

Casitas Municipal Water District
WATER RESOURCES COMMITTEE
Baggerly/Spandrio

February 18, 2020 – 10:00 A.M.

at

Casitas Municipal Water District
1055 Ventura Ave.
Oak View, CA 93022

AGENDA

1. Roll Call
2. Public Comments
3. Board Comments.
4. Manager Comments.
5. Review proposal from WREA for additional tasks related to the Technical Committee recommendations for the Matilija Deep Wells Project.

Right to be heard: Members of the public have a right to address the Board directly on any item of interest to the public which is within the subject matter jurisdiction of the Board. The request to be heard should be made immediately before the Board's consideration of the item. No action shall be taken on any item not appearing on the agenda unless the action is otherwise authorized by subdivision (b) of ¶54954.2 of the Government Code.

If you require special accommodations for attendance at or participation in this meeting, please notify our office in advance (805) 649-2251, ext. 113. (Govt. Code Sections 65954.1 and 54954.2(a). Please be advised that members of the Board of Directors of Casitas who are not members of this standing committee may attend the committee meeting referred to above only in the capacity of observers, and may not otherwise take part in the meeting. (Govt. Code Section 54952.2(c)(6)

MEMORANDUM

TO: Water Resources Committee
From: Michael L. Flood, General Manager
RE: **Review of a proposal from WREA for additional tasks related to the Technical Committee recommendations for the Matilija Deep Wells Project**
Date: February 14, 2020

RECOMMENDATION:

The Water Resources Committee continue to track the Matilija Deep Wells project as appropriate.

BACKGROUND:

The Matilija Deep Wells project is a combination of two different well drilling concepts, one vertical (VerBo) and one horizontal (HoBo).

It has been proposed that each well would be drilled into an ancient bedrock formation many thousands of feet below the ground surface in search of a water-bearing rock structure.

Due to the speculative nature of this endeavor, the Board of Directors set further vetting of the feasibility of the project as a priority in the 2019 Board Priority List.

Pueblo Water Resources was engaged by the District to put together a technical advisory committee (TAC) to review the project and make recommendations on the feasibility.

The TAC produced a memo that outlined several recommendations for further review and exploration by the design engineer, Water Resource Engineers Associates (WREA).

WREA provided a cost proposal to staff to provide responses to those recommendations in January 2020.

DISCUSSION:

The feasibility of the Matilija Deep Wells project continues to be in question and the next steps in exploring that feasibility further has proven to be costly. No budget was assigned to this project in the Casitas MWD FY 2020 budget.

With this in mind, Staff recommends that the Water Resources Committee continue to track this project for the time being until funds are identified and assigned to the project.

Outline Recommendations for Proposed Matilija Groundwater Supply Project Basis of Design Report

In Memorandum #1 (attached) from the Matilija Formation Groundwater Supply Project Technical Advisory Committee (TAC) dated July 1, 2019, a fundamental recommendation was made that a Basis Of Design (BOD) report for the proposed Matilija Groundwater Supply Project (also referred to as VerBo for Vertical Bore) should be prepared and submitted to the Casitas Municipal Water District (CMWD) for approval prior to proceeding further with the project. This BOD report would be the foundation by which the CMWD can objectively and comprehensibly review and consider moving forward with the Pilot Project, currently referred to as the Robles Deep Vertical Bore (RDVB) Test Well. It is the consensus of the TAC that the BOD report, at a minimum, must address the following list of topics and considerations. The outline below is structured so that the BOD report will allow inclusion of responses to address preliminary questions 1 through 7 in the TAC's Memorandum #1.

- I. **PROJECT PURPOSE.** An overall project description for the full scale project should be provided, and should include reconnaissance-level preliminary estimates of costs and schedule, in the event the project were to be advanced from the pilot-scale to full-scale. This discussion should also provide examples of existing deep well sources, with associated costs and reference contacts, if available.

- II. **HYDROGEOLOGIC ANALYSIS.** A background discussion clearly articulating the hydrogeologic setting and the status of research work that has been conducted to date should be provided. This should include description of the target aquifer, discussion of existing data and limitations, consideration of geologic structure and location variability, evaluation of water quality information and potential water quality and treatment issues that may be encountered with the full-scale project. The BOD report needs a discussion of the amount of uncertainty in the interpretation of the geologic structure at depth and how this uncertainty impacts the prediction of the depth of the borehole and, ultimately, the estimated cost range of construction.

