

1992 DRAFT ENVIRONMENTAL
IMPACT STATEMENT
NORTH CREEK PARK

**North Creek
180th Street Southeast
Regional Detention Facility**

Warren G. Gold

AND
County Park



**Draft
Supplemental
Environmental
Impact
Statement**

This Draft Supplemental Environmental Impact Statement (DSEIS) has been prepared to satisfy the requirements of the State Environmental Policy Act (SEPA), Chapter 43.21 C of the Revised Code of Washington, the SEPA Guidelines contained in the Washington Administrative Code 197-11, and the Snohomish County Environmental Policy Ordinance (SCEPO): Title 23 of the Snohomish County Code. This document is not an authorization for an action, and does not contain any decision or recommendation for an action. Following a 30-day review and comment period, a Final Supplemental Environmental Impact Statement (FSEIS) will be issued to accompany a proposed action and will be used by the County Council, in conjunction with the design report, in making the final decision on the proposal.

Date of Issue:

August
July ?, 1992

To: Interested Parties -- North Creek Regional Stormwater Detention Facility and County Park at 180th Street SE

Attached is a copy of the Draft Supplemental Environmental Impact Statement (DSEIS) for the North Creek Regional Stormwater Detention Facility and County Park at 180th Street Southeast. The DSEIS is a supplement to the Final Environmental Impact Statement (FEIS) issued for the Snohomish County Regional Stormwater Detention Facility Siting Study in October 1987. This DSEIS discusses the County's proposal to acquire up to 145 acres of a floodplain to establish a stormwater detention facility and passive recreation area in south Snohomish County.

Snohomish County Surface Water Management and Parks Divisions have already purchased sixty-eight acres in the project area. The stormwater facility would reduce flooding and erosion and improve water quality downstream of the project site. The passive recreation area would provide walking trails, interpretive signs, picnic facilities, three access areas/parking lots, and toilets, drinking fountains and bike racks at each access area. A Master Plan was completed and approved by the Park Board and County Council early in 1992.

This DSEIS examines six alternatives, including a No Action Alternative (Alternative F). Alternatives A through D include provisions for a stormwater facility and County park. These four alternatives differ according to the type of stormwater facility proposed. Each alternative uses a slightly different method to control the flow of water onto the wetland and below the project site.

Alternative E provides only for construction of the County park. No stormwater detention facilities would be constructed. Stormwater control would occur as natural process in the floodplain.

Alternative F is the No Action Alternative. No construction impacts would occur related to either the construction of the stormwater detention facility or the County park and no additional land would be purchased. Land already purchased by the County would remain in public ownership and be used for its open space and natural flood control amenities.

Interested citizens, agencies and jurisdictions are invited to review this DSEIS and provide written comments on its

adequacy and accuracy. A 30-day comment period immediately follows the distribution of the document. The FSEIS will be issued within 60 days of the end of the comment period. A public meeting will be held on August ??, 1992 to discuss the DSEIS. The 30-day review and comment period will close on ?, 1992.

Sincerely,

PETER E. HAHN
Director of Public Works

**NORTH CREEK REGIONAL STORMWATER DETENTION FACILITY
AND COUNTY PARK AT 180TH STREET SOUTHEAST**

DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

This Draft Supplemental Environmental Impact Statement (DSEIS) has been prepared to satisfy the requirements of the State Environmental Policy Act (SEPA), Chapter 43.21 C of the Revised Code of Washington, the SEPA Guidelines contained in the Washington Administrative Code 197-11, and the Snohomish County Environmental Policy Ordinance (SCEPO): Title 23 of the Snohomish County Code. This document is not an authorization for an action, and does not contain any decision or recommendation for an action. Following a 30-day review and comment period, a Final Supplemental Environmental Impact Statement (FSEIS) will be issued to accompany a proposed action and will be used by the County Council, in conjunction with the design report, in making the final decision on the proposal.

Date of issue: ~~July~~ ?, 1992

August

Proposed Action

The proposed action involves acquiring up to 145 acres of land to construct regional stormwater detention facility and park in south Snohomish County. The primary purpose of the stormwater facility is to reduce peak storm flows in North Creek in the lower 6.7 miles of the stream. The purpose of the County park is to provide a passive recreation area that would include walking trails, interpretive signs and access areas. Estimated cost of the preferred alternative (Alternative D) is \$1.65 million.

Lead Agency

Snohomish County Public Works
2930 Wetmore Avenue
Everett, WA 98201

Joint Proponent

Snohomish County Parks
3000 Rockefeller Avenue
Everett, WA 98201

Date of Construction

Summer 1993

Responsible Official

Peter E. Hahn, Director of Public Works

Contact Persons

Mary Wilkosz, Environmental Review
Mohammed Kashani, P.E., Engineering Design

Required Permits

Section 404 Dredge/Fill Permit (Army Corps of Engineers)
Section 401 Water Quality Certification (U.S. Environmental Protection Agency)
Hydraulic Project Approval (Wa. Department of Fisheries)
Reservoir Storage Permit (Wa. Department of Ecology)
Surface Water Right (Wa. Department of Ecology)
Dam Safety Review (Wa. Department of Ecology)
Water Quality Modification (Wa. Department of Ecology)
Grading Permit (Snohomish County)
Floodplain Development Permit (Snohomish County)
Zoning Variance (Snohomish County)
Drainage Plan Approval (Snohomish County)

Principal Contributors

Mary Wilkosz, Sr. Environmental Planner
Debbie Aardahl, Graphic Designer

Date of Issue

August ??, 1992

Written Comments Due

August ??, 1992

Cost: \$10.00 (including sales tax)

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DISTRIBUTION LIST

County Government:

Snohomish County Executive
Snohomish County Council
Snohomish County Department of Community Development
Snohomish County Department of Planning
Snohomish County Parks & Recreation Division
Snohomish Health District

State Government:

Washington Department of Community Development, Office of
Archaeology and Historic Preservation
Washington Department of Ecology
Washington Department of Fisheries
Washington Department of Wildlife

Federal Government:

Bureau of Indian Affairs
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

Tribal Government:

Muckleshoot Tribe

Local Government:

King County Department of Planning & Community Development
King County Surface Water
Puget Sound Water Quality Authority
Everett Planning Department
Everett Public Works Department
Lynnwood Planning Department
Lynnwood Public Works Department
Bothell Planning Department
Bothell Public Works Department
City of Mill Creek

Utilities:

Alderwood Water District
GTE
Snohomish County Public Utility District No. 1

Community and Citizens Groups:

Bothell Chamber of Commerce
Canyon Firs Homeowners
Concerned Citizens of Snohomish County
Economic Development Council
Emerald Heights Homeowners
Envirowatch, Everett Community College
Everett Chamber of Commerce
Forgotten Citizens of South Snohomish
Heron Hills Neighborhood
Mill Creek Community Association
North Creek Presbyterian
North Park Subdivision

Distribution

Olympus I Homeowners Association
Pilchuck Audubon Society
Pioneer Trails
Save a Valuable Environment
Save Our Salmon
Sierra Club
Silver Lake Action Committee
Silver Lake Citizens Advisory Committee
Silver Lake Community Council
Silver Lake Homeowners Association
Snohomish County Association of Realtors
Snohomish County Improvement Alliance
Snohomish Wetlands Alliance
South Snohomish County Homeowners Association
South Snohomish County Preservation Association
Thomas Lake Homeowners
Washington Environmental Council
Washington State University, Cooperative Extension, McCollum
Park Annex

Newspapers and Radio:

Citizen
Northlake News
The Tribune
The Herald
The Enterprise
Seattle Times
Seattle P.I.
Woodenville Weekly
KWYZ Radio
KRKO Radio

Private Consulting Firms Involved In Project:

Kramer, Chin, and Mayo
Parametrix, Inc.
Converse Northwest
Bruce Dees & Associates

Summary

Location of Proposed Project

The proposed project would be located in south Snohomish County immediately south of the City of Mill Creek, west of State Route 527 (the Bothell-Everett Highway), and north of 183rd Street Southeast. It would be sited in a floodplain that straddles North Creek in the middle of the North Creek watershed. Approximately ??? acres of the 19,000-acre North Creek watershed drains into this floodplain. The North Creek watershed drains land in both Snohomish and King Counties. Ninety-five percent of the watershed is in Snohomish County.

Project History and Planning

In 1985, projections of significant growth in south Snohomish County and associated flooding problems prompted the County Public Works Department to sponsor a Regional Detention Facility Siting Study of North Creek, Swamp Creek and Quilceda Creek watersheds. Six potential regional stormwater detention sites were identified in this study for the North Creek drainage, three of which were recommended for development: 1) an old gravel pit just north of 128th Street Southeast; 2) Silver Lake; and 3) 180th Street Southeast road extension. The Silver Lake site was dropped from further consideration following release of the regional study. The design and environmental review process for the 128th Street site has not yet begun.

Environmental Impact Statement Process

This document is a Supplement to the Final Environmental Impact Statement prepared in October 1987 for the Snohomish County Regional Detention Facility Siting Study. Copies of the Siting Study and the Draft and Final Environmental Impact Statements are available for review at the Snohomish County Department of Public Works.

The purpose of this Supplemental Draft Environmental Impact Statement is to evaluate the alternatives now being considered for the 180th Street site and their respective environmental impacts.

Existing Conditions

The project area is located within one of the fastest growing urban areas in Washington State. Population growth in the North Creek watershed is projected to increase from 63,822 people in 1991 to 74,000 in 2000 to 90,000 by 2020. Rapid population growth has precipitated environmental problems like flooding and water quality degradation and has prompted a need for more public recreation areas.

Environmental

The North Creek watershed is rapidly approaching its development capacity under existing land use designations in the 1977 North Creek Area Comprehensive Plan. Rapid development has precipitated considerable flooding problems, particularly in the lower portion of the watershed. In Snohomish County, flooding now occurs two to three times per year in at least three areas within the watershed. These are the Silver Lake to Ruggs Lake corridor; the North Creek

stream corridor from the Penny Creek confluence to Thrasher's corner; and the Interstate 405 and 228th Street interchange.

Urbanization of the watershed has led to a loss of vegetated stream corridors, wetlands, and floodplains, all of which provide natural flood control benefits. At the same time, there has been an increase in impervious (non-porous) surfaces, including roads, driveways, parking lots and rooftops. Rainwater cannot percolate through impervious surfaces, so it simply washes off these hard areas and to streams and low-lying depressions. This results in higher than normal peak flows following precipitation events. High stormwater flows lead to streambank erosion and flooding in low-lying areas. Stormwater is also the primary carrier of sediment and other urban water pollutants.

Flooding has also created problems for fish and other aquatic species. North Creek was once a productive salmon stream but watershed problems that have stemmed from urban growth have caused salmon production in the system to be substantially reduced. One of the main reasons for a reduction in salmon numbers is the frequent peak flows that wash out eggs, erode channel banks, and deposit silt in the lower stream reaches. Reducing peak flows would improve the success of spawning salmon by reducing silt deposition, flow velocities and streambank and channel erosion.

Recreation

Snohomish County Parks and Recreation Division currently holds title to 44 properties, totaling 2,640 acres. ?? developed County parks are in the south County area.

The 1986 Snohomish County Comprehensive Park and Recreation Plan inventoried a total of 387.4 hiking miles in Snohomish County. Over 91 percent (353.4 miles) of these trails are on federal lands, and only 1.5 miles are administered by the County. Only 1 mile of trail is considered useable for interpretive purposes, with 0.5 miles of this total administered by the County.

Purpose of and Need for Project

In light of existing conditions, the primary purposes of the proposed project are to reduce peak flood flows downstream of the project area and to provide a large passive recreation area for south County residents. The site of the proposed project is one of the few remaining undeveloped floodplains in the North Creek basin that is of sufficient size to locate a regional stormwater detention facility and County park.

The floodplain would be suitable for a stormwater detention facility because it has a large amount of undeveloped land, occupies a natural topographic depression, and is located far enough upstream in the watershed to benefit downstream residents who are now experiencing flooding. The site would also provide an opportunity for local resident to learn about the environmental qualities of a floodplain wetland and the purpose and function of a stormwater facility.

Computer modeling of North Creek flows conducted for the design report of the stormwater facility indicate that the preferred stormwater facility design, a bottomless box culvert (Alternative D), could reduce peak flows up to 17 percent under normal operation. If a culvert gate and stop log adjustment were also used, peak flood flows could be reduced up to ?? percent.

Local data is not available to accurately project visitation of the proposed park. There is, however, a passive recreation area in the City of Lynnwood that is of similar size and purpose. This area, Scriber Lake Park, receives approximately 75 visitors per week day and up to 125 visitors per day on the weekend. The proposed park is similar to Scriber Lake park in that it would be intended primarily for use by south County residents. Parking areas would be relatively small and dispersed around the site to encourage low levels of use.

Alternatives

Up to 145 acres of land would be acquired to implement Alternatives A through E. Alternatives A through D include construction of a regional stormwater detention facility and passive recreation area. Alternative E would allow only for construction of the recreation area. Alternative F is the no action alternative.

Alternative A: Bottomless Arch Pipe/County Park

The bottomless arch pipe (culvert) would be constructed within the stream channel at a natural constriction near the downstream end of the project. It could reduce peak flows up to 17 percent. Estimated construction cost of Alternative A is \$837,690, including \$816,000 for the stormwater facility and \$836,874 for the recreation area.

Alternative B: Bioengineered Constriction/County Park

The bioengineered constriction would also be located at the natural channel constriction. Here, the existing stream channel would be narrowed with earth materials and replanted with native riparian vegetation. This alternative would reduce peak flows up to 9 percent. Estimated construction cost of Alternative B is \$1,573,174, including \$736,300 for the stormwater facility and \$836,874 for the recreation area.

Alternative C: Off-Channel Storage/County Park

This alternative would require the reconstruction and raising of the existing berm that parallels the east bank of North Creek. A second berm would also be constructed at the south end of the project area, almost perpendicular to the existing berm. The two berms would form a constriction at the southwest corner of the project. Estimated construction cost of Alternative C is \$2,318,274, including \$1,481,400 for the stormwater facility and \$836,874 for the recreation area.

Preferred Alternative

Alternative D: Bottomless Box Culvert/County Park

The bottomless box culvert is similar to alternative A except that the culvert is shaped like a box instead of in

an arch. This alternative would provide peak flow reductions up to 17 percent under normal conditions and up to ?? percent with a culvert gate and stop log adjustment. Estimated construction cost of Alternative D is \$1,647,874, including \$811,000 for the stormwater facility and \$836,874 for the recreation area.

Alternative E: County Park Only

This alternative would only allow for construction of a passive recreation area. The proposed facilities include barrier-free walking trails, interpretive signs, a parking/access area, toilets and a bike rack. Estimated construction cost is \$836,874.

Alternative F: No Action

No major construction activities would occur in the floodplain. No additional land acquisition would be made. Existing County land would remain in public ownership and be managed for its natural openspace and flood control amenities.

Environmental Impacts

Alternatives A, B and C: Design Alternatives

Because the four stormwater control design alternatives are proposed for the same location, they would create many of the same types of environmental impacts. Differences in the magnitude of the expected impacts would be expected to affect the earth, water, wetland and wildlife resources as a result of the variance in the duration, area and depth of inundation of flood waters.

Earth

Temporary soil erosion could occur in excavation areas during project construction. Depending on the alternative selected, construction activities would occur near RM 6.7 at the site of a proposed control structure (Alternative A, B and D) or adjacent to North Creek and a small unnamed tributary (Alternative C), and in the location of proposed trails, viewpoints and access areas for the park (Alternatives A through E).

In addition, Alternative C would require special geotechnical considerations (such as preloading) to perform construction activities in the deep, saturated peat soils.

Flooding of the floodplain wetland during major flood events would result in sediment being deposited in the wetland at elevations at and below 219 feet. Sedimentation and increased inundation could change the character of the peaty wetland soils over time.

Water

Water quality degradation could occur during construction and operation of the stormwater facility. Soil erosion from construction activities could result in increases in sediment and turbidity downstream of RM 6.7. Once in operation, the stormwater detention system should reduce peak flows and improve water quality downstream of the

project area. Water quality within the floodplain could be degraded as a result of the temporary storage of stormwater runoff and attached urban pollutants.

The proposed facility would reduce peak flows in North Creek downstream of RM 6.7. A reduction of peak flows would in turn reduce soil erosion and scouring of gravel streambeds, thus improving water quality and fish and riparian habitat.

The floodplain wetland could collect much of the sediment and attached pollutants. Some of the plants within the wetland would take up pollutants through their growth process. Some pollutants may be released back into the water during the dormant seasons as a result of the decomposition process. This could negatively affect water quality within the project site. Water quality within the wetland could also be negatively affected by the retention of sediments which otherwise would have been deposited downstream.

Fish

Negative impacts to fish could result from construction activities, from the deleterious water quality impacts discussed above. The two streams in the project area that support salmon, North Creek and Nickel Creek, would be particularly sensitive.

Silt and pollutants could detrimentally impact fish spawning habitat downstream of the project if they are not reduced by settling within the floodplain.

Once in operation, reduction of peak flows downstream would reduce erosion and channel scour, and the transport of silt and pollutants. This should result in improvements in spawning habitat.

Plants

Vegetation would be destroyed during project construction in the vicinity of the stormwater control structure, access areas, trails and viewpoints. This would result in a loss of trees, shrubs and smaller types of plants.

The stormwater detention facility would be located in a disturbed emergent and shrub wetland. Occasional inundation may alter the existing plant communities at the site. The frequency, duration and depth of inundation of the wetland would determine what vegetation species would be able to survive.

Wildlife

The alteration and/or loss of wetland and riparian habitat would negatively impact wildlife species dependent on those habitats for their survival.

Temporary flooding of the floodplain could negatively impact small mammals and some bird species that use the floodplain.

Land Use

Land use impacts would result from the permanent conversion of land currently used or zoned for residential or

commercial purposes to County-owned property. Up to 145 acres of land could be affected. Use of the floodplain as a regional stormwater detention area or County park would preclude its use for agricultural, residential or commercial purposes. Buildings sited lower than the Elevation 220 contour would need to be moved or demolished. Structures located above this elevation adjacent to the facility could be inundated by floods exceeding a 100-year flood event.

Recreation

Impacts to recreation would generally be positive. A new passive recreation area would provide walking trails and environmental education opportunities for local and County residents.

Cultural

Because no cultural resources have been identified in the area, no impacts are anticipated.

Transportation

Because construction activities would be limited to the project area and away from busy roadways, no traffic impacts are anticipated.

One Hundred Eight-third Street Southeast would be paved to the proposed access area to improve access to the new park.

Utilities

No disruptions to utility service are anticipated.

Soil and Ground Water Contamination

The project area was evaluated for potential soil and groundwater contamination. No evidence of hazardous materials or contaminated soils or groundwater were found.

Mitigation

Earth

Temporary erosion control measures would be used during construction to minimize soil erosion and water quality degradation in accordance with state and local regulations.

Following construction, the County would stabilize exposed streambanks with native riparian vegetation.

Organic soils removed from excavated areas would be salvaged where possible, and used to construct new wetlands within the project area to mitigate for wetland impacts.

Water

The stormwater detention facility would be constructed in accordance with federal, state and local regulations. The facility would be designed to reduce peak flows and improve water quality downstream of the project area.

Fish

Construction activities would be scheduled to avoid impacts to water quality and aquatic habitat in accordance with a state Hydraulic Project Approval secured from the Washington

Streambanks of North Creek tributaries would be planted with riparian vegetation, providing shading and streambank stabilization for the purpose of improving fisheries habitat.

Regulation of the rate at which the water leaves the floodwater detention facility would contain flow velocities in the stream channel to a level that would not erode potential spawning areas or streambanks and that would allow fish to migrate upstream and downstream through the project area.

Plants

Vegetation clearing would be limited to areas needed for construction. To the extent feasible, large trees removed during construction would be replaced.

Impacted wetlands would be replaced at a ratio of 1.5:1. A 5-year monitoring plan would be designed, implemented and annually reviewed to evaluate the effects of the project on plant communities within the floodplain.

Wildlife

Replacement of trees and wetlands destroyed by construction activities would also serve as mitigation for lost wildlife habitat.

To the maximum degree possible, wetland and riparian vegetation would be replanted where existing vegetation was removed or significantly damaged by construction activities.

As described above, a 5-year monitoring plan would be developed to monitor plant communities that are beneficial to wildlife.

Land Use

Property located at or below the Elevation 220 contour would be appraised and purchased by the County at fair market value.

If the final project design indicates that the structures are outside the flood elevation and would not be impacted by the project, no mitigation is proposed. On the other hand, if the project impacts these structures, the County would pursue the options of purchasing the property, acquiring flood rights, placing berms around the affected structures or redesigning the project to avoid the impacts.

Recreation

The new County Park would provide a high quality passive recreation opportunity for local and County residents.

Cultural

No mitigation is proposed.

Transportation

One Hundred Eighty-third Street would be paved from the access area to its intersection with State Route 527. This

would be done to control dust in the adjacent residential area.

Utilities

The County would closely coordinate construction activities with the Alderwood Sewer District to prevent disruption of service to local customers.

Soil and Ground Water Contamination

All environmental evaluations will be completed prior to purchase of additional land. The Washington Department of Ecology would be notified if contamination is found as part of these evaluations or during construction activities. The County would assume responsibility for cleanup of the property if no evidence of contamination were found prior to purchase of the land.

