

Chapter 8

Conclusions and Plan Recommendations

Chapter 8

Final Plan Elements

This chapter presents the elements of the Comprehensive Flood Control Management Plan study outlining the future management of the Snohomish River levee system and floodplain areas. The background for developing these elements is presented in Chapter 7.

The final plan is based on results of the modeling efforts, the consensus of the flood control study workshop group, and further review and consultation with the State Departments of Ecology, Fisheries, and Wildlife. Other modifications to the final plan elements resulted from agreements reached as a consequence of the November 1990 floods.

The plan elements discussed below are intended to be workable within the framework of the existing flood protection system. The goals for level of protection are driven by the need to make improvements to the existing levee system, create more equity between the districts, and to build a safe overtopping levee system throughout the valley. The need to make improvements, however, is balanced by the costs involved. Since these flood damage reduction measures are an on-going long term process for which some future details are not known at this time, a plan review process has been outlined to address the inevitable changes and required modifications.

In addition, plan elements include construction and maintenance standards sensitive to fish and wildlife, measures to protect significant habitat features, and options to enhance and/or create fish and wildlife habitat.

Summary of Plan

The plan elements are summarized below. This summary is followed by a detailed discussion on each element of the plan.

- **Level of Protection** - levee overtopping profile based on the Levee and Dike System Coordination Agreement (Appendix E).
- **Levee Design and Maintenance Standards** - adopt the standards in Appendix C.
- **Flood Fight Policies** - adopts the flood fight policies in Appendix F.

- **Habitat and Wetland Needs** - identifies opportunities for joint flood damage reduction and habitat improvements.
- **Land Use Policies** - recommends continuation of existing land use policies.
- **Plan Implementation** - recommends priority projects for implementation. Primary responsibility remains with the diking districts. Funding needs are identified.
- **Coordination of Flood Protection** - recommends closer coordination between districts.
- **Plan Review Process** - outlines a periodic review process for monitoring levee development and plan implementation.
- **Other Recommendations** - identifies the need for improved flood warning, flood awareness of residents, and the development of trail systems which utilize the tops of levees.
- **Action Plan** - identifies actions needed for full implementation of this plan.

Level of Protection - Planned Levee Profile

The level of protection a levee provides is defined as the largest flood which does not overtop the levee. It is important to note that this definition does not take into account the ability of that levee to withstand overtopping. Acknowledging that the levee system will overtop even under a completed plan, the flood control workshop participants decided a system designed to withstand overtopping was essential. This is necessary to assure the integrity of the levee system and to minimize levee failures.

This concept is the basis for the final plan configuration. Levees designed to overtop are initially more expensive than that of non-overtopping levees (of the same height). However, given the eventuality of overtopping, it is a more prudent use of resources to take water safely onto the floodplain via designed overtopping levees. This is in contrast to non-overtopping levees which have a much greater risk of failure and destructive flooding when they overtop.

The intent of the recommended level of protection is to reduce flood damages as much as possible, not to keep out the largest flood possible. Experience from the Thanksgiving weekend flood in November 1990 demonstrated the devastation which occurs from levee failures. The level of

protection is therefore established which allows for safe overtopping of levees. The Soil Conservation Service, for example, has expended considerable resources in checking the materials underlying the Marshland levee and designing solutions to help prevent similar failures in the future.

Appendix E shows in detail the planned levee profile for the Snohomish valley. A summary of this profile in relation to the modeled fully contained 5-year flood and the November 1986 level is shown in Table 8.1. The fully contained 5-year flood profile means that no water leaves the main river channels and is fully contained by the levee system. This does not occur at the present time since some levees are currently below this level. The relationship to the November 1986 flood levels is shown because the intent of the Levee and Dike System Coordination Agreement is to contain a flood equivalent to a Snohomish gage height of 32.6 feet (November 1986 peak).

Within the framework of the Agreement, Ebey Island and all the lower delta special districts may build their levees to the 5 year + 1 Ft level. This level will contain extreme tide events, and in the lower delta, most floods. These districts then will have the opportunity to bring their levees to the Corps' standards under Public Law 84-99. It is also desired to construct an overtopping levee section on Ebey Island. This reach would be located in the vicinity of the Department of Wildlife property on Ebey Slough. This will require future modification of the profile in order to construct an overtopping section at a profile below the 5 year + 1 Ft level.

