Tamalpais
Environmental
Consultants

Sean Condry
Town Of San Anselmo
525 San Anselmo Ave.
San Anselmo, CA 94960

Subject: Evaluation of Irrigation Water Options for Grass Playing Fields at Memorial Park, San Anselmo, California.

This summary has been prepared by Tamalpais Environmental Consultants (TEC) and Edd Clark & Associates (ECA) to provide the Town of San Anselmo with an evaluation of water supply options for the playing fields at Memorial Park in the Town of San Anselmo (Town). The objective of this evaluation is to provide the Town with additional information related to the available irrigation water options in order to make an informed decision regarding the replacement of the grass at the playing fields. A summary of options and cost estimates are provided separately.

The playing fields at Memorial Park include over 3 acres of grass that require significant amounts of water to maintain. A figure showing the park and associated features is included in Figure 1. The Marin Municipal Water District (MMWD) provides potable water for the fields and a new connection to their pipeline was completed in 2021. A variety of water sources can be used in the event that water is not available from the MMWD. Additional potential sources of water include recycled water (both long-term and short-term options), groundwater from existing and new wells, greywater, and rainwater harvesting. Each of these options is discussed in more detail in this report.

The existing fields and irrigation system are in relatively poor condition. The installation of a new irrigation system alone is estimated to use about 25% less water than the existing irrigation system for the same amount of grass. This would be a very significant savings over the current system and TEC recommends the installation of new irrigation and control systems at a minimum to use water as efficiently as possible. The current system uses over 100,000 gallons of water per week in the summer and water use can be higher than that in some conditions. The utilization of alternative water options can reduce the amount of water necessary from the MMWD by approximately 50% or more depending on the options chosen.

We have collected or reviewed information from the following sources:

- the installation of the two existing irrigation wells in the 1970s,
- additional wells and groundwater pumping tests conducted in 2012 and 2013,
- well drilling contractors,
- well maintenance and system installation contractors,
- Marin Municipal Water District (MMWD) personnel related to potable and recycled water options,

- local and state agencies related to groundwater use,
- recycled water delivery contractors,
- local greywater options,
- rainwater harvesting, and
- historical aerial photographs, topographic maps, and other records.

Recycled Water Options

High quality recycled water is now produced at the Las Gallinas Valley Sanitary District. The water is treated and distributed by the MMWD through a network of pipelines. During periods of restricted potable water use, the MMWD set up connections for local customers to collect recycled water in tanks or trucks at the Marin Civic Center. MMWD indicated that the system currently has a capacity in excess of one million gallons per day and could easily meet the water requirements for the park with a drought-resistant source if it was connected by a pipeline. The recycled water pipeline currently extends from the treatment facility to a hydrant near Terra Linda High School, the closest point to San Anselmo. This water source would provide an ideal long-term water source for this type of project in the future.

The MMWD did a study over 10 years ago to connect the Mt. Tamalpais Cemetery to this recycled water source in Terra Linda, but that project wasn't completed due to limited necessity at the time and costs. The cemetery is located about $^3/_4$ of a mile to the northeast of the park. The MMWD representative indicated that this project could be re-evaluated with a new cost estimate to provide San Anselmo and the Ross Valley with a reliable recycled water source. The distance could be as little as 2 miles depending on the route selected, but would include some challenging terrain. However, this route could largely avoid the utility congestion and pavement requirements around city streets. The project would be constructed and operated by MMWD and could provide recycled water to Memorial Park, the Mt. Tamalpais cemetery, and a variety of other irrigation and construction uses in the Ross Valley. This project would likely take several years to fund and was ballparked by the MMWD representative to be between $5 million and $10 million.

The MMWD indicated that they would likely be willing to complete a new budget estimate for this work and that a letter from the Town Council requesting that a new cost estimate for this project would be helpful. While this course of action would be a great long-term solution, it does not address the water needs of the playing fields for the next several years.

The Central Marin Sanitation Agency in San Rafael, which treats wastewater from the Ross Valley, does not currently produce recycled water at the quality necessary for reuse on playing fields. There is no definitive timeline for the necessary upgrades at the facility and associated pipelines to San Anselmo. The estimate for the upgrades to the facility alone is likely in the tens of millions of dollars.

Recycled Water Deliveries by Truck

Recycled water can be brought to the parks in water trucks from the civic center. During the water restrictions in place during the summer of 2021, a contractor provided a water truck with a 1,600-gallon capacity to transport water to meet local landscape and construction water needs. Additional recycled water contractors have expressed their intent to provide recycled water with larger trucks, which could provide up to 3,600 gallons per load of recycled water with a cost of about $800 per load. Lower costs might be achieved with longer-term contracts or additional contractors.

In the event of low water availability from MMWD and groundwater options, the water truck option could provide two loads of recycled water a day to meet about 50% of the water needs of the playing fields for about $10,000 a week. This option would require at least one additional tank at Memorial Park to provide separation between the recycled water and the groundwater wells and a new connection that would allow a truck to unload from the street to the tank relatively quickly and stay out of the traffic corridors.

Local Greywater Recycling

Recycled water may also be available from local sources through greywater capture and treatment systems. Water Champions reviewed potential greywater sources to evaluate whether the existing town buildings adjacent to the park may be retrofitted to collect greywater from the sinks. The water would then be filtered and either drained directly into an underground tank or pumped into a new aboveground tank. Water Champions estimated that this water source could provide about 1,000 gallons per week consistently during the year. The scope and cost estimates provided by Water Champions and Argall Plumbing are included in Attachment 1. Additional engineering and piping costs would still be required. The restrooms at the playground are also a potential source of greywater that could be utilized in a stand alone system in that location or connected to the primary greywater source south of the playing fields.

The available water volume for this strategy is relatively low compared to the water needs for the park, but this could provide a source that lasts throughout the summer time. If additional developments are constructed or redeveloped in the area, it may be possible to capture more significant amounts of greywater in the future and the knowledge gained from this relatively low volume approach now could allow the more efficient utilization of other sources in the future. Piping for greywater could be installed concurrently with the well and irrigation piping to minimize the overall costs for expansion in the future.

Groundwater

Groundwater can be a significant resource and meet a substantial portion of the water needs for the playing fields. Groundwater can be used sustainably when there is a balance between extraction and recharge from the surface over the long-term. Groundwater in this area is relatively shallow with the depth to water measured at about 10 feet in monitoring wells during August 2021 and less than 7 feet in some locations in February 2022.

A geological consultation was undertaken in the 1970s and the Town subsequently installed two irrigation wells (IR-1 and IR-2) around the playing fields. These wells have been inactive in recent years since water has generally been available from the MMWD. The well locations are shown on the Site Plan. The wells are completed to a depth of about 35-45 feet below the ground surface (bgs). The well logs show mostly low permeability clays with sand and gravel lenses that likely provide the water produced. Two cross-sections prepared by ECA showing the geological information are included in Attachment 2. While bedrock was not directly indicated on most of the boring logs, the indications are that bedrock underlies the whole area at a depth of about 50 feet bgs.

A pump test was previously completed on the irrigation wells in 2013 that confirmed the potential for the irrigation wells to average about 4 gallons per minute (gpm) in the short-term. This rate was estimated over 24 hours during the winter and the wells are unlikely to produce this average flow rate for a long duration due to the relatively limited depth of the aquifer that is providing the water. There is significant uncertainty about how much water these wells can supply and what extraction rates could be maintained during the dry season, particularly following periods of lower rainfall. Each of the two existing irrigation wells have been producing over 10,000 gallons of water per week to accommodate early season watering and replanting conducted by the Town in early 2022.

The irrigation wells were refurbished with a new well pump and controls by Forster Pump & Well in August 2021 during the drought to minimize the use of MMWD water. A new MMWD interconnection was also installed to allow the combined use of groundwater with MMWD water. The existing irrigation wells IR-1 and IR-2 were inspected with a video camera in January 2022 and found to have accumulated silt and the steel casings were corroded and clogged. The wells were subsequently cleaned by air jetting and recirculation of an environmentally-friendly well cleaning compound in January and February 2022 to maximize the well yields. The wells were purged and reconnected to the system in early February 2022.

Unfortunately, the water yield from the two existing wells will not be sufficient to meet all the watering needs, but there are several options to increase the amount of groundwater produced. In order to provide additional information about the subsurface and the likelihood of water yields, TEC contracted with Western Groundwater Surveyors (WGS) to provide an electro-seismic evaluation to assess the potential water yield from additional well locations. This is a geophysical technique that can provide an estimate of permeability and potential water yield in an aquifer.

The WGS survey was conducted along a transect of 6 points extending from the northern edge of the batting cage across the meadows picnic area toward the restrooms. An additional calibration location was completed next to IR-1. A complete description of the technology and the results are included in the WGS report provided in Attachment 2. WGS indicates that the best location in this area for another water production well is likely at Sounding 5, which may be where the historical creek channel was located. Unfortunately, this area is also near the sewer line, limiting the potential for a new production well at this location. A new test well could be installed 50 feet from the sewer line and another potential location is near the northern end of the park in the elder garden area.

The WGS survey also indicated that the shallow alluvial aquifer would likely be a better water-producing zone than the deeper franciscan complex bedrock zones, but that additional technical surveys could be completed to assess the deeper zones.

Connection of Existing Well MW-2B

During the pump tests conducted in 2012, Well MW-2B was installed in the playing field and tested for water production. The location of this well is shown in the Site Plan and is about 130 feet south of the restrooms and about 60 feet east of the pathway on the western edge of the fields. This well is a 4-inch diameter PVC well and produced about 4 gpm during the testing conducted in 2012. This flow rate is similar to what was produced by the larger 8-inch diameter steel irrigation wells IR-1 and IR-2. Well MW-2B was recently located during a utility survey using a metal detector.

