Pacific Gas and Electric Company®

Yvonne J. Meeks
Site Remediation - Portfolio Manager
Environmental Affairs

6588 Ontario Road
San Luis Obispo, CA 93405

Mailing Address
4325 South Higuera Street
San Luis Obispo, CA 93401

805.546.5243
Internal: 664.5243
Fax: 805.546.5232
E-Mail: YJM1@pge.com

December 23, 2005

Norman Shopay
Project Manager
California Department of Toxic Substances Control
Geology and Corrective Action Branch
700 Heinz Avenue
Berkeley, California 94710

Subject: Summary of Pore Water Sampling Phase 1
PG&E Topock Compressor Station, Needles, California

Dear Mr. Shopay:

Enclosed is the *Summary of Pore Water Sampling Phase 1,* prepared in accordance with Section 8.2 of the Pore Water and Seepage Study Work Plan dated October 31, 2005. This technical memorandum provides a summary of the data collected during the recent field effort at PG&E's Topock Compressor Station.

Please contact me at (805) 546-5243 if you have any questions or if you need additional information.

Sincerely,

Terry [illegible] for Yvonne Meeks

Enclosure

Summary of Pore Water Sampling Phase 1

Pacific Gas & Electric Topock Compressor Station, Needles, CA

December 23, 2005

This technical memorandum provides a summary of the data collected during a recent field effort at PG&E's Topock Compressor Station. The field effort included three tasks: pore water temperature logging, sediment coring, and testing of various pore water sampling techniques. The results of sediment coring will be documented in a future tech memo, which will be prepared after the sediment cores have been analyzed. The purpose of this tech memo is to provide a summary of the temperature data and the pore water sampler testing so a consensus may be reached on appropriate pore water sampling techniques and sampling depth below the river bottom. Pore water sampling is scheduled to occur during the first week of January 2006.

Introduction

Temperature logging involved insertion of TidbiT® temperature loggers into the river sediments at 10 locations. The target depths for insertion of TidbiTs® were, 1, 3, and 6 feet below the river bottom. Testing of samplers consisted of the collection of one porewater sample from each of three different sampling tools.

TidbiT® Installation and Retrieval

TidbiT® strings were installed at ten locations (three upgradient and seven downgradient locations), shown on Figure 1. The TidbiTs® were programmed to log temperature every 15 minutes, starting on December 5, 2005 at approximately 10 a.m. Prior to placement in the river sediments, the TidbiTs® were all placed in an ice bath to provide a common calibration point.

The TidbiTs® were installed by jetting a 1.5-inch diameter aluminum pipe into the river. Jetting involved pumping water at relatively high velocity through a pipe as the pipe was inserted into the river bottom. The water pressure liquefied the sediment ahead of and along the sides of the pipe, and allowed the pipe to be pushed into the river bottom. A MultiQuip Model QP205SH pump was used to supply water for jetting. The flow rate of the water supplied during jetting was not measured. Based on the manufacturers pump curve, the QP205SH is capable of supplying 80 gallons per minute (gpm) at a total dynamic head of 100 feet. The aluminum pipe was jetted to a depth of at least seven feet into the sediment. The jetting operation had to be accomplished without stopping the flow of water, since any cutoff of water flow would have resulted in the sand settling in around the pipe, and there was insufficient pressure for jetting to be restarted.

The TidbiT® strings were assembled using ¼-inch nylon rope, a 1-pound anchor positioned 1-foot below the bottom (or deepest) TidbiT®, and TidbiTs® positioned 6-, 3-, 1- and 0-feet below the river bottom. A length of zinc-plated chain was attached to the top of the TidbiT® string to serve as an anchor on the river bottom. A loop of floating, high-visibility polypropylene rope was tied to the chain so it could be caught with a boat hook to retrieve the TidbiT® string. Once the pipe was jetted to approximately 7 feet below the river bottom, the total open depth was measured using a tape measure inside the pipe. The TidbiT® string was lowered into the pipe until the bottom was tagged with the anchor at the end of the string. While the TidbiT® string was held in place, the pipe was lifted up and down in 6-inch increments to ensure the sand settled around the TidbiTs®. Once the pipe was pulled from the sediment, the chain and polypropylene rope were dropped through the pipe. The pipe was removed and the excess rope was pulled to the surface. The TidbiT® string, which had purposely been installed about a foot deeper than the target depth, was pulled upward into place by pulling polypropylene rope until the surface TidbiT® was observed emerging from the sand on the river the bottom. This procedure ensured that the TidbiT® string was stretched tightly, and all the Tidbits® were positioned at their target depths below the river bottom.

The TidbiT® strings were installed on December 6-7, 2005, and retrieved on December 12, 2005. The deep TidbiT® at location PS-9b was slightly damaged, and the data were unrecoverable. All of the other TidbiTs® were recovered undamaged, and the data were downloaded on December 13, 2005.

TidbiT® Data Interpretation

The results from TidbiT® string locations are shown on Figures 2 to 11. Also shown on these graphs is the river level as measured at the I-3 gauging station. The graphs are numbered from upstream to downstream, with Figure 2 being the most upstream location and Figure 11 being the most downstream. Temperature was plotted on an inverted axis to allow the temperature plots from different depths to be oriented from top to bottom on the page as the recorders were when buried in the sediments.

On all graphs, the TidbiT® at the river bottom showed the most variation in temperature. There was a general trend of falling temperature over the duration of the test that corresponds with a general trend of rising river levels. All of the TidbiTs® placed at the river bottom became buried by shifting sand during the course of their deployment, some by more than a foot. The shallowest TidbiTs® appear to have recorded diurnal fluctuations that generally correlate with changes in river stage.

The TidbiTs® installed at 1- and 3-foot depths generally recorded a falling trend in temperature over the period of deployment, but did not record diurnal fluctuations. The deepest TidbiTs®, installed six feet below the river bottom, showed the least change in temperature after their initial equilibration period. At some locations, temperature equilibration after installation was rapid. At other locations, (Figures 2, 3, 4, 5, 8, and 9) it took up to two days.

The temperature survey indicates that at a depth of six feet below the river bottom, the diurnal temperature fluctuations are effectively damped out to magnitudes below the resolution of the TidbiTs®. At shallower depths, there is some indication of diurnal fluctuations at some locations. It is therefore recommended that the pore water samples be collected from depths of six feet below the river bottom, below the depth of significant diurnal changes in the flow regime.

Evaluation of Pore Water Sampling Techniques

Three pore water sampling techniques were evaluated on December 10, 2005 - a pushpoint Harpoon™ sampler, a drive-point piezometer, and a modified Geoprobe sampler. Below are descriptions of each sampler.

