 878 (2007).

119. Steven N. Goodman, *Stopping at Nothing? Some Dilemmas of Data Monitoring in Clinical Trials*, 146 ANNALS INTERNAL MED. 882, 882 (2007).

120. Clinical trials pose exactly the same dilemma. Whether and when to stop them

is an extraordinarily difficult question, as scientists will differ in their assessment of both how much we have learned and how much we need to learn. There is no clear ethical guidance on the matter; a utilitarian perspective will put more weight on the fate of future patients, whereas ethical theories that place more value on obligations and individual dignity will favor the interests of patients in the trial.

Id.; see also Mueller et al., *supra* note 118, at 878–79 (warning against trial-stopping rules that allow a trial to be terminated too easily based on the perceived benefits of the treatment because investigators may be biased in favor of overestimating benefits and underestimating adverse effects).

also could solve a potential legal problem. Under the Endangered Species Act, federal actors must insure that their actions are not likely to jeopardize the continued existence of any listed species.¹²¹ The Act allows federal authorities to issue permits for actions undertaken “for scientific purposes or to enhance the propagation or survival of the affected species,”¹²² provided the jeopardy threshold is not crossed. Scientists sometimes complain that research permit requirements stand in the way of needed studies.¹²³ Those complaints should be taken seriously, but they need not be blindly accepted given the very high importance research scientists tend automatically to assign to learning. They should instead be examined in light of societal judgments about the risks and value of learning. Sideboards that limit risk could help reduce permit paralysis (to the extent it exists) by making it easier to demonstrate at the outset that the jeopardy standard is satisfied, and reassuring managers, wildlife agencies, and environmental interests that experiments will remain within acceptable bounds.¹²⁴

Another potential strategy is to conduct experiments in limited portions of a system. For large systems, that may be practical even if the experiments pose a risk of local harm to the managed resource or the economy. A National Research Council (“NRC”) committee recently proposed such a strategy to test the effectiveness of nutrient pollution control actions for reducing the Gulf of Mexico’s hypoxic “dead zone” and the social and economic effects of those actions.¹²⁵ The committee suggested a set of pilot projects which could generate information needed to guide larger-scale control efforts.¹²⁶ Pilot projects are always vulnerable to the criticism that they are simply delaying tactics; if they seem promising, advocates might ask why not launch them at a large scale immediately. That question reinforces the importance of the analysis recommended in the first Part of this Article. A clear explanation of the extent to which pilot projects will provide needed information, and the potential costs if they were undertaken more broadly but turned out not to be as effective as hoped, could help reassure a variety of publics about the need for and value of experiments.

121. 16 U.S.C. § 1536(a)(2) (2006).

122. *Id.* § 1539(a)(1)(A).

123. Karen A. Bjorndal et al., *Better Science Needed for Restoration in the Gulf of Mexico*, 331 *SCIENCE* 537, 538 (2011); Brian W. Bowen & Wayne N. Witzell, *Introduction: Sea Turtle Conservation Genetics*, in *PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON SEA TURTLE CONSERVATION GENETICS*, at 1, 5–7 (Brian W. Bowen & W.N. Witzell eds., 1996).

124. *See supra* note 25 and accompanying text.

125. *NUTRIENT CONTROL ACTIONS*, *supra* note 61, at 28.

126. *Id.*

Small-scale experiments also can provide useful information about management actions taken in several locations. Salvage logging, the controversial practice of rapidly harvesting timber after a fire, is a good example. Timber-dependent communities object to the time necessary for detailed environmental study because lumber value rapidly deteriorates once trees have been killed.¹²⁷ Environmental interests, by contrast, see salvage logging as an excuse to harvest trees that may not in fact be dead, and believe it harms wildlife and slows forest regeneration.¹²⁸ Fierce disagreement about the desirability of salvage logging has produced a flood of litigation. “The courts have been barraged with lawsuits by environmental groups over allegedly ill-conceived post-fire salvage logging projects.”¹²⁹ In 2005, a Ninth Circuit panel chastised the U.S. Forest Service (“USFS” or “Service”) for ignoring opportunities to study and learn from salvage logging operations,¹³⁰ but later the full court decided that it owed the Service more deference.¹³¹

