



MEMORANDUM

To: Olen Zirkle, Ducks Unlimited
From: Neil Schild, P.E.
Prepared by: Laura Jean Wilcox, Hydrogeologist
Reviewed by: Chris Petersen, P.G., C. HG.
Date: March 31, 2006
Subject: Task 7.1a - Survey Sonoma County Water Supply Operations - Telephone Interview March 28, 2006
Attachment: A – Letter report for field trip conducted April 13, 2005 by Jim Gaumer, Dave Sieperda, and Les Heringer at Sonoma County Water Agency
B – Email correspondence with Dan McManus regarding geologic conditions at the M&T site.

Attendees:

Don Seymour	SCWA	707-521-1808	dseymour@scwa.ca.gov
Chris Petersen	MWH	916-418-8264	chris.petersen@mwhglobal.com
Laura Jean Wilcox	MWH	916-418-8411	laura.j.wilcox@mwhglobal.com

1. Introduction

On April 13, 2005, a field trip to tour the Sonoma County Water Agency (SCWA) collector wells was attended by Jim Gaumer, Dave Sieperda, and Les Heringer. A report of their findings is documented in Attachment A. The primary concerns that were raised during this tour included:

- ◆ changes in collector well production rate with time and Russian River location;
- ◆ cost of water and power to produce it; and
- ◆ collector design and spacing.

The goal of this memorandum is to further clarify the construction details, operation, and regional geology of the SCWA site and compare this with the characteristics of the M&T Ranch / Llano Seco Ranch (M&T) Site (**Figure 1**). Based on a review of site conditions and well construction details at SCWA with facilities proposed at M&T, MWH provides an opinion on comparability of well yield and operational costs.

2. Regional Geologic and Hydrogeologic Setting

The single most distinguishing difference between the SCWA and M&T sites is their regional geologic setting. The SCWA collector wells are located in a narrow valley, tightly bounded on the sides and bottom by impermeable bedrock (**Figures 1 and 2**). The alluvial sediments located on the valley floor are shallow, on the order of 100 feet thick, with the basement bedrock at