Harpoon™ Sampler - This sampler consists of a ¼″ diameter stainless steel drive point that is 22″ long. It is attached to a 7/8″ diameter coupler connected to ½″ diameter metal tubing, which extends to the surface. The sampler is advanced by hand up to 22″ deep into sediment. Pore water is pumped to the surface with a peristaltic pump, through 3/8″ diameter polyethylene or Tygon® tubing inside the sampler piping.

Solinst® Drive-Point Piezometer - This sampler consists of a ¾″ to 1.5″ diameter stainless steel drive point attached to steel pipe of smaller diameter. It can be advanced by hand or with a manual or vibrating power hammer. The screened interval from which the sample is drawn is approximately 6″ in length. Similar to the Harpoon™ sampler, water is pumped to the surface through polyethylene or Tygon® tubing for sampling.

Modified Geoprobe Sampler - This sampler consists of 1.25-inch outside diameter Geoprobe rod, which is screened over the bottom six inches. O-rings around the sample tubing prevent water from entering the screened area from above. The sample tubing is installed prior to driving the sampler to the desired depth. The tubing is inserted into a polypropylene cap that is secured to the Geoprobe tip. Once the sampler is driven to depth, the tubing is pulled back 1-2 inches to expose it to the water in the screened portion of the Geoprobe rod. Table 1 lists the advantages and disadvantages of each sampler.

TABLE 1
Comparison of Pore Water Sampling Techniques
Summary of Pore Water Sampling Phase 1

Sampler	Advantages	Disadvantages
Harpoon™ Sampler	1) Lightweight and easy to deploy	1) Difficult to rig for use (15 minutes/sample)
	2) Least impact to river bottom	2) Can't push deeper than 2 feet into river sediment
	3) Deployable from any boat	3) Lots of pieces to decontaminate between sample locations
		4) Potential for getting stuck in sediments due to compression fittings
		5) Variable diameter may cause poor seal in sediment (less of a problem in loose sand)
Solinst® Drive-point Sampler	1) Easy to rig (modified to retain tip)	1) Variable diameter between sampler and drive point may cause poor seal in sediment and difficulty in pulling sampler out of bottom

TABLE 1
Comparison of Pore Water Sampling Techniques
Summary of Pore Water Sampling Phase 1

Sampler	Advantages	Disadvantages
Solinst® Drive-point Sampler	2) Able to push to 6 feet fairly easily 3) Easy to decontaminate between sample locations 4) Tubing is easily inserted into sampler	2) Requires some on-site modification to prevent tip from being left behind in river bottom
Modified Geoprobe® Sampler	1) Easy to assemble – no pipe wrenches required 2) Rigid, heavy, Geoprobe pipe is more easily driven to sampling depth 4) Easy to decontaminate between sample locations 5) Consistent outside diameter provides best seal in sediment	1) Sampler pipe is heavy and may require winch to lift from river bottom

The modified Geoprobe® sampler is the most technically sound sampling method, because it can reach deeper depths, provides the most reliable seal, and is easily decontaminated between sample locations. The Harpoon™ Sampler could not reach the target depth, and is therefore not recommended. The Solinst® drive point sampler could reach the target depth, but would require modification so the tip is not left behind. It is also more difficult to decontaminate and retrieve than the Geoprobe sampler.

Conclusions and Recommendations

Temperature data collected from various depths at and below the river bottom suggests that a sample depth of six feet below the river bottom is sufficient to sample pore water that is not influenced by diurnal fluctionations from the Colorado River.

Based on limited testing, the modified Geoprobe® sampler is recommended as the most efficient, and reliable porewater sampling tool at the target depth of six feet below the river bottom.

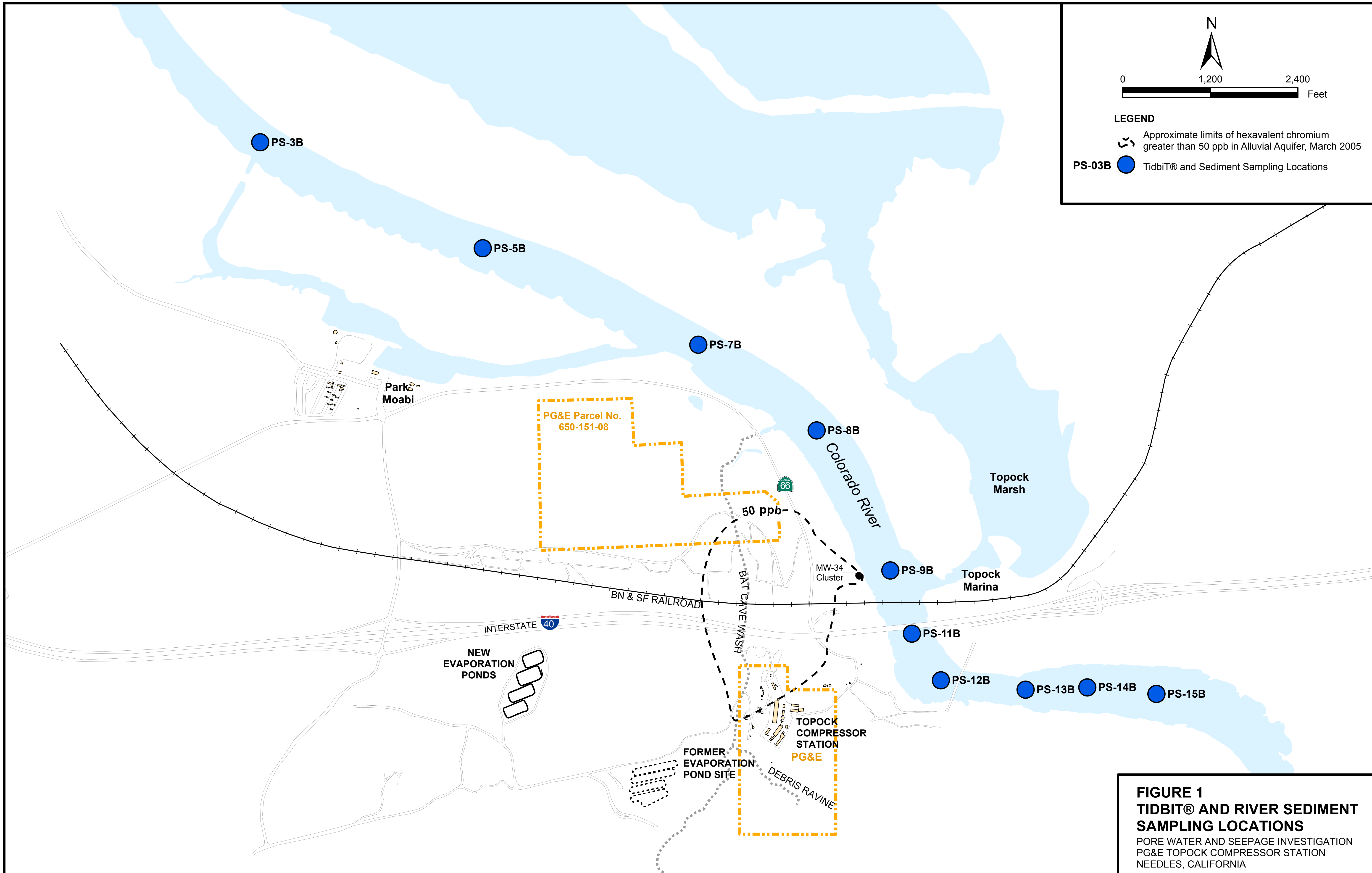


FIGURE 1
TIDBIT® AND RIVER SEDIMENT SAMPLING LOCATIONS
PORE WATER AND SEEPAGE INVESTIGATION
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

