
SECTION 6**ALTERNATIVE FLOOD HAZARD
MANAGEMENT MEASURES**

- **Non-Structural**
- **Structural**
- **Environmental Impacts**
- **Cost**
- **Funding**
- **Schedules and Length of Time of Benefits**
- **Conformance with Goals and Objectives**

(Draft) Section 6

ALTERNATIVE FLOOD HAZARD REDUCTION MEASURES

As discussed previously in this FHRP, flooding problems in Grayland fall into two categories: those related to the main drainage channel operated by Drainage District No. 1, and those occurring on a more localized scale, particularly west of SR 105. To evaluate flooding in the main drainage channel, hydrologic and hydraulic modeling of 2-, 10-, 25- and 100-year storm events with varying tide levels was performed. Three example sites were analyzed for the local drainage issues, and they have served as the basis for recommendations for improvements to local drainage.

Results of the hydrologic and hydraulic analysis of conveyance through Drainage District No. 1's main channel and reports of historic flooding in Grayland showed that small, frequent events do not pose a significant threat to public health and safety or environmental interests. Frequent flooding at the south end and of the channel and near the Post Office site has been reported and shown to occur in the models. Larger (10-year, 25-year and 100-year events) cause overbank flows; however, the main concerns of citizens in Grayland relate to frequent localized drainage problems, mostly west of SR 105, not impacted by water levels in the main drainage channel. Improvement projects proposed to alleviate flood hazards were evaluated within this context, and it was agreed that large capital projects to improve the main drainage channel would provide little if any benefit, and citizens would rather have monies spent on improving the more frequent localized flooding.

Using the criteria set forth in Section 4, Goals and Objectives, flood hazard reduction measures were conceptualized and evaluated by the consultants for constructability and the potential to improve drainage conditions. After this initial screening, several capital improvement and policy alternatives were identified to reduce flooding hazards associated with the main drainage channel. Local drainage issues were addressed by selecting three frequently flooded sites as examples, developing capital improvement and policy solutions and providing cost estimates for the implementation of capital improvement projects. Proposed drainage improvement projects

were then presented to the advisory committee and the interested community members, where they were evaluated and discarded or refined.

Each of the alternatives considered is presented in Table 6-1. Ranking criteria broadly follow the goals of this FHRP. The alternatives are grouped into two categories: (1) the main drainage ditch and (2) the local drainage issues. A rating of Low, Medium, or High was assigned to each category of criteria. These ratings were translated into a total project ranking by evaluating the results from each category, with special emphasis on the implementation feasibility.

MAIN DRAINAGE DITCH

All three of the non-structural alternatives considered were evaluated favorably and determined to have a High ranking for implementation. These alternatives will help to mitigate the impacts of flooding without a large capital expenditure or physical changes that would significantly impact individual landowners. Several of the capital improvement projects (CIPs) were deemed excessive when weighed against the limited concerns of residents of the Grayland area. Other CIPs would provide no significant benefit or were simply infeasible based on physical constraint.

Non-Structural Alternatives

It is recommended that each of the three non-structural alternatives presented here be implemented by Grays Harbor County.

Regulate Development in Flood plains and Impacts to Drainage Courses

Regulations are a means of limiting actions taken by individuals that may put them at risk or adversely affect others or the environment. As detailed in the Regulatory Overview of Section 3 and Appendix B of this FHRP, there are several federal, state, and local laws that pertain to flood hazard management. Any new development in the flood plain should follow the guidelines specified in these regulations.

**Table 6-1
Alternative Evaluation Criteria
Grayland Flood Hazard Reduction Plan
Grays Harbor County**

Ranking Criteria Categories	Proposed Drainage Improvement Project Alternatives Ranking											Local Drainage Issues: Example Projects and General Recommendations										
	Main Drainage Ditch											Non-Structural					Structural					
	Non-Structural			Structural																		
	Regulate Development in Floodplain and Impacts to Drainage Courses	Develop Water Quality Monitoring Program/Protect Agricultural and Natural Resources	Develop Flood Hazard and Water Quality Public Education Programs	Elevate Affected Homes and Businesses	Elevate Affected Bridges	Widen Portions of Channel	Construct Local Levees	Improve Tide Gates	Install Pump Station at Tide Gates	Excavate Entire Channel to Increase Cross-Section	Construct Detention Ponds	In Cases where Structural Improvements Do Not Help Individual Properties, Elevate Affected Homes and Businesses	Create Local Drainage District for Properties West of SR105; Maintain Drainage Courses to the Ocean	Tingstrom Lane Area: Convey Runoff to Ocean Outfall along County Line Road	Tingstrom Lane Area: Convey Runoff to Ocean Outfall along Private Property	Tingstrom Lane Area: Convey Runoff to Main Drainage Channel	Post Office Site: Elevate Road to Eliminate Sag/Improve Conveyance to Main Channel	Post Office Site: Elevate Road to 10-Year Event Level/Improve Conveyance to Main Channel	Post Office Site: Elevate Road to 100-Year Event Level/Improve Conveyance to Main Channel	Muntiny Lane/Lampighter: Convey Runoff to Main Drainage Channel	Muntiny Lane/Lampighter: Convey Runoff to Ocean Outfall	
Public Safety and Health Protection Improved Emergency Access Reduced Road/Structure Flooding	Medium	Low	Medium	Medium	Medium	Low	NSB	NSB	NSB	NF	NF											
Flood Hazard Reduction Benefit Flooding Frequency/Duration Flood Prone Area Reduction Frequent Flood Damage Reduction	Medium	Low	Medium	Medium	Low	Low						Medium	High	High	High	Medium	Medium	High	High	High	Medium	
Environmental/Socio-Economic Benefit Cranberry Farm Preservation Water Quality Protection Fish/Wildlife Enhancement	High	High	Medium	Low	Low	Low						Low	Medium	Medium	Medium	Medium	Low	Low	Low	Medium	Medium	
Implementation Feasibility Land Owner Acceptance Funding Potential Permitting/Legal Issues	High	High	High	Medium	Medium	Low						Medium	Medium	Medium	Medium	Low	Medium	High	Low	High	Medium	
Project's Compatibility with Drainage District Plans County Programs/Ordinances State Regulations	High	High	High	High	High	Medium						High	High	High	High	Low	High	High	Medium	High	Low	
Total Project Ranking	High	High	High	Medium	Low	Low	NSB	NSB	NSB	NF	NF	Medium	High	Medium	High	Low	Medium	High	Low	High	Medium	

