Paso Basin Cooperative Committee

NOTICE IS HEREBY GIVEN that the Paso Basin Cooperative Committee will hold a Special Meeting at **4:00 P.M. on Wednesday, September 12, 2018** at the City of Paso Robles Council Chambers (1000 Spring St., Paso Robles, CA 93446).

NOTE: The Paso Basin Cooperative Committee reserves the right to limit each speaker to three (3) minutes per subject or topic. In compliance with the Americans with Disabilities Act, all possible accommodations will be made for individuals with disabilities so they may attend and participate in meetings.

John Hamon, Chairperson, City of Paso Robles
Reginald Cousineau, Member, Heritage Ranch CSD
Joe Parent, Member, San Miguel CSD
John Peschong, Vice Chairperson, County of SLO
Willy Cunha, Secretary, Shandon-San Juan WD

Steve Martin, Alternate, City of Paso Robles
Scott Duffield, Alternate, Heritage Ranch CSD
Kelly Dodds, Alternate, San Miguel CSD
Debbie Arnold, Alternate, County of SLO
Matt Turrentine, Alternate, Shandon-San Juan WD

Agenda
September 12, 2018

1. **Call to order**
2. **Pledge of Allegiance**
3. **Roll call**
4. **Public Comment – items not on Agenda**
5. **Approval of July 25, 2018 Meeting Minutes**
6. **Receive update of approach to Public Comment and Groundwater Sustainability Plan (GSP) Chapters Review and Approval**
7. **Project Status Update**
    a. Schedule
    b. Groundwater Conditions, Water Budgets, and Sustainable Management Criteria
    c. Monitoring Data and De Minimis Extractors
8. **Consider recommending that each GSA receive and file Paso Robles Subbasin GSP Draft Sections**
    a. Chapter 4. Hydrogeologic Conceptual Model
9. **Receive update on supporting efforts**
    a. DWR Technical Support Services and possible approach for pursuing assistance
10. **Committee Member Comments –** Committee members may make brief comments, provide status updates, or communicate with other members, staff, or the public regarding non-agenda topics
11. **Upcoming meetings**
    a. Regular Meeting - October 17, 2018
12. **Future Items**
13. **Adjourn**

Paso Basin Cooperative Committee
Minutes (DRAFT)
July 25, 2018

The following members or alternates were present:

John Hamon, Chair, Member, City of Paso Robles
Debbie Arnold, Alternate Member, County of San Luis Obispo
Willy Cunha, Secretary, Member, Shandon-San Juan WD
Scott Duffield, Alternate Member, Heritage Ranch CSD

1. Call to Order	Chairperson Hamon calls the meeting to order at 4:00PM.
2. Roll Call	County Staff, Angela Ruberto: calls roll.
3. Pledge of Allegiance	Alternate Member Arnold leads the Pledge of Allegiance.
4. Public Comment – Items not on the Agenda	Chairperson Hamon: opens the floor for public comment on items not on the Agenda. Greg Grewal: comments on number of wells added and replaced in the basin between 2014 and 2018 (cites 125 wells added, 120 wells replaced; totaling 8,000 wells with about 5 new wells being added per year); comments that replaced wells are concentrated in two specific areas: the Jardine Area and the Estrella el Pomar Area; states these wells required deeper drilling, original depth of ~300ft increased to approximately 700ft; emphasizes the variation in depth to water throughout the basin and suggests targeting "problem areas" to understand what contributed to that condition. Leonard Johnson: states concern over the Salinas River, including: the use of the river for flood control–not for replenishing the aquifers running alongside it; the historical concern of water flowing in and under the river; the ecology around the river and the levels of clay being stored since 1942. Dana Merrill, Estrella-El Pomar-Creston Water District (EPCWD): comments that the EPCWD is supportive of the Cooperative Committee and is looking forward to learning what the County GSA has planned regarding aspects of SGMA and how it pertains to their GSA; states that EPCWD has started an initiative to develop more well data in order to provide better understanding of water levels; comments that EPCWD represents a third of the pumping in the Basin and is working on a project with Shandon to develop hydrologic expertise to provide scientifically based technical support to staff; comments that both (Water Districts) are: spending their own money on this project, looking to gain traction with well monitoring and see a benefit to securing voluntary well data. Jerry Reaugh, EPCWD: comments that the EPCWD represents the largest single group of water users in the Basin and is anxious to see

<table>
<tr><td></td><td>what type of outreach they will receive as members of the County's GSA as it pertains to their specific problems; states that it is important to outreach to their membership since EPCWD represents such a significant portion of water users in the Basin; states that the EPCWD has raised $180,000 and is now able to participate in the projects previously mentioned by Dana Merrill; comments that EPCWD is looking very closely at the recycled water project, an important project that will produce new water the Basin and could reduce pumping.

Chairperson Hamon: closes the floor for public comment.</td></tr>
<tr><td>5. Approval of Meeting Minutes and Public Workshop Summaries</td><td>Chairperson Hamon: moves to discuss approval of minutes and asks Committee for questions or comments.

Alternate Member Arnold: requests that corrections be made on pages 4 and 5 of draft Minutes to reflect the correct name of voting Member:
Remove John Peschong as voting Member and replace with Debbie Arnold
Chairperson Hamon: opens the floor for public comment.

Greg Grewal: Speaks.

Chairperson Hamon: asks County Staff if recordings can be recalled to verify information, if needed.

County Staff, Angela Ruberto: responds that recordings can be recalled, and that Committee Minutes are formatted by following the County Board's process of stating who spoke during each item; public comments are included for non-agendized topics only.

Motion By: Secretary Cunha
Second By: Alternate Member Arnold
Motion: The Committee moves to approve Meeting Minutes and Public Workshop summaries from April 23, April 25, April 30, May 14 and May 21, 2018.
<table>
<tr><th>Members</th><th>Ayes</th><th>Noes</th><th>Abstain</th><th>Recuse</th></tr>
<tr><td>John Hamon (Chairperson)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Debbie Arnold (Alternate Member)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Willy Cunha (Secretary)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Scott Duffield (Alternate Member)</td><td>X</td><td></td><td></td><td></td></tr>
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<tr><td>6. Receive overview of approach for Groundwater Sustainability Plan (GSP)</td><td>City Staff, Dick McKinley: presents an overview of approach for Groundwater Sustainability Plan (GSP) Chapters and Draft Review and Approval (attached in Meeting Agenda).</td></tr>
</table>

Chapters and Draft Review and Approval	Chairperson Hamon: comments that GSA Chapter review process could be potentially lengthy; emphasizes the importance of time management during the review period. City Staff, Dick McKinley: comments that it is not defined how individual GSAs should conduct their review process, stating that each GSA may choose to review as they see fit, and that each GSA should consider time restraints while reviewing; adding that there is a mandatory 90 public comment period prior to GSP submission, as well.
7. Project Status Update	City Staff, Dick McKinley: presents update on the Groundwater Sustainability Plan (GSP) Budget (attached in Meeting Agenda); discusses the City of Paso Robles' invoicing and review process as the contracting agency. Montgomery & Associates, Derrik Williams: presents an update on the GSP Schedule (presentation attached in Meeting Agenda). Montgomery & Associates, Tim Leo: presents an update on development of the GSP Water Budget (presentation attached in Meeting Agenda). Secretary Cunha: asks Tim Leo if the four-month timeframe for developing a water budget is sufficient time; Tim Leo responds that it is. Chairperson Hamon: opens the floor for public comment. Greg Grewal and Leonard Johnson: speak. Montgomery & Associates, Tim Leo: comments that Atascadero Subbasin is not accounted for in current water budget; streamflow from the Salinas are included in the model as provided in County records. Chairperson Hamon: closes the floor for public comment. Montgomery & Associates, Tim Leo: presents an overview on the Sustainable Management Criteria Survey (attached in Meeting Agenda). Alternate Member Arnold: asks if well depth in relation to water levels in the Creston Area will be addressed as part of the data collection process. Montgomery & Associates, Tim Leo: responds that, yes, time has been dedicated to mapping out where wells and the principal aquifers are located/screened.

	Chairperson Hamon: asks Tim Leo if an average is used throughout the Basin to track water levels, noting that rainfall is heavier on west side than on east. Montgomery & Associates, Tim Leo: responds that several, spatially distributed, weather stations are used throughout the basin, capturing and accounting for variation in rainfall; confirms confidence in reasonableness of conceptualization of the water budget in the basin based on good science and comprehensive evaluation of the processes that use water in the basin. Chairperson Hamon: opens the floor for public comment. Mary Stover, Greg Grewal, Anne Myhre, and Jerry Reaugh: speak. Montgomery & Associates, Tim Leo: comments that there were 111 responses to the Sustainable Management Criteria Survey. Montgomery & Associates, Derrik Williams: comments that the Sustainable management Criteria Survey was a way to start the public input process. Chairperson Hamon: closes the floor for public comment.
8. Consider recommending that each GSA receive and file Paso Robles Subbasin GSP Draft Sections	Montgomery & Associates, Derrik Williams: provides an overview and description of the Paso Robles Subbasin GSP Draft Outline (attached in Meeting Agenda). Montgomery & Associates, Derrik Williams: describes process of receiving and filing sections of the GSP; states that the Outline was based on a reading of the Sustainable Groundwater Management Act regulations and addresses all requirements; regulations will be cross-referenced throughout GSP; in general, Committee will receive draft GSP sections in chapter order. Secretary Cunha: comments that the Draft Outline matches the regulations and is a very helpful guide. Montgomery & Associates, Derrik Williams: provides an overview and description of the Paso Robles Subbasin GSP Draft sections (attached in Meeting Agenda): • Chapter 1. Introduction • Chapter 2. Agency Information • Chapter 3. Description of Plan Area

Montgomery & Associates, Derrik Williams: suggests the Committee thoroughly review each section and reiterates that the regulations have been fully addressed in each section; states that Dick McKinley is listed as project manager in Draft sections–a place holder until someone has been formally appointed by the Committee or otherwise designated in accordance with the GSP regulations; other place holders are also included in the Draft Sections; explains that the GSP is being written as if the Basin boundary modification request to separate the San Luis Obispo portion of the Basin from the Monterey County portion of the Basin will be accepted by the Department of Water Resources (DWR); DWR will not announce final approval of boundary modification requests until next year, and many important sections of the GSP are being written without knowing the outcome of DWR's decision.

Chairperson Hamon: opens the floor to questions from the Board.

Alternate Member Arnold: suggests the following edits to Draft Chapters 1-3:

- Chapter 1, Section 1.2: subbasin is part of greater Salinas valley Basin… acreage in paragraph before basin boundary is incorrect (note: given what is presented on page 2); confirm or correct
- Chapter 2: Section 2.3.1, Authority of Agencies/Individual GSAs, page 5. Be specific and consistent if/when describing how each agencies' representatives are elected (for example, "elected by districts", "elected at large", etc.)
- Chapter 3, Section 2.3.2: list GSAs weighted voting percentages in the text to help explain who participated, how they participated, and how they came to be.

Montgomery & Associates, Derrik Williams: states that the MOA will be included in the GSP as an attachment.

Chairperson Hamon: opens the floor for public comment.

Dennis Loucks, Greg Grewal, and Jerry Reaugh: speak.

Montgomery & Associates, Derrik Williams: explains that DWR categorizes idle land as native vegetation and unirrigated land/pastures; states that all the water received by the City of Paso Robles from Lake Nacimiento, and the turnout in Creston, is being acknowledged in water budget; will review naming structure regarding the conjunctive use program vs. import of surface water.

	Chairperson Hamon: asks if the GSP will address the number issued by the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. Montgomery & Associates, Derrik Williams: states that this will not be addressed; in DWRs view, the Basin is critically overdrafted; the GSAs and GSP Consultant team are not planning on negotiating the basin's score as part of the GSP development; states that land use questions will be addressed in upcoming GSP sections. Chairperson Hamon: opens and closes the floor for public comment. Montgomery & Associates, Derrik Williams: provides an overview of the Draft GSP Communication and Engagement Plan (attached in Meeting Agenda). Chairperson Hamon: asks if review for chapters 1-3 will need to be completed by the next Regular Meeting scheduled for October 17. Montgomery & Associates, Derrik Williams: Answers no and explains that the Board will be receiving additional Draft Chapters at future meetings; each GSA will need to take it amongst themselves to move forward with the review process; the next time the Board will see the updated Chapters (1-3 and outline) will be mid-2019. Alternate Member Arnold: comments on the importance of providing feedback on the Draft Chapters; asks for clarification on whether or not there is "conjunctive use" in the Subbasin, citing the Shandon turnout and the Nacimiento pipeline as potential sources of "conjunctive use". Montgomery & Associates, Derrik Williams: responds that conjunctive use may have different uses/definitions; agrees to meet with County Staff to clarify, and change if needed, the language used in description of "conjunctive use" in the draft chapters. Secretary Cunha: comments on the accuracy of data sets in Draft Chapter 3; would like to see more accurate, local data sets to be included. Alternate Member Arnold: reiterates the importance of providing immediate feedback on Draft Chapters to help facilitate edits prior to reviewing the final document. City Staff, Dick McKinley: comments that there will be a future opportunity to make additional edits to the GSP Chapters.

Alternate Member, Scott Duffield: recommends utilizing staff to provide additional feedback to consultants throughout review process.

Motion By: Chairperson Hamon
Second By: Secretary Cunha
Motion: The Committee moves to receive and file Paso Robles Subbasin GSP Draft Sections:

- GSP Outline
- Chapters 1-3
- Communication and Engagement Plan.

Members	Ayes	Noes	Abstain	Recuse
John Hamon (Chairperson)	X			
Debbie Arnold (Alternate Member)	X			
Willy Cunha (Secretary)	X			
Scott Duffield (Alternate Member)	X			

9. Receive update on supporting efforts

Secretary Cunha: provides an overview on DWR Technical Support Services and possible approach for pursuing Assistance (Memo and DWR fact sheet attached in Meeting Agenda); if chosen to pursue, the GSAs would need to designate an Agency contact and submit paperwork that describes ideal projects for approval from DWR.

Chairperson Hamon: asks, and Secretary Cunha confirms, that there will only be one opportunity to submit the grant application.

Department of Water Resources, Benn Gooding: confirms Secretary Cunha's understanding, and overview, of the program; recommends submitting application as soon as possible.

Chairperson Hamon: suggests the Committee provide direction to Staff to initiate project development.

Alternate Member Arnold: asks County Staff if a monitoring well location could be determined by using previously identified data gaps.

County Staff, Angela Ruberto: responds that there have been efforts to identify data gaps throughout the Basin, including a matrix developed by Montgomery & Associates that compares the benefits of targeting specific areas based on the identified data gaps.

City Staff, Dick McKinley: suggests a motion be made to direct staff to work toward identifying appropriate monitoring well locations.

Secretary Cunha: asks who the lead Agency contact will be.

