

CHAPTER 7: RECOMMENDED PLAN IMPLEMENTATION

7.1. PLAN ADOPTION AND REVISION

The basin plan must be adopted by Thurston County, Lacey and Olympia in order to work effectively, because the plan recommendations span all three jurisdictions. The county commissioners and city councils will take public testimony on the plan at public hearings publicized through the media. Each jurisdiction may adopt the plan as written or direct the staff to prepare changes. Any revisions proposed by one jurisdiction must gain the support of the other jurisdictions so that all three jurisdictions adopt the same version of the plan. The basin plan may also be adopted by reference in the jurisdictions' Comprehensive Plans, which would give the basin plan additional authority. Comprehensive Plan revisions are reviewed by the appropriate Planning Commission, then forwarded to the commissioners or city councils with a recommendation.

The plan will also be submitted to the Department of Ecology for approval. The Department may also approve or request revisions. Approval by the Department of Ecology will make the recommendations eligible for a variety of state grant and loan programs.

Adoption by the county and cities does not commit actual dollars to specific recommendations. Each recommendation must then go through a separate implementation process, depending on the nature of the recommendation. The cost estimates will be refined and the details of each recommendation will be fleshed out at that time. Each recommendation will be subject to further public review through the implementation processes.

Some recommendations of the Regional Nonstructural Stormwater Management Plan, adopted in previous basin plans (see appendix G), still require revisions to local ordinances or regulations. For instance, the nonstructural management plan recommends restricting development in the floodplain. The recommendation has already been adopted by the county commissioners in the county's critical areas ordinance, but county flood regulations must still be revised to be consistent with the critical areas ordinance and fully implement the recommendation. Revising the flood regulations would require additional actions by the county commissioners and more opportunities for public comment. The cities must also revise their flood regulations to implement this recommendation.

All city and county capital facilities must be included in the jurisdictions' capital facilities plans, which are adopted as part of the Comprehensive Plans. The capital facilities plans must support projected population growth for 20 years, and identify sources of funding for 6 years. The capital facilities plans cover all capital projects including sewer, roads, etc, and, depending on the funding source, they may need to balance the stormwater projects against other public needs, which could result in some stormwater projects receiving lower priority (Olympia stormwater projects are funded exclusively from stormwater utility funds, so they do not compete with other capital needs). The capital facilities plans may be updated once a year.

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The capital recommendations must also be coordinated between jurisdiction so that the correct project share is budgeted in the appropriate year for joint projects.

The county and cities currently have a general interlocal agreement on stormwater projects, which provides the basis for shared participation on projects. Specific agreements attached to the general agreement detail the actual cost shares for various projects. For instance, the ambient monitoring agreement details the annual water quality monitoring budget and specifies the financial contribution of each jurisdiction. Some of the basin plan recommendations would require development of new interlocal agreements and/or revision of existing ones. These agreements must be approved by the county commissioners and city councils.

Each recommendation must be incorporated into the appropriate agencies' annual work plans and budgets. The annual planning process usually begins in early summer for the local jurisdictions, leading eventually to budget approval by the end of the year. Coordination between jurisdictions begins early in the planning process, which insures that each jurisdiction's budget allocation reflects their correct share for joint projects.

The commissioners and city councils review and approve the annual plans and budgets, with opportunities for public comment. No actual funds are committed to any project or program until this time. Each jurisdiction has its own specific process for adopting the annual budget. The cities accomplish most of the initial review and revision in subcommittees. The county commission requests input from the Storm and Surface Water Advisory Board, prior to approving the stormwater budget.

Many recommendations identify a "lead agency". The lead agency for capital projects is usually the jurisdiction where the project will be constructed. The lead agency is responsible for making sure that all the needed interjurisdictional coordination occurs. The lead agency for capital projects and some nonstructural projects usually does the work, pays for the project, and bills the other participating jurisdictions. Some recommendations would be implemented separately by each jurisdiction, but planned cooperatively. The Stream Team program is an example of how the local jurisdictions plan and coordinate a program together, even though it is funded separately. Many drainage basin recommendations require this kind of close coordination because the basins cross city and county boundaries.

The basin plan must be revised and updated in the future, as the basin changes and additional information becomes available. Monitoring will be critical to revising the basin plan.

Ambient monitoring would indicate the overall trends in the condition of the watershed. If monitoring detects continued declines in water quality or habitat, additional measures may be needed to protect the basin's resources. Project-specific monitoring would provide essential information for determining the most effective actions.

Project-specific monitoring would be incorporated in the funding and operation of each capital project and would include pre-construction (baseline) and post-construction data collection. Project-specific monitoring plans must be designed to portray as accurately as possible the effectiveness of each management measure under a range of environmental conditions, which would take several years.

The results of monitoring would be interpreted for management implications and fed back into the basin planning process. As the basin develops, the conditions will change and the basin model would need to be updated to reflect the changes. The model would be revised and the original predictions would be checked periodically. Sufficient time must elapse between model runs to implement and monitor plan measures and land use changes.

Between model runs, the jurisdictions would continue to monitor and report on the basin's water resources through ambient water quality monitoring, stream flow and precipitation monitoring, habitat surveys and citizen reports. The plan would be revised to reflect the additional knowledge, and the revisions would go through an adoption process similar to the original adoption. In this way, the basin plan would be a dynamic document that evolves in response to changing conditions.

7.2 IMPLEMENTATION PHASES

The citizen advisory task force strongly recommended that the basin plan should address the top priority problems first and make the best use of existing programs and scarce funds. The task force emphasized that local government should not build expensive capital facilities without well-documented need. Task force members and basin planning staff developed a 3-stage implementation strategy to insure that the plan responds to community needs as efficiently as possible. The plan implementation would be staged based on the following criteria:

1. The top priority problems should be addressed first.
2. Initial water quality improvement actions should reduce known contamination at the sources, rather than building treatment facilities at outfalls.
3. An educational approach to solving water quality problems should be emphasized, rather than a regulatory approach.
4. Existing water resource programs should be improved instead of starting new programs.
5. Problem sites should be monitored for water quality improvements following implementation of the initial remedial actions.
6. Contamination sources should be clearly identified for sites that continue to show problems.

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7. Constructing water quality treatment facilities should be a last resort after all identified sources of contamination have been reduced as much as possible.

7.2.1 PRIORITIZATION

Each individual recommendation was ranked to develop the basis for each stage of implementation. The initial ranking was based on criteria developed by the Thurston County Storm and Surface Water Advisory Board (SSWAB), a citizen board that advises the Board of County Commissioners. The cities of Lacey and Olympia were not directly involved in the ranking process, and may choose to revise the project rankings to reflect their priorities, when they adopt the plan. The initial criteria included: ability to implement; environmental sustainability; effectiveness; property damage; public health and safety; and vision statement compliance (the "vision statement" is a plan for comprehensive, coordinated water resources in Thurston County, developed by the SSWAB). The basin task force's criteria, described above, were added to the initial ranking worksheet, including: staging prerequisite; problem priority; cost; and source reduction.

