

FCA Comments regarding the proposed NMFS Horizontal Screen Criteria:

11.6.1.7 Horizontal Screens: Horizontal screens have been evaluated as experimental technology, because they operate fundamentally different than conventional vertically oriented screens. This fundamental difference relates directly to fish safety, because when inadequate flow depth exists with vertically oriented screens, there is no potential for fish to get trapped over the screened surface. In contrast, when water level on horizontal screens drops and most or all diverted flow goes through the screens, there is high likelihood that fish will become impinged and killed on the screened surface. In addition, if depths become shallow and flow rate is high over a horizontal screen, the resulting cross-section velocity may be too high to allow fish to swim away from the horizontal screen surface.

***FCA Comment:** This opening statement is not correct. Horizontal screens are fundamentally different than vertically oriented screens in how they function; however, they are not different from conventional screens in the fact that, if they are operated outside of their design parameters, they could potentially harm fish. Why else would there be criteria for design of all screen types? With the current design (influenced by lessons learned from the Widows Creek screen), it is impossible for “most or all of the diverted flow” to go through the screens, due to the sealed weir wall. Instead, most or all of the flow goes to bypass. ODFW staff members have observed this at screens with sealed weir walls. In addition, with a sealed weir wall, the minimum depth over the screen is fixed. If the depth over the screen is less than that of the weir wall height, then all of the flow is going to bypass and the approach velocity is zero. In that case, fish are simply in a flume that carries them back to the stream via the bypass.*

Horizontal screens are considered to biologically equivalent to conventional screens only if the following criteria and guidelines are achieved in design and operation:

11.6.1.7.1 Design Development: Since site-specific design considerations are required, NMFS engineers must be consulted throughout the development of the horizontal screen design.

***FCA Comment:** All screen types have site specific design considerations such as inlet structures, flow volumes, bypass design, orientation, elevations, power sources, frequency of active cleaning, etc. This is not unique to horizontal screens and therefore horizontal screens should not be held to a higher standard. This essentially, and unnecessarily, keeps horizontal screens in a perpetual state of “experimental status” and therefore ensuring higher project costs, longer timelines, and a competitive disadvantage.*

11.6.1.7.2 Hydrologic and Hydraulic Analysis: The horizontal screen design process must include an analysis to verify that sufficient hydrologic and hydraulic conditions exist in the stream so as not to create a passage impediment in the stream channel (see Section 4.1), or in the off-stream conveyance, including the screen and bypass. This analysis must conclude that all criteria listed below can be achieved for the entire juvenile outmigration. If the

following criteria cannot be maintained per this design analysis, a horizontal screen design must not be used at the site.

FCA Comment: *Is there a definition of what the analysis would consist of? Is this saying that if a passage barrier already exists in the stream, then a horizontal screen can't be considered? Is this saying that there are different criteria during juvenile outmigration? Shouldn't this be a requirement for all screen designs?*

11.6.1.7.3 Screen Geometry: Horizontal screens must be set at slopes and other geometry consistent with prototypes developed through conducted research and/or associated physical models. The screen designer must provide evidence of research or an example site that confirms the adequacy of the design.

FCA Comment: *Is this merely saying that the proposed horizontal screen design must have been tested and shown to be similar to the design for a particular site? Would a screen such as the Farmers Screen need to show that research (and develop a prototype) for every potential screen site? There is a lot of ambiguity in this section which inevitably leads to differing application standards depending on who is reviewing the project.*

11.6.1.7.4 Site Limitation: Horizontal screens must not be used in stream or river channels.

11.6.1.7.5 Flow Regulation: For a horizontal screen to be installed, the site must have a good head gate, capable of maintaining sufficiently consistent diversion rates to allow a horizontal screen and bypass to operate within these criteria and guidelines.

11.6.1.7.6 Channel Alignment: Horizontal screens must be installed such that the approaching conveyance channel is completely parallel and in line to the screen channel (no skew) for at least twenty feet or two screen channel lengths upstream of the screen civil works (whichever is greater). Horizontal screens must be installed such that a smooth hydraulic transition occurs from the approach channel to the screen channel (no abrupt expansion or contraction).

