CHAPTER 7.
ALTERNATIVE ANALYSIS APPROACH

FLOODING ISSUE IDENTIFICATION

Flooding issues and concerns were identified by examining historical flooding patterns along the Yakima River, reviewing previous studies, and collecting information from Advisory Committee members and County staff. Advisory Committee members completed a flood problem questionnaire during the second committee meeting; members absent from the meeting were contacted by telephone for their input.

Each flooding issue was discussed further at Advisory Committee meetings to define the problem, evaluate related issues, and determine a range of solutions. Higher priority issues were discussed in greater detail. Specific flood hazard management options were then developed to address each flood issue.

FLOOD HAZARD MANAGEMENT OPTIONS

A variety of options is available to address flooding concerns in the Yakima Valley, involving engineering, environmental protection and enhancement, and planning measures. Comprehensive flood hazard management emphasizes selecting the appropriate mix of approaches to minimize the impact of flooding on the community for the foreseeable future.

Flood hazard management measures are commonly classified as structural or nonstructural. Structural measures involve physical activities in or near the river, such as excavation, placement of bank protection materials, and other engineering and construction activities. Nonstructural measures can involve drainage and land use regulations, flood preparedness programs, public education, or maintenance programs. It is the policy of the current federal administration to encourage the use of cost-effective, long-term nonstructural alternatives.

The Advisory Committee examined potential structural and nonstructural solutions to the problems identified using summary sheets detailing various flood hazard management options. The summary sheets, included in Appendix G, can be used to analyze solutions to future flooding problems, or as educational material for private property owners addressing flood hazard issues. The options are categorized by their objective and briefly described below.

Nonstructural Measures

Public Information

Public information activities to advise people of the risks associated with flood hazards and about flood insurance and ways to reduce flood damage can include the following:

- Elevation certificates
- Map determinations
- Outreach projects
- Hazard disclosure
- A flood protection library
- Flood preparedness programs.

Regulatory and Mapping

Regulatory and mapping measures to provide protection for new development through land use regulation and the collection of accurate floodplain information can include the following:

- Higher regulatory standards
- Low density zoning
- Open space preservation
- Ordinance consistency
- Interagency agreements
- Additional flood data, including accurate floodplain and floodway mapping
- Flood data maintenance.

Flood Damage Reduction

Flood damage reduction measures address flood damage to existing buildings. Removing or reducing flood hazards can be accomplished through the following measures:

- Acquiring or relocating flood-prone structures
- Floodproofing flood-prone structures
- Developing repetitive loss plans.

Flood Preparedness

Flood preparedness activities involve emergency management. Actions are taken to minimize the effects of flooding on people, property, and the contents of buildings. Flood preparedness measures include the following:

- Individual action plans
- Comprehensive planning
- Flood warning systems
- Flood facility maintenance programs
- Dam safety programs.

Structural Measures

Alignment Control

Alignment control alternatives, designed to accommodate discharge along a course that allows the channel to develop without eroding adjacent property, can include the following:

- Spur dikes
- Flow realignment
- Vane dikes
- Cutoff channels.

Bank Protection

Bank protection measures, designed to produce a stable, durable streambank that can withstand floodwaters up to the predicted 100-year flood flow, can include the following:

- Re-establishing riparian vegetation (bioengineering)
- Cabling trees
- Constructing approach dikes
- Installing gabions
- Fencing
- Constructing windrow revetment
- Reducing bank slope
- Constructing standard trench fill revetment (riprap).

Conveyance Capacity

Conveyance capacity is the amount of discharge that can occur in a river before water spills over the bank and floods adjacent areas. It is determined by such factors as channel bed slope, cross-sectional area, and channel roughness. Increasing the first two or decreasing the last increases conveyance capacity. Conveyance capacity alternatives include the following:

- Gravel bar scalping
- Construction of overflow channels
- Vegetation and debris removal
- Channel widening or deepening.

Floodplain Protection

Floodplain protection measures reduce flood hazards for property, structures, and occupants in the 100-year floodplain. Protection from inundation, floating debris, sediments, and the force of water flowing in the floodplain may be achieved through the following alternatives:

- Setback levees
- Low dikes (floodplain levees)
- Ring levees
- Cutoff levees
- Storage reservoirs
- Floodproofing of structures.

Streambed Controls

Streambed controls prevent streambed degradation and upstream headcutting, and control bed slope, bed elevation, and water surface elevation by dissipating river energy that would otherwise alter the characteristics of the streambed. Streambed controls include the following:

- Stabilizers
- Drop structures.

ALTERNATIVE ANALYSIS AND SELECTION

Potential flood hazard management solutions were developed for each issue identified in this study. The potential solutions include construction projects, new policy decisions, land use modifications, additional development standards, and options for retrofitting existing structures. Several criteria were considered in selecting the alternatives. The alternative that

best met the goals and objectives of the CFHMP and that received support from the Advisory Committee was selected for recommendation.

Considerations for Evaluating Alternatives

Evaluating any flood hazard management alternative requires an understanding of existing floodplain use, a clear community vision of future floodplain use, and a review of current floodplain management practices, both within the community and across the nation. The alternative evaluation must also take into consideration the following:

- Ease of implementation
- Cost effectiveness
- Potential for success in solving the issue and providing public benefit
- Environmental considerations
- Applicable policies and regulations

Cost-effectiveness was evaluated by comparing planning-level cost estimates to potential public benefits. Cost estimates were also used to approximate overall funding requirements for the CFHMP. Preliminary cost estimates were based on unit cost data compiled from several sources and verified with County staff. Unit costs were obtained from recent County and COE projects, WSDOT bid tabulation summaries, cost guides (e.g. Means), contact with construction contractors, and KCM data. Markups for contingencies, engineering, and other indirect costs are commonly accepted values.