Notes:
NSB = No Significant Benefit
NF = Not Feasible

To reduce localized flooding, land use policies in the Grayland area must ensure that development does not impact drainage courses and that increases in runoff are kept to a minimum. Regulations that address the goal to protect drainage pathways should be enforced. This requires that the County:

- Identify permanent drainage pathways.
- Prevent filling or blocking of natural drainage courses. Prevent alterations or relocations of drainage courses that affect their flood carrying capacity. This can be done by vigorously enforcing the Uniform Building Code and the County Zoning Ordinance.
- Limit fill materials for new development or improvements to the minimum necessary to elevate homes and septic mound systems above the designated flood level.
- Review all filling activities for adverse downstream and upstream impacts.
- Establish policies to comply with Sections 401 and 404 of the Clean Water Act. (Related to construction measures for flood hazard protection that may affect wetlands)
- Establish policies to formalize the posting of warnings of flooding hazards during events that cause closure of roadways, bridges, or facilities.

This alternative received High or Medium rankings for all of the criteria defined in Table 6-1. It has the most comprehensive benefits of all of the alternatives considered.

Develop Water Quality Monitoring Program/Protect Agricultural and Natural Resources

Grays Harbor County has initiated a program through their health department to sample water in Grayland's main drainage ditch. Samples are analyzed for fecal coliform counts, which is a determination of the presence of fecal matter from warm blooded animals (in itself, not necessarily harmful, but useful as an indication of contamination from leaking septic systems and the potential presence of other harmful bacteria).

This program should be continued, and if any problem areas are located, further testing in other sites may be warranted. If funding can be obtained, perhaps through a Centennial Clean Water Grant, further water quality testing is recommended. In order to perform a more comprehensive analysis of water quality to protect natural resources, this program could be expanded to

monitor more parameters and more locations. The additional parameters for analysis would be limited to those with the potential to occur in Grayland and cause damage to natural resources (cranberry bogs, wildlife, vegetation, etc.). They may include heavy metals, nutrients from fertilizers, compounds used in pesticides, and oil and grease.

Additional sampling locations would include significant lateral connecting ditches and main channel locations near the cranberry bogs. Periodic monitoring of waters near the tide gates would give an indication of the suitability of stormwater runoff released to Grays Harbor. The watershed divide at the southern end of the channel could also be monitored periodically to ascertain the incoming water quality and identify pollution from outside of the Grayland watershed. This is also an important monitoring point because of the potential for directional shifts in flow that occasionally cause drainage from the Grayland area to flow south (a water quality concern voiced by the Shoalwater Tribe in Tokeland).

While a water quality monitoring program will not reduce flooding, it can have significant environmental and economic benefits. The feasibility of continuing the fecal coliform monitoring is High, because it is relatively inexpensive, effective, and it is compatible with the goals of the Grayland community and local, state, and federal agencies. An expanded program would have a High feasibility as well, if grant monies can be obtained.

Develop Flood Hazard and Water Quality Public Education Programs

Educational programs are important tools to protect the public safety and health of citizens in flood prone areas. It is recommended that a series of posters be developed for display in the lobbies of County offices and other public places to inform people of the flooding issues in Grayland. Pamphlets should also be distributed to educate the public. Examples of topics to be included in the educational series are as follows:

- Flood zones in Grayland - Where they are and what they mean
- Potential for damages when buying/building a structure or farming in a flood plain
- Likely impacts to roads and bridges in flood plains

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- The importance of maintaining existing drainage courses, not creating any that drain wetlands, and minimizing the use of fill materials
 - Impacts of flooding on water quality, including increased erosion and sedimentation, and the washing of pesticides and herbicides into the main channel (and possibly contaminating the cranberry bogs)
 - Measures to reduce flood hazards and minimize damages
 - Explanation of regulatory programs and permits related to improvements on private property

While education programs of this nature will serve to inform people of the dangers of construction within flood plains and the need to maintain natural drainage courses, it does not guarantee changes in existing practices. This is a choice that must be made by individuals and the community as a whole; therefore, the medium ratings assigned to the safety, flood hazard reduction, and environmental benefits depend upon public attitudes and actions. Without significant interest or acceptance of the goals, the rankings could be lowered. Implementation feasibility and compatibility with agency goals are seen as high priorities, so overall, assuming adequate public participation, this alternative received a High ranking.