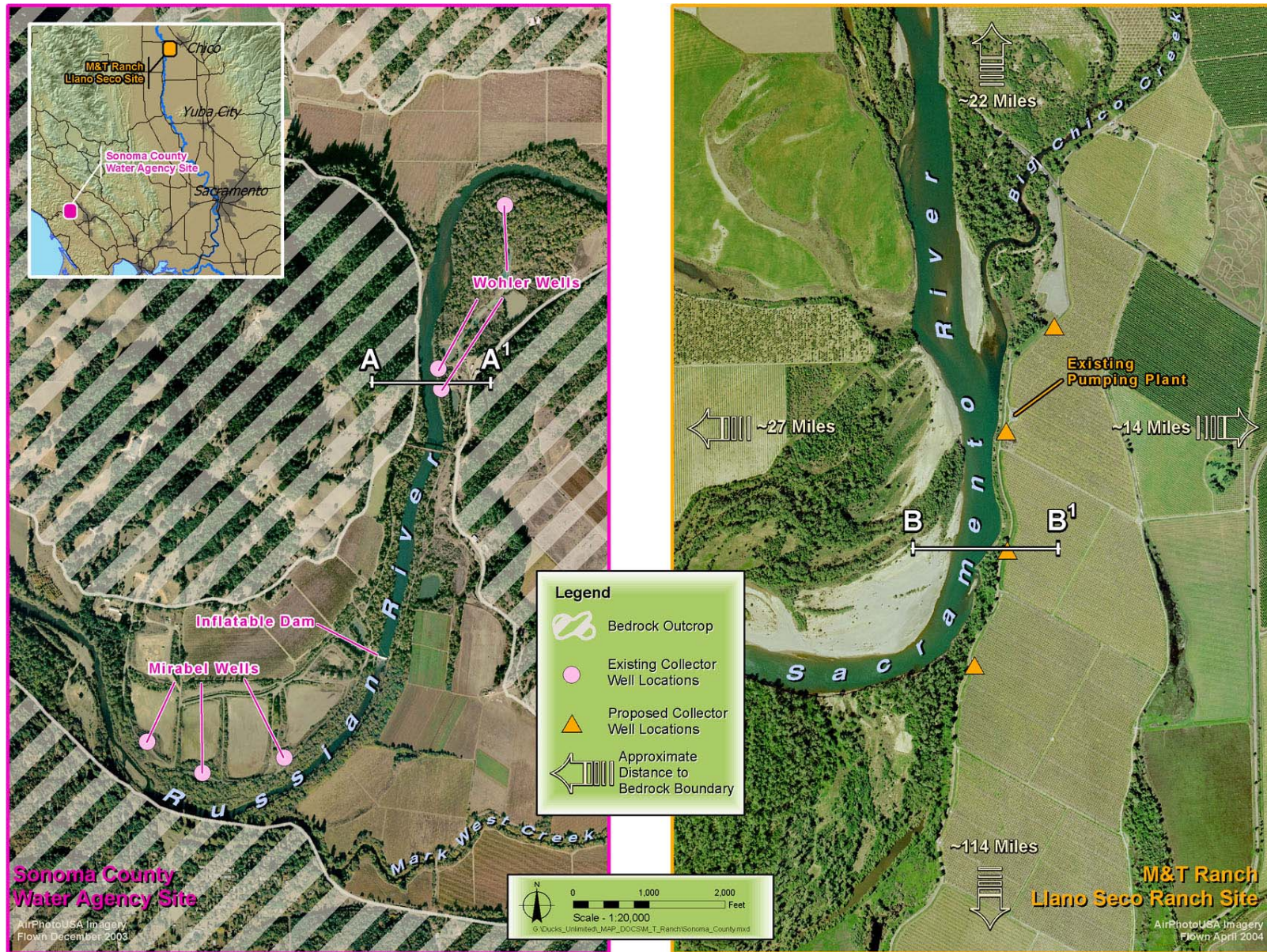


FIGURE 1: Locations of Sonoma County Water Agency and M&T Ranch / Llano Seco Ranch Sites