In December 1990, the Corps of Engineers accepted the Snohomish County model results depicting the 5-year flood profile for purposes of eligibility under P.L. 84-99. Serious deficiencies in most of the dikes, however, due to lack of adequate backslope and vegetation management, will make eligibility for this program difficult to obtain. The Marshland Flood Control District levees and the French Slough Flood Control District were mostly constructed by the Soil Conservation Service. These two districts are therefore not eligible for Corps assistance, resulting from an agreement between SCS and the Corps. These levees and others in the valley which do not meet Corps standards will be eligible for assistance from FEMA in the event of a presidential disaster declaration.

Table 8.1

PLANNED LEVEL OF PROTECTION

The goals shown below are specific for each district. The stationing shown are from the planned levee profiles shown in Appendix E.

DISTRICT	LEVEL OF PROTECTION IN RELATION TO FULLY CONTAINED 5-YEAR FLOOD(3)	RELATIONSHIP TO TO SCS PROFILE AND NOV 1986
<u>FLOOD</u>		
<u>Marshland Flood Control District</u>		
Upper End:		
Sta. 0+0-0 to 12+00	5 + 1 Ft	+ 1.7 Ft
Sta. 12+00 to 80+00	5 + 0	+ 0.7 Ft
City of Snohomish Area (2.)		
Sta. 80+00 to 180+00	5 + 1 Ft to 5 + 0	+ 1 to 2 Ft
Lower End to Lowell		
Sta. 180+00 to 447+40	5 - 1 Ft	Nov 1986 Level
<u>French Slough Flood Control District</u>		
Upper end from Lords Hill to River (Sta. 0+00 to 20+00)		
	5 + 1	+ 1.7 Ft
Remainder (Sta. 20+00 to 167+48)		
	5 + 0	+ 0.7 Ft
<u>Drainage Improvement District 13</u>		
Entire District (Sta. 0+00 to 153+54)		
	5 - 1 Ft	Nov 1986 Level
<u>Drainage District 6</u>		
Entire District (Sta. 0+00 to 115+47)		
	5 - 1 Ft	Nov 1986 Level
<u>Diking Improvement District 1</u>		
Entire District (Sta. 0+00 to 687+00)		
	5 + 1 Ft	+ 2 Ft
<u>Lundvall Levee</u>		
Entire levee (Sta. 0+00 to 53+00)		
	5 + 1 Ft	+ 2 Ft (4)
<u>Diking District 2</u>		
Entire district (Sta. 0+00 to 130+00)		
	5 + 1 Ft	+ 2 Ft (4)

Levee Design and Maintenance Standards

The plan specifies minimum design requirements for levees to ensure that the future system will meet engineering standards and is also sensitive to fish and wildlife. These standards are shown in Appendix C.

The minimum design requirements are 2:1 side slopes for the riverward side of levees, 2.5:1 on the landward side of non-overtopping levees, 5:1 on the landward side of over-topping levees, and a 12 ft top width.

Maintenance standards are recommended which provide continued structural integrity, maintain access, and also are sensitive to the biological requirements of riparian fish and riparian wildlife.

These standards encourage minimal herbicide use, bio-stabilization methods of bank protection, and require tide gate replacements to incorporate fish passage. Also additional habitat features such as vegetative buffers, permanently ponded water, and perching snags are to be developed (or left) where possible.

Flood Fight Policies

The flood fight policies shown in Appendix F have been developed with the intent to foster the concept of equitable flood protection for all areas of the valley. These policies recognize that the activities occurring during flood fights have a direct bearing on the level of protection provided by levees. These policies support the concept of controlled overtopping of levees. They are needed to assure that flood fight efforts are balanced by the level of protection provided by the levees.

Flood fights occur during an emergency situation when the Snohomish River exceeds flood stage. Flood stage is considered to be 25 feet at the Snohomish gage; however, serious flooding does not usually begin until the river is above 29 or 30 feet (gage height). Flood fight activities include monitoring conditions of the levee system, sandbagging driveways and minor depressions in levees, sandbagging of boils and seepage problem areas, and repair of minor bank sloughs.

