October 23, 2013

Mr. Jim Well
Ducks Unlimited
3074 Gold Canal Drive
Rancho Cordova, California 95670-6116

Re: Response to NMFS, CDFW and USFS Concept Design for Cone Screens at M&T Ranch Diversion on the Sacramento River

Dear Jim,

A team of hydraulic engineers and fishery biologists from National Marine Fisheries (NMFS), California Department of Fish and Wildlife (CDFW) and the U.S. Fish and Wildlife Service (USFWS) developed a conceptual design for cone screens to replace the existing cylindrical screens at the existing M&T pump intake (Thomas, Heise and Meier, August 8, 2013). This design has been proposed as an additional project alternative for solving the long-term sedimentation problems at the M&T pumps. The Expert Panel that has been working to identify a suitable long-term solution since 2003 (Drs. Mike Harvey, Yantao Cui, Bob Mussetter and Eric Larsen), along with Dennis Dorratcague and Neil Schild (MWH) who have assisted with certain engineering aspects of the investigations. This memorandum summarizes the opinions resulting from those reviews. The complete review by MWH and a brief memo from Dr. Cui are attached (**Enclosures 1 and 2**).

Based on the technical requirements for the installation and the **existing** configuration of the river at the site, MWH believes that *the cone screen option can be installed in lieu of the present cylinder screen installation*, and they provide additional details on the required dimensions of various elements of the new installation (Enclosure 1). Under the assumption that the river remains in its current location and the upstream gravel bar does not migrate downstream across the intakes, the cone screens may provide some advantages over the existing screens because water would be drawn from higher in the water column, providing an additional approximately 3 feet of buffer against further sediment buildup. However, because they are higher in the water column, they would also be subject to greater risk of being impacted by floating debris.

Whether or not the cone screens would provide additional benefit under existing conditions is, unfortunately, not the central question that must be answered to insure a long-term solution to the problems at the site. As has been clearly documented through numerous studies by the Expert Panel and others, the long-term sedimentation problems at the existing intake result primarily from the tendency of the river to migrate toward the west, allowing the upstream gravel bar to migrate downstream, potentially burying the intake with coarse sediment. The temporary rock toe that was constructed in 2007 has effectively stopped additional westward migration adjacent to the upstream gravel bar, but the resulting bankline is over 300 feet farther to the west (and the river is effectively over 300 feet wider) than in 1997 when the existing intakes

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were constructed. Because of the additional widening, there is considerable uncertainty about whether holding the river at its current location is sufficient to prevent continued downstream migration of the gravel bar.

The cone screen proposal indicates that a sheet pile perimeter wall will be necessary to protect the screens from scour and debris accumulation under the screen units and this wall will redirect flows at the river bed, causing flow acceleration and continued movement of gravels past the screens. While this may be true with the existing river topography, this is a local scour process that will not prevent burial of the screens if the gravel bar continues to move downstream.

The Expert Panel continues to believe that groins are the best way to insure that the gravel bar does not migrate downstream, and we do not believe the advantages of the proposed cone screens would out-weigh the disadvantages and additional cost for their installation.

There was also apparently some uncertainty during the August 13, 2013 meeting about what the Expert Panel specifically means by "maintain current river alignment". As noted above, this means that the river must be prevented from migrating further to the west to maintain the viability of the existing intake. It also means that, in preventing further westward migration, the flow path over the range of discharges at which the pump must operate (>=5,000 cfs) must remain along the east side of the river in the immediate vicinity of the intake. The available information indicates that further restriction of the river (e.g., with the proposed groins) may be necessary to prevent the gravel bar from migrating downstream, potentially burying the intake.

Sincerely,

TETRA TECH, INC.

Robert A. Mussetter, PhD. PE
Principal Engineer

Michael D. Harvey, PhD, PG
Principal Geomorphologist

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MEMORANDUM

MWH
MONTGOMERY WATSON HARZA

ENCLOSURE 1

To: Jim Well
Ducks Unlimited

Date: 16 August 2013

From: Dennis Dorratcague
Neil Schild

Reference:

Subject: Review of Cone Screens Installation at M & T Intake

Neil Schild and Dennis Dorratcague reviewed the AFSP members' report, *Concept Design for Cone Screens at the M & T Diversion on the Sacramento River*, and we have the following comments.

General & Background

There is little doubt that the cone screen option can be installed in lieu of the present cylinder screen installation that was completed in 1997. The initial installation was completed early that year at a total cost of under $5 million. This included the conveyance pipe from the river diversion to the western end of the Phelan Canal.

The four existing cylinder screens are mounted on a manifold at the waterside toe of the levee with a top elevation of the cylinder screens at 109.0 feet. The minimum river water surface was 112.6 feet with 3 feet allowance required on the Sacramento River for boat traffic.

The top of the collector manifold pipe is 101.25 feet with the bottom of the cylinder screens at 104.5 feet. This means that the vertical connection between the collector and bottom of cylinder screen is about 3.25 feet long.

On the cylinder screens the manufacturer specified a minimum of 4.5 feet of clearance between the screens. The distance from the centerline of the back riser to the centerline of the front riser (riser nearest levee to riser out towards center of river) is 13 feet 3 inches. The centerline of risers upstream to downstream is 16 feet 9 inches.

In the literature for cone screens there isn't a recommended clearance between cone screens. An installation at this site using the existing manifold arrangement means the distance from an outer edge to the other cone screen would be 15 inches. This would be the front to back cone screens.