Table 7-1 presents the worksheet used to rank the recommendations, and table 7-2 presents the results, in order from highest to lowest rank. The ranking process resulted in three groups of projects: highest rated (130-171 points), medium rated (110-129 points) and lowest rated (62-109 points).

The three phases of implementation described below were based on the prioritized list of recommendations. Several recommendations appear under more than one phase, because they would be implemented in stages. For instance, the stormwater treatment recommendations for the lakes are listed in all three phases, because source reduction and education would occur in phase 1, followed by monitoring in phase 2, and finally, treatment facilities as a phase 3 last resort.

7.2.2 PHASE 1

The first phase of implementing the recommended plan would address the worst problems in the basin, including flooding on Boulevard Road, Wiggins Road and Chambers Ditch, and water quality degradation in Chambers Ditch and Ward and Hewitt Lakes. Phase 1 would emphasize increased stormwater maintenance, reduction of known pollution sources, and limited drainage system improvements.

1. Increase stormwater maintenance

The Chambers Drainage District would expand to encompass all of the drainage area that contributes to the ditch, and would increase maintenance for Chambers Ditch, with assistance from the county. Stormwater system maintenance would be increased for Ward, Hewitt and

Table 7-1 Recommendation ranking worksheet

<u>Criteria</u>	<u>Points</u>
A. Ability to Implement - 60 points	
A1 Public Cost: Availability of Outside Funds	0 - not available 3 - medium 5 - high grant availability
A2 Public Cost: Effect on the Tax Base	0 - no change in tax base 3 - will increase tax base
A3 Public Cost: Private Costs vs. Public Costs	0 - no private cost 2 - at least 25% privately funded
A4 Public Cost: Operations and Maintenance Costs	0 - high cost 3 - medium cost 5 - low cost
A5 Technical Feasibility	0 - unproven technology 10 - proven technology/unknown site conditions 20 - proven technology on site
A6 Equity	0 - local benefit/regional cost 5 - costs borne equally by beneficiaries
A7 Legal Mandate	0 - not mandated 20 - mandated
B. Environmental Sustainability - 60 points	
B1 Aquatic/Riparian Resources	0 - no impact 7 - protects/preserves 15 - improves/restores
B2 Water Quality	same as B1, above
B3 Channel Stability	same as B1 above
B4 Minimum Flows	0 - no impact 3 - protects/preserves 5 - improves/restores
B5 Maximum Flows	same as B4 above
B6 Aquifer Recharge	same as B4 above
C. Effectiveness - 40 points	
C1 Completeness of Solution	0 - totally dependent on other projects to work 7 - partial solution without other projects 15 - solves problem by itself
C2 Accommodation of Future Growth	0 - no accommodation 5 - at least some accommodation
C3 Solves Regional Problem over Local Problem	0 - primarily local benefits 5 - some local, some regional benefits 10 - mostly regional benefits
C4 Multiple Use Capability	0 - single use only 5 - potential for limited multiple uses 10 - multiple use

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Table 7-1 continued

D. Property Damage - 40 points

- | | |
|-----------------------------------|---|
| D1 Jurisdictional Liability | 0 - low risk if project not done
7 - medium risk if project not done
15 - high risk if project not done |
| D2 Property Loss or Inconvenience | 0 - no or minor prevention
15 - moderately prevents property loss
25 - prevents property loss |

E. Public Safety - 60 points

- | | |
|--|---|
| E1 Public Health Hazard | 0 - does not solve a public health hazard
15 - solves a suspected problem
30 - solves a documented problem
40 - solves declared public health hazard |
| E2 Transportation Interruption-
Safety Considerations | 0 - minor problem/partial solution
5 - medium problem/partial solution or minor
problem/complete solution
10 - major problem/partial solution or medium
problem/complete solution
20 - major problem/complete solution |

F. Vision Statement* - 30 points

- | | |
|--|--|
| F1 Comprehensive Approach | 0 - addresses one water resource locally
5 - addresses one water resource regionally
10 - addresses multiple water resources locally
15 - addresses multiple water resources regionally |
| F2 Promotes Interjurisdictional
Solutions/Cooperation | 0 - only one jurisdiction
10 - involves multiple jurisdictions |
| F3 Concurrency | 0 - not needed to meet 6-year growth projection
5 - needed to meet 6-year growth projection |

G. Supplemental Criteria - 45 points

- | | |
|-------------------------------|--|
| G1 Staging Prerequisite | 0 - last resort measure
7 - other measures hinge on this but other measures also must
precede it
15 - necessary first step that must precede other measures |
| G2 Problem Priority | 0 - low priority
7 - medium priority
15 - high priority |
| G3 Budgetary Constraints | 0 - cannot do within existing budget
5 - Can do entirely within existing budget |
| G4 Watershed Source Reduction | 0 - Does not reduce a problem source
10 - Reduces or eliminated a problem source in the watershed |

* "Vision Statement" is a philosophy developed by the Thurston County Storm and Surface Water Advisory Board for a county-wide coordinated water resources management program.

Table 7-2 Project Ranking

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PROJECT DESCRIPTION	RANKING SCORE	PRIORITY	PARTICIPANTS
6.2.15 SW maintenance program	171	H	TC
6.1.1 Ditch maintenance	160	H	TC,O,L,DD
6.2.4 Conservation plans for farms	147	H	CD
6.2.1 Septic surveys	144	H	TC
6.2.7 Homeowner nonpoint education	138	H	TC,O,L
6.2.5 WQ monitoring	137	H	TC,O,L
6.2.13 Ward Lk SW	137	H	TC,O
6.1.4 Boulevard Rd pond	135	H	TC,O
6.2.12 Hewitt Lk SW	135	H	TC
6.1.3 Wiggins ditch improvements	134	H	TC,O
6.2.2 Septic maintenance workshops	134	H	TC
6.3.4 Lakes education	121	M	TC,L,O
6.3.1 Riparian planting	120	M	TC,CD
6.1.2 Yard waste education	117	M	TC,DD
6.2.11 Implement Lacey Chambers Lake plan	115	M	L
6.1.6 Misc SW upgrades	115	M	TC
6.2.14 Smith Lk SW	112	M	TC
6.2.3 Herman Rd SW treatment	111	M	L
6.2.9 Sediment investigation	102	L	TC
6.2.8 Wiggins ditch treatment	102	L	TC,O
6.2.10 Monitor Yelm Hwy outfall	99	L	TC
6.1.7 Ferndale Ct pond	93	L	TC
6.3.3 Habitat monitoring	90	L	TC,CD
6.1.8 South trib model	85	L	TC
6.2.6 Goose control	73	L	TC,L,O
6.3.2 Rich Rd gravel	70	L	TC
6.1.5 Limerick St pond	62	L	TC

TC=Thurston County

O=Olympia

L=Lacey

CD=Thurston Conservation District

DD=Chambers Drainage District

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Smith Lakes and Wiggins Ditch. Basin-wide stormwater maintenance would be evaluated and improved. These steps would implement part or all of the following recommendations:

- 6.1.1-Chambers Ditch maintenance
- 6.1.3-Wiggins Ditch maintenance
- 6.2.12-Hewitt Lake stormwater
- 6.2.13-Ward Lake stormwater
- 6.2.14-Smith Lake stormwater
- 6.2.15-Basin-wide stormwater maintenance

Increased maintenance would help to reduce flooding and water quality degradation from sediment build-up in drainage systems. Better maintenance would also increase the life of existing drainage system and reduce the need for costly future improvements.