Flood fights are directed by the Snohomish County Director of Public Works. In addition, the U. S. Army Corps of Engineers participates in flood fights at the request of the

Public Works Department. Volunteer crews are organized by the Snohomish County Department of Emergency Management. Other activities are conducted by private landowners and special districts. It is the intent of the policies described in Appendix F to provide a coordinated approach to flood fight activities by all involved organizations. In this way, the goals of equitable flood protection can be fostered with each district receiving approximately the same level of protection. Maintaining the safety of personnel involved in a flood fight is an overriding concern.

Habitat and Wetland Needs

Programs and options are recommended which blend environmental needs in the Snohomish Valley with flood damage reduction measures.

Wetland and Habitat Programs

The Snohomish River levee system is located in a unique riverine environment. For this reason, it is the desire of all the affected parties to preserve the habitats associated with the levees. In addition to the habitat enhancement options, and levee design and maintenance standards discussed above, there is a need for improved bank stabilization using vegetation rather than rock armoring. It is therefore recommended that a demonstration program be established for biotechnical bank stabilization. This is particularly needed for the unique environment of the tidally influenced Snohomish delta.

As discussed under the flood control options in Chapter 7, opportunities exist for reestablishment of wetlands and use of these areas for flood storage. These are unique opportunities which should be pursued vigorously. Funding for implementation of such a program will require multi-agency cooperation and use of resources. Coordination between agencies and development of creative funding mechanisms will be needed. One idea is to establish a wildlife-enhancement trust fund or mitigation bank which could accumulate funds for implementation of these projects. In addition, there will be a need to monitor the success of such programs. Since these are fairly innovative projects, the success of wetland recovery, benefits to fish production, water quality, and use of these areas by waterfowl and other wildlife will need to be monitored.

Recommended Flood Control Options

Options are identified below which benefit fish and wildlife as well as reduce flood damages. Areas are identified for which the levees can remain at or be reduced to a lower level of protection to provide off-channel flood

storage. In addition to flood control benefits, these areas may be allowed to revert back to wetlands with an increase in fish and wildlife habitat, depending on funding sources. Chapter 7 describes these options in more detail.

Department of Wildlife Land, Ebey Island

The Department of Wildlife (WDW) owns and manages approximately 450 acres on Ebey Island. This area is presently behind District 1 levees, but WDW would agree to a lower level of protection. Funding needs to be identified, however, which will provide the rest of Ebey Island with the same level of protection by construction of a containment levee. In addition, the loss of dike assessments from the WDW land will need to be mitigated by providing additional maintenance funds.

This option reduces maximum water levels in Ebey Slough for a 5-year flood by about 8 inches for the 5 miles between its source at the Snohomish River to its junction with Steamboat Slough. Peak levels on the Snohomish River would be reduced by about 6 inches for a distance of roughly 3 miles, both upstream and downstream from Ebey Slough.

Buyout of Drainage District 6

District 6's levee protects about 450 acres of low-intensity agricultural land, primarily beef pasture. Purchasing this property for off-channel flood storage benefits will reduce flood levels very close to those described in the DOW land option in the above discussion (i.e., 6 to 8 inches reduction in peak flood elevations for a 5-year flood for parts of Ebey Slough and the Snohomish River).

The Corps has repaired breaches in this levee at least 6 times in the past, and State FCAAP money has been used for several repair and maintenance projects. Since 1960, approximately \$1.9 M has been spent on repair of this levee. A predominate benefit of this option is that the public would not pay for the repair of this levee every 2 to 5 years at a cost approaching \$100,000 for each breach in the levee.

In addition to the flood protection benefits to other parts of the valley, this option will have the major benefit of reestablishing a wetland. This wetland would benefit wildlife as well as fish production through providing increased juvenile rearing habitat. Buyout of District 6 will also be a significant benefit by combining with the Department of Wildlife land on Ebey Island to create a habitat corridor around Ebey Slough for several miles.

Land Use Policies

This section addresses both current and potential land uses in the flood plain.