BAO \\ZINFANDEL\PROJ\PACIFICGASELECTRICCO\TOPOCKPROGRAM\GIS\MXD\2005\PWS_SEDIMENT_LOCS.MXD PWS_SEDIMENT_LOCS.PDF 12/22/2005 18:42:06

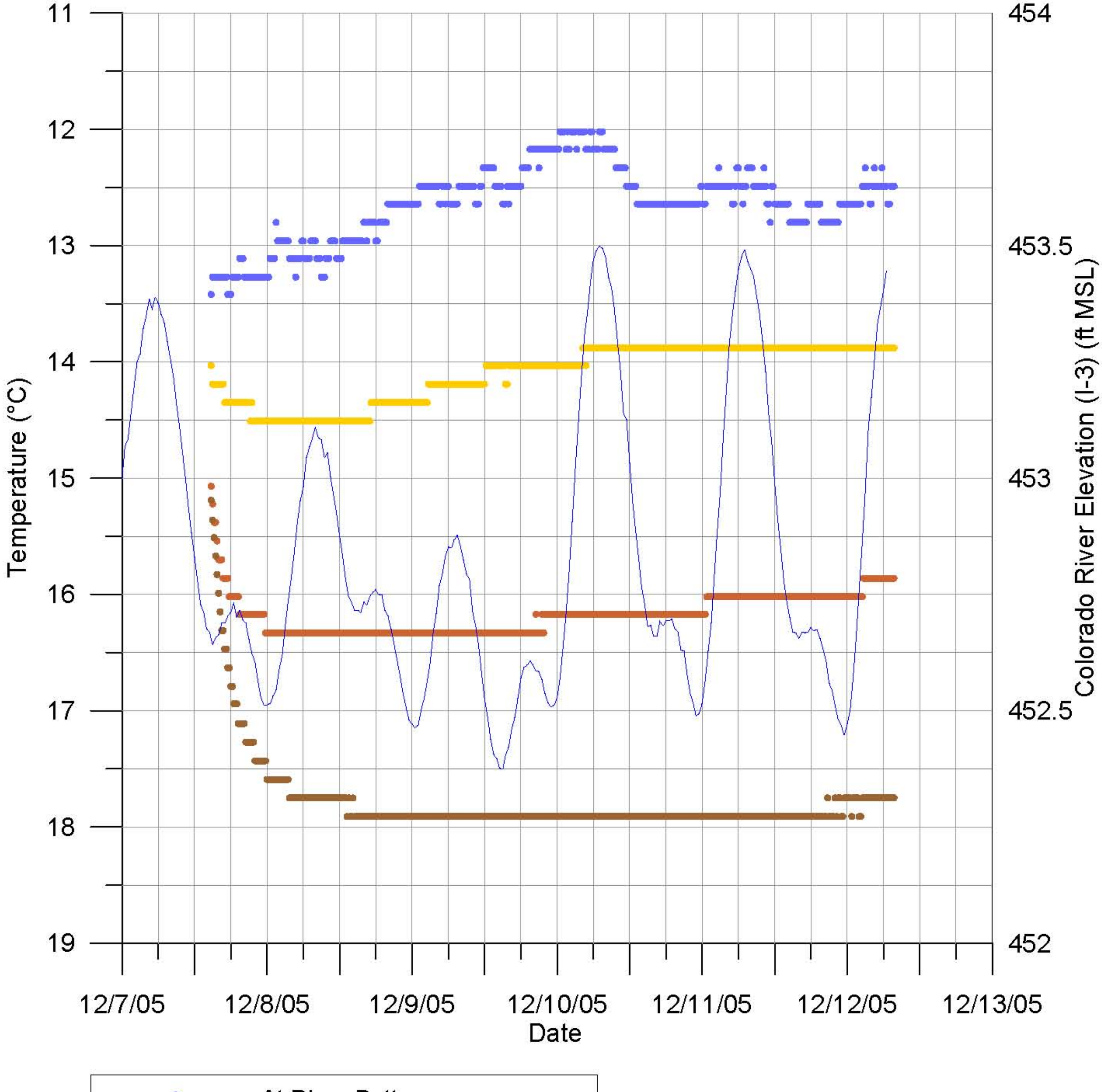


FIGURE 2
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-3b
SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