Alternatively, it might be possible to carry out experiments in analogous systems where environmental or economic risks are lower. Networks of lands designated for experimental purposes could provide useful study sites. The USFS already has a system of eighty experimental forests and ranges scattered across the country.¹³² Originally established in 1908, the system has grown in a fairly ad hoc manner, but it contains representatives of the majority of U.S. forest cover types and a broad range of environmental conditions.¹³³ The experimental forest system hosts a number of long-term studies with both management and basic science implications.¹³⁴ It could be put to better use to serve current management priorities, however, through better networking, more centralized management and oversight, and addition of new sites which provide good models for key management issues. Moreover, the system could be expanded to include federal lands beyond the national forests.

127. Kathie Durbin, *Unsalvageable*, HIGH COUNTRY NEWS (May 16, 2005), <http://www.hcn.org/issues/298/15501>.

128. Reed F. Noss et al., *Managing Fire-Prone Forests in the Western United States*, 4 FRONTIERS ECOLOGY & ENV'T 481, 485 (2006); Durbin, *supra* note 127.

129. Robert B. Keiter, *Breaking Faith with Nature: The Bush Administration and Public Land Policy*, 27 J. LAND RESOURCES & ENVTL. L. 195, 217 (2007).

130. *Ecology Ctr., Inc. v. Austin*, 430 F.3d 1057, 1064 (9th Cir. 2005), *overruled by* *Lands Council v. McNair*, 537 F.3d 981 (9th Cir. 2008) (en banc).

131. *Lands Council v. McNair*, 537 F.3d 981, 992–94 (9th Cir. 2008) (en banc).

132. *Experimental Forests and Ranges*, U.S. DEP'T OF AGRIC. FOREST SERV., <http://www.fs.fed.us/research/efr/> (last visited Apr. 13, 2011).

133. Ariel E. Lugo et al., *Long-Term Research at the USDA Forest Service's Experimental Forests and Ranges*, 56 BIOSCIENCE 39, 43 (2006); *Experimental Forests and Ranges*, *supra* note 132.

134. Lugo et al., *supra* note 133, at 44–45.

Finally, natural resource agencies should be prepared in advance to take advantage of learning opportunities offered by unplanned “experiments” like the Deepwater Horizon disaster in the Gulf of Mexico, and by management actions which are likely to have later analogues, such as dam removals.¹³⁵ Some federal researchers should always be “on call” for reassignment to unexpected or rapid developments, and federal research units should plan studies of potentially precedent-setting events. A discretionary pot of rapidly mobilizable grant funds should also be maintained for such contingencies.

2. Budgeting for Learning

The salvage logging and hypoxia examples mentioned above lead to another topic—budget structuring—which may unintentionally limit the ability to experiment. In federal natural resource agencies, research and management work is generally the province of distinct divisions; although budgeting practices vary, research and management budgets are sometimes also separated.¹³⁶ If researchers and managers jointly agree to conduct management experiments, there may be difficult issues about who should bear the costs. Research budgets may be too small to support large-scale management experiments, but managers may resist experiments if they have to pay the costs.¹³⁷

A better architecture for learning could include research funding dedicated to projects jointly conceived and executed by research and management personnel. Management incentives could more strongly

135. See, e.g., K.M. Kibler et al., *Learning from Dam Removal Monitoring: Challenges to Selecting Experimental Design and Establishing Significance of Outcomes*, RIVER RES. & APPLICATIONS, June 7, 2010, available at <http://onlinelibrary.wiley.com/doi/10.1002/rra.1415/full>; Noreen Parks, *A Ravenous River Reclaims Its True Course: The Tale of Marmot Dam's Demise*, SCI. FINDINGS, Mar. 2009, at 1, 1–5, available at <http://www.fs.fed.us/pnw/sciencef/scifi111.pdf> (describing removal of the Marmot Dam in 2007).