Floodplain Land Use

This plan has been developed within the framework of existing comprehensive plans and land use zoning. These plans include the Snohomish County comprehensive plan for the Snohomish/Lake Stevens area, and comprehensive plans for the Cities of Everett and Marysville. The City of Everett proposes intense development of parts of the floodplain downstream from Lowell, along the Snohomish River. The ongoing growth of Marysville is continuing in the area adjacent to Allen Creek which is also part of the Snohomish delta floodplain. The vast majority of the floodplain land use is agriculture, however. Other pockets of commercial development include the area of Harvey Field in Marshland and an area on the fringe of the French Slough floodplain, towards Monroe.

This plan does not propose any changes to current land use policy. It supports the concept of continued agricultural use of the floodplain. This plan recognizes that even with the significant improvements to the levees outlined in this plan, periodic flooding will continue to occur. Agricultural use of the floodplain is most compatible with the hazards associated with this flooding; however, continued agricultural use will depend on maintaining the integrity of the existing levee system.

Areas within the Cities of Everett and Marysville are located far enough downstream and on the fringe of the floodplain so that little impact to adjacent areas will result from development of these areas. Also, in the Lowell area, a requirement for a 200-foot setback from the river and preservation of existing wetlands will assure adequate channel capacity for floodwater.

Effects of Basin Development

This study only addressed the issue of how to manage the flood flows of the Snohomish River based on the frequency of floods recorded at the Monroe gage. Other problems can also occur such as interior drainage from runoff behind leveed areas. Interior runoff is creating nuisance-type problems for many of the districts and will continue to be aggravated as urbanization continues. While interior runoff does not have the destructive force of river flooding, it may become serious enough to create localized flooding problems and reduction of productivity. These problems should continue to be monitored and solutions created where possible.

Flooding in the Snohomish Valley is generated by runoff from the Skykomish and Snoqualmie River basins. Increased clear-cutting and urbanization in the upper parts of these basins could increase runoff with potential for major increases in flows on the Snohomish River. These effects should be monitored and controlled to the maximum extent possible.

Plan Implementation

The goals established in this plan for level of protection will require a significant investment by the agricultural community living in the Snohomish River floodplain. The existing levee system provides little more than 5-year level of protection, with many areas flooding with 3 to 4-year floods. In addition, poor structural stability of many levees means that the potential for levee failure is great. Some of the existing structures such as the Marshland berm, only function as well as they do because they are higher than the levees/berms on the opposite bank of the river. For these reasons it is highly desired to bring the levees up to the levels and standards specified in this plan.

The primary responsibility for implementing this plan is with the diking districts. When a district applies to the County for a shorelines and grading permit for a levee improvement project, this plan will be used as guidance for issuing permits. It will be the responsibility of the project proponent to show how their project meets the requirements of this plan.

A list of projects with recommended priorities for implementation are shown in Table 8.2. The projects with highest priority are categories A and B, identified as such because they are needed to remedy the most serious deficiencies. Category A projects are those required to correct serious structural problems, whereas category B projects are needed to bring the levees up to the levels recommended in this plan. Category A projects are also identified for key facilities such as sewage treatment plants. Category C projects are lower priority projects which can wait for completion of Category A and B projects. These priorities will be used by the County in ranking projects.

The major goal of this plan is to develop a flood protection system which is equitable to all floodplain residents and landowners. Improvements in the interim will improve the flood protection system for individual districts; however, eventual completion of the recommended level of protection goals in this plan will be a system-wide improvement over existing conditions. This is due to the added structural stability of the levees and improved flood protection for all districts; however, for large floods on the order of

Table 8.2

Project Prioritization

Snohomish River Flood Control Plan

District	Project Description	Priority Level\1	Possible Funding Sources
Diking Improvement District 1	Improve backslope and structural conditions levees to design standards	A	District, FCAAP, RI\2
	Level of protection improvements to Plan levels with construction of inflow spillway through Department of Wildlife land	B	District, FCAAP, RI, Corps \3
	Construction of outflow levee on north end of Ebey Island	C	District, Corps
	Improved tide gates/pump plants - north end of Ebey Island	C	District
Drainage District 6	Improve backslope and structural conditions of levees to design standards	A\4	District, FCAAP, RI
	Level of protection improvements to Plan levels	B	District, FCAAP, RI
	Improved drainage/tide gates or pumps	A	District, SCS
Drainage Improvement District 13	Improve berm and/or levee to design standards and levels in this Plan	A	District, FCAAP, RI
Marshland Flood Control District	Replace Marshland berm along Lowell-Snohomish River Road with levee which allows overtopping. (Complete 1958 SCS Watershed Project)	A	District, SCS
	Improve upper levee to Plan levels.	B	District, FCAAP, RI with SCS approval