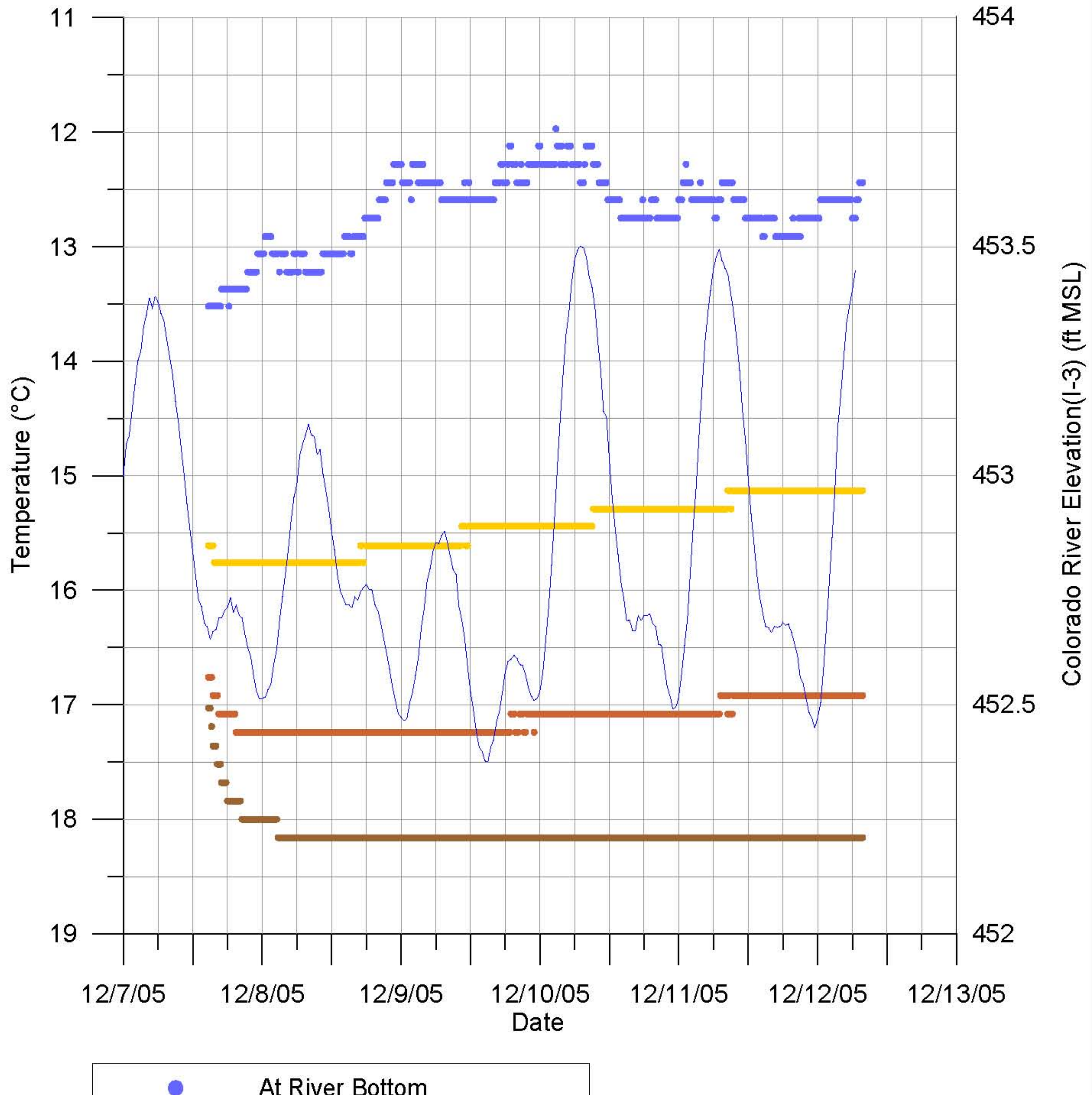


FIGURE 3
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-5b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

\\odin\proj\topock\PoreWaterSampling\Grapher\5b.grf

CH2MHILL

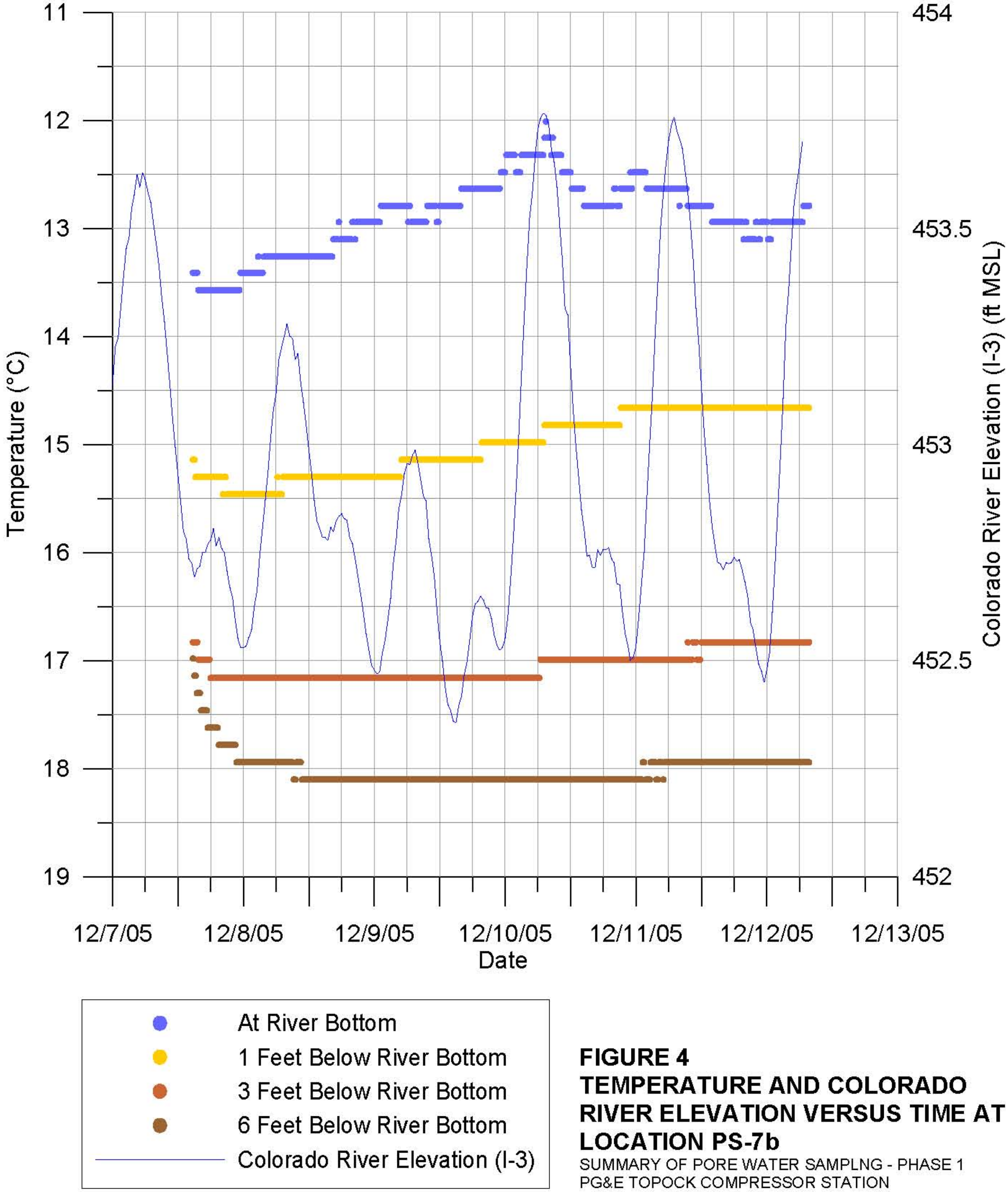


FIGURE 4
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-7b
SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