	Alternate Member Arnold: comments that the monitoring well would still be in use long after the Committee has dissolved, and that the County could potentially add the well to an existing well monitoring program. County Staff, Carolyn Berg: states that the well could be added into the San Luis Obispo County Flood Control District's existing well monitoring program; well ownership would depend on the Agency's boundaries that the well resides in, and that Agency would own and operate that well and share the data with the County. **Motion By:** Alternate Member Arnold **Second By:** Secretary Cunha **Motion:** The Committee moves to direct County Staff to proceed with pursuing DWR's Technical Support Services Grant.

Members	Ayes	Noes	Abstain	Recuse
John Hamon (Chairperson)	X			
Debbie Arnold (Alternate Member)	X			
Willy Cunha (Secretary)	X			
Scott Duffield (Alternate Member)	X			

10. Committee Member Comments	Secretary Cunha: comments that he appreciates the participation and input from the public. Alternate Member Arnold: comments that she appreciates seeing developed Draft GSP Chapters.
11. Upcoming Meetings	Next meeting: Special Meeting set for Wednesday, September 12, 2018 at 4:00PM, Location: Paso Robles - City Council Chambers. Next meeting: Regular Meeting set for Wednesday, October 17, 2018 at 4:00PM, Location: Paso Robles - City Council Chambers.
12. Future Items	Gwen Palfrey: speaks. Montgomery & Associates, Derrik Williams: suggests that members of the public should work with their local GSAs to have their comments effectively noted, and that ongoing comments are predicted throughout the GSP development process; can come back to the Board to discuss a plan that establishes a commenting/posting period. Chairperson Hamon: states that a commenting plan should be should be included on the September 12, 2018 Agenda.

13. Adjourn

Next meeting set for Wednesday, September 12, 2018 at 4:00PM
Location: Paso Robles - City Council Chambers

Motion By: Chairperson Hamon
Second By: Secretary Cunha
Motion: The Committee moves to adjourn the meeting.

Members	Ayes	Noes	Abstain	Recuse
John Hamon (Chairperson)	X			
Debbie Arnold (Alternate Member)	X			
Willy Cunha (Secretary)	X			
Scott Duffield (Alternate Member)	X			

I, Willy Cunha, Secretary to the Paso Basin Cooperative Committee, do hereby certify that the foregoing is a fair statement of the proceedings of the meeting held on July 25, 2018, by the Paso Basin Cooperative Committee.

Willy Cunha, Secretary of the Paso Basin Cooperative Committee.
Drafted by: Joey Steil and Angela Ruberto, County of San Luis Obispo

PASO BASIN COOPERATIVE COMMITTEE
September 12, 2018

Agenda Item #6 – Receive update of approach to Public Comment and Groundwater Sustainability Plan (GSP) Chapters Review and Approval

SUBJECT
Receive update of approach to Public Comment and Groundwater Sustainability Plan (GSP) Chapters Review and Approval

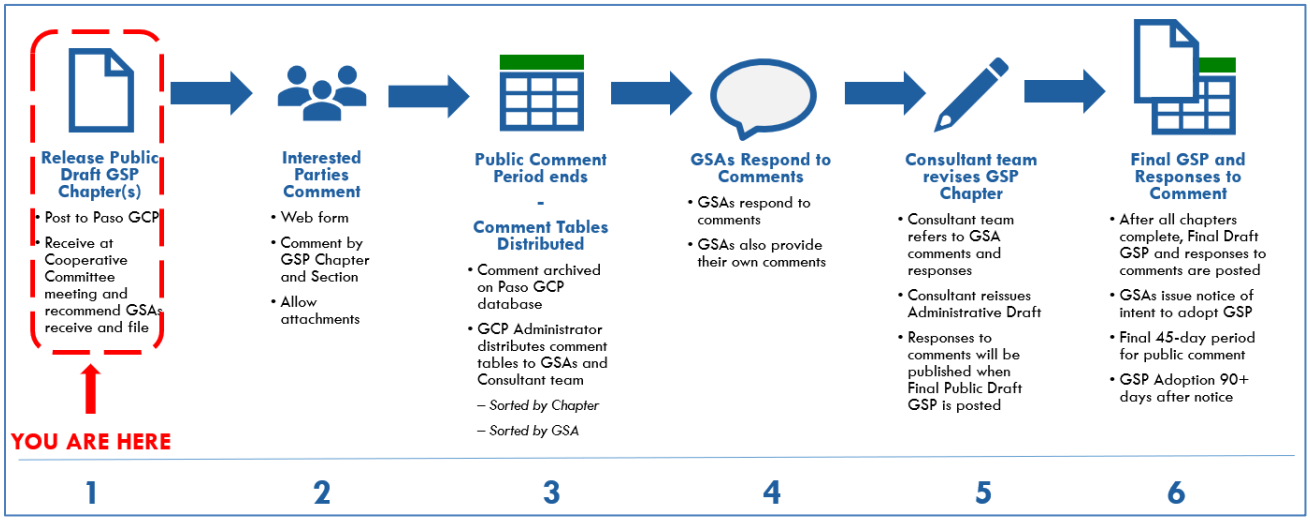
RECOMMENDATION
It is recommended that the Paso Basin Cooperative Committee (Committee) receive update of approach to Public Comment and GSP Chapters Review and Approval.

PREPARED BY
Angela Ruberto, County of San Luis Obispo

BACKGROUND
At the July 25, 2018 Paso Basin Cooperative Committee meeting, Chairperson Hamon requested an overview of the public comment process at an upcoming meeting.

DISCUSSION
This item is intended to provide an overview of the process by which Draft GSP Chapters will be routed, reviewed, publicly vetted, revised and compiled.

The GSP Consultant team develops Draft GSP Chapters to publicly vet information, findings and approaches. The Draft GSP Chapters are publicly vetted at the Cooperative Committee and each GSA's Board meetings. The steps for this process as summarized as follows:



Six Step Public Comment Process Flow Chart

Step	
1	**Release Public Draft GSP Chapter(s)** • Draft GSP Chapters are submitted to the Paso Basin Cooperative Committee at a public meeting. The Paso Basin Cooperative Committee receives and considers recommending that each GSA receive and file the Draft GSP Chapters.
2	**Interested Parties Comment (~45 Days)** • Upon the Committee's recommendation, each GSA receives and files the Draft GSP Chapters and Committee Comments, if any, at a public meeting. • The Draft GSP Chapters, and accompanying fillable web "Comment Forms" are posted to PasoGCP.com and the GSAs' websites. o Draft GSP Chapters and Comment Forms are posted for duration of 45-day public comment period, during which the public, the GSAs, and individual Cooperative Committee Members/Alternates may provide comments using the posted Comment Form, or alternative if necessary.
3	**Public Comment Period ends, Comment Tables Distributed** • All comments received through pasogcp.com Comment Form, or accepted alternative, are compiled and distributed to the GSAs for consideration.
4	**GSAs Respond to Comments** • Staff of the GSAs review, consider, and draft responses to public comments from constituents within their jurisdiction. • GSAs provide the list of comments and draft responses to consultant team for use in the Draft GSP Chapter revision process. o *Comments from interested parties outside of the subbasin may be addressed by any GSA.*
5	**Consultant team revises GSP Chapter** • The consultant team will modify each GSP chapter based upon the input from the five GSAs and the responses to public comments before circulating an Administrative Draft of the revised chapters. • Staff of the GSAs will review the Administrative Draft to ensure each GSA's input and responses to public comments were satisfactorily addressed.
6	**Final GSP and Responses to Comment** • After all Draft GSP Chapters have gone through steps 1-5, the Final Public Draft GSP is posted with a summary list of comments and responses. • Each GSA issues Notice of Intent to adopt the GSP, starting a required 90-day notice to any City or County within the area of the proposed plan o *The five GSAs will set a final 45-day public comment period to allow time to respond to public comments within the 90-day noticing period.*

* * *

PASO BASIN COOPERATIVE COMMITTEE
September 12, 2018

Agenda Item #8 – Consider recommending that each GSA receive and file Paso Robles Subbasin GSP Draft Sections

SUBJECT

Receive Draft GSP Outline and Chapters and consider recommending that each GSA receive and file Draft GSP Outline and Chapters

RECOMMENDATION

It is recommended that the Paso Basin Cooperative Committee (Committee) receive and consider recommending that each GSA receive and file Paso Robles Subbasin GSP Draft Chapter 4 - Hydrogeologic Conceptual Model.

GSP Chapter		Status
1	Introduction to Paso Robles Subbasin GSP	Draft out for public comment until 10/15/2018
2	Agency Information	Draft out for public comment until 10/15/2018
3	Description of Plan Area	Draft out for public comment until 10/15/2018
4	**Hydrogeologic Conceptual Model**	**To be received by Cooperative Committee on 9/12/2018**
5	*Groundwater Conditions*	*Under Development, anticipated 10/17/2018*
6	*Water Budget*	*Under Development, anticipated 1/23/2019*
7	*Sustainable Management Criteria*	*Under Development, anticipated 1/23/2019*
8	*Monitoring Networks*	*Under Development, anticipated 1/23/2019*
9	*Projects and Management Actions*	*Under Development, anticipated 4/24/2019*
10	*Plan Implementation*	*Anticipated 4/24/2019*
11	*Notice and Communications* *C&E Plan	*Under Development, anticipated 4/24/2019* Draft out for public comment until 10/22/2018 (*C&E Plan only)
12	*Interagency Agreements*	*Anticipated 4/24/2019*
13	*Reference List*	*Anticipated 4/24/2019*

PREPARED BY

Not Applicable – See attached Draft GSP Chapter 4, provided by the GSP Consultant.

ATTACHED

1. Draft Chapter 4. Hydrogeologic Conceptual Model (9/5/2018)

* * *

DRAFT

Chapter 4

Paso Robles Subbasin Groundwater Sustainability Plan

Published on:	**September 5, 2018**
Received by the Paso Basin Cooperative Committee:	**September 12, 2018**
Posted on PasoGCP.com:	**September 19, 2018**
Close of 45-day public comment period:	**November 3, 2018**

This Draft document is posted on pasogcp.com and is being distributed to the five Paso Robles Subbasin Groundwater Sustainability Agencies (GSAs) to receive and file. Comments from the public are being collected using a comment form. The form can be found online at pasogcp.com. If you require a paper form to submit by postal mail, contact your local GSA.

- County of San Luis Obispo
- Shandon-San Juan Water District
- Heritage Ranch CSD
- San Miguel CSD
- City of Paso Robles

Draft
Paso Robles Subbasin
Groundwater Sustainability Plan
Chapter 4

Prepared for the Paso Robles Subbasin Cooperative Committee and the Groundwater Sustainability Agencies

September 5, 2018

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

CHAPTER 4. HYDROGEOLOGIC CONCEPTUAL MODEL

This chapter describes the hydrogeologic conceptual model of the Paso Robles Subbasin, including the Subbasin boundaries, geologic formations and structures, and principal aquifer units. The chapter also summarizes general Subbasin water quality, the conceptual interaction between groundwater and surface water, and generalized groundwater recharge and discharge areas. This chapter draws upon previously published studies, primarily hydrogeologic and geologic investigations by Fugro Consultants Inc. completed for San Luis Obispo County in 2002 and 2005. Fugro Consultants' 2002 and 2005 reports are the definitive geologic reports of the Subbasin. All subsequent investigations, such as the 2016 groundwater model update, adopted the geologic interpretations of the 2002 and 2005 Fugro Consultant reports. The Hydrogeologic Conceptual Model presented in this chapter is not intended to be exhaustive, but is a summary of the relevant and important aspects of the Subbasin hydrogeology that influence groundwater sustainability. More detailed information can be found in the original reports (Fugro, 2002 and 2005). This chapter, along with Chapter 3 – Basin Setting, sets the framework for subsequent chapters on groundwater conditions and water budgets.

4.1 SUBBASIN TOPOGRAPHY AND BOUNDARIES

The Subbasin is a structural northwest-trending trough filled with sediments that have been folded and faulted by regional tectonics. The top of the Subbasin is the ground surface. The elevation of the Subbasin ranges from approximately 2,000 feet above mean sea level (msl) at the southeastern corner to approximately 600 feet above msl in the northwest where the Salinas River exits the Subbasin. The central part of the Subbasin forms a broad plain with relatively minor relief. Figure 4-1 shows the topography of the Subbasin using 100-foot contour intervals.

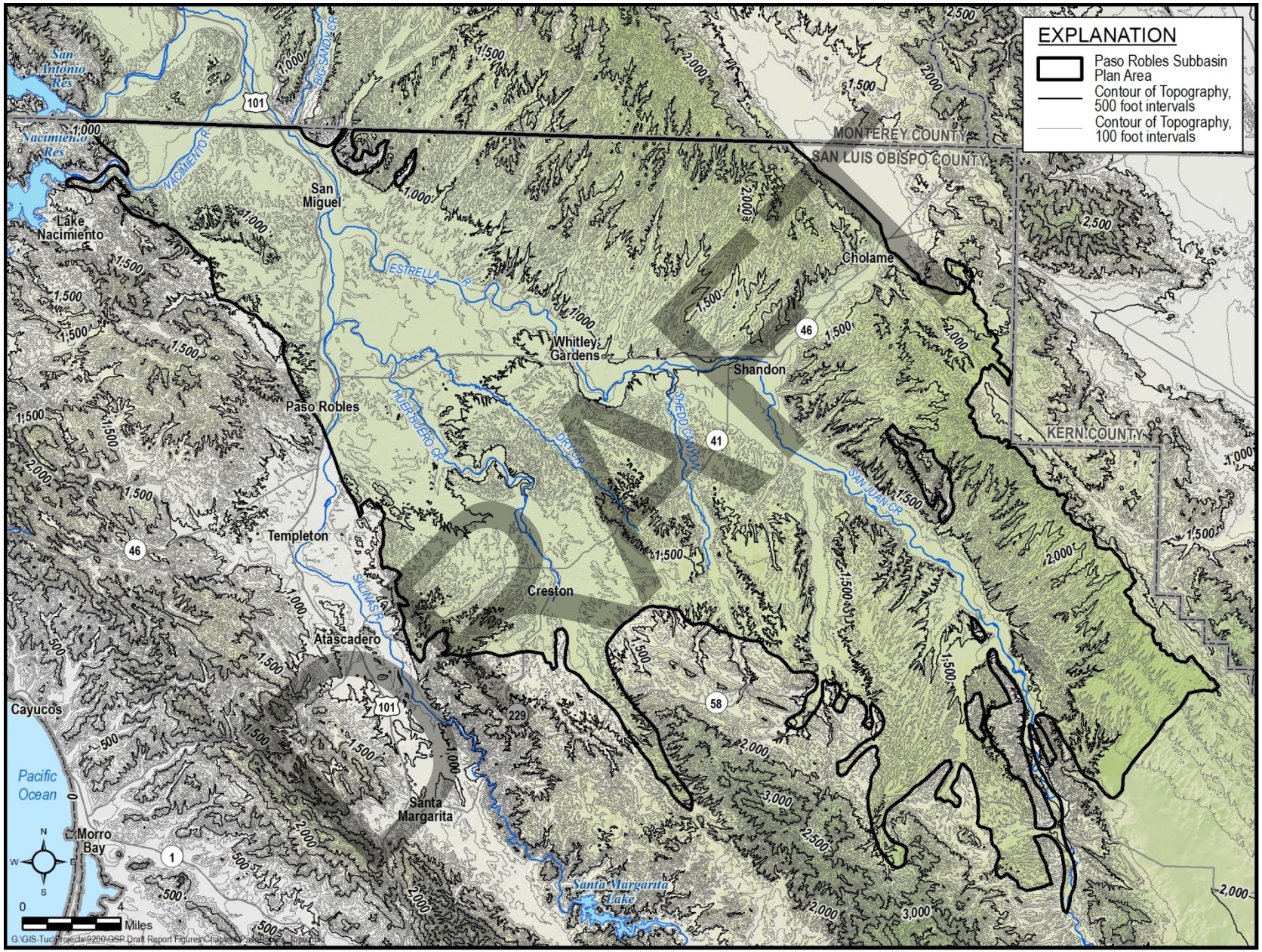

Figure 4-1. Paso Robles Subbasin Topography

The Subbasin is bounded by sediments with low permeability, sediments with poor groundwater quality, rock, and structural faults. In some areas the sediments of the Subbasin are continuous with adjacent subbasins. Specific Subbasin lateral boundaries include the following:

- The western boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Santa Lucia Range. An additional section of the western boundary is defined by the San Marcos-Rinconada fault system which separates the Paso Robles Subbasin from the Atascadero Subbasin.
- The northern boundary of the Subbasin is defined by the county line between San Luis Obispo County and Monterey County. This boundary is not defined by a physical barrier to groundwater flow; water-bearing sediments are continuous with the Salinas Valley Upper Valley Subbasin in Monterey County.
- The eastern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Temblor Range. The San Andreas Fault forms the northeastern Subbasin boundary and is approximately parallel to the boundary further south.
- The southern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the La Panza Range. To the southeast, a watershed divide separates the Subbasin from the adjacent Carrizo Plain Basin; sedimentary layers are likely continuous across this divide.