FCA Comment: *What is the basis for this? Where did the 20 feet or two channel lengths come from? The Lacombe screen and the North Greenpoint screens both have a fairly radical bend just upstream of the leading edge of the screen and both have performed well. For a screen of 80 CFS, this requirement would call for a 300 foot straight flume before the screen. This would add not only extraordinary cost but also create much more site disturbance while creating greater distance for fish to travel to get back into the river or stream through the bypass with no improvement to screen function. Also, this would be in direct conflict with 11.5.1.2 from the February 2008 NMFS Anadromous Salmonid Passage Facility Design which states, "The screen location must be chosen to minimize the effects of the diversion on*

instream flows by placing the bypass outfall as close as biologically feasible (i.e., considering minimizing length and optimizing the hydraulics of the bypass pipe) and practically feasible to the point of diversion”.

11.6.1.7.7 Bypass Flow Depth: For horizontal screens, the bypass flow must pass over the downstream end of the screen at a minimum depth of one foot.

FCA Comment: *Is the USGS testing data being taken into account here? USGS Open-File Report 2010-1042 evaluates the impact of water depth on salmonid smolts and fry and concludes that a range of minimum depths of 15 to 20 cm (5.9 to 7.9 inches) could be acceptable and that the screen flume interface is not an obstacle to fish passage at depths of less than one foot. These tests were performed at the request of NMFS to determine acceptable depth of water over the screen. As written, this requirement eliminates the ability to screen most small diversions with a horizontal screen due to the much higher level of bypass flow required. Quite often, small diversions have proper site attributes for a horizontal screen to work well and have site attributes that make other technologies difficult or impossible to utilize. The best available scientific data would point to horizontal screens as an excellent tool for protection of endangered species at depths as low as 6 inches.*

11.6.1.7.8 Bypass Flow Amount: Bypass flow is used for transporting fish and debris across the plane of the screen and into the bypass. For diversion rates less than 100 cfs, about 15% of the total diverted flow should be used as bypass flow for horizontal screens. For diversion rates more than 100 cfs, about 10% of the total diverted flow should be used for bypass flow for horizontal screens. The amount of bypass flow must be approved by NMFS engineers.

FCA Comment: *Where is the data supporting this requirement? As we have stated previously, this requirement doesn't match up with the other criteria. Providing a minimum depth and minimum sweeping velocity gives a basis for calculating the minimum amount of bypass flow that will be met by meeting the other criteria. As screens get larger, percentage of bypass flow decreases. This requirement would mean removing larger amounts of water from the stream than is absolutely necessary for proper screen function. The USGS report also shows safe and effective fish passage by maintaining depth and sweeping velocity requirements, not through a percentage of total flow. This represents one more example of an unnecessary and conflicting requirement that is not supported by scientific data, and will have the effect of making it nearly impossible to install a horizontal screen.*

11.6.1.7.9 Diversion Shut-off: If inadequate bypass flow exists at any time (per Sections 11.6.1.7.8 and 11.6.1.7.9), the horizontal screen design must include an automated means to shut off the diversion flow, or a means to route all diverted flow back to the originating stream.

11.6.1.7.10 Sediment Removal: The horizontal screen design must include means to simply and directly remove sediment accumulations under the screen, without compromising the integrity of the screen while water is being diverted.

FCA Comment: *Why is this specifically called out here when section 11.10.1.7 of the current criteria covers sediment management already where it says, "Provision must be made to limit the build-up of sediment where it may impact screen operations"? Sediment accumulation in front of a vertical screen is as much or more of an issue as it is with a horizontal screen and therefore shouldn't require redundancy.*

11.6.1.7.11 Screen Approach Velocity: If a horizontal screen is not equipped with an automated mechanical screen cleaning system, screen *approach velocity* must be less than 0.2 ft/s and uniform over the entire screen surface area. If equipped with an automated mechanical screen cleaning system, screen *approach velocity* must be less than 0.4 ft/s and uniform over the entire screen surface area.

