

2010 USGS Biological Testing:

The following is a description of the events that led to the current biological testing currently under review and performed by the USGS Biological Resources Discipline. It is important to note that the official report from the USGS is a combination of both the biological testing completed in 2009 regarding injury and mortality and the current biological testing completed in the spring of 2010 regarding behavioral response to the screen. When reviewing the report, it is important to remember that the bulk of the report is pertaining to the 2009 testing and the current testing information is generally found at the end of each section (Table 5 is the only data table within the report that pertains to the current biological testing).

Background:

The first Farmers Screen was constructed in 2002 in Hood River, Oregon. That first screen was designed to screen 75 CFS diverted from the main stem of the Hood River. At that time, specific criteria were created to guide future installations of the Farmers Screen. Among the criteria was a minimum depth of water over the screen of 12 inches. This depth criterion was set based on the one large screen that had been constructed and observed.

As other Farmers Screen installations were developed, a desire to operate the screens at a shallower depth of water over the screen arose. The desire for a shallower depth came from two issues: the need to decrease the amount of by-pass flow necessary to operate the small screens and improved cleaning dynamics at shallower depths for small screens. Several small screens were installed in Oregon and Idaho with a reduced depth of water over the screen. Monitoring of the installed small screens with reduced operational depth of water over the screen surface revealed potential and actual operational problems associated with the small modular screen design. The observed problems with the small Farmers Screens centered on the potential for the screen to de-water and therefore to impinge and kill fish.

Working closely with ODFW staff, FCA identified the causes of the de-watering events and made design changes to the small screens to eliminate the possibility of de-watering. The potential for de-watering stems from the ability to manipulate flow of water through the weir wall as opposed to over the weir wall. Early designs of the Farmers Screen modular units had flush gates built into the weir wall. These sediment flush gates were subsequently eliminated and an external flush mechanism was incorporated which eliminates the incentive for the water user to improperly operate the screen. The weir wall is now a solid, sealed panel. The desired depth of water is maintained as long as adequate flow enters the diversion to meet the by-pass flow requirements. As flows decrease, the amount of water diverted to the irrigator decreases until it reaches zero and all flow is directed to by-pass flow. This function has been observed repeatedly at a small screen in the John Day basin where the weir wall is comprised of solid concrete.

Aside from the potential to de-water, concerns about fish protection in general at shallower water depths over the screen surface were voiced from state and federal resource agency representatives.

This concern led to biological testing at an installed screen at the ODFW Oxbow Hatchery facility in Cascade Locks, OR. The biological testing performed in the spring of 2009 by US Geological Survey Biological Resources Discipline entitled “Biological Evaluations of an Off-Stream Channel, Horizontal Flat-Plate Fish Screen – The Farmers Screen” evaluated the performance of the Farmers Screen at various water depths in relation to injury and mortality rates for juvenile salmonids passing over the screen. The full results of that test are available in the above mentioned test report. A summary statement from that report is, “When operated within its design criteria....., the screen provided safe and efficient downstream passage of juvenile salmonids under a variety of hydraulic conditions.”

Injury and mortality rates for fish passing over the screen at the reduced water depth was proven to be within NMFS standards, however there were some remaining concerns about potential behavioral response of fish at the reduced depth. Specifically, there was concern that fish would enter the diversion, move down the flume or conveyance to the screen, encounter the velocity and depth transition at the leading edge of the screen, then reject the screen and then hold between the head gate and the screen and therefore be delayed in their downstream migration.

Another biological test was designed to address the concerns about behavioral response to the Farmers Screen operated at less than 12 inches of water depth. Again, USGS Biological Resources Discipline was contracted to design, implement, and report the results of the testing. Specific parameters were requested by NMFS staff for the test site, including 100 feet of flume or conveyance prior to the screen and velocities in the flume that would be low enough for a juvenile salmonid to physically reject the screen and hold for an extended period upstream of the screen. The suggested velocities were 2 feet per second in the upper end of the flume, gradually increasing to 4 feet per second at the screen. Also, NMFS staff requested that smolting steelhead trout (*O. mykiss*) be utilized due to their strong desire to migrate downstream.

In order to accommodate the requested testing conditions, a modular screen section and a constructed flume had to be utilized. There are no Farmers Screen installations that meet the requested testing conditions. Screened water from the Herman Creek Farmers Screen was utilized and the testing apparatus was constructed in the rearing ponds at the ODFW Oxbow Hatchery facility.

In order to provide a comparison of the test apparatus and actual operating Farmers Screens, hydraulic data has been included. During the USGS testing, the depth over the screen was manipulated using the flush gate in the weir wall. When the testing was completed, a comparison set of data was collected with the water flowing over the weir wall at comparable depths. As the hydraulic data suggests, the test apparatus was a fair representation of typical operating conditions at an installed Farmers Screen.

The data in the table provided is from the USGS testing on the test apparatus as well as data from installed screens. The data from the USGS testing contains velocities from the flume (10 ft, 50 ft, and 100 ft down the flume) as well as mean velocities on the screen itself and mean depth on the screen. The AV (approach velocity) provided in the table has not been corrected for net open area.