Oregon
Theodore R. Kulongoski, Governor

Department of Fish and Wildlife
Fish Division
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January 26, 2006

To Whom It May Concern:

I understand that Farmer's Conservation Alliance is engaged in an outreach campaign targeted to private landowners, watershed councils, and irrigation districts to promote the benefits of fish screens for both agriculture and fish. Along with their outreach efforts, FCA will identify appropriate sites to install their patented horizontal screens. As manager of ODFW's Fish Screening and Passage Program I fully support FCA's efforts.

ODFW has been constructing fish protection screens since the early 1940's. We currently operate four fish screen fabrication and construction shops in the state. Over the last few decades we have installed or funded installation of over 1500 fish screens. We are currently installing approximately 75 screens per year. With all of this effort, we are still unable to come close to screening all of the diversions that are currently being operated in waters holding native fish. It has been estimated that there are approximately 55,000 surface water diversions, and most of these are probably unscreened. To make real progress in protecting Oregon's native fish from entrainment into water diversions it is important that other conservation groups and private fabricators join us in this effort. FCA has done more to that end than any other group or individual, and ODFW welcomes their assistance in the identification and screening of diversions that are unscreened and therefore entrain fish.

FCA and Farmers Irrigation District has developed a very promising screen design and through the promotion of that design are educating water users on the benefits and importance of providing fish screens. Throughout the development of their screen design, the construction and evaluation of their screen and the promotion of the screen FCA has went out of their way to coordinate with our agency to ensure that the screens meet ODFW's fish screen criteria. ODFW has greatly enjoyed the partnership that has developed between ODFW and FCA and looks forward to continued coordination in the effort to protect Oregon's native fishes from unscreened diversions. The ODFW Fish Screening and Passage Program whole-heartedly supports FCA in their efforts.

Sincerely,

Ray Hartlerode

Ray Hartlerode
Program Manger
ODFW Fish Screening and Passage Program

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
PORTLAND OFFICE
1201 NE Lloyd Boulevard, Suite 1100
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F/NWR5

January 27, 2006

Julie O'Shea
Farmers Conservation Alliance
PO Box 1621
Hood River, OR 97031

Les Perkins
Farmers Conservation Alliance
PO Box 1621
Hood River, OR 97031

RE: Overshot Horizontal Flat Plate Fish Screen

Dear Ms. O'Shea and Mr. Perkins:

The National Marine Fisheries Service (NMFS) appreciates Farmers Conservation Alliance's (FCA) efforts in developing the Overshot Horizontal Flat Plate Fish Screen (horizontal screen) and proposing thoughtful additional installation of this technology. As we noted in our January 16, 2004, letter to the Farmers Irrigation District (FID), the horizontal screen technology is promising and is a suitable technology for protection of juvenile salmon and steelhead. This letter details NMFS' anticipation of proposals by the FCA for installation of horizontal screens and our intent to work closely with the FCA on the development of the new installations.

We appreciate FID's collaborative work with NMFS, U.S. Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), and the Confederated Tribes of the Warm Springs Indian Reservation of Oregon (CTWSR) personnel. In June 2001, NMFS confirmed (in a June 26, 2001, letter to Bonneville Power Administration [BPA] dated June 26, 2001) that the horizontal screen was worthy of further development, as biological testing appeared promising and protective hydraulic conditions at the screen appeared attainable through careful design. In that letter, NMFS also stated that, "to achieve our acceptance of the facility for long-term use, the screen effectiveness must be gauged through post-construction evaluation of: 1) hydraulic conditions at the screen; and 2) biological evaluation of fish passing through the entire facility." As requested by NMFS, the FID has conducted these evaluations by following the protocol as described in the *Experimental Fish Guidance Devices Position Statement of National Marine Fisheries Service, Northwest Region*, November 1994.

The FID extensively monitored and studied the horizontal screen. The horizontal screen, as designed by criteria developed by the FID, has repeatedly performed well in biological testing. In 2000 and 2001, the U.S. Bureau of Reclamation (USBR) provided laboratory facilities, staff, and the physical model to further technical development of the horizontal screen. A multi-agency group

(NMFS, USFWS, ODFW, CTWSR, USBR, and FID) worked together on the physical model to gain an understanding of the following parameters on screen performance:

- approach and sweep velocities (and how the two work together)
- depth over the screen
- bypass flow control
- flow conditions on the screen
- diversion to bypass flow ranges
- aproach channel conditions

Concurrently, biological testing was conducted at a prototype installation in 2000 and 2001. This prototype (was built several years prior to the USBR physical model) and is located within the FID canal, in a location receiving screened flow; therefore, no listed fish were occupying this area. This prototype, even though there were some obvious design defects, tested quite well biologically, indicating low levels of injury and mortality of juvenile and smolt fish incurred due to passage over the screen.

