Chapter 2

Alternatives Considered

This section provides a description of the No Action and Proposed Action alternatives. The following sections provide a general summary of the problems and solutions associated with barrier, screen, and flow effects to listed anadromous salmonids.

2.1 No Action Alternative

Under NEPA, the No Action Alternative is the most likely future condition without the Proposed Action. Although the Proposed Action is mandated under the ESA through the 2000 FCRPS BiOp, the No Action Alternative is identified for comparison purposes as directed by NEPA.

The No Action Alternative is considered to be represented by Reclamation's level of involvement in the Lemhi, Upper Salmon, Middle Fork Clearwater, and Little Salmon Subbasins prior to issuance of the 2000 FCRPS BiOp. Since 1999 and before the FCRPS BiOp was issued, Reclamation has provided technical assistance for certain irrigation-related projects to help protect and restore ESA-listed anadromous fish. Reclamation provided technical assistance in both the Upper Salmon and Lemhi Subbasins, but has not been involved with any projects in the Little Salmon or Middle Fork Clearwater Subbasins at that time.

Involvement in the Upper Salmon and Lemhi Subbasins has been part of Reclamation's Federal obligation to conserve listed species under the ESA. The scope of the Reclamation involvement for this particular purpose can fluctuate at the discretion of Congress from one year to the next. Under the No Action Alternative, Reclamation would continue to provide technical assistance only in the Lemhi and Upper Salmon Subbasins at or above the same scope of involvement that occurred before the FCRPS BiOp was issued, depending on funding.

2.2 Proposed Action

The Proposed Action is the implementation of Reclamation's responsibilities under Action 149 of the 2000 FCRPS BiOp in the Lemhi, Upper Salmon, Middle Fork Clearwater, and Little Salmon Subbasins. Reclamation is specifically required to implement Action 149 to conserve listed species under the ESA.

Reclamation must secure construction authority from Congress before it can fund any construction activities. Reclamation is expecting that construction in FY 2002 and FY 2003 will be done entirely by local interests using established processes and infrastructure. Reclamation's programs in FY 2002 and FY 2003 will be for coordination activities, technical assistance, and assistance with environmental compliance permit and ESA consultation activities to be completed on behalf of any other Federal agency that provides construction funding.

Annual work plans would be developed jointly between Reclamation and the established planning groups in each subbasin. Priorities would be determined in the work groups using the NPPC Subbasin Plans and following the guidance of the Federal Habitat Team 5-Year Plans and Research, Monitoring, and Evaluation (RM&E) plans. The annual work plans would reflect the realities of funding limitations, biological priorities, landowner willingness to participate, NEPA, ESA, permitting processes, and other issues.

The number of projects that Reclamation could accomplish is likely proportional to the number of problems in each of the subbasin. For instance there are approximately 209 dams and diversions in the Lemhi Subbasin and 165 dams and diversions in the Upper Salmon Subbasin, respectively (NPPC 2001). While there is less data available for the Clearwater and Little Salmon Subbasins there is substantially less irrigated agriculture in these basins and most diversions are likely pump systems.

Reclamation will complete its involvement related to the FCRPS BiOp in each subbasin within 10 years and cannot maintain further commitments related to the FCRPS BiOp after this point. Consequently, project operation and maintenance (O&M) must be the responsibility of the landowner, and long-term O&M oversight, if appropriate, would become the responsibility of a third party (such as a watermaster or State agency).

The Proposed Action would improve flows, eliminate instream passage barriers, and correct fish screen deficiencies on private lands that are related to irrigation. Activities related to flow improvements may include water acquisition or leasing. Activities related to instream barriers may include the consolidation of irrigation diversions to reduce the number of instream barriers or the removal of individual gravel push-up dams and replacement with diversion structures that provide for fish passage. Activities related to fish screens may include screening unscreened irrigation diversions or replacing obsolete screens with screens that meet NMFS criteria.