2. Reduce sources of nonpoint pollution

The plan would employ multiple strategies to reduce pollution sources. Suspect septic systems near water bodies would be monitored and failing systems would be repaired. Septic system owners would be offered free training on system care and maintenance. Conservation plans for farms would be developed and implemented. Homeowners in targeted areas would be offered free training in common sense gardening, least-toxic household products, and hazardous materials disposal. Education efforts would expand on existing programs. These steps would implement all or part of the following recommendations:

- 6.2.1-Septic surveys and repairs
- 6.2.2-Septic maintenance training
- 6.2.3-Herman Road ditch stormwater treatment
- 6.2.4-Conservation plans for farms
- 6.2.7-Homeowner nonpoint pollution education
- 6.2.8-Wiggins Road ditch stormwater treatment
- 6.3.6-Lake user education

Septic system monitoring and repairs would reduce fecal coliform contamination at several problem sites. Better septic system maintenance would prevent additional fecal coliform contamination from new failures in the future. Conservation planning would help reduce fecal coliform and nutrient loading in runoff from agricultural sites. Homeowner education would reduce nutrient loading and contamination from a range of household products.

3. Make limited capital improvements to drainage systems

Phase 1 would include the top priority drainage improvements on Boulevard Road and Wiggins Road, where flooding poses a high risk to significant arterial roads. Boulevard Road

improvements would include culvert enlargements, ditch improvements, and enlargement and connection of the ponds east and west of Boulevard Road. The under-sized culverts on Wiggins Road ditch would be enlarged, some of the ditch would be piped, and additional stormwater storage would be provided upstream of the ditch, if possible. These steps would implement part or all of the following recommendations:

- 6.1.3-Wiggins Road ditch improvements
- 6.1.4-Boulevard Road drainage improvements
- 6.2.8-Wiggins Road ditch stormwater treatment

Boulevard Road drainage improvements would substantially reduce the frequency of flooding on Boulevard Road near Wilderness. Wiggins Road ditch improvements and upstream stormwater detention would reduce flooding and make the culverts less prone to clogging. The cost of responding to flooding emergencies would be reduced.

4. Continue to monitor water quality

Ambient water quality monitoring would be continued and a few of the monitoring sites from the basin plan study would be added to the ongoing monitoring program. This would implement part of the following recommendation:

- 6.2.5-Water quality monitoring

Continued monitoring would provide the background information needed to detect additional sources of water quality degradation.

7.2.3 PHASE 2

The second phase of implementing the recommended plan would follow-up on phase 1 improvements and would also address medium priority flooding problems and habitat degradation. Phase 2 would emphasize follow-up monitoring of water quality and flooding problems and include additional drainage system improvements, if needed. Phase 2 would also include limited riparian planting and improved enforcement of shoreline regulations.

1. Conduct follow-up monitoring at problem sites

Additional monitoring would be conducted at problem sites following implementation of phase 1 source control and flood control measures. Monitoring would determine the effectiveness of phase 1 and the need for additional measures. This would implement part or all of the following recommendations:

- 6.1.5-Limerick Street pond

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- 6.1.6-Chambers Ditch vicinity ponds
- 6.1.7-Ferndale Court pond
- 6.2.3-Herman Road stormwater treatment
- 6.2.5-Long-term water quality monitoring
- 6.2.8-Wiggins Road ditch stormwater treatment
- 6.2.12-Hewitt Lake stormwater treatment
- 6.2.13-Ward Lake stormwater treatment
- 6.2.14-Smith Lake stormwater treatment

The staged approach to flooding and water quality would insure that known sources are addressed first, and no capital facilities are built unnecessarily. All possible sources would be reduced or controlled, which could eliminate the need for expensive treatment facilities.

2. Implement additional source control measures

Phase 2 source control measures would include yard waste education and new target audiences for homeowner nonpoint pollution control efforts. Yard waste education would be targeted at homeowners who live along Chambers Ditch or near stormwater ponds. Homeowner education would be provided for Smith Lake area residents. These measures would implement all or part of the following recommendations:

- 6.1.2-Chambers Ditch homeowner yard waste disposal
- 6.2.7-Homeowner nonpoint pollution education
- 6.2.14-Smith Lake stormwater treatment
- 6.3.4-Lake user education

The phase 2 source control measures would provide additional water quality improvements and reduce flooding along Chambers Ditch.

3. Protect and improve key habitat areas

Selected sites along lower Chambers Creek would be revegetated with native plants. This step would implement the following recommendation:

- 6.3.1-Riparian revegetation

4. Install medium priority drainage improvements and Chambers Lake treatment facilities

The stormwater facilities identified by the city of Lacey in the *Chambers Lake Stormwater Management Plan* would be installed in Lacey neighborhoods along the lake. Improvements would be made on several stormwater facilities in the vicinity of Chambers Ditch.

Improvements and mitigating measures would be made on Chambers Ditch, if needed. These steps would implement all or parts of the following recommendations:

- 6.1.1-Chambers Ditch maintenance
- 6.1.6-Chambers Ditch vicinity stormwater upgrades
- 6.2.11-Lacey *Chambers Lake Stormwater Management Plan* implementation

Additional Chambers Ditch improvements and mitigating measures would insure that the ditch has enough capacity to prevent flooding. The improvements to stormwater facilities in the Chambers Ditch vicinity would reduce local flooding problems and help reduce flooding in Chambers Ditch. Implementing Lacey's Chambers Lake plan would reduce stormwater contamination of Chambers Lake and help slow down eutrophication of the lake.

7.2.4 PHASE 3

The third phase of implementing the recommended plan would address additional measures identified through follow-up monitoring, and lower priority habitat problems. Phase 3 would include additional drainage system improvements if needed, limited habitat and stormwater monitoring, and miscellaneous lower priority recommendations.