This well can be connected to the existing irrigation system without any additional permitting with the County. The installation will require a vault at the surface that can be accessed by personnel periodically and sometimes an equipment truck will be necessary to service the well pump. The location in the middle of the field does provide a number of limitations for access, but could be accommodated in the new park plans. The cost to connect Well MW-2B to the existing system could be minimized by including the necessary trenching and piping requirements with the new irrigation system.

Installation of Additional Wells

Additional wells may be installed to monitor the aquifer and to potentially find additional locations for irrigation supply wells. The installation of one or two additional groundwater wells could be used in conjunction with existing wells MW-1 and MW-3 for assessing groundwater elevations during active pumping of the irrigation wells. Each shallow well could be installed for about $10k with permitting, contractor, and oversight costs.

The historical investigations indicate that the shallow groundwater aquifer is underlain by bedrock. It is possible that there is a deeper water source if a well is drilled into the rock and a fracture is encountered. The potential yield from this type of well could meet all of the watering needs, but the costs for installation are relatively high (cost could exceed $200k to $300k) and there is a risk of not encountering a good water source. Drilling into bedrock also requires a much larger drilling rig for a longer period of time.

TEC and ECA have also investigated the use of a horizontal extraction well to tap into the more permeable zones with much longer well screens. This technology has a number of limitations, including the need for additional soil borings before the project commences, clearance from sewer lines, a relatively high cost, and uncertain water production.

Rainwater Harvesting

A significant volume of water could be collected during heavy rainfall events and stored for later use. Stormwater could be collected from several sources, including runoff from nearby rooftops, the tennis courts, playground parking lot, and storm drain system. The water would be filtered prior to being stored in a storage tank.

One of the challenges for this strategy is the storage volume relative to the anticipated water use during the dry season. Very large storage volumes, potentially in excess of 100,000 gallons would be necessary to make a significant contribution to the summer time watering needs for the playing fields. Multiple tank options might be considered and cost estimates are currently being prepared to further evaluate these options.

These are large tanks and there are several options available to meet different project requirements. A 20,000 gallon tank could be installed initially with greywater and stormwater collection options to provide testing of these water use strategies prior to the installation of more tanks. Two potential tank location options are shown in Figure 1. This tank could receive water from a variety of water sources in the wet season, provide storage for recycled water, and reduce the need for an additional aboveground tank. These underground tanks could be placed adjacent to the tennis courts, under the infield area of the adjacent baseball field, east of the pathway along the eastern side of the playing fields, or within the infields or playing fields.

Water Storage and Control System

A concrete water storage tank with a reported capacity of about 8,000 gallons of water is located on the southern edge of the playing fields adjacent to the tennis courts. The two existing irrigation wells are connected to this tank and an electrical control panel with breakers and pump control boxes is located next to the tank. The control panel and tank appear to date back to the original installation in the 1970s. The control panel needs to be upgraded and replaced. TEC has not inspected the interior of the concrete tank, but this tank appears to be usable for the immediate future.

The existing storage volume is low compared to the average daily use of 13,000 to 15,000 gallons during the summer. This volume should be increased to allow more water use options in the future. It is anticipated that an additional tank would have a capacity of 8,000 to 20,000 gallons. The existing tank location is shown on the Site Plan. There are a variety of aboveground tank options that might be considered for this location with a wide range in cost.

A new underground pipe connection would be needed for a recycled water truck to easily and quickly pump water from the asphalt area off of Sunny Hills Dr.

Options to Consider

This report has summarized a variety of available water options and each option can have a number of advantages and disadvantages. TEC is working with the Town to create and update different combinations of options to find the right balance of water conservation and use of the park. There is no guarantee that any of these options would be able to provide a sufficient source of water to meet all of the water needs of the existing playing fields.

The installation of artificial turf would be one way to achieve a significant reduction in water usage. Preliminary estimates for the installation of artificial turf for Field #1 would reduce the water necessary by over 30%. One of the limitations of having a hybrid approach with artificial turf and natural grass is the necessity for a solid transition between the field types, which reduces the flexibility of the current layout.

In order to maximize the production of the existing wells and include the option for deliveries of recycled water, TEC recommends the connection of MW-2B to the irrigation system, the installation of a new control panel and water storage tank, and recycled water connection to Sunny Hills Dr.. The additional installation of any of the well options, greywater, and rainwater harvesting options could also significantly reduce the need for MMWD water. The projects could be completed in phases with some trenching and piping completed prior to the grass planting to avoid the disruption of the grass in the future.

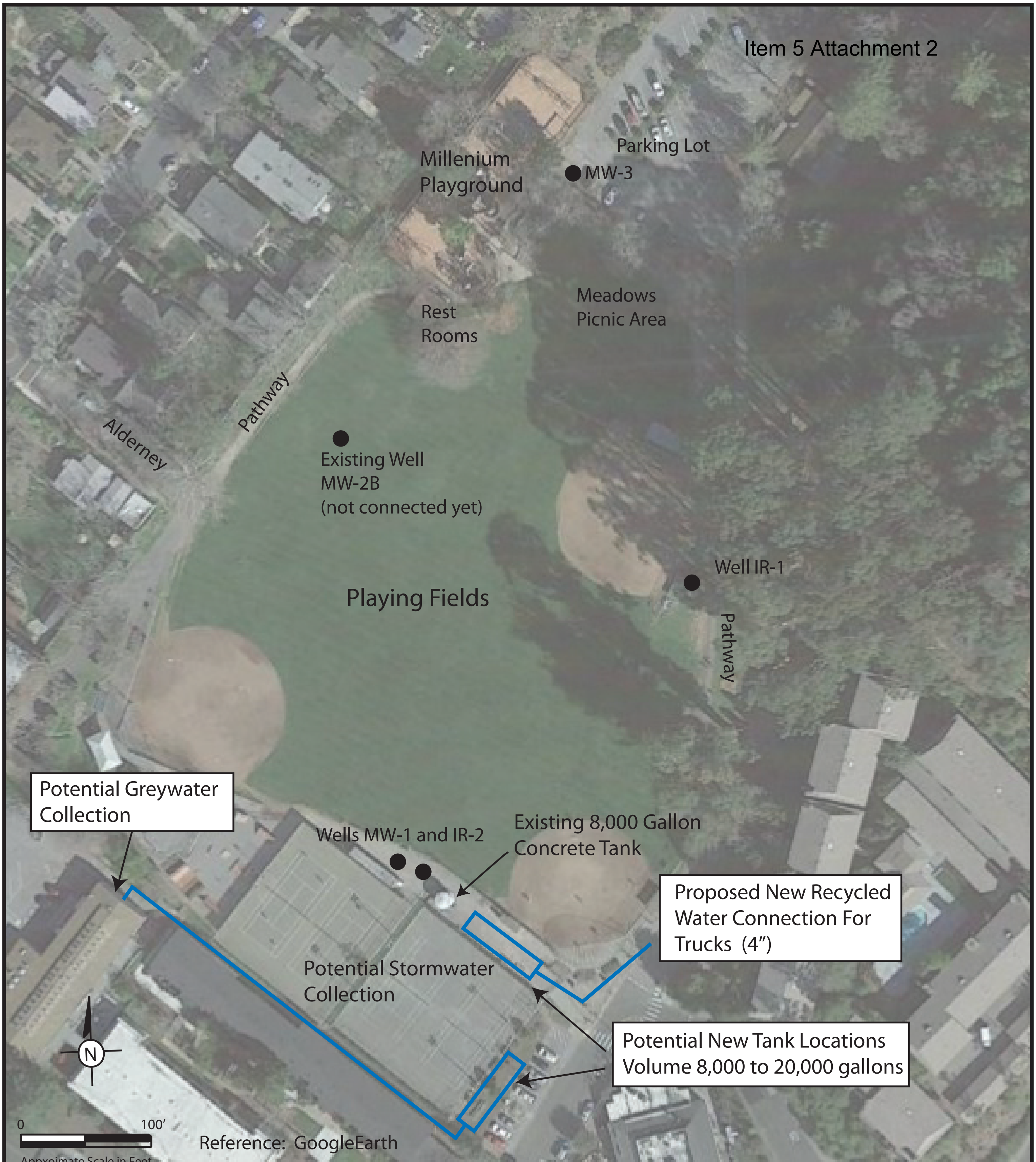
We appreciate the opportunity to provide this summary to the Town. Please let us know if you have any questions or would like additional information.

Sincerely,

Aaron O'Brien, PE
President
Tamalpais Environmental Consultants

Attachments: Figure 1: Site Plan

Attachment 1: Water Champions and Argall Plumbing Cost Estimates
Attachment 2: Geological Cross-Sections
Attachment 3: Western Groundwater Surveyors Report



