

Flood Damages Prevented U.S. Army Corps of Engineers – Sacramento District

This paper provides a brief overview of the methodology employed by the U.S. Army Corps of Engineers in its estimates of “damages prevented” by Corps flood risk management reduction activities. This performance measure is used in part to demonstrate the effectiveness of some of the nation’s investments in water resources infrastructure.

Background

As part of the Congressional documents for the Energy and Water Development Appropriations Bill of 1984, House Report No. 98-217 directs the U.S. Army Corps of Engineers to issue an annual report to Congress on floods, flood damage, and other natural disasters requiring Corps intervention. Damages prevented are reported by reservoir project. Accordingly, the Sacramento District Office of the Corps of Engineers compiles and releases estimates of cumulative flood damage prevention reports annually on flood control reservoirs within its jurisdiction to its headquarters in Washington D.C.

The damages prevented report represents preliminary estimates by reservoir using data available at the end of the fiscal year. Because the Corps is responsible for all federal flood control storage, the report includes damages prevented by Corps-operated projects and non-Corps projects that have federal flood control storage. Regardless of the project owner, the Corps has responsibility for all federally owned control storage.

When compiled by all Corp districts, data provides a broad national picture of storm events and the extent of national beneficial flood damage reduction produced by the Corps. Because of the general nature of the subject and the rapid compilation of the preliminary estimates, the report’s accuracy and completeness are considered preliminary and not intended for detailed research.

Deriving Flood Damages Prevented Estimates

The effect of reservoir operations on downstream flow (damages prevented) is determined by routing and comparing regulated and unregulated (i.e. natural or without-project) river stages for selected sites. This involves comparison of the observed flows and damages with the flood reduction structure with the



unregulated flows (those that would have been observed without the flood control dams) and the potential resulting damages. The reduction in river stage or flow that resulted from reservoirs operations is used to index the value of damages prevented.

Steps in Determining Damages Prevented-

In general terms, flood damages prevented are determined in the following manner:

1. Elevation of a given flood stage is determined at a gauged location at National Geodetic Vertical Datum (NGVD) or other measuring reference tool with consideration of the flood damage reduction structure operation.
2. A theoretical elevation or level of water without the project (dam, levee) is established.
3. A derived stage-damage function or curve is estimated for both the actual and the theoretical elevations
4. Difference in damage estimates represents damages prevented.

The stage-damage curve estimation, referred to above in step three, is based on a statistical procedure for predicting damage to individual flood plain structures as a function of river stage and the probability of reaching that stage during a particular flood event. The stage-damage curve is a rating curve within a river reach that shows the amount of damage that would occur for different river levels. To develop the curve, potential damage is estimated using topography along the river to determine the areas and the number of residential structures or other improvements/land use conditions that would be inundated at a given flood level.

A floodplain inventory is one of the most important components of the stage-damage curve and, accordingly, the damages prevented estimate. In general, older and out-of-date floodplain inventories will probably underestimate the actual value of the damages avoided or prevented. One reason for this is that due to the presence of a flood-control structure more development is likely to have taken place in a floodplain since construction was completed. Secondly, technology and use of larger homes have added to the valuation (aside from cost adjustments) within the potential floodplains. Additionally, capital equipment costs per acre for agricultural lands have increased over the past 50-60 years while per acre labor requirements have decreased. This equipment is vulnerable in the case of a flood event and would add to the tally of property at risk.

Components of Floodplain Inventory

A flood plain inventory is a list of floodplain property. It is used to determine the number and type of structures, their value, and their first floor elevations (where water enters the structure). An inventory is usually accomplished through contour mapping or USGS maps to establish for ground elevations.

The number and type of structures are important parameters in estimating potential flood damages. The number of structures in the study floodplain area

includes detached garages, sheds, barns, and similar structures. Structure types are defined as residential, commercial, industrial, and public.

Structure value is also included in Corps floodplain inventories. These values reflect the replacement costs minus depreciation to the existing (pre-flood) structure. Replacement is the cost of physically replacing the structure subjected to flooding. Depreciation accounts for deterioration occurring prior to flooding and variations in remaining useful life of the structure.

Another element involved in the inventory is the determination of the structures content value. Historically the value of residential, commercial, and industrial contents has been equated to some percent of the structure's value determined by survey.

Agricultural crops grown in the area are also considered as part of the inventory at risk. Losses to perennial crops are evaluated based on their establishment costs, their longevity, their annual production costs, and the value of the produce lost. Annual crops are valued with consideration for the annual production costs incurred prior to a flood event and the net income lost as a result of the flood. Agricultural equipment at its depreciated value is included as property at risk should a flood event occur.

Post Flood Assessment Adjustments

In March, 1999 the U.S. Army Corps of Engineers, Sacramento District published the Post Flood Assessment Report, Sacramento and San Joaquin River Basin, California. It was recognized in the report that many of the flow-damage curves used in the computation of the "damages prevented" were outdated and that updating the damage assessments were necessary. Based on interviews and damage information collected from affected California counties and individuals, adjustments were made to previously submitted "Damages Prevented Reports" to represent more accurate information on the Shasta Dam and Sacramento River Flood Control Project, and the Folsom Dam and American River Levee. The post flood evaluation covered the flood events of 1983, 1986, 1995, and 1997. The accompanying table for Shasta Dam and Folsom Dam reflects these updated numbers.

Accompanying Table

The table reflects the annual damages prevented reported for each year that a flood event occurred. The total of these data indicate the cumulative damages that have occurred over the life of the project. It should be recognized that these are nominal dollars which do not take into considered any effects on inflation. To determine the current value of all flood damages prevented over the life of the project. These data are adjusted using the Gross Domestic Product Implicit Price Deflator. Adjustments in each recorded annual damage prevented entry illustrate the October, 2010 price level for purposes of comparison with current cost estimates of providing flood risk management.