1. Monitor fish habitat and the Yelm Highway outfall

The fish habitat on Chambers Creek would be monitored, probably using the state's Timber-Fish-Wildlife method. The stormwater outfall at Yelm Highway and Chambers Ditch would be sampled. This would implement some or parts of the following recommendations:

- 6.2.5-Long-term water quality monitoring
- 6.2.10-Yelm Highway stormwater outfall
- 6.3.3-Chambers Creek fish habitat monitoring

The stormwater monitoring would determine if the Yelm Highway stormwater system was causing contamination of Chambers Ditch. The habitat monitoring would provide baseline information on the health of the creek's ecosystem, and would help determine the effectiveness of habitat protection and enhancement efforts.

2. Implement additional capital improvements if needed

Additional stormwater system improvements would be installed, based on the results of phase 2 monitoring. Facilities would be constructed only if previous measures proved inadequate. This step would implement some or parts of the following recommendations:

- 6.1.5-Limerick Street pond

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- 6.1.7-Ferndale Court pond
- 6.2.3-Herman Road ditch stormwater treatment
- 6.2.8-Wiggins Road ditch stormwater treatment
- 6.2.10-Yelm Highway stormwater treatment
- 6.2.12-Hewitt Lake stormwater treatment
- 6.2.13-Ward Lake stormwater treatment
- 6.2.14-Smith Lake stormwater treatment

These stormwater facilities would help reduce water quality contamination at several problem sites in the basin.

3. *Miscellaneous lower priority recommendations*

The remaining basin plan recommendations would be implemented, including:

- 6.1.8-South Tributary modeling
- 6.2.6-Goose control program
- 6.2.9-Chambers Creek sediment tracking
- 6.3.2-Rich Road & Chambers Creek gravel enhancement

These measures would help improve habitat in Chambers Creek, reduce nonpoint pollution and provide information to help prevent future stormwater impacts in the southern basin.

7.3 FUNDING

Revenues for financing the basin plan recommendations can be grouped into two categories: local sources and grants. Existing local sources include stormwater utility fees, road funds, city and county general funds, various building fees, and development charges. Each local source generates money from a different mix of residents. Other potential mechanisms for generating local revenues include shellfish districts, aquifer protection areas and local improvement districts. Grants include a variety of federal and state programs. Historically, stormwater needs have been funded by a mix of utility fees, road funds and grants.

7.3.1 LOCAL REVENUE SOURCES

Stormwater Utility Fees

Thurston County, Olympia, Lacey and Tumwater all have stormwater utilities that collect fees from property owners within their boundaries (Thurston County only collects fees in the northern county). The charges are based primarily on the amount of impervious area (as measured, estimated or averaged) and the type of property use. Each jurisdiction's utility has a unique rate structure. Table 7-3 compares the local jurisdictions' utility rates.

Some of the local stormwater utilities' current rate revenues may not be sufficient to finance the basin plan recommendations. One possible source of revenues for basin plan recommendations would be increasing the stormwater utility rates.

Table 7-3 Local Stormwater Utility Rates (Annualized)¹

Land Use	Olympia	Tumwater	Lacey	Thurston County
Single-Family Residential	\$72.00/60.00 ²	\$54.00	\$63.00	\$20.00 + 1.00 per acre ⁴
Duplex	\$144.00/120.00 ²	\$108.00	\$126.00	\$13.00 per unit + 1.00 per acre ⁴
Multi-Family Residential	\$102 + (28.80/53.28/79.20 per gross impervious area ÷ 2528 sq. ft.) ²	9.00 + (45.00 per gross impervious area ÷ 3250 sq.ft.)	\$26.64 to \$618.12 per gross acre ³	\$6.00 per unit
Commercial, Industrial, and Schools	Same as multi-family	Same as multi-family	Same as multi-family	\$5.56 per 1,000 sq ft impervious area
Streets, Roads, and State Government	30% of commercial charge	30% of commercial charge	30% of commercial charge (no charge to WDOT)	30% of commercial charge

Notes:

¹Olympia, Lacey and Tumwater charge monthly rates and offer various incentives for improved facilities. Contact the local Public Works Department for complete details. Lacey rates effective 4/1/95.

²Olympia's rates vary according to the date of development, in order to reduce rates for developments which meet higher standards. The higher rate is the base rate which most parcels pay.

³Lacey sets 7 nonresidential rates on a scale according to the % of impervious area. Parcels which mitigate their stormwater impacts receive a one-step rate reduction.

⁴Thurston County surcharges residential parcels \$1.00/acre for each additional acre over one-half acre. The duplex rate also applies to triplex and fourplex.

Road Funds

Funding for drainage improvement and maintenance in Thurston County is largely the responsibility of the Roads and Transportation Services Department. Road drainage improvements such as culverts and ditches are constructed as a part of road projects because they are necessary to accommodate transportation needs. Road funds currently support only minor capital improvements. Thurston County's stormwater system is largely comprised of ditches and culverts. Minimal additional funds can be expected from this source. Olympia and Lacey use a variety of sources for street repairs and construction, including grants and

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general funds. Lacey road funds could probably be used to partially fund facilities designed to treat road runoff.

Other Local Revenue Sources

Other existing local revenue sources that could be used for stormwater programs include:

- General Funds
- Plan Review and Inspection Fees
- Connection Fees (General Facilities Charges)
- Latecomer Fees

State law permits local governments to create a variety of districts and jurisdictions to fund specific types of projects. None of these mechanisms have been created in Thurston County, or Olympia, but they could theoretically be used to fund stormwater projects. Lacey has used LIDs to fund stormwater projects. Potential mechanisms for generating local revenues include:

- Shellfish Protection Districts
- Aquifer Protection Areas
- Impact Fees
- Street Utility Fees
- Fee-in-Lieu of Construction
- Local Improvement Districts (LIDs)
- Flood Control Zone Districts

7.3.2 GRANTS

Adopting the basin plan will improve the local jurisdictions' ability to compete for increasingly limited grants. Local governments have been highly successful in obtaining state and federal grants in the past. Most state-administered grants target either existing water quality or flooding problems, but not both, which sometimes causes problems for combined facilities. Problems which cause property damage or present public health or safety hazards usually rate highly for grant eligibility. Public involvement and education programs are also eligible for limited grant funding. Funds targeted at historical problems may also address potential future problems, or they may free up other funds for the prevention of potential problems.