Tamalpais Environmental Consultants

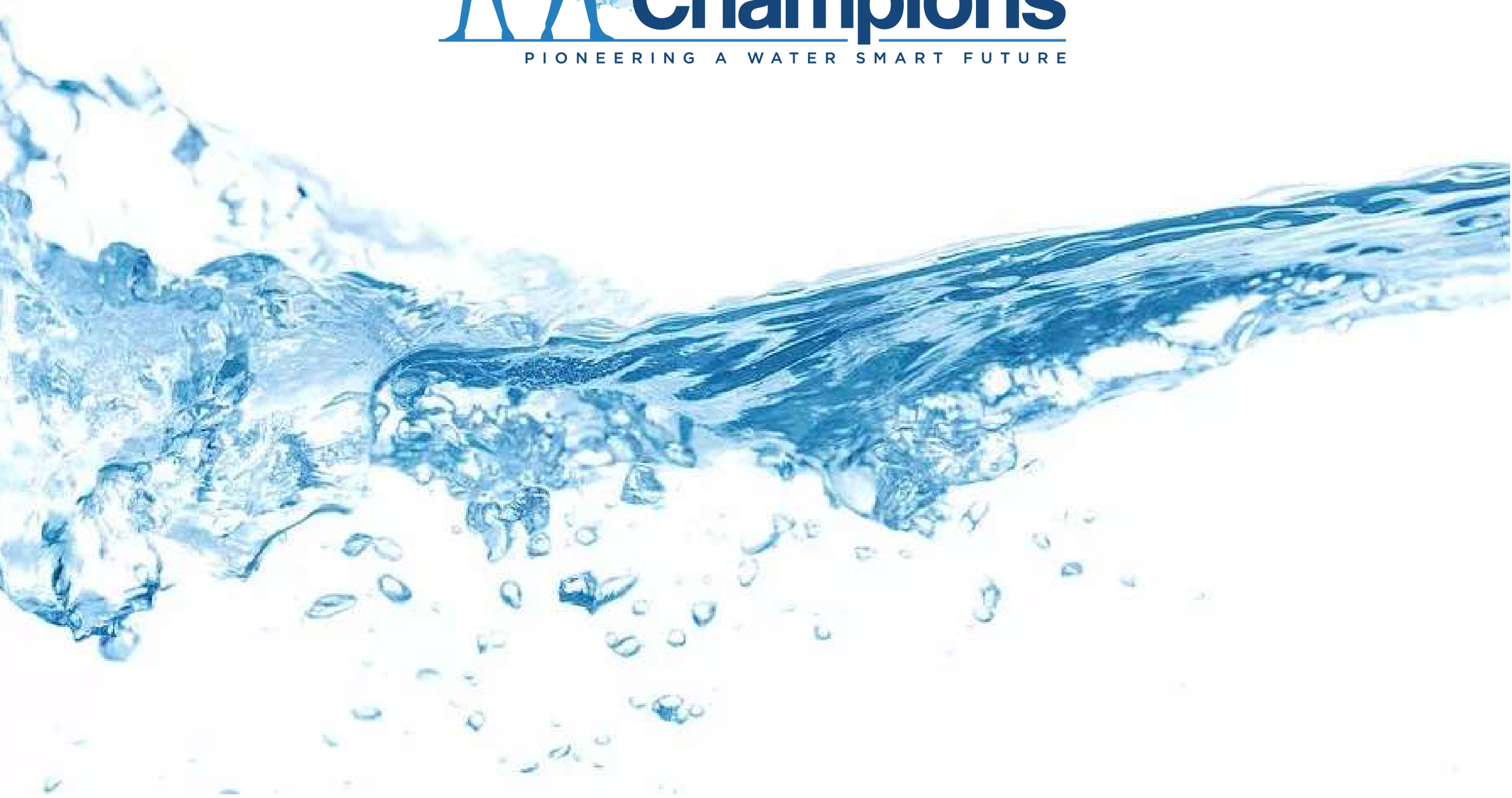
Site Plan

Memorial Park
San Anselmo, California

Figure 1

Attachment 1 - Water Champions and Argall Plumbing Cost Estimates

Water Champions
PIONEERING A WATER SMART FUTURE



WATER CONSERVATION SYSTEM INSTALLATION PROPOSAL

Created by:

Paul Mann, Water Champions
Paul@TheWaterChampions.com
510-708-4065 or 833-3WATERS

Prepared for:

Aaron O'Brien
32 Hill Avenue
Fairfax, CA 94930

Item 5 Attachment 2

SUMMARY

Dear Aaron, 2/21/2022

Thank you for contracting Water Champions to conduct an analysis and provide a proposal for methods of capturing and reusing water for irrigating the Memorial Park ballfield in San Anselmo.

As we are now in uncertain times of climate change, it appears that higher temperatures, drought, water scarcity, and rising municipal water prices will be among the new normal. We will need to engage new solutions to make our water go farther and create water security.

Capturing and recycling greywater and rainwater for the ballfield are great alternatives to using potable water, and will conserve a substantial amount of potable water in the long run. With our solutions, the San Anselmo Parks and Recreation Department will better be able to maintain the beauty of the ballfield with the water that would otherwise go down the drain, and enjoy a more sustainable way of keeping the grass green year-round.

We at Water Champions are pleased to provide the design for the installation of the ballpark's water conservation system. We specialize in implementing innovative solutions that capture, recycle, conserve and make water go farther. We pride ourselves in custom-designing and installing just the right solution for our customers and providing ongoing monitoring and support to ensure each system runs smoothly for years to come.

Item 5 Attachment 2

On the following pages, I have outlined the current situation, opportunity, proposed solution, and primary system component options with approximate prices for your review.

Should you have any questions, comments, or concerns regarding this proposal, please feel free to contact me directly at 510-708-4065 or at Paul@TheWaterChampions.com.

We look forward to the hopeful installation of our solutions to help ensure long-term water sustainability, security and green abundance at the Memorial Park baseball field!

Regards,

PaulMann

Item 5 Attachment 2

WATER CAPTURE EVALUATION

Current Situation

The San Anselmo Memorial Park ballfield is upgrading their irrigation system. In that process, their is discussion of redoing the three grass ballfields, either with natural grass or with turf.

The existing ballfield will typically consume approximately 100,000 gallons of water per week for irrigating the three ballfields in the peak summer months. Currently, this water is provided through two wells on site, one 7,500 gallon above-ground concrete water tank, and potable water from the Marin Municipal Water District (MMWD). Alternate water sources, such as recycled water delivery by truck or pipe have also been evaluated or used.

With the apparent ongoing drought, limited reservoir storage capacity in Marin, and possible restrictions and penalties that are or could be imposed by MMWD, a decision must be made whether to keep irrigating the grass currently on the ballpark, switch to artificial turf, or make a different decision altogether that ensures long-term sustainability against ongoing drought.

Opportunity

The San Anselmo Memorial Park ballfield has a series of storm water runoff pipes that run through the ballfield, as well as along the perimeter of the park. While the exact volume of water could not be identified for this report, those familiar with the field suggest that a high volume of water runs through them during the Winter months.

The Parkside pre-school and day care and gymnasium building rooftop is also a source of water. The rooftop measures approximately 8,392 square feet and, as such, produces approximately

Item 5 Attachment 2

5,035 gallons of water per inch of rain. The downspouts on the west side of the building feed into a 12" storm water runoff pipe runs on the south side behind the tennis courts. Based on last year's 20 inches of rainfall, this would produce 100,700 gallons annually. This number could double to triple based on previous years and normal rain flow averages.

The San Anselmo Parks & Recreation Department also has water coming off its neighboring administrative building that houses the San Anselmo Parks & Recreation Department staff and various artists. The rooftop measures approximately 11,684 square feet and, as such, produces approximately 7,010 gallons of water per inch of rain. The majority of this rainwater feeds into a storm water runoff pipe that runs under the subsidized housing project, and the rest exits onto the surface concrete or asphalt. Based on last year's 20 inches of rainfall, this would produce 140,200 gallons annually. This number could double to triple based on previous years and normal rain flow averages.

Lastly, the pre-school has approximately 35 pre-schoolers and 5 teachers who wash their hands approximately 5 times daily throughout the year. The gymnasium has approximately 50 students who wash their hands approximately 2 times per day 5 days per week. Lastly, the San Anselmo Parks & Recreation Department has approximately 15 people who wash their hands 2 times per day 4 days a week. This produces, in total, approximately 4,050 gallons of greywater per month, as detailed in the graph below. As these facilities are open almost all year round, there is a potential annual production of approximately 48,600 gallons of greywater produced annually and predominantly on an even basis each month, even in the dry weather months, that could be recycled on-site into 100% germ-free, clear water for reuse on the ballfield or back into the building's toilets for flushing.

Item 5 Attachment 2

Recycled Water Production Potential

	Fixture Flow Rate in Gallons/Minute	# People Using Sink	# Days/Week Sink Is Used	# Sink Uses/Day Per Person	Minutes/Sink Use	Total Gallons/Week	Total Gallons/Month
Preschool Sink 1	1.5	35	5	5	0.25	328.125	1312.5
Preschool Sink 2	1.5	35	5	5	0.25	328.125	1312.5
Preschool Sink 3	1.5	5	5	4	0.33	49.5	198
Gymnastics Sink 4	1.5	50	5	2	0.33	247.5	990
SAP&RD Sink 5	1.5	15	4	2	0.33	59.4	237.6
Total						1012.65	4050.6

Proposed Solution

Per the schematic image below, we recommend a multi-tier approach to capturing and storing water for the ballfield as follows:

1. Intercept the 12" storm water runoff pipe that runs between the skateboard park and the pre-school (as indicated below with a red line) and use a 280 micron vortex filter to spin off the clean water for storage. This pipe also contains the rainwater collected from the rooftop of the pre-school/gymnasium.
2. Capture the greywater from the two bathroom sinks and one cleanup sink in the pre-school