Community Involvement

A public meeting was held at the Mill Creek City Hall on June 27, 1991 to inform the public about the status of the project and solicit comments for this Draft Supplemental Environmental Impact Statement. Written comments were accepted until July 17, 1991. As discussed below, the community will have another opportunity to provide written and oral comments following release of this draft document. Written comments will be included as an appendix to the final document.

Agency and Tribal Coordination

Numerous federal, state and local agencies and the Muckleshoot Tribe were contacted during this environmental review process. In May 1992, an informal meeting and site tour were held with the City of Mill Creek, Washington Departments of Fisheries, Ecology, and Wildlife, and the U.S. Army Corps of Engineers and Environmental Protection Agencies.

These agencies will have the opportunity to review and comment on the draft document. Their comments will be carefully considered when preparing the Final Environmental Supplemental Impact Statement (FSEIS) and included in an appendix to the document.

Future Coordination and Project Action

This DSEIS is being released for a 30-day review and comment period. Agencies, groups, and individuals wishing to respond to the document should do so in writing before the deadline on August ?, 1992. Comment letters will be printed and responded to in the Final Supplemental Environmental Impact Statement.

A public meeting will be held on ??? at ??? to provide an additional opportunity for comments.

The State Environmental Policy Act requires the FSEIS to be issued within 60 days of the end of the comment period. The FSEIS will be forwarded with a complete design report to the County Council for their review and action. The Council may schedule one or more public hearings before making their decision. All releases, meetings and hearings will be

announced in project newsletters or notices to those on the mailing list, as well as advertised in the Herald and other local papers.

If the County Council approves construction of one of the design alternatives, the Department of Public Works would then identify funding sources and develop an implementation schedule. Construction is scheduled for summer 1993.

Related County Actions

Besides being the site of a regional stormwater detention facility, the project vicinity is also the site of several County transportation and recreation projects.

164th Street SW/SE Road Widening

The environmental review of the 164th Street SW/SE road widening is now in progress. Phase I of the project would widen the roadway from Ash Way to the Mill Creek city limits. Phase II of the project would widen 164th Street from Ash Way to Spruce Way. Provisions for bike lanes, sidewalks, curbs, gutters, street lights, and traffic signal improvements are also proposed as part of that projects. For further information contact Snohomish County Department of Public Works.

164th Street Intersection Realignment

Four intersections on 164th Street are scheduled for realignment. The realignment of East Shore Drive with 6th Avenue West, 2nd Place West with North Road, and Cascadian Way with 1st Avenue Southeast is scheduled for summer 1994. The environmental review of these realignments was completed in September 1987 and approved by the County Council in November of that year.

The 164th Street/Ash Way intersection is scheduled for realignment in the summer of 1993. A draft Environmental Assessment was distributed for public comment and review in March 1992.

Martha Lake County Park

Snohomish County Parks recently acquired the Martha Lake Resort and Tavern at the south end of Martha Lake. A new 6.7-acre park will be constructed in this location in summer 1993. The master planning process for this park is scheduled for fall 1992. Citizens interested in participating in the planning process should contact County Parks.

ALTERNATIVES

The proposed project would be located in south Snohomish County, south of the City of Mill Creek and west of State Route 527. It would be sited near the middle of the 19,000-acre North Creek watershed, just downstream of North Creek's confluence with Penny Creek (Figure 1). North Creek flows in a southerly direction within the western portion of the project area.

The proposed project would be located within the North Creek floodplain in the vicinity of 180th Street Southeast (Figure 2). The project has two primary components: 1) a stormwater detention facility and 2) a County park.

The stormwater detention facility would provide temporary detention of floodwaters from North Creek and its tributaries to the Elevation 219 topographic contour. Because the facility would be directly capturing floodwaters from the North Creek channel and not stormwater runoff from dispersed sources, it is perhaps more accurately described as a flood control facility. Once completed, the facility would have the effect of reducing peak flows and improving water quality in the lower 6.7 miles of North Creek. River Mile 6.7 is the downstream boundary of the project site and the location of a natural constriction in the stream channel. This constriction is incorporated into the stormwater facility designs described as part of Alternatives A, B, C and D.

The four stormwater (or flood) control design alternatives evaluated in this document are described in more detail in the draft design report for the Snohomish County North Creek Regional Stormwater Detention Facility at 180th Street Southeast (Snohomish County Surface Water Management, February 1992). The facility designs would provide for the same volume (up to 224 acre-feet) of floodwater detention, because they rely on the same natural depression for storage. Each of the design alternatives uses the adjacent floodplain for temporary floodwater storage and incorporates mitigation measures for fish and wildlife habitat and wetlands.

The alternatives differ in the methods used to capture and detain floodwaters from North Creek and its tributaries. The differences affect the reduction in peak flows experienced downstream of the project.

Alternatives A, B, C and D all contain provisions for construction of a new County park that would provide passive

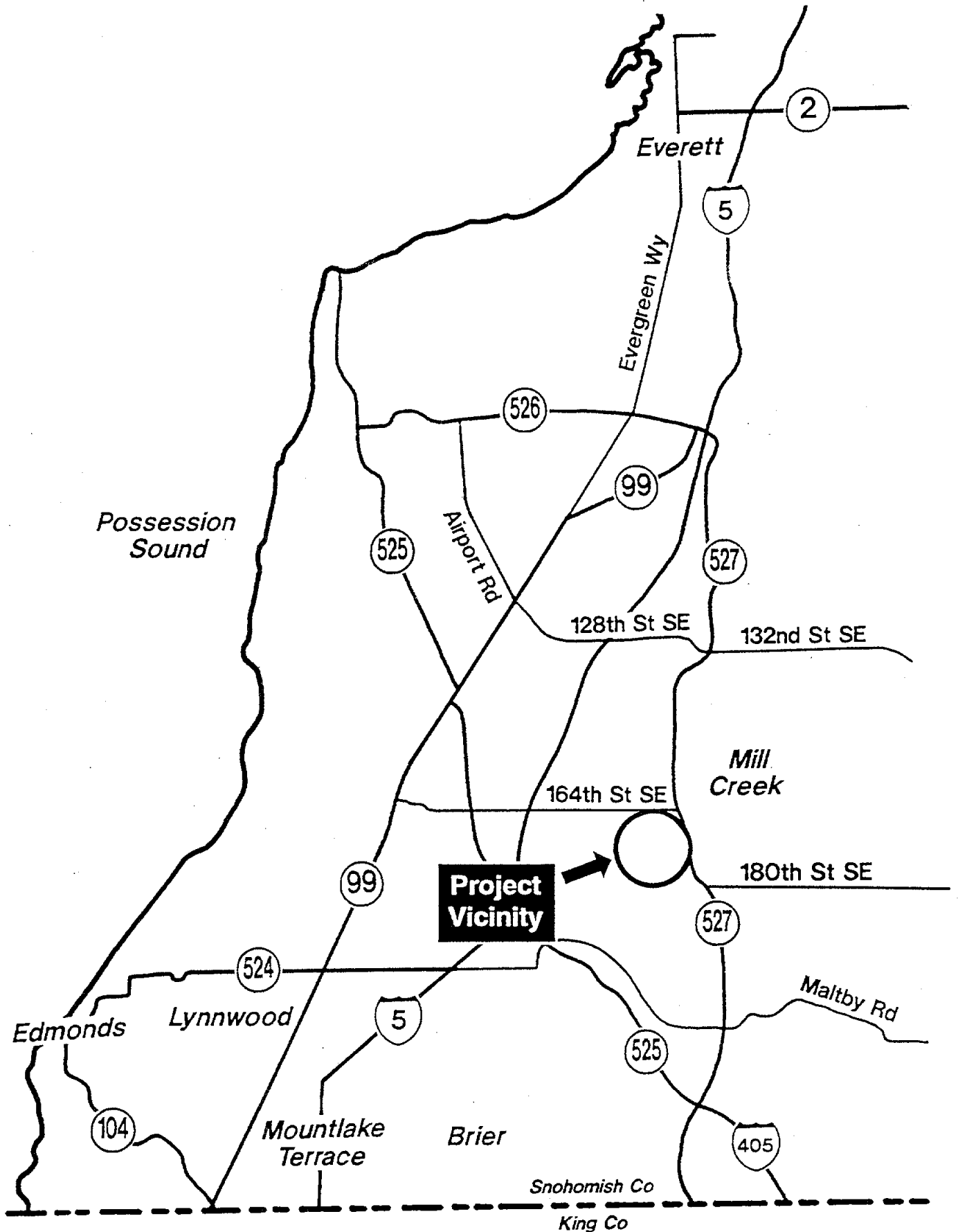


Figure X. Project Vicinity Map

recreational opportunities in the form of nature trails and interpretive exhibits. Design drawings and a detailed description of the park facilities are contained in the North Creek Park and Storm Water Detention Facility Master Plan Report (Snohomish County Parks, January 1992). The Master Plan was prepared in late 1991 under the direction of a citizen and agency advisory committee and has been approved by the County Park Board (February 1992) and County Council (May 1992).

Approximately 68 acres of land has already been jointly purchased by Snohomish County Parks and Surface Water Management (Table 1) to fulfill a portion of the land requirements for both projects. The stormwater detention facility would require purchase of an additional 52 acres (for a total of 120 acres). The park would require purchase of an additional 77 acres (for a total of 145 acres). An estimated 104 acres of land would be jointly used by both project components. If neither component of the project is constructed, the land will remain in County ownership and be managed for its natural open space and flood control amenities.

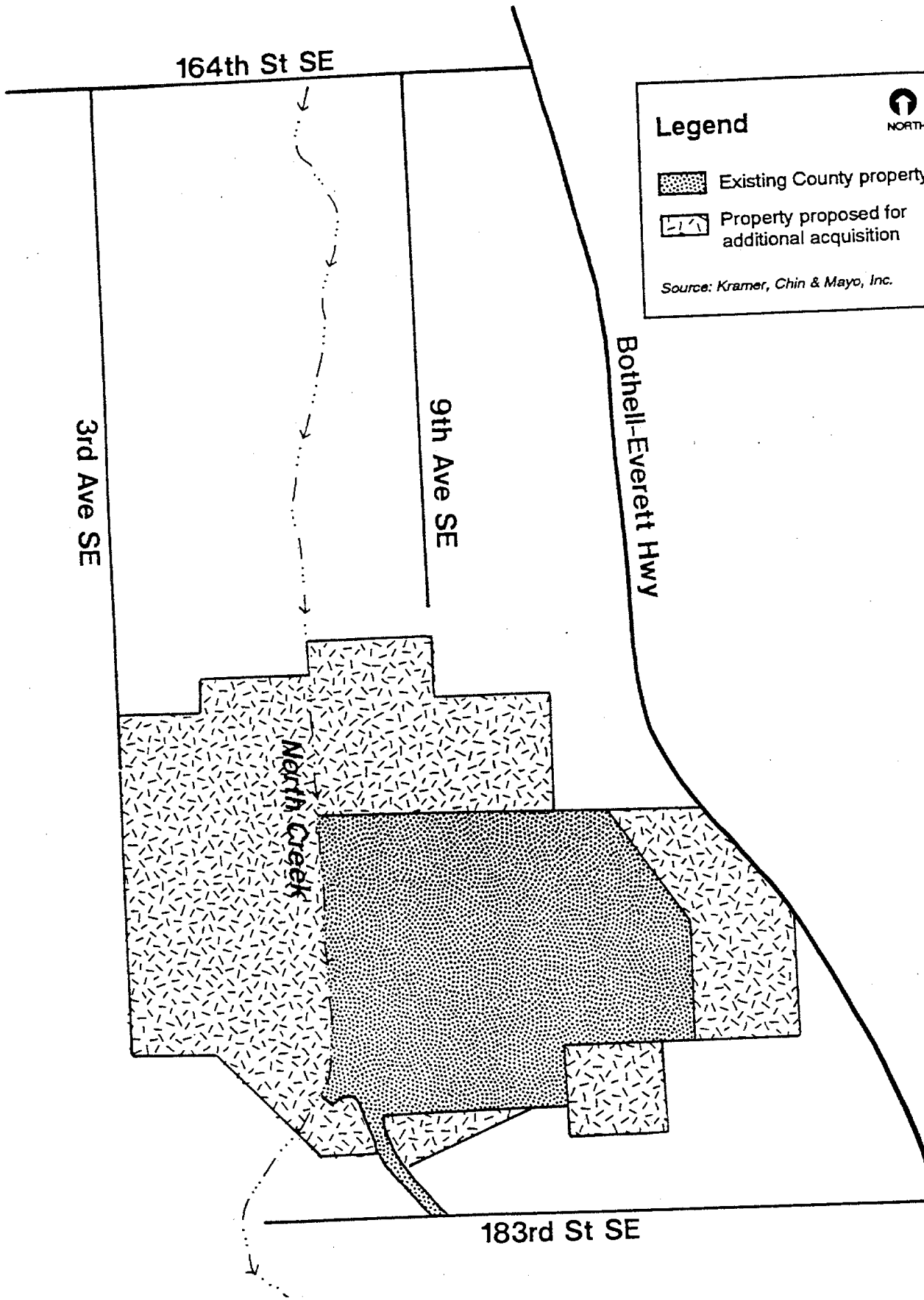
Table 1. Existing Land Ownership and Proposed Acquisitions (Bruce Dees & Associates, January 1992).

	Parks	Surface Water	Acres
North	X	X	19
South	X	X	17
East	X		16
West			25
SUBTOTAL			77
Existing Acres			68
TOTAL			145

Alternative A: Bottomless Arch Culvert/County Park

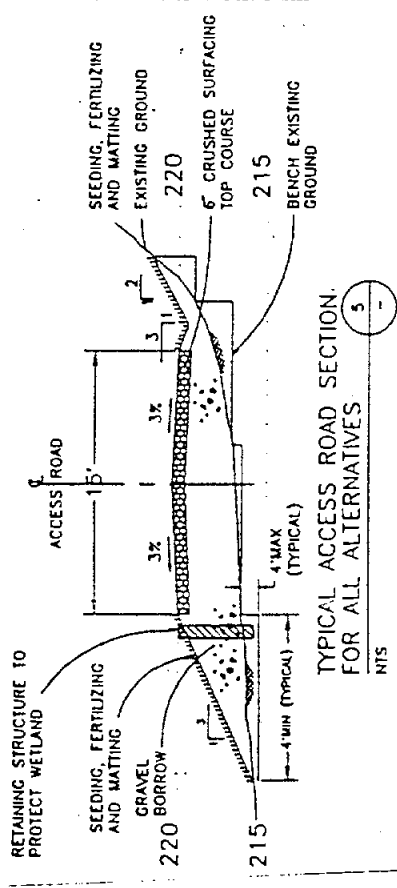
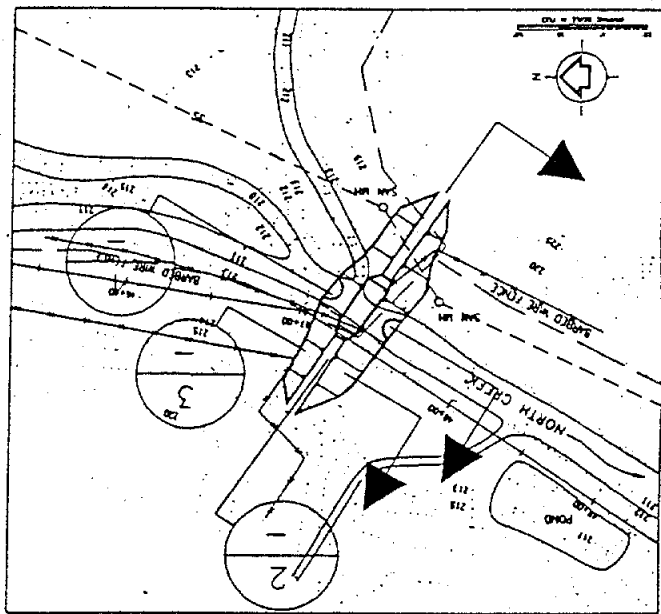
Bottomless Arch Culvert

Alternative A would involve constructing a berm, approximately 150 feet long, across the North Creek channel at a natural constriction near River Mile 6.7 (Figure). The berm would have a 3:1 slope rising from the channel invert to a minimum of 5 feet above the channel invert at the initial overflow. The top of the berm would be at Elevation 218. North Creek would divert around the culvert if a 100-year or larger flood event occurred.



2
 Figure X. Land Ownership

Source: Kramer, Chih & Mayo, Inc.
June, 1992



CONTROL FACILITY
SCALE AS NOTED

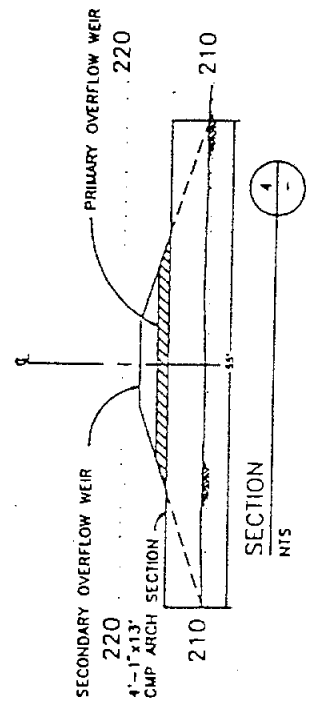
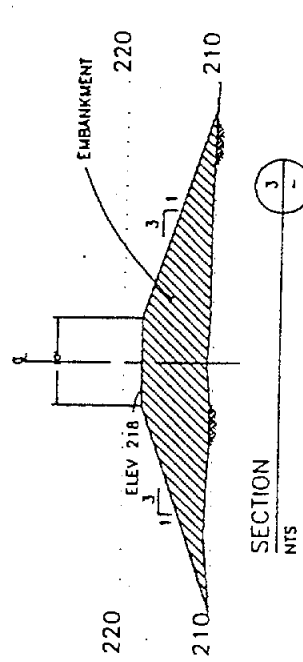
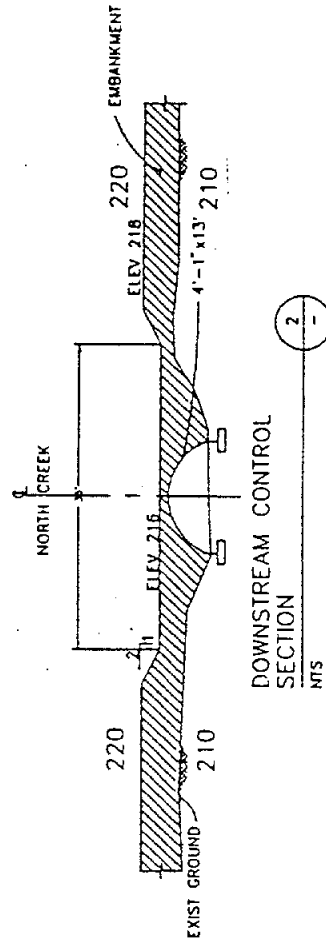
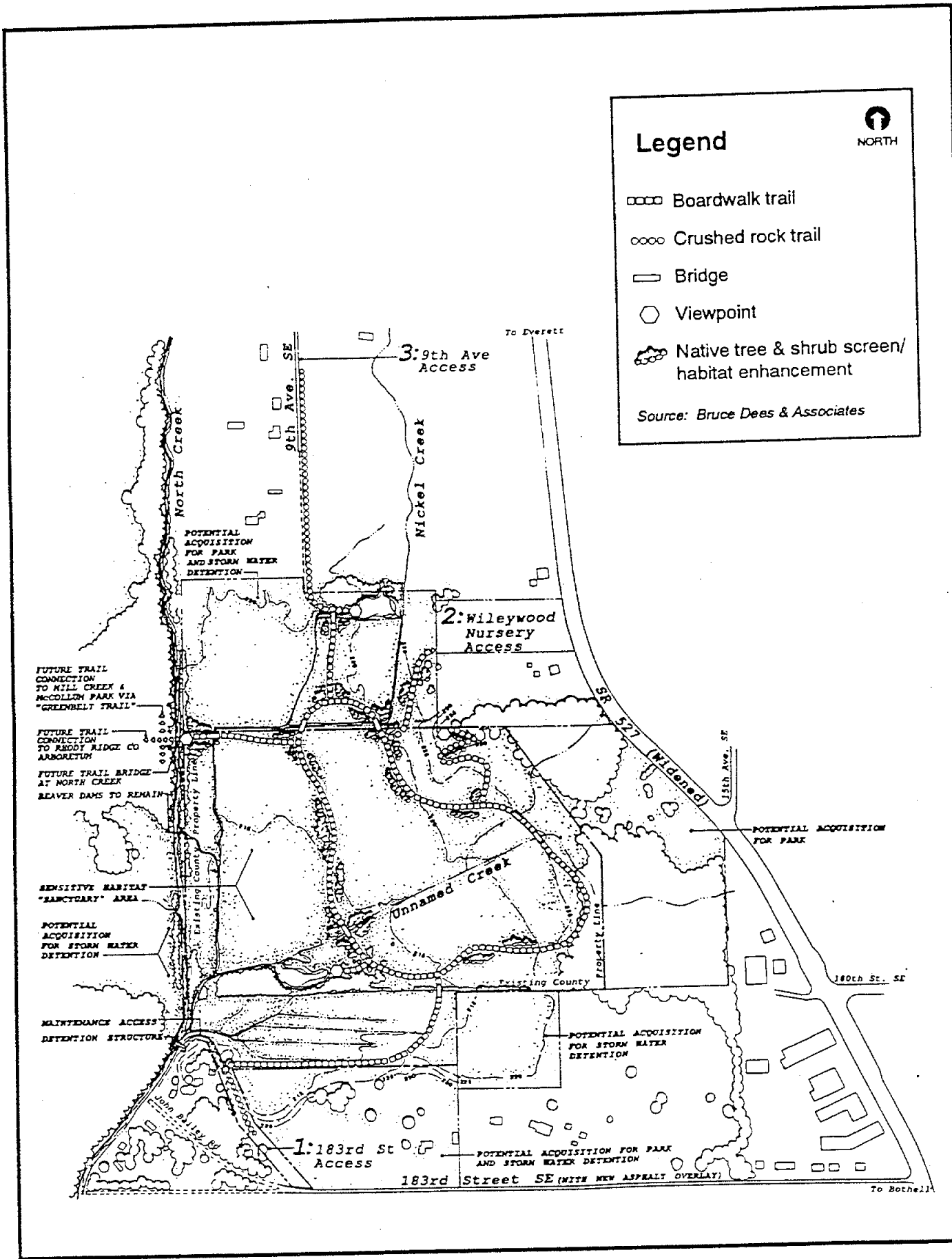


Figure X. Alternative A. Bottomless Arch Pine



4
 Figure X: Alternative E, North Creek County Park

A bottomless, corrugated metal arch pipe would be constructed within the berm. The arch would be 13 feet wide in diameter and 4.1 feet high. The culvert would control the flow of water out of the detention area. It would be bottomless to minimize detrimental impacts to the stream channel and to the salmon and other aquatic life that use the stream.