District	Project Description	Priority Level \1	Possible Funding Sources
French Slough Flood Control District	Improve levees to plan levels	C	District, FCAAP with SCS approval
	Reconstruct pumping station to original discharge capacity and stable foundation	A	SCS
Diking District 2, 4 and Lundvall - Private dike	Improve structural conditions of levees	B	District, FCAAP
Diking District 5	Improve structural conditions of levee to design standards	B	District, FCAAP RI
Diking District 3/City of Marysville, Biringer	Improve structural conditions of levees to design standards	B	District, City of Marysville
	Improved drainage for interior depending on development	A	District, City of Marysville, developers
City of Everett	Maintain flood protection for sewage treatment plant	A	City
	New development	B	Developers, cit
City of Snohomish	Protection of sewage treatment facility	A	City

- NOTES: \1 Priority levels: A - highest priority to resolve serious structural deficiencies. B - primary priority for implementation of plan recommendations. C - secondary priority.
- \2 County River Improvement fund.
- \3 Corps projects require feasibility study showing positive benefit/cost ratio greater than 1.
- \4 Funding for buyout option should be strongly pursued prior to making substantial levee improvements.

20-year return period or longer, French Slough and upper Marshland are more heavily flooded. This is because they are on the upstream end of the river valley and receive floodwater first. They therefore take water onto the floodplain and provide off-channel storage for those areas downstream. Once the improvements in this plan are completed for all districts, it may be appropriate to make some adjustments to the French Slough and upper Marshland levees; however, this is expected to be several years in the future. In the interim, this problem is balanced by the deficiencies in the downstream levees (i.e., below the City of Snohomish), primarily Districts 13, 6 and 1.

The levee profile agreed to and presented in Appendix G will be a level which will be feasible for all the special districts in the Snohomish valley. A very high priority project is the completion of the lower Marshland levee by SCS. Completion of this levee with a safe, overtopping levee will help stabilize the flood protection system. Removal of the "berm" on Lowell-Snohomish River Road will help reduce conflicts during flood fights, and prevent damages which may occur from sudden failure of the berm.

The highest priority for Ebey Island (District 1) is to improve the levee profile on Ebey Slough up to the level in this plan. In addition, improvements to the backslope of the Ebey Island levee need to be made in order to provide for adequate structural stability. It is also the long term goal of this plan to provide for an overtopping section (or sections) to safely take water onto Ebey Island, and improvements on the north end of the island to drain the flood waters.

Drainage Improvement District 13 needs to improve the "farmers' berm" and sections of Riverview Road downstream of Swans Trail Road to the planned levee profile. This structure must have adequate backslope, good sod cover, and uniform overtopping level to minimize the potential for failure from overtopping. In this way, floodwater can be safely directed onto the floodplain, avoiding homes and farm buildings. District 13 drains into District 6 on Ebey Slough. If District 6 is bought out, improvements to the drainage system for District 13 will need to be made to assure adequate capacity for removing floodwaters behind the containment dike to be built between District 13 and 6.

The lower valley diking districts are primarily at the levels in this plan. Improvements will need to be made in the future to assure adequate backslope and maintenance of these dikes (vegetation and structural integrity).

Funding

The levee improvements recommended under this plan will require about \$6 million to complete, based on construction cost estimates. Table 8.3 shows estimated costs for each special District. Additional costs may be required for engineering and habitat mitigation projects. Many small projects will be funded through district assessments. Full implementation of this plan, however, will be difficult without additional funding. The goals in this plan are intended to be realistic, achievable targets for each district; however, some districts, such as District 13 and 6, will have more difficulty in implementing this plan.