Most grants require some amount of local matching funds, which may sometimes take the form of services-in-kind. Grant sources have dried up in recent years as government has reduced spending at all levels. Grants help bolster finite local funds, but they are highly uncertain and cannot be relied on for long-term planning. Grant sources for stormwater projects include:

- Centennial Clean Water Fund Grant Program
- Flood Control Assistance Account Program
- Puget Sound Water Quality Authority Public Involvement and Education Fund
- Washington State Ecosystems Conservation Project
- EPA Clean Water Act Section 319 Grants

7.3.3 DEBT FINANCING MECHANISMS

Local government's ability to pay for the basin plan recommendations is limited by the existing revenues described above. These revenue sources might be able to pay for gradual implementation of basin plan recommendations with available funds over several decades. This "pay-as-you-go" approach could not implement the basin plan recommendations in time to prevent or repair the damage they are intended to address. Local governments have two basic debt financing mechanisms for obtaining additional, up-front funds in excess of current revenues: loans and bond sales.

Local jurisdictions have historically used loans for smaller capital projects and sold bonds to finance major improvements such as new schools or bridges. Thurston County, Olympia and Lacey have never sold bonds to finance stormwater projects because past projects have been small enough to fund from existing revenues. However, as local governments proceed with comprehensive facilities planning for stormwater and other infrastructure projects, bonds have become a more realistic approach.

Major capital improvement projects often require large sums of capital for construction, but they have low operating costs and long life spans. Debt financing offers a method for spreading out the impact of high-cost construction over a long period of time. Mechanisms such as bonds and low-interest loans have long been used to ease the immediate burden of financing capital construction, but they add financing charges to the total cost of the projects.

The basin plan recommends a combination of ongoing and one-time activities. The ongoing activities such as monitoring, maintenance and education constitute the base work programs of the stormwater utilities or other local agencies. The capital facilities would be one-time expenditures for facilities with finite life spans. Existing or projected revenues must be sufficient to fund ongoing activities because debt-financing of basic work programs would be financially risky.

Capital facilities are good candidates for debt-financing, because they require a one-time expenditure. The cost of capital facilities can be spread across the lifespan of the facilities, or some shorter period. Spreading the cost over several years reduces the financial burden of any particular year, but the longer that financing is extended, the greater the additional financing charges. Debt-financing would probably delay implementation of lower-priority projects,

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because they could not be funded until the debt from the high-priority projects was retired. Sources of debt-financing include:

- Washington Public Works Trust Fund
- Department of Ecology Centennial Clean Water Fund Loan Program
- Washington State Revolving Fund for Water Pollution Control
- Revenue Bonds

7.3.4 COST SHARING

The following tables show the proposed cost distribution between participating jurisdictions. Capital facility costs are distributed according to the proportion of contributing area in each jurisdiction. Nonstructural costs are split evenly between jurisdictions.

NOTE: The tables show the total cost of all recommendations, but the columns for individual jurisdictions only show costs that would require additional expenditures beyond existing budgets.

Table 7-4 Phase 1 Implementation Costs

BASIN PLAN PHASE 1						
PROJ- ECT #	Description	TOTAL COST	LACEY	OLYMPIA	COUNTY	OTHER
1. INCREASE STORMWATER MAINTENANCE						
6.1.1	Chambers Ditch Maintenance	193,477			66,990	126,487
6.2.15	Dedicated maintenance crew	16,325			16,325	
2. REDUCE SOURCES OF NONPOINT POLLUTION						
6.2.1	Sanitary surveys	108,000			108,000	
6.2.2	Septic maintenance training	16,067			16,067	
6.2.4	Farm planning	60,000				*
6.2.7	Nonpoint pollution education	4,802	1,601	1,601	1,601	
6.3.6	Lake user education	13,732	4,577	4,577	4,577	
3. HIGH PRIORITY DRAINAGE SYSTEM IMPROVEMENTS						
6.1.3	Wiggings Ditch Improvements	238,623		213,056	25,567	
6.1.4	Boulevard Road pond**	454,935		220,974	63,810	66,580
4. WATER QUALITY MONITORING						
6.2.5	Water quality monitoring	17,300	5,767	5,767	5,767	
TOTAL		1,123,261	11,945	445,975	308,704	193,067

* This project can be partially funded from the existing budget

** The county share of R-6.1.4 excludes the cost of land that has already been acquired by the county

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Table 7-5 Phase 2 Implementation Costs

BASIN PLAN PHASE 2						
PROJ-ECT #	Project Description	TOTAL COST	LACEY	OLYMPIA	COUNTY	OTHER
1. FOLLOW-UP MONITORING						
6.2.5	Water quality monitoring	NA	NA	NA	NA	NA
2. ADDITIONAL SOURCE REDUCTION MEASURES						
6.1.2	Yard Waste Education	1,040			*	
6.2.7	Nonpoint pollution education	**	*	*	*	
6.3.4	Lake user education	NA	NA	NA	NA	
3. PROTECT AND IMPROVE KEY HABITAT AREAS						
6.3.1	Riparian planting	NA	NA	NA	NA	NA
4. MEDIUM PRIORITY CAPITAL FACILITIES						
6.1.1	Chambers ditch improvements	**				
6.1.6	Chambers facility upgrades	185,000			185,000	
6.2.11	Lacey Chambers Lake projects	NA	NA	NA	NA	NA
TOTAL		NA	NA	NA	NA	NA

* These projects can be funded from existing budgets

** Cost to be determined following phase 1 implementation

Table 7-6 Phase 3 Implementation Costs

BASIN PLAN PHASE 3						
PROJ-ECT #	Project Description	TOTAL COST	LACEY	OLYMPIA	COUNTY	OTHER
1. MONITOR HABITAT AND YELM HIGHWAY OUTFALL						
6.2.10	Yelm Highway runoff treatment	68,185			68,185	
6.3.3	Fish habitat monitoring	4,000			4,000	
2. CAPITAL FACILITIES IDENTIFIED BY MONITORING						
6.1.5	Wilderness Limerick pond	119,039			119,039	
6.1.7	Ferndale Court pond	233,724			233,724	
6.2.3	Herman Road treatment facility	216,439	216,439			
6.2.8	Wiggins ditch treatment facility	437,226		390,380	46,846	
6.2.10	Yelm Highway runoff treatment	68,185			68,185	
6.2.12	Hewitt Lake stormwater treatment	390,000			390,000	
6.2.13	Ward Lake stormwater treatment	254,600		151,577	103,023	
6.2.14	Smith Lake stormwater treatment	222,666			222,666	
3. MISCELLANEOUS RECOMMENDATIONS						
6.1.8	South Trib hydrologic model	20,000			20,000	
6.2.6	Geese control	4,583	1,528	1,528	1,528	
6.2.9	Sediment investigation	1,401			*	
6.3.2	Chambers Creek gravel project	590			*	
TOTAL		2,040,636	217,966	543,485	1,277,194	