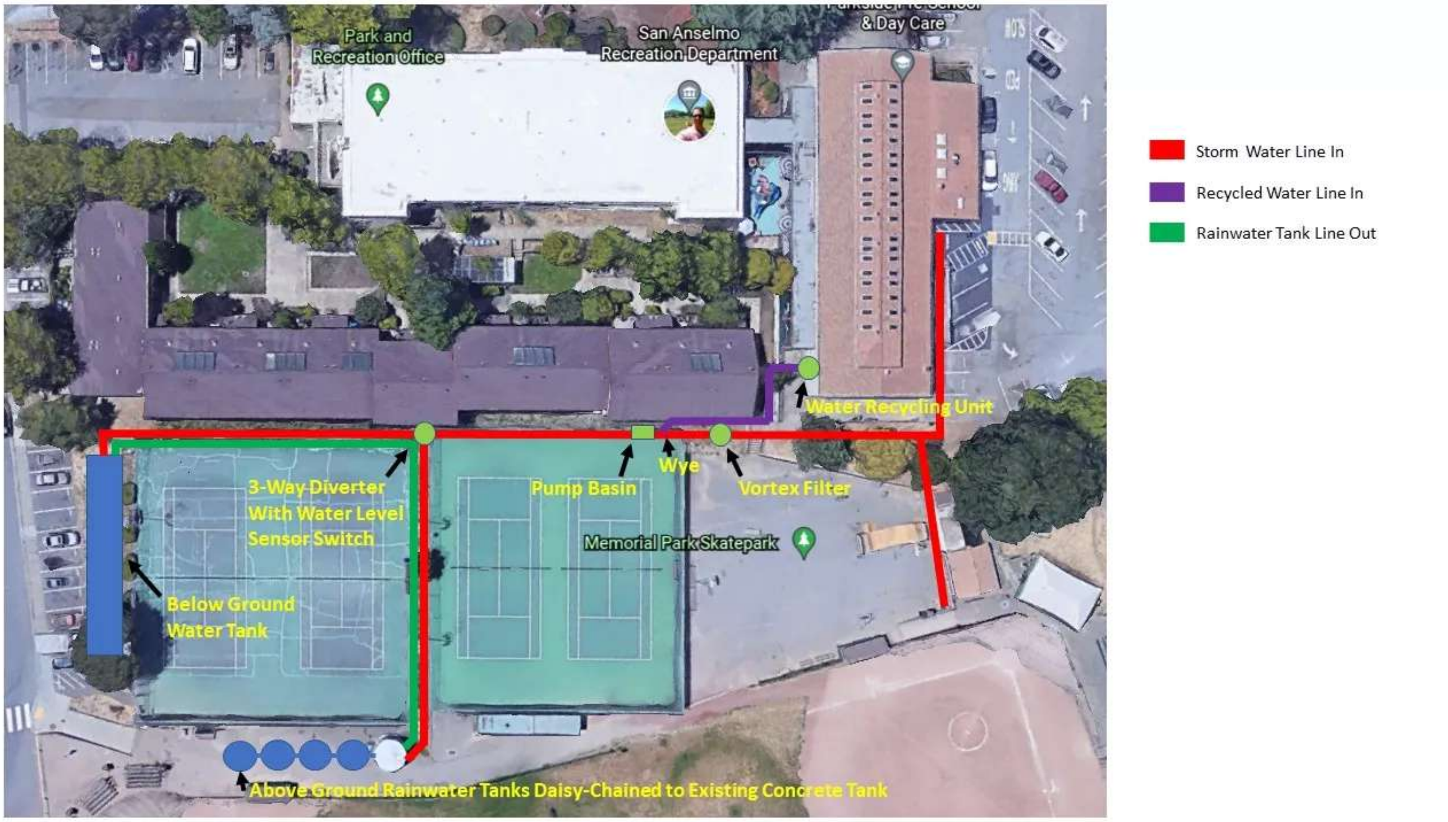
Item 5 Attachment 2

Water Champions

and run it into a Hydraloop water recycling system to process it to 100% germ-free, clear water. Output the clean water into the 12" storm water runoff pipe via a wye, just after the vortex filter and behind the south side of the tennis courts, for storage (as indicated below with a purple line). Note that the Hydraloop system also has pressurized ports that could be retrofit to the toilets in the Parkside pre-school, daycare and gymnasium for flushing if desired.

3. Just after the wye, install a pump basin to pressurize the water and install a 3-way diverter that enables water to either be pumped into a below-ground cistern located at the east end of the tennis courts or diverted to pump up and into the existing above-ground concrete water tank, which would be daisy-chained to additional above-ground tanks for additional storage on the front northeast corner of the tennis courts.
4. The below ground cistern would have a pump with a line out (as indicated below with a green line) to replenish the concrete above-ground tank and daisy-chained above-ground tanks as needed to provide water to the ballpark irrigation system.

Item 5 Attachment 2



Because the majority of water that could be used for irrigation will collect during the winter months when water can be collected from the rooftop and ground runoff, it is recommended the larger capacity of water storage the better. During the warmer months when this water may be used up, it can be augmented through the recycled water from the pre-school and gymnasium.

If necessary, additional greywater can be recycled from the San Anselmo Parks & Recreation Department building as a separate future project. In addition, recycled water can be delivered by

Item 5 Attachment 2

truck through a 3rd party from the San Rafael recycled water filling station or from nearby natural streams, such as the Russian River. If necessary, additional storm water runoff pipes could be accessed (there is an 18" pipe that runs in front of the tennis courts, a 10" pipe that runs under the HUD, a 24" pipe that runs through the middle of the ballfield, and another 24" pipe that runs at the top of the ballfield). Lastly, additional greywater from the bathroom near the Millennium Playground can be captured and recycled to clear water that can also feed into the water storage tanks.

Primary System Component Options

Based on the recommended configuration above, here are the options and costs for consideration:

1. **Hydraloop H600 water recycling system** - this NSF350 certified unit will capture the greywater from the pre-school sinks (and other sources if desired) and take it through a 6-stage cleaning process to output 100% germ-free, clear water that can be stored for irrigation. Click here to see a video of how the H300 (residential model) works and click here for the specs on the H600 commercial model recommended for this project. Approximate cost: $8,995 plus tax.
2. **WISY Vortex Filter** - this filter will intercept the 12" storm water drain pipe or, more likely, a 6" artery pipe off the 12" pipe and will filter out clean water for storage. Click here to see a video of how it works. Approximate cost: $938 plus tax.
3. **Below-ground cistern** - in the grass on the east end of the tennis courts, the area is 75 feet long, and 15 feet wide on one end and 22 feet wide at the other end. As such, there is the capacity to install a variety of sizes of tanks, either in concrete or in plastic:
    1. Concrete cistern - By example, a 25,000 gallon concrete cistern would cost approximately $60,000 delivered, a 50,000 gallon concrete cistern would cost approximately $90,000 delivered, and a 119,000 gallon concrete cistern is the largest cistern we could fit and would cost approximately $180,000 delivered.
    2. Poly cistern - The largest poly tank we could fit would be a 20,000 gallon tank that

measures 55' long x 8.4' wide x 8.9' high and would cost approximately $57,200 plus $7,700 delivery. Theoretically, we may be able to get two of these tanks in side-by-side and daisy-chain them.

4. **Above-ground water tanks** - based on the current 7,500 gallon concrete tank that measures 15' in diameter x 10' high, and a remaining 50' to the left of the tank to the bench and an additional 25' to the water fountain, there exists two primary options (note that we were not able to find any manufacturers of concrete tanks):
    1. High-density polyethylene tanks - by example, there is enough room to daisy-chain up to seven 5,000 gallon tanks that are 129" in diameter x 96" high at a cost of approximately $4.584 each, or six 10,000 gallon tanks that are 144" in diameter x 161" high at a cost of approximately $15,360 each.
    2. Metal tanks - by example, there is enough room to daisy-chain up to five 7,500 gallon metal tanks that have the same 15' diameter x 10' tall dimension as the existing concrete tank and would cost approximately $36,000 each.

Once primary system components have been selected, more exact water capture and reuse calculations can be provided, as well as a final estimate that includes all parts, installation equipment, and labor will be assembled for your review.

WHY CHOOSE WATER CHAMPIONS?

At Water Champions, we're passionate about saving water and ensuring our customers are exuberant about the quality and workmanship of the solutions that we install for them. That's why we take the time to constantly research and test for the most innovative and long-lasting water capture, reuse and conservation solutions possible to bring to you.

Our team are not only trained and experienced experts in installing the solutions we provide, but we also pride ourselves in providing customized, full-service services for you, including system design, permitting, financing and annual system maintenance contracts.

When you work with Water Champions, you work with a team of environmentally-conscious individuals who are committed to enabling a future where water capture and recycling systems conserve huge amounts of water for every home and building in every community and help to create a green abundance to enjoy. Together, we are pioneering a water smart future we can all feel good about.

By purchasing our solutions, you too become a water champion and become part of the solution as we, together, reimagine water use and secure a more abundant, sustainable future. And, thinking on a global scale, 5% of our profits are donated to Water.org, a great charity that has empowered more than 38 million people with access to safe water or sanitation through affordable financing in water-stressed areas around the world. With Water Champions, by saving water locally, you are also making a difference globally!

Item 5 Attachment 2

GRIER ARGALL PLUMBING, INC.
P.O. Box 2723
San Anselmo, CA 94979
Phone (415) 457-0748 / Fax (415) 456-3929
Lic# 736901
grierargall@gmail.com

PROPOSAL

Date: February 22, 2022

WO#: 9959

To: Town of San Anselmo
1000 Sir Francis Drake Blvd
San Anselmo, CA. 94960

Location: 1000 Sir Francis Drake Blvd
San Anselmo, CA. 94960
(Isabel Cook School Location)

Reference: Hand wash sink drain to a tank beyond upper walkway past vista room entry.

We propose to furnish labor and material to complete the following work:

Item #	Description	Cost
1	Install exposed drain along wall in kids bathrooms serving hand sink for grey	6,480.00
	water, run drain under building and expose itself	
2	Cut 1' slot in concrete from tank location 1' deep. Install one 3" gravity drain,	6,940.00
	one 1-1/2" PVC discharge and one 1" conduit to edge of retaining wall.	
	Includes removal, dump runs.	
3	Patch concrete.	1,130.00

Total Job $ 14,550.00

Permit: $TBD

QUALIFICATIONS: Materials to be used ABS DWV pipe and fittings copper and pex for water piping.
Opening, patching, excavation and backfilling of floors, walls & or ceilings to be done by others.

We appreciate the opportunity to provide you with an estimate to complete this work. If the above meets with your approval, please sign and date the form below and return to our office.