The bottom of the Subbasin is generally defined as the base of the Paso Robles Formation, which is an irregular surface formed as the result of folding, faulting, and erosion (Fugro, 2002). The Subbasin boundary and bottom are not considered absolute barriers to flow because some of the geologic units underlying the Paso Robles Formation produce sufficient quantities of water, but the water is generally of poor quality and it is therefore not considered part of the Subbasin.

Figure 4-2 shows the lateral boundaries of the Subbasin and the approximate depth to the bottom of Paso Robles Formation in areas where it is saturated. The Paso Robles Formation is either not present or not saturated east of the San Juan fault system and there is very little well data in this portion of the subbasin.

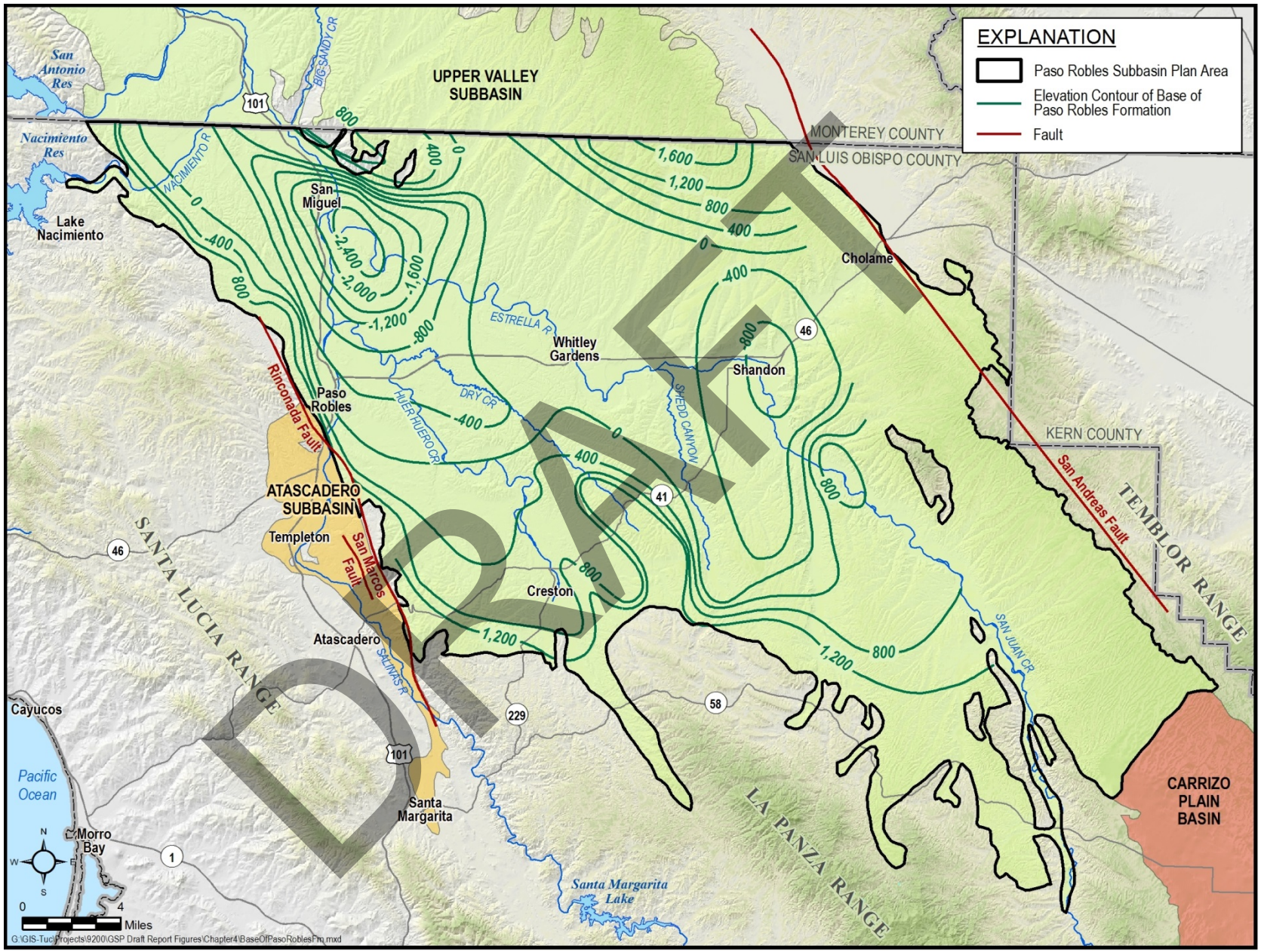

Figure 4-2. Base of Subbasin as Defined by the Base of the Paso Robles Formation

4.2 SOILS INFILTRATION POTENTIAL

Saturated hydraulic conductivity of surficial soils is a good indicator of the soil's infiltration potential. Soil data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (USDA NRCS, 2007) is shown by the four hydrologic groups on Figure 4-3. The soil hydrologic group is an assessment of soil infiltration rates that is determined by the water transmitting properties of the soil, which includes hydraulic conductivity and percentage of clays in the soil, relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typlically less than 10 percent clay and more than 90 percent sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soil stypically have greater than 40 percent clay, less than 50 percent sand

The hydrologic group of the soil generally correlates with the hydraulic conductivity of underlying geologic units, with lower soil hydraulic conductivity zones correlating to areas underlain by clayey portions of the Paso Robles Formation. The higher soil hydraulic conductivity zones correspond to areas underlain by alluvium or areas of coarser sediments within the Paso Robles Formation.

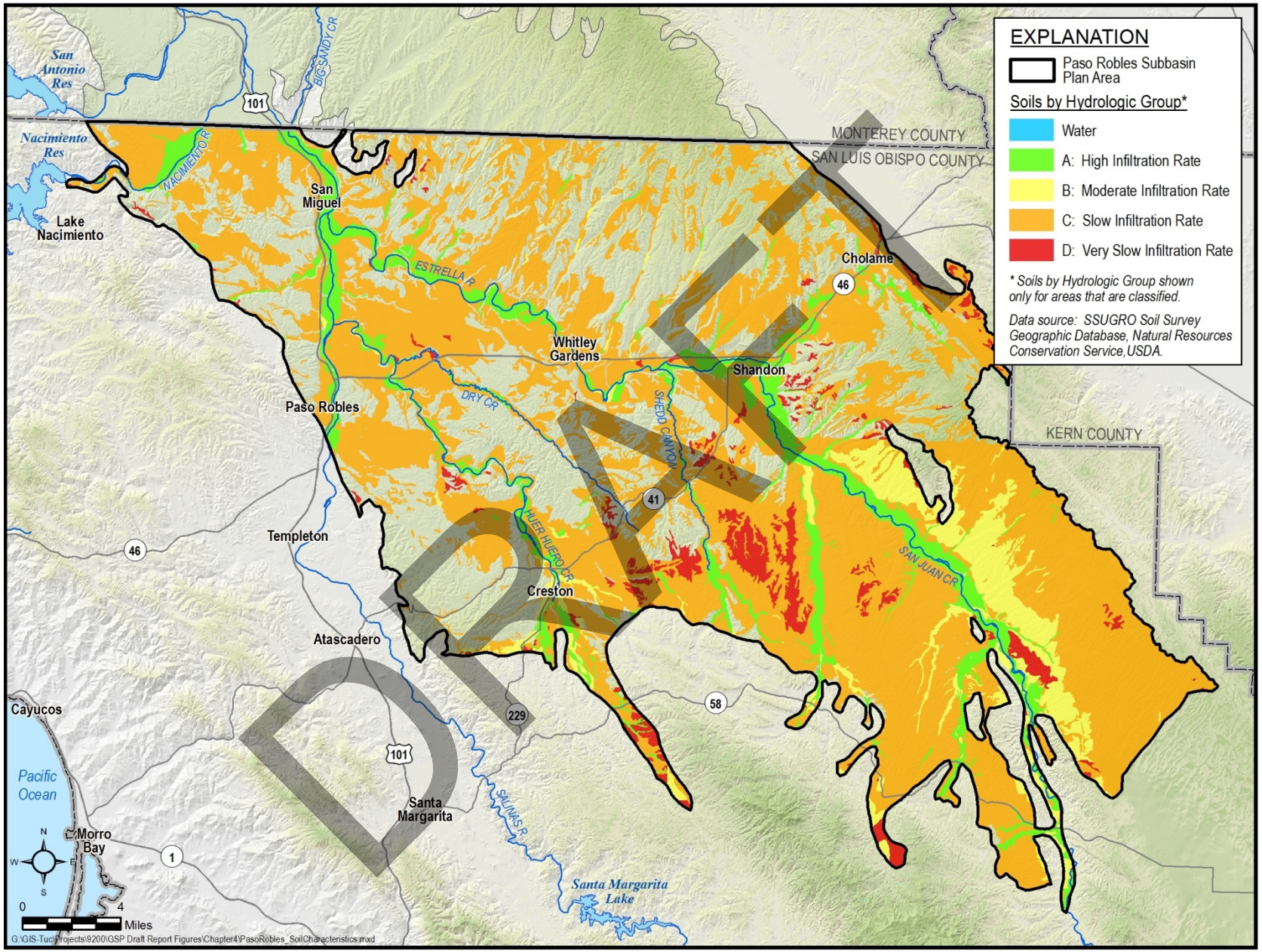

Figure 4-3. Paso Robles Subbasin Soil Characteristics

4.3 REGIONAL GEOLOGY

This section provides a description of the geologic formations in the Subbasin. These descriptions are summarized from previously published reports by Fugro (2002 and 2005). Figure 4-4 shows the surficial geology and geologic structures of the Subbasin (County of SLO, 2007). Figure 4-5 provides the location of the geologic cross-sections shown on Figure 4-6 through Figure 4-10. The selected geologic cross-sections illustrate the relationship of the geologic formations that constitute the Subbasin and the geologic formations that underlie and surround the subbasin. The cross-sections are from different reports so the format differs but the units are consistent. Figure 4-6 through Figure 4-8 are from the *Paso Robles Groundwater Basin Study* (Fugro, 2002); Figure 4-9 and Figure 4-10 are from the *Paso Robles Groundwater Basin Study, Phase II: Numerical Model Development, Calibration, and Application* (Fugro, 2005).

4.3.1 REGIONAL GEOLOGIC STRUCTURES

The base of the Subbasin is locally divided by two semi-parallel bedrock ridges: the San Miguel Dome and the Creston Anticlinorium (Figure 4-4). These two bedrock ridges are often not exposed at the ground surface, but are apparent in the subsurface cross-sections. The subsurface expression of the bedrock is illustrated on the cross-sections shown on Figure 4-6, which shows the Creston Anticlinorium, and Figure 4-8 which shows the San Miguel Dome. Between the San Miguel Dome and Creston Anticlinorium, there is no clear bedrock ridge as shown on Figure 4-7. This gap allows for sediments on the east side of the ridges near Shandon to continue and be connected with sediments on the west side of the ridges.

The deepest portion of the Subbasin is west of the San Miguel Dome and north of Paso Robles, with over 3,000 feet of sediments (Fugro, 2005). This deep trough extends through the Paso Robles area and shallows progressively to the south. As shown on Figure 4-6, the sediments are generally relatively thin on the order of a few hundred feet in the Creston area. East of the San Miguel Dome and near the community of Shandon the Paso Robles Formation is over 2,000 feet thick.

The faults within and along the borders of the Subbasin boundaries are shown on Figure 4-6. The predominant fault near the eastern side of the Subbasin is the San Andreas Fault. The predominant fault near the western side of the Subbasin is the San Marcos-Rinconada fault system. Within the Subbasin and sub-parallel to the San Andreas Fault are the Red Hill, San Juan, and White Canyon faults. It is unknown to what degree these faults are barriers to groundwater flow. In the center of the Subbasin are the King City fault and various unnamed faults. It is unknown to what degree these internal faults are barriers to groundwater flow. These faults could create compartments in the sediments and limit the ability of groundwater to move within the Subbasin.