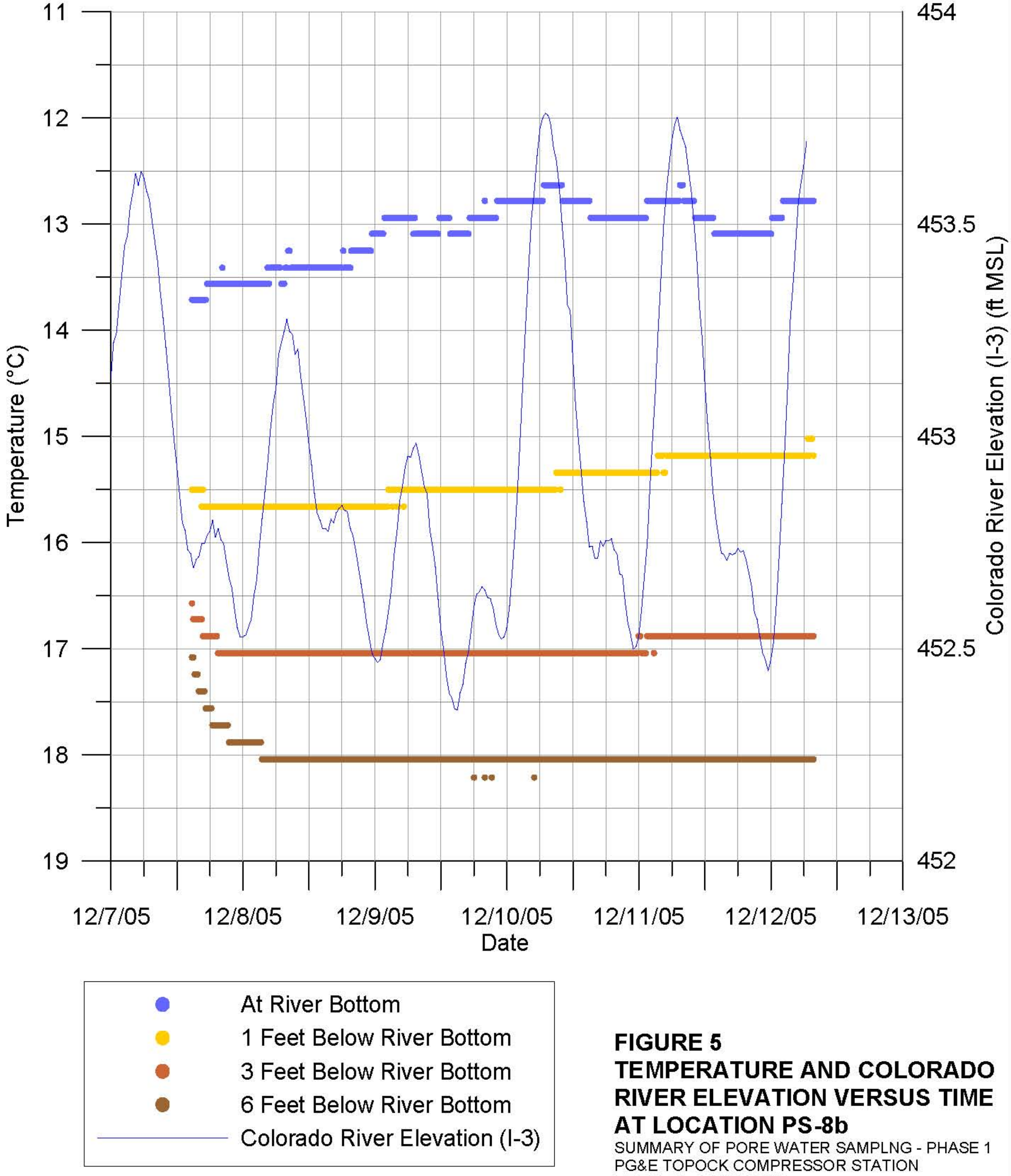
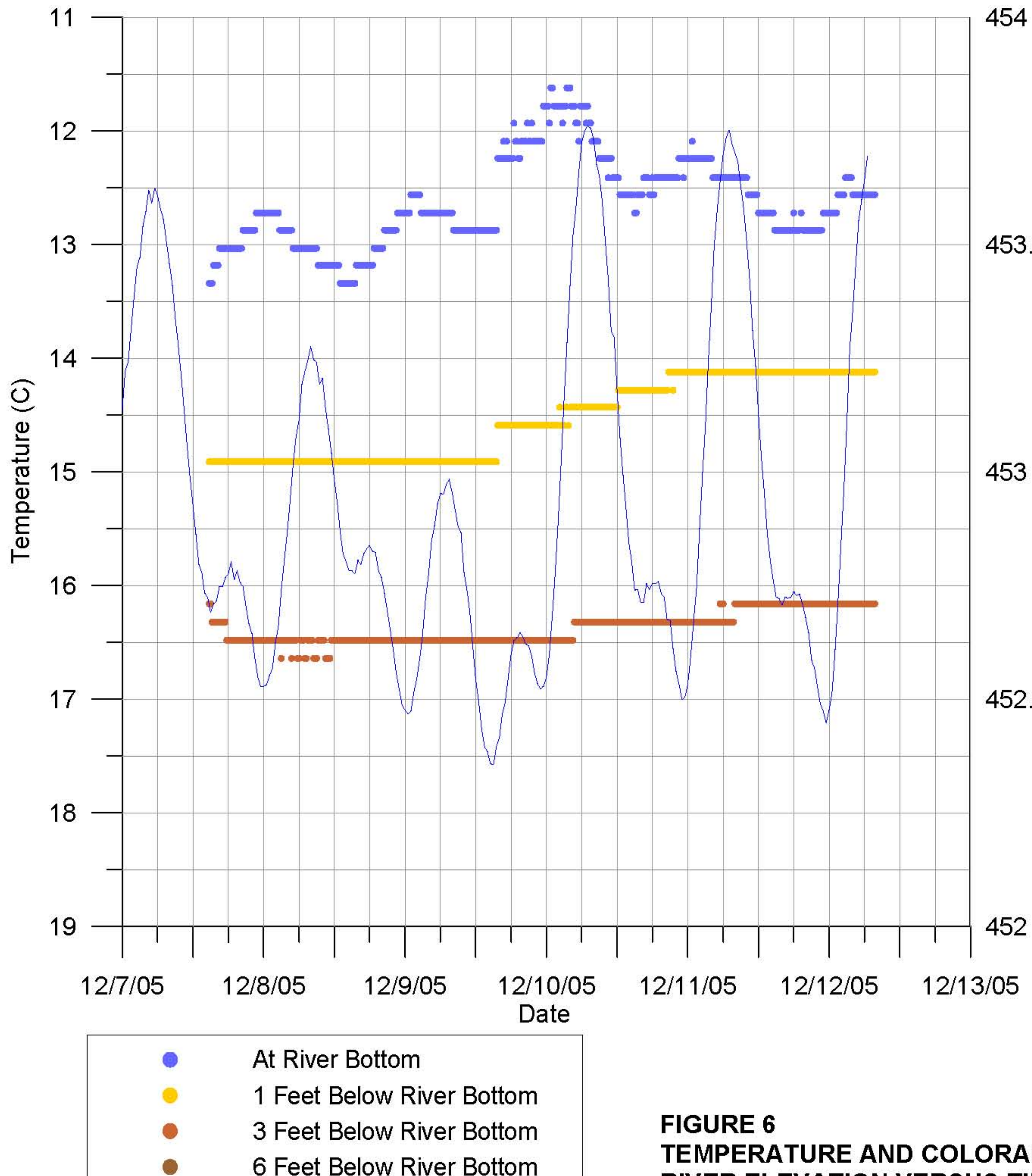


FIGURE 5
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-8b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL



Note: TidbiT Temperature data was not collected at the 6-ft depth for PS-9.