136. The USFS is an example; Research and Development is one of five USFS program areas, each with its own mission. U.S. DEP'T OF AGRIC., THE U.S. FOREST SERVICE—AN OVERVIEW 13 (n.d.), available at http://www.fs.fed.us/documents/USFS_An_Overview_0106MJS.pdf. Research and development has its own budget line item. U.S. DEP'T OF AGRIC. FOREST SERV., FISCAL YEAR 2012 BUDGET OVERVIEW 16 (n.d.), available at <http://www.fs.fed.us/aboutus/budget/2012/justification/FY2012-USDA-Forest-Service-overview.pdf>. NMFS does its budgeting differently. Research work at NMFS is overseen by the Office of Science and Technology. *Organization Chart*, NOAA FISHERIES SERV., http://www.nmfs.noaa.gov/org_chart.htm (last visited Apr. 13, 2011). But budget requests combine research and management. NAT'L OCEANIC & ATMOSPHERIC ADMIN., BUDGET ESTIMATES FISCAL YEAR 2012, at 231, available at http://www.corporateservices.noaa.gov/nbo/fy12_presidents_budget/NOAAFY12_PB.pdf.

137. Such budget issues reportedly doomed a proposed USFS large-scale salvage logging study. Interview with Ann Bartuska, Deputy Under Sec'y for Research, Educ., & Econ., U.S. Dep't of Agric., in Washington, D.C. (Nov. 8, 2010).

encourage research. Evaluation of managers for career advancement could consider the extent to which they have made progress in addressing key knowledge gaps. Researchers, at least those who control funding decisions, could be provided similar incentives by explicitly evaluating them on the extent to which they have helped resolve management uncertainties.

The federal research budget in a global sense also needs to better support indirect learning through studies related to managed systems but not tied directly to short-term management issues. A portion of federal research funding should be more closely coordinated with management priorities, but with a long-term focus. Such studies may be the best way to attack the “unknown unknowns.” This sort of work can probably best be done in the academic world, where freewheeling inquiry is rewarded and failure is more likely to be tolerated. Admittedly, it will be tricky to distribute this sort of funding effectively because the incentives are not well calibrated either for those who might distribute the funds or for those who seek funding. Managers typically want to emphasize short-term results, while research scientists are very good at claiming that their pet project fits whatever real-world priorities funders articulate. Perhaps the best way to distribute such funds would be through an advisory body with long-term ties both to management agencies and to academic researchers.

A potential model is EPA’s Science to Achieve Results (“STAR”) program, which provides funding for “targeted research that complements” research done at federal laboratories.¹³⁸ The STAR program funds work EPA views as important to its mission, but does not have the capacity to carry out at its own research facilities. EPA aspires to “focus STAR research on gaps in knowledge related to EPA’s mission, its high-priority research needs, and subjects with the greatest uncertainty and potential impact.”¹³⁹ Toward that end, review of STAR proposals includes a novel step; proposals rated as eligible for funding on the basis of scientific merit are then separately evaluated for relevance to the agency’s mission.¹⁴⁰ It is not clear, however, that the STAR program has found the right balance between highly focused, short-term research and longer-term exploration. In a 2003 review, the NRC noted that the program had moved to a greater emphasis on solicitation of focused research as opposed to exploratory

138. Nat’l Ctr. for Env’tl. Research, *STAR Grants and Cooperative Agreements*, U.S. ENVTL. PROT. AGENCY, http://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/recipients.welcome/displayOption/grants (last visited Apr. 13, 2011).