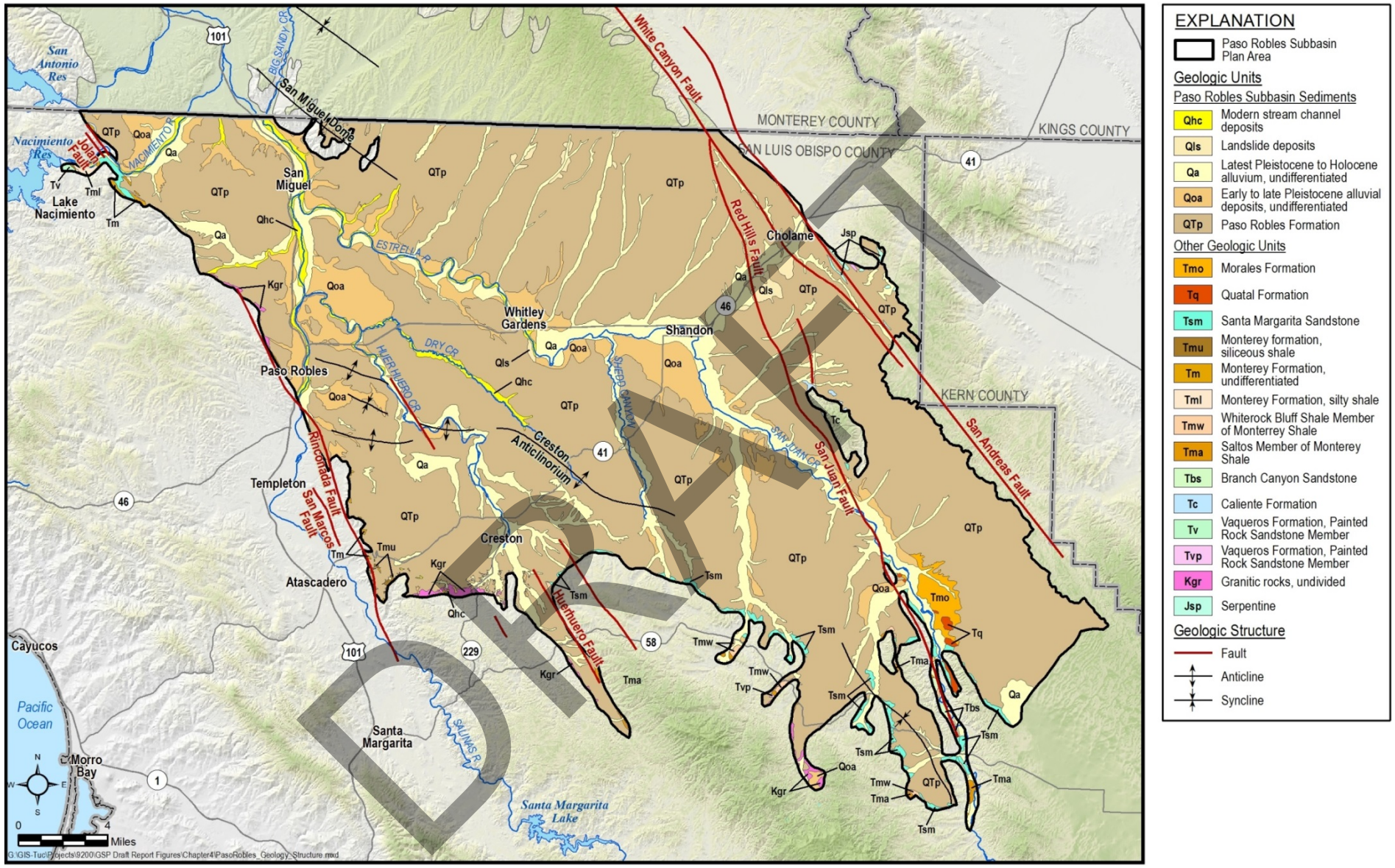

Figure 4-4. Surficial Geology and Geologic Structures

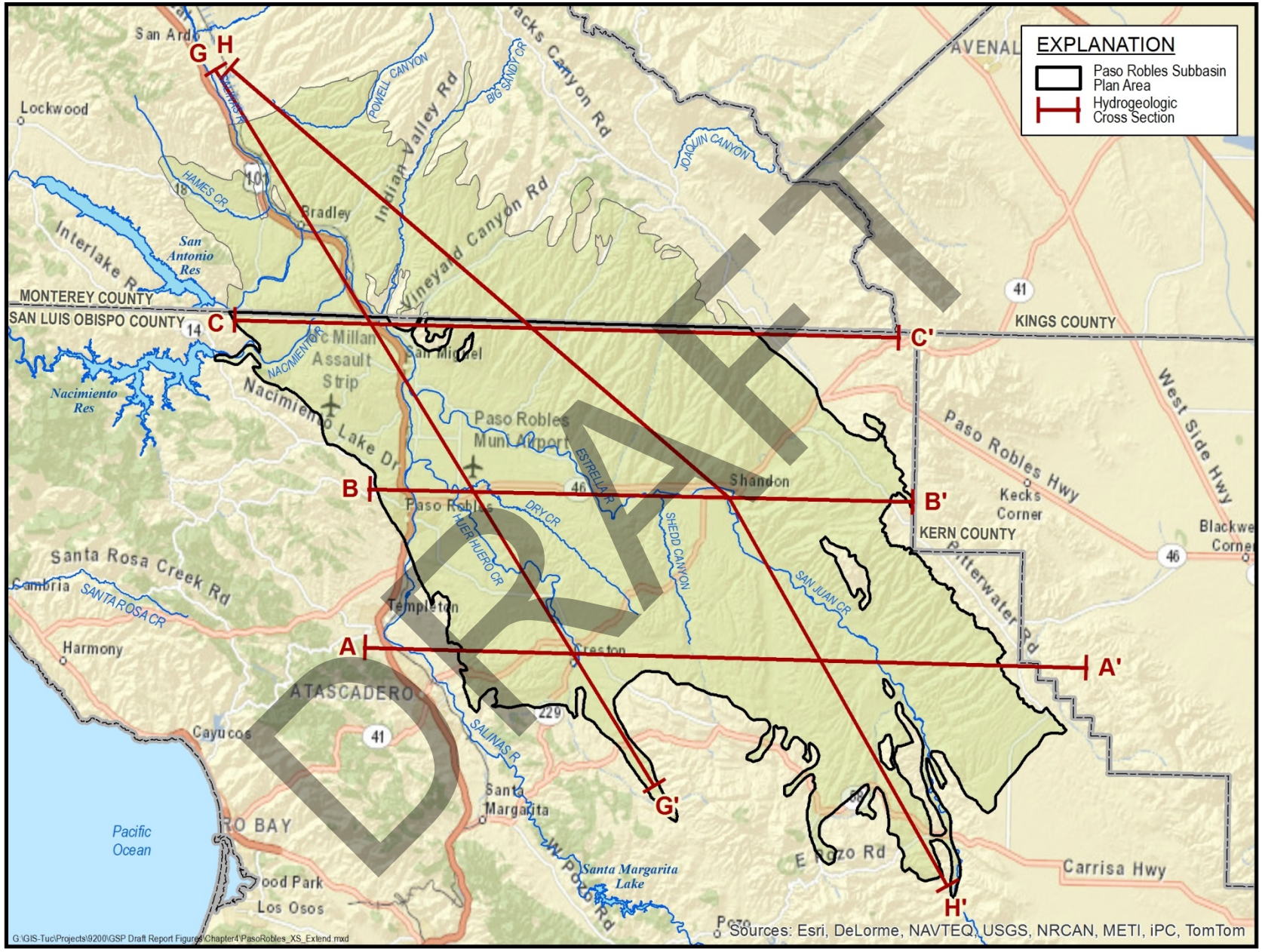

Figure 4-5. Cross Sections Locations

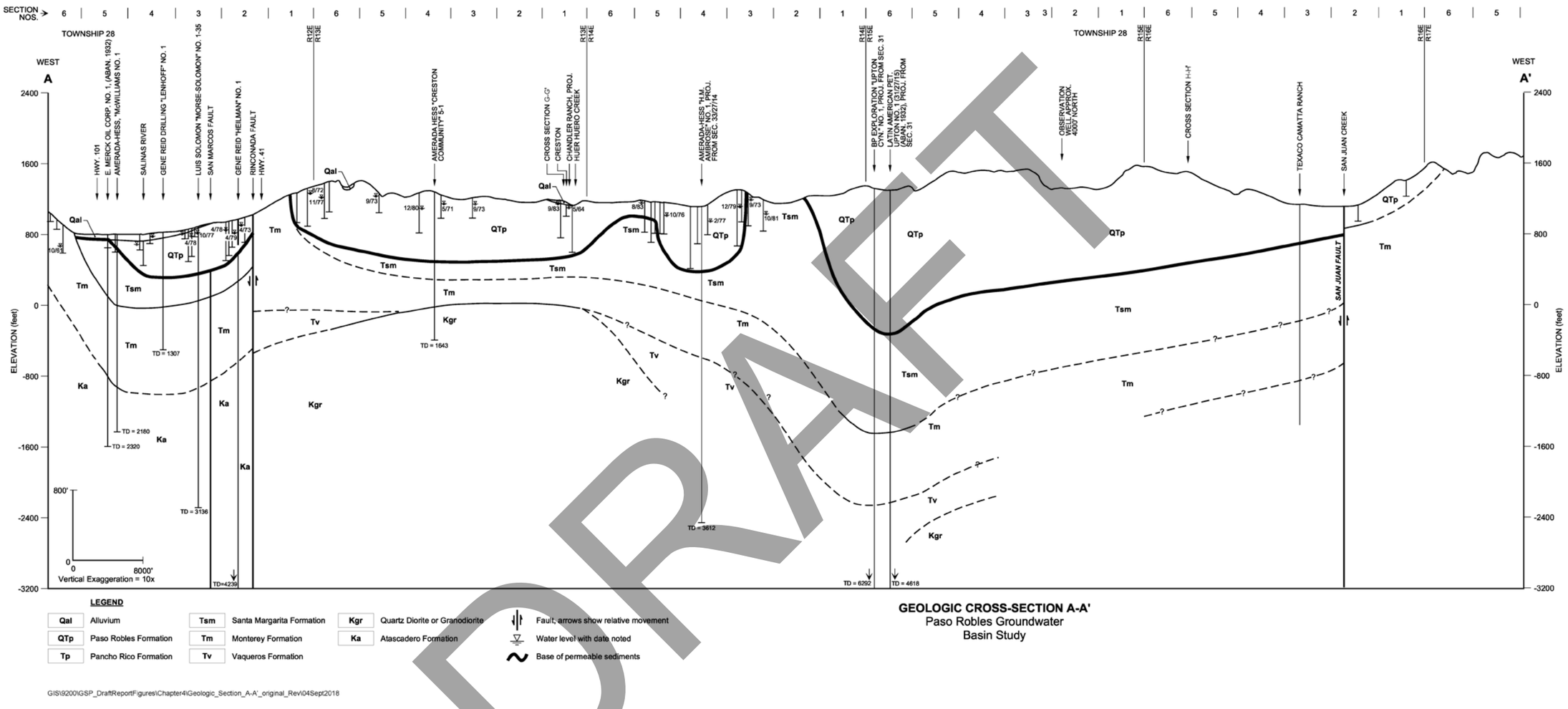

Figure 4-6. Geologic Section A-A′

Source: Modified from Fugro (2002)

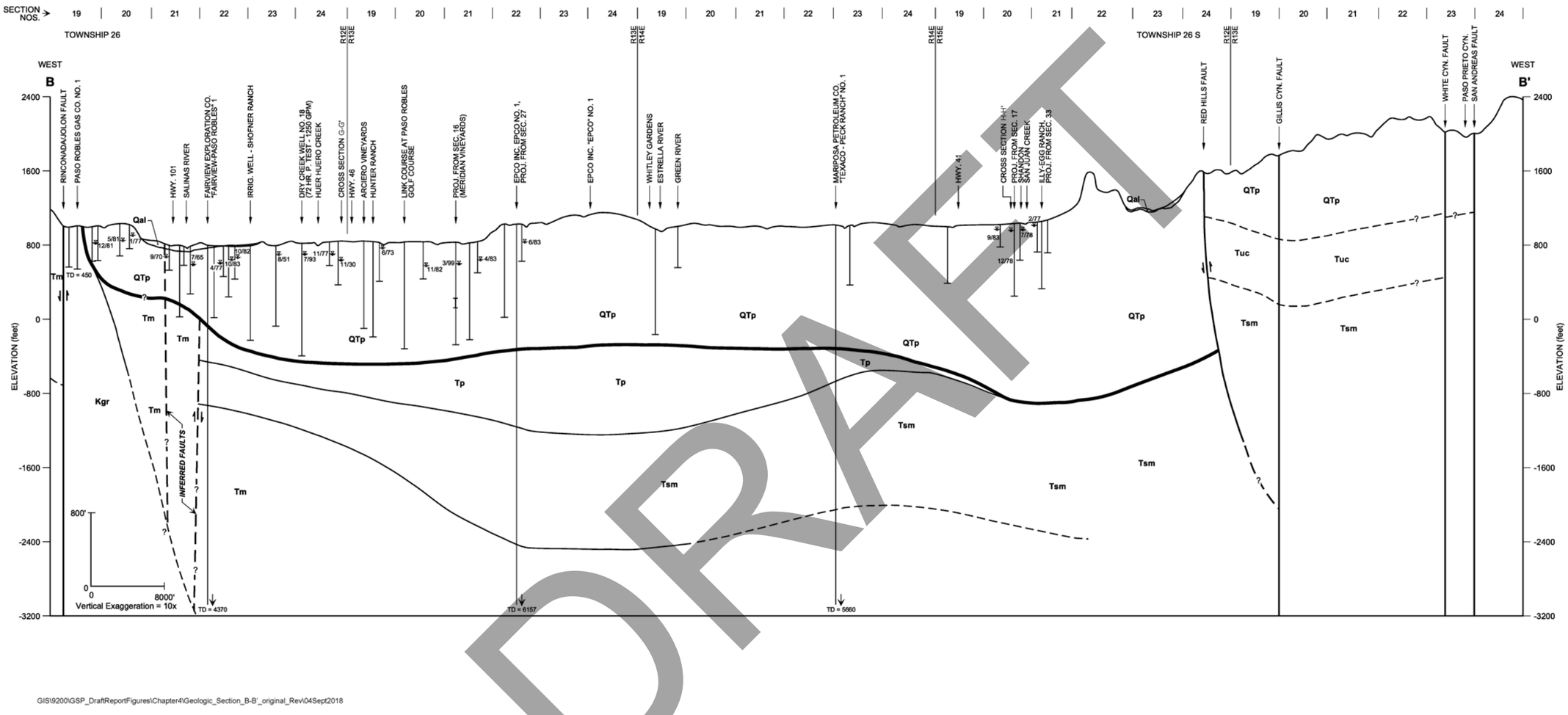

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Figure 4-7. Geologic Section B-B'

Source: Modified from Fugro (2002)