The following is a list of potential measures that Reclamation expects to implement or contribute to implementation. Depending on the subbasin-specific conditions, not all measures apply to all subbasins. Discretion will be used in determining which measures are appropriate in meeting the particular passage, flow, and screen deficiencies for each situation.

GOALS	POTENTIAL MEASURES
Correct passage barriers	• Consolidate diversions. • Remove push-up dams and replace with pump systems, infiltration galleries, or other permanent type structures with viable fish passage facilities.

Correct streamflow deficiencies

- Acquire water for flow during critical migration periods.
- Provide alternative irrigation diversion systems (minimize instream diversion/returns).
- Re-engineer existing diversion/wasteway configurations that permit excessive water withdrawals from the streams.
- Replace headgates

Correct screen deficiencies

- Utilize rotary drum screens that meet NMFS criteria.
- Utilize flat screen or other screen technology.
- Utilize groundwater well screens buried in river gravels/automated valve outlets.
- Utilize screen methods to protect fish from wasteway attraction flows.

Because the specific choice of locations and the number of willing participants is not known, nor can the choice of specific measures be determined at this time, the EA is prepared at a programmatic level.

When specific locations for these activities have been determined, Reclamation would fulfill other compliance requirements that are not covered by this EA. Examples of these additional requirements include:

- Cultural resource surveys to determine the presence of resources eligible for listing on the National Register of Historic Places (NRHP) in locations that may be affected by construction or operation of the proposed modifications.
- Consultation with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP) if NRHP-eligible resources are found.
- Surveys for listed or proposed threatened or endangered species.
- Any necessary permits under Section 404 of the Clean Water Act.
- State of Idaho permits for instream work.
- ESA consultation with NMFS and USFWS

2.3 General Implementation Description

Reclamation will be working to correct barrier, screen, and flow deficiencies related to irrigation withdrawals within the four identified Mountain Snake Province Subbasins. The number of structures (dams, diversions, intake structures, canals) varies among the four subbasins. A complete inventory of all structures in each subbasin is not currently available. Some data are available for the Lemhi and Upper Salmon subbasins, which have larger areas of irrigated agriculture than the Middle

Fork Clearwater or Little Salmon subbasins. The Lemhi Subbasin has more than 200 diversions or dams, and the Upper Salmon River subbasin has more than 150 diversions or dams (NPPC 2001) (see Section 3.3, Hydrology and Water Quality). The large number of instream structures illustrates the potential for substantial enhancement to salmonid habitat and survival rates through improved efficiency in water withdrawals, removal of instream barriers, and improved fish screens. Working cooperatively with private landowners, Reclamation proposes to implement incremental changes within these watersheds. Changes would involve redesign and alteration of irrigation structures to meet NMFS standards for screens and fish passage.

Figure 2.3-1 is illustrative of a typical irrigation system associated with a salmon-bearing stream, and identifies some of the obstacles to fish survival that can occur due to such a system. This example depicts a stretch of river with two diversion canals. Canal 1 represents the simplest form of irrigation diversion - an open canal or ditch without any water control structures or screens. Canal 2 represents a more complex system, with an existing intake system and a fish screen.

Point A on Figure 2.3-1 identifies a point of diversion into Canal 1. A diversion weir or structure at B-1 raises the river elevation to allow gravity flow into the canal. Among the problems for fish associated with such a structure are:

- Water intake is unregulated and restricted only by the size of the canal, rather than the irrigation need, which often leads to excess water withdrawal;
- There are no screens to restrict out-migrating juvenile salmonids from entering the canal; and
- The outfall (Point H-1) can attract adults migrating upstream that may enter the canal rather than continuing upstream. This outfall may be an attractant because flow from the canal may be of greater velocity and colder than water in the mainstem of the river.