- III. **RDVB Test Well Pilot Project.** This section of the BOD report should include a comprehensive evaluation of the following topics.
 - a. **Pilot Project Objectives** (describe goals and relation to full-scale project)
 - b. **Site Description** (including size, layout requirements)
 - c. **Permitting Requirements** (including fees, time requirements, CEQA compliance, agency approvals needed)
 - d. **Exploration Techniques** (including drilling techniques, type of equipment needed, drill string requirements to maintain vertical bore in steeply dipping indurated sediments, etc.)
 - e. **Drilling, Well Construction, Development** (including discussion of downhole survey requirements and methods, well design, materials description, BOPs,

screens, seals and seal placement techniques, cuttings and drilling and development fluid disposal, wellhead features, development techniques, etc.)

- f. **Other Construction Logistics** (including site preparation, water supply, operational hours and total construction period, noise abatement, vehicle traffic, discharge monitoring plan)
- g. **Testing Program** (including pumping methods, artesian control, type of tests to be performed, test water disposal, etc.)
- h. **Monitoring Program** (including parameters, frequency, duration, reporting)
- i. **Metrics** (i.e., how will it be determined that the Pilot Project supports moving forward to the full-scale project?)
- j. **Costs** (for all elements of the Pilot Project, including consideration of potential contingency costs due to the geologic uncertainty. This section should also include preliminary quotes from potential drilling contractors and any other subcontractors required to complete the Pilot Project.)

CASITAS MUNICIPAL WATER DISTRICT
Ventura County, CA
PILOT PROJECT

**ROBLES DEEP VERTICAL BORE (RDVB) IN MATILIJA FORMATION
BASIS OF DESIGN**

Scope of Work and Fee Estimate

Item	SCOPE OF WORK DESCRIPTIONS	Hours					
		A	B	C	D	E	F
1.	Project Purpose	10	10	12	20	4	10
1a.	Compile an overall project description for the pilot- and full-scale projects, reconnaissance-level preliminary estimates of costs and schedule, in the event the project were to be advanced from the pilot-scale to full-scale. Provide examples of existing deep well sources, with associated costs and reference contacts will be provided, as available.						
2.	Hydrogeologic Analysis	4	6	4	24	16	10
2a.	Complete a background discussion clearly articulating the hydrogeologic setting and the status of research work conducted to date. A description of the target aquifer, discussion of existing data and limitations, consideration of geologic structure and location variability, evaluation of water quality information and potential water quality and treatment issues for the full-scale project will be included. A discussion of the amount of uncertainty in the interpretation of the geologic structure at depth and how this uncertainty may impact the prediction of the depth of the borehole and, ultimately, the estimated cost range of construction will be provided. Geologic cross sections and technical basis, including references, for such, will be included.						
3.	RDVB Test Well Pilot Project	36	150	49	270	75	495
3a.	Pilot Project Objectives including goals and relation to full-scale project.						
3b.	Site Description including size, layout requirements, basis of site selection for both the pilot and full-scale projects, will be included.						
3c.	Permitting Requirements A list including fees, time requirements, CEQA compliance, agency approvals needed will be included.						
3d.	Exploration Techniques discussion including drilling techniques, type of equipment needed, drill string requirements to maintain vertical bore in steeply dipping, indurated sediments, etc. will be included						
3e.	Drilling, Well Construction, Development A discussion of downhole survey requirements and methods; well design; materials description; Best Operating Practices; screens, seals and seal placement techniques; cuttings and drilling and development fluid disposal; wellhead features; development techniques, etc. will be included.						
3f.	Other Construction Logistics including site preparation, water supply, operational hours and total construction period, noise abatement, vehicle traffic, discharge monitoring plan, well equipping will be addressed.						
3g.	Water Quality and Treatment including a discussion of expected water quality and potential for natural gas and/or oil will be included.						
3h.	Testing Program including pumping methods, artesian control, type of tests to be performed, test water disposal, etc. will be provided.						
3i.	Monitoring Program including parameters, frequency, duration, reporting will be included.						