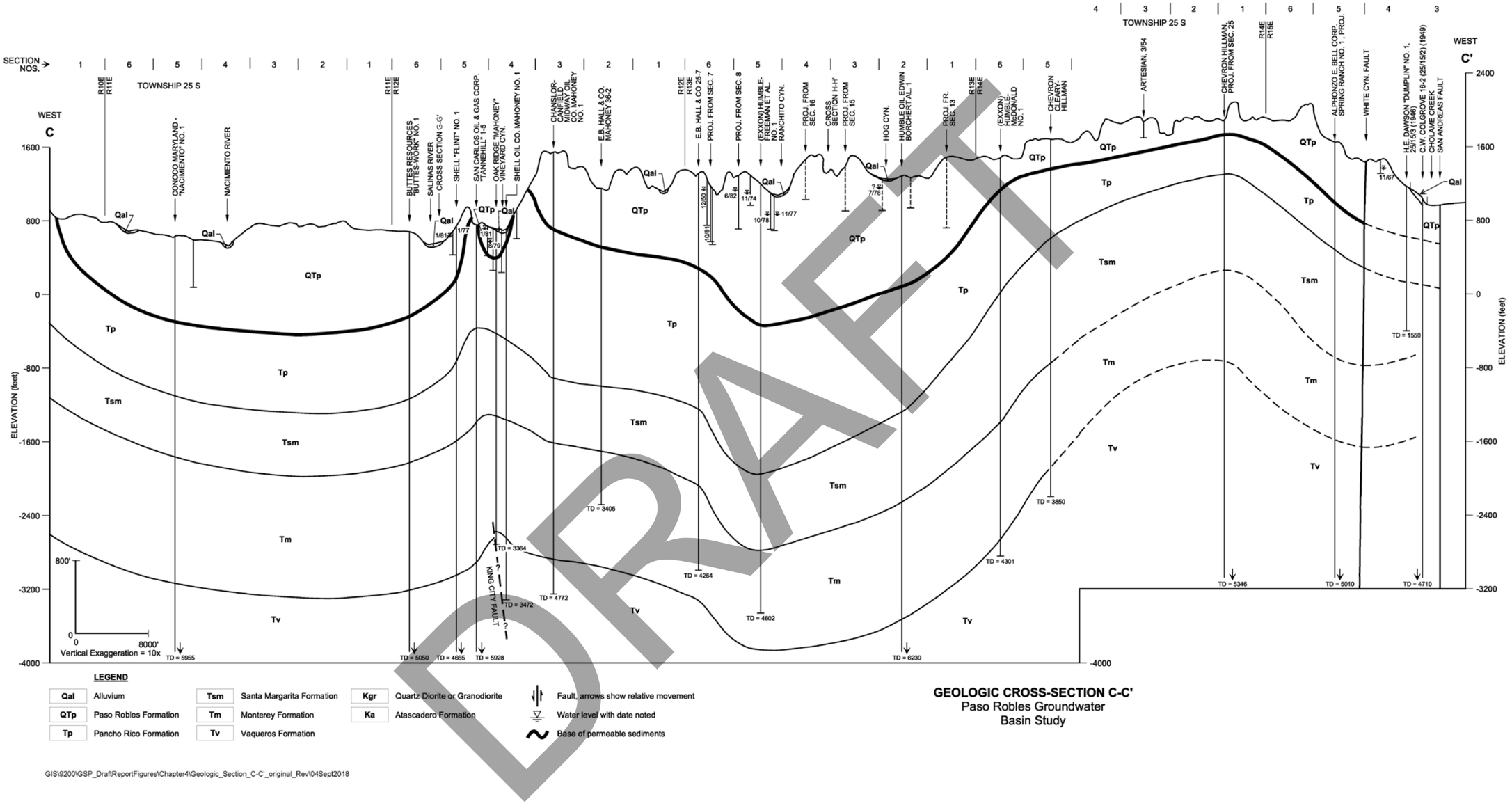


Figure 4-8. Geologic Section C-C′

Source: Modified from Fugro (2002)

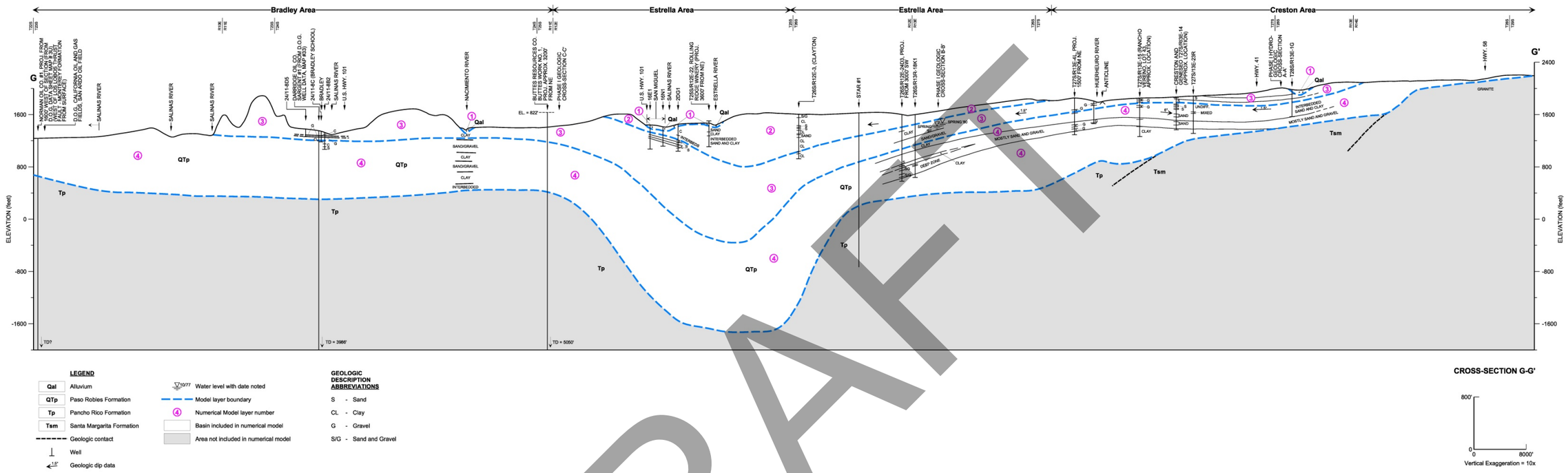
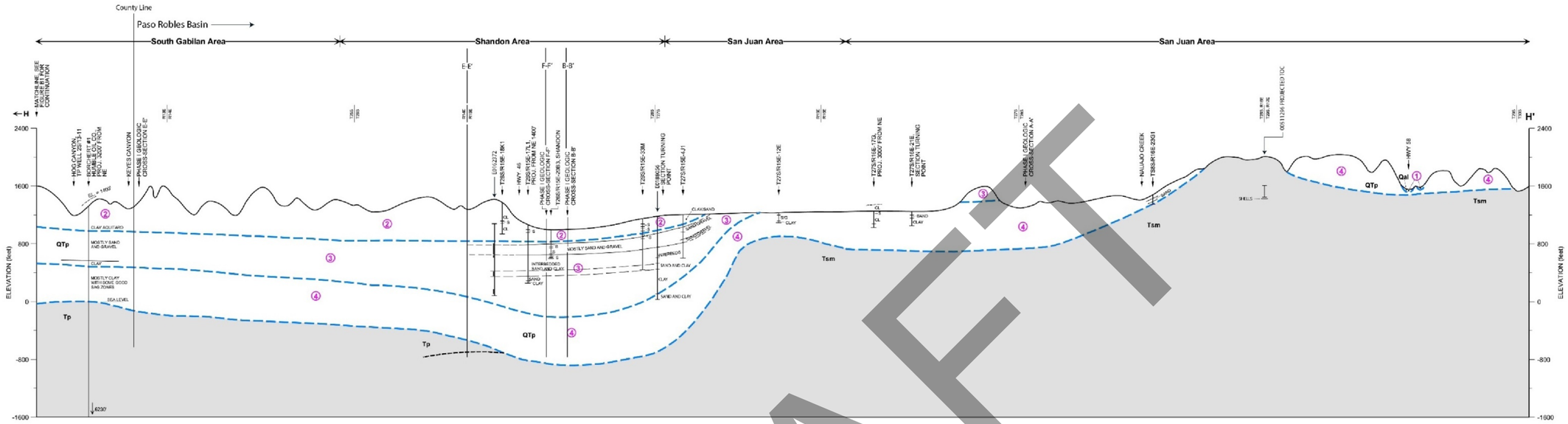


Figure 4-9. Geologic Section G-G'

Source: Modified from Fugro (2005)

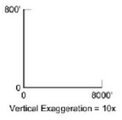


LEGEND

Qal	Alluvium
QTp	Paso Robles Formation
Tp	Pancho Rico Formation
Tsm	Santa Margarita Formation
------	Geologic contact
⊥	Well
18°	Geologic dip data
▽10/77	Water level with date noted
- - -	Model layer boundary
④	Numerical Model layer number
	Basin included in numerical model
	Area not included in numerical model

GEOLOGIC DESCRIPTION ABBREVIATIONS

S	-	Sand
CL	-	Clay
G	-	Gravel
S/G	-	Sand and Gravel



CROSS-SECTION H-H'
(Continued)

Figure 4-10. Geologic Section H-H'

Source: Modified from Fugro (2005)

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4.3.2 GEOLOGIC FORMATIONS WITHIN THE SUBBASIN

The main criteria used by previous authors for defining which geologic formations constitute the groundwater basin are:

1. The formation must have sufficient permeability and storage potential for the movement and storage of groundwater such that wells can reliably produce more than 50 gallons per minute (gpm) on a long-term basis, and
2. The groundwater produced from the geologic formation must be of generally acceptable quality (Fugro, 2002). DWR (1979) classifies groundwater with a conductivity of 3,000 micromhos/centimeter or less as fresh, and therefore of acceptable quality.

The only two geologic formations that reliably meet these two criteria are the Quaternary-age alluvial deposits and the Tertiary-age Paso Robles Formation. Therefore, these are the only two formations that constitute the Subbasin. A general discussion of these two formations is presented below.

ALLUVIUM

Alluvium occurs beneath the flood plains of the rivers and streams within the Subbasin. Figure 4-4 shows the location of the alluvial deposits, labeled as Quaternary alluvium, identified as Qa. These deposits are typically no more than 100 feet thick and comprise coarse sand and gravel with some fine-grained deposits. The alluvium is generally coarser than the Paso Robles Formation, with higher permeability that results in well production capability that often exceeds 1,000 gpm.

PASO ROBLES FORMATION

The largest volume of sediments in the Subbasin are in the Paso Robles Formation. This formation has sedimentary layers up to 3,000 feet thick in the northern part of the Estrella area and up to 2,000 feet near Shandon. Figure 4-4 shows the location of the Paso Robles Formation deposits, identified as QTp. Throughout most of the Subbasin the Paso Robles Formation sediments have a thickness of 700 to 1,200 feet.

The Paso Robles Formation is derived from erosion of nearby mountain ranges. Sediment size decreases from the east and the west, becoming finer towards the center of the Subbasin, indicating sediment source areas are both to the east and west. The Paso Robles Formation is a Plio-Pleistocene, predominantly non-marine geologic unit comprising relatively thin, often discontinuous sand and gravel layers interbedded with

thicker layers of silt and clay. The formation was deposited in alluvial fan, flood plain, and lake depositional environments. The formation is typically unconsolidated and generally poorly sorted. The sand and gravel beds in the Paso Robles Formation have a high percentage of eroded Monterey shale and have lower permeability compared to the overlying alluvial unit. The formation also contains minor amounts of gypsum and woody coal.

Poor quality groundwater with elevated concentrations of iron, manganese, and in some cases hydrogen sulfide odor have been observed within deeper portions of the Paso Robles Formation in some areas.

4.3.3 GEOLOGIC FORMATIONS SURROUNDING THE SUBBASIN

Underlying and surrounding the Subbasin are older geologic formations that either typically have low well yields or have poor quality water. In general, the geologic units underlying the Subbasin include:

1. Tertiary-age or older consolidated sedimentary beds;
2. Cretaceous-age metamorphic rocks; and
3. Granitic rock.

Figure 4-11 shows the location of oil and gas exploration wells drilled in the Subbasin. These oil and gas wells help identify the depth and extent of the geologic formations that surround and underlie the Subbasin.

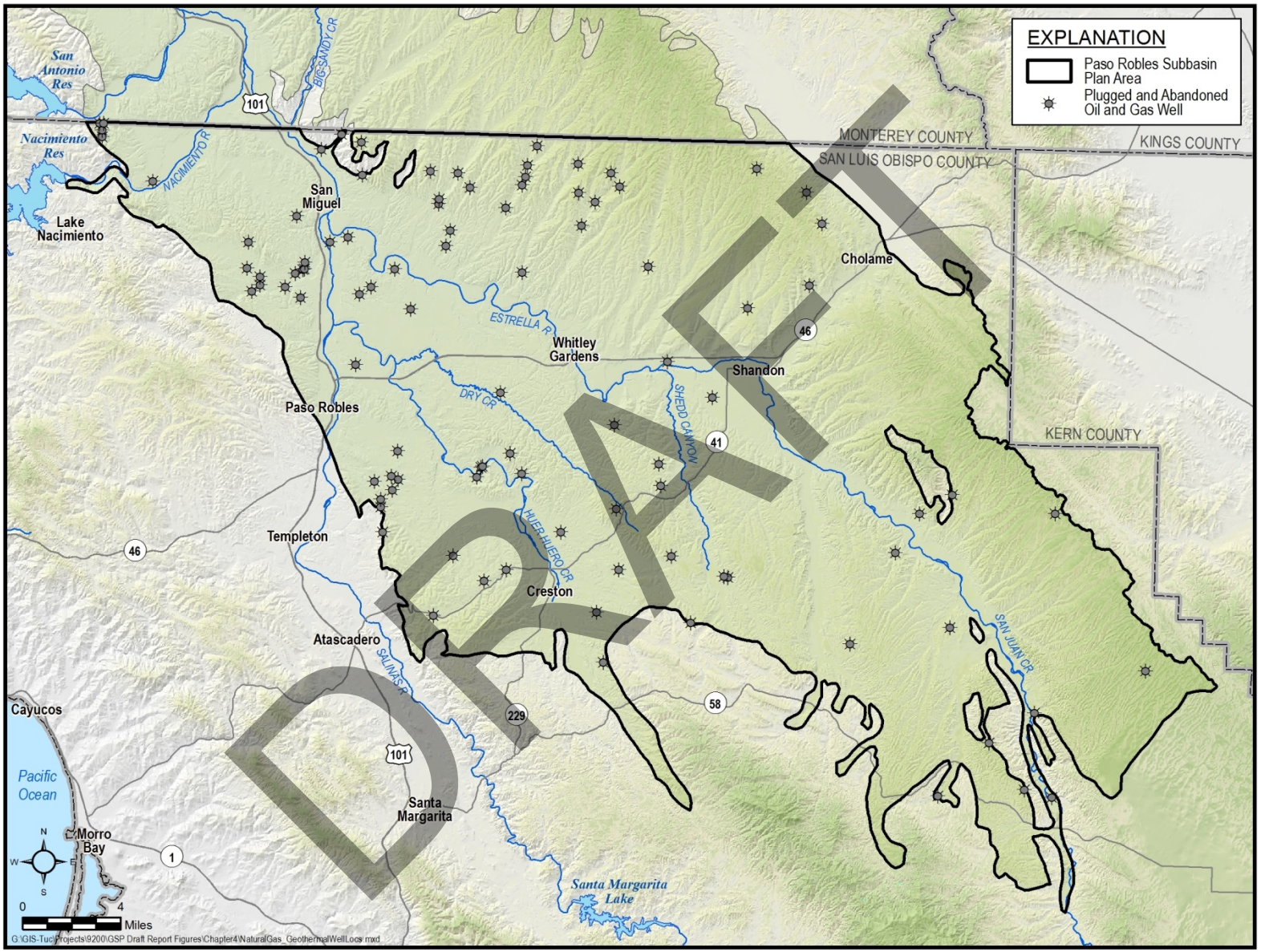

Figure 4-11. Natural Gas Exploration Well Locations and Geothermal Wells

PANCHO RICO FORMATION

The Pancho Rico Formation (Tp) is a Pliocene-age marine deposit found mostly in the northern portion of the study area. In places it appears to be time-correlative to the Paso Robles Formation, and may be in lateral contact as a facies change. The unit predominantly consists of fine-grained sediments up to 1,400 feet thick that yield low quantities of water. The Pancho Rico Formation additionally has poor water quality associated with tar sands that are present at the bottom of this formation (State Division of Mines, 1974).