In order to raise the elevation of the cone screens closer to the water surface, the risers on the manifold would have to be extended from current 3.25 feet to as much as 7.5 feet if the top of the cone screen is to be placed near the water surface. .

Sediment

The main question is what will the river location be in the future? If the river channel moves away from the intake, any type of screening system will not work without water. This is our greatest concern with the existing cylinder screens or the cone screen concept.

The proposed concept calls for a sheet pile wall creating a platform for the cone screens to rest on. Will this design provide flow patterns which will deflect sediment and prevent the buildup of gravel on the platform and against the cone screens? Do we still need groins to make sure that this alternative is viable over the long term? Is the toe revetment from the windrow rock placed a few years ago, sufficient to provide sufficient flow for these screens at the intake?

These questions can be better answered by Tetra Tech and Yantao.

Sweeping and Approach Velocities
If no provisions are made for keeping the river flow sufficiently close to the intake to provide a sweeping flow, then sweeping velocity criteria cannot be met. In the report it is stated that the agencies can provide a variance. This raises several questions. What data is required for the agencies to grant the variance? Can the variance be granted ahead of time? This would allow continued operation even if the intake is located in a backwater area caused by a shift in the river channel. Otherwise, such a shift in the river channel might require a curtailing water withdrawals due to criteria violation.

The 12-foot diameter cone screens suggested in the concept report are sized for a 0.33 fps approach velocity. In the northwest, to obtain a variance on sweeping velocity requirements, the approach velocity had to be reduced to 0.20 fps. This would reduce the amount of water that can be withdrawn to about 104 cfs.

Another question that might require modeling is: Will the sheet pile wall and platform improve or hinder sweeping flows at the cone screens?

Screens Higher in the Water Column
In the report it was suggested that the cone screens could be mounted higher in the water. This has the advantage of raising the screens further above the bottom of the river. However, being closer to the surface the cone screens are more susceptible to impact from floating debris. This would subject the screens to an additional force from debris catching on the cone screens. It could also damage the hydraulic motors and cleaning mechanism, which pivots around a pin on top of the screens. Debris is of concern as during the cylinder screen installation piles were called for upstream only, but the operator had the contractor install additional protection (Mussetter: What Is Minimum WSEL During Operations?) downstream and across the top of the cylinder screens. During recent high flows large trees have reportedly passed over the cylinders with only minor damage to the screens.

The maintenance of the cleaners on the exterior of the cones may require more maintenance because of the debris that moves along the river bank. If there is damage, the divers would likely have to be called in for a quick repair although three cones may supply enough water for short periods of time. If the hydraulic motors need to be serviced or replaced they will have to be removed and installed by the divers.

Construction
There are concerns of installing the cofferdam as it was quite difficult to install during the original construction in 1997. This was due to the rip rap on the levee face and large rocks in the vicinity of the toe of the levee bank. Also, since original construction, additional large rocks have been placed around the foundation for the manifold. The recent dive report indicates that the clearance below the bottom of the cylinder screens ranges from three to five feet. The shallow depths are near the levee, and the larger clearance is under the upstream cylinders. The cofferdam would take longer than one week suggested in the report.

During construction water would have to be supplied to the Phelan Canal by some means, probably a temporary screening facility in the river with pipes over the levee to the existing pump station. Temporary pumps would also need to be installed. These facilities could be sized for the smaller winter flows, but a schedule would have to be worked out to see if this is possible.

Hydraulic Lines
The location of the hydraulic pumps and lines to the motors has to be determined to provide the least construction costs but provide the highest reliability. Lines could be buried down the face of the levee. This would require temporary removal and replacement of the bank protection. The option of solar power may not likely provide the level of reliability and performance required for this diversion.

Conclusion
Cone screens installed in place of the cylinder screens provide some advantages and disadvantages. It provides water withdrawal higher in the water column in case of sediment buildup, but it is also more

susceptible to damage by floating debris. This alternative does not address the main question: Will there be sufficient flow at the screen location to make the necessary water withdrawals?

It seems to me that the operator needs to weigh in on this option as there may be advantages that offset the potential problems related to this type of installation. There are also disadvantages associated with the other intake options downstream or across the river. The primary objective here is to weigh the cost of changing the types of fish screens justified to provide the potential reliability while overriding the possible disadvantages and additional cost of operations and maintenance.

MEMORANDUM

ENCLOSURE 2

To:	Jim Well Ducks Unlimited	**Date:**	20 August 2013 (revised October 14, 2013)
From:	Yantao Cui, Ph.D., Senior Hydraulic Engineer	**Number of pages:**	1
Subject:	Review of Cone Screens Installation at M & T Intake		

I have reviewed the memorandum titled "Conceptual Design for Cone Screen at M&T Ranch Diversion on the Sacramento River" by S. Thomas, G. Heise, and D. Meier dated August 8, 2013. My comments with the conceptual design are as follows.

Replacing the current cylinder screen with cone screen will not provide long-term solution to the M&T pump intake unless accompanied with auxiliary alternatives such as the construction of the proposed 9-dike groins or continued dredging of the gravel bar. Without the groins and without continued dredging, the gravel bar will most likely continue to grow and migrate downstream, eventually burying the intake.

The proposed addition of the platform is unlikely going to be helpful in solving the sedimentation problems at the intake. On the contrary, it may actually exacerbate the problem because the decreased shear stress from the platform is likely going to attract more local sediment deposition.