CASITAS MUNICIPAL WATER DISTRICT
Ventura County, CA
PILOT PROJECT

**ROBLES DEEP VERTICAL BORE (RDVB) IN MATILIJA FORMATION
BASIS OF DESIGN**

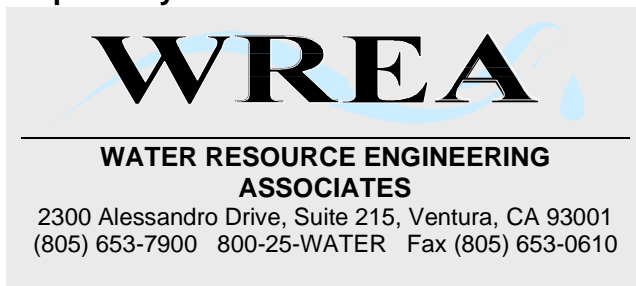
Scope of Work and Fee Estimate

Item	SCOPE OF WORK DESCRIPTIONS	Hours					
		A	B	C	D	E	F
3j.	Metrics A discussion of how it will be determined that the Pilot Project supports moving forward to the full-scale project, will be included.						
3k.	Preliminary Cost Estimates All elements of the Pilot Project will be costed, including consideration of potential contingency due to the geologic uncertainty; preliminary quotes from potential drilling contractors and any other subcontractors required to complete the Pilot Project will be included.						
Total		50	166	65	314	95	515

Fee Estimate

A	Principal Engineer	50	Hrs	@	\$205	=	\$10,250
B	Principal Hydrogeologist	166	Hrs	@	280	=	46,480
C	Senior Engineer	65	Hrs	@	175	=	11,375
D	Project Geologist	314	Hrs	@	180	=	56,520
E	Project Engineer, Staff Geologist, Env. Professional	95	Hrs	@	120	=	11,400
F	Technicians, Word Processing, Graphics	515	Hrs	@	110	=	<u>56,650</u>
Fee Estimate Subtotal						=	\$192,675

Prepared by:



1861 Knoll Drive, Ventura, CA 93003
(805) 644-2220



TO: Lou Nagy
Water Resource Engineering Associates

FROM: Kear Groundwater
P.O. Box 2601
Santa Barbara, CA 93120-2601

DATE: January 6, 2020

SUBJECT: *KG Scope of Services for Robles Deep Vertical Test Bore
Casitas Municipal Water District*

Dear Lou,

Kear Groundwater (KG) provides this overview scope of services for the “basis of design” of the Robles Vertical Deep Test Bore (RVDTB) at the Casitas Municipal Water District (Casitas) parcel (APN 011-0-270-030) near Ojai, Ventura County, California, just west of the Robles Canal and southwest of the diversion to Lake Casitas from the Ventura River. This overview follows our April 2018 memorandum with recommendations for the drilling and testing of RVDTB, which has also been referred to as the VerBo, after "Vertical Bore" in similar convention to the HoBo Project stemming from our November 2016 Water Source Analysis.

1. RVDTB Project Purpose

RVDTB would explore stratigraphy below the Casitas-owned parcel to form a streamlined study of water quality and potential water quantity from Eocene-aged sandstones in the area, namely the Matilija Formation, without encroaching onto lands not owned by Casitas, namely by the United States Forest Service or Bureau of Reclamation. RVDTB would allow for drought-period release of groundwater impounded within the target formation.

To provide an overall RVDTB project description from pilot- to full-scale implementation, KG will conduct research and analyses, confer with the CMWD, WREA and other advisor team members to prepare an overall project description for pilot and full-scale projects, preliminary estimates of costs and schedule. Within this of purpose and findings that could be presented in a public forum and include global examples of deep water well drilling projects.