SANTA MARGARITA FORMATION

The Santa Margarita Formation (Tsm) is an upper Miocene-age marine deposit, consisting of a white, fine-grained sandstone and siltstone with a thickness of up to 1,400 feet. The unit is found beneath most of the Subbasin. The Santa Margarita Formation is relatively permeable, but is not considered part of the Subbasin because the water quality is usually very poor. The geothermal waters contained in the Santa Margarita Formation in this area are often highly mineralized and characterized by elevated boron concentrations that restrict agricultural uses.

MONTEREY FORMATION

The Miocene-age Monterey Formation (Tm) consists of interbedded argillaceous and siliceous shale, sandstone, siltstone, and diatomite. The unit is as great as 2,000 feet thick in the study area, and is often highly deformed. Wells in the Monterey Formation are generally of too low yield to consider the Monterey Formation part of the Subbasin; although isolated areas in the Monterey Formation can yield more than 50 gpm. Additionally, groundwater produced from the Monterey Formation often has high concentrations of hydrogen sulfide, total organic carbon, manganese, and iron.

VAQUEROS FORMATION

The marine Oligocene-age Vaqueros Formation (Tv) is a highly cemented fossiliferous sandstone that reaches a thickness up to 200 feet. Springs in the Vaqueros Formation with flows up to 25 gpm are common in canyons on the western and southern sides of the study area. Most water wells tapping this formation produce less than 20 gpm. Generally, the quality of water in this unit is good, though hard due to the calcareous cement within the rock.

METAMORPHIC AND GRANITIC ROCKS

The southern and western edges of the Subbasin are bordered by Cretaceous-age metamorphic and granitic rock. The metamorphic rock units include the Franciscan, Toro, and Atascadero Formations. The Franciscan consists of discontinuous outcrops of shale, chert, metavolcanics, graywacke, and blue schist, with or without serpentinite. The Toro Formation (Kt) is a highly consolidated claystone and shale that does not typically yield significant water to wells. The Atascadero Formation (Ka) is highly consolidated, but does have some sandstone beds that yield limited amounts of water to wells.

The granitic rock unit (Kgr) lies east of the Rinconada fault system, south of Creston, east of Atascadero, and in the area northwest of the City of Paso Robles. The granitic rocks are often capped by a layer of granular decomposed granite that may be weathered to clay. This decomposed granite may be up to 80 feet in thick and may contain limited amounts of groundwater.

4.4 PRINCIPAL AQUIFERS AND AQUITARDS

Water-bearing sand and gravel beds that may be laterally and vertically discontinuous are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers. Two aquifers exist in the Subbasin:

- A relatively continuous aquifer comprising alluvial sediments that underlie streams;
- An interbedded and discontinuous aquifer comprising sand and gravel lenses in the Paso Robles Formation.

Figure 4-4 shows the location of geologic sections that were used to depict the aquifers in the subsurface. Figure 4-12 through Figure 4-15 show the aquifers and model layers in profile, which are interpreted from the geologic logs, geophysical logs, groundwater levels, and water quality (Fugro, 2002 and 2005). For the GSP several additional well logs were added to the sections to refine the extent of the aquifers. These logs have been labeled with the state well inventory number (e.g. E0188061). Appendix 4A contains the well logs used to update the sections.

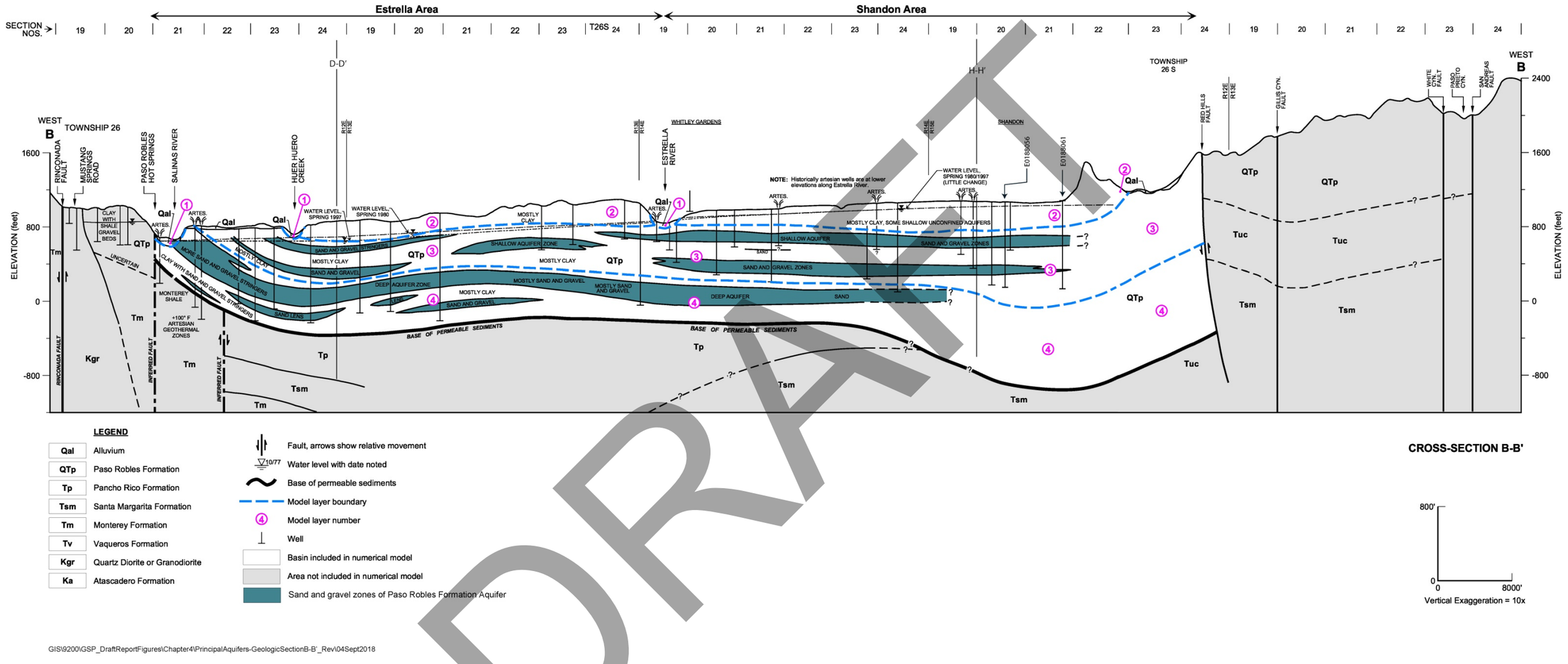

Figure 4-12. Aquifers - Geologic Section B-B'

Source: Modified from Fugro (2005)

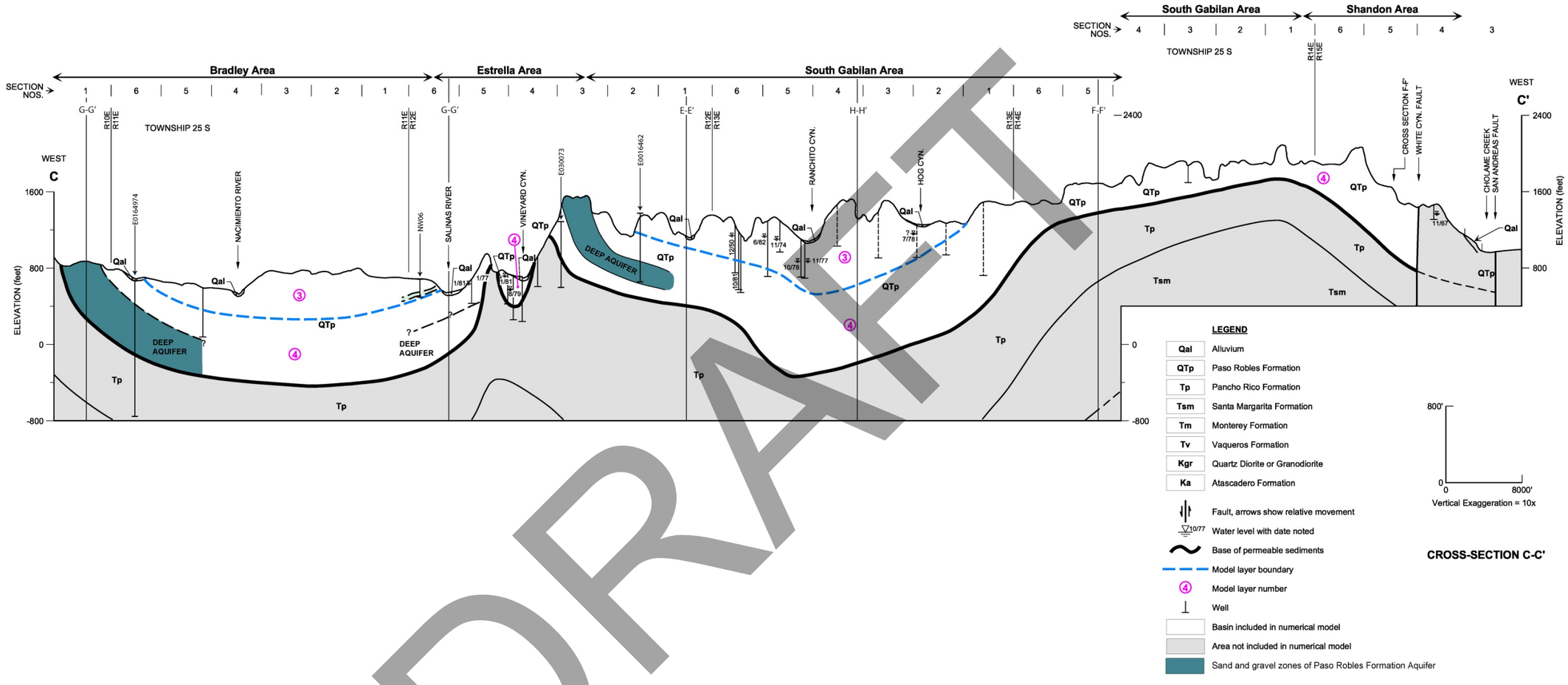

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Figure 4-13. Aquifers - Geologic Section C-C'

Source: Modified from Fugro (2005)

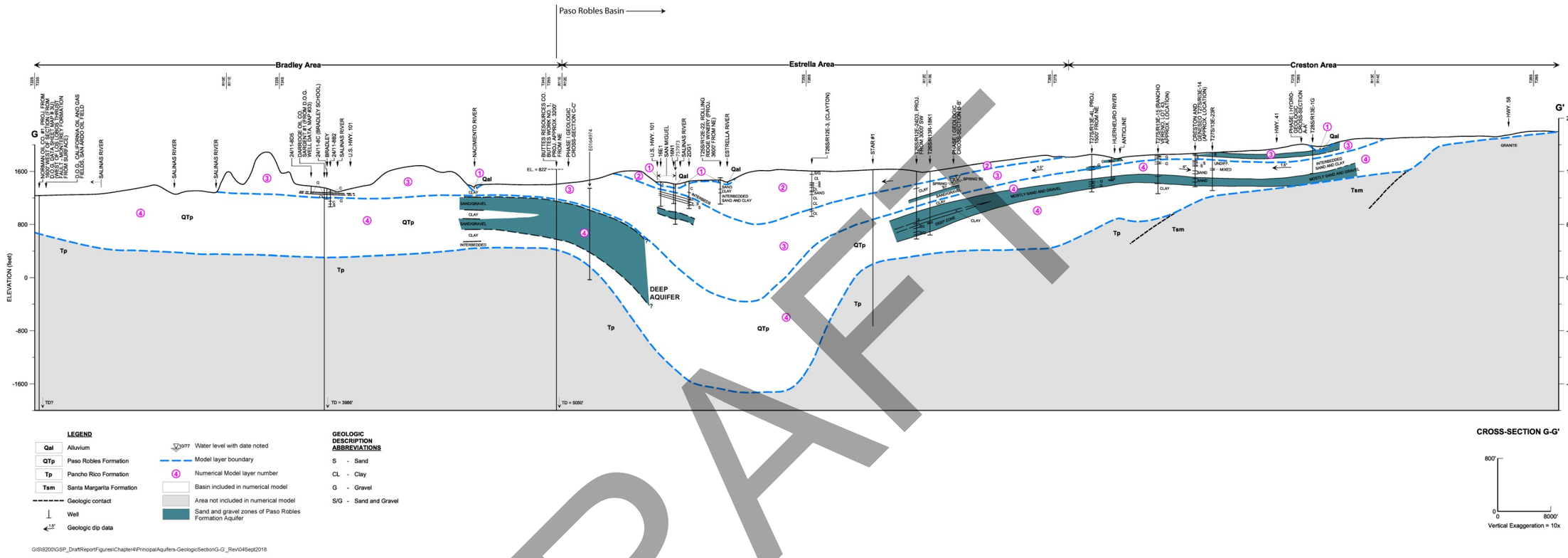
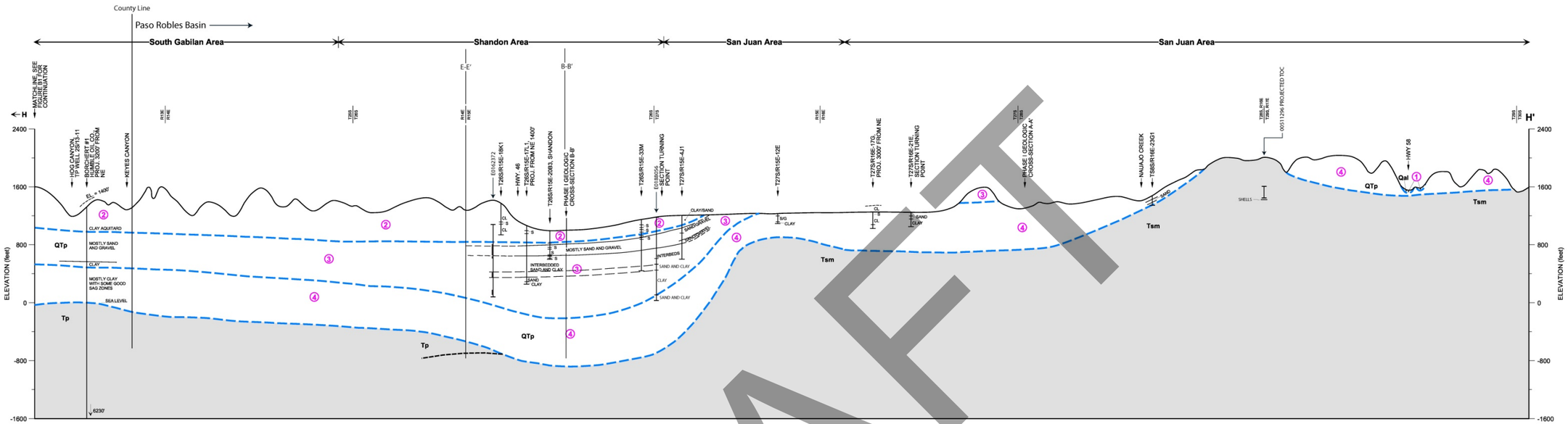


Figure 4-14. Aquifers - Geologic Section G-G'

Source: Modified from Fugro (2005)



LEGEND

Qal	Alluvium
QTp	Paso Robles Formation
Tp	Pancho Rico Formation
Tsm	Santa Margarita Formation
	Geologic contact
	Well
15°	Geologic dip data
10/77	Water level with date noted
	Model layer boundary
④	Numerical Model layer number
	Basin included in numerical model
	Area not included in numerical model

GEOLOGIC DESCRIPTION ABBREVIATIONS

S - Sand
CL - Clay
G - Gravel
S/G - Sand and Gravel

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CROSS-SECTION H-H'
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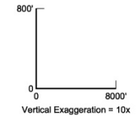

Figure 4-15. Aquifers - Geologic Section H-H'

Source: Modified from Fugro (2005)

4.4.1 ALLUVIAL AQUIFER

The unconfined Alluvial Aquifer is generally composed of saturated coarse-grained sediments and occurs along Huer Huero Creek, the Salinas River, and the Estrella River; the extent of this aquifer is shown on Figure 4-4. The alluvial aquifer varies in thickness, but is generally about 100 feet thick. The Alluvial Aquifer is highly permeable. Wells screened in the alluvial aquifer can yield up to a 1,000 gpm (Fugro, 2005).