On June 27, 2001, NMFS received a letter and biological assessment from BPA. In this letter, BPA requested formal consultation on a proposed fish screen replacement, bypass flow return system construction, and water intake modification project on the FID Canal in the Hood River watershed. The horizontal screen was proposed to replace an existing drum screen. The old drum screen did not meet the NMFS Juvenile Fish Screen Criteria and posed a danger to all fish that passed through the facility. On August 17, 2001, NMFS completed a biological opinion on this proposed project. NMFS concluded that the proposed action was not likely to jeopardize the continued existence of Endangered Species Act Lower Columbia River steelhead and Lower Columbia River Chinook salmon. The fish screen and associated facilities, later named the Davenport screen, were subsequently constructed and are now in operation.

The installation of the FID Davenport horizontal screen is a product of the lessons learned both from the prototype and the physical model. Hydraulic and biological testings of the FID canal screen were conducted in 2003. Hydraulic information developed included the assurance of:

- a uniform water surface elevation across the entire screen
- sub-critical flow at steady-state (except the "throat")
- no vortical flow
- velocity through the screen based on gross screen area = 0.083 fps
- average sweeping velocity = 3.6 fps
- total system inflow = 83.07 cfs
- diverted flow = 64.41 cfs
- bypassed flow = 18.65 cfs

Biological information gathered in 2003 included:

- fry were observed passing across the screen with no impingement
- injuries to Chinook salmon and steelhead fry and steelhead smolt were either non-existent or very minimal (the control loss (1.52%) was higher than the test loss (0.01%) and latent mortality of steelhead smolts was greater for the control fish

(1.8%) than for the test fish (0.6%))

- scale loss for smolts was not increased (over that seen in the control group) as a result of passage over the screen
- no latent mortality occurred with steelhead and Chinook salmon fry (for steelhead smolts, latent mortality was minimal and equivalent to that of the control fish)

The Davenport fish screen appears to handle debris load well and is somewhat self-cleaning; however, NMFS and FCA must proceed cautiously into development of additional sites, especially on this particular issue. NMFS anticipates that the future monitoring and reporting of debris characteristics by the FID of the Davenport screen will validate the self-cleaning nature of the screen. NMFS at this time remains concerned about this issue, but is confident that the designs of the new installations can be completed carefully to minimize occlusion of the screen by debris. Further, as we stated to the FID in 2004, on a site-by-site basis we intend to ensure that the project sites are appropriately suited for this technology. It is important that these screens are monitored, and we look forward to working with you to develop a NMFS-approved monitoring program.

NMFS is pleased that the FCA is proposing to use the design criteria (Enclosure 1) developed by the FID and to carefully implement additional projects using the horizontal screen design, as used in the Davenport installation. The future installations should be developed to work as well as, and use the same design concepts as, the Davenport screen. NMFS is prepared to actively participate in design development to ensure compliance with appropriate design criteria. Further, we are interested in continuing involvement with the screen through construction and post construction to ensure that the protectiveness seen in the Davenport installation is repeated in future installations.

Based on site-specific conditions (such as bypass flow availability), and assurance that the hydraulic conditions on the Davenport screens can be reasonably simulated (thus the positive effect is repeatable), NMFS is ready to assist the FCA in the continuing development of the horizontal screen. NMFS staff has enjoyed the collaborative design effort that the FCA has provided. We encourage the FCA to provide this same productive forum throughout the development of additional horizontal screen projects. If you have any questions, please contact Melissa Jundt of my staff at 503-231-2187 or email melissa.jundt@noaa.gov.

Sincerely,

Keith Kirkendall

Keith Kirkendall, Chief
FERC & Water Diversions Branch
Hydropower Division

Enclosure

cc: Jerry Bryan, FID; Mike Lambert, ODFW; Ray Hartlerode, ODFW; Timmie Mandish, USFWS; Ron Rhew, USFWS

Enclosure 1 - Operation, Siting, and Design Criteria[1]

Operation

The intended operation of the overshot horizontal fish screen (the Farmer's Screen) is to safely pass fish and effectively manage debris and sediment. Fish and debris are passed over the screen and off the end to the bypass channel. Diverted water passes through the screen and then flows from a sub-screen chamber over a uniform control weir to the attenuation chamber and then to the inlet of a water conveyance facility.

Water is introduced to the screen through an inlet transition section. Water flowing through the screen develops the following three velocity components:

- Sweeping velocity (V_S) is the average velocity of water moving directly across (parallel to) the screen from input to bypass output.
- Boundary layer velocity (V_B) is the velocity of water in the non-diverted (bypass) flow at or very near the screen (as opposed to V_S which is the velocity of water **above** water layer traveling at V_B).
- Normal velocity (V_N) is the velocity of water passing through the screen approximately perpendicular to the plane of the screen material.

