Fish Screen Design Criteria for Small Diversions

Fish Friendly Farming Workshop, March 29, 2011

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Presentation Goals

• Provide information on fish screen design criteria,

• Show examples of off-the-shelf products,

• Show how those products and custom designs can be used to meet screening needs.
Design Criteria

- NMFS and CDFG documents similar but not identical,
- Both address the following:
  - *Minimum screen area required*
  - *Maximum screen opening size*
  - Sweeping velocity
  - Screen orientation
  - Cleaning systems
  - *Fish bypass system design*
  - *Operations and maintenance*

The guidelines and criteria are general in nature.

This presentation was prepared to provide basic information on fish screen design criteria and does not include all criteria covered in NMFS of CDFG fish screen design documents. Screen design criteria presented are for fry-sized salmonids (salmon and steelhead trout).
Minimum Screen Area Required
Expressed as a velocity perpendicular to the screen face

Approach Velocity, \( V_a = 0.33 \text{ ft/s} \)

- with Automated Cleaning System
  - 3.0 square feet screen area per cfs capacity =
  - 1.0 square inch screen area per gpm capacity

- without Automated Cleaning System
  - 12 square feet per cfs pump capacity =
  - 4.0 square inch per gpm pump capacity

- Flow should be evenly distributed over all wetted screen area.
<table>
<thead>
<tr>
<th>Max Flow (gpm)</th>
<th>Max Flow (cfs)</th>
<th>Screen Area (ft²)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>0.11</td>
<td>1.4</td>
</tr>
<tr>
<td>200</td>
<td>0.45</td>
<td>5.4</td>
</tr>
<tr>
<td>449</td>
<td>1.00</td>
<td>12.1</td>
</tr>
<tr>
<td>1000</td>
<td>2.23</td>
<td>27.0</td>
</tr>
<tr>
<td>2000</td>
<td>4.45</td>
<td>54.0</td>
</tr>
</tbody>
</table>

Screen area assumes a non-self cleaning screen.
Sweeping Velocity

- Preferred screen orientation allows river current to move debris and fish away from the screen.
Screen Opening Size

• Round or square holes
  3/32 inch = 0.094 inch

• Slotted openings
  1.75 mm = 0.068 inch

• 27% open area minimum
Screen Material Options

• Punch plate (round openings) SS, Al, 3/32 inch openings, 5/32 in centers, 33% open area

• Wire Cloth (square openings), SS, Al?, CuNi, 3/32 inch openings

• Wedge wire (profile wire) SS, CuNi, 1.75 mm openings
Automated Cleaning Systems

• Water backwash

• Air burst

• Brush
Example Products
Only unobstructed screen area counts. Units must be supported above the stream bed.
Images from Custom Technology, Co. (CTC)
Water backwash cleaning system
Neutrally buoyant
Sized for 1,400 gpm
Cost $2,700 - $3,000

Image from Intake Screens, Inc.
Image from RiverScreen
Example 2: Sump Diversion System

In this system, water flows into sump, turning pump on during diversion season. Water is then pumped to the reservoir.

Each 4” x 6” opening good for 6 gpm.
Example 1: Vault Diversion System

Vault doors are open during diversion season. When flow in the creek is high enough to fill the pipe inside the vault, the pump turns on.
Example 3: Pipe in Creek Diversion System

In this system the pipe rests directly on the bottom of the creek bed.
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Example 4: Gravity-fed Diversion System

In this system the pipe sits at the bottom of the creek bed in a pool, and the difference in elevation between the pool and the reservoir allows the pipe to fill the reservoir without a pump.