4.4.2 PASO ROBLES FORMATION AQUIFER

Geologic information reported in Fugro (2002) suggests that the sand and gravel zones that constitute the Paso Robles Formation Aquifer are generally thin, discontinuous, and are usually separated vertically by relatively thick zones of silts and clays. Figure 4-4 shows the extent of the Paso Robles Formation in the Subbasin. In general, the sand and gravel zones occur throughout the Paso Robles Formation, although they may be locally discontinuous or absent in some areas. As shown on Figure 4-14, near Creston the shallow sand and gravel zones appear to be disconnected from other parts of the Paso Robles aquifer by faults and structural folds. The shallow aquifer zone near Creston may be an isolated aquifer area.

4.4.3 AQUIFER PROPERTIES

Data reported in Fugro (2002) were reviewed to estimate representative aquifer hydraulic properties. Most aquifer tests have been conducted in the Estrella and Creston areas. Estimated aquifer properties are summarized in Table 4-1.

Table 4-1. Paso Robles Subbasin Aquifer Hydrogeologic Properties

Well Location	Test Duration (hours)	Flow (gpm)	Well Depth (feet)	Perforated Interval	Transmissivity (gpd/ft)	Q/s (gpm/ft)	Hydraulic Conductivity (ft/day)
Alluvial Aquifer							
28S/13E-36	24	367	70	40	186,300	68	620
Paso Robles Formation Aquifer							
27S/12E-09	72	300	450	170	8,800	4.9	6.9
26S/12E-22	12	220	430	100	900	1.2	1.2
25S/11E-24	12	150	350	90	800	0.62	1.2
27S/12E-18	8	140	225	35	4,100	3	15.7
26S/12E-20	48	115	400	50	7,600	10	20
26S/12E-36	24	400	660	280	8,800	5.1	4.2
26S/12E-35	18	690	830	370	7,900	4.9	2.9
27S/14E-18	24	600	740	220	6,100	5.5	3.7
26S/13E-16	24	200	820	350	3,100	2.63	1.2
26S/12E-25	24	500	730	340	5,700	3.6	2.2
25S/13E-30	24	600	720	260	6,900	79	3.5
26S/13E-7	24	600	825	380	3,200	3	1.1
26S/13E-7	24	600	990	610	5,000	4.2	1.1
24S/11E-34	24	850	612	100	2,805	4.5	3.8

Source: Fugro, 2002

Based on limited aquifer property data available for the Alluvial Aquifer, the transmissivity may be in the range of 150,000 to 200,000 gallons per day per foot (gpd/ft); or between 20,000 and 27,000 square feet per day (ft^2/day). Hydraulic conductivity of the Alluvial Aquifer may be over 500 feet per day (ft/d).

The estimated transmissivity of the Paso Robles Formation Aquifer ranges between 800 gpd/ft and about 9,000 gpd/ft; or between 100 and 1,200 ft^2/day. The geometric mean of the tabulated transmissivity values for the shallow aquifer zone is about 3,500 gpd/ft, or 470 ft^2/day.

The estimated hydraulic conductivity of the Paso Robles Formation Aquifer ranges from about 1 ft/d to about 20 ft/d. The geometric mean of the tabulated hydraulic conductivity values for the Paso Robles Formation Aquifer is 5 ft/d.

Limited data exist to assess the confined storage properties, such as storativity, of the Paso Robles Formation aquifer (Fugro, 2002). Table 4-2 summarizes reported estimates of specific yield for unconfined portions of the aquifers. Average specific yield was estimated by analyzing 10 to 20 of the deepest well completion logs for each area. Each lithologic interval was assigned a specific yield by comparison of the formation description with published estimates based on extensive field and laboratory investigations conducted in southern

coastal basins by the DWR and modified for the Paso Robles Formation (DWR, 1958). The assigned specific yield was then weighted according to the thickness of each bed and averaged over the entire depth of the well (Fugro, 2002). Results of this analysis suggested that a representative average value for specific yield for the Paso Robles Formation in the Subbasin was 0.09. This specific yield may be low. Average specific yields for unconsolidated sand and gravel sedimentary aquifers are commonly between 0.1 and 0.3 (Driscoll, 1986).

Table 4-2. Paso Robles Subbasin Specific Yield Estimates

Area	Number of Wells Used to Calculate	Average Estimated Specific Yield
Creston Area	47	0.09
Estrella	20	Not provided
San Juan	5	0.10
Shandon	20	0.08
North and South Gabilan	20	0.09
Basin Wide Average		**0.09**

Estimates of vertical hydraulic conductivity for each of the aquifers were not in reports from previous studies for the Subbasin. Estimates of vertical hydraulic conductivity incorporated into the basin-wide groundwater model are discussed in an appendix to Chapter 6.

4.4.4 Confining Beds and Geologic Structures

There is limited information regarding the continuity of stratigraphic features in the Subbasin that restrict groundwater flow within the Subbasin. Conceptually, the presence of laterally continuous zones of fine-grained strata within the Paso Robles Formation can restrict vertical movement of groundwater. These fine-grained zones are generally shown on the sections on Figure 4-12 through Figure 4-15. These figures show that the fine-grained strata are likely more continuous than the sand and gravel layers. These fine-grained zones act as confining beds, and are the cause of the artesian wells that were historically reported in the Subbasin. Fine-grained layers that limit vertical movement of groundwater appear to be more prevalent in the Estrella and Creston areas than in the eastern portion of the Shandon area. This may indicate that infiltration and recharge is more limited to the west.

There is some anecdotal evidence that subsurface geologic structures such as folds and faults may affect groundwater flow in the Subbasin. Additional investigations would be needed to characterize the effect of structures on groundwater flow.

4.5 PRIMARY USERS OF GROUNDWATER

The primary groundwater users in the Subbasin include municipal, agricultural, rural residential, small community water systems, and small commercial entities. Municipal, domestic, and agricultural demands in the Subbasin currently rely almost entirely on groundwater. The municipal sector pumps primarily from the Paso Robles Aquifer. The agriculture sector uses groundwater from the Alluvial Aquifer and the Paso Robles Aquifer.

4.6 GENERAL WATER QUALITY

This section presents a general discussion of the natural groundwater quality in the Subbasin, focusing on general minerals. The general water quality of the Subbasin described in this section is a summary of results in the Fugro 2002 report. A more complete discussion of the distribution and concentrations of specific constituents is presented in Chapter 5: Current Conditions.

Groundwater in the Subbasin is generally suitable for drinking and agricultural uses. The two main water types found in the Subbasin are calcium bicarbonate and sodium bicarbonate. Calcium-bicarbonate type is the most prominent and is found in the Creston and San Juan areas. Sodium-bicarbonate is the second most dominant water type and is found in the Estrella and Shandon areas. Minor areas of sodium-chloride type water can be found in the eastern portion of the Subbasin and near Cholame Valley. In the northwest portion of the Subbasin, magnesium bicarbonate waters are found in the San Miguel area and a mixed water type is seen in the Bradley area. A summary of general water quality as indicated by average total dissolved solids (TDS), chloride (Cl), and nitrate (NO3) concentrations in groundwater is provided in Table 4-4 (Fugro 2002).

Table 4-3. Summary of General Water Quality by Area

Area	TDS (ppm)			Cl (ppm)			NO3 (ppm)		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Creston	490	190	1620	112	25	508	16	2	41
San Juan	753	160	2170	162	13	699	18	ND[1]	56
Shandon	606	270	1610	110	31	451	13	5.6	35
Estrella	624	350	1270	126	32	572	9	ND	30
Bradley	897	400	1280	131	40	400	14	ND	55
Gabilan	745	370	1320	87	38	209	39	11	71

[1]ND = Non-detect. For the purpose of computing an average, half the detection limit was used.

4.7 GROUNDWATER RECHARGE AND DISCHARGE AREAS

Areas of significant, natural, areal recharge and discharge within the Paso Robles Subbasin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge is provided in Chapter 6: Water Budgets.

4.7.1 GROUNDWATER RECHARGE AREAS INSIDE THE SUBBASIN

In general, natural areal recharge occurs via the following processes:

1. Distributed areal infiltration of precipitation, and
2. Infiltration of surface water from streams and creeks,

Figure 4-16 shows the Soil Agricultural Groundwater Banking Index (SAGBI) map for the Paso Robles Subbasin. The map was developed by the California Soil Resource Lab at UC Davis and the University of California Agricultural and Natural Resources Department. The map displays a suitability index for groundwater recharge on agricultural land. The SAGBI is based on five major factors that are critical to successful groundwater banking: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition.

Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but this map provides good guidance on where natural recharge likely occurs.

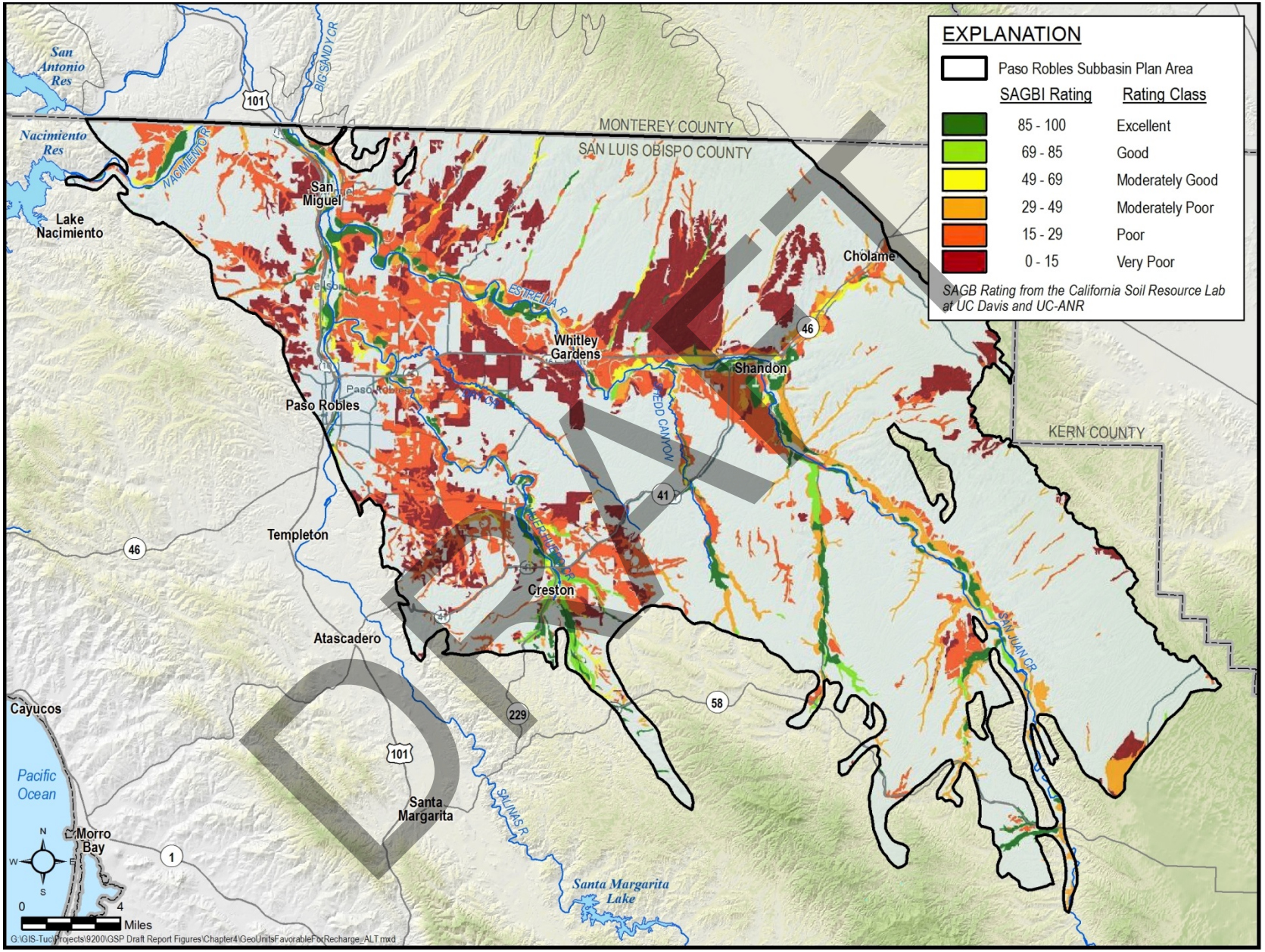

Figure 4-16. Potential Recharge Areas

4.7.2 GROUNDWATER DISCHARGE AREAS INSIDE THE SUBBASIN

Natural groundwater discharge areas within the Plan area include springs and seeps, groundwater discharge to surface water bodies, and evapotranspiration (ET) by phreatophytes. Springs and seeps identified in the National Hydrology Dataset (NHD), and shown on Figure 4-17, tend to be located in the foothills of the Santa Lucia and Temblor mountain ranges. Based on the elevation of mapped springs and seeps, it is likely that these discharge groundwater from shallow, and possibly perched aquifer units. Groundwater discharge to streams – primarily, the Salinas River and Estrella River – has not been mapped to date. Instead, areas of potential groundwater discharge to streams are identified using the groundwater flow model. Orange areas on Figure 4-17 represent streams in the model where simulated average groundwater discharge to the stream reach is at least 10 acre-feet per year. In contrast to mapped springs and seeps, which are derived from groundwater in the Paso Robles Formation, groundwater discharge to streams is derived from the Alluvium.