139. NAT’L RESEARCH COUNCIL, *THE MEASURE OF STAR: REVIEW OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY’S SCIENCE TO ACHIEVE RESULTS (STAR) RESEARCH GRANTS PROGRAM 123* (2003).

140. *Id.* at 48–49.

work.¹⁴¹ The NRC also recommended that EPA engage outsiders in identifying research priorities, perhaps beginning with a “state of the science” review of key areas to identify potential for high-impact research.¹⁴² That outside perspective could also be a valuable counterweight to the natural agency tendency to emphasize quick results.

B. *Improving Information Diffusion*

The production of information is only the first step in the information pipeline. Much data and information simply sits in reports or journal articles. It is not useful for management efforts unless it reaches the people who must make management decisions and reaches them in a form they can use. Information diffusion is therefore a key step in learning. It is also one where bottlenecks are common.¹⁴³ Two major sets of policy efforts could reduce barriers to effective information diffusion: improvements in data architecture and the creation or improvement of intermediaries who can more effectively link information producers with information users.

1. Data Architecture and Information Flow

One of the most frustrating impediments to learning in federal resource management agencies is lack of information sharing. It is widely recognized that data, including basic environmental documents like Environmental Impact Statements (“EIS”) and Endangered Species Act biological opinions, are not archived in ways that facilitate sharing within agencies, between agencies, and with the larger research community.¹⁴⁴ Nor are they produced in a common format that would facilitate data exchange and synthesis.¹⁴⁵ Even within a single agency, data may be collected and compiled at many different offices, in ways that make meaningful aggregation impossible. Modernizing environmental information architecture will impose some short-term costs, but could be accomplished in any administration willing to make it a priority.

141. *Id.* at 24.

142. *Id.* at 6–7.

143. Doremus, *supra* note 14, at 434–39.

144. *See, e.g.*, Edward A. Boling, *Toward a Better NEPA Process for Decisionmakers*, 39 ENVTL. L. REP. 10,656, 10,658–59 (2009); James L. Connaughton, *Modernizing the National Environmental Policy Act: Back to the Future*, 12 N.Y.U. ENVTL. L.J. 1, 8–9 (2003); Doremus, *supra* note 14, at 438; Daniel A. Farber, *Adaptation Planning and Climate Impact Assessments: Learning from NEPA’s Flaws*, 39 ENVTL. L. REP. 10,605, 10,610–12 (2009); Michael B. Gerrard & Michael Herz, *Harnessing Information Technology to Improve the Environmental Impact Review Process*, 12 N.Y.U. ENVTL. L.J. 18, 30–34 (2003).

145. Doremus, *supra* note 14, at 438–39.

Two key steps could make information more accessible and useful. First, the Council on Environmental Quality (“CEQ”)¹⁴⁶ should establish uniform standards for natural resource information formatting, presentation, and archiving, to facilitate aggregation, comparison, and cross-agency use. Second, individual agencies which generate or use classes of environmental analyses should make them available in searchable database form. So, for example, the various regional offices of the U.S. Fish and Wildlife Service (“FWS”) and National Marine Fisheries Service should digitize all their Endangered Species Act biological opinions (in a format established by CEQ) and make them available through a centralized access point with search capabilities. EPA, which is statutorily required to review all federal EISs,¹⁴⁷ could host an EIS database. USFS, Bureau of Land Management, National Park Service, and FWS land management planning documents could form another database. Modern information tools could do much more, of course, such as linking geographically related documents with geographic information system (“GIS”) tags.¹⁴⁸ However, the first step, which would be enormously helpful in facilitating the kind of learning needed for effective adaptive management, would be simply to create digital databases.

Such a step is conceptually simple, but of course more difficult in practice. It will impose short-term resource costs, while the payoff will be slower to materialize. It will require commitment and leadership from the White House and sustained funding from Congress. But if we are to make learning-based management strategies effective, it is the sort of infrastructure investment we need to make.