The second diversion system is more sophisticated, but also presents a number of hazards for salmonids. A diversion structure at Point B-2 diverts water, and a control structure (C-1) limits the amount of water entering the canal. Typically, this is a manually controlled headgate that meters water into the canal as the gate is raised or lowered. A bifurcation structure is located at Point C-2, where excess water is returned to the river; the excess water returns along the wasteway (Point E) and spills into the river at Point H-2. The flow at this point could be another source of attraction for upstream-migrating salmon. The stretch of the mainstem river identified by Point G could be dewatered from water withdrawal at the two upstream diversion structures. This would make the river impassable to migrating fish. Farther along the canal, a fish screen is located at Point D; the screen is intended to divert all incoming smolts along the face of the screen and into a return pipe (Point F) that carries them back to the mainstem of the river. Efficiency of the screen depends on whether appropriate design criteria are met. The water continues along the canal, is used to irrigate the fields, and then is returned to the river by the same canal. Once again, the entry point into the river (Point H-3) can attract adults.

Reclamation is tasked by Action 149 to address issues related to barriers to passage, screening, and low flows caused by diversion systems similar to those described. The actions that address each of these three issue elements are detailed more specifically in the following sections.

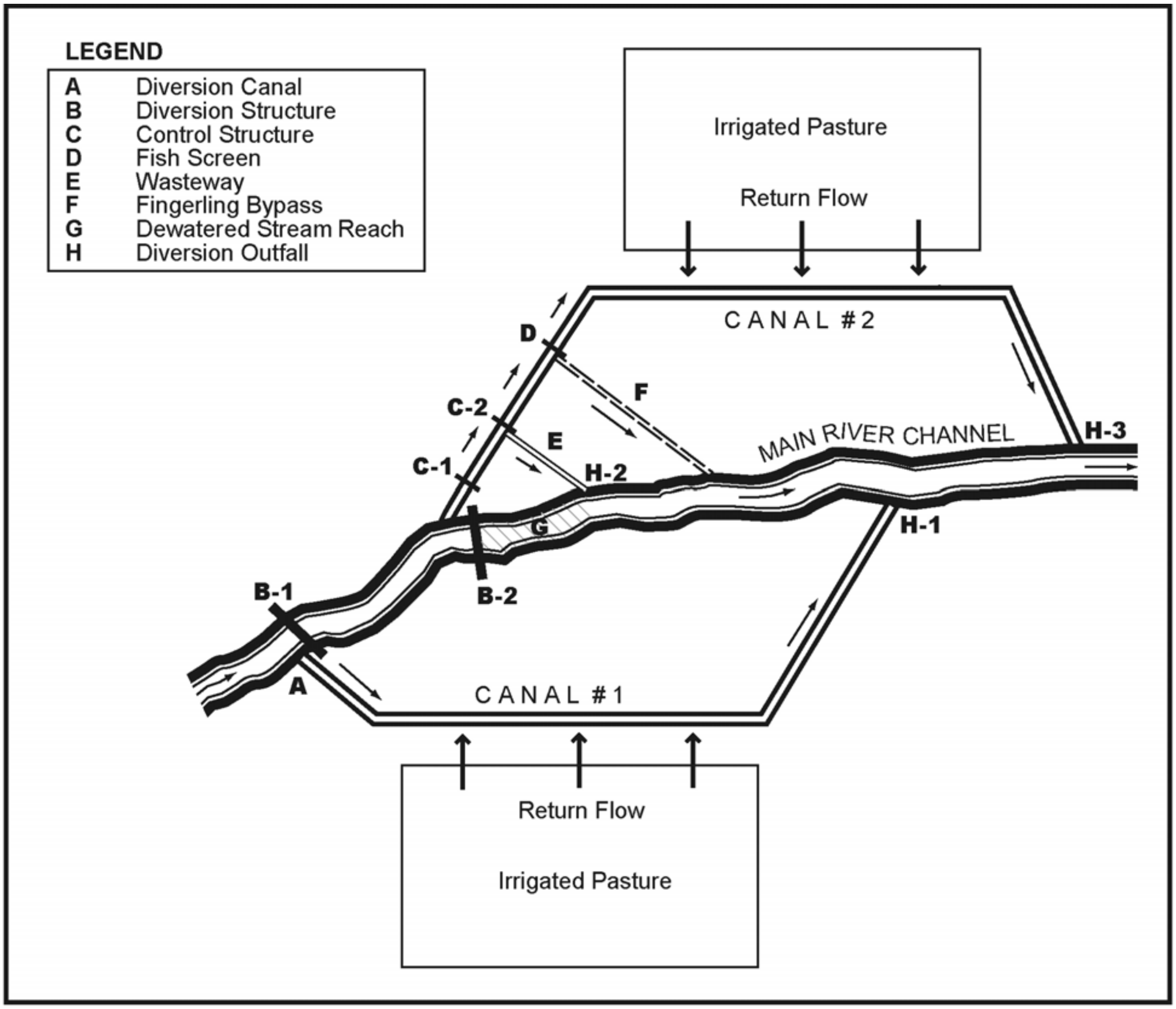

Figure 2.3-1. Typical fish hazards associated with irrigation water withdraw sy stems.

The intent of this graphic is to identify some of the many problems due to agricultural water withdrawals that salmonids encounter at many stages in their life cycle as they migrate downstream as smolts and back upstream as adults. These situations and various more are manifest in a variety of configurations throughout the subbasins. Any one irrigation facility can be associated with a combination of flow, barrier or screen deficiencies.