* These projects can be funded from existing budgets

REFERENCES CITED

- Aqua-Terra Consultants. 1994. *Chambers watershed HSPF calibration for Thurston County, Washington, final calibration report*. By D.C. Beyerlein and J.T. Brascher. Everett, WA.
- Arno, Stephen F. and Ramona Hammerly. 1977. *Northwest trees*. Seattle: The Mountaineers.
- Baranski, C. February 1991. Letter to Phillip Jensen dated February 21. Washington Department of Fisheries, Olympia, WA.
- Bartoldus, Candy C., E.W. Garbisch and M.L. Kraus. 1994. *Evaluation for Planned Wetlands*. Environmental Concern Inc. St. Michaels, MD.
- Bisson, Peter. 1992. Habitat needs of salmon in the city. Paper presented at symposium, *Salmon in the City: effects of urbanization on fish habitat*, March 11-13. Sponsored by the American Public Works Association, Pack Forest, Eatonville, WA.
- Bissonnette, P. Bellevue experiences with urban runoff quality control strategies. In *Perspectives on nonpoint source pollution, proceedings of a national conference*. U.S. Environmental Protection Agency.
- Booth, D. 1992. *Geomorphic impacts of urbanization*. Paper presented at symposium, *Salmon in the City: effects of urbanization on fish habitat*, March 11-13. Sponsored by the American Public Works Association, Pack Forest, Eatonville, WA.
- Boule, Marc et al. See U.S. Department of Defense. Army Corps of Engineers.
- Bretz, J. H. 1910. Glacial lakes of Puget Sound. *Journal of Geology* 18:448-458.
- . 1913. Glaciation of the Puget Sound region. *Washington Geology Survey Bulletin* 8.
- Brown, R.E. See U.S. Department of Agriculture. Forest Service.
- Burg, M.E., D.R. Tripp and E.S. Rosenberg. 1980. Plant associations and primary productivity of the Nisqually salt marsh on southern Puget Sound, Washington. *Northwest Science* 54:222-236.
- Castelle, A. See Washington State. Department of Ecology.
- City of Kent. See Kent, City of.
- City of Lacey. See Lacey, City of.
- City of Olympia. See Olympia, City of.
- Cole, G.A. 1983. *Textbook of limnology*. St. Louis: C.V. Mosby Company.
- Cowardin, L. et al. See U.S. Department of the Interior. Fish and Wildlife Service.
- Crandell, D.R., D.R. Mullineaux, and H.H. Waldron. See U.S. Department of Interior. Geological Survey.
- Creso, Irene. 1984. *Vascular plants of western Washington*. Tacoma, WA.
- Curry, J. R. 1962. Late quaternary sea level; a discussion. *Geological Society of America Bulletin* 72:1707-1712.
- Davis, S., S. Berg and J. Michaud. See Thurston County. Department of Public Health and Social Services.
- Dinicola, R.S. See U.S. Department of Interior. Geological Survey.
- Dion et al. 1994. See US Department of the Interior Geological Survey.
- Entranco. 1994. *Engineering Report: Martin Way East/Woodalnd Creek Treatment Facility*. Prepared for Thurston County Department of Water and Waste Management. Bellevue, WA.
- Federal Emergency Management Agency. 1982. *Flood insurance study, Thurston County and regions*. Washington, D.C.
- Franklin, J.F. and C.T. Dyrness. See U.S. Department of Agriculture. Forest Service.
- Glick, R., M.L. Wolfe and T.L. Thurow. 1991. Urban runoff quality as affected by native vegetation. *Presented at the 1991 International Summer Meeting sponsored by the American Society of Engineers*, Albuquerque, NM. ASAE Paper No. 91-2067.

References

- Gregory, S. V., F. J. Swanson, W.A. McKee, and K.W. Cummins. September 1991. An ecosystem perspective of riparian zones. *BioScience* 41(8):540-550.
- Hansen, C. See Thurston County Department of Public Health and Social Services.
- Historical Research Associates, Inc. 1992. *Cultural resources assessment of the Chambers farmstead, Thurston County, Washington*. Prepared by G. Thompson and L. Mighetto. Seattle, WA.
- Hitchcock, C. L. and A. R. Cronquist. 1976. *Flora of the Pacific Northwest*. Seattle: University of Washington Press.
- Horner, R. R. and S. R. Wonacott. 1985. *Performance evaluation of a detention basin and coalescing plate oil separator for treating urban stormwater runoff*. Water Resources Series Technical Report No. 98. Seattle: University of Washington Department of Civil Engineering.
- Horner, R. R. 1988a. *Long term effects of urban stormwater on wetlands*. Proceedings of the Engineering Foundation Conference on Urban Runoff; Potosi, MO.
- . 1988b. *Biofiltration systems for storm runoff water quality control*. Prepared for Washington State Department of Ecology, Municipality of Metropolitan Seattle, King County, City of Bellevue, City of Mountlake Terrace, City of Redmond, WA.
- Horner, R.R., J.J. Skupien, E.H. Livingston and H.E. Shaver. 1994. *Fundamentals of urban runoff management: technical and institutional issues*. Terrene Institute, Washington, DC.
- Johnson, A. and J. Caldwell. March 1992. Analysis of fish habitat and stormwater management options for Woodland Creek, Thurston County, Washington. Paper presented at symposium, Salmon in the City: effects of urbanization on fish habitat, March 11-13. Sponsored by the American Public Works Association, Pack Forest, Eatonville, WA.
- Kent, City of. City Code Chapter 7.20. Kent, WA.
- Kessler, Richard. 1990. *The oak woodlands of Thurston County, WA: mapping and description of stands*. Prepared for Washington Department of Wildlife and the Capitol Land Trust. Olympia, WA.
- Klein, R. 1979. Urbanization and stream quality impairment. *Water Resources Bulletin* 15(4). American Water Resources Association.
- Kruckeberg, Arthur. 1991. *The natural history of Puget Sound country*. Seattle: University of Washington Press.
- Lacey, City of. Water Resources Division. 1992a. *Lacey stormwater monitoring program final report*. Lacey, WA.
- . 1992b. *Chambers Lake stormwater management plan*. Prepared by Kramer, Chin and Mayo, Seattle, WA.
- Lacey, City of. 1994a. *Wetlands protection, Lacey municipal code chapter 14.28*. Lacey, WA.
- Lacey, City of. 1994b. *Environmental protection and resource conservation plan*. Lacey, WA.
- Lacey, City of, and Thurston County. 1994. *City of Lacey and Thurston County land use plan for the Lacey urban growth area: a joint planning document prepared as the Lacey comprehensive land use plan and an element of the Thurston County comprehensive land use plan*. Lacey, WA.
- Lang, F. A. 1961. A study of vegetation change on the gravelly prairies of Pierce and Thurston Counties, western Washington. Master's thesis, University of Washington.
- Linsley et al. 1982. *Hydrology for engineers*, 3rd edition. McGraw-Hill.
- Lowrance, R. R., R. Todd, and L. Asmussen. 1984. Nutrient cycling in an agricultural watershed. *Journal of Environmental Quality* 13:22-27.
- Lowrance, R.R., R. Todd, J. Fail, Jr., O. Hendrickson, Jr., R. Leonard, and L. Asmussen. 1984. Riparian forests as nutrient filters in agricultural watersheds. *BioScience* 34:374-377.
- Lucchetti, G. 1992. *Effects of urbanization on fish habitat*. Paper presented at symposium, Salmon in the City: effects of urbanization on fish habitat, March 11-13. Sponsored by the American Public Works Association, Pack Forest, Eatonville, WA.