2. Trusted Intermediaries as Information Diffusion Agents

The question of how managers seeking to implement adaptive management or other information-intensive strategies obtain useful information is one that has not received enough attention in the policy literature. Natural resource managers are, I believe, systematically risk-averse in the sense that they do not want the resources under their supervision to be harmed by their management choices and, perhaps even more strongly, they do not want to be blamed for any harm the resources suffer.¹⁴⁹ They are also typically resource-limited, understaffed, and

146. The CEQ, established by NEPA, is the environmental arm of the Executive Office of the President. Council on Envntl. Quality, *About*, THE WHITE HOUSE, <http://www.whitehouse.gov/administration/eop/ceq/about> (last visited Apr. 13, 2011). It is, therefore, the office in the best position to centralize administration environmental policy.

147. 42 U.S.C. § 7609(a) (2006).

148. See Farber, *supra* note 144, at 10,610–11.

149. See *supra* note 25.

overcommitted. They do not have a lot of time to keep up on the latest literature and ideas or to consider how ideas developed in other contexts might help them in their tasks. Their staff, which is often heavy on bachelors- and masters-level expertise, may not have the background or training to make those judgments effectively or with confidence. Resource management agencies may, therefore, fall behind on awareness of both data and new techniques that could be helpful in achieving their goals.

One way to read the much-criticized opinion of the Seventh Circuit in *Sierra Club v. Marita*¹⁵⁰ is as a cautionary tale about knowledge diffusion. The *Marita* decision dealt with management of lands within the national forest system.¹⁵¹ Plaintiff environmental groups asserted that the USFS had ignored the theory of island biogeography and its lessons for the size of reserves needed to protect native species.¹⁵² They contended that the Service had ignored well-established scientific principles, submitting more than 100 published articles in support of their position.¹⁵³ The Service responded that, although the theory of island biogeography was “of interest,” it had not yet been applied to forest management in the region.¹⁵⁴ In essence, the Service argued that it was not sure how to apply the theory to its work, and was not required to make figuring that out a priority.¹⁵⁵ To the horror of conservation biologists,¹⁵⁶ the court sided with the USFS,

150. 46 F.3d 606 (7th Cir. 1995). For a sampling of critical commentary, see Greg D. Corbin, *The United States Forest Service's Response to Biodiversity Science*, 29 ENVTL. L. 377, 404–07 (1999); Doremus, *supra* note 24, at 576–79; Patricia Smith King, *Applying Daubert to the “Hard Look” Requirement of NEPA: Scientific Evidence Before the Forest Service in Sierra Club v. Marita*, 2 WISC. ENVTL. L.J. 147, 158–70 (1995); Brian Scott Pasko, *The Great Experiment That Failed? The Role of a “Committee of Scientists” as a Tool for Managing and Protecting Our Public Lands*, 32 ENVTL. L. 509, 532–36 (2002); Courtney Schultz, *Responding to Scientific Uncertainty in U.S. Forest Policy*, 11 ENVTL. SCI. & POL’Y 253, 259–61 (2008). *But see* Fred Bosselman, *What Lawmakers Can Learn from Large-Scale Ecology*, 17 J. LAND USE & ENVTL. L. 207, 247–52 (2002) (arguing that scientific evidence does not support the notion that declines in forest species are primarily a result of fragmentation); A. Dan Tarlock, *Biodiversity and Endangered Species*, in STUMBLING TOWARD SUSTAINABILITY 311, 319 (John C. Dernbach ed., 2002).

151. *Marita*, 46 F.3d at 608.

152. *Id.* at 617–18.

153. *Id.* at 618.

154. *Id.* at 618–19.