Structural Alternatives

The structural alternatives proposed here require a relatively large capital outlay. They present only stop-gap means of protecting against flood damages; however, the first two are recommended for locations determined to be critical.

Elevate Affected Homes and Businesses

Existing homes and businesses (including basements) affected by flooding associated with the main channel should elevate their structures. Although the Federal Emergency Management Agency (FEMA) did not perform detailed modeling to establish the base flood level, they did specify the 100-year tide elevation for the Port of Grays Harbor as elevation 10 feet. This elevation and the FEMA flood plain mapping can be used as a basis for required bottom elevation of structures. The cost of elevating houses and businesses would be borne by the owner. The ranking of this criteria was Medium because it will not reduce large-event flooding in Grayland (thereby providing better access on roads and benefits to cranberry growers); it will only alleviate damage to individual structures. This is consistent with committee recommendations, as

they would rather see improvement project monies be used to solve the more widespread frequent flooding problems.

Elevate Affected Bridges

The only bridge of frequently flooded is the Grange Road Bridge, at the south end of the main channel. Closure of this bridge two to three times during the winter rainstorms does not present a significant inconvenience or emergency access hazard as there are alternative routes (cross-streets and SR 105) nearby. Elevating this structure would be costly and would provide only a limited benefit, therefore this alternative received a Low ranking.

Widen Portions of the Channel

Widening a restrictive section of the main drainage channel downstream of an area determined to have high water levels can alleviate the backwater effects and lower the water level. A 4,500-foot portion of the channel north of the developed area of Schmid Road, yet south of the tidal marsh region, has been identified as a potential for widening. While this would provide a significant change in water surface elevation (up to 2 feet) in small, frequent events along the reach of channel paralleling Schmid Road, the larger events that could cause overtopping of the channel would only be reduced by about one half of a foot in elevation.

There are no homes in this particular reach, but there may be significant environmental impacts to a proposed 20-foot widening. The results of modeling a 10-foot wider channel reach showed minimal benefit in small and large events. In terms of widening the channel in other locations, there are few areas that could be widened without removing homes, and there is concern from the State Department of Wildlife that the spruce trees alongside the channel may support a listed species, the Marbled Murrelet. For this reason, and the limited benefits from widening portions of the channel, this alternative received a Low ranking.

Construct Local Levees/Improve the Tide Gates/Install Pump Station at the Tide Gates

These alternatives were considered but discarded because they would provide no significant benefit. Local levees would interfere with existing homes and impound runoff intended to reach the main drainage channel and present a greater local frequent flooding problem. They could also be prohibited by regulations protecting the riparian corridor and the potential

habitat of the Marbled Murrelet. Sensitivity testing with the HEC-II computer model showed that the water elevations in the main channel during 24-hour peak flood events do not significantly change with widely varying tide levels. Therefore, channel elevations are not controlled by outlet conditions through the tide gates and improvements to the tide gates or the installation of a pump station would not improve backwater conditions. It should also be noted that levees and pump stations are very expensive alternatives, and without evidence of significant benefit, they were easily eliminated from the planning process.

Excavate Entire Channel to Increase Cross-Section/Construct Detention Ponds

These alternatives were considered but discarded by physical limitations that rendered them not feasible. There are many houses, bridges, and roads along the main drainage channel that would be impacted by excavation for deepening and widening of the channel. The cost (financial and social) of such an improvement is prohibitive and such an improvement would not be supported by the community. Because of Grayland's low elevations and high water table, detention ponds or vaults cannot be constructed and would provide no benefit in the low-lying areas. The construction of detention ponds in the upland areas would be costly and would pose a downstream hazard in the event of failure. Large dams would be required to store enough water to make a difference in flood levels. Much of the stormwater in the main channel comes from the low-lying areas of Grayland, so the actual benefit of upland detention ponds would not warrant the expenditure or risk.

LOCAL DRAINAGE ISSUES: EXAMPLE PROJECTS AND GENERAL RECOMMENDATIONS

Three sites of localized flooding were selected as example project sites. The site conditions were reviewed, and several alternative preliminary designs for improved stormwater conveyance were developed. It is intended that the recommendations from these sample projects be implemented (after more extensive design) and that similar improvements be made at other sites of localized flooding in Grayland, such as along Rockney Place and other areas west of SR 105.

Two non-structural alternatives have been identified for the example project sites and as general recommendations for the Grayland area. Several feasible structural alternatives were developed for the three example sites. It is recommended that the County and residents of

Grayland implement both of the non-structural alternatives and each of the High ranking structural alternatives. More detailed preliminary design graphics for these alternatives have been presented in Section 2 of this report.