FIGURE 6
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-9b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

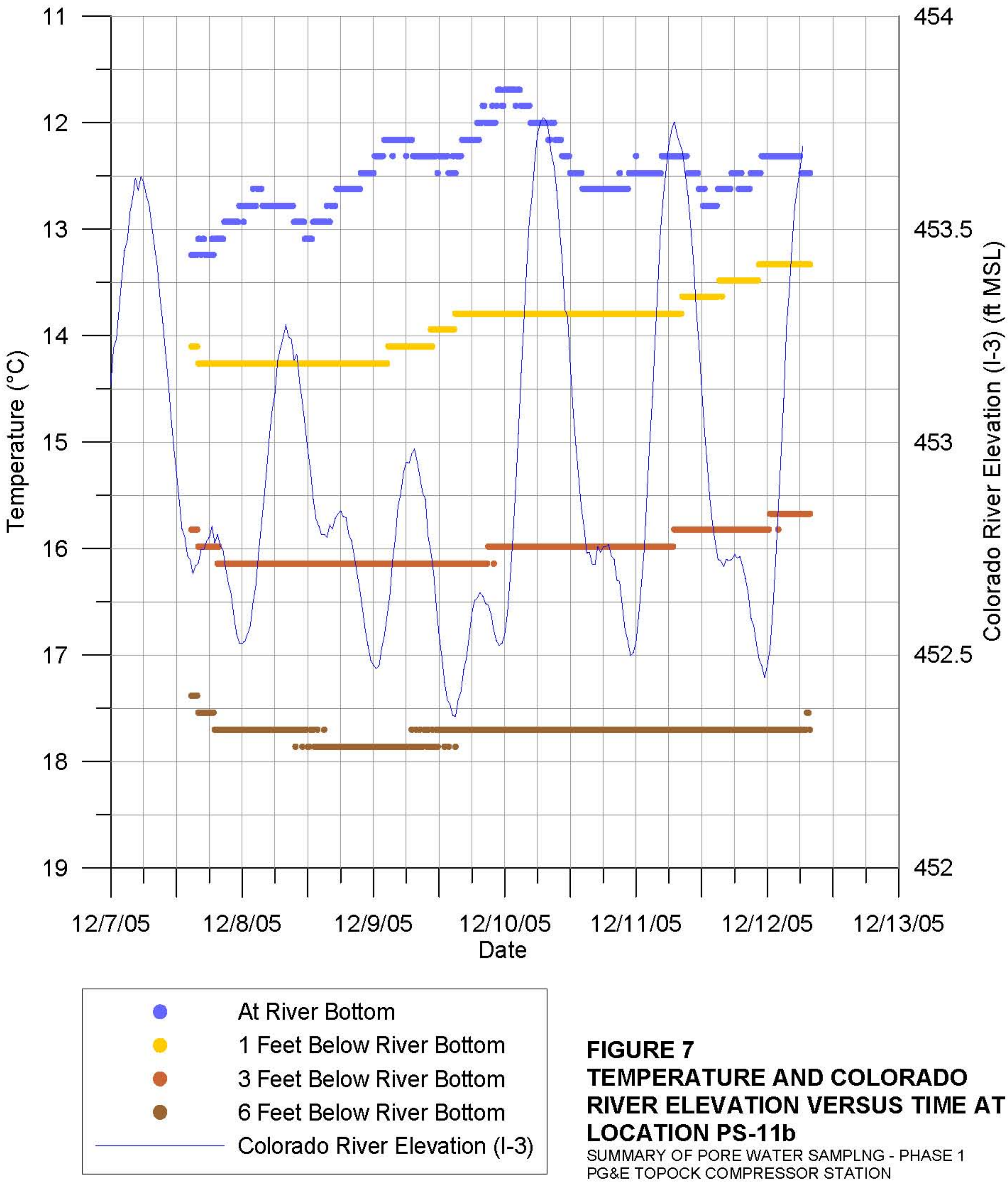


FIGURE 7
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-11b
SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