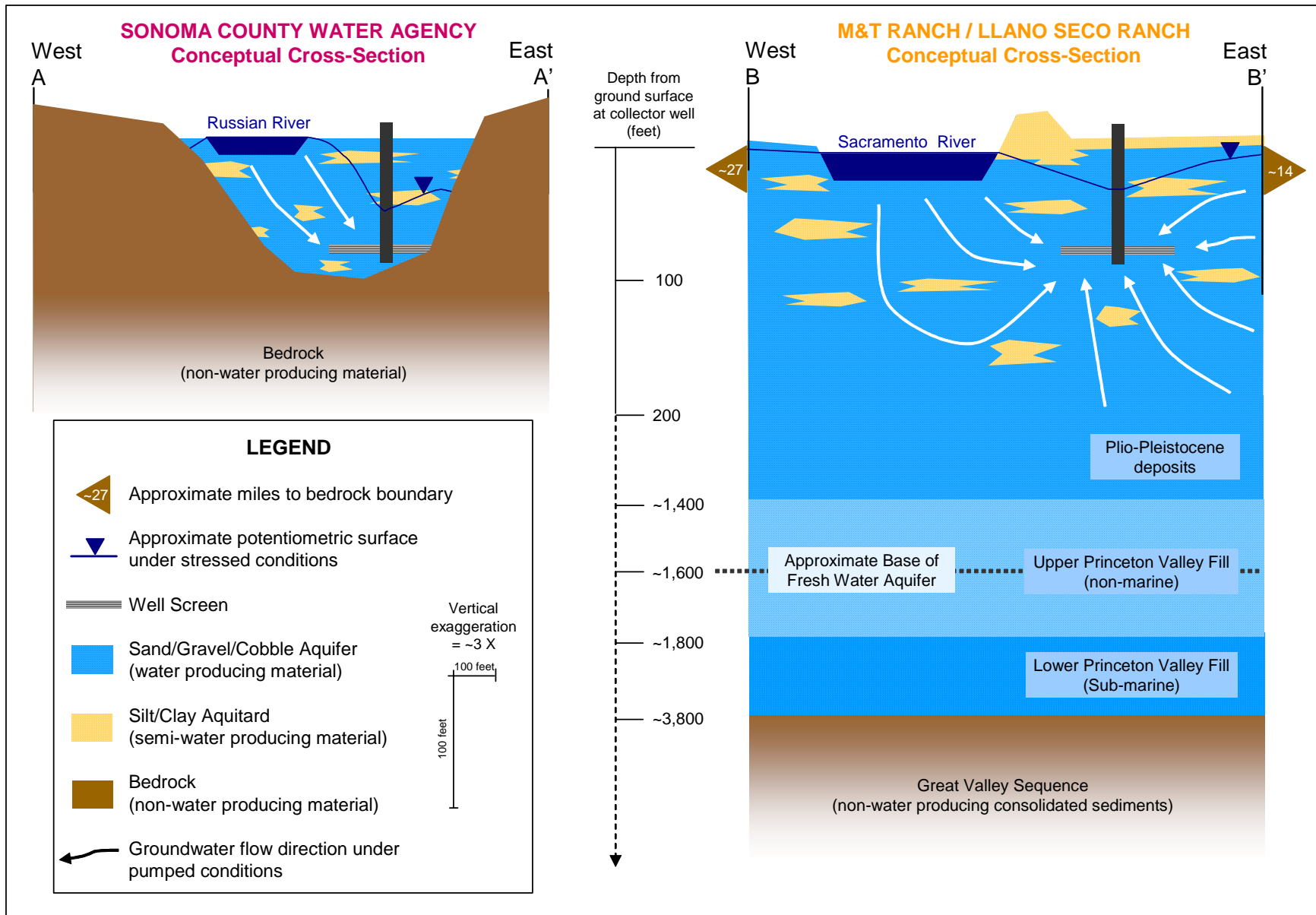


FIGURE 2: Conceptual Cross Sections at Sonoma County Water Agency and M&T Ranch / Llano Seco Ranch Sites

depths of 100 feet below ground surface at some collector well locations. The Russian River recharges this “bath tub” alluvial system as it flows towards the Pacific Ocean. The river is the only significant form of recharge for the alluvial sediments in the narrow valley. Because of the tightly bounded setting and limited recharge to the aquifer, drawdown is expected to be substantial at the SCWA site. In fact, drawdown is a problem and to mitigate, SCWA has constructed artificial recharge facilities to replenish the groundwater system in summer months when natural river flow is low.

At the M&T site, comparable impermeable bedrock is located no less than 14 miles (to the east) from the well locations (**Figure 1**). This distance is greater to the north, south, and west where the central valley sediments meet with basement bedrock of the Sierra Nevada and Coast Ranges. The depth of permeable sediments in the Central Valley is also very extensive. Although not shown to scale on **Figure 2**, the total depth of alluvial fill in the Central Valley is upwards of 3,800 feet in the vicinity of the M&T site (**Attachment B**). At that depth lies the Great Valley Sequence which has comparable bedrock permeability to that found at the SCWA site. The depth to fresh water at the M&T site is estimated at 1,600 feet below ground surface. At the M&T site, the groundwater aquifer is recharging the Sacramento River (under non-stressed conditions). The hydrogeologic setting of the M&T site dictates potential for significantly higher natural recharge rates than the SCWA site because of the extensive aquifer both vertically and horizontally.

3. Collector Design and Spacing

The SCWA collector wells are located in two groups, the Mirabel Group (three wells) and the Wohler Group (three wells). The first two Wohler wells were constructed in the 1950s and are located approximately 330 feet apart from each other, have 8-inch diameter slotted mild steel laterals of approximately 100 feet in length, and have caissons approximately 100 feet in depth (**Table 1**). A large amount of interference (additional drawdown) is experienced between the two wells because of the close spacing. As described in **Figures 1 and 2**, the aquifer is approximately 800 feet in width and 100 feet in depth. This contributes to increased drawdown in the collectors because there is no recharge to the aquifer except for infiltration from the Russian River. Average combined yield of the two 1950s Wohler wells is 32 million gallons per day (MGD). Yield is shown to increase when the Russian River level is risen by the use of an inflatable dam (**Figure 1**). The response is immediate and significant because of the transmissive nature of alluvial material in this unconfined aquifer.

TABLE 1: Well Completion and Proposed Construction Information for Collector Wells

Collector Well	Agency	Total Depth	Date Constructed	Spacing to Nearest Collector (feet)	Diameter of Laterals (inches)	Number of Laterals	Length of Laterals (feet)
Wohler (new)	SCWA	~100	2002	2,200	12, 18	10, 2	100, 380
Wohler 1 & 2	SCWA	~100	1950s	330	8	NA	NA
Mirabel 1,2,&3	SCWA	~100	1970s	867	12	NA	NA
Proposed M&T	M&T	~105	NA	1,500	12	12	200

The third Wohler well was recently constructed and is currently being tested. This well is approximately 2,200 feet upstream of the older Wohler wells, has two 18-inch diameter laterals of wire-wrapped stainless steel between 350 and 380 feet in length, eight to ten additional

laterals of wire-wrapped stainless steel approximately 100 feet in length, and is approximately 100 feet deep (**Table 1**). The two 18-inch laterals were completed using a horizontal drill rig which was a method used to achieve maximum lateral length. The total cost of this well was doubled by installation of these two laterals. This well is anticipated to have a maximum production capacity of 28 MGD, but will be operated at 8 MGD with 20 MGD standby for emergency situations.