Non-Structural Alternatives

Elevate Affected Homes and Businesses

After constructing the recommended alternatives and implementing the non-structural alternatives, there will likely be a few properties that experience occasional localized flooding. Since much of the area is within 100-year designated floodplains, there will still be many properties subject to shallow flooding on a less frequent basis. To protect these properties, it will be necessary to elevate the structures and possibly the septic tank drainfields. The cost of doing so will be the responsibility of the individual owner. It will be up to the individual property owner to evaluate the relative costs of elevating versus the cost of the damage resulting from flooding and determine whether or not to spend the money to make the improvements. Some owners may find it possible and less expensive to provide adequate protection for their structures by installing a low earth berm around the structures and a sump pump to remove water from inside the berm. Costs will vary widely depending on the location, structure and height that it must be raised. But, as a rough guideline, the cost of elevating a house may average \$20,000. The cost of elevating a drainfield or installing a mound system could cost an additional \$10,000 or more. Construction of an earth berm and installation of a sump pump would be substantially less. If interested in pursuing these alternatives, property owners should contact local contractors and obtain bids for the work.

Create Local Drainage District for Areas West of SR 105; Maintain Drainage Courses to the Ocean

Drainage in the Grayland area can and should follow traditional pathways. This means that drainage from west of SR 105 should discharge to the ocean, not to the main drainage channel (with the exception of drainage at the Mutiny Lane/Lamplighter site). Several existing drainage pathways have been identified to convey stormwater runoff from the area west of the highway to ocean outfalls. Without regular maintenance, they can become blocked by sedimentation, debris and deliberate filling. The following actions are needed:

- Identify pathways

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- Prevent filling by enforcing regulations
 - Establish a stable funding mechanism for capital improvements and maintenance
 - Obtain permanent easements
 - Obtain permits
 - Maintain pathways

Through the public education programs and regulations discussed earlier, public understanding of the need for these drainage courses can be broadened; however, a program will be needed to create new drainage courses and maintain existing ones. By forming a local drainage district, residents can obtain a reasonable interest rate for the capital improvement project costs and ensure that funding will be available for regular ditch maintenance.

The advisory committee reached a consensus to not rely on big government (county, state or federal) to solve local drainage problems. The community desires to solve problems locally. Therefore, it is recommended that local residents should organize their neighbors to pursue solutions, and technical assistance for legal and engineering issues will be necessary from the County.

Structural Alternatives

Example Project No. 1: Tingstrom Lane Area

Drainage ditches along Cranberry Beach Road, Tingstrom Lane, and Tingstrom Lane East have not been maintained, and they are inadequately sized to handle stormwater runoff in the area. Many driveway culverts are partially or fully blocked. The historic area outfall has not been maintained.

Each of the alternatives proposed at Tingstrom Lane would resolve only the frequent minor drainage problems. The area would still be subject to occasional flooding from extreme high tides and/or storm events (the design storm used to size the ditches and culverts was the 25-year event). Under more extreme conditions, the proposed improvements would not be capable of conveying the entire runoff volume; however, following extreme events, these improvements would remove the water more quickly, allowing a faster recovery.

The potential obstacles to implementing these alternatives include the possibility of one or more homeowners objecting to improvements and effectively blocking the movement of water by not allowing improvements to their ditch section or by not buying into the Local Improvement District. Permitting for ocean outfalls is not anticipated to be an obstacle.

Convey Runoff to Ocean Outfall along Cranberry Beach Road. Alternative 1 proposes the following preliminary solutions this site:

- Install a ditch and culvert system along both sides of Tingstrom Lane East and Tingstrom Lane to carry stormwater to a ditch running west along Cranberry Beach Road.
- Install a ditch along the north side of Cranberry Beach Road west of Tingstrom Lane to carry stormwater to an ocean outfall.
- Install an ocean outfall (culvert) through the dunes at the west end of the Cranberry Beach Road ditch system.
- Install catchbasins/manholes along Tingstrom Lane with inlet elevations set above the wetland normal pool elevation
- Place rip-rap at culvert outlets for erosion control.

This alternative received High and Medium criteria rankings, with the total project ranking of Medium. It would greatly improve public safety and health, reduce flood hazards, and it is compatible with agency plans. Maintenance of the outfall would be performed by County staff, as Cranberry Beach Road is a County road. By conveying runoff away from the main drainage channel, it assures that there will be no additional burdens on the systems of the cranberry farmers, and it removes the risk of contamination of waters in the main channel. Implementation feasibility is lower than the other option at Tingstrom (discussed below) because of costs and the loss of local control of the system.

Convey Runoff to Ocean Outfall along Private Property. Alternative 2 is similar to Alternative 1, with a modification made in the outfall location.

- Install ditches along both sides of Tingstrom Lane to carry runoff west to the existing channel leading to the beach. Install a culvert beneath Tingstrom Lane and maintain the existing culvert running north/south at the end of the street.

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- Install a ditch along a portion of Cranberry Beach Road, west of Tingstrom Lane. Route discharge through a culvert to the ditch along Tingstrom Lane leading to the beach drainage.
 - Place rip-rap at culvert outlets for erosion control.
 - Obtain an easement for the beach drainage/outfall.

This alternative received High and Medium criteria rankings, with the total project ranking of High. It meets the criteria discussed above for Alternative 1 with one exception, the outfall would not be maintained by the County, thus adding to the homeowner costs. Having the outfall along a private road raises the chance that an individual homeowner might object to this alternative. This alternative would be the cheapest. It maintains the existing system and keeps local control, and it could be implemented incrementally. For these reasons, this alternative is recommended for the Tingstrom Lane Area.