155. *See id.*

156. Both the Society for Conservation Biology and the American Institute of Biological Sciences appeared as amici in support of the Sierra Club. *Id.* at 621. Shortly after the decision was issued, for example, a letter to the editor in the Society for Conservation Biology newsletter called for members to write to the chief of the USFS, urging greater use of conservation biology in forest management decisions. Randy Webb, *Letter to the Editor*, SOC’Y FOR CONSERVATION BIOLOGY NEWSL. (Feb. 2, 1997), <http://www.combio.org/Publications/Newsletter/Archives/1997-5-May/nl-su018.cfm>.

deferring to its determination that application of the theory was uncertain.¹⁵⁷

Of course it may be that the USFS rejected the Sierra Club's suggestions simply because it wanted to get out the cut. But in this and other situations it may also be true that information, and an understanding of the potential implications of new information or methodologies for management, is limiting. It is difficult for resource managers like the USFS to keep up with the latest developments, especially if their application to management problems is indirect or unclear. Courts, which are especially deferential to methodological choices and decisions in the face of scientific uncertainty,¹⁵⁸ are not well-suited to police that sort of ignorance. Improved knowledge diffusion would both provide tools for managers who are genuinely committed to their assigned tasks and reduce the availability of uncertainty as an excuse.

Efficient and effective knowledge diffusion often depends on the availability of intermediaries who have the trust of the parties to whom they are bringing knowledge as well as the expertise and resources needed to get that knowledge. One possible model would be an academic corps modeled on the Cooperative Extension Service ("CES"), which was launched in 1914 to help bring the agricultural research being produced in the land-grant colleges to farmers.¹⁵⁹ Its statutory purpose is explicitly one of knowledge diffusion: "to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture . . . and to encourage the application of the same."¹⁶⁰ CES, which includes

157. *Marita*, 46 F.3d at 621. Of course there was more to *Marita* than the question of how specifically the plaintiffs' preferred scientific methodology had been articulated with respect to the lands in question. Doremus, *supra* note 24, at 577 ("*Marita* is a difficult case to parse, in part because the opinion wanders back and forth between disagreements about goals and disagreements about methods of ensuring that those goals are achieved."). At a minimum, the decision was motivated in part by the idea that the governing statutes required the USFS to consider values other than preservation and the court's belief that, even with respect to preservation, the USFS was entitled to some deference to its understanding of what elements it was mandated to preserve.

158. In *Marita*, the USFS argued that the theory in question "had been developed as a result of research on actual islands or in the predominantly old-growth forests of the Pacific Northwest and therefore did not necessarily lend itself to application in the forests of Wisconsin." *Marita*, 46 F.3d at 622. That may have been just an attempt to justify a management decision reached for other reasons, but it is not implausible that something like that reasoning may have been part of the decisionmaking process. In either case, the court agreed, ruling that "however valid a general theory may be, it does not translate into a management tool unless one can apply it to a concrete situation." *Id.* at 623.

159. David W. Cash, "In Order to Aid in Diffusing Useful and Practical Information": *Agricultural Extension and Boundary Organizations*, 26 SCI. TECH. & HUM. VALUES 431, 433-34 (2001).

160. 7 U.S.C. § 341 (2006).

specialist researchers based at the land-grant universities and their experiment stations and county agents with offices in rural areas, seems to successfully mediate both the transfer of knowledge from the universities to farmers and communication in the other direction regarding issues farmers regard as research priorities.¹⁶¹ It transfers not only data but methods, such as up-to-date models, to diffuse users.¹⁶²

Crucial to the transfer function is that extension agents enjoy the trust of farmers and have regular opportunities to interact with them both formally at conferences and informally based on relationships built over the years. The trust of researchers is also important. In the case of CES, much of the applied research is carried out by extension specialists based at universities and agricultural experiment stations.¹⁶³ Those researchers may themselves regularly meet with their agricultural constituents, or they may interact primarily with county agents who then interact with the farmers.¹⁶⁴ The key point is that there needs to be an intermediary organization which enjoys the trust, respect, and attention of both knowledge producers and knowledge consumers.