When constant inflow is available to submerge the control weir and screen, an elevated grade line is achieved, and steady-state operation begins. Water entering the screen either sweeps above the screen at V_S (substantially unaffected by the hydraulic condition at the screen) or becomes part of the near-screen hydraulic condition. Water in the near-screen hydraulic condition is diverted between a slower moving boundary layer component, V_B, and a component that passes through the screen at V_N. The V_N flow is the diverted water flow. Water traveling at V_S preferably achieves a relatively uniform fluid flow over water closer to the screen. To the extent that propagating waveforms appear at the water surface elevation over the screen, the V_N oscillates along the vertical axis. This phenomenon enhances screen self-cleaning.

The velocity of the water passing down through the screen (V_N) is relatively uniform across the entire plane of the screen due to the uniform control weir. This uniform velocity ensures that the screen operates without "hot spots," which are non-uniform areas of velocities greater then the acceptable V_N. The uniform control weir also ensures the screen is sufficiently submerged so that fish and debris pass over the screen with adequate water depth. The screen is typically designed with a taper wall to ensure that V_S remains sufficiently high throughout the length of the screen. Correct V_S also reduces the likelihood of trapping debris or delaying fish along the screen. The V_S is typically at least fifteen times greater than V_N. Site-specific adjustments in design and operation are required to optimize system performance over a range of flow levels and site conditions.

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[1]This enclosure is adapted from criteria developed by the Farmer's Irrigation District listed at http://www.farmerscreen.org/tech-info.htm.

Siting

The Farmer's Screen requires proper site conditions in order to function correctly and efficiently. The following information provides the minimum conditions required in order to reliably install the Farmer's Screen at a given site.

These criteria must be met in order for the Farmer's Screen to perform reliably:

- **Bypass water:** Generally, for screens 100 cfs and smaller, a minimum of 15% of the total diverted flow must be maintained for transporting fish and debris across the plane of the screen. For screens 100 to 500 cfs, a minimum of 10% of the total diverted flow must be available for proper operation.

- **Sediment type and load:** Site sediment - suspended and bed load - must be characterized. If sediment is present, then sediment management facilities must be included as an integral component of the screen project.

- **Backwater profile:** The influence of backwater from the water conveyance system must be taken into account when designing the screen system.

- **Debris type and load:** Generally, the Farmer's Screen manages even large volumes of debris in a highly effective manner. In instances where aquatic plants are present, lower V_N values, covers to block UV light, and upstream, fish-safe antifouling treatment might be required.

- **Footprint area:** Adequate area must be available to accommodate the screen structure.

Design

The Farmer's Screen requires proper flow parameters in order to function correctly and efficiently. The following information provides the minimum conditions required in order to realize optimum cleaning dynamics and fish protection from the Farmer's Screen.

The following criteria must be met in order for the Farmer's Screen to perform reliably:

- **Normal velocity (V_N):** The velocity of flow throughout the entire plane of the screen (generally perpendicular to the plane of the screen), at any given point, should not exceed 0.25 ft/s after correcting for net open area (V_N in this case is the velocity through the open parts of the screen, or through-slot-velocity is V_N).

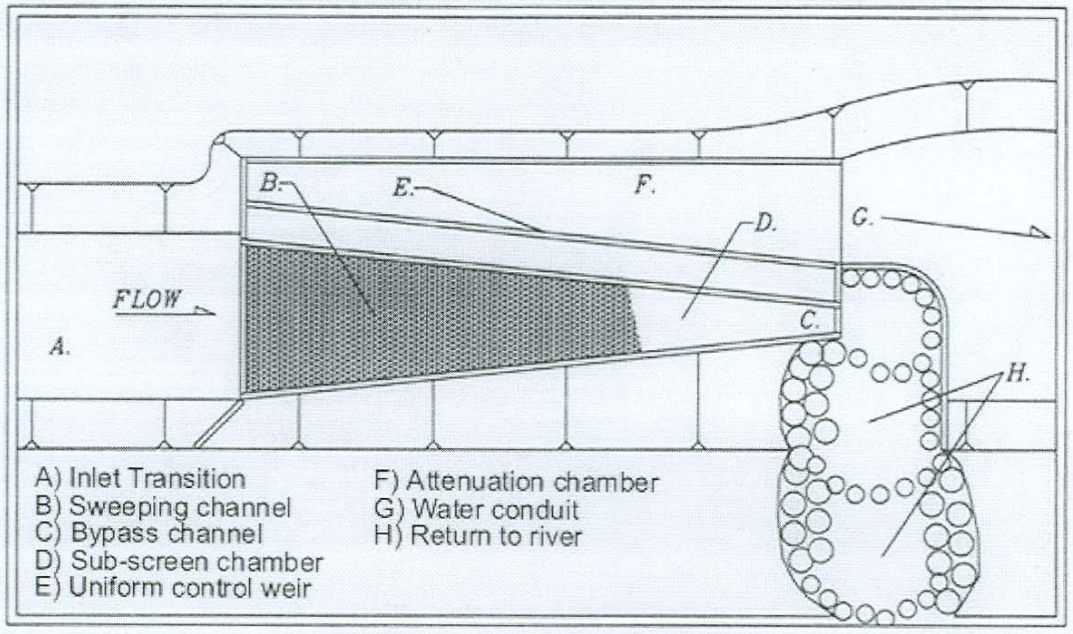
- **Sweeping velocity (V_S):** The water traveling parallel to the plane of the screen should have a sustained velocity throughout the entire length of the screen, averaging about 4 to 8 ft/sec in order to achieve the maximum cleaning dynamics and fish protection. A taper wall is usually required to maintain correct velocity parameters.