Convey Runoff to Main Drainage Channel. This alternative proposes a similar collection system to those discussed above; however, runoff from the area would be conveyed to the main drainage ditch through a new culvert running along County Line Road. This raised several concerns.

- There may be a legal issue with liability for conveying waters from one watershed to another (there is a viable path to the ocean, it does not have to go to the channel).
- Flooding in the main drainage channel may render this alternative infeasible (results of the modeling and resident observations show that even relatively small events cause overtopping of the bridge downstream at Grange road).
- Drainage District No. 1 does not want to compound the conveyance difficulties of the main ditch at this location by taking in more runoff.
- Cranberry farmers are concerned with the increased risk of pollution transport from new lateral connections to the ditch.

This alternative was considered early in the planning stages but it received a Low ranking because the advisory committee reached the consensus that conveying runoff from the Tingstrom Lane area to the main drainage channel was undesirable for the reasons listed above.

Example Project No. 2 - Post Office Site

The Post Office project site is located along Cranberry Road, near the intersection with Schmid Road. There is an existing stormwater conveyance system in place at this site, but portions of it are blocked, and frequently during storm events, runoff pools to the east of the post office driveway and crosses the center-line crest of Cranberry Road, inundating the intersection at Schmid Road and compounding the drainage issues on the north side of the road. Water in the main drainage channel occasionally backs-up the culvert installed to drain this area. The main drainage channel also overtops its west bank during some storm events, causing the intersection to flood. The limited availability of data at this site preclude sizing of the conveyance system, however general recommendations were made.

The alternative proposed here is to raise Cranberry Road and upgrade the existing drainage system to better handle smaller, frequent events by the following measures:

- Unblock and maintain the post office driveway culvert.
- Install a drop inlet and culvert across Cranberry Road from the pooled area to the drainage ditch on the north side of the road.
- Regrade the existing channel on the north side of Cranberry Road. Install a drop inlet and replace the culvert to the main channel. Install a flap gate at the culvert outlet to the main channel.
- Place rip-rap at the culvert outlet for erosion control.
- Maintain drainage ditches on the east side of the bridge.

Because water levels in the main channel often will prevent the discharge of local stormwater from this site, it is also proposed that Cranberry Road west of the bridge be elevated. Actual roadway designs would be needed because of the vertical curves involved in reaching the proper approach slope for the bridge. Three different cases for elevations of the new road segment were considered. Further hydraulic modeling should be undertaken during the design of an actual solution at this site. There may be upstream and/or downstream impacts related to raising the road.

Case I: Elevate Road to Eliminate Sag. A 250-foot stretch of roadway would be raised by approximately 1.25 feet. This alternative would eliminate some of the more frequent flooding, but

not all. For this reason, it received mostly medium rankings for the goals, with some concerns raised as to the impacts on cranberry farms, and natural resources. The overall project ranking was Medium.

Case II: Elevate Road to 10-Year Event Level. A 300-foot stretch of roadway would be raised by approximately 1.75 feet to a road elevation of approximately 12.5 feet. This would raise the road above the modeled main channel flood plain water elevation for a 10-year storm with a concurrent high tide. This would eliminate the inundation of the intersection during frequent, small storm events and larger events including the 10-year storm. This case has received a High ranking because it meets most of the ranking criteria without providing excessive protection (see Case III).

Case III: Elevate Road to 100-Year Event Level. A 350-foot stretch of roadway would be raised by approximately 2.75 feet to a road elevation of approximately 13.5 feet. This would raise the road above the modeled main channel flood plain water elevation for a 100-year storm with a concurrent high tide. In addition to the environmental concerns, this alternative is considered excessive. The consensus of local residents attending planning meetings is that road blockage during a 100-year event is acceptable. There have been no reports from the committee of any events that have even reached the low chord of the bridge (approximately elevation 13.5 feet). Therefore, this alternative has received a Low ranking.

Example Project No. 3 - Mutiny Lane/Lamplighter Site

The Mutiny Lane/Lamplighter project site is located at the north end of the Grayland Drainage study area, along SR 105. It encompasses several arterial streets and private drives, but the main flooding issues are along the state highway. Flooding has been reported on the west side of SR 105, south of Ewart Street/Schmid Road, at the intersection with Mutiny Lane and at the intersection with Jado Place. On both sides of the highway, flooding occurs in front of the Lamplighter Restaurant. There is no stormwater conveyance system in the project area north of Schmid Road. An intermittent swale/ditch runs along the south side of Hart Street. Another lateral ditch runs along the north side of Schmid Road, however it does not appear to be adequately maintained. All of these ditches are undersized for adequate conveyance of large storm events.

The following recommendations are made under the assumption that the main drainage channel is adequately sized for stormwater conveyance from the project basin.

Convey Runoff to Main Drainage Channel

- Install ditch and culvert systems along both sides of SR 105 leading into a culvert and ditch system running to the east along Schmid Road.
- Connect system to the existing main drainage channel.
- Require that properties south of Schmid Road join the Drainage District.

