January 11, 2010

MEMORANDUM FOR: Dave Ward

FROM: Bryan Nordlund

SUBJECT: Review of Farmers Conservation Alliance (FCA) site selection criteria

At the last Fish Screen Oversight Committee (FSOC) meeting in September 2009, FCA agreed to develop a set of “weed-out” criteria, for the purpose of defining sites with adequate conditions for horizontal screens, such as the FCA design. The FSOC agreed to review these and provide comments for the January 2010, FSOC meeting. My review comments follow.

1) The weed-out conditions (last page of the FCA distribution) are generally insufficient to assure screen design conditions can be maintained.

2) The first requirement is to have "....some means of flow regulation...", which is not adequate. Some means of flow regulation is too broad - could mean anything from a push-up dam modified by an excavator to regulate diverted flow, to a computerized remotely-controlled headgate. Flow regulation for a water diversion in any basin in the Northwest will include a multitude of methods that have been passed down from generations of ownership of the property. Not all of methods of flow regulation are adequate for regulating diversion rate at a site with a horizontal screen, but I’m willing to bet that a majority of water users could claim "....some means of flow regulation...",. This is a question that should be asked in the site questionnaire, with an expected answer that includes the extreme scenarios for operation of the diversion.

Any horizontal screen has a depth related Achilles heel - that being, a drop in water surface elevation can cause total or partial dewatering of the screen surface, which adversely affects fish egress as well as the hydraulics that are required for adequate screen cleaning capability. Of course, even if an operable headgate is installed, these impacts still can occur if the headgate isn't operated to maintain design screen hydraulic conditions. This could be rectified to a large degree by requiring an operable headgate before a site is approved for a horizontal screen, coupled with an agreement to operate the diversion to maintain hydraulic screen criteria within the design range. In other words, if bypass flow is less than the minimum required (see #3 below), the diversion will need to be shut off.

3) The second condition requires "Adequate flow to ensure by-pass flow availability at all times ". Instead, this condition should spell out what constitutes adequate bypass flow for the site in question, and verify whether the site has sufficient flow to use a horizontal screen. Also, ensuring bypass flow is available does not necessarily provide any assurance that bypass flow will be provided for safe screen and bypass operation.

I expected to see an analytical approach and an agreement to assure proper bypass operation. For example, if sweeping velocity is two ft/s and minimum flow is one foot deep on the screen, and the best fit for a horizontal screen is 4 feet wide, then 8 cfs (2 ft/s x 1 ft x 4 ft) of bypass flow is required. If the canal capacity at this site does not include an additional 8 cfs beyond the maximum diverted rate, this means that the site is not appropriate for a horizontal screen. Or, if the stream function is substantially diminished by diverting an extra 8 cfs, this means the site is not appropriate for a horizontal screen.

To resolve this issue, a template single row table should be developed with columns titled; "Minimum Diversion Rate", "Maximum Diversion Rate", Minimum Flow Depth on Screen", "Diversion Capacity", "Proposed Screen Dimensions", "Sweeping Velocity", "Calculated Bypass Flow Requirement". To verify the site can operate with a horizontal screen, the diversion has to have the capacity to provide the calculated required bypass flow without substantially impacting instream flow, and the diverter needs to sign off to verify he will maintain the required bypass flow.

4) I note that there are screens constructed to regional conventional screen criteria that do not have adequate bypass flows at times. When bypass flow is inadequate with conventional screens, fish are in no danger of impingement because there is no place for a fish to get trapped by shallow depth, as exists when water level on horizontal screens drops. With conventional screens, there are typically means to check up the water surface, to assure fish safety and reliable cleaning. If all diverted flow goes through the screens, there is high likelihood that fish could become impinged and killed because sweeping velocity may present to great of a physical challenge for egress of fish from the screen surface. I note that this same reasoning led the FSOC to establish minimum submergence depth and stream bottom offset criteria for end-of-pipe screens, which have infinite egress routes, in comparison to horizontal screens with a single bypass route that could be compromised by improper operation. I understand that FCA has a design fix for this, and they have agreed to provide this for FSOC review.

5) The third weedout condition requires a minimum of 6" elevation differential from the point of diversion to the distal end of the screen. Based on the current minimum depth requirement for horizontal screens of one foot, I'd like to see a analysis that demonstrates that the drop in canal grade will produce the hydraulics required to make a horizontal screen properly self-clean at all diverted flows. For example, if there is 6" of drop in the canal water surface elevation and 2 mile distance between the point of diversion and the screen, the hydraulic gradient is not sufficient to produce the required sweeping velocity. It would make better sense to me if this criterion was in terms of canal gradient and canal length (from headgate to screen), not elevation differential. The designer should also verify that the canal velocity that results from this canal gradient is sufficient to provide the requisite hydraulic conditions at the screen site, before the site is approved for a horizontal screen.

6) The fourth weedout condition has a similar flaw - if a minimum of 12" elevation drop is available between the POD and bypass outfall, this means that 6" of that drop is available for the bypass return. If that 6" of head is dispersed over 2 miles of bypass, velocities will be too low and siltation and poor bypass egress will be the result. Again, this should be in terms of bypass pipe slope and length, not total drop. The designer should also verify that the bypass velocity that results from this gradient is sufficient

to provide the requisite hydraulic conditions in the bypass, before the site is approved for a horizontal screen.

7) There needs to be another site check to verify that the stream slope is greater than the canal slope at all stream flows, to avoid a result where the stream elevation is higher than the bypass flow elevation - and water will flow from the stream into the bypass pipe. There needs to be a site weed-out criterion for this scenario, and probably would be best coupled with the suggestion in #6 above.

8) There needs to be an additional criterion that stipulates in clear language, that the diversion owner/operator agrees to maintain the screen and bypass in design conditions, and will check the screen on a daily basis.

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