Alternative A would temporarily detain up to 17 percent of floodwater flows (Table 2). The greatest reduction in peak flood flows would occur with smaller storm events. The facility would not detain or reduce peak flows in excess of a 500-year flood event.

The estimated construction cost of the bottomless arch culvert is \$816,100.

Table 2. Comparison of Stormwater Facility Designs (Kramer, Chin and Mayo, June 1992).

County Park

The new County park would be designed for passive recreation opportunities. This day use area would include: wetland and upland trails, interpretive signs, picnic and toilet facilities, three parking lots and access areas (only one of which would be constructed and maintained by the County), and vegetation plantings (Figure).

The trails would generally be 4 feet wide and be accessible to wheelchairs. They would be designed and constructed to minimize impacts to wetlands and other wildlife habitats. Floating boardwalks would be used in areas where water levels would temporarily fluctuate. The boardwalks would have a bull rail on both sides and encased Styrofoam floatation. The wood would be pressure treated with a waterborne preservative such as Chemonite that would not leach out into the water or soils. Pile supported trails would be used at stream crossings and viewpoints. These trails would also have handrails. The viewpoints would be 8 to 12 feet wide. A third trail type would be used in the drier upland areas and be made of compacted crushed rock or asphalt over a crushed rock base. These trails would generally be 6 feet wide.

Interpretive signs would be installed throughout the park to educate users about the multiple functions of the facility: recreation, flood control, water quality, and wetland and other wildlife habitats. A minimum of five signs and one map at each access point are proposed.

Table 7. Estimated peak flow reductions (cfs)
 (Kramer, Chin and Mayo, May 1992).

Approximate Storm Event (-year storm)	Water Year 1985-86 Land Use	Full Build-Out Alt. A	Full Build-Out Alt. B	Full Build-Out Alt. C	Full Build-Out Alt. D	Full Build-Out Alt. E & F
1.25	190	240	270	260	270	290
2	260	330	350	350	340	380
5	360	450	470	480	440	510
10	430	540	550	570	510	600
25	530	660	660	680	610	720
50	610	750	740	780	680	800
100	690	850	820	870	750	900
200	780	960	910	970	830	990
500	900	1110	1040	1110	930	1120

3
 ble 7. Estimated peak flow reductions (%)
 (Kramer, Chin and Mayo, May 1992).

pproximate storm Event (-year storm)	Full Build-Out Alt. A	Full Build-Out Alt. B	Full Build-Out Alt. C	Full Build-Out Alt. D	Full Build-Out Alt. E & F
1.25	17	7	10	7	?
2	13	8	8	11	?
5	12	8	6	14	?
10	10	8	5	15	?
25	8	8	6	15	?
50	6	8	3	15	?
100	6	9	3	17	?
200	3	8	2	16	?
500	1	7	1	17	?

Picnic facilities would be constructed in upland areas in a manner that would not detract from the natural setting. The tables would be constructed of heavy-duty wood (or other materials like recycled plastic) and be sited on a pad of crushed rock or concrete.

Access and parking areas are proposed for 183rd Street (12 car stalls and 1 bus stall), State Route 527 adjacent to the Wileywood Nursery (20 car stalls), and 9th Avenue (10 car stalls). The County would be responsible for constructing and maintaining the 183rd Street access. In conjunction with development of the access area, 183rd would be paved with asphalt from the access area to the intersection with 527.

The City of Mill Creek would be responsible for constructing the 9th Avenue access, while Wileywood Nursery would be responsible for these activities at its proposed access site.

A drinking fountain, bike rack, and two toilets would be provided at each access area. The 9th Avenue and 183rd Street sites would have chemical toilets in an attractive wood enclosure. Flush toilets would be provided at the Wileywood Nursery. The parking areas would be paved with asphalt and striped. They would have curbs and a catch basin to collect stormwater runoff.

Native plants would be planted in areas disturbed by construction and in other locations to: screen access areas from adjacent neighbors, protect and diversify wildlife habitat, and for aesthetic purposes.

The estimated construction cost of the County park, including the 183rd Street access area, is \$836,874.

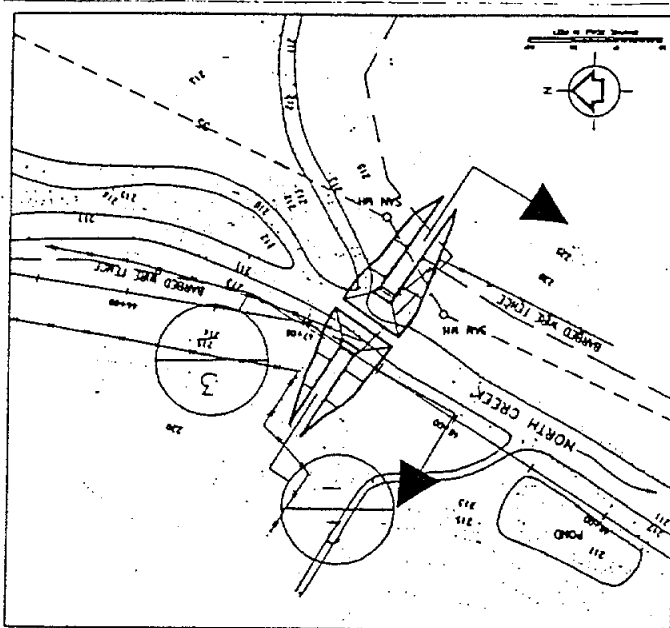
Total Construction Cost: \$1,652,974.

Alternative B: Bioengineered Constriction/County Park

Bioengineered Constriction

Similar to Alternative A, the primary hydraulic feature of Alternative B would be sited in the natural channel constriction in North Creek (RM 6.7) (Figure ?). Instead of using a culvert to control the release of floodwaters from the floodplain, Alternative B relies on a "bioengineered" approach that provides wildlife habitat and is more natural appearing. The trapezoidal-like shape of the bioengineered constriction offers less hydraulic control during flood events than the more traditional engineering designs used in

Source: Kramer, Chin & Mayo, Inc.
June, 1992



CONTROL FACILITY
SCALE AS NOTED

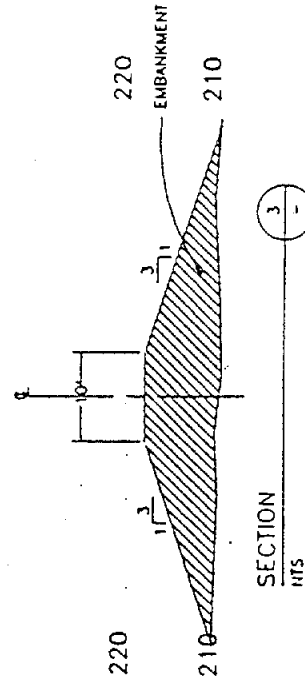
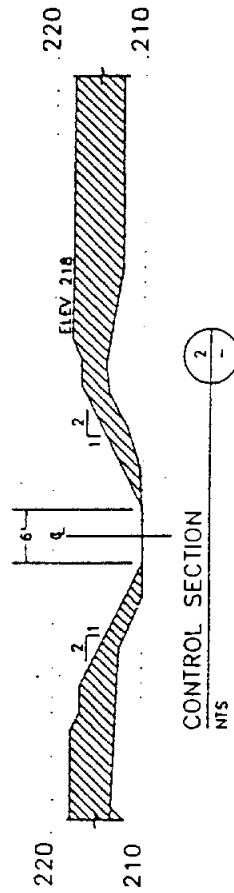


Figure ⁵X. Alternative B, Bioengineered Construction

Alternatives A, C and D. Accordingly, Alternative B would only reduce up to 9 percent of peak flows downstream of the project site (Table 2). The reduction in flows would not vary substantially between various size flood events.

The bioengineered constriction would be constructed from natural and synthetic textiles, native riparian vegetation, and rocks in the vicinity of RM 6.7. The constructed stream banks would further narrow the existing constriction and provide control over the rate of flow out of the detention area.

The constructed stream banks would be 5 feet high and would consist of a series of layers of earth 12 to 18 inches high, enveloped by the textile material. Live, rooted plants would be planted between and within the constructed layers. The bottom layers would also contain 3- to 5-inch rocks to inhibit erosion at the base of the stream banks. The streambed would remain in its natural condition though it would have slightly less channel surface area as a result of the narrowing (to 6-feet).

Similar to Alternative A, this alternative would also require construction of an embankment on both sides of North Creek to extend the stream banks into the existing channel corridor and create the desired cross-sectional configuration. The minimum bottom width of the stream channel would be 6 feet. The embankment would have a 3:1 slope rising from the channel invert to 6 feet above the channel invert. The embankment would remain at Elevation 217 to its intersection with the natural ground elevation.

The estimated construction cost of the bioengineered constriction is \$736,300.

County Park

See Alternative A for description and cost of County Park.

Total Construction Cost: \$1,573,174.

Alternative C: Off-Channel Storage/County Park

Off-Channel Storage

Alternative C varies from Alternatives A, B and D in that floodwater detention would be achieved by enhancing the ability of North Creek to divert water into the floodplain rather than by constructing a control facility within the natural constriction of the stream channel (Figure). This option offers less reduction in peak flow (a maximum of 10 percent) than the other design alternatives (Table 2), but

Source: Kramer, Chin & Mayo, Inc.
June, 1992

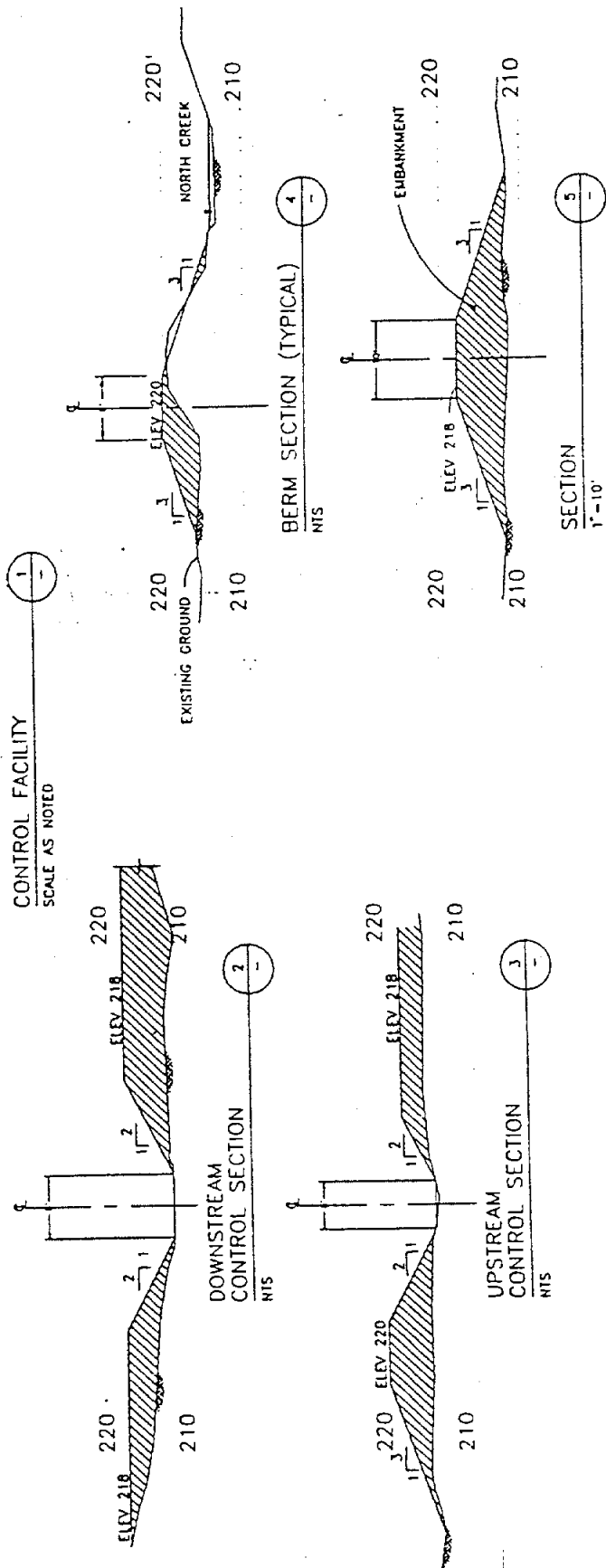
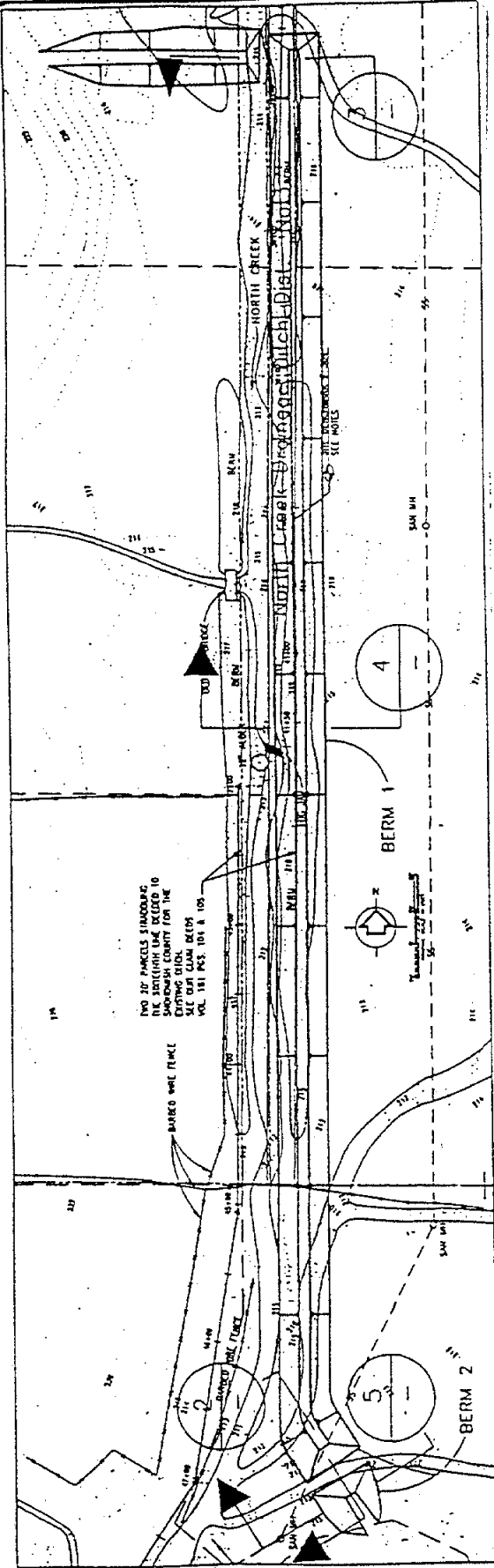


Figure X. Alternative C, Off Channel Storage

has the benefit of not requiring instream construction. The greatest reductions in peak flows occur for small flood events of 5-year intervals or less. From an ecological perspective, the primary disadvantage of Alternative C is that it would destroy the riparian vegetation that has reestablished along the existing east-bank dike and some palustrine wetland habitat in the floodplain.

Alternative C would separate the floodwater storage area from North Creek by reconstructing and raising the elevation of the existing east-bank berm (Berm 1) that parallels North Creek through the project site, and constructing a new berm (Berm 2) adjacent to North Creek at the southwest end of the project area. The height of the existing berm ranges from Elevation 216 to 219 where still intact, and has numerous breaches along its length. This berm would be reconstructed by plugging the numerous breaches that now exist along its length and establishing a uniform top elevation of 220 feet.

Berm 2 would be constructed on either side of the unnamed tributary that joins North Creek at the southwest end of the site and in a manner similar to that described for Berm 1. The bottom width of the opening in Berm 2 would be 8 feet. The top elevation would be 218 feet for the primary overflow and 220 feet for the emergency overflow.

The eastern portion of Berm 2 would be feathered into the existing site contours. Berm 1 creates a higher water surface elevation through this restricted channel reach. This in turn causes the stream to overtop its banks at the upstream end of Berm 1. The flow that overtops the berm would drain into the floodplain. Drainage of the floodplain would be controlled by the characteristics of the opening in Berm 2 and the downstream water surface elevation.

The estimated construction cost of the off-channel storage facility is \$1,481,400.

County Park

See Alternative A for description and cost of County Park.

Total Construction Cost: \$2,318,274.

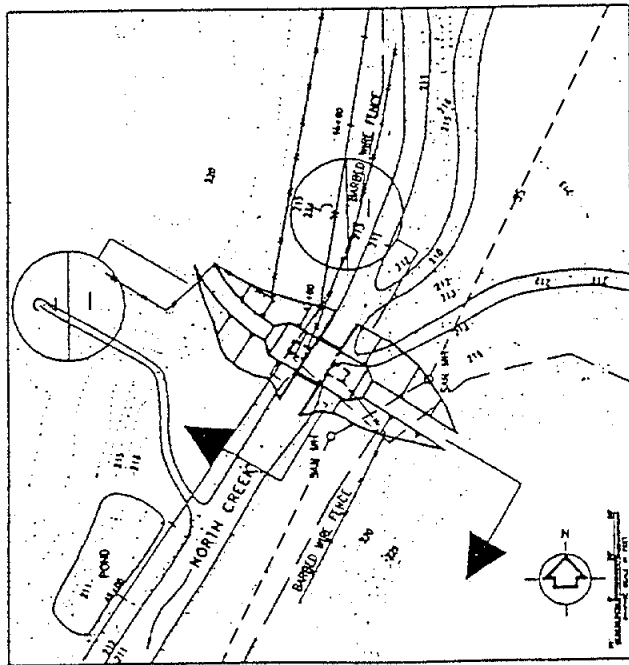
Preferred Alternative:

Alternative D: Bottomless Box Culvert/County Park

Bottomless Box Culvert

Alternative D, the preferred alternative, is similar to Alternative A except that a box culvert (4 feet high by 13 feet wide) is used to control the release of floodwaters

Source: Kramer, Chin & Mayo, Inc.
June, 1992



CONTROL FACILITY
SCALE AS NOTED

220
210

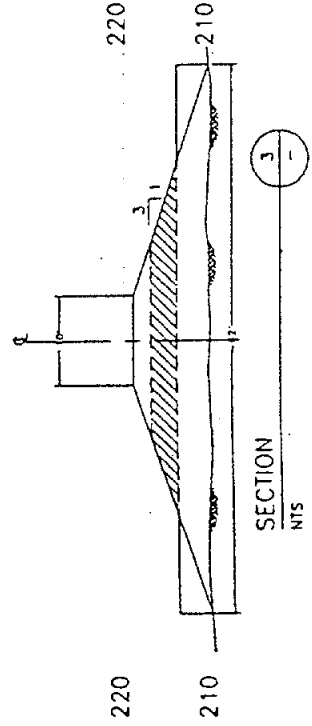
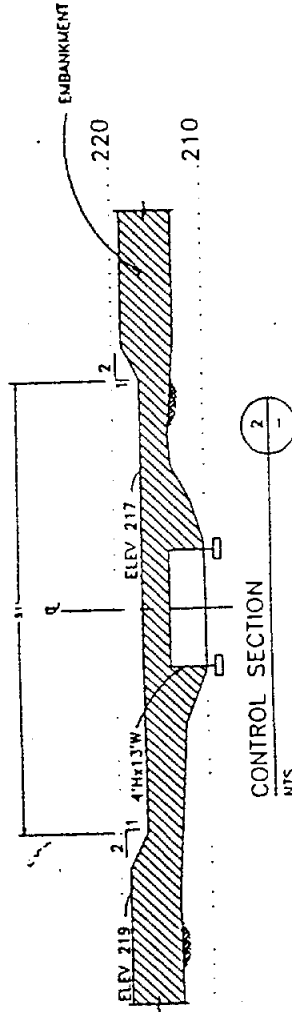


Figure X. Alternative D, Bottomless Box Culvert

from the floodplain (Figure). This alternative provides the greatest reduction in peak flows (from between 7 and 17 percent), with the most reduction occurring with the largest flood events (Table 2). If the optional culvert gate and stop log adjustment were used, peak flows could be reduced up to ?? percent.