Sincerely,

Grier Argall

Grier Argall
President

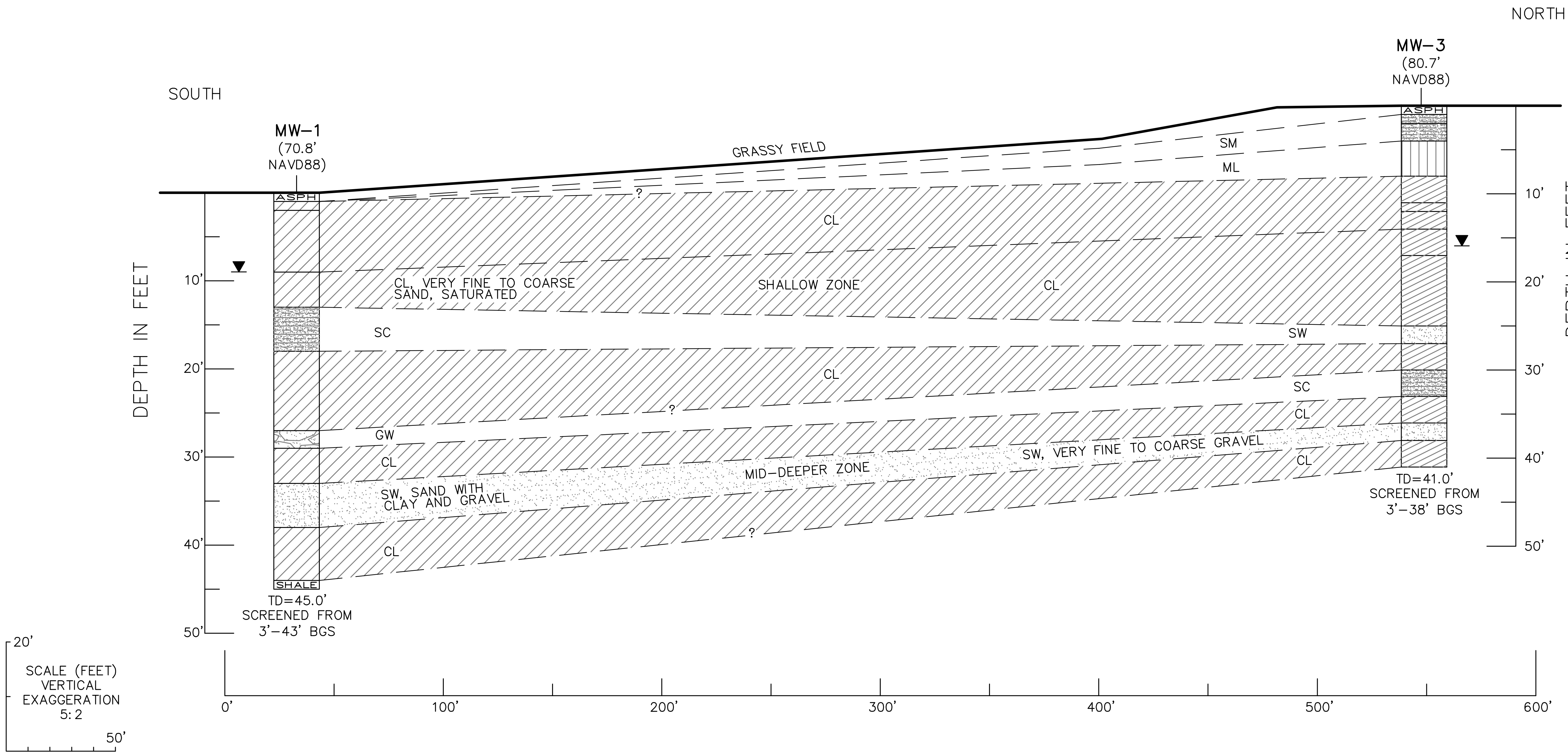
Approved by:______________________________ Date:____________________

I hereby accept the above performed service or goods as being satisfactory and acknowledge that equipment has been left in good condition.
All complaints regarding workmanship or materials used must be reported within 3 days after completion of work done.