FCA Comment: *What is the definition of uniform here? As FCA has shown through operational data and through the USGS biological testing, the approach velocity is not uniform but instead is alternating between a positive and negative number. The oscillating velocities found in the Farmers Screen greatly contribute to the self-cleaning characteristics of the technology. The USGS biological testing has shown a high level of protection for salmonid smolts and fry under these conditions. Section 11.6.1.1 (covering approach velocity in the current criteria) makes no mention of the approach velocity being uniform over the entire screen surface area. Why the difference here? Once again, ambiguity left to individual interpretation will lead to differing application standards and could conceivably be used to prohibit installation of any horizontal screens.*

11.6.1.7.12 Screen Sweeping Velocity: For horizontal screens, *sweeping velocity* must exceed twice the approach velocity and gradually increase for the entire length of screen. Higher *sweeping velocities* may be required to achieve reliable debris removal and to keep sediment mobilized. The design *sweeping velocity* must be consistent with successful prototypes developed through conducted research. *Sweeping velocity* should never be less than 2.5 ft/s, or an alternate minimum velocity based on an assessment of sediment load in the water diversion system.

FCA Comment: *The minimum sweeping velocity stated in this section as 2.5 ft/s makes sense based on operational and biological testing data, however, as the USGS report states, a sweeping velocity of twice the approach velocity would not be adequate and should be more like 30 to 60 times the approach velocity. A sweeping velocity of twice the approach velocity would also contradict the proposed maximum approach velocity of 0.2 ft/s in combination with the minimum sweeping velocity of 2.5 ft/s. It is also not possible to have a sweeping*

velocity that gradually increases for the entire length of the screen without installing the screen at a slope and therefore rendering the screen incapable of protecting fish or managing debris. None of the prototypes or installed screens has this characteristic including the Herman Creek screen where the biological testing was performed by USGS. What is the basis for this requirement? A requirement that the sweeping velocity increase along the length of the screen is not possible to achieve and therefore would make it impossible to install a horizontal screen and still meet NMFS criteria.

11.6.1.7.13 Screen Approach Velocity: For horizontal screens, *approach velocity* and *sweeping velocity* must work in tandem to allow self cleaning of the entire screen face and to provide good bypass conditions. If this has not been demonstrated by a prototype to be hydraulically similar to the proposed design, the screen design must include retrofit capability for an automated screen cleaning system.

***FCA Comment:** Why have two sections titled “Screen Approach Velocity”? Would this be better if combined with section 11.6.1.7.11? Or rather, is this language meant to replace the previous language?*

11.6.1.7.14 Inspection and Maintenance: Daily inspection and maintenance must occur of the screen and bypass to maintain operations consistent with these criteria.

***FCA Comment:** This is already addressed in sections 11.10.1.1 and 11.10.1.3 of the current criteria.*

11.6.1.7.15 Monitoring: Post construction monitoring of the facility must occur for at least the first year of operation. This monitoring must occur whenever water is diverted, and include an inspection log (in table form) of date and time, water depth at the bypass, debris present on screen (including any sediment retained in the screen openings), fish observed over the screen surface, operational adjustments made, maintenance performed and the observer’s name. A copy of the inspection log must be provided annually to the NMFS design reviewer, who will review operations and make recommendations for the next year of operation.

Summary: *It would appear that the NMFS requested biological testing results have not been taken into account by NMFS staff. Some of the proposed criteria are impossible to meet and many of them are so restrictive that it makes the vast majority of potential sites where a horizontal screen could be the best available technology now off limits. Data gathered during 10 years of design, operation, and testing as well as results from installation, operation, and evaluation of 21 Farmers Screens in a range of sizes and conditions seem to have been summarily dismissed. Indications made in recent emails that this is considered by NMFS staff to*

be a final draft of the criteria document is distressing, given that there are so many inconsistencies within the criteria, and so many instances where USGS biological testing results appear to be in conflict with the resulting criteria they were intended to inform.

It is difficult not to conclude, given the contradictory and arbitrary nature of this document, that NMFS intention is to prevent any Farmers Screens from being installed anywhere anadromous fish are present.

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