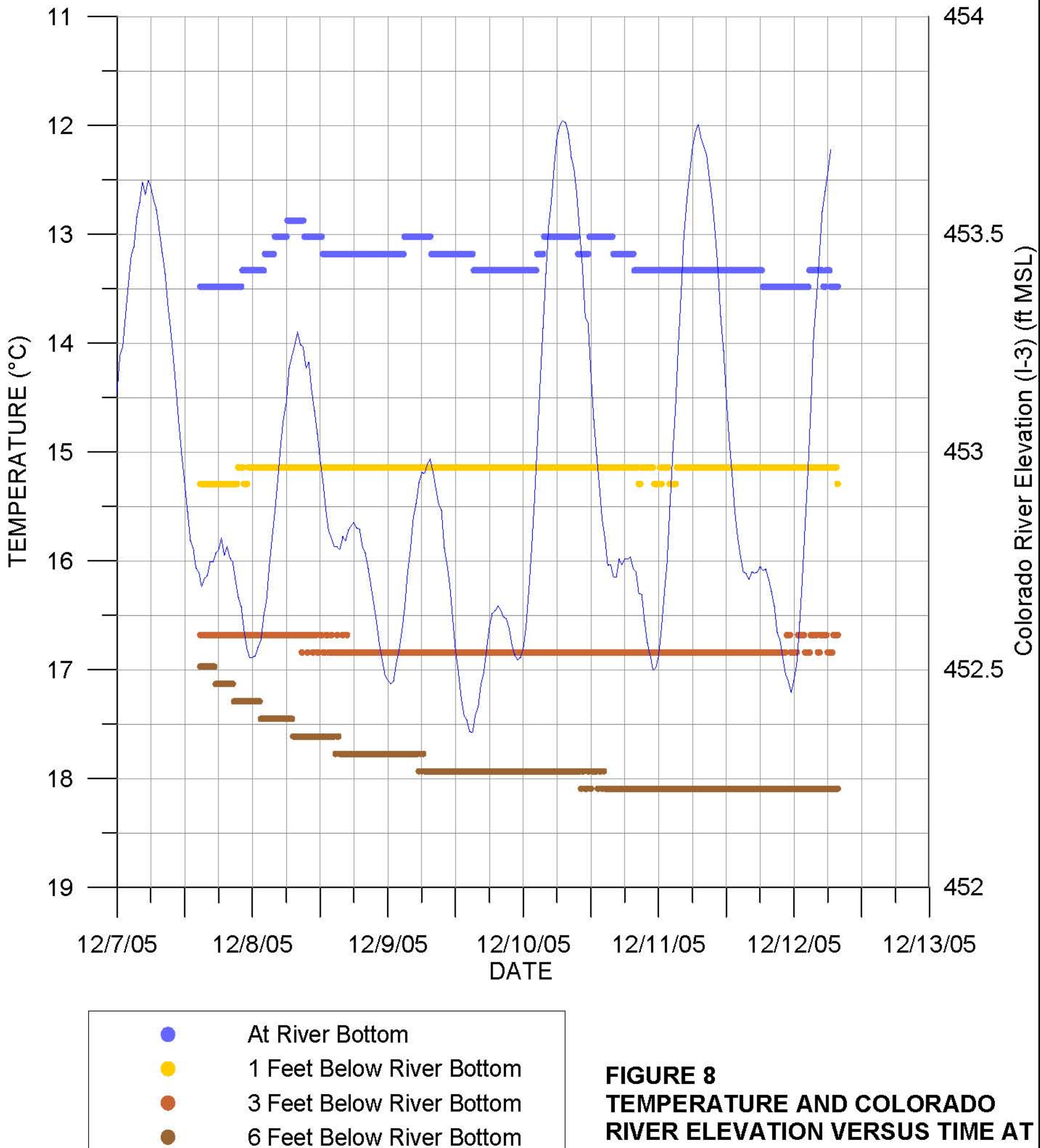


FIGURE 8
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-12b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

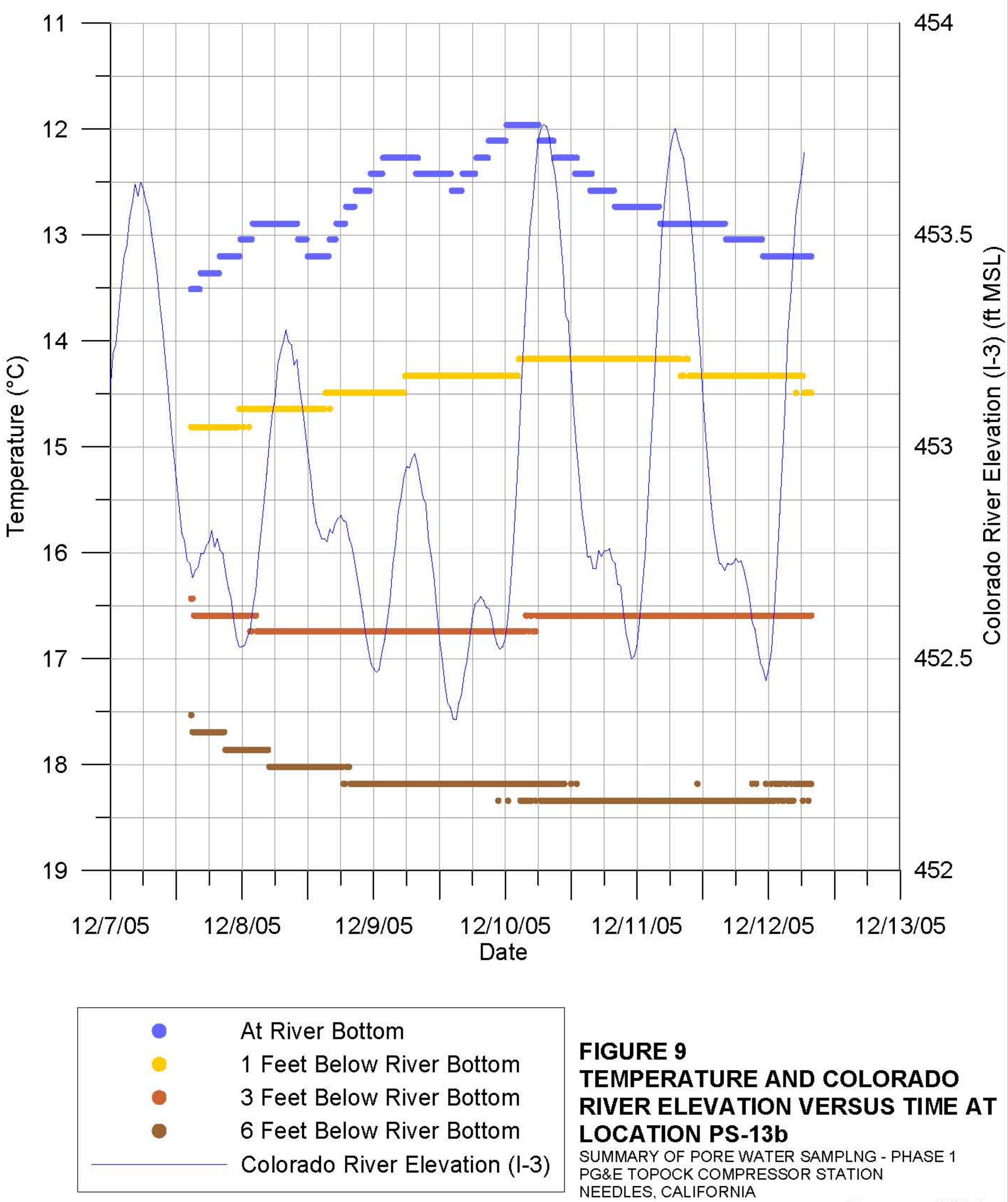


FIGURE 9
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-13b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