Potential for success was determined by conducting a reconnaissance-level engineering analysis, in which options were investigated without too much time being dedicated to any specific design. Such an analysis evaluates if the flooding issue is specifically addressed, considers the public benefit derived, reviews the existing regulatory environment, and considers funding possibilities, environmental impact, and community values. If appropriate, computer analysis tools are used to assess potential changes in river hydraulics and to perform floodplain overlay analysis. Such tools include HEC-2, a river conveyance capacity computer model, and ARCVIEW, GIS analysis software. The goal of the reconnaissance-level analysis is to determine the feasibility of a solution.

Due to the possible far-reaching effects of flood events, solving flooding problems sometimes requires the implementation of a variety of structural and nonstructural measures; a selected solution may include both short- and long-term alternatives.

Flood hazard management measures that involve structural modification of the floodplain produce unavoidable environmental impact through changes forced on natural processes. The impact on fisheries and wildlife; on scenic, aesthetic, and historic resources; on water quality; and on hydrology were considered in evaluating alternatives. A table of effects associated with various flood hazard management alternatives (Table 7-1) was provided to Advisory Committee members during the alternative selection process. Upon completion of the CFHMP, environmental assessment documentation—a SEPA checklist—will be prepared.

Applicable policies and regulations were also considered in the alternatives analysis and selection. Alternatives were evaluated for consistency with the goals and objectives developed in this CFHMP, policies currently being developed in the local GMA process, and applicable

federal and state regulations. Only alternatives consistent with existing regulations and policies were selected for recommendation.

Alternative Selection

Recommended alternatives were selected according to ratings given by the Advisory Committee. Advisory Committee members rated each alternative on a scale from one to three. A rating of one meant that the member considered the alternative unacceptable; two meant acceptable, and three meant preferred. The ratings were totaled for each alternative, and the alternative receiving the highest rating was recommended. Advisory Committee voting results are tabulated in Appendix H.

TABLE 7-1
PROBLEM ADDRESSED AND ENVIRONMENTAL IMPACT ASSOCIATED WITH FLOOD HAZARD MANAGEMENT MEASURES

Alternative (a)	Problem Solved (+ = problem solved; 0 = problem not addressed; - = problem aggravated)							Impact (+ = positive impact; 0 = no impact; - = negative impact)					
	Channel Migration	Bank Erosion	Conveyance Capacity	Property Protection	Streambed Degradation / Aggregation	Public Knowledge	Long-term Flood Control Expenditures	Fisheries	Wildlife	Scenic/Aesthetic /Historic	Water Quality	Hydrology	Recreation
Non-Structural													
Public Information Program	0	0	0	+	0	+	+	+	0	0	+	+	0
Regulatory Measures	+	0	+	+	0	0	+	+	+	+	+	+	+
Flood Damage Reduction of Existing Structures	0	0	0	+	0	0	+	+	+	+	+	+	+
Flood Preparedness/ Emergency Management	0	0	0	+	0	+	-	0	0	0	0	0	0
Alignment Control													
Spur Dikes	+	+	-	+	-	0	-	+	0	0	+	0	0
Flow Realignment	+	+	-	+	-	0	-	-	-	-	-	-	-
Vane Dikes	+	+	-	+	-	0	-	-	-	-	+	-	0
Cutoff channels	+	+	-	+	-	0	-	-	-	-	-	-	-
Bank Protection													
Bioengineering	+	+	0	+	0	0	+	+	+	+	+	0	0
Cabling Trees	+	+	-	+	0	0	0	+	+	+	+	0	0
Approach Dikes	+	+	-	+	0	0	-	-	-	-	-	-	0
Gabions	+	+	-	+	0	0	-	-	-	-	0	0	0
Fencing	+	+	-	+	0	0	-	+	0	0	+	0	0
Windrow Revetment	+	+	-	+	0	0	-	0	0	0	+	0	0
Reducing Bank Slope	+	+	+	0	0	0	0	0	0	0	0	0	0
Standard Riprap	+	+	-	+	0	0	-	-	-	-	+	0	0
Conveyance Capacity													
Gravel Bar Scalping	0	+	+	+	+	0	-	-	-	0	-	0	0
Overflow Channels	+	+	+	+	0	0	-	+	0 to +	0	0	0	0
Vegetation & Debris Removal	0	-	0	0	- or +	0	-	-	-	-	-	0	- to 0
Channel Widening or Deepening	+	+	+	+	+	0	-	-	-	0	- to 0	0	- to 0
Floodplain Protection													
Setback Levees	+	0	-	+	0	0	-	+	+	+	+	0	+
Low Dikes (Floodplain Levees)	+	0	-	+	-	0	-	-	-	- to 0	-	-	-
Ring Levees	+	-	-	+	-	0	-	0	0	- to 0	-	0	0
Cutoff Levees	+	-	-	+	0	0	-	-	-	- to 0	0	0	0
Storage Reservoirs	+	+	0	+	0	0	-	-	-	- to 0	- to 0	+	0 to +
Floodproofing of Structures	0	0	0	+	0	0	+	0	0	0	0	0	0
Streambed Control													
Stabilizers	+	+	-	0	+	0	-	-	-	-	+	0	0
Drop Structures	+	+	-	0	+	0	-	-	-	-	+	0	0

a. See Appendix G for further information on flood hazard reduction alternatives