Table 8.1 also shows possible sources of funding for implementation of these projects. The major sources of funding are the Districts themselves, State FCAAP funds, County River Improvement, and other agencies such as the Soil Conservation Service (SCS) and the U. S. Army Corps of Engineers. Due to the limited funds available to the Districts and through the state FCAAP program, other sources of funding need to be developed. Marshland is in a unique position because of the unfinished SCS project outlined in the 1958 Marshland Watershed report. This project has approximately 2.9 miles of levee on the downstream end of the Marshland District which needs to be completed. It is recommended that this project be completed so that improvements to the existing levee system can begin, and a controlled flooding system can be created. One of the obstacles to completion of this project is the cost to relocate the County road. For this reason, SCS and Marshland should investigate design options which minimize impacts to the road, and work with the County to investigate funding options for relocating the road.

Although the primary responsibility for dike improvements rests with the special districts, financing many of the improvements will be difficult. This is particularly true for the smaller districts such as District 13, and for those districts which experienced major damage to the levee system in November 1990. The costs to rebuild levees (even with FEMA or other agency support) will limit for a number of years the ability of districts to make substantial improvements. For this reason, Snohomish County should seek alternative funding which will help make the needed levee improvements. This is particularly important in light of the goal of this plan to build a safe overtopping levee system. Similarly, SCS should seek improvement funds for other districts when the Marshland project is completed.

Creative sources of funding for habitat enhancement projects need to be developed. Combinations of funds from different sources may be available to implement projects like the buyout of District 6. These sources may include state and federal habitat enhancement funds, and county conservation funds.

Table 8.3

Cost Estimates for Planned Levee Improvements

<u>District</u>	<u>Average Height Increase (Ft)</u>	<u>Cost in Thousand's of Dollars</u>
French Slough	<0.1	\$ 15
Marshland	0.1	1,900\ <u>a</u>
District 1	0.5	1,500
District 13	0.8	900\ <u>b</u>
District 6	0.6	240
Lundvall	0.3	130
District 2	<0.1	130
District 4	<0.1	94
District 3	0.3	110
	TOTAL	5,019

Costs based on \$6.00/c.y. for fill material, based on recent costs for diking district repair projects. Construction costs only - does not include engineering. Design based on 12 ft top width, 2.5:1 backslopes for non-overtopping sections and 5.0:1 for overtopping sections. Costs are rough estimates based on surveyed levee profiles, planned levee profiles and approximate existing top width and backslope.

\ a Includes \$1.2 M for relocation of Lowell-Snohomish River Road, as part of SCS project for lower Marshland.

\ b Includes \$0.6 M for relocation of Rivershore Road. Cost savings could be obtained by improving berm to the overtopping levels or building a one-way road to the planned profile.

Coordination of Flood Protection

An important conclusion of this plan is that individual diking districts cannot provide flood protection without effecting flooding in other parts of the valley. Building levees higher in one part of the valley can cause more flooding in another by removing an area of the floodplain for temporary storage of floodwaters. It is therefore necessary to coordinate levee development on a system-wide basis.

While this plan forms a coordinated levee plan for the valley, implementation will become the responsibility of individual diking districts. Cooperation among districts will be extremely important in the future. Recently, the Coordinated Diking Council (CDC) has been formed by most of the districts. Since the flood of November 1990, the Marshland Flood Control District has become a member of the CDC. It is hoped that this body will continue to function as a dispute resolution organization, and help smooth the implementation of this plan.

In a few locations, very close cooperation will be required between districts. This is because flooding in one district will cause flooding in another; for example, levee overtopping in District 13 will cause flooding of District 6. Similarly, overtopping of Lundvall's dike will cause flooding of Districts 2 and 4. It is therefore important for these districts to work closely together. These districts may consider merging to better coordinate and use their resources.

Plan Review Process

It is recommended that the levee improvements be monitored as they are made so that progress toward the levels recommended in this plan can be assessed. This needs to be done so that each district can determine how well they are doing. At the present time there are major differences in levee heights between the districts. This is expected to continue in the near future until funding is obtained to bring the less financially capable districts up to the levels and design standards of this plan.