2. RVDTB Hydrogeologic Analysis

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Around the Casitas-owned parcel, south-dipping and overturned strata in the Santa Ynez Mountains to the north are known to underlie the area as encountered in local oil exploration wells drilled between the 1920s and 1960s, which correlate to be present at depths below 5000 feet underneath the Casitas parcel. Of these sedimentary strata, the Eocene-aged sandstones (including the Matilija Sandstone) are generally more porous and permeable. Recharge to the Matilija Sandstone aquifers, which would feed RVDTB, appears to occur primarily via precipitation on the local mountain ridges that reach up to 3000 ft higher elevation than Lake Casitas. The sandstone forms prominent strike ridges in the Santa Ynez Mountains and reaches a maximum exposed thickness of more than 2500 ft by Matilija Springs.

Our report will provide a background discussion that clearly states the hydrogeologic setting and uncertainties in addition to target aquifer quality and characteristics, including geologic cross sections based on existing data and refined with field-reconnaissance efforts.

3. RVDTB Pilot Project Implementation

KG's recommended approach to RVDTB pilot- and full-scale implementation would be similar to oil exploration well drilling techniques. Pilot scale implementation would be conducted as an engineering study and test well permitted by the County of Ventura. Regional drilling contractors capable of this specialized work include Barbour Well Drilling, Layne Christensen Company, Western Strata Exploration, Pacific Coast Well Drilling, and Crown Drilling. Oil well contractors may also be solicited for the drilling effort given their experience in deep drilling projects. An example of Barbour's preliminary quotation for pilot project implementation is attached, engineer's estimate is modified in section 3.11, below.

Professional services associated with field phases of this project include assistance with contractor mobilization, full-time geologic supervision and logging of drill cuttings, witnessing of geophysical logging, selection of casing depths, selection of perforation intervals, observation of casing installation, cementing operations, sampling of waters, estimation of volumes generated, interpretive support, and formal reporting.

A line-by-line breakdown of RVDTB pilot-scale implementation, including discussions on its costs, objectives, site area, permitting requirements, exploration drilling and well construction techniques, and test pumping protocols and expected water quality, follows.

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- 3.1 Pilot project objectives:** The pilot project intends to provide a proof-of-concept and geologic controls at a lower cost and smaller diameter completion than an anticipated full-scale VerBo buildout. Months to years of monitoring and testing will be conducted prior to full scale buildout or replication of concepts proven via the pilot phase of the Verbo project. These objectives will be further elucidated in a basis for design report.
- 3.2 Site Description:** The size of the parcels targeted for the VerBo pilot project, rig footprint, spoils and cuttings storage, noise projections, access, testing water, etc., will be described in this section.
- 3.3 Permitting requirements:** The permitting process, efforts conducted to date, including CEQA compliance, time requirements, county permitting, etc. will be clarified.
- 3.4 Exploration techniques:** The VerBo pilot bore is conceptualized to be drilled with rigs more suited to the deep exploration for mineral and petroleum resources than typical water well rigs. The process will include drilling of a shallow conductor, some 50 feet in depth and 24 inches diameter, followed by a deeper casing (1600 ft, 12-inches diameter) to seal out the Sespe Formation and potentially Coldwater formations which supply existing nearby water wells with groundwater. These relatively shallow casings may be drilled via conventional deep water well drilling rigs, logging techniques, etc., if the bids to conduct the work in this fashion are favorable. If not, the shallow casings, which will be encased in cement, will be drilled with a single rig capable of completing the project wholly. Once these have been set, the final internal drilling (10-inches diameter) to explore the target aquifers will begin. Throughout the process the adequate number of drill collars, hole stabilizers, penetration rates, holdback tension, bit weights, etc., will be closely monitored to maintain a relatively plumb and aligned bore. For the purposes of the pilot project, the key will be to maintain the bore within the parcel boundaries of Casitas ownership.
- 3.5 Drilling, Well construction, development:** KG geologists will log the cuttings and mud properties in coordination with the drilling contractors mud engineers. Microfossils and macrofossils will be analyzed in-house or via contracted paleontological services for formational and age correlation analysis. Upon reaching total depth (currently estimated at 7000 ft), contracted loggers will run suites of geophysical logs including the standard water well suites (gamma, resistivity, etc.) as well as sonic logging, gyroscopic deviation surveys, and nuclear magnetic resonance surveys to best identify zones of likely groundwater production. Assuming favorable formations materials are encountered, an oil-field rated 7-