This alternative received High rankings on most of the criteria set forth in the alternatives ranking table. Taking the area's stormwater runoff to the main drainage ditch seems to most closely follow the natural drainage course, therefore permitting obstacles are not expected.

Convey Runoff to Ocean Outfall. The system described above was modified to consider discharge to an ocean outfall; however, this option was dropped early in the planning process because of feasibility concerns that included the following:

- Overcoming an adverse grade near the intersection of Ewart Street and SR 105
- Normal pool high water levels in the lake/wetland near the same intersection
- Permitting issues related to changing water levels in the lake/wetland
- Existing local drainage problems between the highway and the ocean

This alternative received an overall Low project ranking, mainly because of implementation feasibility

ENVIRONMENTAL IMPACTS

In general, the non-structural improvements proposed will tend to enhance environmental/natural resources by furthering the protection of water quality and reducing flooding, thereby reducing resultant habitat disturbance, pollutant transport, erosion and sedimentation.

Structural alternatives had both positive and negative impacts to cranberry farming, water quality and fish and wildlife. These impacts were addressed individually during the criteria ranking presented in Table 6-1. The Low rankings attributed to elevating structures (homes and

bridges) reflects the fact that these options do not propose any environmental benefits. This does not imply that they would be making the situation worse for natural resources. The Low rankings for the example project at the Post Office site can be attributed to the fact that raising the road may create more flooding and disturbance along the channel, in the cranberry bogs and in the wetland southwest of the Cranberry Road bridge. More modeling is necessary to determine if this is indeed the case; therefore, the recommendation to raise the road (pending further study and design) was made. Medium and High rankings tend to reflect the benefit of reduced flooding on the environment.

General environmental issues to be considered for any capital improvements are as follows:

- Sidecasting of excavated ditch material into wetlands is prohibited.
- All improvements must comply with regulations, policies and permitting requirements, as described in Section 3 and Appendix B of this FHRP. This may include compliance with regulations including one or more of the following:
 - Shoreline Master Program
 - Hydraulic Permit Application
 - Certification of Compliance with the Clean Water Act
 - Section 10 - Rivers and Harbors Act
 - National Environmental Policy Act
 - Washington State Environmental Policy Act
 - State Flood Plain Management
 - Grays Harbor County Zoning Code and Flood plain Ordinance
- Proposed disturbance of the spruce trees along the main drainage channel would initiate a Section 7 (of the Endangered Species Act) consultation to determine whether this is a Marbled Murrelet habitat.
- Proposed ocean outfalls and disturbance along the dunes in Grayland would require approval from the Endangered Species Division of the WDFW. Peregrine Falcons have been spotted in this area, and it must be determined that

stormwater conveyance improvements would not affect their feeding or migrating patterns. The biologist for the Grayland Area believes that a telephone call or brief proposed project submittal would be enough to address the issue.

COSTS

Main Drainage Channel

Three recommended non-structural alternatives for the main drainage channel are program and policy recommendations. Their costs have been approximated as follows:

- **Regulate development in flood plain and impacts to drainage courses:** Regulations can be enforced under existing County regulatory programs with minimal impact to operating budgets.
- **Develop water quality monitoring program/protect agricultural and natural resources:** This program has already been initiated through the Grays Harbor County Health Department, but its expansion will require approximately \$10,000 - \$20,000 in additional funding per year.
- **Develop flood hazard and water quality public education programs:** These programs tend to rely heavily on volunteers and can be successfully completed for approximately \$5,000 - \$10,000 per year.

Elevating affected homes and businesses (including septic systems) will cost approximately \$10,000 to \$60,000 per structure. This cost will vary with the size of the structure, the site conditions, the elevation height required and other factors.

Local Drainage Improvement Example Projects

Order-of-magnitude cost estimates for the example projects were developed for the alternative that remained after the preliminary screening processes. These costs, in February 1995 dollars, do not include escalation, financial costs or operation and maintenance costs. The final costs will depend on the actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule and other variable factors. As a result, the final project costs will vary from the estimate presented here. The formation of local utility districts to fund projects not funded by County or State road funds, as well as operation and maintenance costs are presented and discussed in the funding section below.

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- Tingstrom Lane area—Convey runoff to ocean outfall along county line road \$166,000
 - Tingstrom Lane area—Convey runoff to ocean outfall along private property \$110,000
 - Post Office site—Elevate road to eliminate sag/improve conveyance to main channel \$34,000
 - Post Office site—Elevate road to 10-year event level/improve conveyance to main channel \$38,000
 - Post Office site—Elevate road to 100-year event level/improve conveyance to main channel: \$45,000
 - Mutiny Lane/Lamplighter—Convey runoff to the main drainage channel: \$203,000

FUNDING

Once costs are identified, there are several potential sources of funding that may be considered and evaluated. The first to be considered by most residents is property tax revenues. In Grays Harbor County, the majority of property taxes are distributed to special purposes such as schools, roads, the Port District and the cities. Only 11 percent of total property taxes are available to the County without previous designated uses. These are used to support the basic functions of County government and are placed in the general fund or the current expense fund. They support police, fire, parks, planning, administration and other basic County services. Seventy per cent of these funds go to support the criminal justice system. Because of this, there is substantial competition for the remaining funds and there is generally little or no money left for special needs such as drainage and flood hazard reduction. Therefore, other sources must be considered.