Like Alternative A, Alternative D would require construction of an embankment across North Creek at the natural constriction at the southwest corner of the project area. The embankment would contain an overflow weir 51 feet in length with a top elevation of 217 feet. On either side of this weir the berm would rise to the emergency overflow at Elevation 219. The berm at the crest of the emergency overflow would be 10 feet wide and its slide slopes would be 3:1. This design would contain the typical 100-year flood to less than Elevation 219 over the entire site.

The estimated construction cost of the bottomless box culvert is \$811,000. This cost includes an optional adjustable culvert gate and stop log adjustment for the primary overflow weir.

County Park

See Alternative A for description and cost of County Park.

Total Construction Cost: \$1,647,874.

Alternative E: County Park Only

Alternative E differs from the previously described alternatives in that it only provides for construction of a passive recreation area. A stormwater control facility would not be constructed under this alternative.

See Alternative A for the description and cost of the County Park.

Total Construction Cost: \$836,874.

Alternative F: No Action

Neither the stormwater detention facility nor the County park would be constructed under the No Action Alternative. The detention of North Creek flood waters in the project area would naturally occur through the flooding of the floodplain lands adjoining the east and west banks of North Creek.

The 68 acres of land already purchased by the County would remain in public ownership and be used for natural flood control and open space purposes. No additional land would be acquired. No substantial improvements or construction would occur at the wetland site. The existing east-bank dike would be allowed to continue to erode.

Earth

The proposed project would be sited mostly within a disturbed floodplain that lies adjacent to the east and west banks of North Creek in the vicinity of 180th Street Southeast. The floodplain exists within a natural depression between the 210- (at North Creek) and 220-foot topographic contours. Slopes within the floodplain are between 0 and 5 percent, and increase to upwards of 15 percent in the uplands surrounding the natural depression. Wetland (hydric) soils cover most of the floodplain, and are surrounded by drier upland (loam) soils in higher elevation areas. A geotechnical field analysis of the project area indicates that peat exists below a shallow (three- to six-inch) topsoil layer. The peat is up to 15 feet thick, and is underlain by three to nine feet of organic silt deposits. Depth to groundwater at the time of the geotechnical evaluation ranged from 0.5 to 3 feet in the floodplain.

Direct impacts to earth resources would result from project construction. The stormwater control structure would require construction of an embankment, flow control structure and permanent access road. The County park would require construction of access areas, trails and viewpoints. Construction activities could lead to increased sediment loads in North Creek if proper erosion control measures are not used.

Operation of the stormwater control structure would likely result in an increase in sedimentation within the floodplain. Downstream of the project, however, there should be a reduction in sedimentation and erosion that would lead to an improvement in water quality and salmon habitat. Operation of the proposed park would have minimal impacts to earth resources.

Mitigation for impacts to earth resources would take many forms. Up to 145 acres of land would be acquired and the majority of it left in its existing condition, preserving it from future development. Construction activities within the floodplain would be minimized to reduce the need for special design and construction considerations and commitment to long-term maintenance. Temporary erosion control measures would be used during construction to control increases in sediment downstream of the project site. Finally, a five-year monitoring program would be developed, implemented and annually reviewed to assess impacts to soil and other natural resources as a result of project operation.

Studies and Coordination

General soils information was summarized and mapped from the Soil Survey of Snohomish County Area, Washington. Site specific field work was conducted by Converse Consultants Northwest and other geotechnical consultants to determine the composition and depth of the saturated, compressible soils (Appendix ?). Additional soil analyses were conducted

by Parametrix, Inc. to identify wetland habitats. Relevant information sources are cited below:

Converse Consultants NW. February 10, 1992. "Geotechnical Engineering Report: Proposed North Creek Detention Facility, Bothell, WA." Kramer, Chin and Mayo, Seattle, WA.

Jongejan-Gerrard-McNeal. ?? Feasibility Study North Creek Regional Detention and Park Facilities. Surface Water Management Division, Department of Public Works, Snohomish County, Everett, WA.

Kramer, Chin and Mayo. May 1992. Snohomish County North Creek Regional Stormwater Detention Facility at 180th Street SE: Draft Design Report. Surface Water Management Division, Department of Public Works, Snohomish County, Everett, WA.

Parametrix, Inc. April 1992. North Creek Wetland and Habitat Assessments. Surface Water Management Division, Department of Public Works, Snohomish County, Everett, WA.

U.S. Department of Agriculture, Soil Conservation Service. July 1983. Soil Survey of Snohomish County Area, Washington.

Washington Department of Ecology. June 1991. Draft Stormwater Management Manual for the Puget Sound Basin. Publication 90-73. Olympia, WA.

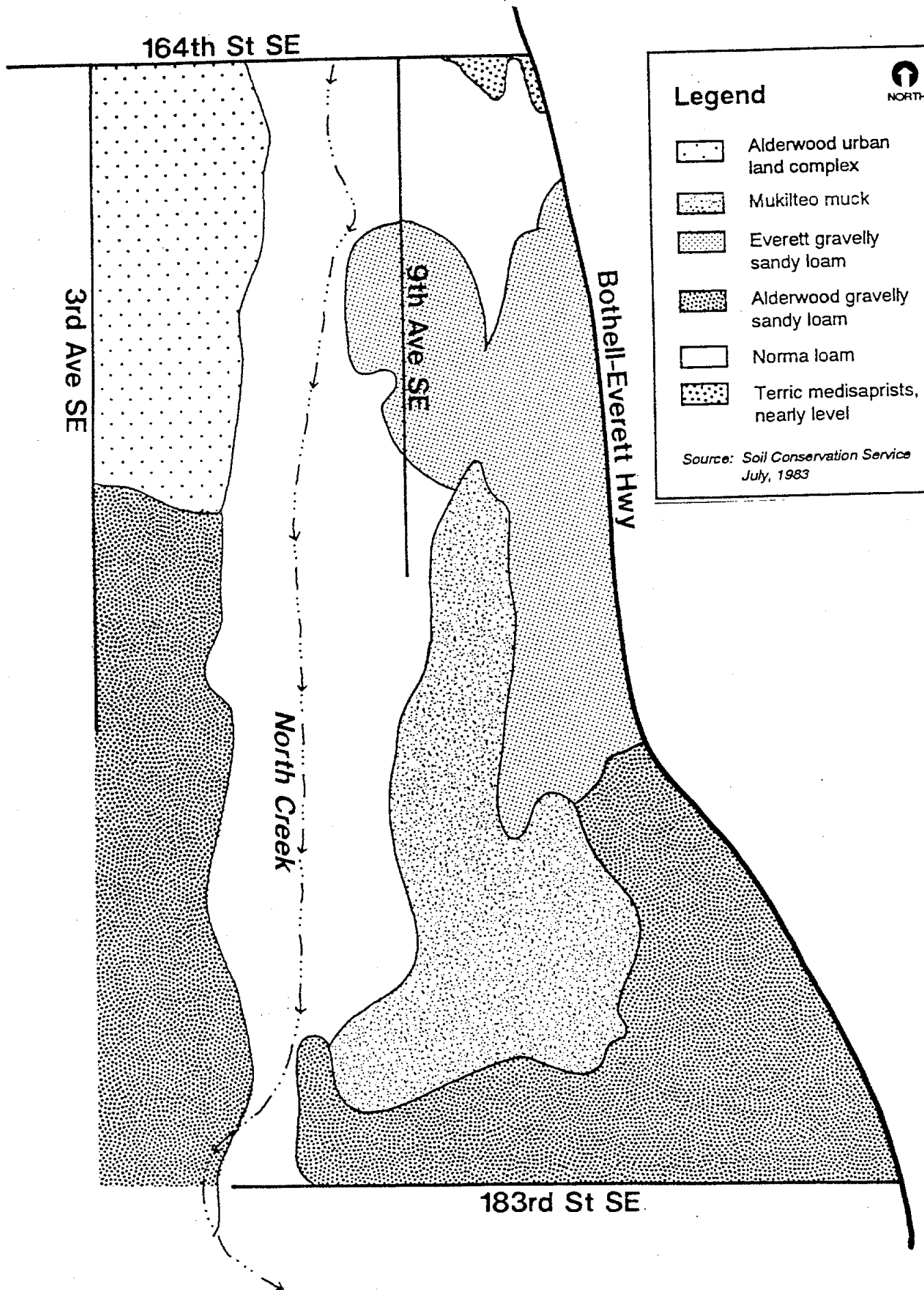
Affected Environment

General Soil Units







The County soil survey identifies four soil units within the project area: Mukilteo muck, Norma loam, Alderwood gravelly sandy loam, and Everett gravelly sandy loam (SCS, July 1983) (Figure ?). The presence of these soil units was later confirmed by County staff and consultants as part of the wetland evaluation process. Two of these soils, the Mukilteo muck and Norma loam, are identified by the SCS as wetland (hydric) soils. A hydric soil is defined as being saturated, flooded or ponded long enough during the growing season to develop low oxygen conditions in the upper layers. These four soil units are described more specifically below:

Mukilteo Muck

The Mukilteo Muck unit is a very deep, very poorly drained soil, that forms in depression areas. Slopes are typically from 0 to 1 percent. Native vegetation is mainly sedges and rushes. Typically, the upper layer is dark reddish brown muck, four inches deep. The next layer is dark reddish brown and black organic material 31 inches thick. Next is a layer of black organic material, 19 inches thick. Below this is a fine sandy loam to a depth of 60 inches or more. In some areas a large amount of woody material is in the profile. In Snohomish County, this soil unit is used as cropland, pasture, and for wildlife habitat. The propensity for ponding and its low soil strength make the Mukilteo muck



Legend

-  Alderwood urban land complex
-  Mukilteo muck
-  Everett gravelly sandy loam
-  Alderwood gravelly sandy loam
-  Norma loam
-  Terric medisaprists, nearly level

Source: Soil Conservation Service
July, 1983

8
Figure X. SCS Soil Units

unsuitable for urban development. It is subject to severe ponding.

Norma Loam

The Norma Loam unit parallels both sides of North Creek in the project area. It is a very deep, poorly drained soil found in topographic depressions on glacial outwash plains and till plains. The native vegetation is mainly hardwood trees. Typically, the surface layer is very dark gray loam about 10 inches thick. The next layer is often a dark grayish brown sandy loam about 18 inches thick. A dark gray sandy loam is found below this middle layer to a depth of 60 inches or more. Within Snohomish County, this soil unit is mainly used for hay and pasture and for wildlife habitat. Because it is subject to ponding, it is poorly suited for urban development.

Alderwood Gravelly Sandy Loam

This well drained soil unit is found in the drier upland areas of the project site to the south and east of the Muckilteo Muck. Slopes are from 2 to 8 percent. Native vegetation is mainly conifers and hardwoods. The surface layer is typically a very dark grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is dark yellowish brown and dark brown very gravelly sandy loam about 23 inches thick. A 5-inch thick layer of olive brown very gravelly sandy loam exists below this layer. A weakly cemented hardpan is found at a depth ranging from 20 to 40 inches. This soil unit is mainly used for urban development and as woodland, but is also used for hay and pasture.

Everett Gravelly Sandy Loam

The Everett gravelly sandy loam is located in drier upland soils east of the Mukilteo Muck and north of the Alderwood loam. Slopes are from 8 to 15 percent. It is very deep and somewhat excessively drained. Conifers are the common native vegetation. The surface layer, where mixed to a depth of 6 inches, is typically a dark brown gravelly sandy loam. The subsoil is dark brown very gravelly sandy loam about 12 inches thick. The upper part of the substratum consists of approximately 5 inches of brown very gravelly sandy loam. The lower part of the substratum, to a depth of at least 60 inches, is dark brown extremely gravelly sand. The substratum is weakly cemented in some areas. This soil unit is mainly used as woodland and for urban development.

Site-Specific Field Work

Subsurface conditions were evaluated throughout the project area by completing a site reconnaissance, and by drilling a series of 20 hand-auger explorations (from 1 to 11 feet deep) and a single deep boring with a truck-mounted drill (to 32.5 feet below the land surface). These detailed soil analyses indicate that the floodplain is underlain by recent alluvial sediments, peat, silt, and sandy silt transported and deposited by North Creek and its tributaries (Converse Consultants Northwest, 1991). The peat layer is typically found beneath a 3- to 6-inch layer of topsoil. Where test

re 9 pits have been excavated, it is up to 15 feet thick (Appendix 7). The organic silt layer beneath the peat is between 3 and 9 feet thick. The total thickness of these two compressible soils can only be estimated. They are believed to thicken toward the north and west of the project area.

General subsurface conditions in the vicinity of the proposed embankment consist of organic soil over silty sand with roots over relatively clean sand. The average depth of the first two layers is about 2.5 feet, and extends up to 3.5 feet deep. The clean sand exists to about 20 feet below the ground surface. Hard, sandy silt comprised of layers of peat and organic silt is located at depths of 20 to 26 feet. Fine to medium sand extends to at least 32.5 feet. At the time of the field evaluation, groundwater in this area was between 0.5 and 3 feet deep in the upper sand unit, and artesian groundwater conditions were found in the lower sand unit.

The site of the proposed access road is wooded and ranges in elevation from 213 to 220 feet. Topsoil and/or peat were encountered to a maximum depth of 1 foot, overlying silty sand with roots. Depth to groundwater in this area ranged from 1.5 to 3 feet.

Environmental Impacts

Generally speaking, negative impacts to soil resources could occur during project construction and operation. The magnitude and location of the impacts would vary according to the alternative selected.

Construction activities would directly impact soils and require special techniques in saturated, organic soils. Without proper erosion control measures, construction activities could also contribute to soil erosion in the project area and increased sediment loads downstream of the project site. Impacts resulting from construction activities are discussed below under the specific alternatives.

Once in operation, the regional stormwater detention facility could impact soils by altering sedimentation rates within the project area, altering sediment loads in North Creek downstream of the project, and altering streambank erosion and channel scour downstream of the project. These impacts are all related to facility design, and specifically, to the floodwater storage process, including the height of flood waters, area of flooding, duration of flooding and water velocity.

As described in the Water Resources Section, all of the design alternatives maximize the floodplain's ability to store up to 224 acre-feet (nearly 7.3 million gallons) of floodwater to the Elevation 219 topographic contour. Each alternative provides longer periods of temporary floodwater storage than occurs under existing conditions. The height of floodwaters and area of flooding is controlled by the

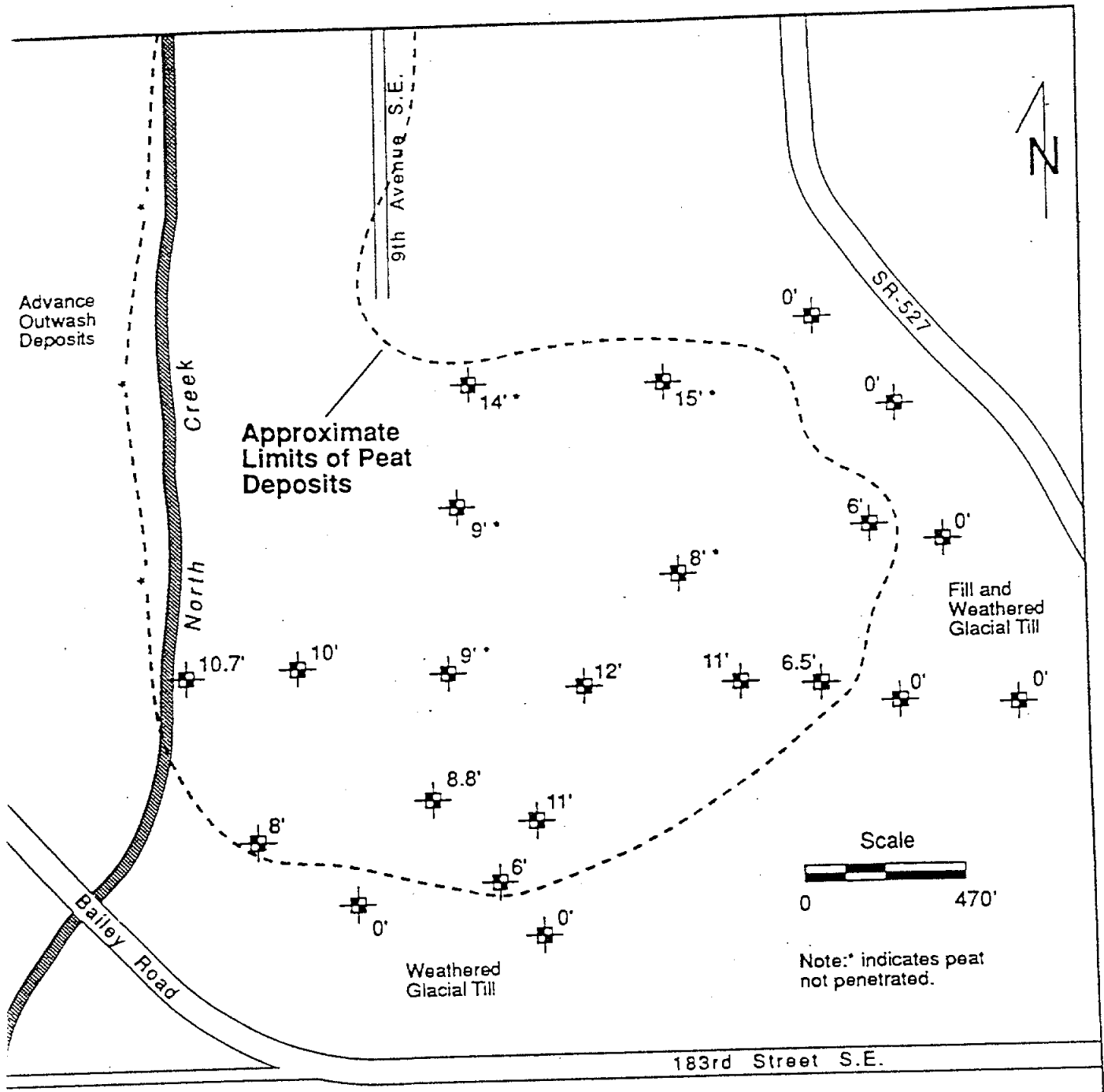


Fig 9. Depth of Peat

ability of the facility to back water up into the floodplain. The duration of flooding (or detention time) is controlled by the rate of release of floodwater from the storage site.

Longer detention times would result in more sediment being deposited in the floodplain. The stormwater control facility would reduce the velocity of the water, allowing sediment to settle out of the water column where it could then accumulate on the top layer of soil, changing the surface soil composition. Through this process, the surface soil on the floodplain could be adversely impacted by the accumulation of larger amounts of fine sediments (and attached pollutants) than occurs under existing conditions.

Although, a regional stormwater facility could negatively impact existing sedimentation processes within the floodplain area, it should result in a positive impact downstream of the project site. The stormwater detention facility would help to capture fine sediments from North Creek, and in turn minimize the amount of sediment carried by the creek downstream of the project area. (The benefit of decreased sedimentation downstream of the project would be enhanced by longer detention times in the floodplain.) A reduction in fine sediments downstream of the project should improve water quality and salmon spawning habitat (fine sediments clog up gravels used for spawning, preventing salmon eggs from hatching).

Additionally, because a stormwater detention facility would reduce peak flows downstream of the project site, it would help to minimize erosion of streambanks and scour of the streambed. The degree to which streambank erosion and gravel scour would be reduced would depend on the amount of hydraulic control afforded by the alternative. In general, the greater the reduction in peak flow, the less hydraulic energy there is available for erosion and scour.

Alternative D: Preferred Alternative: Box Culvert/County Park

Direct impacts to earth resources resulting from construction of the stormwater facility would occur in the vicinity of the embankment, flow control structure, and permanent access road (Figure ?). This would involve removing existing vegetation to approximately 5 feet outside of the planned site of the structure. If excessive amounts of organic soils are encountered they would be excavated. An average of between 2 and 2.5 feet of excavation is anticipated. Loose areas would then be compacted to achieve a firm, stable subgrade surface. If needed, trenches would be dug to drain groundwater to at least 2 feet below the subgrade surface. Well-graded silty sand with gravel (glacial till) would be used as fill for the embankment. If needed, free-draining imported sand and gravel would be used for the access road.

Operation of the preferred facility design would result in a longer period of temporary floodwater storage than any of the other designs. This characteristic of the facility presents tradeoffs with respect to soil impacts.

As discussed above, the longer the floodwater detention time within the floodplain, the greater the propensity for sedimentation to occur in that area. Because pollutants like heavy metals are known to attach to fine sediments, surface soils would be negatively impacted by this process. However, if fine sediments settle out of the water in the project area, they would be prevented from washing back into North Creek downstream of the project site. This should lead to an improvement in water quality and salmon habitat in the lower seven miles of the stream.

See Alternative E for a discussion of impacts to soil resources related to the construction and operation of the County park.

Alternatives A, B and C: Other Design Alternatives

Alternatives A, B and C rely on the same location and general processes for floodwater storage as the preferred alternative. Because they offer less hydraulic control than Alternative D, they would be expected to create less sedimentation impacts to the floodplain soils. Accordingly, these alternatives would also provide smaller reductions in sedimentation downstream of the project, and in turn a smaller improvement in water quality, erosion and scour potential, and salmon habitat.