Table 1.4-1 summarizes the basic problems associated with each of these obstacles to the maintenance of healthy salmonid populations, the consequences of these problems, and typical solutions to be applied by Reclamation, and cooperating agencies and landowners. The solution to any one problem potentially can address any number or combination of flow, screen, or barrier issues. For example, replacement of a gravel push-up dam and uncontrolled canal inflow with a permanent, engineered diversion structure and controllable headgate may correct both a barrier and a streamflow problem. However, Reclamation must differentiate among flow, screen and barrier components of each implemented project for purposes of tracking and reporting accomplishments to meet terms of the FCRPS. These solutions constitute the specific on-the-ground actions that Reclamation will be making as a part of their response to Action 149.

2.3.1 Barriers to Fish Passage

Existing barriers to fish passage fall into two basic categories:

- Diversion structures without fish ladders that span the entire stream width and prevent upstream migration; and
- Diversion structures that do not span the entire stream width but severely alter streamflow patterns and prevent migration.

2.3.1.1 Diversion Weirs or Dams

Problem: Dams and weirs may prevent upstream fish passage because of excessive height, lack of fish ladders, or lack of an adequate downstream channel permitting adult fish passage to and beyond the diversion structure. These structures can remove 100 percent of the water from the river, dewatering a stretch of river between the structure and the downstream return channel. Often, this is due to a poor or inefficient irrigation diversion design that diverts excessive flows.

Photo 2.3-1. L6 Diversion structure on the Lemhi River.

Solution: Diversion structures can be modified to provide fish passage using NMFS-approved designs for both upstream and downstream migrants. If modification of the existing structure is not possible then replacement with a new structure with fish passage design may be necessary. Another alternative could be the use of infiltration galleries where irrigation water is collected through a perforated pipe buried in the streambed and transferred to the irrigation system by gravity or pumps. Solutions for diversion structures are often related to other system improvements such as headgate modification, replacement, or consolidation. An example is the recent L-6 diversion enhancement project on the Lemhi River, which was designed by Reclamation (Photo 2.3-1). The new diversion structure includes an adjustable weir and fish ladder that allows fish passage in all but the lowest flows (Reclamation 2000).

Table 2.3-1. Summary of Problems and Potential Solutions to Fish Passage in the Snake River ESU Subbasins.