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inch-diameter steel casing will be run into the 10-inch bore with a grout shoe at the base. This casing will be cemented in place such that the annulus between the casing and bore are filled with cement from the bottom up, completely sealing the casing in place. Then, using oilfield technologies, the deepest identified zone will be perforated, penetrating both the steel and cement, and groundwater allowed to flow under (assumed) high artesian pressure to displace the drilling fluid and the rate and water quality can be monitored. This flow may last for many hours until a representative sample of groundwater can be collected. This process will then be repeated consecutively upward until all identified zones in the Verbo have been evaluated in this manner, and the flowing artesian water is a blend of all waters adjacent to the perforations.

3.6 Other construction logistics: Other logistical considerations include light site grading and preparation, makeup water supply, traffic routing, bridge capacity, discharge water issues, and well equipping with high-pressure valves connected in series to ensure containment of the water at pressure. Undeveloped fluids, namely drilling mud, will be separated from the drill cuttings and hauled off for proper and manifested disposal. The drill cuttings will be either spread on site or used as a gravel, chip, or aggregate material for various fill or construction projects as needed by Casitas.

3.7 Water Quality and treatment: each water sample and the blended water will be subject to a complete title 22 analysis. This will include complete general mineral and general physical analyses, metals, VOCs, semi-VOCs, and pesticides, etc., assumed at Casitas direct expense. Dissolved gases will also be tested, namely hydrogen sulfide and methane, in the water and any precipitated gases that can be collected in the standing/flowing water.

3.8 Testing program: as currently conceptualized, the testing program will consist of consecutive collection of upward flowing blended waters as each zone is perforated. Assuming all remain open, and do not require sealing due to poor quality waters, excessive gas, or oil, the well head will be shut in and pressure monitored over time. The well head will be opened and allowed to flow at a controlled, constant and monitored rate over the course of a 24-hour period on a monthly basis for the first year and quarterly thereafter. The water, not expected to be prohibitively compromised in quality, will be allowed to flow to the nearby Robles Canal and into Lake Casitas.

3.9 Monitoring program: KG anticipates monitoring artesian pressure, quality, and flows in the Verbo itself, as well as nearby creek, spring, river, and well water levels, flows, and

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quality as applicable and allowed by FS299 permit. Each monthly and quarterly event will be reported to include all data collected to that reporting date.

3.10 Metrics: Upon completion of the monitoring program the success of the Verbo Pilot project will be measured in the amounts of water that appear to be sustainable without significantly affecting other beneficial uses of local water. A cost-benefit analysis of the full-scale project will be prepared and evaluated, followed by a determination whether the full scale project is a worthwhile pursuit.

3.11 Costs: Project costs are anticipated to be highly variable and dependent on factors including the timing of the project and economic conditions. Rough order of magnitude costs are expected to be as follows:

- 3.11.1 Permitting and preparation: \$200,000
 - 3.11.2 Site preparation and logistics: \$100,000
 - 3.11.3 Conductor casing drilling and installation: \$50,000
 - 3.11.4 Shallow sealing casing: \$300,000
 - 3.11.5 Deep drilling: \$800,000
 - 3.11.6 Geophysical logging: \$100,000
 - 3.11.7 Deep Casing: \$200,000
 - 3.11.8 Deep sealing: \$100,000
 - 3.11.9 Perforating: \$200,000
 - 3.11.10 Water quality Sampling and analysis: \$50,000
 - 3.11.11 Well head pressure apparatus: \$500,000
 - 3.11.12 Testing monthly and quarterly (16 events): \$160,000
- Rough estimated total (excluding team fees/soft costs): \$2,760,000

In sum for this initial project phase, KG will provide a full RVDTB “basis of design” report and formal presentation to Casitas staff, committee, or board under Tasks 1 and 2. Task 3 will be implemented thereafter as determined by Casitas.

Please do not hesitate to contact us with any questions.

Best Regards,

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KG16-0335

A handwritten signature in black ink, appearing to read 'Jordan Kear', written in a cursive style.

Jordan Kear
Principal Hydrogeologist
Professional Geologist No. 6960
California Certified Hydrogeologist No. 749

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