

## Western Water and Power Solution Bulletin

Research and Development Office — Denver, Colorado

Bulletin No. 1  
June 2007

### Flow Deflectors to Prevent Stilling Basin Abrasion Damage

*Installing flow deflectors at stilling basins reduces maintenance and repair costs*

#### What Is The Problem?

Stilling basin abrasion damage is a widespread problem for river outlet works and spillways at Reclamation dams and other dams worldwide. As shown in Diagram A, recirculating flow patterns can draw abrasive materials (sand, gravel, rock, etc.) into a stilling basin from the streambed and turbulent flow continues to move them against the concrete surface causing severe abrasion damage. Managers often defer abrasion damage repairs because of the interruption of water deliveries and high costs. Alternative remedies, such as downstream channel treatments, have had limited success and costs can be prohibitive.

Recirculating Flow Pattern

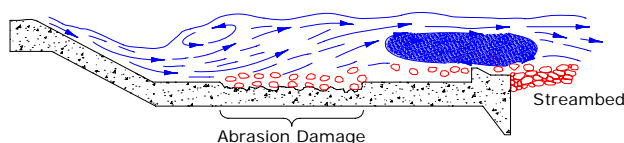


Diagram A: Recirculating flow draws material into a stilling basin

#### What Is The Solution?

A flow deflector is a device that is placed across the downstream portion of a stilling basin to change the flow pattern within the basin. As shown in Diagram B, installing a flow deflector improves the flow pattern over the basin and will 1) reduce or eliminate abrasion damage, 2) increase basin life significantly, 3) decrease costly repairs, and 4) lessen frequent cleaning and maintenance. The flow deflector consists of a reinforced steel plate panel that is attached in a vertical orientation to the walls of the stilling basin. One or two flow deflectors (staggered horizontally and vertically) are installed based on the geometry and flow characteristics of the basin, as determined by hydraulic analyses, scale modeling and/or velocity profile field measurements.

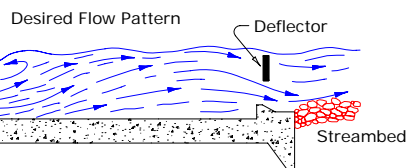


Diagram B: Improved flow pattern with deflector installed

Cleaning and repairing stilling basins requires underwater diving and/or dewatering the basin which can be time consuming and require extended water delivery interruptions. Installing a flow deflector eliminates the high costs associated with these activities and reduces water delivery interruptions. This makes the basin self-cleaning under certain flow conditions and materials are carried away thus preventing abrasion damage and the need for recurring repairs.

#### Who Can Benefit?

All water managers whose facilities include spillway and river outlet works stilling basins with abrasion damage can benefit from this technology, although at this time applications are limited to basin widths less than about 30 ft.

#### Where Have We Applied This Solution?

The first prototype flow deflector was installed in 2002 at Mason Dam in Oregon. After three operational seasons with the flow deflector in place, a dive inspection in June 2005 revealed no signs of abrasion damage and showed that the flow deflector has successfully kept materials from being drawn into the basin. The deflector cost \$27,000 to build (uninstalled). Two flow deflectors were installed in 2006 at Choke Canyon Dam in Texas. The flow deflectors were furnished and installed as a component of a large concrete repair project for a total cost of \$57,000.



Choke Canyon Dam Flow Deflectors

#### Future Development Plans

In some cases a more costly, vertically movable flow deflector may be required for effective performance over the full range of discharges. We also plan to investigate flow deflectors for basins wider than 30 ft.

#### More Information

A detailed report on the Mason Dam flow deflector is available at [http://www.usbr.gov/pmts/hydraulics\\_lab/pubs/HL/HL-2005-01.pdf](http://www.usbr.gov/pmts/hydraulics_lab/pubs/HL/HL-2005-01.pdf)

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#### Collaborators

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