In the resource management context, that role seems to be limiting. There certainly are extension agents and researchers who focus on the intersection between agriculture and resource conservation, but their association with agriculture can lead to distrust by environmental interests and resource managers who view their mission as conservation. There also are research arms of federal resource management agencies, such as the USFS' Research and Development unit, whose mission is "to develop and deliver knowledge and innovative technology to improve the health and use of the Nation's forests and grasslands—both public and private."¹⁶⁵ But something seems not to be going as well as it could in the delivery phase. Curiously, of all its various constituencies, the one least satisfied with the USFS's research and development operations is the USFS itself.¹⁶⁶ Federal information users have little confidence that products of the research and

161. Cash, *supra* note 159, at 439–40.

162. *Id.* at 439–41.

163. *Id.* at 433–34.

164. *Id.* at 439–40.

165. U.S. DEP'T OF AGRIC. FOREST SERV., FOREST SERVICE RESEARCH AND DEVELOPMENT FISCAL YEAR 2009 PERFORMANCE AND ACCOUNTABILITY REPORT 3 (2010), available at http://www.fs.fed.us/research/publications/2009_RD_Performance_Accountability_Report_1.3.11.pdf.

166. U.S. DEP'T OF AGRIC. FOREST SERV., AMERICAN CUSTOMER SATISFACTION INDEX 15 (2006), available at http://www.fs.fed.us/research/pdf/2006_fs_rd_customer_satisfaction_survey_final_report.pdf (showing satisfaction rate of sixty-eight percent for USFS "customers," lower than other federal agencies, nongovernmental organizations, educators, or any other users).

development operation will provide feasible solutions to their problems or help them anticipate emerging problems.¹⁶⁷ The high rate of litigation focused on the science of USFS management decisions¹⁶⁸ suggests that external stakeholders are also unsatisfied with the way science is making its way into the management process, though they blame managers rather than agency researchers.

To the extent that entities with a resource management knowledge translation mission already exist, perhaps they simply need more funding or a renewed focus on delivering useful information to resource managers in a timely fashion. I believe, however, that some structural and cultural changes would also be useful. There should be more opportunities for research and management personnel within agencies to work together on designing and implementing studies to address management needs.¹⁶⁹ Performance measures for research units should explicitly include the development and provision of management-relevant information, in conjunction with managers.¹⁷⁰ In addition, more emphasis should be put on synthesis and on conveying information not generated by the intermediary organization. Resource managers do not need to learn of every individual study relevant to their work in isolation. Indeed, paying too much attention to individual studies outside the larger context can increase confusion, leaving resource managers uncertain whether they should recast their management efforts every time a new study comes out.¹⁷¹ What is needed instead is periodic updating of the overall state of the field and interpretation and synthesis of the totality of knowledge by those with

167. *Id.* at 18–19.

168. For a review of this litigation in the Ninth Circuit and the difficulties it has caused that court, see generally Sara A. Clark, *Taking a Hard Look at Agency Science: Can the Courts Ever Succeed?*, 36 *ECOLOGY L.Q.* 317 (2009).

169. See David W. Cash et al., *Countering the Loading-Dock Approach to Linking Science and Decision Making: Comparative Analysis of El Niño/Southern Oscillation (ENSO) Forecasting Systems*, 31 *SCI. TECH. & HUM. VALUES* 465, 467–68 (2006) (noting the need for “coproduction” of information through collaborations between researchers and users). At least some USFS researchers are well aware of the value of these kinds of cooperative efforts and their role in promoting knowledge diffusion. See Emile Gardiner et al., *Establishing a Research and Demonstration Area Initiated by Managers: The Sharkey Restoration Research and Demonstration Site*, 106 *J. FORESTRY* 363, 363–64 (2008).