References

- Macklin, J. D. and D. C. Thompson. 1992. *Oregon white oak woodlands of Fort Lewis, Pierce County, Washington*. Report to the Seattle District Corps of Engineers, Environmental Resources Section. Contract # DACA 67-90-D 0009. Bellevue, WA.
- Marr, R.R. et al. See Washington State. Department of Transportation.
- McGavock, E.H. et al. See U.S. Department of Interior. Geological Survey.
- McMillan, A. See Washington State. Department of Ecology.
- Miller, R.J. and E.L. Brannon. 1981. The origin and development of life history patterns in Pacific salmonids. In proceedings, Salmon and trout migratory behavior symposium, edited by E.L. Brannon and E.O. Salo.
- Nelson, Ralph. 1992. *Hydrologic impacts of urbanization*. Paper presented to the American Public Works Association at Pack Forest Conference Center, Eatonville, WA.
- Noble, J.B. and E.F. Wallace. See Washington State. Division of Water Resources.
- Olympia, City of. 1988. *Comprehensive plan*. Olympia, WA.
- . 1994a. *Comprehensive plan for Olympia and the Olympia Growth Area*. Olympia, WA.
- . 1994b. *Olympia Municipal Code, Section 13.16, Procedures for the collection of storm GFC and stormwater utility billing*. Olympia, WA.
- Pedersen, E.R. 1981. The use of invertebrate data for evaluating impacts of urban stormwater runoff. Master's thesis, Department of Civil Engineering, University of Washington.
- Petterjohn, W. T., and D. L. Correll. 1984. Nutrient dynamics in an agricultural watershed: observations on the role of the riparian forest. *Ecology* 65:1466-1475.
- Poultridge, A. See Washington State. Department of Natural Resources.
- Powers, P. 1991. Letter to Phillip Jensen dated January 24. Washington Department of Fisheries, Olympia, WA.
- Puget Sound Water Quality Authority. 1990. *1991 Puget Sound water quality management plan*. Olympia, WA.
- Randall, Warren R., R. F. Keniston, D. N. Bever, and E. C. Jensen. 1990. *Manual of Oregon trees and shrubs*. Corvallis, OR: Oregon State University Book Stores
- Reinelt, L. et al. 1990. *Puget sound wetlands and stormwater management research program*. Seattle: University of Washington.
- Reed, P.B. See U.S. Department of the Interior. Fish and Wildlife Service.
- Robison, E. G. 1993. A quantitative habitat assessment protocol for field evaluation of physical habitat for small wadable streams: Oregon Version. Unpublished draft. Corvallis, OR: Oregon State University, Fisheries and Wildlife Dept.
- Rodrick, E. and R. Milners, eds. See Washington State. Department of Wildlife.
- Scott, J.B. 1982. *The potential and realized impacts of urban nonpoint source pollution upon the fish populations of Kelsey Creek, Bellevue, Washington*. M.S. thesis, University of Washington, Seattle.
- Schlosser, I.J. 1991. Stream fish ecology: a landscape perspective. *BioScience* (41)10:704-712.
- Schueler, Thomas R. 1987. *Controlling urban runoff, a practical manual for planning and designing urban BMPs*. Washington D.C.: Washington Metropolitan Water Resources Planning Board.
- . 1994. The importance of imperviousness. *Watershed Protection Techniques* 1(3):100-111.
- Schuett-Hames, D., L. Bullchild, S. Hall and A. Pleus. 1992. *T-F-W Ambient Monitoring Manual*. Olympia, WA: Northwest Indian Fisheries Commission.
- Seattle Audubon Society. 1993. *Washington State breeding bird atlas*. Seattle, WA.
- Sedell, J.R., F.H. Everest and F.J. Swanson. 1982. Fish habitat and streamside management: past and present. Pages 244-255 in Proceedings of the Society of American Foresters Annual Meeting. Society of American Foresters, Bethesda, MD.
- Sedell, J. R. and R. L. Beschta. 1991. Bringing back the "bio" in bioengineering. In Proceedings of the American Fisheries Society Symposium 10:160-175.

References

- Shapiro and Associates, Inc. 1994. *City of Olympia wildlife habitat study final recommendations*. Prepared for City of Olympia Public Works Department. Seattle, WA.
- Shuller, M. 1992. *Diversity in life histories of native salmon in our streams*. Presentation to the American Public Works Association at Pack Forest Conference Center, Eatonville, WA.
- Steward, C.R. 1983. *Salmonid populations in an urban environment: Kelsey Creek, Washington*. M.S. thesis, University of Washington, Seattle.
- Thurston County. *Thurston County Code*. Olympia, WA.
- . 1995. *Thurston County Comprehensive Plan*. Olympia, WA.
- Thurston County. Office of County Engineer. 1907. *In the matter of the petition of Frank Wood et al for a county ditch, surveyor's report*. By T.D. Young. Olympia, WA.
- Thurston County. 1918. *Petition to the Board of Commissioners of Thurston County regarding establishment of a drainage district for the Woods Ditch*. Olympia, WA.
- Thurston County. 1919. *Map of Drainage District No. 3, Thurston County*. By C.O. Mannes. Olympia, WA.
- Thurston County. Board of County Commissioners. 1919. *Resolution establishing Drainage Improvement District Number 3*, dated September 2, 1919. Olympia, WA.
- Thurston County. Department of Public Health and Social Services. 1992. *Northern Thurston County ground water management plan*. Olympia, WA.
- . 1993. *Budd Inlet/Deschutes River water quality study final report*. By S. Davis, S. Berg and J. Michaud. Olympia, WA.
- . 1994. *Chambers Basin Comprehensive Drainage Basin Plan Water Quality Assessment*. By C. Hansen. Olympia, WA.
- Thurston County. Department of Public Works. July 1978. *Final environmental impact statement on proposed Thurston County Lakes Restoration Project*. Lakes Program, Olympia, WA.
- . 1991. *Drainage design and erosion control manual for Thurston County and the cities of Lacey, Olympia, and Tumwater, Washington*. Storm and Surface Water Program, Olympia, WA.
- Thurston County Department of Water and Waste Management. 1994. *Drainage design and erosion control manual for Thurston County*. Thurston County, Olympia, WA.
- Thurston Regional Planning Council and Thurston County Department of Public Works. 1983. *Stormwater management in north Thurston County, Volumes I and II*. Olympia, WA.
- Thurston Regional Planning Council. 1987. *Wetlands and stream corridors phase II, Volume 1 and 2, final report and appendices*. Olympia, WA.
- . 1988. *Memorandum of understanding: an urban growth management agreement*. Olympia, WA.
- . 1990a. *Industrial lands inventory summary*. Olympia, WA.
- . 1990b. *Shoreline master program for the Thurston region*. Thurston County, Olympia, WA.
- . 1991. *The profile*. Olympia, WA.
- U.S. Department of Agriculture. Forest Service. 1973. *Natural vegetation of Oregon and Washington*. By J. F. Franklin and C. T. Dyrness. General Technical Report PNW-8. Portland OR.
- . Pacific Northwest Region. 1985. *Management of wildlife and fish habitats in forests of western Oregon and Washington, Part 1 and 2*. Ed. by R. E. Brown.
- U.S. Department of Agriculture. Soil Conservation Service. 1990. *Soil survey of Thurston County, Washington*. Olympia, WA.
- U.S. Department of Defense. Army Corps of Engineers. 1985. *Wetland plants of the Pacific Northwest*. By Marc Boule, K. Brunner, J. Malek, F. Weinmann, and V. Yoshino. Seattle.
- U.S. Department of Defense. Army Corps of Engineers. 1989. *Federal manual for identifying and delineating jurisdictional wetlands*. Washington, DC.
- U.S. Environmental Protection Agency Office of Water. 1993. *Guidance specifying management measures for source of nonpoint pollution in coastal waters*. Publication # EPA-840-B-92-002. Washington DC.