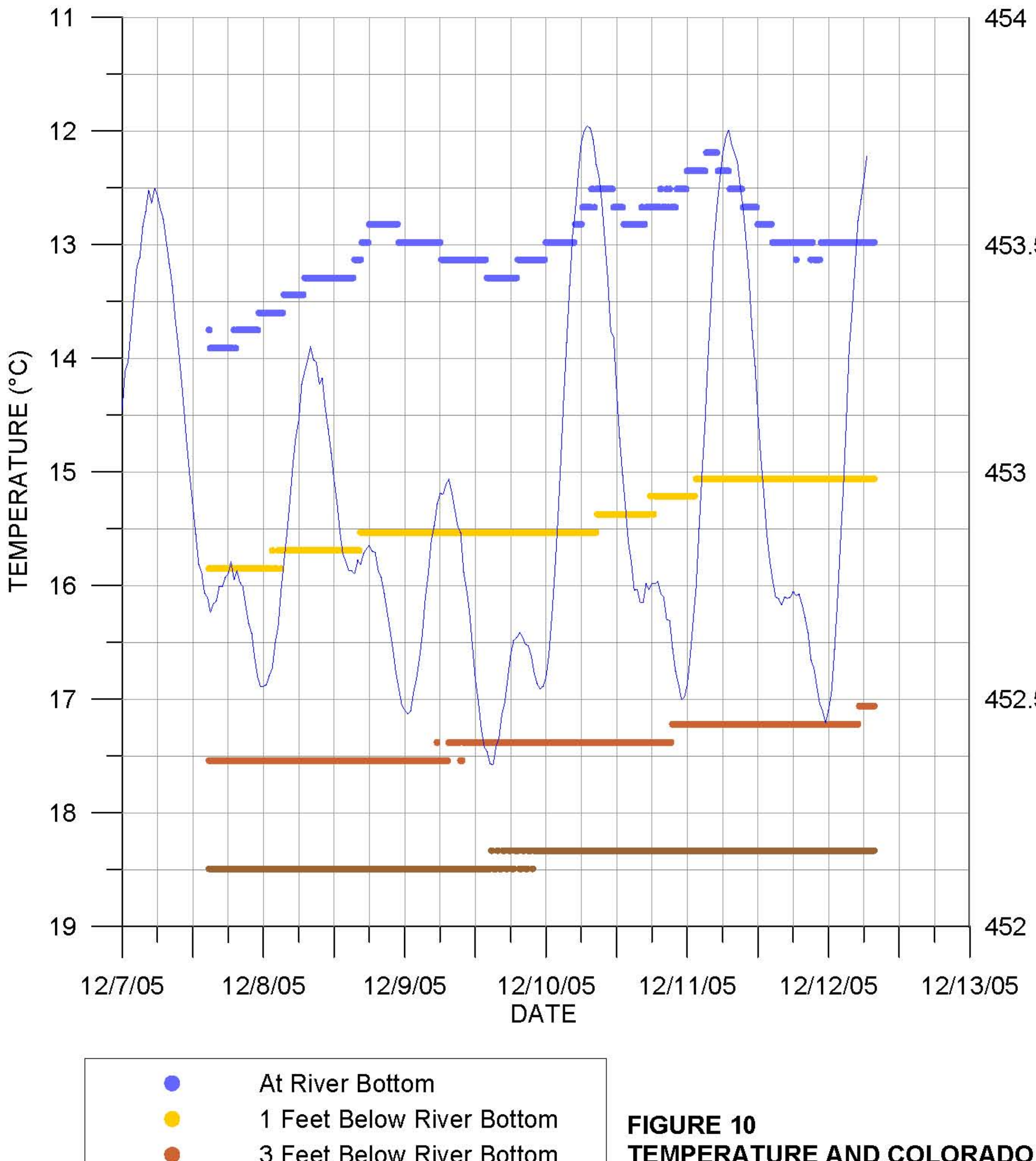


FIGURE 10
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-14b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL

\\odin\proj\topock\PoreWaterSampling\Grapher\14b.grf

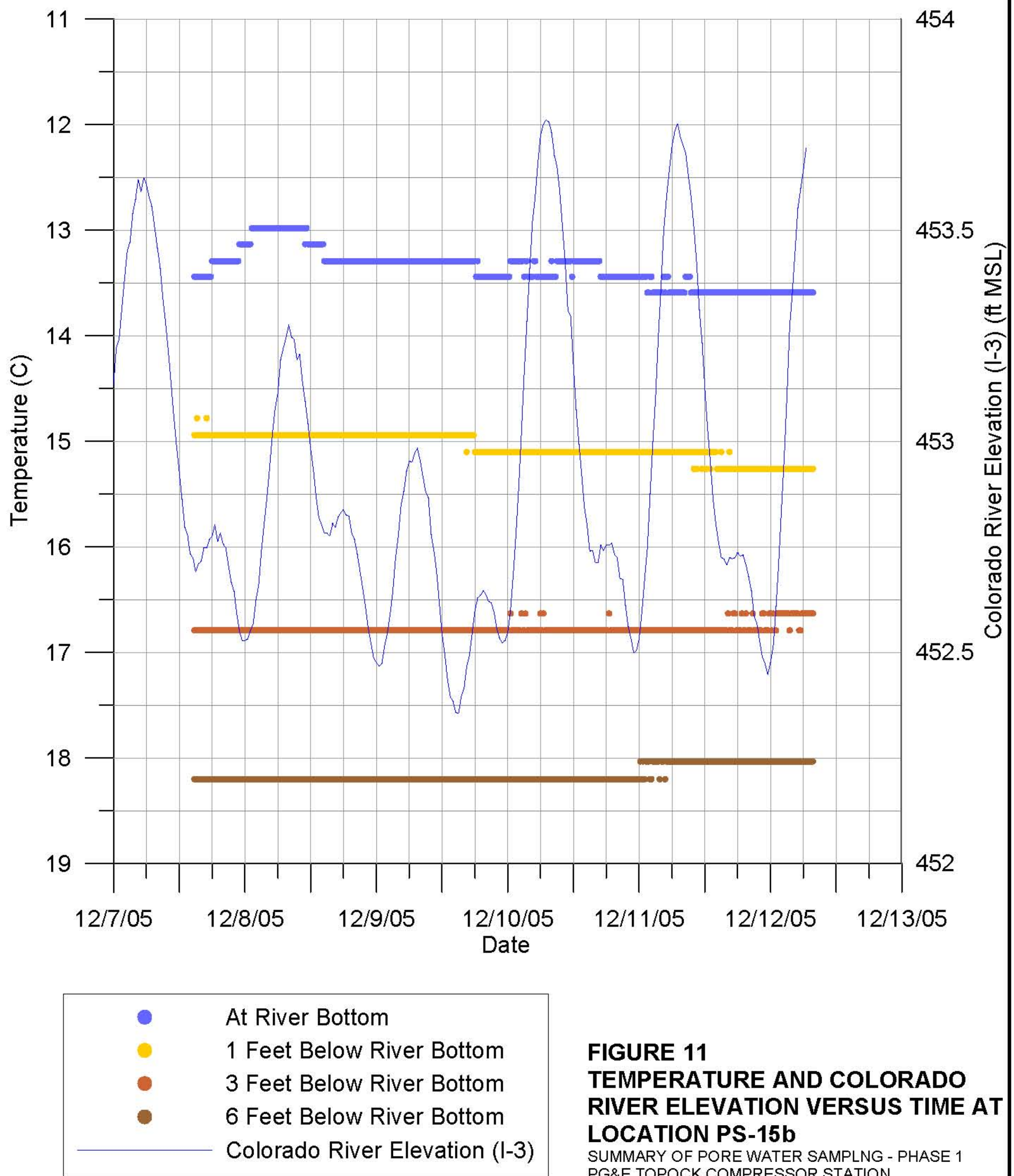


FIGURE 11
TEMPERATURE AND COLORADO RIVER ELEVATION VERSUS TIME AT LOCATION PS-15b

SUMMARY OF PORE WATER SAMPLNG - PHASE 1
PG&E TOPOCK COMPRESSOR STATION
NEEDLES, CALIFORNIA

CH2MHILL