	Barriers	Screened Diversions	Unscreened Diversions	Flows
Problems	• Water control and diversion structures within the mainstem of the river that create barriers to fish passage.	• Some existing screens do not meet current design criteria.	• Not all water diversion canals or intake pumps are screened.	• Excessive water withdrawals in streambed during critical times for upstream or downstream movement of fish can dewater streams or otherw ise prevent successful in- or out-migration. • Canals and irrigation structures that alter water flow patterns. • Return flows from irrigation canals that act as false attractants to migrating adults.
Consequences	• Upstream fish passage is blocked due to exces s height of barrier or complete water withdrawal. • Manipulation of gravels and rocks within the streambed has a negative effect on stream geomorphology which can alter riparian conditions and lead to deterioration of water temperature and water quality. • Failure of push-up dams can alter geomorphology of streams and fill the dow nstream low flow channel. • Not all associated structures, such as fish ladders, work as designed.	• Screens may not operate efficiently, failing to return all juveniles back to the mainstream of the river. • Screen bypass structures do not function as intended, leaving juveniles stranded. • Screens require excessive maintenance.	• Juveniles enter or are drawn into diversions, resulting in mortality during subsequent irrigation operations. • Juveniles can be stranded during flood irrigation operations, or sucked into pumps for spray irrigation operations.	• Adults are unable to move upstream to suitable spawning territory. • Juveniles are unable to move downstream to continue out-migration pattern. • Certain stream areas with suitable habitat for spawning go unused as spawning adult fish are unable to reach tributaries or stream reaches disconnected by dewatered areas. • Canal outfalls can serve as an attractive nuisance for upstream migrants. • Excessive w ithdrawal can dew ater streams.
Solutions	• Replace temporary pushup dams with permanent structures. • Provide upstream and dow nstream fish passage. • Where appropriate, replace barriers and intake structures with advanced alternatives, such as infiltration galleries buried in gravel, or pumps.	• Adhere to recognized design criteria for all screens, including water velocity, stream angle, structure and screen sizing, cleaning mechanisms, and other elements. • Ensure that adequate maintenance and operating mechanisms are in place for all screens. • Place appropriately designed screens in irrigation canals	• Place appropriately designed screens in irrigation canals. • Adhere to recognized design criteria for all screens, including w ater velocity, stream angle, structure and screen sizing, cleaning mechanisms, and other elements. • Ensure that adequate maintenance and operating mechanisms are in place for all screens	• Enhance efficiency of diversion structures, allow ing more water to remain in mainstem of river. • Efficiency measures, such as diversion consolidation, automated headgates, and control structures, allow more w ater to remain in the river to enhance fish passage. • Purchase permanent w ater right and transfer to a third party. • Design canal outfalls to prevent diversion of adults migrating upstream into canals.

NOTES **1.** Under Action 149, Reclamation is not responsible for improvements outside of the stream channel.
2. Under Action 149, Reclamation is not responsible for transportation-related improvements, such as culvert replacement

The following is a list of options that could be implemented by Reclamation to solve barrier problems. These are subject to the Best Management Practices (BMPs) (Appendix B) and NMFS review.

- Replace ineffective bank-to-bank gravel push-up dam with an engineered, permanent, bank-to-bank concrete diversion structure that accommodates fish passage
- Replace ineffective bank-to-bank gravel push-up dam with an engineered, permanent, bank-to-bank diversion structure that accommodates fish passage using natural materials
- Remove ineffective bank-to-bank permanent concrete diversion structure and replace with an engineered, permanent, bank-to-bank, concrete diversion structure that accommodates fish passage
- Remove ineffective bank-to-bank permanent non-concrete diversion structure and replace with an engineered, permanent, bank-to-bank diversion structure that accommodates fish passage using natural materials
- Replace ineffective bank-to-bank gravel push-up dam with an engineered, permanent concrete diversion structure that partially crosses the width of the stream and accommodates fish passage
- Replace ineffective bank-to-bank gravel push-up dam with an engineered, permanent diversion structure that partially crosses the width of the stream and accommodates fish passage using natural materials
- Remove ineffective bank-to-bank permanent concrete diversion structure and replace with an engineered, permanent, concrete diversion structure that partially crosses the width of the stream and accommodates fish passage
- Remove ineffective bank-to-bank permanent non-concrete diversion structure and replace with an engineered, permanent diversion structure that partially crosses the width of the stream and accommodates fish passage using natural materials
- Replace ineffective gravel push-up dam that partially crosses the width of the stream with an engineered, permanent concrete diversion structure that partially crosses the width of the stream and accommodates fish passage
- Replace ineffective gravel push-up dam that partially crosses the width of the stream with an engineered, permanent diversion structure that partially crosses the width of the stream and accommodates fish passage using natural materials