In addition, Alternative C, because of its design requirement for two large embankments within the floodplain wetland, would pose more severe construction impacts to the earth resources in this area.

See Alternative E for a discussion of impacts to soil resources related to the construction and operation of the County park.

Alternative E: County Park Only

Under this alternative, construction impacts to soil resources would result only from construction of the passive recreation facility and its access areas. There would be no change to existing flood-related sedimentation processes.

Alternative F: No Action

No construction or additional land acquisition would occur under the No Action Alternative. The east-bank dike would continue to erode as a result of beaver activity, allowing for natural flooding of the floodplain and deposition of sediment (and attached pollutants).

Less sediment would be retained within the floodplain under existing conditions than it would if a regional stormwater detention facility were in place. Water would be moving faster through the floodplain and be able to carry more

sediment over the land and back to the North Creek stream channel. The fine sediments would be transported downstream of the project area, contributing to degradation of surface water quality, gravel beds used by spawning salmon, and contributing sediment loads to the Sammamish River and Lake Washington aquatic systems. Further, the No Action alternative would result in increased erosion of the streambanks and scour of the stream channel downstream of the project site due to larger peak storm flows traveling at higher velocities.

Mitigation:

Snohomish County Surface Water Management and Parks and Recreation Divisions currently owns 68 acres of land. A total of up to 145 acres of land could eventually be acquired for this project (see Land Use Section). Additional land acquisition within the floodplain would eliminate pressures for development (and consequent soil impacts) and other activities detrimental to floodplain soil.

During project construction, the County would provide temporary erosion control measures as per Washington Department of Ecology and Snohomish County regulations.

Where feasible and if necessary, organic soils excavated during project construction would be used to construct new wetland habitat within the project area to mitigate for wetlands damaged by construction activities.

The flow control structure and emergency spillway would be protected from erosion with geotextile material, sand and gravel and 8- to 12-inch riprap. Depending on location, the riprap would be from 1.5 to 2 feet thick. The portion of the embankment that would not be subjected to flowing water would be vegetated with native grasses and vegetation.

The impacts of sedimentation in wetlands is poorly understood. For this reason, once the project is in operation, a five-year monitoring program would be implemented and reviewed annually to better understand the implications of this process. If severe negative sedimentation impacts are discovered to be occurring as a result of project, a plan would be developed to modify project operation.

Water

The project area is located near the center of the 19,000-acre North Creek watershed. North Creek is a typical Puget Sound lowland stream. The headwaters of the 12.6-mile stream begin about five miles upstream of the project area in a highly urbanized commercial and residential area near Everett Mall Way. Less than seven miles downstream of the project area, North Creek drains into the Sammamish River. The Sammamish River drains into Lake Washington.

The proposed project would be sited in a 78-acre floodplain located mostly on the east side of North Creek between River Mile (RM) 6.7 and RM 7.2. The floodplain was settled as part of the historic Bailey family homestead in the late 1800s. The early homesteaders straightened the once meandering North Creek and dug drainage ditches east and west of the creek to drain the area. Around the turn of the century a dike was constructed on the east bank of North Creek to prevent the floodplain from becoming inundated during heavy rains. In recent years, however, the dike has eroded, allowing floodwaters to again flow back into the area.

The proposed regional stormwater detention facility would impact stream hydraulics and water quality. The preferred facility design (Alternative D) would reduce peak storm flows downstream of the project area by 7 to 17 percent (depending on the size of the storm). Floodwaters could be temporarily stored in the floodplain to the Elevation 219 contour during a 100-year or larger storm event.

Impacts to water quality within and downstream of the project area could occur during project construction if proper erosion control measures are not used. Once in operation, the stormwater control facility should help to improve water quality downstream of the project area as a result of improved flood control. Water quality within the floodplain could be negatively impacted but the level of degradation beyond existing conditions is not known.

Mitigation measures include temporary erosion control measures in accordance with state and local regulations, regular maintenance of the stormwater facility, and, as described in other sections of this document, a 5-year resource monitoring program.

Studies and Coordination:

Information on watershed characteristics was obtained primarily from the draft management plan now being prepared for the North Creek watershed.

Information on specific stream reaches and wetlands was obtained from the Snohomish County Stream and Wetland Survey.

Streamflow data were gathered from annual water resources data reports for the State of Washington prepared by the United States Geological Survey (USGS). Two United States Geological Survey monitoring gages were located on North Creek from October 1984 to September 1986.

Computer modeling of the hydraulic characteristics of the four design alternatives was obtained from the design report for this project.

The water quality data presented in this document were gathered as part of Surface Water Management's ambient water quality monitoring program. Two of the County's monitoring stations are located along North Creek in the project vicinity.

The above information sources and other relevant documents are cited below:

James M. Montgomery, Consulting Engineers, Inc. February 1986. Snohomish County Regional Detention Facility Siting Study. Volumes 1-3. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

Kramer, Chin & Mayo, Inc. June 1991. Draft North Creek Watershed Management Plan: Water Quality Assessment. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

_____. July 1991. Draft North Creek Watershed Management Plan: Watershed Characterization. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

_____. May 1992. Snohomish County North Creek Regional Stormwater Detention Facility at 180th Street Southeast: Draft Design Report. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

Parametrix, Inc. April 1992. North Creek Regional Stormwater Detention Facility Wetland and Habitat Assessments. Surface

Water Management, Department of Public Works, Snohomish County, Everett, WA.

Surface Water Management, Department of Public Works, Snohomish County. October 1987. Final Environmental Impact Statement: Snohomish County Regional Stormwater Detention Facility Siting Study. Everett, WA.

_____. December 1988. Snohomish County Watershed Ranking Project. Everett, WA.

U.S. Geological Survey. Stream Flow Statistics and Drainage Basin Characteristics for the Puget Sound Region, Washington. Volume II: Eastern Puget Sound from Seattle to the Canadian Border. Open-File Report 84-144B. Tacoma, WA.

_____. Water Resource Data: Washington: Water Year 1986. Water Data Report WA-86-1. Tacoma, WA.

Washington Department of Ecology. June 1991. Draft Stormwater Management Manual for the Puget Sound Basin. Publication 90-73. Olympia, WA.

Affected Environment:

North Creek Watershed

North Creek is approximately 12.6 miles long and drains a watershed 19,000 acres in size (Figure). Elevations within the watershed range from 520 feet near the headwaters to about 20 feet at the confluence with the Sammamish River. The stream gradient decreases from about 50 feet per mile in the upper basin to less than 20 feet per mile near the mouth.

The North Creek watershed is highly urbanized and contains a considerable amount of impervious (hard, non-porous) surfaces, including roads, rooftops, parking lots and buildings. These impervious surfaces prevent rainwater from percolating into the groundwater. Instead, stormwater runoff flows over the impervious surfaces and directly into North Creek and its tributaries. The streams respond with highly erratic, flash flows following storm events.

As the density of urban development increases in the watershed, peak flows following storm events will continue to increase. This leads to flooding in the low elevation floodplains in the downstream portion of the watershed.

In addition to changing the dynamics of streamflow in North Creek, the rapid urbanization of the watershed has also

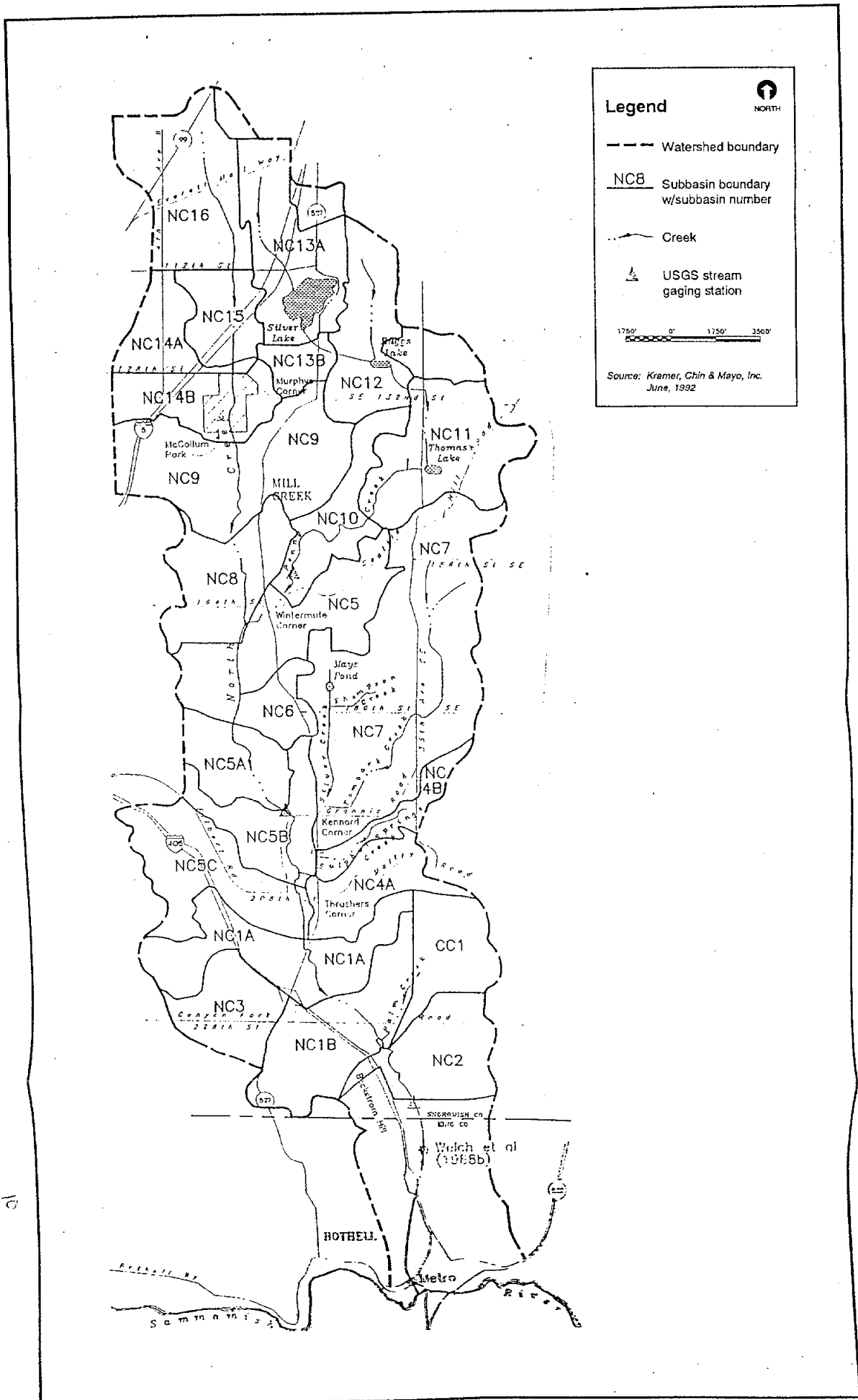


Figure X: North Creek Watershed

contributed to a decline in water quality. Monthly water quality samples taken upstream and downstream of the project area indicate that, similar to other urban streams in the Puget Sound area, North Creek is experiencing regular violations in state surface water quality standards (Appendix).

Hydrology

North Creek

Average monthly streamflow at 196th Street SE gage was 16.3 cubic feet per second (cfs) in 1985 and 18.5 cfs in 1986. Minimum streamflow was recorded at 5.0 cfs in October 1984, while the maximum streamflow for this period of record was 266 cfs in January 1986. The data indicate that average annual streamflow of North Creek at the project area is less than 20 cfs. Hence, the stream does not qualify as a State Shoreline under the Washington State Shoreline Management Act.

Average monthly streamflow of North Creek in Bothell (RM 1.5) during this same time period was recorded at 38.9 cfs. Minimum streamflow was recorded at 6.8 cfs in October 1984, while the maximum streamflows was 914 cfs in January 1986.

When the January 1986 rainstorm occurred it produced what was considered at that time to be a 25-year flood event. This means that a flood event of that magnitude would, on the average, be expected to occur every 25 years (or 4 times every 100 years). Increasing development in the watershed has considerably worsened the propensity for flooding. Under existing development conditions, the January 1986 rainstorm event would now produce a 5-year flood event. In other words, a flood event of that magnitude is now expected to occur every five years (or 20 times every 100 years).

Penny Creek

Penny Creek enters the east bank of North Creek less than one-quarter mile above the project area (RM 7.3). The largest tributary to North Creek, this stream drains 3,400 acres including a suburban residential community, buffalo farm and topsoil extractor. Penny Creek is dammed about one-half mile above its confluence with North Creek. The dam has minimal impact on streamflows, but it is a barrier to fish migration. County biologists surveyed all but the lower half mile of Penny Creek in January and February 1985; the remainder was surveyed in May 1985. At that time they estimated streamflow to be between 0 and 16 cfs in the 12 stream segments observed.

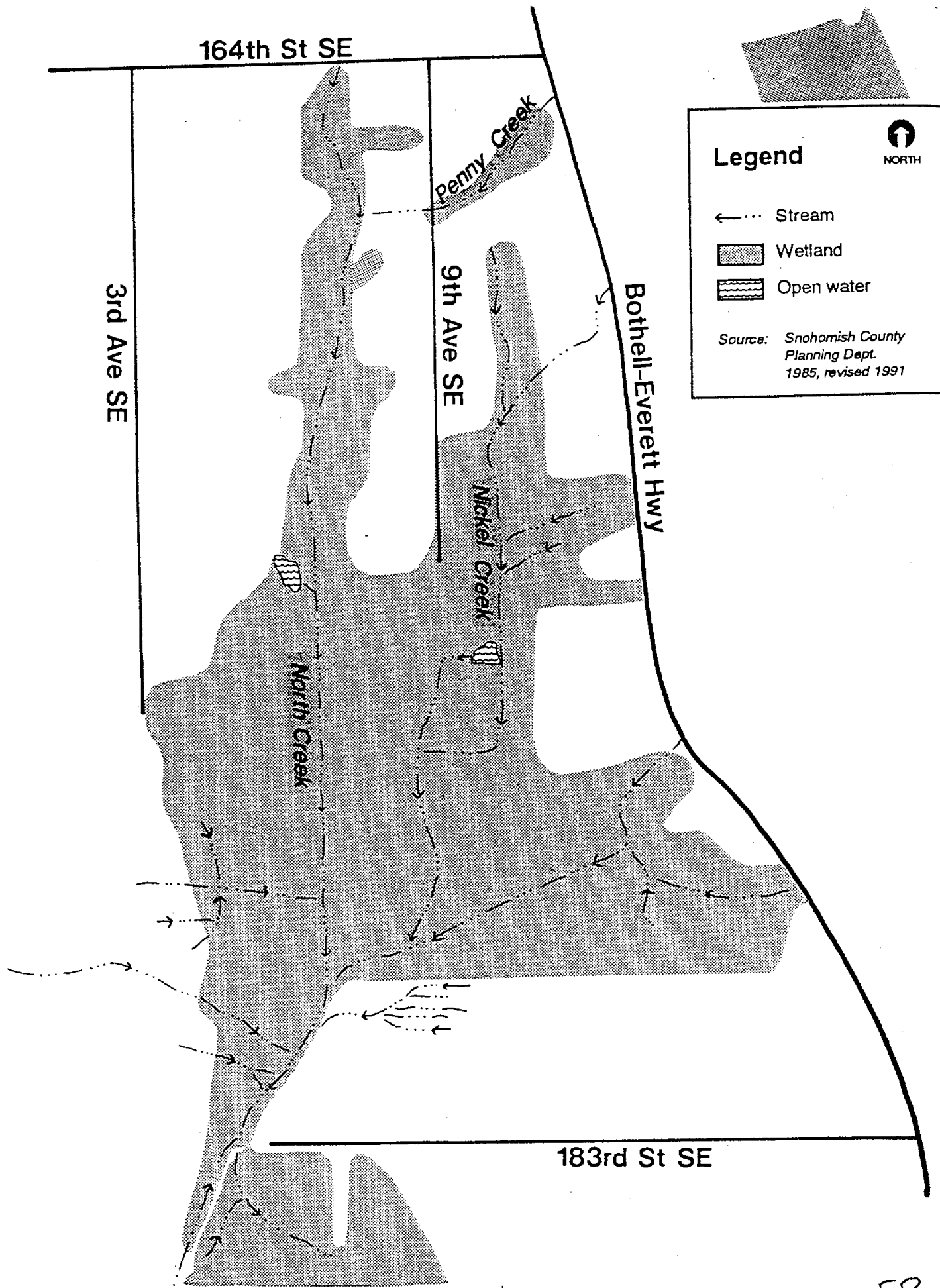
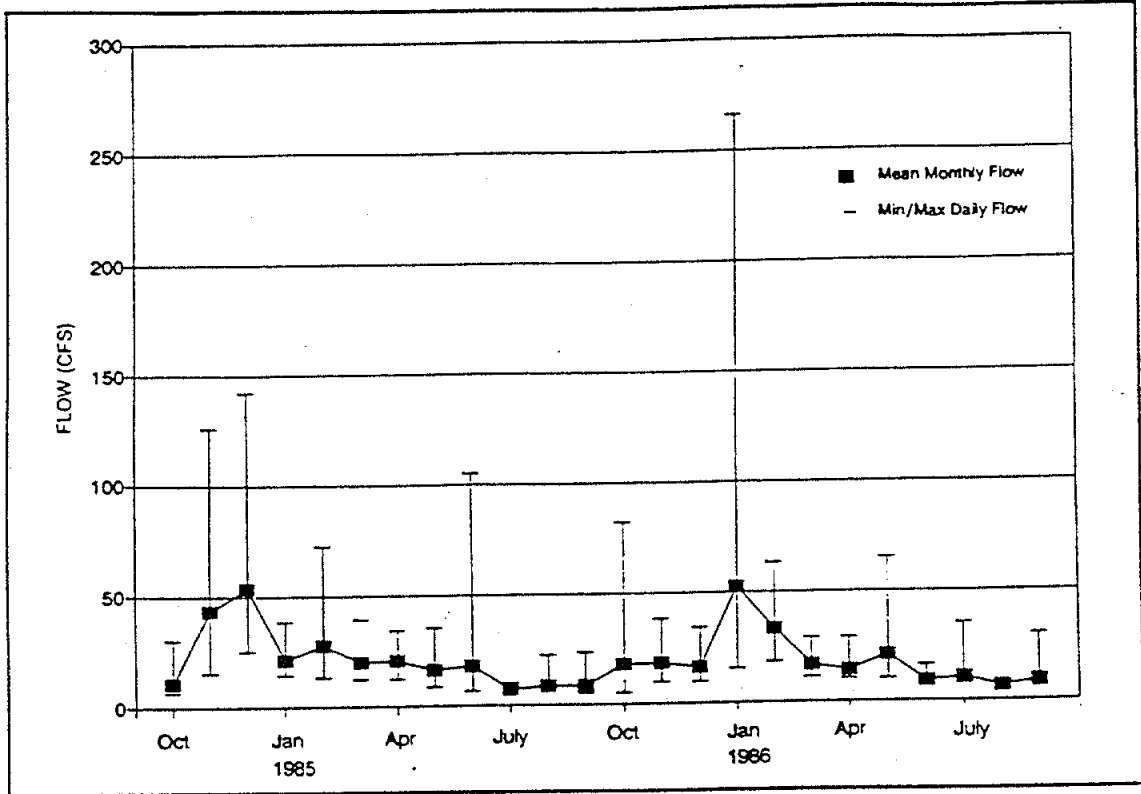


Figure X. Water Resources and Wetlands

Source: Kramer, Chin & Mayo, Inc.
June, 1992

NORTH CREEK BELOW PENNY CREEK



NORTH CREEK NEAR BOTHELL

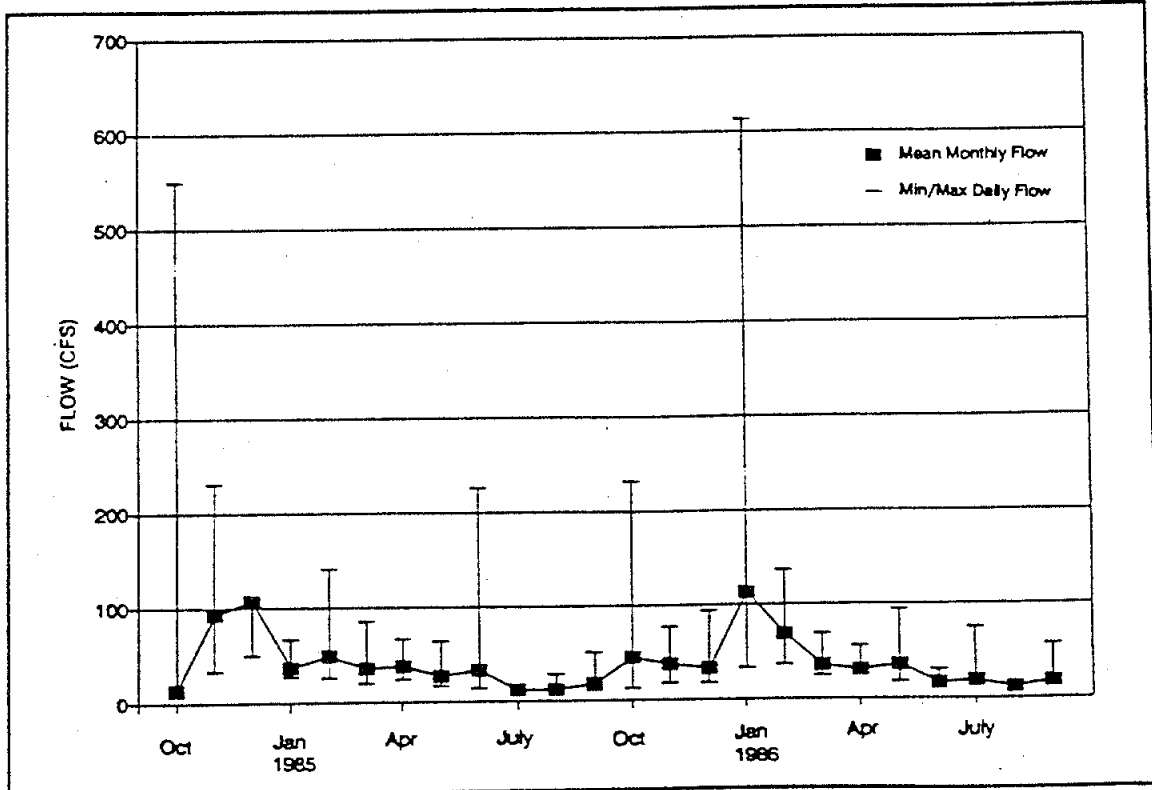


Figure X. WSGS Streamflow Records for North Creek, 1985-86

Nickel Creek

Nickel Creek and an unnamed creek join together in the southwest corner of the project area before entering North Creek near RM 6.7. Within the floodplain, both of these streams are confined to linear drainage ditches built decades ago for agricultural purposes. Runoff from the commercial and light industrial area adjacent to the Bothell-Everett Highway (SR 527) drains into both tributaries.

