Fish Screen Maintenance Manual

Prepared by the Siskiyou RCD

For the California Dept. of Fish and Game

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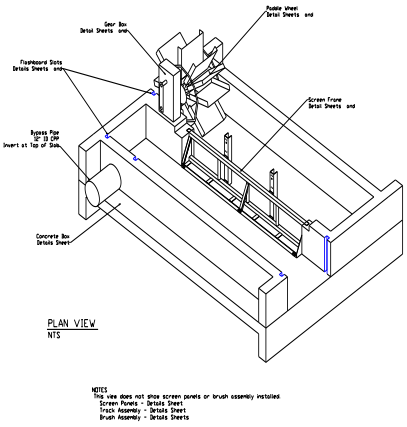
Diagram of Parts



NOTES
This view does not show screen panels or brush assembly installed
Screen Panels - Details Sheet
Track Assembly - Details Sheet
Brush Assembly - Details Sheets

Metal Fabrication Designs for Fish Screens

File Name	Specifications
Slots Designs*	
slots18x30.dwg	18" screen panel 30" walls
slots18x30.dwg	18" screen panel 36" walls
slots18x48.dwg	18" screen panel 48" walls
slots24x30.dwg	24" screen panel 30" walls
slots24x36.dwg	24" screen panel 36" walls
slots24x48.dwg	24" screen panel 48" walls
*Note total # of slots will change (by) if trapping box is included	
Screen Frame Designs	
sf12x18in.dwg	12 foot long screen 18" tall
sf12x24inrev.dwg	12 foot long screen 24" tall
sf16x18in.dwg	16 foot long screen 18" tall
sf8x24in.dwg	8 foot long screen 24" tall
sf16x24inrev.dwg	16 foot long screen 24" tall
sf20x2rev	20 foot long screen 24" tall
Screen Panel Designs	
sp15in.dwg	screen panel 15" by 4'
sp18in.dwg	screen panel 18" by 4'
sp24in.dwg	screen panel 24" by 4'
Brush Assembly Designs	
brush.dwg	Brush assembly for 18" screen
brush2ft.dwg	Brush assembly for 24" screen
Track Assembly Designs	
tract8ft.dwg	Track Assembly 8 ft screen
tract12ft.dwg	Track Assembly 12 ft screen
tract16ft.dwg	Track Assembly 16 ft screen
tract20ft.dwg	Track Assembly 20 ft screen
Paddle Wheel Designs	
pw23in.dwg/pwc23in.dwg	Paddle wheel & components for 23" radius paddle wheel (for a 15" screen panel). Paddle wheel is 18" wide
pw28in.dwg/pwc28in.dwg	Paddle wheel & components for 28" radius paddle wheel (for a 18" screen panel). Paddle wheel is 18" wide
pw34in.dwg/pwc34in.dwg	Paddle wheel & components for 34" paddle wheel (for a 24" screen panel). Paddle Wheel is 18" wide.
pw34in2wide.dwg/pwc34in2wide.dwg	Paddle wheel & components for 34" paddle wheel (for a 24" screen panel). Paddle wheel is 24" wide.
Drive Assembly Designs	
driverounded.dwg	Drive assembly
Gear Box Designs	
gearbox.dwg	Standard CDFG gear box design

Parts List

The following is a list of replacement parts for the removable parts of the fish screen. Below is a list of potential supply vendors. However, all vendors change their stock without notice. For up to date information, contact the Fish Screen contractors listed below.

Screen Panel Parts

3/16" rivets
1 1/2" x 1 1/2" x 3/16" Angle
14 gage stainless steel perforated plate
1 1/2" x 3/16" Flat Bar

Screen Frame Parts

Neoprene Block
3" x 1 1/2 " x 3/16" channel
2" x 1" x 3/16" channel
neoprene spacers
2" channel
2" x 2" x 3/16" angle
½ x ½ x 1/8 " angle
2" x 2" x 1/8" tube
2" x 1/8" flat stock
3/16" plate

