Inefficiency is endemic to the arrangements that govern most of irrigated agriculture. Particular attention is paid in this chapter to two problems: (1) Public demands for instream flows may be subordinated to farmers’ demands for water withdrawals, and (2) drainage water from irrigated land may be excessive in quantity and pollutants.

A total value framework is presented for benefit cost analysis and methods of estimating nonmarketed use and existence value are discussed. Assuming that the benefits of water quantity and quality in instream and wetlands uses can be estimated, the chapter considers what kinds of institutional arrangements can be developed to ensure that these benefits are fully addressed in water management and policy. Commonly suggested solutions include regulation, administrated efficient prices, and property rights to facilitate water markets; more recently, the possibility of stable cooperative solutions to common property problems has been suggested. These alternative approaches are examined at the conceptual level. Many of the inefficiencies of the water economy could be eliminated via water markets based on transferable property entitlements. However, this solution alone is unlikely to provide adequately for instream and wetlands uses. Literature on principal-agent problems is discussed which suggests some promising approaches.

The quantity of drainage water from irrigated agriculture is likely to be excessive and its quality suboptimal for further use, so long as governing institutions fail to provide adequate incentives for efficient irrigation and drainage. While inefficiency is endemic throughout irrigated agriculture, this chapter will emphasize nonfarm demands for instream flows and downstream
water of acceptable quantity and quality. Particular attention will be paid to estimating the value of water in recreational and ecosystem support uses, and designing institutions that bring these values to bear on irrigators’ water application and drainage decisions.

Consider an irrigation district serving a few hundred independent farmers, somewhere in the Western United States. The district is a nonprofit entity that buys water from a Federal agency, say the U.S. Bureau of Reclamation (Reclamation), at a price well below its real cost and sells it to member farms. The district operates and maintains its internal delivery system, and establishes the institutional arrangements among its members with respect to water rights, allocation of water excess to satisfying its obligations under water rights, delivery schedules, and the conditions for water transfer (or lease of water rights) among members.

It is likely that the district pays anywhere from one-quarter to one-twelfth of the real cost of providing water to it, the remainder being borne by citizens all across the Nation (U.S. Department of the Interior, 1980). In addition, much of the irrigated land is devoted to crops that are subsidized via the U.S. Department of Agriculture’s (USDA) commodity programs, resulting in a “double subsidy” (Moore and McGuckin, 1988). Many of the farms in the district would not be viable economic entities in the absence of these subsidies, a fact that has obvious implications for the pattern of land settlement in the West. On the other hand, subsidization of water in service of farm viability objectives likely leads also to excessive application.

The district is in a relatively low rainfall zone and, in common with many arid area irrigation projects throughout the world, occupies land with relatively high concentrations of various salts in the soil. These salts are dissolved by irrigation water, which would benefit crop yields if drainage was adequate. Eventually, however, water tables rise, bringing excessive concentrations of salts back to the root zone. Like many Western irrigation projects, the farms in the district are experiencing salinity problems. In addition, the quality of ground water -- which is used conjunctively with surface water in the district -- is reduced, and some of the salt-polluted drainage waters return to the surface streams, reducing their quality. The salinity problem is partially internal to the district as farmers bear costs of drainage problems to agricultural productivity, and external as downstream users of surface and ground water suffer from reduced water quality. Downstream users include other irrigators, urban users, and fish and wildlife in the wetland that is the ultimate downstream sink. Many plants and aquatic creatures are sensitive to ordinary salts and thus damaged when salt concentrations rise. In addition, elements such as selenium, that are toxic in trace quantities, occur in drainage water from the district.