- Remove ineffective permanent concrete diversion structure that partially crosses the width of the stream and replace with an engineered, permanent, concrete diversion structure that partially crosses the width of the stream and accommodates fish passage

- Remove ineffective permanent non-concrete diversion structure that partially crosses the width of the stream and replace with an engineered, permanent diversion structure that partially crosses the width of the stream and accommodates fish passage using natural materials

- Barrier removal, headgate reconstruction, screen accommodation associated with surface water diversion consolidation.

General Impacts: The two primary concerns regarding replacement or modification of instream structures is the disturbance to fish habitat and the potential for harming Federally listed salmonids that occur in the subbasins. Construction must be done at the time of the year when flows are low and with the least chance that listed species may be present. Construction must use accepted practices to minimize the potential for erosion and sedimentation. Other potential impacts include the disturbance of riparian vegetation during the construction phase.

2.3.1.2 Push-Up Dams

Photo 2.3-2. Push-up dam on Lemhi River.

Problem: Push-up dams (Photo 2.3-2) are created by using heavy equipment (such as a bulldozer or excavator) to move existing or place new gravel and rock, trees, stumps, cars, and refrigerators within the river to create a diversion structure. In some instances, the dam is repaired or replaced as needed if spring runoff washes it out. In others, it is removed annually, after one irrigation season, then replaced at the beginning of the next irrigation season. Although inefficient and harmful to water quality and fish, this traditional practice is a relatively inexpensive method of water diversion. These structures often prevent fish movement, lack passage structures, and contribute to channel infill. Many years of wash-out and rebuilding of these dams can result in a build-up of gravels downstream of the dam. This gravel build-up can alter the river geomorphology, obliterate the low flow channel, and severely constrain fish passage. In addition, water may flow entirely within the porous gravels accumulated downstream of the dam, leaving no surface flow for juvenile or adult fish passage.

Solution: Push-up dams can be replaced with diversion structures that provide adult and juvenile fish passage and efficient water withdrawal. This can include permanent structures, infiltration galleries, or pumps. If a permanent structure is used, adequate means of adult fish passage must be maintained. This can be a dam or weir with a properly designed fish ladder, a weir or dam on only one side of a bifurcated channel, or a structure such as a vortex weir that combines the water retaining capacity to build enough head to divert water into a canal with adequate water bypass to create a fish passage channel. Infiltration galleries work by collecting water through a perforated pipe buried beneath the streambed. A pump or gravity system moves water from the pipe to a conveyance system. This relatively new technology provides several benefits: because there is no diversion structure, there is no blockage of fish movement, water withdrawal is efficient, and the system involves less maintenance than other options.

A variety of fish ladder types are available. Regardless of type, the two most important design factors are fish ladder pool size and dissipation of downstream energy (Reclamation 1997). A minimum recommended pool size for fish ladders is normally 6 feet wide by 10 feet long by 6 feet deep. The pool should allow at least 0.2 cubic feet of water per pound of fish. Energy dissipation requirements often control design. Average maximum velocities between pools should not exceed 8 feet per second.

General Impacts: The general impacts for replacing pushup dams are the same as those described under diversion weirs or dams (2.3.1.1). The difference is that mounds of gravel must be removed from the streambed that were used as a diversion structure rather than a concrete or wood structure. The same general principles apply for reducing effects to fish and fish habitat but different mechanical methods would be employed to remove and/or redistribute the mounded gravel.