The three Mirabel wells were constructed in the 1970s and 80s, are located south of the inflatable dam, consist of 12 inch wire-wrapped stainless steel laterals, and are approximately 100 feet deep (**Table 1**). Water is diverted into ponds which help maintain yields of the collectors. Water drawn from 7 vertical wells is pumped into the Mirabel caissons to decrease drawdown and allow for higher pumping rates. The tightly bounded valley and ponds effect the Mirabel wells in the same way that as the inflatable dam effects the 2 southern Wohler wells. Combined production from the Mirabel wells is 55 MGD.

None of these wells can be compared to proposed locations at the M&T site because the aquifer is tightly bounded and recharged only by the Russian River, as explained in **Section 2**.

4. Operational Costs

The main difference between the SCWA distribution system and M&T is the mechanics of delivery. SCWA pressurizes their pipes and system to generate 500 feet of head prior to release into their distribution system. M&T requires the lift (no greater than 100 feet) to convey water to an open canal.

5. Conclusion

A review of the regional and local hydrogeology at the SCWA and M&T sites shows that the two are drastically different. At SCWA, the alluvial aquifer is tightly bound at approximately 100 feet below ground surface and at the valley edges by nearly impermeable bedrock. The width of the valley is 800 to 4,000 feet. At M&T, the bounding depth is far enough away from the proposed wells to not pose a limitation to well yield. Permeable sediments extend to approximately 3,800 feet below ground surface. The width of the valley also does not pose a limitation on well yield with the nearest bounding bedrock unit outcropping approximately 14 miles to the east. It is recommended that a facility with more similar hydrogeologic conditions be used as a comparison to the proposed M&T site. Such a facility would be the Nearman Water Treatment Plant in Kansas City, Kansas. Here the geologic and river conditions are similar to the M&T site. More information on this site can be found in an April 2006 letter report entitled Survey Results of Collector Well Operators.

ATTACHMENT A

-----Original Message-----

From: Les Heringer [mailto:lsheringer@sunset.net]
Sent: Friday, April 15, 2005 2:24 PM
To: Jim Gaumer (E-mail); Dave Sieperda (E-mail)
Subject: SCWA Tour of Ranney Collectors

This is a report of our field trip on 4-13-05 for a visit and tour of the Sonoma County Water Agency. Jim Gaumer, Dave Sieperda, and Les Heringer made the trip to Santa Rosa, which is where the headquarters is of the SCWA. We met with Don Seymour, Water Agency Principal Engineer; Cordel Stillman, Capital Projects Manager; Kent Gylfe, Water Agency Principal Engineer; and Hody Wilson, Water Agency Operations Coordinator. They were very open and interested in providing us with as much information as they could. The SCWA has 5 Collectors on-line and they are in the final construction phases for a 6th Ranney Collector. The Collectors were each designed to pump about 20 million gallons/day. This works out to be 30 cfs/Collector. Their first Collector was installed in 1959. Their primary reason for using Collectors is because of water quality. The water that comes out of the Collectors does not require filtration. They only chlorinate the water as it comes out of the Collector. The SCWA serves 600,000 people in the Sonoma County area. They have to charge \$450/ acre foot to pay for the expense of providing water. We asked them for a definitive cost of actual Ranney operation and maintenance and actual power costs but they were unable to give us a good number that applied only to the Collectors and not all the other water related facilities. Their lift averages around 450-500' which includes piping the water to the various communities in the greater Sonoma County area. Each of their Ranney Collectors has 2 pumps with 1000-2000 horsepower electric motors. They are able to purchase their electricity through the Western Area Power Association and pay a greatly reduced rate of \$.07/ kwh. They said their power bill is over \$1 million/year. They also have their own power plant in the Geysers which generates 2.6 megawatts. The 6th Collector that they are just finishing construction on has a budgeted cost of \$8 million. It will have 2-2000 hp motors. It is 16' in diameter and has 18" laterals. Their other Collectors are 13' in diameter and have 12" laterals. The number of laterals in each Collector varies from 7 to 12. The laterals all range from 3' to 12' off of the bottom of the caissons so they are approximately 88' to 97' below surface elevation. The saturated thickness of the sands and gravels above each lateral ranges from approximately 39' to 60'. They have a full time maintenance man for every Collector. Their Caissons are all around 100' deep. The draw down is 60' in each caisson when the pumps are running. Their gravels are very porous and coarse so water moves readily through them. The SCWA engineers said the maintenance on the 100' long pump shafts is intensive. This is understandable being on the receiving end of a 1000-2000 hp electric motor. The SCWA engineers told us that they were having a serious problem with the Russian River migrating away from one of their Collectors. They estimated the river has migrated 100-150' away from the Collector and has left a gravel bar in its place. Where this has happened they estimated the output of the Collector has decreased from 20 million gallons/day to 12 million gallons/day. The pumping level in the Collector has dropped 6' where they are having this problem. The SCWA has been considering putting in what they call J-hooks or W-weirs to limit the meander of the