Nickel Creek is just over 2 miles long and drains the southern area of Mill Creek. It originates in the vicinity of the Lively Environmental Center, about one-quarter mile east of State Route 527, just south of Seattle Hill Road. Streamflow data for Nickel Creek were collected by the County in May 1985. At that time Nickel Creek was estimated to have between 2 and 3 cfs of streamflow.

Unnamed tributaries, east of North Creek

The headwaters of the unnamed creek on the east side of North Creek are formed by two smaller creeks that originate just east of SR 527. No stream survey data is available for the unnamed streams. Field observations indicate that the average streamflow in these streams is less than the flow of Nickel Creek.

Unnamed tributaries, west of North Creek

Three unnamed creeks enter the west side of North Creek in the project area. They are all less than one-half mile long and drain forested, wetland and low-density suburban residential land. Field observations suggest that each stream contributes less streamflow to North Creek than that contributed by Nickel Creek.

Open water areas

There are two small open water areas in the floodplain (Figure ?). Discussion with local residents suggest that neither pond is natural. The pond east of North Creek was created as a result of a small-scale peat mining operation in the 1960s. The pond west of North Creek was created much earlier by the original homesteaders. This second pond is now mostly overgrown with vegetation. Its original purpose is unknown.

Water Quality

North Creek is designated by the Washington Department of Ecology as a State AA surface water. The AA rating is the most stringent of the state's surface water quality ratings. This rating means that the water in the streams should be of

sufficient quality to be used for stock watering, fisheries and secondary recreational uses.

Appendix ? contains a summary of Snohomish County Surface Water Management's ambient water quality monitoring data for 1990 and 1991. Water quality data have been collected monthly since July 1990 at monitoring stations located about a mile upstream (near 164th Street SE) and less than one quarter mile downstream (intersection of John Bailey Road and 183rd Street SE) of the proposed stormwater detention facility. On several occasions concentrations of suspended sediment, turbidity, nutrients and metals have exceeded state AA water quality standards. High temperatures and low dissolved oxygen concentrations have also been measured.

The sources of the water quality degradation are difficult to pinpoint in that in this area North Creek receives runoff from Penny Creek, Nickel and the unnamed creeks. Livestock and local residential septic systems are potential sources of nutrients and fecal coliform bacteria.

Environmental Impacts

The flood control and water quality benefits of a regional stormwater detention facility are targeted towards residents downstream of the project area. Residents in the immediate project vicinity would not directly benefit from flood control or water quality improvements, but through the construction of a County park, they would enjoy passive recreation and environmental education opportunities.

A potential negative impact to water quality could occur in the project area itself. The degree of positive and negative impacts vary according to the stormwater facility design. General environmental impacts are described below and followed by a synopsis of site-specific water resource impacts.

Temporary Floodwater Storage

All of the design alternatives would maximize the floodwater storage potential of the floodplain. In all cases, the floodplain could be flooded up to the Elevation 219 contour, allowing for temporary storage of up to 224 acre-feet of water (Table 3, Figure ?). Flooding to the Elevation 219 contour would occur during 100-year or larger flood events.

Water Quality

Short-term impacts to water quality within and downstream of the project area could result from construction activities. Vegetation removal and soil excavation or disturbance could elevate levels of suspended sediment and turbidity in North

Table : 100-year and 500-year peak water surface elevations
 (Kramer, Chin and Mayo, May 1992).

Alternative	Peak flow		Elevation		Peak flow		Elevation	
	100-year (cfs)	500-year (cfs)	100-year (feet)	500-year (feet)	100-year (cfs)	500-year (cfs)	100-year (feet)	500-year (feet)
A	850		218.5		1110		218.9	
B	820		218.2		1040		219.0	
C	870		218.4		1110		218.8	
D	750		218.4		930		219.4	
E	900		216.5		1120		217.4	
F	900		216.5		1120		217.4	

*Assumes full build-out conditions.

Source: Parametrix, Inc.
May, 1992

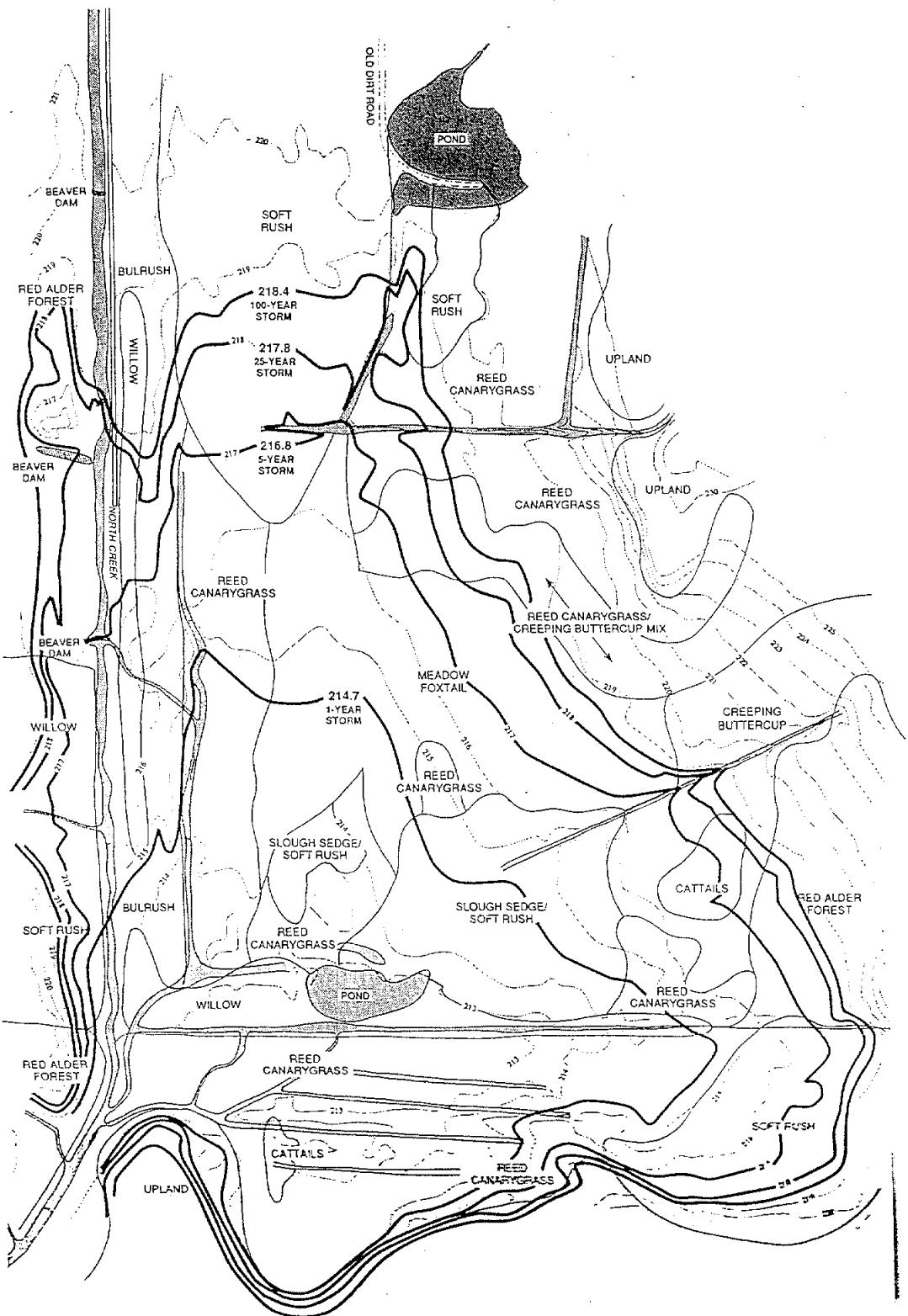
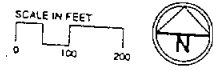


Figure X. Alternative D's
Elevation of Flooding

Creek if proper erosion control measures are not used. Additional construction impacts include minor contributions of petroleum products and metals to streams due to contamination from construction equipment operation and construction supply/material spills.

Once in operation, improvements in water quality downstream of the project would result from a reduction in peak flows and the temporary detention of stormwater. A reduction in flooding would decrease erosion of streambanks and scour of gravel beds. The better the facility design is able to reduce downstream flooding, the greater the likelihood for improvements in downstream water quality.

Within the floodplain area, the temporary detention of stormwater runoff would cause floodwaters to slow upon entering the floodplain, allowing fine grained sediment to settle out of the ponded water. Because all of the design alternatives rely on the same site for floodwater storage, the impacts to water quality within the floodplain would be similar. Water quality within the wetland system could be adversely impacted by the accumulation of fine sediments and attached pollutants.

Although some species of wetland plants are known to help remove pollutants from the water column, biofiltration would probably not contribute to an improvement in water quality within the floodplain. Because the plants would not be harvested at the end of the growing season, they would decay and release the contaminants back into the water and soils.

Alternative D: Preferred Alternative: Bottomless Box Culvert/County Park

The bottomless box culvert would result in a larger reduction of peak storm flows than any of the other design alternatives (Table 7). Alternative D provides for peak flow reductions of 7 to 17 percent under the existing density of development in the North Creek watershed. Generally speaking, the larger the storm, the greater the reduction in peak flow. A 100-year storm would flood up to the Elevation 218.4 contour.

Storm flows varying from the annual through the 10-year flood event would pass through the culvert. Storms between the 10-year and 100-year storm would discharge through the culvert and primary overflow weir. Storms greater than the 100-year storm would discharge through the culvert, primary overflow weir, and the emergency overflow weir. The maximum velocity would be about 11 feet per second. If the culvert were to become blocked during a 100-year flood event, the

5
 Table . Comparison of anticipated flooding between the preferred and No Action alternatives. (Parametrix Inc., April 1992).

Flood Event (years)	Preferred Alternative			No Action Alternative		
	Elevation (feet)	Area (acres)	Depth (feet)	Elevation (feet)	Area (acres)	Depth (feet)
1.25	214.7	24	0-3.7	214.6	20	0-3.6
5	216.8	44	0-5.8	215.1	28	0-4.1
25	217.8	56	0-6.8	215.8	34	0-4.8
50	218.1	59	0-7.1	216.2	38	0-5.2
100	218.4	62	0-7.4	216.5	41	0-5.5

maximum water surface elevation would rise to 219.6. The maximum velocities through the culvert would be about 10 feet per second under a worse-case scenario.

See Alternative E for a discussion of the water resource impacts related to the construction and operation of the proposed County park.

Alternative A: Bottomless Arch Pipe/County Park

Alternative A is second to the preferred alternative in providing reductions in peak flows downstream of the project area. The bottomless arch pipe design would provide for peak flow reductions of 1 to 17 percent. Generally speaking, this design optimizes flood control benefits for smaller storm events.

A 100-year storm would flood up to an elevation of 218.5 feet while a 500-year storm would flood up to an elevation of 218.9 feet.

See Alternative E for a discussion of the water resource impacts related to the construction and operation of the proposed County park.

Alternative B: Bioengineered Constriction/County Park

Of the four design alternatives, Alternative B would provide the smallest reduction in peak flows downstream of the project area because the natural drainage outlet of the floodplain would not be substantially modified. Instead, this alternative would require narrowing the existing constriction at the southwest corner of the project site and revegetating the altered streambanks.

Peak flows would be reduced by 7 to 9 percent under Alternative B, with the percent reductions being fairly constant for the spectrum of flood events.

A 100-year storm would flood up to an elevation of 218.2 feet while a 500-year storm would flood up to an elevation of 219 feet. ^(Table 2)

See Alternative E for a discussion of the water resource impacts related to the construction and operation of the proposed County park.

Alternative C: off-channel Storage/County Park

Similar to Alternative B, this alternative would allow for temporary storage of floodwaters without installing a culvert in the North Creek stream channel. Peak flows would be reduced by 1 to 10 percent under Alternative C. Similar

^(Table 2)

to Alternative A, an off-channel storage facility would provide a higher percentage of peak flow reduction for smaller flood events.

A 100-year storm would flood up to an elevation of 218 feet while a 500-year storm would flood up to an elevation of 219 feet.

See Alternative E for a discussion of the water resource impacts related to the construction and operation of the proposed County park.

Alternative E: County Park Only

The passive recreation area proposed under this alternative would exert minimal impacts on water resources within or downstream of the project area. In effect, the environmental impacts of Alternative E would be nearly identical to impacts from the no action alternative described below.

Alternative F: No Action Alternative

Alternative F, the No Action Alternative, would not result in changes to the existing hydraulics of the stream. Beaver activity would continue to hasten erosion of the east bank dike, allowing for an eventual return of natural flood processes.

The floodplain provides natural flood control benefits, but larger reductions in peak flows would be provided with any of the design alternatives, and especially with the preferred alternative. Peak flows downstream of the project area would continue to increase within increasing development in the upper North Creek watershed.

The No Action Alternative would provide the least amount of water quality improvement downstream of the project area. This is because the natural floodplain would not be as effective in capturing sediment and attached pollutants carried by floodwaters as a regional stormwater detention facility. Additionally, because peak flows downstream of the project area would be larger than they would for the other alternatives, streambank erosion and scour of the streambed would be more likely to occur.

Mitigation

Temporary erosion control measures would be used during project construction in accordance with state and local regulations.

An Hydraulic Project Approval would be obtained from the Washington Department of Fisheries. Construction activities would conform to all conditions stipulated in this permit.

The regional stormwater detention facility would be maintained regularly by the County to ensure that it adequately performed the flood control and water quality purification functions for which it was designed.

As described in other sections of this document, a 5-year monitoring program would be implemented and reviewed annually to better understand the water resource impacts of the project. If severe negative water quality impacts are discovered to be occurring, a plan would be developed to modify project operation.

FISH

The project area is centrally located within the North Creek watershed. North Creek and its tributaries are home to numerous species of anadromous and resident fishes. The fisheries resources of North Creek include anadromous (coho, Chinook, sockeye, steelhead, and sea-run cutthroat) and resident (rainbow trout, cutthroat, kokanee, three-spine stickleback, sculpin, speckled dace, redbreast shiner, largescale sucker, yellow perch, and large and small mouth bass) fish. Coho and Chinook are the principal salmon species using the creek. There are no threatened or endangered fishes using the stream system.

Potential impacts to fisheries could result during project construction through a degradation of water quality. Stormwater runoff is the primary carrier of urban nonpoint source pollutants such as sediment, oil and grease and heavy metals. The ponds would capture and filter stormwater runoff before releasing it into natural waterways.

Fisheries impacts would be minimized by performing construction activities within the time constraints imposed by a Hydraulic Project Approval. Temporary erosion control measures would be used to minimize sediment impacts downstream of the project area.

Studies and Coordination

Information on the fisheries habitat of North Creek and tributaries within and immediately upstream of the project area was obtained from: 1) the 1985 Snohomish County Streams and Wetlands Survey; 2) field studies conducted for the proposed regional stormwater detention system and the North Creek Watershed Management Plan; and 3) interviews with the Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and the Lively Environmental Reserve.

The WDF provided information on salmon fisheries. That agency has conducted annual surveys of salmon spawning areas in the Puget Sound since the 1950s. In North Creek, the WDF spawning area survey is limited to coho salmon and to between River Miles 8.9 and 10.0, roughly between 164th Street and 128th Street (Figure ?).

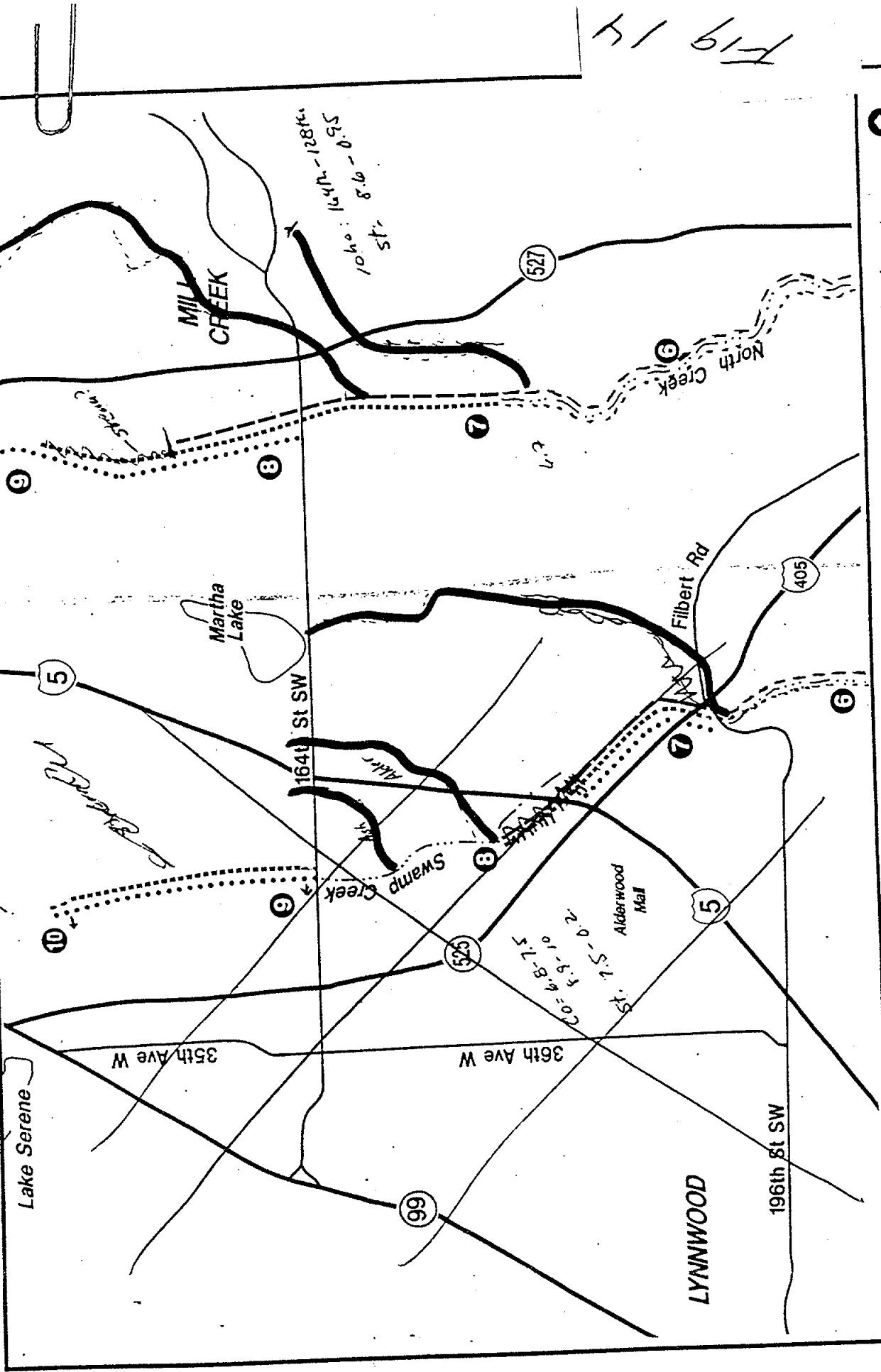
The WDW has conducted annual surveys of steelhead (and cutthroat trout) spawning areas in North Creek since 1984 (Figure ?). These surveys are limited to between River Miles 8.6 and 0.95. Cutthroat spawning surveys have also been conducted between River Miles 8.95 and RM 9.8.

The Lively Environmental Reserve provided information about their fisheries education program. Since 1975, the Lively Reserve has, in coordination with the Washington Department of Fisheries, annually released up to 50,000 coho fry into Nickel Creek. In 1989, a high of 16 coho salmon returned to Nickel Creek.