Brush and Brush arm

Nylon Brush
4" by 1 ½" Neoprene wheel
¾" x 1 ½" x 3" neoprene block
rubber spacer
5/8" bolt
¼" bolt
¼" hinge bolt
3/8" tension bolt
Tension Spring

Paddle Wheel

7-16" Drive Shaft
1 ½ x 1 ½ x 1/8 " Aluminum Angle
16 gauge aluminum sheet
1" x 3/16" Alum Flat Bar
3/8" x 10" Diameter Aluminum Plate

Gear Box

Sprocket # 50B48
Sprocket # 50B16
¼" x 5/8" bolts
Bearing Dodge #124208

Supply Vendors List

In addition to the vendors listed below, many of the Fish Screen Contractors

Vendor	Phone	Address	
Applied Industrial	541-779-8613	P.O. Box 100538 Pasadena, CA 91189-0538	Rod end bearing Roller Chain Taperlock sprocket
Industrial Brush Corporation	909-591-9341	P.O. Box 2608 Pomona CA. 91769	Brush arms
Intake Screens			Cone screen
Duus Perforated	408-293-5717	242 Phelan Ave San Jose, CA 95112	Perofrated aluminum plate
Heaton Steel	541-884-1729	428 Spring St. Klamath Falls, OR 97601	Angle iron, aluminum culvert
McMaster-Carr	562-695-2449	P.O Box 7690 Chicago, Il 60680-7690	Wheel-roller
Karr Products	1-800-527-7763	P.O. Box 2807 Des Plaines IL. 60017-2807	Bearings
Marble Mtn. Machinery	468-5575	9937 N. Hwy 3 Fort Jones, CA. 96032	Bearings
Etna Hardware Store	467-3905	427 Main Street Etna , CA 96027	Misc bolts, washers, nuts
Fort Jones Lumber yard	468-5505	12325 Marble View Ave. Fort Jones 96032	Rebar, concrete
Meeks Lumber	842-1578	513 N. Foothill Dr. Yreka, CA 96097	Rebar, concrete
Scott Valley Ready Mix	467-3446	P.O. Box 967 Fort Jones, CA. 96032	Concrete

Contact Information

Fish Screen Contractors

The following contractors have been used in the past on Fish Screen fabrication and maintenance.

Metal Fabrication	**Phone**
Lyn Brown	468-5296
Bill Fowler	467-5703
Jon Quigley	467-5171
Dave Bennet	468-2654
Warren Farnum	Out of area
Excavation and Concrete	
Bill Parry	467-3138
Berryhill Contracting	467-4161
Mark Johnson	467-3107
Wade Dickinson	467-4120
Kevins Backhoe	459-0603

California Dept of Fish and Game

Rick Davis
Phone : 530-841-2550
Email : rdavis@dfg.ca.gov

Mark Elfgen
Phone: 530-841-2560
Email: melfgen@dfg.ca.gov

Summary of Operations

General maintenance:
There are approximately 90 fish screens in the Scott River watershed. 58 were installed by funding sources through the Siskiyou RCD and an estimated 30 were installed by the CDFG Yreka Stream Improvement Headquarters. The fish screens installed by the RCD and CDFG are very similar in design and operation. However, fish screens installed and funded by the CDFG Yreka Stream Improvement Headquarters are maintained and operated by CDFG Staff for the life of the fish screen. Fish screens installed and/or funded through the Siskiyou RCD require the water user(s) of that diversion to maintain the fish screen for the life of the screen. Over the past ten years the Siskiyou has provided funding for 61 fish screen installations, 58 are still in operation. Despite efforts to provide uniform and adequate fish screen maintenance, the quality of maintenance provided by the water users on different diversions varies. Some water users provide excellent fish screen maintenance while other water users provide very poor maintenance.

Poor fish screen maintenance reduces the life of the fish screen, negates the intent of the fish screen (protecting fish from diversion activity) and reduces the diversion potential of the structure. An average fish screen costs an estimated $15,000 to install and deserves adequate maintenance. The Siskiyou RCD and CDFG predicted that some users would inadequately maintain the fish screens installed by the Siskiyou RCD. Efforts to make users aware of the maintenance requirements and importance of the fish screens have been made by the RCD and SWRC with maintenance improvement occurring on some diversions. However, it became quite clear that some diversion users needed oversight and assistance in maintaining their fish screens while others needed assistance in operating their diversions in relation to biological considerations.