Attachment 2 – Geological Cross-Sections

DATA FOR MW-1: STATE OF CALIFORNIA WELL COMPLETION REPORT #E0165070

DATA FOR MW-3: STATE OF CALIFORNIA WELL COMPLETION REPORT #E0165077



EDD CLARK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

CROSS SECTION MW-1 TO MW-3

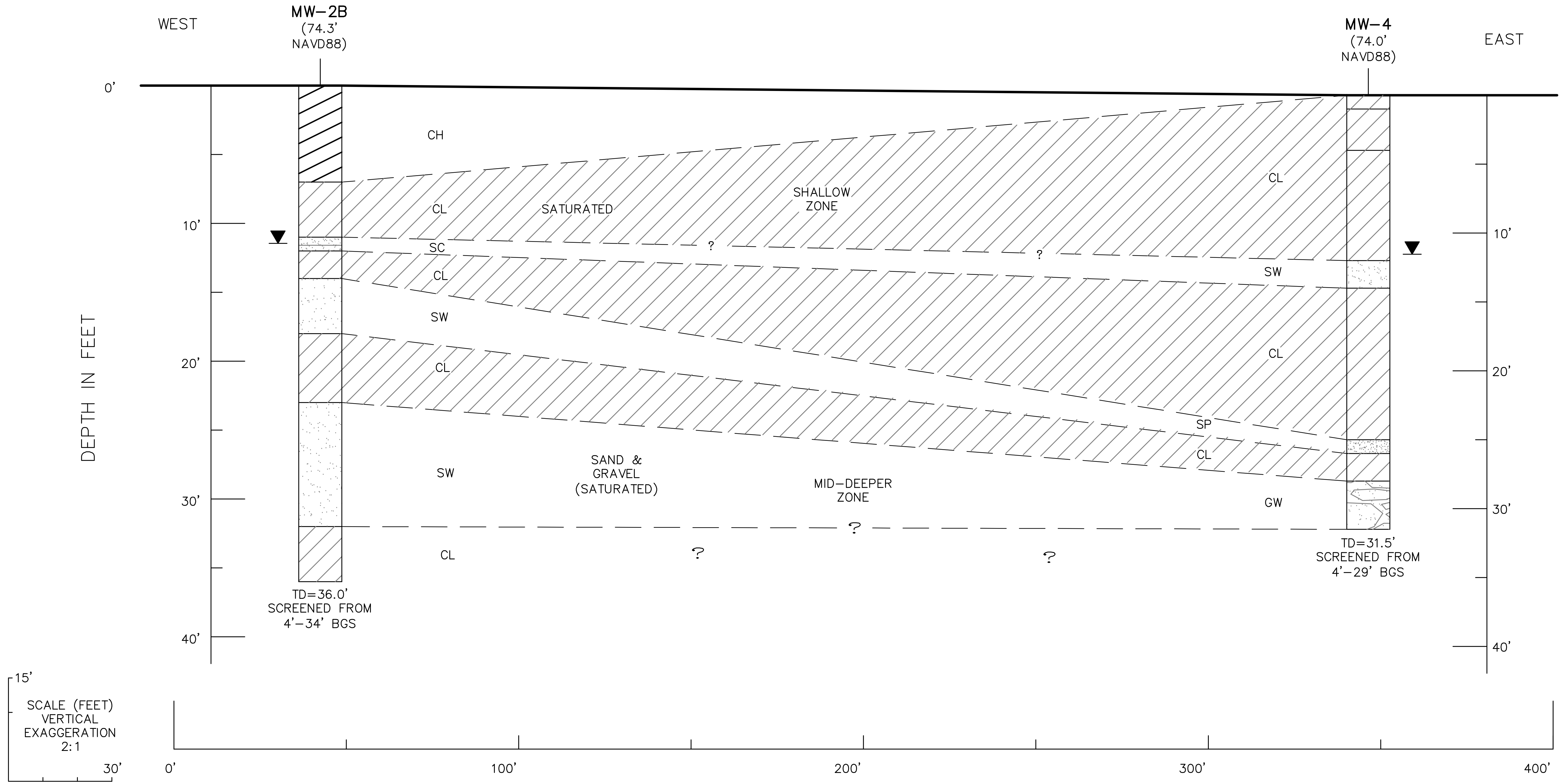
MEMORIAL PARK
1000 SIR FRANCIS DRAKE BLVD
SAN ANSELMO, CALIFORNIA 94960

FIGURE 1

JOB#	REVIEWED BY	DATE	REVISED DATE	PAGE OF
1002,001.21	EC&A, GRETCHEN WAMBACH	JANUARY 2022		1 1

DATA FOR MW-2B: STATE OF CALIFORNIA WELL COMPLETION REPORT #E0165073

DATA FOR MW-4: STATE OF CALIFORNIA WELL COMPLETION REPORT #E0165078



EDD CLARK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS

CROSS SECTION MW-2B TO MW-4

MEMORIAL PARK
1000 SIR FRANCIS DRAKE BLVD
SAN ANSELMO, CALIFORNIA 94960

FIGURE 2

JOB#	REVIEWED BY	DATE	REVISED DATE	PAGE OF
1002,001.21	EC&A, GRETCHEN WAMBACH	JANUARY 2022		1 1

Attachment 3 – Western Groundwater Surveyors Report

GROUNDWATER SURVEY REPORT

LOCATION
1000 Sir Francis Drake Blvd.
San Anselmo, CA 94960

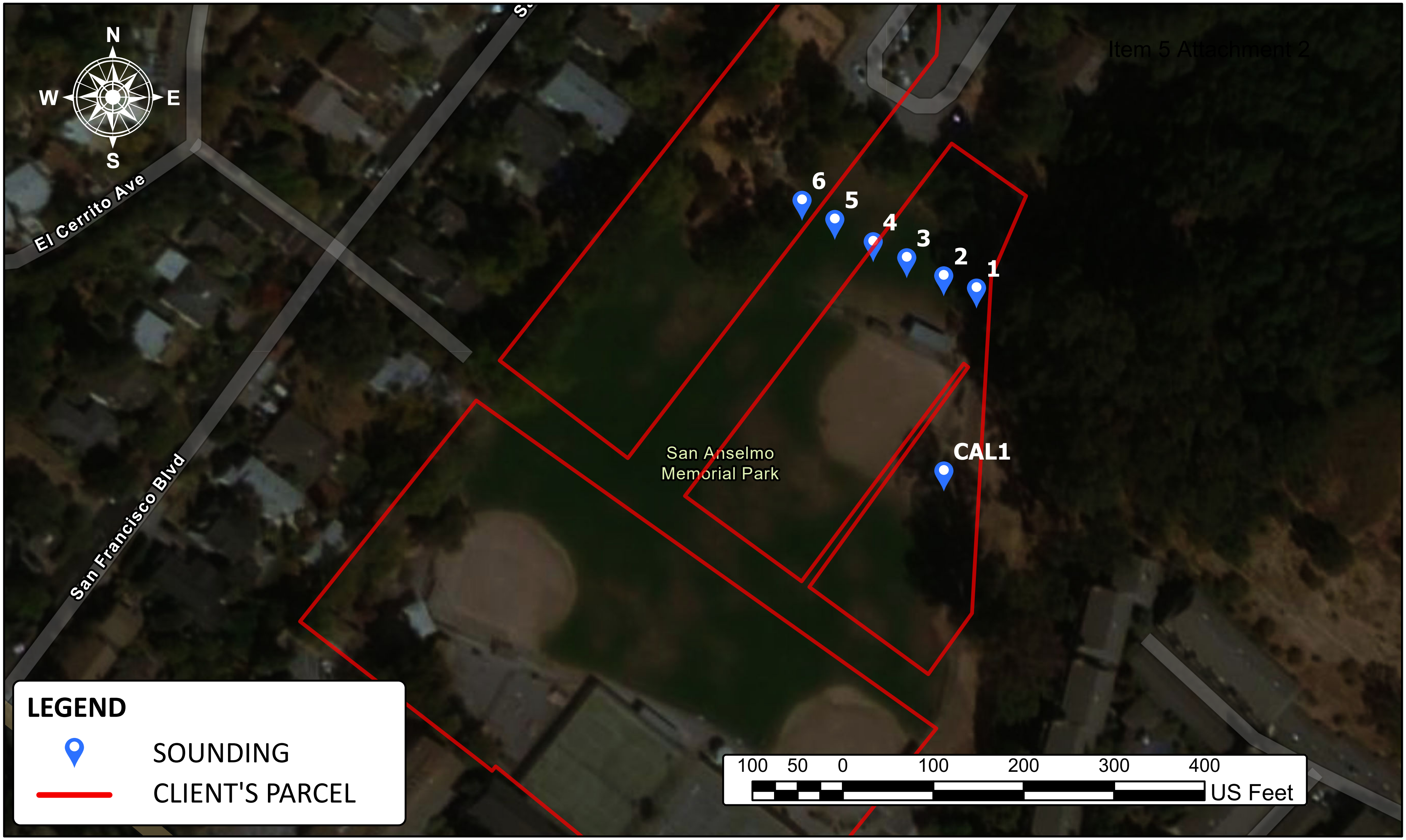
CLIENT
Tamalpais Environmental Consultants
Aaron O'Brien

WESTERN GROUNDWATER
SURVEYORS, INC.

8733 Lakewood Drive Suite B
Windsor, CA 95492
707.837.6247

March 15, 2022

Table of Contents



WESTERN GROUNDWATER SURVEYORS, INC.
8733 Lakewood Drive, Suite B
Windsor, CA 95492

Aaron O'Brien
Figure 1
Sounding Location Map

Memorial Park, 1000 Sir Francis Drake Blvd., San Anselmo, CA 94960

CREDITS: JR BROWN
03/07/2022

Item 5 Attachment 2

SUMMARY

Western Groundwater Surveyors Inc. (WGS) performed a groundwater survey on February 25, 2022 at 1000 Sir Francis Drake Blvd., San Anselmo, CA. The purpose of the survey is to evaluate the underlying aquifer for development of an irrigation water well.

Six soundings were selected for subsurface geophysical data collection. The sounding locations were determined based on site specific geologic conditions and subsurface data from neighboring and onsite well completion reports. A calibration sounding near a productive well with a known depth and yield was available at the time of the survey. One calibration sounding was conducted near Irrigation Well 1 to improve the accuracy of our data.

The two existing irrigation wells on the property are drilled into an alluvial river deposit above the bedrock formation (Franciscan Mélange). Based on the results below and the fact that the Franciscan Mélange is typically a low yielding formation for water wells, the primary opportunity to develop the necessary groundwater for the project is likely within the alluvial deposit.

Based on the results below it is our recommendation to perform further geological and geophysical exploration of the property with the goal to identify subsurface features demonstrating higher hydraulic conductivity such as paleo-creek channels. Such features if identified would have a greater potential to provide the water needs of the property.

Table 1. A summary of the Groundwater Survey results

Soundings	Drilling Depth (feet)	Estimated Yield GPM
1	52	Category B (2-6 gpm)
2	56	Category B (2-6 gpm)
3	56	Category B (2-6 gpm)
4	66	Category B (2-6 gpm)
5	82	Category C (5-10 gpm)
6	77	Category B (2-6 gpm)

**WGS does not recommend drilling in an area with an interpreted yield of less than 5 gallons per minute (Category A & B) due to factors in the drilling process that can at times significantly and detrimentally, affect the final yield of a low yield aquifer. Non-recommended yields have the possibility of being as low as 0.0 gallons per minute. It should be noted that non- recommended well sites (category A & B) have been successfully drilled on other projects and produced the estimated yields. However, as stated above there is a greater risk of drilling a non-productive well for category A & B locations.*

PROFESSIONAL GEOLOGIST
Nathan T. Booth
PG 9930
EXP. 9/30/23
STATE OF CALIFORNIA

Nathan Booth

President
Western Groundwater Surveyors Inc.
707-837-6247

INTRODUCTION

The objective of the survey is to locate a source of groundwater, estimate (interpret) its depth, and (to the degree possible) estimate the permeability (yield) of the rock formation that contains the groundwater (aquifer). The groundwater, if found, will be produced by drilling a water well into the aquifer in order to serve the property.

Prior to field work WGS preformed a hydrogeologic assessment of the region including the property of interest. The hydrogeologic assessment included review of available geologic maps, topographic maps and well completion reports for nearby wells. Selection of the testing (soundings) locations on the site take into consideration the hydrogeologic assessment, accessibility of well drilling equipment, County required setbacks for wells, interference from electrical distribution lines and testing conditions (soil depth).

Subsurface data for this survey was supplemented using the Seismoelectric method, which has the potential to provide the approximate depth and yield of subsurface water-bearing formations. This method is sometimes referred to as the Electro-Kinetic Survey (ESI) method.

GEOLOGY

Franciscan Complex Mélange (fsr)
The site geology is the Franciscan Complex, undivided central and coastal belts of sandstone. Mostly massive, brown and orange weathering, green to gray feldspathic wacke. A tectonic mixture of variably sheared shale and sandstone containing hard tectonic inclusions largely of greenstone, chert, graywacke, and their metamorphosed equivalents, plus exotic high-grade metamorphic rocks and serpentinite.

Qa
Alluvial pebble gravel, sand and clay of valley areas.

All of the geologic information is taken from geologic maps provided by government agencies and well reports registered with the State of CA. This information is used to provide geologic information relevant to this survey.

DATA ACQUISTION AND PROCESSING

Subsurface geophysical data was acquired using an AquaLocate GF6 Seismoelectric Survey System. This method works because electrical signals are often produced when seismic compression waves encounter water-saturated rocks. More details of this system and the basic theory of the Seismoelectric method are provided in Appendix A. In order to record the electrical signals, four electrodes have to be inserted vertically into the ground and connected to the GF6 receiver. The electrodes are 1.0 meters long and constructed from steel with a copper sheath surrounding the steel core.

Table 2. Detailed locations of Seismoelectric soundings

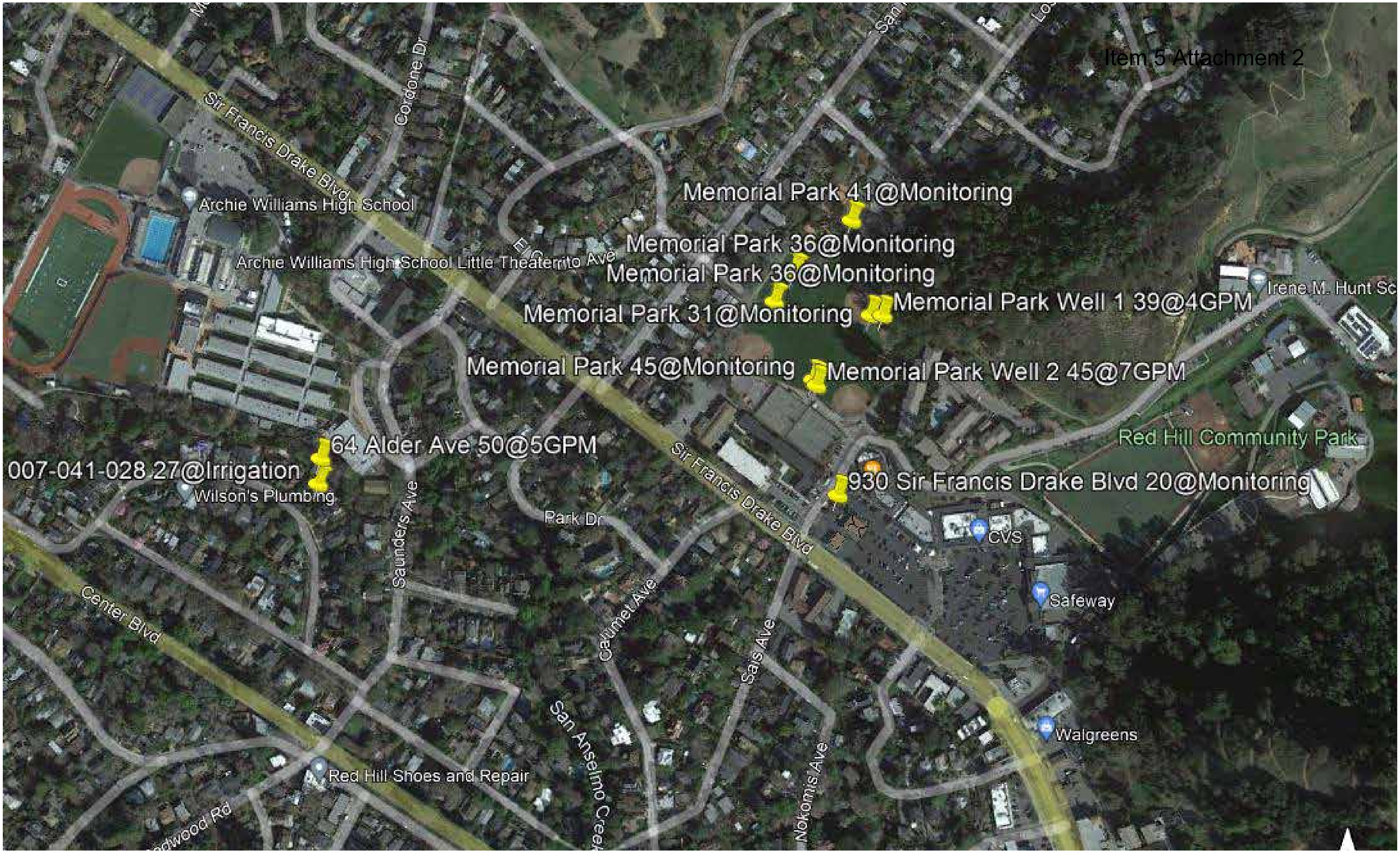
Latitude	Longitude	Sounding
37.98321°	-122.56577°	1
37.98329°	-122.56599°	2
37.98333°	-122.56611°	3
37.9834°	-122.56628°	4
37.98345°	-122.56636°	5
37.98341°	-122.56658°	6
37.98284°	-122.56605°	Well Calibration (IW-1)