References

- U.S. Department of Interior. General Land Office. 1853. Map of Township No.18 North Range No.1 West Willamette Meridian.
- U.S. Department of the Interior. Fish and Wildlife Service. 1979. *Classification of wetlands and deepwater habitats of the United States*. By L. Cowardin et al. FWS/OBS-79/31. Washington, DC.
- . 1987. National wetland inventory. Washington, DC.
- . 1988. National list of plant species that occur in wetlands. By P. B. Reed. NEC-88/18.47. Saint Petersburg, FL.
- U.S. Department of the Interior. Geological Survey. 1965. *Age and origin of the Puget Sound trough in western Washington*. By D. R. Crandell, D. R. Mullineaux, and H. H. Waldron. Professional Paper 525-B:B132-36.
- . 1981. *Water resources data, Washington water year 1981 v.1*. Water-data report WA-81-1. Tacoma, WA.
- . 1988. *Water resources data, Washington water year 1986*. By E. H. McGavock, W. D. Wiggins, P. R. Boucher, R. L. Blazs, L. L. Reed, and M. L. Smith. Water-data report WA-86-1. Tacoma, WA.
- . 1989. *A regional rainfall-runoff simulation model for the Puget Sound area of Washington State*. By R. S. Dinicola. Water Resources Investigation Report. Tacoma, Washington.
- . 1990. *Characterization and simulation of rainfall-runoff relations for headwater basins in western King and Snohomish counties, Washington*. By R. S. Dinicola. Water Resources Investigations Report 89-4052. Tacoma, WA.
- . 1994. *Hydrology and quality of ground water in northern Thurston County, Washington*. By N.P. Dion, G.L. Turney and M.A. Jones. Water-Resources Investigations Report 92-4109. Tacoma, WA.
- Van Cleef, J.S. 1885. *How to restore our trout streams*. Transactions of the American Fisheries Society 14:50-55.
- Washington State. *Washington Administrative Code*.
- Washington State. *Revised Code of Washington*.
- Washington State. Department of Conservation. 1964. *Miscellaneous stream-flow measurements in the State of Washington, 1890 to January, 1961*. Water-Supply Bulletin No. 23. Olympia, WA.
- Washington State. Department of Ecology. 1972. *Final Guidelines for the Shoreline Management Act of 1971*. Olympia, WA.
- . 1976. *Reconnaissance data on lakes in Washington, vol. 4*. Olympia, WA.
- . 1984. *Shellfish protection strategy*. Olympia, WA.
- . 1988a. *Wetland regulations guidebook*. Publication #88-5. Olympia, WA.
- . 1988b. *Washington's wetlands*. By A. McMillan. Publication #88-24. Olympia, WA.
- . 1989. *A guide to conducting wetland inventories*. Publication #89-60. Olympia, WA.
- . 1991. *Washington State wetlands rating system*. Publication #91-57. Olympia, WA.
- . 1992a. *Wetland buffers: use and effectiveness*. By A. Castelle. Publication #92-10. Olympia, WA.
- . 1992b. *Stormwater program guidance manual for the Puget Sound basin: volumes 1 & 2*. Publications #92-32 and 92-33. Olympia, WA.
- . 1994a. *Focus: Water quality in Washington State (section 303(d) of the Federal Clean Water Act)*. Publication F-WQ-94-37. Olympia, WA.
- . 1994b. *Survey of chemical contaminants in ten Washington lakes*. By D. Serdar, A. Johnson, and D. Davis. Publication #94-154. Olympia, WA.
- Washington State. Department of Fish and Wildlife. 1995. *Priority habitats and species list*. Olympia, WA.
- Washington State. Department of Fisheries. 1975. *A catalogue of Washington streams: vols. 1 & 2*. By R. W. Williams, R. M. Laramie and J. H. Ames. Olympia, WA.

References

- Washington State. Department of Natural Resources. 1991. *Boomtime: a history of the Woodard Bay natural resources conservation area*. By A. Poultridge. Division of Land and Water Conservation, Olympia, WA.
- . 1994. *Endangered, threatened and sensitive vascular plants of Washington*. Natural Heritage Program, Olympia, WA.
- Washington State. Department of Transportation. 1982. *Summary-Washington State highway runoff water quality study, 1977-1982*. By B. W. Mar, R. R. Horner, J. F. Ferguson, D. E. Spyridakis, and E. B. Welch. WA-RD-39.16. Olympia, WA.
- Washington State. Department of Wildlife. 1991. *Management recommendations for Washington's priority habitats and species*. Ed. by E. Rodrick and R. Milner. Olympia, WA.
- . June 1993. Priority habitat and species tabular data report. Olympia, WA.
- Washington State. Division of Water Resources. 1966. *Geology and ground-water resources of Thurston County, Washington*. By J. B. Noble and E. F. Wallace. Water Supply Bulletin No. 10. Olympia, WA.
- Wetzel, R.G. 1983. *Limnology*, second edition. New York: Saunders College Publishing.
- Williams, R.W., R.M. Laramie and J.H. Ames. *See* Washington State. Department of Fisheries.
- Woodward-Clyde. 1989. *Analysis of storm event characteristics for selected rainfall gages throughout the United States*.