170. On this score, the USFS’s current strategic plan is lacking. The performance measures it proposes for the Research and Development office include only customer satisfaction and numbers of patent applications. U.S. DEP’T OF AGRIC. FOREST SERV., *USDA FOREST SERVICE STRATEGIC PLAN, FY 2007–2012*, at 24 (2007), available at <http://www.fs.fed.us/publications/strategic/fs-sp-fy07-12.pdf>. Conspicuously missing is any measure of the extent to which research improves management outcomes.

171. Health care providers and consumers suffer this sort of confusion when they are buffered by unfiltered news of, for example, every major study on the efficacy of mammograms for breast cancer detection and treatment. See, e.g., *Sorting Through Mammogram Confusion*, *NAT’L PUB. RADIO* (Oct. 14, 2010), <http://www.npr.org/templates/story/story.php?storyId=130569731>.

knowledge both of the relevant science and of management needs. Unfortunately, that sort of synthetic work generally falls between the cracks. Researchers tend not to be rewarded for it, while managers tend not to have the time or expertise to do it well.

Although some of the needed entities, or similar entities which could be converted to a diffusion function, already exist within the federal government, there is no reason why this role needs to be confined to government entities. It is essential only that intermediaries have the trust of both researchers and managers. In the resource management world, there may be nongovernmental organizations, such as The Nature Conservancy, which are well-positioned to fulfill that role.

CONCLUSION

Adaptive management subsumes many different challenges. It is an incentives problem, an accountability problem, and a flexibility problem. But it is also an information policy problem, and that aspect has been underappreciated. Before deciding to employ, or to continue to employ, an adaptive approach to management, and before determining the parameters of such an approach, managers should undertake an explicit, structured analysis of the need for and practicality of learning.

This is not a new or radical idea; Hilborn and Walters, who are among the leading scientific proponents of adaptive management, called for it nearly twenty years ago in the context of fisheries management:

Once a clear set of alternative hypotheses or stock response models is available, it is worth doing a simple calculation of the expected value of perfect information . . . in order to determine whether further adaptive policy analysis is worthwhile. The essential idea behind this calculation is to find the policy option that would be best if there is no future learning . . . , then to see how much improvement could be obtained from that nonadaptive baseline if it were known for certain which model is correct, that is, if perfect information were suddenly available.¹⁷²

Yet many policymakers and public resource managers still have not learned this important lesson. As a result, adaptive management, which is a form of structured decisionmaking,¹⁷³ is frequently required or adopted without any structured analysis of the benefits it is expected to produce or the tradeoffs inherent in realizing those benefits. That in turn leads to the cynical (but not necessarily false) assumption that the purpose of adaptive

172. HILBORN & WALTERS, *supra* note 107, at 493.

173. Lyons et al., *supra* note 4, at 1684.

management is to reduce political pressures or evade oversight, rather than to improve management outcomes. If adaptive management is truly necessary, the ongoing confidence of stakeholders as well as policymakers will be needed to sustain it. If it is not truly necessary, it should not be employed. Either way, a formal, structured analysis at the point of deciding whether and how to use it will be helpful.

In some crucial cases, that analysis will show that learning, although valuable, would be costly or difficult. All is not necessarily lost in those cases. Some barriers to learning are the result of policy choices. The right policy steps might be able to reduce those barriers sufficiently to make important learning practicable. There are systematic steps that can encourage the production of relevant information and facilitate its diffusion to managers in a form they can trust and use. Those steps are not costless in the short run, but they should pay dividends over time.

Sometimes, though, the conclusion will simply be that adaptive management is not the right choice. Perhaps the costs of learning are too high and cannot be lowered through any feasible measures. Perhaps the opportunities to adjust management efforts are too limited. In those cases, the structured analysis recommended here can provide a needed reality check, reminding managers and policymakers not to count on adaptive management to justify action in the face of important uncertainties or to prevent or correct management errors. Faced with the reality that adaptive management is not a panacea, policymakers may have to directly confront difficult questions about the relative costs of different sorts of errors and develop forthright approaches to making decisions in light of uncertainty.