Six seismoelectric soundings were recorded on the property. Locations are displayed in Figure 1 and detailed in Table 2. The locations of the sites were chosen by WGS and the Client. The data was processed using software that is proprietary to the GF6 Seismoelectric system.

RESULTS AND INTERPRETATION

Although it is possible to interpret the depth to the top of the aquifer, the interpreted depth to the bottom is the more critical value. This is because the interpreted yields assume that the full thickness of the aquifer is used to produce water and that presenting the depth to the top would not provide a realistic estimate of the actual drill depth required in order to obtain the interpreted yield. Another reason for presenting the depth to the bottom of an aquifer is that the depth to the top of an aquifer can vary depending on the time of year and longer-term weather conditions, as well as other wells drawing water from the same aquifer. Thus, because the depth to the top of an aquifer may change due to the conditions described above, a well that is drilled only a short distance into an aquifer may have a yield that is more susceptible to these changes. Additionally, a cone of depression may occur around a well as it is pumped, further reducing the yield of a well that is only drilled for a short distance into an aquifer. The cone of depression may be more pronounced for wells drilled into low permeability formations. However, if a sufficient yield is obtained before the interpreted bottom of the aquifer is reached then it may be reasonable to stop drilling before this depth is reached.

Interpreted Yield (gpm)	Category
0 – 3	A
2 – 6	B
5 – 10	C
8 – 15	D
12 – 25	E
18 – 35	F
25 – 50	G
35 – 65	H
50 – 95	I
70 – 130	J
100 – 180	K
140 – 250	L
200 – 350	M
300 – 550	N
450 – 850	O
> 850	P



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Aaron O'Brien

Neighboring Well Logs

Memorial Park, 1000 Sir Francis Drake Blvd., San Anselmo, CA 94960

CREDITS: JR BROWN
03/07/2022

Because many factors influence the interpreted yield, including the method used to drill a well, in order to present the interpreted yields with accuracy that is realistic, the yield interpretation for each sounding is presented as one of a range of yields and is assigned an alphabetic label (category), as defined in the Table 3 (right).

NEIGHBORING WELLS

Table 4. Data obtained from neighboring well logs.

Neighboring Well Locations	Drill Depth (feet)	Drillers Estimate (gpm)
Memorial Park	39	4
Memorial Park	45	7
Memorial Park	41	Monitoring
Memorial Park	36	Monitoring
Memorial Park	36	Monitoring
Memorial Park	45	Monitoring
Memorial Park	31	Monitoring
930 Sir Francis Drake Blvd	20	Monitoring
64 Alder Ave	50	5
APN: 007-041-028	27	Irrigation

To best interpret the well drillers estimated gallons per minute (gpm) in the above table two notes should be made. First, the estimated gpm was determined by the driller after a short 2-4 hours test (typical) and would be better defined as a maximum short term pumping rate. So, the above stated gpm values likely overstate the gpm the well would produce over a longer 12- or 24-hour pumping period. Secondly, the estimated gpm in the above table were taken at the time the well was completed and do not account for seasonal or long-term changes in the aquifer that may have a negative impact on a wells production.

RECOMMENDATIONS

Six soundings were selected for subsurface geophysical data collection. The sounding locations were determined based on site specific geologic conditions and subsurface data from neighboring and onsite well completion reports. A calibration sounding near a productive well with a known depth and yield was available at the time of the survey. One calibration sounding was conducted near Irrigation Well 1 to improve the accuracy of our data.

The two existing irrigation wells on the property are drilled into an alluvial river deposit above the bedrock formation (Franciscan Mélange). Based on the results below and the fact that the Franciscan Mélange is typically a low yielding formation for water wells, the primary opportunity to develop the necessary groundwater for the project is likely within the alluvial deposit.

Based on the results below it is our recommendation to perform further geological and geophysical exploration of the property with the goal to identify subsurface features demonstrating higher hydraulic conductivity such as paleo-creek channels. Such features if identified would have a greater potential to provide the water needs of the property.

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It should be noted that non- recommended well sites (category A & B) have been successfully drilled on other projects and produced the estimated yields. However, as stated above there is a greater risk of drilling a non-productive well for category A & B locations.

Prior to drilling (if done) it should be ascertained that the drill operator has substantial experience with the drilling equipment and that he or she operates the equipment correctly. In addition, the property owner should be present during the drilling process. It should be noted that drilling always causes some damage to the aquifer local to the drill site and this should be considered prior to drilling to an aquifer that has an interpreted low yield. This report should be used as a guide, along with the driller's experience with drilling in the area.

If it is decided to drill a well, part of its development should include a long flow test (often 4 to 12 hours in length) in an attempt to remove all of the sediment and air that may have been introduced into the surrounding rock formation (aquifer) by the drilling process, and that may restrict the flow of water into the well and therefore, the subsequent yield. The flow test may need to be longer for less productive water bearing zones. We consider well development part of the water well completion process.

As stated earlier in this report, the interpreted depths in this report should be generally used as a maximum depth to drill. If the interpreted yield is obtained at a shallower depth than that provided by the interpretation, drilling to greater depths is not necessarily recommended.

All of the data, analysis, interpretations and conclusions in this report have been prepared by persons who have had a rigorous training in the acquisition and analysis of Seismoelectric data.

APPENDIX A

The Seismoelectric Survey Method

INTRODUCTION

The Seismoelectric method, sometimes called the Electrokinetic Survey (ESI) or Electroseismic method, is a geophysical technique that attempts to provide the depth to groundwater and an estimate of the permeability, and hence yield, that might be expected from a well drilled into the aquifer. The physics of the method has been understood since the 1930's when Thompson (1936) and Ivanov (1939 and 1950) were the first to realize that a seismic compression wave (p-wave) impulse will provide sufficient oscillating pressure in rock pore fluids to produce a measurable oscillating electrical potential at the ground surface.

The Seismoelectric method is related to the commonly known phenomenon called streaming potential, where flowing subsurface water produces a voltage measurable on the ground surface. A more distant relative of the method, where rapidly rising air produces electrical charge separations, thus creating large potential differences, are thunderstorms.

Since the papers by Thompson and Ivanov were written, many investigations into the method have been completed and many papers have been published; the more significant of these are listed at the end of this document.

Until recently, the electrical signal from a seismic pulse impinging on subsurface groundwater was difficult to measure since electrical noise, especially powerline noise, contaminated the data. However, Groundflow Ltd., based in the United Kingdom, discovered a new detection method that is now patented both in the United Kingdom and the United States. This method uses electrically isolated lines from each electrode pair, referencing their potentials to a floating virtual earth, and positioning the electrode pairs close to the seismic source, thereby achieving a significant improvement in the signal to noise ratio.

A significant amount of research is now being done into this method with organizations such as the Massachusetts Institute of Technology (MIT) and the Exxon Production and Research Company. The Australian Nuclear Science and Technology Organization has also become involved.

BASIC THEORY OF THE METHOD

Seismoelectric effects are initiated by seismic waves, usually p-waves, passing through a porous rock and inducing relative motion between the rock matrix and the fluid within the rock pores. Motion of ionic fluid through capillaries in the rock occurs with cations preferentially adhering to the capillary walls, so that the applied pressure and resulting fluid flow relative to the rock matrix separates the cations and anions thus producing an electric dipole. This is called the Seismoelectric effect.

This is illustrated in Figure 1. A seismic source produces a seismic compression wave, which then propagates into the ground at a speed depending on the rocks through which it passes. Generally this speed varies from about 5000 ft/sec to over 10,000 ft/sec in sedimentary rocks, but can be faster in igneous and metamorphic rocks. The wave spreads out to form a hemisphere as illustrated in Figure 1. When the initial pressure pulse reaches the water table, or a rock saturated with water, electrical charges are separated as described above, and the electrical signal is transmitted back to the ground surface at approximately the speed of light. Conversely, when the wavefront emerges from the saturated zone (aquifer) at depth into a layer with little water, the signal decays to zero. The signal also usually decays to zero if the water in the aquifer becomes saline. Generally, the amplitude of the signal will also decay slowly with depth, as the spreading seismic wave loses its high frequency components and its amplitude decreases due to spherical divergence along with other factors. The fundamental relationships between the spreading seismic wave, the resulting electrical dipoles (charge separations) and the voltage at the ground surface are complex.