2.3.1.3 Irrigation Ditches as Attractive Nuisance

Problem: Return flow entering the mainstream of a smaller river such as the Lemhi or other tributaries to the Salmon River may actually be greater than the flow within the stream channel. The return flow may also be cooler due to shading or volume effects. Returning adult fish may be attracted to this return flow, mistaking the return flow channel for the mainstem river. Fish waste valuable energy attempting to navigate through canals, may become trapped, and can die.

Photo 2.3-3. Attractive nuisance flow from irrigation return.

Solution: Attractive nuisance flows (Photo 2.3-3) are often associated with other problems, such as improperly designed diversions. More accurately metering of water intake would reduce the need for return flows that could create a false attraction. In addition, necessary return flow discharges can be designed to minimize the attraction of these flows to salmon. In some cases it may be necessary to place some type of screening at the return point to eliminate access for upstream migrants.

General Impacts: Because the solutions to attractive nuisance flows are implemented outside the stream channel there is less of a concern regarding disturbance to fish habitat than with instream construction practices. Still, all construction should use accepted BMPs to minimize any sediment that enters the stream from construction or ground-disturbing activity. Proper design is a key component to ensure adequate delivery of irrigation flows while minimizing the potential for an attractive nuisance at the return point.

2.3.2 Fish Screens

Issues related to fish screens or pumps typically fall into 2 categories: (1) diversion canals or pumps that are unscreened; and (2) existing fish screens that do not meet current design criteria for fish screens, as established by NMFS (NMFS 1995).

2.3.2.1 Unscreened Diversion Ditches

Problem: Older diversion canals were typically designed simply to convey water from the river to the irrigation site. These designs did not accommodate juvenile fish migrating downstream. Juvenile fish are particularly vulnerable and may not be able to escape the velocity of the intake flow into the irrigation canal. Juvenile mortality can be high without a screening device to gather and return fish to the river. Juvenile mortality can occur from intake into irrigation pumps, flood irrigation onto fields, increased predation in a vulnerable situation, and poor water quality within the canal, among other causes.

Photo 2.3-4. New fish screen in Lemhi Subbasin.

Solution: Fish screens should be designed according to NMFS criteria and return juveniles safely back to the river (Photo 2.3-4).

General Impacts: There would be minor impacts associated with installation of NMFS screens on irrigation canals because of the disturbed nature of these sites and the distance from natural water bodies. These sites are generally previously disturbed sites in an agricultural setting. In limited cases it may be necessary to use fish screens at the point of diversion. These would require extended coordination with NMFS and IDFG. Potential impacts would be similar to those described for diversion weirs and dams (2.3.1.1) and would require similar protection measures regarding the timing of construction and instream BMPs.

Photo 2.3-5. Nonconforming wiper-style fish screen.

2.3.2.2 Non-Conforming Fish Screens

Problem: Even where fish screens exist, they may not conform to new screen criteria as devised by NMFS (NMFS 1995) (Photo 2.3-5). Old screens may exhibit a variety of problems, including excessive screen mesh size, poor screen location, cleaning and maintenance issues, high approach velocities, and problems with bypass pipe design, all of which contribute to juvenile mortality. If proper design criteria are not met, screens may not function as intended, resulting in juvenile mortality, excessive maintenance requirements, and other drawbacks. In general, newer screen design criteria result in screens that require significantly less maintenance while minimizing juvenile mortality by sweeping young salmon efficiently back to the river through bypass features.

Solution: Modern screen criteria take into account such factors as migrational stage of fish present, screen location, both sweeping and approach water velocity, design features to ensure that screens are self-cleaning and low-maintenance, and adequate bypass design. Properly designed screens ensure that outmigrating juvenile fry and fingerlings are gathered up by the natural flow sweeping the face of the screen in a non-harmful manner, guided into a bypass pipe of sufficient size, and returned to the mainstem of the river in a location with sufficient flow velocities to minimize predation and carry them safely into the downstream current. The return pipe should meet all design criteria, including minimum and maximum flow velocities.