Fig 14

Apply for permits: Ash, M.D. for permit Nilsen

Use Base map + put on these



North
 Steelhead
 Salmon
 Cutthroat
 Coho
 River mile

Source: Washington Department of Fisheries; Washington Department of Wildlife.

Figure 8. Spawning Survey Areas

Additional sources of fisheries information are listed below:

 . July 1991. Draft North Creek Watershed Management Plan: Watershed Characterization. Everett, WA.

Fisheries information used in this DSEIS was collected from the following sources:

Kramer, Chin and Mayo. July 1991. Draft North Creek Watershed Management Plan: Water Quality Assessment. Surface Water Management, Department of Public Works, Snohomish County, Everett.

Parametrix, Inc. 1991. North Creek Wetland and Habitat Evaluation. Surface Water Management, Department of Public Works, Snohomish County, Everett.

Water Resources Group, Snohomish County Planning Department. 1985. Snohomish County Streams Reach Inventory. Everett, WA.

Affected Environment

North Creek provides spawning and rearing habitat for a variety of resident and anadromous (ocean-going) fish. Resident species include rainbow trout, cutthroat, kokanee, three-spine stickleback, sculpin, speckled dace, redbreast shiner, largescale sucker, yellow perch, and large and small mouth bass. Anadromous species that use these waters include coho salmon, chinook salmon, sockeye salmon, steelhead, and sea-run cutthroat trout. Coho, steelhead and cutthroat trout are the principal anadromous species using the North Creek system.

In the past two decades, the ability of North Creek to support anadromous salmonids has been significantly reduced to the combined effects of reduced rearing habitat, altered runoff levels during storm events, and increases in nonpoint source pollutants. Fish habitat in the immediate vicinity of the proposed detention site has been significantly impacted by the channelization of North Creek and its tributaries, the deposition of sand and gravel during storm events, and livestock use of the area. However, the presence of several beaver dams and existing riparian vegetation provide for spawning and rearing habitat for resident and anadromous species. Review of current WDW and WDF records confirmed on-site observation of use of this area by salmonids. Personal communication with agency staff verified the year-round use of this reach of the creek.

Salmon populations have decreased dramatically in the past 15 years, and in particular, the last 5 years. The decline in salmonids is attributed to a combination of reduced rearing habitat for juveniles (including a reduction of streamflow), altered runoff levels during storm events, and water pollution. Adult coho spawner counts in the vicinity of 164th Street dropped from 247 fish per mile in 1976 to 92 fish per mile in 1985 to 18 fish per mile in 1990 (Kramer,

Chin & Mayo, July 1991). Counts of spawning chinook peaked at 44 in 1981, but in 1988 no chinook were counted. Chinook spawning is especially limited by low or no flows in late summer and early fall. Coho and chinook salmon are reported to use North Creek upstream and downstream of 164th Street, but the habitat is now limited by the low flow regime in late summer. On October 4, 1990, a pair of sockeye were observed spawning in North Creek at its confluence with Nickel Creek.

The North Creek steelhead population has also decreased substantially. The Lake Washington steelhead populations are all in an unofficial threatened status. Since 1984, the maximum steelhead escapement to the North Creek watershed has been 66 adults in 1986. The average return over the past 7 years is 38 with a low of 24 fish in 1988. The escapement goal for the North Creek watershed is 87 adults, while the goal for the entire Lake Washington system is 1,217 adults. Steelhead spawning areas have been observed in recent years between RM 6.95 and RM 8.45.

The majority of recent cutthroat spawning activity has occurred upstream of the project area between RM 7.9 and RM 8.5.

Environmental Impacts

Generally speaking, impacts to fisheries could occur as a result of: 1) habitat degradation and/or erosion from construction activities; 2) soil and/or water quality degradation within the floodplain from the temporary detention of floodwaters; 3) stranding of fish within the floodplain as a result of rapid ramping rates; and 4) altered streamflows in North Creek downstream of the project from the release of stormwater flows.

Alternative D: Preferred Alternative: Bottomless Box Culvert/County Park

Alternative D requires the construction of a bottomless culvert within the stream channel in the vicinity of RM 6.67. Construction activities within the stream channel, if not properly timed or executed, could damage stream gravels and contribute to streambank erosion. Fine sediments could then be transported downstream and where they could settle on gravels used for spawning. Removal of streamside vegetation could also contribute to an increase in surface water temperature and/or subsequent decrease in dissolved oxygen.

Once in operation, the bottomless box culvert should pose only minimal impact to the channel bottom and spawning habitat. The bottomless culvert would be designed to provide upstream and downstream fish passage. Its large size should prevent the formation of barriers from flood debris. The facility would be designed to control velocity at the control structure so that fish could get upstream. If necessary, gravel would be placed in the passage or in the

downstream opening to simulate natural streambed conditions and encourage fish passage.

The ramping times should reduce the probability of fish stranding over existing conditions and provide better control over the volume and velocity of water in the stream channel below RM 6.7. The bottomless culvert would be designed to provide for ramping rates that are sufficient to allow fish to find channels within the floodplain after a high water event. The bottomless box culvert would provide ramping rates of ?? hours for a ??-year storm event. This rate would allow the detention area to completely drain in ?? hours. The ramping rate would also impact the volume and velocity of streamflows released from the control structure. The bottomless culvert would maintain streamflow velocities of ?? cfs up to a 100-year event.

As described in the Water Resources Section, a reduction in peak flows would reduce erosion and flooding downstream of the site. This should improve fisheries habitat. There should be less fine sediment to settle and clog stream gravels. Stream gravels would be less likely to be carried downstream because their streamflow velocities would be minimized and therefore have less hydraulic energy to move them during high water events.

Impacts to fisheries resulting from construction and operation of the County park are discussed under Alternative E.

Alternative A: Bottomless Arch Pipe/County Park

Similar to the preferred alternative, Alternative A would involve construction of a bottomless culvert in the vicinity of RM 6.7. Construction and operation impacts would be similar to the impacts posed by Alternative D.

However, because this culvert would be in the shape of an arch and not be adjustable, it would provide smaller reductions in peak flows downstream of the project area. For this reason, it would not be as effective in reducing the potential for scour and streambank erosion below the project site.

Impacts to fisheries resulting from construction and operation of the County park are discussed under Alternative E.

Alternative B: Bioengineered Constriction/County Park

Alternative B requires the construction of a bioengineered streambank within the stream channel near RM 6.67. This alternative would provide the least impact to fish and riparian habitat since construction would be limited to both sides of the creek, an open cross section would be preserved and rock armoring of the embankment (consisting of riprap and a gravel blanket) would be limited to areas which could be subjected to velocities greater than the vegetation could withstand.

The riparian vegetation that would be planted on the streambank after construction would provide shading to help keep stream temperatures down and also provide wildlife habitat.

The potential for formation of a barrier to fish passage at the site of the bioengineered streambank would be less than it would be with Alternatives A or D, because this type of control structure, which resembles a natural stream channel, would not be covered and so flood debris would be less likely to become entangled at the constriction site.

Alternative B would have a ramping time of ?? to ?? hours for a ?-year to ?-year event. This rate would allow the detention area to completely drain in ?? hours which should provide fish in the floodplain with enough time to locate stream channels and not get stranded. The bioengineered streambank would maintain streamflow velocities from between ?? to ?? cfs up to a 100-year event.

Impacts to fisheries resulting from construction and operation of the County park are discussed under Alternative E.

Alternative C: Off-Channel Storage/County Park

Similar to Alternative B, an instream control structure would not be constructed under Alternative C. Construction activities would be concentrated in the vicinity of the existing east-bank dike and immediately north of the unnamed creek that joins Nickel Creek near the south end of the project area..

The reconstruction of a ??-foot portions of the east-bank dike would require the removal of the riparian vegetation that now exists along that side of the stream corridor. Without the riparian vegetation, stream temperatures could increase over existing levels. Increases in temperature could lead to decreases in dissolved oxygen within the stream.

Because Alternative C lacks a control structure at the downstream end of the detention area, it would be less effective than Alternatives A or B in reducing peak flows downstream of RM 6.7. It would therefore be less effective in reducing streambank and channel erosion downstream of the project site.

Impacts to fisheries resulting from construction and operation of the County park are discussed under Alternative E.

Alternative E: County Park Only

Alternative F: No Action Alternative

Under Alternative D, there would be no significant change over present conditions. Continued development in the upper

portion of the North Creek watershed would result in increased flooding, siltation and pollution of the stream, further impacting fish habitat. Increases in the frequency and size of floods would lead to increased scour and the continued loss of suitable gravel for spawning habitat.

Mitigation

The construction schedule would be established at times that do not interfere with spawning or migration in accordance with an Hydraulic Project Approval issued by the Washington Department of Fisheries.

In accordance with state and local regulations, temporary erosion control measures would be used during construction to minimize erosion and sediment transport downstream of the project area.

Plants

Sixty-seven species of plants comprising twelve plant communities were identified as part the wetland and habitat assessment conducted for this project. Much of the existing vegetation is characteristic of disturbed wetlands; over one-third of the species are introduced or exotic. Past land uses that have contributed to the introduction of exotic species include farming, livestock grazing, ditching, diking and peat mining. The wetlands identified in this field assessment were classified under the U.S. Fish and Wildlife Service wetland classification system as either palustrine emergent (in the floodplain) or palustrine scrub/shrub (along North Creek and tributaries) wetlands. Because the entire floodplain is essentially wetland, and the wetland extends beyond the maximum area proposed for temporary inundation, boundaries were not delineated.

The wetland meets local government criteria for a Class I wetland (Snohomish County Aquatic Resources Protection Program) and state criteria for a Category I and II wetland (Washington State Four-Tier Wetlands Rating System). These ratings reflect the moderate to high ecological value of the wetland.

Construction of the preferred alternative would impact approximately ?? acres of wetland habitat and ?? acres of upland habitat. Operation of the stormwater detention facility could temporarily inundate up to 78 acres of wetland habitat to the Elevation 220 contour. Because the inundation would be of a relatively short duration and occur during the dormant season, operation of the facility is not expected to significantly alter the existing plant communities.

Wetland habitat destroyed during construction of the project would be replaced at a 1.5:1 ratio. Where possible, damaged areas would be replanted with native wetland and riparian species. A 5-year monitoring program would be developed and reviewed annually to evaluate the impacts of project operation.

Studies and Coordination

Undeveloped vegetated areas were identified from aerial photos and field surveys. The approximate boundaries of identified wetlands were verified in the field by Department of Public Works and Parametrix, Inc. environmental staff.

In addition, Parametrix, Inc. conducted a wetland and habitat assessment. Field observations for this study were made in 1990 and 1991. This and other relevant studies are cited below:

Kramer, Chin & Mayo. July 1991. North Creek Watershed Management Plan: Watershed Characterization. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

Parametrix, Inc. April 1992. North Creek Regional Stormwater Detention Facility: Wetland and Habitat Assessments. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

Water Resources Group, Department of Planning, Snohomish County. 1985. Snohomish County Streams and Wetlands Survey. Everett, WA.

Affected Environment:

Wetland habitat in the project area occupies more than 78 acres of land. This acreage represents the total amount of land that could be temporarily inundated up to the Elevation 220 contour as the result of a 100-year or larger flood event. For perspective, the North Creek watershed contains 1,623 acres of wetlands within 253 identified and mapped wetland areas (Kramer, Chin & Mayo, July 1991). Wetlands larger than 10 acres in size represent approximately 15 percent of the wetlands in the watershed. Most of the wetlands in the watershed are associated with North Creek, its tributaries and floodplains.

Twelve plant communities have been identified within the wetlands occupying the project area (Figure ?). The relative abundance, typical elevation and dominant species in these communities is shown in Table ?. A total of sixty-seven species of plants have been identified in this area (Table ?).

Environmental Impacts

The construction and operation of the proposed stormwater detention facility is not expected to significantly harm the existing wetland plant communities. Significant changes in the distribution and abundance of wetland plants are more likely to result from the removal of livestock from the wetland. Removal of livestock would particularly effect the northern part of the wetland which contains many non-native pasture grasses and soft rush. Following livestock removal there should be a gradual replacement of the non-native meadow communities to communities dominated by native trees, shrubs and emergent wetland plants. This process should promote greater plant diversity and greater abundance of native plant species.

Alternative D: Preferred Alternative: Box Culvert/County Park

In addition to the impacts described above, the vegetation impacts associated with the construction of the preferred alternative include loss of a portion of the existing riparian habitat near RM 6.7 to allow for the construction of the control structure (?? acres) and the 150-foot embankment (?? acres) and access road (?? acres).

Operation of the box culvert system is not expected to increase the frequency, depth or duration of flooding to the degree necessary to substantially alter existing wetland

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 (Perrine & Co., Inc., April 1972)

Table . Plant communities.

Community	Area (acres)	Elevation (ft)	Typical Plants
Reed canarygrass	29	213-225	Reed canarygrass, bitterweet nightshade, bedstraw, creeping buttercup, field horsetail, marsh speedwell
Soft rush	19	215-220	Soft rush, velvet grass, creeping buttercup, smooth brome, Canadian thistle, orchard grass, bed straw, stinging nettle
Red alder forest	14	217+	Red alder, red cedar, big-leaf maple, salmon berry, red elderberry, red osier dogwood, skunk cabbage, lady fern, scouring rush, water parsley
Meadow foxtail	13	214-219	Meadow foxtail, timothy, orchard grass, soft rush, reed canarygrass, curly dock
Willow	6	215-216	Willow, Douglas spirea, red osier dogwood, red alder, black cottonwood, skunk cabbage, reed canarygrass, duck weed, soft rush, cattails
Creeping buttercup	6	216-220	Creeping buttercup, slough sedge, parentucellia, parentucellia, soft rush, bulrush
Small-fruited bullrush	6	214-220	Small-fruited bullrush, reed canarygrass, bentgrass, slough sedge, bitterweet nightshade, soft rush, creeping buttercup
Reed canarygrass Creeping buttercup	5	216-225	
Open water	2	213	Water parsley, bulrush, common cattail, soft rush
Cattail	1	213-217	Cattail, soft rush, yellow monkey flower, creeping buttercup
Slough sedge/soft rush	1	216	Slough sedge, creeping buttercup, soft rush,

Table . Plant species found in and adjacent to the proposed facility (Parametrix Inc., April 1992).

Scientific Name	Common Name	Wetland Indicator	St
Trees			
<i>Alnus rubra</i>	Red alder	Facultative	
<i>Betula papyrifera</i>	Paper birch	Facultative	upland
<i>Populus tremuloides</i>	Quaking aspen	Facultative	
<i>Populus trichocarpa</i>	Black cottonwood	Facultative	
<i>Prunus emarginata</i>	Bittercherry	Upland	
<i>Pseudotsuga menziesii</i>	Douglas fir	Upland	
<i>Rhamnus purshiana</i>	Cascara	Upland	
<i>Salix</i> spp.	Willow	Facultative	wetland
<i>Thuja plicata</i>	Western redcedar	Facultative	
Shrubs			
<i>Cornus stolonifera</i>	Red-osier dogwood	Facultative	wetland
<i>Lonicera</i> spp.	Twin-berry	Facultative	
<i>Lonicera involucrata</i>	Honeysuckle	Facultative	
<i>Rubus discolor</i> *	Himalayan blackberry	Facultative	upland
<i>Rubus laciniatus</i> *	Evergreen blackberry	Upland	
<i>Rubus spectabilis</i>	Salmonberry	Facultative	
<i>Salix</i> spp.	Willow	Facultative	wetland
<i>Sambucus racemosa</i>	Red elderberry	Facultative	upland
<i>Spiraea douglasii</i>	Douglas spirea	Facultative	wetland
<i>Symphoricarpos albus</i>	Common snowberry	Facultative	upland
Herbs			
<i>Agrostis alba</i> *	Redtop	Facultative	wetland
<i>Alopecurus geniculatus</i>	Water foxtail	Facultative	wetland
<i>Athyrium felix-femina</i>	Lady-fern	Facultative	
<i>Bromus inermis</i> *	Smooth brome	Upland	
<i>Carex obnupta</i>	Slough sedge	Obligate	
<i>Carex</i> spp.	Sedge	Facultative	wetland
<i>Circaea alpina</i>	Enchanter's nightshade	Facultative	wetland
<i>Cirsium arvense</i> *	Canadian thistle	Facultative	upland
<i>Cirsium vulgare</i> *	Bull thistle	Facultative	upland
<i>Dactylus glomerata</i> *	Orchard grass	Facultative	upland
<i>Epilobium angustifolium</i>	Fireweed	Facultative	upland
<i>Epilobium watsonii</i>	Watson's willow-herb	Facultative	wetland
<i>Equisetum arvense</i>	Field horsetail	Facultative	
<i>Equisetum hyemale</i>	Scouringrush horsetail	Facultative	wetland
<i>Equisetum telmateia</i>	Giant horsetail	Facultative	wetland
<i>Galium</i> spp.*	Bedstraw	Facultative	
<i>Graminae</i> spp.	Grasses	Facultative	
<i>Holcus lanatus</i> *	Common velvet-grass	Facultative	
<i>Iris pseudacorus</i>	Yellow iris	Obligate	
<i>Juncus efusus</i>	Soft rush	Facultative	wetland
<i>Juncus</i> spp.	Rush	Facultative	
<i>Lemna minor</i>	Duckweed	Obligate	
<i>Lysichitum americanum</i>	Skunk cabbage	Obligate	
<i>Maianthemum dilatatum</i>	False lily-of-the-valley	Facultative	upland
<i>Mentha</i> spp.*	Mint	Facultative	wetland

Table 7, cont.

<i>Amulus glabratus*</i>	Yellow Monkey-flower	Obligate
<i>Ananthe sarmentosa</i>	Water-parsley	Obligate
<i>Parentucella viscosa*</i>	Parentucellia	Facultative
<i>Phalaris arundinacea*</i>	Reed canarygrass	Facultative wetland
<i>Poa pratense</i>	Timothy	Facultative upland
<i>Plantago major</i>	Common plantain	Facultative
<i>Poa spp.*</i>	Bluegrass	Facultative
<i>Polygonum spp.*</i>	Smartweed	Facultative
<i>Portamogeton spp.*</i>	Marsh cinquefoil	Obligate
<i>Pteridium aquilinum</i>	Bracken-fern	Facultative upland
<i>Ranunculus repens*</i>	Creeping buttercup	Facultative wetland
<i>Rumex spp.*</i>	Dock	Facultative
<i>Sagittaria spp.*</i>	Bulrush	Obligate
<i>Sanicula jacobaea*</i>	Tansy ragwort	Upland
<i>Solanum dulcamara</i>	Bittersweet nightshade	Facultative
<i>Taraxacum officinale</i>	Common dandelion	Facultative upland
<i>Trifolium pratense*</i>	Red clover	Facultative upland
<i>Trifolium repens</i>	White clover	Facultative upland
<i>Typha latifolia</i>	Common cat-tail	Obligate
<i>Urtica dioica</i>	Stinging nettle	Facultative
<i>Verbascum spp.</i>	Mullein	Upland
<i>Veronica scutellata</i>	Marsh speedwell	Obligate
<i>Veronica spp.*</i>	Speedwell	Facultative wetland

plant communities (Table ?). Figure ? shows the approximate area of inundation associated with 1-year, 5-year, 25-year and 100-year flood events. Figures ? graphically compare the depth and duration of flooding between the preferred alternative and the no action alternative (Alternative F).

Vegetation impacts resulting from construction and operation of the County park are described under Alternative E.

Alternatives A: Bottomless Arch Culvert/County Park

Vegetation impacts associated with construction of the bottomless arch culvert would be nearly identical to the impacts described for the preferred alternative.

Operation of the bottomless arch culvert system would impact vegetation in a manner similar to the preferred alternative. The potential areal extent of inundation would be similar for all the alternatives described. The depth and duration of flooding would vary according to the facility's ability to detain floodwaters. A quantified analysis of the depth and duration of flooding from the operation of Alternative A was beyond the scope of this EIS.

Vegetation impacts resulting from construction and operation of the County park are described under Alternative E.

Alternative B: Bioengineered Constriction/County Park

The construction of bioengineered streambanks would pose the least amount of damage to existing vegetation when compared with the other design alternatives. Approximately ?? acres of riparian habitat would be impacted by construction of the streambanks (?? acres) and access road (?? acres).

Operation of the facility proposed under Alternative B would impact vegetation in a manner similar to the preferred alternative. The potential areal extent of inundation would be similar for all the alternatives described. The depth and duration of flooding would vary according to the facility's ability to detain floodwaters. A quantified analysis of the depth and duration of flooding from the operation of Alternative B was beyond the scope of this EIS.

Vegetation impacts resulting from construction and operation of the County park are described under Alternative E.

Alternative C: off-channel storage/County Park

Construction of the off-channel storage facility would result in the greatest damage to riparian and wetland habitat. Approximately ?? acres of riparian vegetation would be removed in conjunction with reconstruction of the east-bank dike. An additional ?? acres of palustrine emergent wetland habitat would be removed during construction of a second berm just north of the unnamed creek in the south project area.

Operation of the facility proposed under Alternative C would impact vegetation in a manner similar to the preferred

alternative. The potential areal extent of inundation would be similar to the other alternatives described. The depth and duration of flooding would vary according to the facility's ability to detain floodwaters. A quantified analysis of the depth and duration of flooding from the operation of Alternative C was beyond the scope of this EIS.