Russian River. They have put their Collectors at least 1000' apart to minimize the interference of one to another. The cone of depression is quite large. The SCWA engineers also think the lack of river scouring in the area of this Collector has reduced the productivity of this Collector. They said scouring breaks up the fine particles that tend to create a cemented or compacted layer. With no scouring adequate water is not able to get to the laterals. They are only able to run 1 of the 2 pumps in the Collector. They also said in areas where there is slack water, algae creates a problem. The algae tends to reduce the openings in the river bottom which reduces the productivity of the Collector. With 3 of their Collectors they have 40 acres of infiltration ponds to help feed the laterals. In the summer they put a temporary rubber bag across the river to create a dam and raise the river's elevation. Then 2 low-head pumps supply water to the 40 acres of ponds. These 2 low-head pumps have circular drum fish screens similar to those of Glenn Colusa Irrigation District. The SCWA engineers said that NOAA has been after them to replace these screens. Bypass flows seem to be the problem. The water in the ponds is maintained at a depth of 18". There are 4 infiltration ponds and they are cycled, where every 2 weeks, 1 is drained and disked and deep ripped. This is done to eliminate a hard layer that is created and to eliminate any build-up of algae. This is done to maintain their porosity which maximizes their efficiency. These infiltration ponds are needed in the summer to compensate for lower river levels which reduces the output of the Collectors. They told us that the city of Ukiah was also having similar problems with their 1 Collector.

I spoke to Paul Smith from the Ukiah Public Utilities District. He said their Collector was built in the 1960's. It was originally engineered to be more productive but ended up being 6mg/d. This is 9 cfs. They have 2-200 hp motors and low-head pumps to pump this amount of water. The reason they have low-head pumps is that they have to put this water through an adjacent water treatment plant where they have 2-350 hp electric motors. Ukiah has also had a problem with river migration. The river has moved an estimated 70' away from the Collector. Willows are now growing on the silt and sand that is being left next to the plant. The Collector capacity has been reduced to 4 mg/d. They added 5 more stainless steel wire mesh laterals to try to overcome this productivity problem. There were originally 9 steel slotted laterals installed when the plant was built. The new laterals have not helped the productivity of the plant. They are now going to have Lane-Christiansen of Virginia, air purge the laterals to try to increase the Collector's productivity. He agreed with the idea that the lack of river scouring near the Collector was decreasing its output. Ukiah is very short of water and are now putting in water storage tanks for a backup water supply.

I have also attached a photo of 3 of SCWA's Collectors. The migrating river and accumulating gravel bar is immediately south of Collector No. 3.

ATTACHMENT B



Laura J
Wilcox/User/Americas/Montgo
mery Watson

03/31/2006 03:06 PM

To
cc
bcc
Subject Fw: depth of bedrock at M&T?

----- Forwarded by Laura J Wilcox/User/Americas/Montgomery Watson on 03/31/2006 03:06 PM -----



"McManus, Dan"
<mcmanus@water.ca.gov>

03/29/2006 03:22 PM

To "Laura J Wilcox" <Laura.J.Wilcox@us.mwhglobal.com>
cc
Subject RE: depth of bedrock at M&T?

Laura Jean,

The situation along the Sac River near the M&T pumps is extremely different than the Sonoma region. The base of Plio-Pleistocene deposits is about 1400 ft from ground surface, then you are into a the Upper Princeton Valley Fill for about 400 ft (non-marine canyon fill), then you hit the top of the Lower Princeton Submarine Valley Fill for about ~2000', then finally the Great Valley Sequence, which would be consider basement similar to the Sonoma area. More importantly, the base of freshwater in under the M&T area is about 1600 feet below ground surface.

Dan

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