The only feasible alternative to providing good maintenance and ensuring long operating lives of the fish screens was to provide staffing assistance similar to that provided by the Yreka Stream Improvement Headquarters for the CDFG installed fish screens. The staffing required in maintaining and repairing fish screens as well as handling biological considerations of the RCD screens could not be assumed by the limited CDFG staff at the Yreka Stream Improvement Headquarters. Therefore, the Siskiyou RCD applied for this contract, which has been successful and a cost effective program. The ultimate goal of the RCD is to develop a self-sufficient fish screen maintenance program for the RCD funded by the surface water users. This contract helped the RCD determine the need, and staffing commitment required to provide adequate fish screen maintenance for 60 fish screens.

This contract provided fish screen maintenance oversight and maintenance training for all of the RCD fish screens for three years. Training efforts focused on spring start-ups with mostly on one-on-one training and interaction. Several meetings were held with multiple diversion users present. Efforts toward training and developing a community wide fish screen maintenance program were reduced mostly due to the development of the efforts of the Siskiyou RCD to develop a watershed wide Incidental Take Permit (ITP). Among other measures, the ITP would require proper maintenance and provide maintenance oversight opportunities for Siskiyou RCD staffing.

Maintenance oversight staffing varied throughout the period of the contract and was dependent on the activity of the diversions. The spring is the most active time of the year with the winter being the slowest, mostly due to the number of screens in operation and volume of water diverted. RCD staff learned which fish screens required the most maintenance needs either due to lack of diversion user participation or conditions of the screen or watershed. In general, the fish screens on French Creek require the most maintenance due to the volume of organic material in the stream and decomposed granite being the parent material of the watershed. There are several users who provided excellent maintenance and the RCD only visits those sites monthly. Of note, the AP Cattle Company on the East Fork of French Creek provides excellent maintenance of 7 RCD fish screens and houses the screens in doors over the winter when not in operation. There are also several diversion users who wanted a fish screens but do not want either CDFG or RCD staff routinely visiting the fish screens. The RCD respected these requests and only makes annual stops or phone calls to check on the fish screens and/or provide expendable materials such as brushes. Our experience is that these fish screens are often improperly operated and generally in poor condition.

The RCD has found that two part time staff positions are satisfactory in providing proper maintenance oversight. A third contracted position is also utilized to repair and replace broken fish screen parts, primarily brush arms and paddle wheels. December of 2006 required additional maintenance as flows were very high resulting in removal and movement of numerous fish screens to high ground. We also found that several head gate structures did not provide adequate protection from high flows and were required to add to the bulkhead elevations as flows increased. Efforts required to reinstall the fish screen with the diversion users, clean-out debris within the fish screen, check and clear the alignment of the by-pass have been significant.

Refurbishment of Fish Screens:

The California Department of Fish and Game refurbishes the fish screens under their care about once out of every five years. When refurbishing the fish screens, the CDFG removes the screen panel from the frames and sandblasts all Ferris components of the screen, replaces needed bearings and chains, inspects the paddle wheel, then re-paints the screen.

The Siskiyou RCD and water users whom have received fish screen from the Siskiyou RCD are likely unable to provide the five year refurbishment schedule. This proposal allowed the RCD to refurbish some of the fish screens that have been installed the longest. The fish screens that received refurbishment have been operating for a minimum of seven years. Because the RCD fish screens are unlikely to receive refurbishment treatment on the five year interval, the RCD inspected all the screens and replaced damaged bearings, damaged brush arms, replaced brushes painted rusted areas on frames. While this is inferior to the quality provided by the CDFG, it will extend the life and improve the operation of the fish screens.

The following is an estimated average cost and labor requirement to provide adequate oversight of the RCD fish screens.