Options that may be implemented by Reclamation according to the BMPs and NMFS approval include:

- Standard screened surface water diversion and return
- Screened diversion intake buried in stream channel
- Screening pump diversions from stream channel

General Impacts: The vast majority of screen replacement would be implemented in irrigation canals away from the stream channel. These projects would use standard construction BMPs and would have a low potential for adverse effects to terrestrial or aquatic resources. NMFS and the Idaho Department of Fish and Game (IDFG) have developed criteria for fish screen design that will be implemented for all fish screens designed and constructed under the implementation of Action 149.

2.3.3 Low Flow Issues

The Mountain Snake Province Subbasins are located in an arid climate and fed predominantly through the melting of the snowpack in the surrounding mountain ranges. As the snowpack diminishes in late summer, low flow in the rivers can be exacerbated by irrigation withdrawals. For example, according to the Lemhi Model Watershed Plan, "Water quantity and irrigation are almost inseparable in the Lemhi River watershed. Much of the instream water flow is used at least once, and in some cases, as many as three times for irrigation purposes" (ISCC 1995).

Problem: Inadequate flow in the river results in conditions unfavorable to either upstream migration of spawning adults, or out-migration of juveniles. Intensive diversion of water for agriculture can disconnect tributaries from the mainstem river. In the Lemhi, it is estimated that fish production has been lost from at least 10 tributary creeks that previously supported anadromous fish populations (ISCC 1995), eliminating significant stretches of spawning habitat due to dewatering.

Even main river channels can be dewatered for short stretches, downstream from major diversions before any water is returned to the main channel. For example, in the past as much as a 3-mile long stretch of the lower Lemhi was vulnerable to dewatering for part of the summer during low flow years (ISCC 1995). It is not necessary for the river to be entirely dewatered for the channel to become impassable. Depending on river bottom conditions, flow can occur predominantly through river gravels during times of extremely low flow, effectively preventing fish passage.

In some river systems, much of the water flowing through tributaries is lost directly to alluvial gravels, where it sinks into underground flows. This is estimated to be the case in the Lemhi Subbasin. Of the estimated annual water yield of 1.055 million acre-feet in the subbasin, an estimated 0.875 million acre feet (MAF) are lost to evaporation, plant transpiration, and underground flows (ISCC 1995) by the time it reaches the town of Salmon at the confluence with the Salmon River.

Solution: The solution to low flow problems is complex. It is intertwined with Idaho water rights law, availability of water, the development of new technologies for water use, and Reclamation's parameters for fulfilling Action 149. One potential solution is to increase the efficiency of water use. The previously cited reconfiguration of the L-6 diversion on the Lemhi is an example of an improvement to an irrigation diversion that was intended to allow more water to remain in the river without compromising an irrigator's water right. Efficiencies to water use can come from improvements such as diversion consolidation, installation of better diversion control structures, or installation of manual and/or automated headgates. As improvements to other diversions occur along the river, it is reasonable to expect cumulative improvements to flow. Reclamation will investigate the potential for purchase of water rights with willing land owners but must operate within the constraints of Idaho water law. In addition, Reclamation must complete its obligations in each subbasin within 10 years. This would require the permanent transfer of purchased water rights to a third party that could ensure that water remains in-stream.

General Impacts: Solutions that include modifying, consolidating, or replacing headgates would require some construction adjacent to streams. While the problems associated with this stream-side construction are not as serious as construction within the stream channel, precautions are needed to minimize sediment entering the stream or the disturbance of fish habitat. Implementation of BMPs would sufficiently minimize any risk to listed salmonids. Construction also could affect riparian vegetation and there may be a need for appropriate mitigation following construction disturbance. Solutions that require the transfer of water rights would not require any construction and would have no adverse effects. These BMPs are interim guidelines that will be finalized following public comment on this EA.