Figure 4-18 shows the distribution of potential groundwater-dependent ecosystems (GDEs) and Natural Communities Commonly Associated with Groundwater (NCCAG) within the Plan area. In areas where the water table is sufficiently high, groundwater discharge may occur as ET from phreatophyte vegetation within these GDEs. Appendix 4B describes methods used to determine the extent and type of potential GDEs. Figure 4-18 shows only potential GDEs. There has been no verification that the locations shown on this map constitute groundwater dependent ecosystems. Additional field reconnaissance is necessary to verify the existence of these potential GDEs.

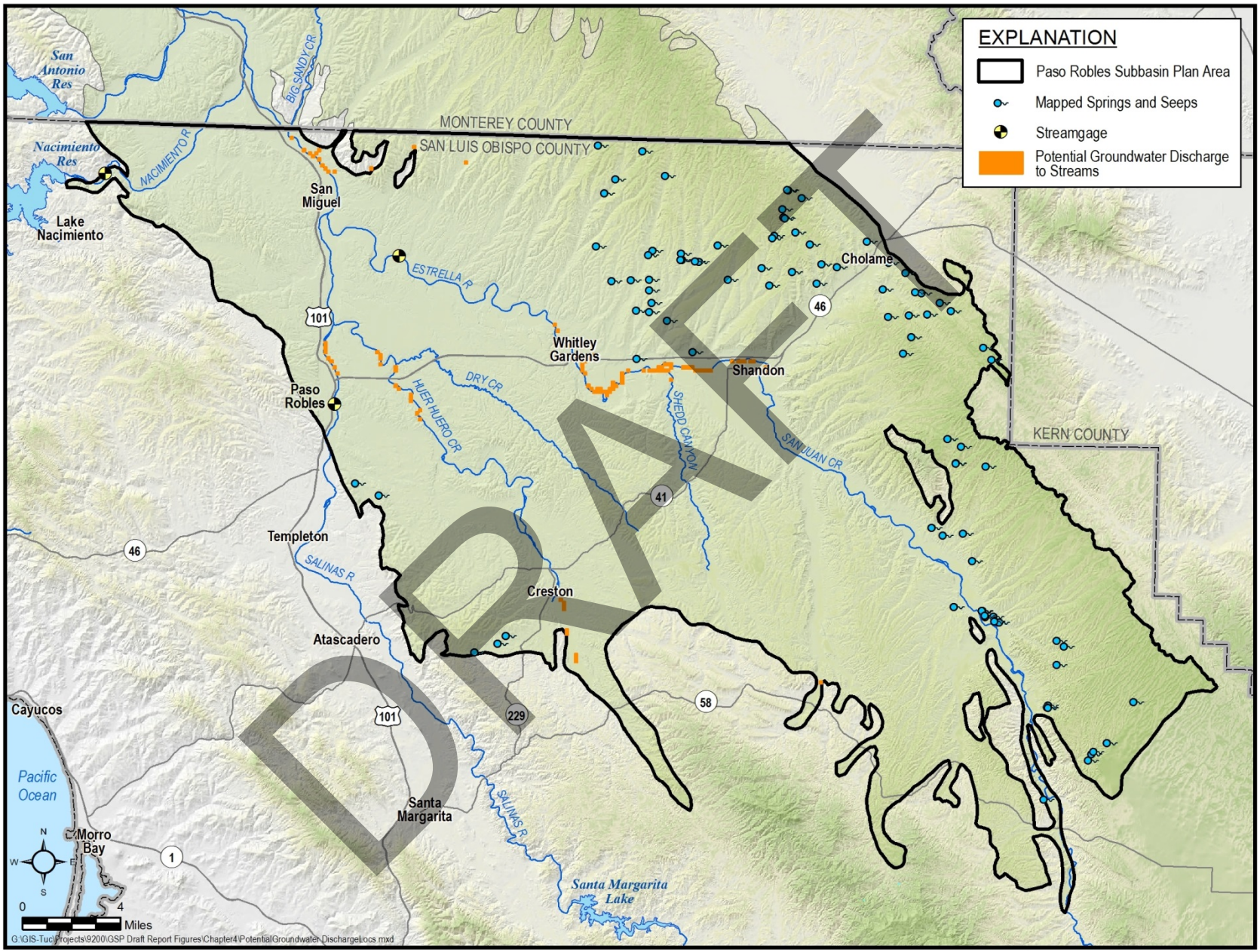

Figure 4-17. Potential Groundwater Discharge Areas

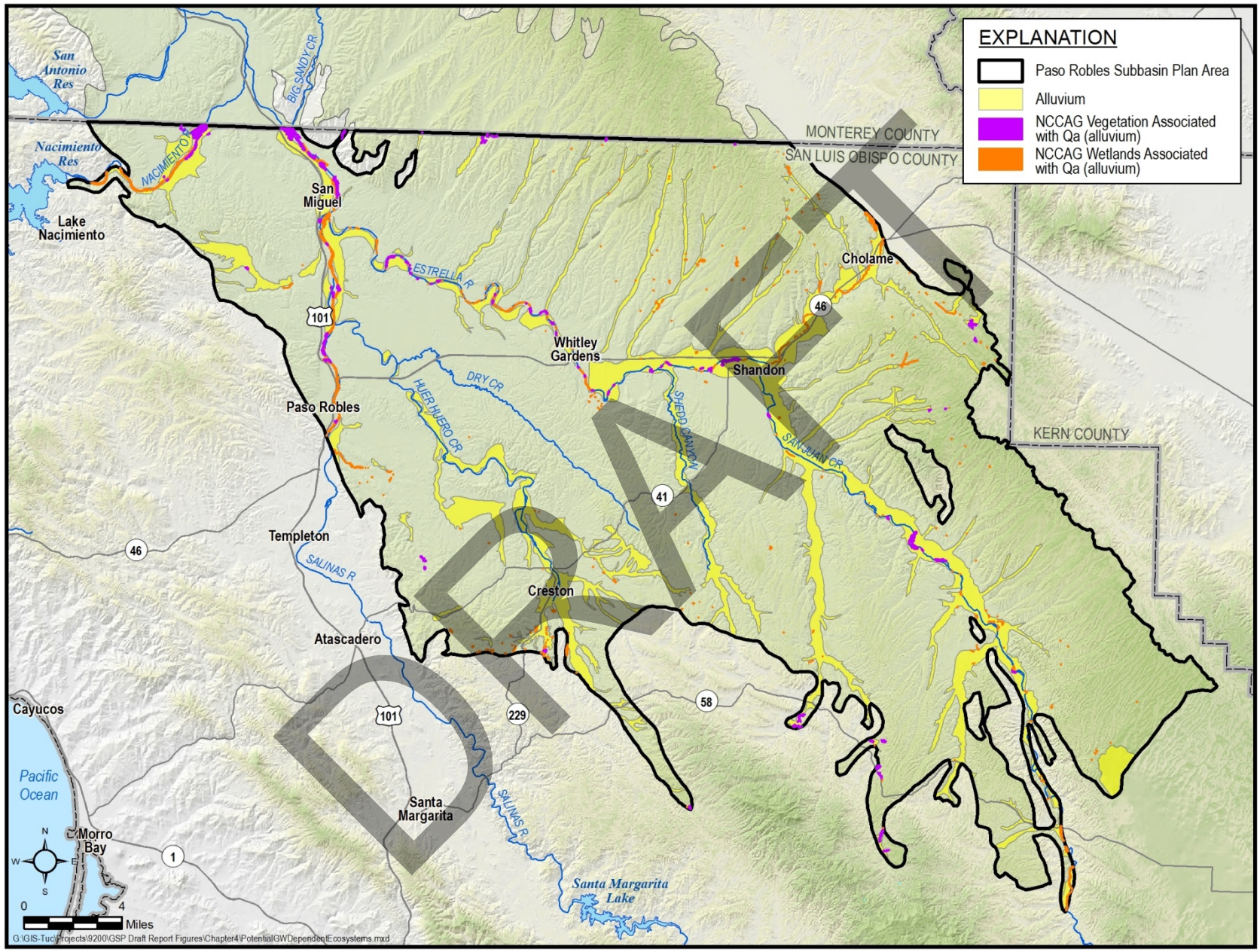

Figure 4-18. Potential Groundwater- Dependent Ecosystems

4.8 SURFACE WATER BODIES

Figure 4-19 shows the rivers in the Subbasin that are considered significant to the management of groundwater in the Subbasin. Significant streams in the Subbasin include the Salinas River, the Estrella River, Huer Huero Creek, San Juan Creek, Dry Creek, and Shedd Canyon. These rivers and creeks are ephemeral, and during most of the year the streams lose water to the shallow aquifers. A complete description and quantification of the stream/aquifer interaction is included in Chapters 5 and 6. There are no natural lakes in the Subbasin.

There are no reservoirs within the Subbasin; however, there are two reservoirs in the watershed. The Salinas Dam south of the Subbasin on the Salinas River forms Santa Margarita Lake. The Salinas Dam was constructed in the early 1940s as an emergency measure to provide adequate water supplies for Camp San Luis Obispo. The United States Army Corps of Engineers (USACE) now has jurisdiction over the dam and reservoir facilities. The City of San Luis Obispo has an agreement with USACE to divert the entire yield of Santa Margarita Reservoir for water supply. Nacimiento Reservoir lies just outside of the Subbasin to the northwest. The reservoir discharges to the Nacimiento River, which crosses the northwest corner of the Subbasin.

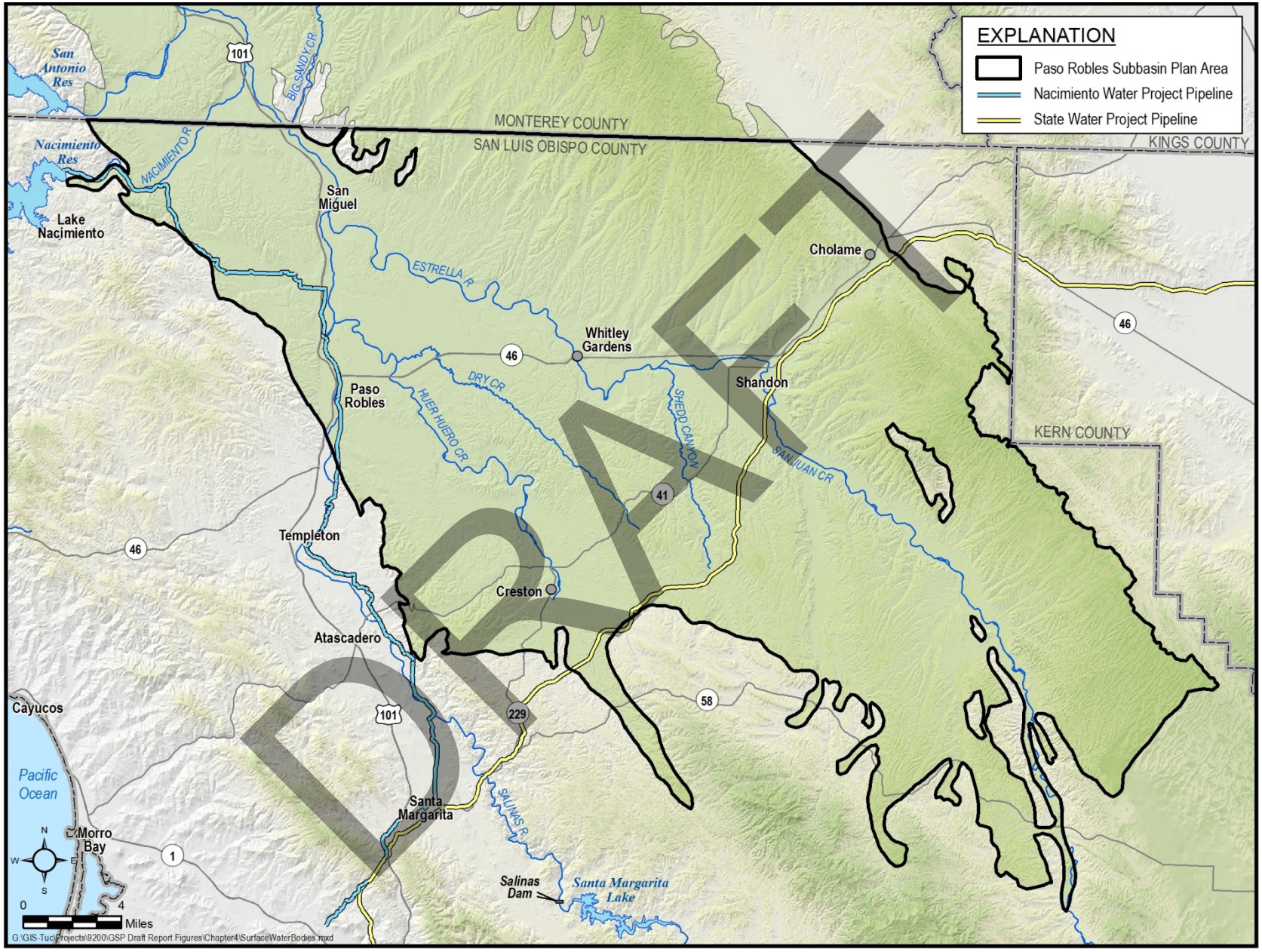

Figure 4-19. Surface Water Bodies

4.9 DATA GAPS IN THE HYDROGEOLOGIC CONCEPTUAL MODEL

All hydrologic conceptual models contain a certain amount of uncertainty, and can be improved with additional data and analysis. The hydrogeologic conceptual model of the Paso Robles Subbasin could be improved with certain additional data and analyses. Several data gaps are identified below.

AQUIFER CONTINUITY

Aquifer continuity has a significant impact on how projects and management actions in one part of the Subbasin may influence sustainability in other parts of the Subbasin. As noted earlier, the Paso Robles aquifer comprises many discontinuous sand and gravel beds. However, Figure 4-12 shows a previous interpretation of a deep sand and gravel zone that is relatively continuous across the Subbasin. The continuity of this zone may prove to be important in how effective various projects and programs may promote sustainability. The extent and continuity of the Paso Robles Aquifer should be confirmed through existing or new well logs or other methods such as aerial geophysics. This is particularly important in the areas around Shandon and San Juan.

FAULT INFLUENCE ON GROUNDWATER FLOW

Southeast of the City of Paso Robles is an interbasin fault. It is unknown whether this fault and others are barriers to groundwater flow. If these interbasin faults are barriers to groundwater flow, they could compartmentalize the Subbasin and have a significant impact on where projects must be located in order to achieve sustainability. It may be possible to get a better understanding of the influence of these faults by performing aquifer tests and geophysical surveys in the vicinity of these faults.

VERTICAL GROUNDWATER GRADIENTS

There are no nested wells to demonstrate vertical hydraulic gradients. Demonstrating vertical gradients could be important to assess vertical flows between the Alluvium and the Paso Robles Aquifer as well as vertical flows within the Paso Robles Aquifer.