Annual mileage 2005: 4,842
Annual hours 2005: 643.75
Annual materials purchase/repairs 2005: $544.05

Total annual costs for:

2002 $1,976.17
2003 $10,636.38
2004 $17,985.02
2005 $14,368.36

Total seasonal costs 2005:

1/1 – 3/31: $1,780.93

4/1 – 7/31: $6,246.42

8/1-12/31: $6,341.01

Fish Screen Maintenance Plan for Self-Cleaning Screens built by the Siskiyou RCD:

Summary of Maintenance over duration of contract:
In summary, the RCD feels fish screen maintenance cannot perpetually occur without some oversight similar to that provided by the CDFG. In general, flashboards are not properly set and by-pass volume is often too small in the spring. There are numerous cases where assuring by-pass connection to the stream does not occur in the summer months and by-pass volume is reduced to an ineffective volume. Maintenance oversight is also needed in providing maintenance and repair to the screens. It is the opinion of the RCD that a minimum of the existing oversight is required to achieve the target life of 20 years for the fish screens installed with RCD funding. The RCD also understands that this is not the burden of the CDFG to fund and is actively seeking alternative methods to provide long term fish screen maintenance oversight/assistance. Our best method is through the ITP process the RCD is actively pursing. We hope to have the ITP operating in 2008 and fish screen maintenance would be a measure a community group could either fully or partly fund.

Appendix A

Fish Screen Maintenance Plan for Self Cleaning Fish Screens

(Adopted 3/1999, Updated 3/2006)

Fish Screen Maintenance Manual for Self-Cleaning Screens - Siskiyou RCD:

The following is an aid to help the diversion user properly operate and maintain your fish screen. Contrary to the name, self-cleaning fish screens require significant maintenance. Depending on the specifics of your diversion and the time of year, your screen may require cleaning up to three times a week. Cleaning your screen is a commitment which needs to be done routinely in order to extend the life of the screen, comply with existing regulation and receive your full adjudicated volume.

Fish screens allow the diversion user to have control over the flow of the ditch, protect the ditch from flood damage and saves fish from being lost down the diversion. They are expensive pieces of equipment which should have over a twenty year life, if operated properly. Improper use or care of the screen will end up costing the diversion user extra time and money and will result in fish loss. When the Siskiyou RCD completes the construction of the screen, we will ensure it is operating properly and run through demonstrations with all diversion users. Upon assurance of proper operation, the maintenance is up to the diversion user(s). The RCD and California Department of Fish and Game (CDFG) will provide technical support as needed, but the fish screen and maintenance of unit is the responsibility of the affected diversion users(s).

The responsibility of caring for the fish screen can be broken into three categories: Cleaning the fish screen, adjusting the fish screen and maintaining the fish screen. All three responsibilities can be done in less then fifteen minutes if the screen is visited routinely.

Cleaning the screen: Your fish screen has moving brushes which are driven by a paddle wheel or electric motor. **Turn off motor or block paddle wheel for extensive cleaning. When adjusting or cleaning your screen, be aware of the danger created by the moving arms and extreme force created by the motor or the paddle wheel. Do not put yourself in a position where the moving parts may be able to catch you or your clothing.**

The screen should be checked at least once every week days to ensure it is operating properly and free of debris. The spring runoff, thunderstorms, and fall (leaves falling) may require more inspections. In some instances, your visits to the screen may be more or less frequent then weekly. Items which make the cleaning process easier include: Hip boots, a square tip shovel, and a long handled bristle brush and a grease gun.

Begin cleaning by removing all debris from the structure. Large debris in the fish screen can cause serious damage as well as plug the by-pass system. Then significantly increase the by-pass flow by removing the by-pass flash boards in order to draw debris to the by-

pass pipe. The increased draw will encourage floating debris to move to the by-pass, cleaning the screen. You may need to use a square tip shovel to remove sediment from the floor. Note: If the stream where the by-pass enters is dry or near dry, do not open up the by-pass to flush debris as fish may be lost in the process. Contact CDFG @ 841-2550 if you have any questions or if there is a risk of loosing fish.