Other potential sources may be considered in several categories as shown in Table 6-2.

These sources were reviewed in the advisory committee. In the Grayland area, many of the most serious drainage problems are along and on the state highway and local roads. These problems should be solved by both the State and County, using State highway and County road funds.

The committee agreed that the remaining drainage problems should be resolved locally rather than relying on other government agencies. This keeps local control of the solutions, assures response to local issues and may result in more cost effective solutions. The Grayland area has a history of successful response from the existing drainage district. However, the purpose of the district is limited to maintaining the main drainage channel, not the lateral ditch system. Many areas that are tributary to the district are not included in the district and do not contribute financially to the district. Therefore, it is not appropriate to expect the district to accept additional water from those areas.

Therefore, areas tributary to the district should be required to join the district before drainage improvements are made that will deliver more runoff to the district's system. This includes, for example, the area along SR 105 south of Schmid Road especially.

West of SR 105, substantial capital improvements and reliable on-going maintenance of drainage systems is necessary to reduce drainage problems. For these reasons, formation of a local special district is recommended. Funding generated by the district can be supplemented by funding from the County, grants and other sources. The majority of the funding is likely to have to come from locally generated taxes.

The most likely source for supplemental grant funding for drainage and flood related improvements is the State's FCAAP grants.

Because of the expense of creating a district, a single additional district should be formed. The steps for forming the district are described in Washington State law. Formation of the district will include a petition to the County Commissioners, a public hearing and a vote of the property owners affected. Thereafter, operation of the district would be controlled by a three person, locally elected board.

Using the Tingstrom Lane area as an example, the annual costs to property owners can be estimated. For evaluation purposes it was assumed that:

- Construction costs are \$110,000
- The County pays for 30 percent or \$33,000, reducing capital costs to \$77,000 for the community (note: County funding is not assured and will depend on availability in the annual budgeting process)
- Tingstrom Lane area property owners' share of the costs of forming the district are \$20,000
- Construction costs and district formation costs are amortized over 10 years with a 6 percent interest rate
- Annual maintenance and administration costs are \$5,000
- There are approximately 40 properties in the Tingstrom area that would be subject to assessment.

This results in annual costs of approximately \$18,000 for the area. Dividing the total by the 40 properties would result in annual assessments of approximately \$450 per property or \$37.50 per month per property. If 50 percent funding from FCAAP for the capital projects is obtained, the annual costs would be reduced to \$320 per property.

Although the capital needs of other areas west of SR 105 are not the same as Tingstrom, the potential costs to Tingstrom Lane property owners can serve as an example. There are similar needs in each of the areas.

Formation of a district would provide a funding base and a local management structure for local residents to discuss and address drainage issues. Final decisions regarding local solutions would be made locally.

As discussed above, there are not adequate County funds for the County to provide solutions. With the large percentage of absentee owners and the level of effort needed to maintain ocean outfalls, it is unlikely that volunteer efforts will be successful in providing the necessary improvements in the short term or the necessary maintenance over any long period of time.

SCHEDULES AND LENGTH OF TIME OF BENEFITS

If the necessary budget is available, the non-structural improvements for the main drainage channel should be implemented within the 1995 fiscal year or as soon as possible. Grant monies to help with the development of the educational program should be applied for during the next grant application period. All non-structural benefits should be ongoing efforts, and the time of benefits is expected to be indefinite. Elevating homes and businesses is an individual property owner concern. For this reason, the process will be an ongoing one that proceeds as individuals decide the process is necessary and allocate funds accordingly. The time of benefits of elevating structures is expected to equal the life of the structure.

Final design of localized drainage improvement projects that are funded by County and/or State Road funds (Post Office Site and Mutiny Lane/Lamplighter Area) should be implemented as soon as funding is established. Improvements could be completed within one year of the establishment of funding. With proper maintenance, these benefits are expected to last 50 years (before the culverts and drainage structures will need to be replaced).

Improvements that require the establishment of a local drainage district and/or grant funding will take longer to implement. Because of the need for consensus building, the petition to County Commissioners, the public hearing and property-owner vote required to establish a special district, and the length of time involved in obtaining grants, the establishment of funding for improvements could take one to two years. It is expected that improvements similar to those of the Tingstrom Lane Area could be identified, designed and completed within one year of the establishment of proper funding. With proper maintenance, the length of time of benefits of such improvements are expected to be on the order of 50 years (before the culverts and drainage structures will need to be replaced).

CONFORMANCE WITH GOALS AND OBJECTIVES

Comprehensive goals and objectives were developed to provide an organized framework to guide the analysis and planning processes. The goals represent the general results and improvements desired by Grayland and Grays Harbor County, while the objectives are the specific action items that will deliver these results.

All of the goals set forth in Section 3 of this report were met. The objectives provided a basic framework to develop methods to achieve the goals; as such, they were refined and discarded to better reach the goals as the analysis proceeded. For example, to achieve Goal No. 3 (Provide practical, cost-effective solutions that will result in measurable reductions in flooding frequency, duration and frequently flooded area damages), Objective 3a (identify drainage channel improvements) included enhance performance of tide gates. After completing the hydrologic and hydraulic analysis of the main drainage channel, it was determined that enhancing the performance of the tide gates would provide no significant benefits to flood hazard reduction. Therefore, efforts were put into other objectives that would help to meet Goal No. 3.