- **Depth of water over screen:** The depth of water over the entire screen area should be maintained at a uniform level between one and two feet. The actual depth will vary as a function of screen size and overall hydraulic conditions. A taper wall is usually required to maintain a uniform water surface elevation over the plane of the screen.

- **Screen area:** The total screen area must be large enough to achieve the correct V_N after correcting for net free area (calculated using through-slot-velocity).

- **Screen hole size:** Screen hole size, material, and open area should be in compliance with NMFS standards and allow for an appropriate footprint size and approach velocity.

- **Length to width ratio:** The length to width ratio must be correctly determined to avoid disruptive hydraulic conditions across the entire plane of the screen.



Features

A. Inlet transition (from canal to screen)
B. Sweeping channel
C. Bypass (output) channel
D. Sub-screen chamber
E. Uniform control weir
F. Attenuation chamber
G. Water conduit
H. Return to river

United States Department of Agriculture

NRCS Natural Resources Conservation Service

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Subject: Farmers Screen, NRCS Programs and CIG Grant **Date:** March 22, 2009

To: Les Perkins, Farmers Conservation Alliance

Les,

As the State Technical Representative on the Conservation Innovation Grant (CIG) between the Natural Resources Conservation Service and Farmers Conservation Alliance I wanted to clarify a few points in relation to this contract.

The Natural Resources Conservation Service (NRCS), an agency of the U.S. Department of Agriculture, provides voluntary technical and financial assistance to people interested in protecting and enhancing soil, water, wildlife habitat and related natural resources on non-federal lands. NRCS staffs work in every county in the nation to provide conservation planning assistance, natural resource information, engineering expertise, and other technical and financial assistance to help private landowners develop, install and maintain conservation measures on their land.

NRCS provides financial and technical assistance for fish screens at agricultural water diversions and recognizes the importance of this component in irrigation systems and protection of aquatic species. As a federal agency, we understand our unique position to facilitate private lands conservation and our responsibilities to the Endangered Species Act. This authority allows us to assist other federals agencies whose mandate is the recovery of ESA listed species through the implementation of innovative and technologically sound conservation measures. The $529,000.00 CIG grant between NRCS and FCA is one such investment that NRCS has identified as providing a new, unique approach to meeting this particular resource challenge.

The development of screening technology that significantly reduces operation and maintenance efforts by limiting mechanical components and efficiently transporting stream-borne debris and sediments are critical considerations to NRCS and landowners whom we provide assistance. The FCA design has represents a large step forward in addressing these issues and the reduced-scale; modular application provides a method for screening many of the smaller diversions our agency works on. The ability to screen diversions with difficult site conditions and access is another benefit.

I look forward to working with you and FCA through the course of our CIG contract and appreciate your willingness to provide a training session at our upcoming NRCS Oregon Engineers meeting in April.

Sincerely,

Sean Welch, PE
State Hydraulic Engineer
USDA NRCS, Oregon

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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January 10, 2006

To Whom It May Concern:

I am the U.S. Fish and Wildlife Service's Aquatic Resources Coordinator, Oregon Fish and Wildlife Office, Portland, Oregon. My agency has been actively working with Farmers Conservation Alliance (FCA) in evaluating new fish screening technology in Oregon, as well as undertaking a partnership with Farmers Conservation Alliance to seek new opportunities to install and operate new fish screening technology in Oregon. We have met with Farmers Conservation Alliance personnel recently to discuss methods to streamline regulatory compliance for future fish screen installations, and will meet again next week. We anticipate our regulatory streamlining partnership with Farmers Conservation Alliance, as well as Oregon Department of Fish and Wildlife and National Marine Fisheries Service, will result in more rapid regulatory approval of future fish screen installations, as well as more certainty for individual landowners who are considering Farmers Conservation Alliance fish screen installations.

Please contact me if I can answer any questions regarding the successful partnership the U.S. Fish and Wildlife Service has with Farmers Conservation Alliance.

Sincerely,

Doug Young
Aquatic Resources Coordinator

cc: Julie O'Shea, FCA