Once the floor of the fish screen pad is clean, use the brush to remove the floating debris from the actual screen panel. The bristle brush can also be used on the back side of the screen to remove sand pinned in the perforated holes (occurs mostly in systems carrying decomposed granite). Make sure the floating debris is also removed from the by-pass area as well. Once the screen is clean, walk up the diversion up to the take out in order to remove large debris from the ditch or potential debris.

Adjusting the screen: Each time you visit your screen check the following areas which may need adjustment:

Head Gate Flash boards: The head gate flash boards are located at the front of the structure. These flash boards are only used when the diversion is not operating or to prevent sand trapped in the diversion from entering the fish screen. They are to be installed in the winter to keep high flows out of your diversion.

By-Pass Flash boards: The by-pass flash boards are used to regulate the amount of flow returning to the stream through the by-pass system. All by-pass culverts are designed to return 100% of the maximum diversion flow to the stream should you decide you need to shut off your diversion.

One by-pass flash board will have a notch or hole bored in it which allows the minimum amount of flow required to safely return fish to the stream (usually a 2" X 4" hole). At minimum, the notched board must be fully submerged and the hole or notch must not be blocked or impeded. The notch size is determined related to the amount of water needed to safely return fish to the stream. Any amount of water returning to the stream which is larger than the notch is acceptable.

In some cases, the flow volume of the stream below the diversion take out is not enough to keep fish alive. In fact, the channel may by dry. When the flows are inadequate below the diversion (where the by-pass pipe enters), notify the CDFG for assistance and direction. The CDFG can be contacted @ 841-2550. The CDFG will either request you to close the by-pass entirely, or they may put a fish trap in your diversion. Do not be afraid to call the CDFG for assistance, they are there to help you develop proper maintenance standards.

Paddle Wheel Flash boards: The Paddle Wheel flash boards are used to regulate velocity and depth of water within the screen structure. Different settings with the Paddle wheel flash boards need to be adjusted to the point that the paddle wheel turns at the proper speed. Adjust the flashboards in concert with the small flash boards at the paddle wheel so that the brushes make complete cycles (slide from one end of the screen and back) about once a minute but not less than once every five minutes. Wiping repetitions should be kept low as excessive speeds increase unneeded wear to the screen and moving parts.

A second and more important consideration with the paddle wheel flashboards is to eliminate the differentiation in water elevations on both sides of the screen panel. A differentiation of water elevations at the screen indicates that there is an excessive impingement velocity at the screen panel. This can impinge the fish against the screen. In order to eliminate the elevation change, add flashboard to the paddle wheel slot until the water elevation is the same on both side of the screen panel.

Maintaining the screen: There are a lot of moving parts on a fish screen that need to be checked for proper operation and potential ware. Make sure all set screws, nuts and bolts are present and tight. Lubricate all areas which need lubrication or have a grease zirk. Properly lubricate the chains and remove all excess grease or oil. Check all parts for increased wear. The best method to ensure the screen has been properly surveyed and maintained is to run through the following checklist.

Self Cleaning Fish Screen Check List

Maintenance:

- □ Check all bearings for lube and loose set screws.
- □ Grease all track bearings and track.
- □ Check gear box for proper lubrication and loose set screws.
- □ Look for worn gears, chains or any other moving parts.
- □ Check paddle wheel spokes and cords for cracks.
- □ Check brushes for proper tension and condition.
- □ Check general condition of frame, frame panels and drive arm. Make sure screens are securely set in frame panels (with no gaps).
- □ Flush screen site unless steam is dry or near dry.
- □ Keep the site clean and remove tall weeds.

Adjustment:

- □ Set flash boards so the brushes make a full rotation approximately once every minute (yet more than once every five minutes).
- □ Make sure minimum by-pass flows are occurring and by-pass system is safe for fish.
- □ Adjust by-pass if water level is over screen panels (should be no higher than the top of the screen plate).

Cleaning:

- □ Clean out large debris (sticks) which may jam in by-pass or obstruct moving parts
- □ Open up by-pass flash boards to create draw (unless stream flow can't support fish)
- □ Use shovel to remove debris on bottom of screen
- □ Clean all floating debris off of screen plate & wipers
- □ Reset by-pass to proper operation
- □ Walk up the ditch to the take out to remove large debris.