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REFERENCES

Washington State Department of Ecology. *Comprehensive Planning for Flood Hazard Management*. Publication #91-44 First Edition. August 1991.

Grays Harbor County Dept. of Public Works and CH2M HILL. *Draft Grays Harbor County Capital Facilities Plan*. Prepared for Grays Harbor County Board of Commissioners. December 1994.

Parametrix, Inc. et al. *Utilities Comp Plan Phase I, Grays Harbor County*. Prepared for Grays Harbor County. October 1991.

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TABLE 6-2

Alternatives for Funding Flood Hazard Reduction Plan Implementation Measures

	Primary Purpose	Process to form or obtain	Cost to obtain	Control	Revenue Potential	Public Acceptance	Adverse Impacts
Basic County Revenues							
Current Expense	Provide general County government services	Already exists	None	County Commissioners		Good	Competes with other County service needs
Road Fund	Develop and maintain roads	Already exists	None	County Commissioners	Moderate, restricted to those services required as a result of road impacts or to provide roads.	Good	Competes with other road needs
River Improvement Fund	Provide services related to flooding or erosion along rivers	Commissioner vote	None	County Commissioners	Minimal, competes with other County revenues and is subject to overall tax levy lids	Generally good	Competes with other demands for County revenues
Bonding	To spread costs of capital projects that have long-term benefits over long periods of time.	Commissioners have limited authority to issue General Obligation Bonds and may issue revenue bonds without a public vote. A ballot is required for bonds that exceed basic limits.	Moderate, includes interest	County Commissioners	Moderate, subject to statutory limits, ability to repay and limited to capital programs	Variable	Requires repayment in future, may limit debt available for other purposes
Real Estate Excise Tax for CIP related to development	RCW 82.46 authorizes optional real estate excise taxes to fund capital projects	Commissioner vote	Minimal	County Commissioners	Moderate	Variable	Minimal, potential voter resistance
Conservation Futures for open space acquisitions	N/A						
Special Districts							
Stormwater Utility	RCW 36.89 authorizes stormwater programs including capital and maintenance programs to address problems associated with stormwater runoff such as flooding and water quality.	Vote of County Commissioners	Minimal, generally includes preparation of a plan for use of the funds and a public involvement program to assess acceptance of proposal	County Commissioners	Significant	Generally acceptable, widely implemented throughout Puget Sound region and other areas of the country.	May be perceived as another "tax" and another government bureaucracy

TABLE 6-2

Alternatives for Funding Flood Hazard Reduction Plan Implementation Measures

	Primary Purpose	Process to form or obtain	Cost to obtain	Control	Revenue Potential	Public Acceptance	Adverse Impacts
Flood Control Zone District	RCW 86.15 authorizes formation to address flood control or stormwater related issues.	Resolution of intent, public hearing and vote of County commissioners	Moderate, generally includes cost to prepare program proposal and conduct public involvement program to assess public acceptance	County Commissioners	Substantial, can assess taxes or utility rates and charges	Generally favorable if need is understood	May be viewed as additional bureaucracy and as unnecessary
Special District	RCW 85.38 authorizes formation to provide drainage and flood control services	petition, public hearing and vote of property owners affected	Moderate, includes preparation of plan for operation, assessment role, public hearing and vote	Three locally elected board	moderate, based on benefit	High if locally supported	narrow purpose, may conflict with broader purpose governments
Water and Sewer Services	RCW 36.94 authorizes Counties to provide water and sewer services, may provide stormwater services by amending comprehensive sewer plan	Amend or prepare comprehensive sewer plan, Commissioner vote	Moderate, cost of developing or amending comprehensive sewerage plan	County Commissioners	moderate, may use utility rates or taxes	Moderate	May be viewed as another tax and unnecessary bureaucracy
Water and Sewer Districts	RCW 56.04 authorizes formation of sewer districts. Sewer district may provide stormwater control services.	Petition, hearing, vote of affected property owners	Moderate, cost to develop plan, assessment roll, hearing, petition and vote	Locally elected board	Moderate	Moderate	May compete with other agency programs or local funding needs
Lake Management District	RCW 36.61 authorizes formation to protect water quality of lakes, not applicable in Grayland	Petition or resolution, public hearing and vote of property owners	Moderate, cost to develop plan, assessment roll, hearing and vote	County Commissioners	Moderate, subject to benefit of clean lake	Variable depending on perceived threat to local lake	May compete with other local funding needs
Shellfish Protection District	RCW 90.72 authorizes formation to protect shellfish areas from pollution	Vote of County commissioners	Minimal	County Commissioners	High, subject to political will	Variable, dependent on perceived threat to shellfish	May be perceived as competing with other local funding needs
Local Improvement District	See below	See below	See below	See below	See below	See below	See below
Utility Local Improvement District	RCW 36.94 authorizes to provide funding for capital improvements	Petition or resolution, hearing and vote of affected property owners	Moderate, cost of preparing plans, cost estimates and assessment role	County commissioners following vote of property owners to establish	Moderate	Generally high because those benefiting are paying	Minimal, cannot be used to assess those causing flood problems, only those benefiting