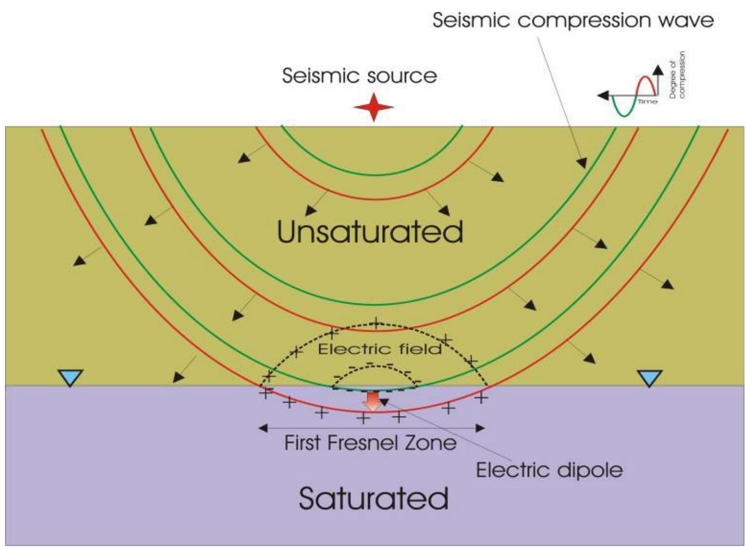

Figure 1. Schematic drawing illustrating the basic principles of the Electroseismic method at the top of an aquifer. This diagram should be rotated about its axis (seismic source) by 180° to image the hemispherical nature of the seismic wave.

The circular area (in plan view) encompassed by the leading edge of the pulse when the negative part the pulse just intersects the interface is called the first Fresnel Zone. As can be seen in Figure 2, the curvature of the wavefront and the Fresnel geometry ensures that the signal is focused back to the shot point.

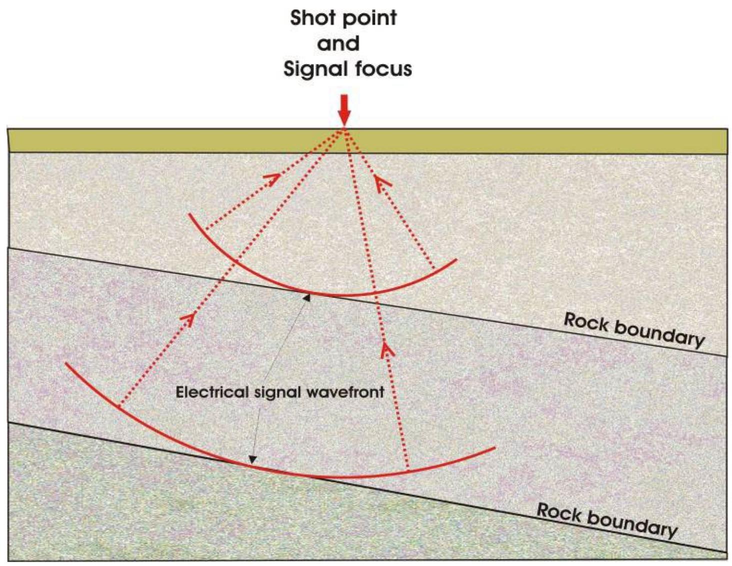

Figure 2. Schematic showing the focusing of the electrical signals back to the shot point.

MEASURING THE SEISMOELECTRIC EFFECT

The geometry of the seismic source and electrode array used to measure the Seismoelectric effect are illustrated in Figure 3. The electrodes in the array are spaced symmetrically about the seismic source at distances from the source of about 2.5 and 8 feet. The seismic wave is created and the instrument measures the resulting electrical signal.

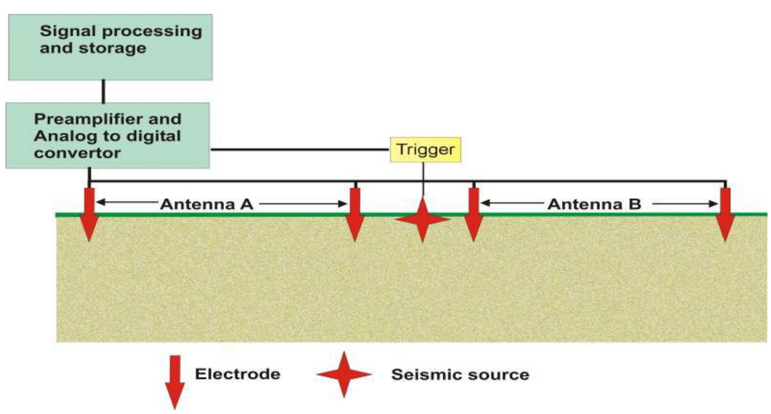

Figure 3. The geometry of the seismic source and electrodes used to measure the Seismoelectric effect.

One of the instruments used to measure the Seismoelectric effect is called the AquaLocate GF6. This instrument incorporates the floating electrode system described earlier in this text.

INTERPRETATION

Water can move within the pores of the rock easier in good aquifers (high permeability and porosity) than in poor ones and this provides the basis for assessing aquifer quality. If the water moves easily then it will move rapidly when under the influence of the seismic pulse. If the rock has a low permeability or hydraulic conductivity, then the water will move slowly. This causes the shape of the Seismoelectric signal to be different in these two cases. A good aquifer will produce a more rapid rise in the signal amplitude than a poor one, all else being equal. A steeper rise time implies that the signal contains higher frequencies than a slow rising signal and the signal is said to have a greater bandwidth. Water yield estimates can be obtained from the signal bandwidth and the calculations to do this are programmed into the GF2500 instrument. The depth to the top of the aquifer is found from the time taken for the seismic signal to travel to the aquifer, which can be found from the time to the first arrival of the Seismoelectric signal. Likewise, the depth to the bottom of the aquifer can be estimated from the time when the ESI signal decays to zero. In other words, the aquifer thickness can be found from the length of the Seismoelectric signal. The velocity of seismic waves in different rock types is generally well known from seismic surveys, although there can be significant variations in the velocity of rocks, depending on several factors.

LIMITATIONS OF THE METHOD

The main limitations of the Seismoelectric method relate to the depth of investigation and the depth resolution, the chemistry of the water, the geology of the aquifer and to the geometry of the signal generation array.

The depth of investigation depends on the strength of the seismic source and on the nature of the soil and subsoil. A soft soil and subsoil will attenuate the seismic signal and limit penetration depth. A hammer source can usually provide investigation depths to 250 or 300 feet. A buffalo source can investigate to depths of over 1500 feet.

Resolving the thickness of an aquifer depends on the length of the seismic pulse, which depends on the speed of seismic waves in the rocks. The higher the speed of the seismic pulse the longer is its wavelength and consequently, the lower is its resolution. In low speed rocks resolution may be 5 to 15 feet whereas in rocks with high velocities the resolution may be 15 to 45 feet, or even less.

Predicting the depth to an aquifer depends on knowing the seismic velocity of the rocks under the sounding site. Since the velocity of even well-defined rocks, for example sandstone, can vary widely from site to site, unless these velocities are measured, then an estimate has to be used. If a local well is available where a sounding can be conducted, then this will provide a "calibration", and should make the interpreted depth more reliable.

If an aquifer contains saline water then the Seismoelectric signal is essentially "short circuited" and no signal is observed, hence Seismoelectric signals are only observed from freshwater aquifers.

The focusing effect of layered aquifers discussed earlier is advantageous when using the electrode array centered about the seismic source and works well for most layered, usually sedimentary, rocks. However, the method is not as effective in areas where the aquifer lies in cavities and large fractures although it can detect aquifers in fractured brittle rocks if they form layers. Limestone Karst terrain is an example of where the method is not usually successful.

AQUIFERS

An aquifer is a water saturated permeable geologic layer, or fracture zone, that is able to transmit significant quantities of water. A geologic layer that cannot transmit significant quantities of water is usually referred to as an aquiclude. An aquitard is a rock unit that generally has a low permeability and hence will transmit only very limited quantities of water and are generally not suitable for production wells. The terms Aquifer or aquitards can be used to define most geologic strata. The most common aquifers include permeable sedimentary rocks such as sandstones, limestones, sand and gravel layers, and highly fractured volcanic and crystalline rocks. Common aquitards are unfractured shales, clays and dense (unfractured) crystalline rocks.

Sedimentary aquifers form layers and usually have a large lateral extent, whereas aquifers in fracture zones in igneous and crystalline rocks may have a very limited lateral extent. When searching for water using any geophysical method, including the Seismoelectric method, the type of aquifer that may be present should be considered, both when planning a survey and especially when considering drilling.

The Seismoelectric method responds to a subsurface circular area whose radius depends on the dimensions of the first Fresnel zone and for practical purposes is approximately equal to one third of the depth to the aquifer. If the survey is conducted in an area where the aquifers reside in fracture zones, it is possible that the Seismoelectric signals will predict the occurrence of an aquifer, which occurs within a fractured area whose lateral extent is limited, but the drill hole may not intersect the fracture zone that provides the Seismoelectric signal. Since the radius of the circle of influence for the Seismoelectric method increases with the depth of the investigation, the difficulty of intersecting the fracture zone with a drill becomes greater as the depth to the aquifer increases.

REFERENCES

The Massachusetts Institute of Technology (MIT) publications on this subject are listed on http://eaps.mit.edu/erl/research/papers.html. Of particular importance are papers by Stephen Pride, borehole experiments by Oleg Mikhailov and computer modeling by Matthew Haartsen.

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