It is anticipated that the Coordinated Diking Council (CDC) will play an important role in monitoring levee development. For this reason, a copy of the interlocal agreement establishing the CDC is included in this plan as Appendix G. As significant levee improvements are made, however, it is recommended that a more formal review occur. This would be coordinated by the County Public Works Department and would be accomplished by convening a group similar to the workshop participants used to formulate this plan.

The frequency of review depends on the rate of levee improvements. At this time, 3 to 5 years appears to be an appropriate length of time. Also, circumstances resulting from a major flood, or a request by the Coordinated Diking Council could trigger the Plan review process. It is proposed that the review process take approximately six months and modifications be made in the form of an appendix to this plan, with ultimate approval by the Snohomish County Council.

This review process could result in recommending changes to this plan. For example, once all the levees have been built to the levels in this plan, at that time it would be appropriate to make some adjustments to the level of protection needs of individual districts. While it is not expected that major changes would be made to this plan, some changes could be made to improve the equity of flood protection without changing the overall level of protection of the valley.

The Snohomish County FEQ model of the Snohomish River was important to defining the levee profile in this plan. It is important that the accuracy of this model be verified by monitoring future floods. This must include establishing additional staff gages in the valley with dedicated citizens able to record river levels through a flood. By keeping the model active in the Public Works Department, it will be possible to check on the accuracy of the model. To be truly effective, however, channel cross-section data will need to be verified. Any changes to the levee system likewise must be surveyed and submitted to the County for use in updating the model.

Other Recommendations

Flood Awareness and Warning

It is generally the responsibility of floodplain residents to keep informed about weather patterns and flood warnings through radio and other news media. The lead time for flooding on the Snohomish River is usually long enough after flooding on the Skykomish and Snoqualmie Rivers so that residents have sufficient warning; however, improved communication during flood emergencies is necessary. This is needed to warn residents of impending levee failure so that necessary evacuation can occur. It is recommended that each district develop a phone network or other communication system to ensure that each resident is fully warned. It is also recommended that an annual flood awareness meeting be held in the fall, before flood season. The intent of this meeting is to keep residents informed of what they can do to help themselves, and to provide information on what other agencies can and cannot do. This is particularly important for new floodplain residents.

Public Access Dike Trail System

The use of levees as access to river areas has been discussed. Public access to the Snohomish River and lower delta channels is limited. It has been desired to improve public access to the river system for recreational purposes, including fishing, bird watching, hiking, etc. Improved public access is supported by this Flood Control Management Plan provided that safeguards are included to assure integrity of the levee system. Opportunities for public access need to be developed as part of a coordinated recreation plan. Funding for recreational facilities may be available to enhance levee maintenance funds.

Development of recreational trails on top of levees, primarily for foot traffic, is possible in many areas. However, integrity of levees as overtopping levees must be assured if a trail system is established. This is particularly important to prevent erosion induced levee failure during an overtopping flood event. While concerns of private landowners would need to be considered, opportunities for joint use of levees should be investigated and funding sought. This may be an additional source of funding for levee maintenance available to each district.

Action Plan

1. Complete the SCS Marshland Watershed Project for the lower 2.9 miles of the Marshland levee system.
2. Pursue funding to bring levees to equitable levels and structural conditions defined in the Plan. Work with Soil Conservation Service, the Army Corps of Engineers, Snohomish County, etc. In the absence of major funding by federal agencies, Snohomish County and the State FCAAP program must take a lead role in improving levees to the levels in this plan.
3. Modify the Snohomish County Shorelines Management Master Program and other County ordinances as needed to fully implement this plan.
4. Pursue buyout funds for District 6 and other wetland purchases.
5. Provide enforcement to monitor activities and follow up on potential violations through non-permitted activities. This shall include surveys of levee improvements for verification of levee profile relative to the planned levee profile. Special districts will be responsible for surveying their projects. Snohomish County will remain the lead agency responsible for enforcement.

Action Plan - continued

6. Develop a vegetation management plan with specific recommendations for habitat associated with dikes. Such a vegetation management plan must be site specific and examine each location for specific recommendations which will assure levee integrity and maintain habitat. Work with the Corps to modify their standards.
7. Develop a public access and trail plan for the levee system.
8. Expand gaging system for valley to improve flood warning and predictive capabilities of future model revisions.