Vegetation impacts resulting from construction and operation of the County park are described under Alternative E.

Alternative E: County Park Only

Construction of the County park would directly impact vegetation in the areas proposed for access sites, trails and wetland viewpoints. Approximately 0.87 acres of wetland habitat would be impacted by construction of the floating boardwalk trails (.84 acres), four viewpoints (.01 acres) and eight bridges (.02 acres). Construction of the three access areas (.64 acres), crushed rock trails (.11 acres) and one upland viewpoint (.003 acres) would result in a loss of approximately 0.75 acres of upland vegetation.

Because visitor use of the new park would generally be confined to trails and access areas, no additional impacts to vegetation are expected from park operation.

Alternative F: No Action Alternative

If this alternative is implemented no construction activities would occur within the project area associated with development of a stormwater control facility or County park. Accordingly, there would be no direct impacts to wetland or other habitats.

The primary impacts to vegetation would occur in the riparian corridor downstream of the project area. This is because this alternative would not afford any reduction in flooding other than what naturally occurs. Flooding would contribute to the erosion of streambanks and loss of vegetative cover.

Mitigation:

Vegetation clearing would be minimized to the area needed for construction of the stormwater control facility and recreation and access areas.

Disturbed wetland plant communities would be revegetated with native wetland vegetation at a ratio of 1.5:1. Mitigation wetlands would be constructed within the project area.

A 5-year monitoring program would be designed and reviewed annually to assess the impacts of the operation of the stormwater control facility and ensure that the created wetland habitats perform the desired functions and values. If sensitive vegetation communities are negatively impacted by project operation, design modifications would be evaluated.

WILDLIFE

The proposed project would occupy up to 145 acres of the North Creek stream corridor and floodplain, including wetland, riparian and upland wildlife habitat. The wetland and riparian habitats have been identified as a priority habitat area by the Washington Department of Wildlife. The diverse plant communities, flowing streams and small ponds make this area highly valuable for wildlife habitat. A habitat assessment of the project area prepared specifically for this project identified a total of 43 species of birds, several large mammals, and amphibians and reptiles using the area.

As described in the Plants Section of this document, approximately ?? acres of wetland (and riparian) habitat and ?? acres of upland habitat would be damaged by construction activities in the project area. Once in operation, up to 78 acres of wetland habitat could be temporarily inundated during a 100-year or larger flood event.

The mitigation measures include replacing damaged wetlands at a ratio of 1.5:1; removing livestock currently grazing the area, and developing and implementing a 5-year monitoring program.

Studies and Coordination

Wetland and riparian habitats were identified from the Snohomish County Stream and Wetland Survey prepared by the Water Resources Group of the Department of Planning in 1985. In addition, a field assessment of wetland and other wildlife habitats in the project area was conducted by Parametrix, Inc. from August through October of 1990. Most of the information in this section was derived from that report.

The Washington Department of Wildlife provided maps and information on priority habitats and species; and rare, threatened, and endangered species from their Natural Heritage Database.

Relevant documents are listed below:

Kramer, Chin and Mayo. July 1991. Draft North Creek Watershed Management Plan: Watershed Characterization. Everett, WA.

Parametrix, Inc. April 1992. North Creek Regional Stormwater Detention Facility Wetland and Habitat Assessments. Surface Water Management, Department of Public Works, Snohomish County, Everett, WA.

Affected Environment

The project area has been used for more than a century for a variety of agricultural activities. The floodplain has been drained, farmed, grazed and for a short period, mined for peat. The streams have been straightened, and in some

cases, diked. These activities were economically productive, but also detrimental to the natural vegetation that originally covered the land and provided wildlife habitat.

The floodplain is no longer used for economic activities, although a small number of livestock still graze in the area. In recent years the dike that parallels the east bank of North Creek has succumbed to erosion. With the help of beavers, breaches have formed, allowing North Creek to once again flow onto the adjacent floodplain. Native wetland vegetation communities have recolonized the area and have been joined by introduced wetland species, most notably reed canarygrass. Over time, a riparian plant community has recolonized the east-bank dike.

Although the floodplain has been disturbed, its wetland, open water and riparian areas continue to provide valuable wildlife habitat. Seldom visited by people, the floodplain serves as a quiet refuge in the midst of a rapidly growing urban area. The wet pasture areas are used by raptors and song birds for foraging and also provide habitat for small mammals. The flooded emergent and open water areas provide foraging and nesting habitat for waterfowl. The riparian areas provide the most diverse wildlife populations in the project area. Woodpeckers and mixed flocks of chickadees, kinglets and warblers forage in the deciduous trees. Robins and jays perch in trees above the creek. Sparrows, wrens, and other bird species forage and nest in trees and shrubs along the creek. Raccoons regularly forage on crayfish adjacent to the creek. Beaver dams and evidence of beaver activity is everywhere within the stream corridor.

Open water areas also provide important wildlife habitat. Mallards, gadwall, teal and other waterfowl species overwinter and may nest at the pond. Great blue herons and common snipe forage immediately adjacent to the pond. Barn swallows and violet-green swallows forage on insects over the pond.

During the 1990 field study, a total of 43 species of birds were observed at the project site, including waterfowl, raptors, woodpeckers and songbirds (Table ?). More bird species are believed to use the site at different times of the year, including waterfowl species during the winter and breeding songbirds during the spring.

Twelve species of mammals are believed to use the project area (Table ?). Mammals that have been seen or that have left evidence of their presence include: black bear, coyote, raccoon, black-tailed deer, striped skunk, moles, voles, deer mice and beaver. Evidence of eastern cottontails was not observed during field visits, but they probably use the site.

Five species of reptiles and amphibians are believed to inhabit the site, including the: northwestern salamander,

Table 4. Presence of bird species observed at North Creek wetland by habitat types during surveys conducted in fall 1990 and spring 1991.

<i>Bird Species</i>	<i>Habitat Type</i>		
	<i>Emergent Wetland</i>	<i>Riparian Zone</i>	<i>Pond</i>
<i>Canada goose</i>	F,P		F,P
<i>Mallard</i>	F,P		F,P
<i>Gadwall</i>	F,P		F,P
<i>American widgeon</i>	F,P		F,P
<i>Blue-winged teal</i>	F,P		F,P
<i>Cinnamon teal</i>	F,P		F,P
<i>Green-winged teal</i>	F,P		F,P
<i>Northern harrier</i>	F		
<i>Red-tailed hawk</i>	F		
<i>Great blue heron</i>	F,P	F,P	F,P
<i>American coot</i>			F,P
<i>Killdeer</i>	F,P		
<i>Common snipe</i>	F,P		
<i>Rufous hummingbird</i>	F	F,P	
<i>Northern flicker</i>		F,P	
<i>Downy woodpecker</i>		F,P	
<i>Eastern kingbird</i>			F,P
<i>Willow flycatcher</i>		F,P,B	F,P,B
<i>Barn swallow</i>	F		F,P
<i>Violet-green swallow</i>	F		F,P,B
<i>Tree swallow</i>	F		F,P,B
<i>Steller's jay</i>		F,P	
<i>Black-capped chickadee</i>		F,P	
<i>Bushtit</i>		F,P	
<i>Bewick's wren</i>		F,P,B	
<i>Marsh wren</i>	F,P,B		F,P,B
<i>American robin</i>		F,P	
<i>Golden-crowned kinglet</i>		F,P	
<i>Ruby-crowned kinglet</i>		F,P	
<i>American pipit</i>	F,P		
<i>Cedar waxwing</i>		F,P	
<i>Yellow warbler</i>		F,P,B	
<i>Yellow-rumped warbler</i>		F,P	
<i>Common yellowthroat</i>	F,P,B		F,P,B
<i>Red-winged blackbird</i>			F,P,B
<i>Black-headed grosbeak</i>		F,P,B	
<i>Evening grosbeak</i>		F,P	
<i>Purple finch</i>		F,P	
<i>House finch</i>		F,P	
<i>American goldfinch</i>		F,P,B	
<i>Rufous-sided towhee</i>		F,P,B	
<i>Savannah sparrow</i>	F,P,B		
<i>Song sparrow</i>		F,P,B	

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able Mammal, amphibian, and reptile species observed at or likely to occur at the North Creek wetland.

Common Name	Scientific Name
Pacific water shrew	<i>Sorex bendirii</i>
Vagrant shrew	<i>Sorex vagrans</i>
Townsend's mole	<i>Scapanus townsendii</i>
Coyote	<i>Canis latrans</i>
Raccoon	<i>Procyon lotor</i>
Striped skunk	<i>Mephitis mephitis</i>
Black-tailed deer	<i>Odocoileus hemionous</i>
Beaver	<i>Castor canadensis</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Creeping vole	<i>Microtus oregoni</i>
Muskrat	<i>Ondatra zibethicus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Northwestern salamander	<i>Ambystoma gracile</i>
Long-toed salamander	<i>Ambystoma macrodactylum</i>
Red-legged frog	<i>Rana aurora</i>
Bullfrog	<i>Rana catesbeiana</i>
Garter snake	<i>Thamnophis spp.</i>

The North Creek wetlands appear to be sites of groundwater discharge. The slopes on the east and west sides of the wetlands contain many seeps and springs where groundwater surfaces.

The wetlands on the project site function to control stormwater runoff from adjacent sites, and provide flood storage to North Creek. During peak flows, waters entering the wetland are slowed. As storm inputs decline, water absorbed by the wetland soils and retained in the wetland basin are gradually released. This reduces the peak flood flows downstream from the wetland. The value of the wetland to flood control of North Creek is further evaluated in engineering reports (KCM 1992).

The wetlands augment low flows in North Creek as groundwater discharge sites and by releasing storm waters gradually after major storm events.

Wetlands improve the water quality of runoff that flows through them by collecting sediments and associated pollutants. In addition, plants can absorb dissolved nutrients from surface water and immobilize them in tissue. While quantitative assessments of this function have not been made and would be difficult to measure on this site, the site hydrology and topography suggest that this may occur at moderate to high rates.

RECREATION

Recreation activities in the wetland basin apparently include duck hunting, bird watching, and nature walks. The potential recreation value of these wetlands for these activities appears moderate to high.

long-toed salamander, red-legged frog and bullfrog and garter snake (Table ?). The amphibians all require open water for reproduction.

Environmental Impacts

Because the design alternatives rely on the same area for flood storage and allow for flooding at similar frequencies and durations, they would impose similar impacts to the plant communities and the wildlife dependent on these communities for habitat.

Temporary flooding during the late fall could alter the existing distribution and proportion of emergent and palustrine wetland plant communities. Flooding would normally occur during the dormant season of most plant species and therefore be of limited impact.

Temporary flooding could create larger seasonal ponds and provide larger or more open water areas. An expansion of flooded areas may temporarily force smaller mammals to the outer limits of the wetland fringe. The expansion of the wetland sites may destroy ground nesting for certain species of waterfowl such as mallards, but the flooding should almost always occur before the nesting season begins.

Wildlife using riparian habitat downstream of the project site should benefit from an upstream stormwater control facility. The project would have the general effect of reducing peak flows in North Creek and consequently reduce the potential for streambank erosion and loss of riparian vegetation.

Besides these general operation impacts common to all of the design alternatives, there are construction impacts unique to each alternative. These impacts are discussed below.

Alternative D: Preferred Alternative: Bottomless Box Culvert/County Park

As discussed in the Plants section of this document, construction of this alternative would result in a loss of approximately ?? acres of wetland habitat and ?? acres of upland habitat. The loss of this wildlife habitat should have minimal effect of species that use the project area because the impact area is relatively small when compared to the area as a whole. Habitat losses would be temporary in nature until replanted native species are established.

Impacts to wildlife resulting from the construction and operation of the County Park are discussed under Alternative E.

Alternatives A: Bottomless Arch Pipe/County Park

The impacts to wildlife from construction of Alternative A would be nearly identical to the preferred alternative because it would require construction of similar structures in the same location.

Impacts to wildlife resulting from the construction and operation of the County Park are discussed under Alternative E.

Alternative B: Bioengineered Constriction/County Park

Wildlife impacts resulting from construction of Alternative B would be similar to the impacts associated with Alternatives A and D. However, this alternative varies from the other two in that once it is constructed and replanted, the streambanks in the vicinity of the bioengineered constriction would provide riparian habitat.

Impacts to wildlife resulting from the construction and operation of the County Park are discussed under Alternative E.

Alternative C: Off-Channel Storage/County Park

Of all the design alternatives, Alternative C would impose the greatest impact to vegetation and wildlife habitat. Approximately ?? acres of riparian habitat would be removed to reconstruct and raise the elevation of the existing east-bank dike that parallels North Creek. Twenty-two of the observed bird species use riparian habitat. In addition, approximately ?? acres of palustrine emergent wetland habitat would be removed to construct a second berm just north of the unnamed creek that drains the floodplain east of North Creek. Twenty of the observed bird species use this habitat type. The impact of the second berm would be less significant, because much of the project area is covered by this wetland type.

Impacts to wildlife resulting from the construction and operation of the County Park are discussed under Alternative E.

Alternative E: County Park Only

Implementation of Alternative E could impact wildlife in two primary ways. Construction of the park would directly impact approximately ?? acres of vegetation, including ?? acres of wetland and/or riparian vegetation. This land would no longer be useable as wildlife habitat. Although a regional stormwater detention facility is not proposed as part of this alternative, further alterations to wildlife habitat would also be expected due to changes in the existing distribution and abundance of plants. This is because continued erosion of the east-bank dike would gradually allow the return of natural flooding patterns.

Further impacts to wildlife could result when the passive recreation area is open to the public. Human use of the area could disturb or even displace sensitive wildlife species. Nesting and breeding waterfowl and large mammals are examples of such species.

Alternative F: No Action Alternative

No construction activities would occur in the floodplain under this alternative.

Assuming that beaver activity continues in the project vicinity, the east-bank dike would continue to erode in isolated areas. This would improve the creek's ability to flood the adjacent floodplain wetlands and enhance habitat for both fish and wildlife.

Downstream of the project site, the increased likelihood for uncontrolled flooding erosion could result in a gradual loss of riparian habitat along the streambanks, as under present conditions.

Mitigation

Damaged wetland habitat would be replaced at 1.5:1 mitigation ratio.

A 5-year monitoring program would be developed and reviewed annually to help minimize the mortality rate of desired vegetation communities and ensure survival of planted species. As part of this monitoring program, the operation of the stormwater control facility and County park would be evaluated in terms of the impact wildlife communities.

LAND USE

The project area is located in an unincorporated area of south Snohomish County, immediately south of the City of Mill Creek. The project area is located within the boundaries of 1977 North Creek Area Comprehensive Plan and the more recently established Urban Growth Area boundary delimited in the 1991 City of Mill Creek Comprehensive Plan. Land use within the project area is designated as "Open Space and Greenway" and "Business Park" in this plan. The Mill Creek Plan expressly recognizes the project area as "a prime candidate for cooperatively developing a park site in conjunction with Snohomish County."

The proposed project could eventually occupy up to 145 acres, including a large floodplain and adjacent upland areas. The floodplain has been used for a century or more for agricultural purposes, including farming, livestock grazing, and in the 1960s and 1970s, limited peat mining. A small number of cattle and horses currently graze the area.

Sixty-eight acres of land have already been purchased by County. Up to 77 additional acres could eventually be acquired, 36 of which would be jointly used for stormwater control and recreation purposes. Approximately 41 more acres would be acquired for the park.

Acquired land would be appraised and purchased by the County at fair market value.

Studies and Coordination

Most of the information in this Land Use section was obtained from the North Creek Area Comprehensive Plan and the City of Mill Creek Comprehensive Plan. These and other relevant land use documents are listed below:

City of Mill Creek. January 1992. City of Mill Creek Comprehensive Plan. Mill Creek, WA.

Kramer, Chin & Mayo, Inc. July 1991. North Creek Watershed Management Plan: Watershed Characterization. Surface Water Management, Snohomish County Department of Public Works, Everett, WA.

Department of Planning, Snohomish County. December 1977. North Creek Area Comprehensive Plan. Everett, WA.

_____. November 1989. 1989 Snohomish County Annual Demographic Trends and Forecasts. Everett, WA.

Affected Environment

Population

Snohomish County is Washington State's third most populous and its fastest growing county (Department of Planning, Snohomish County, November 1989). Between 1980 and 1990, the County's population grew from 337,720 to 465,642, an increase of 38 percent. It is projected to climb an additional 25 percent (555,900 people) by the year 2000. More than two-thirds of the population growth is attributed

to in-migration (people moving into the County).

The project area is located immediately south of one of the most urbanized cities in south Snohomish County, the City of Mill Creek. Population figures recently released by the Washington Office of Financial Management cites the 1991 population of Mill Creek at 7,780. Mill Creek's population is projected to increase to 9,018 by the year 2000 and to 12,313 by the year 2010. Population growth in the North Creek planning area is expected to increase by 82 percent between the years 1990 (59,641 people) and 2010 (108,805 people).

Existing Land Use and Ownership Patterns

In 1990, Snohomish County Surface Water Management and Parks and Recreation Divisions jointly purchased approximately 68 acres of land in the project area for \$1.2 million. Up to 77 more acres of land (145 total acres) may be purchased for this project to maximize the temporary stormwater storage and passive recreation potential of the project site (Table ?). In the event that the project is not developed, the land would remain in County ownership and be preserved for its natural flood control and open space amenities.

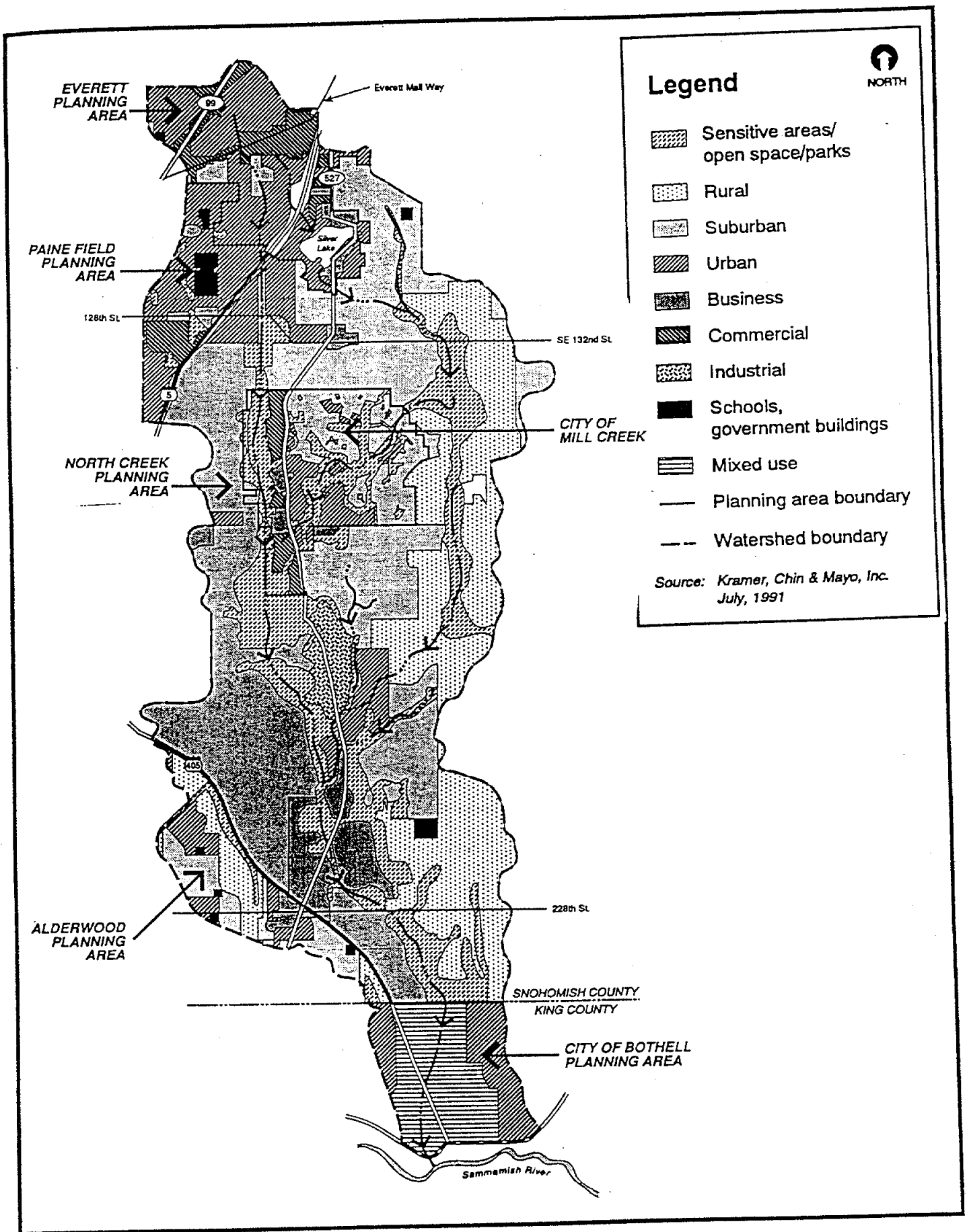
Table ?. Potential Land Use Acquisitions.

AREA	PROPOSED USE		ACRES
	PARK	DETENTION POND	
North	X	X	19
South	X	X	17
East	X		16
West	X		Approx. 25
SUBTOTAL			77
Existing			68
TOTAL			145

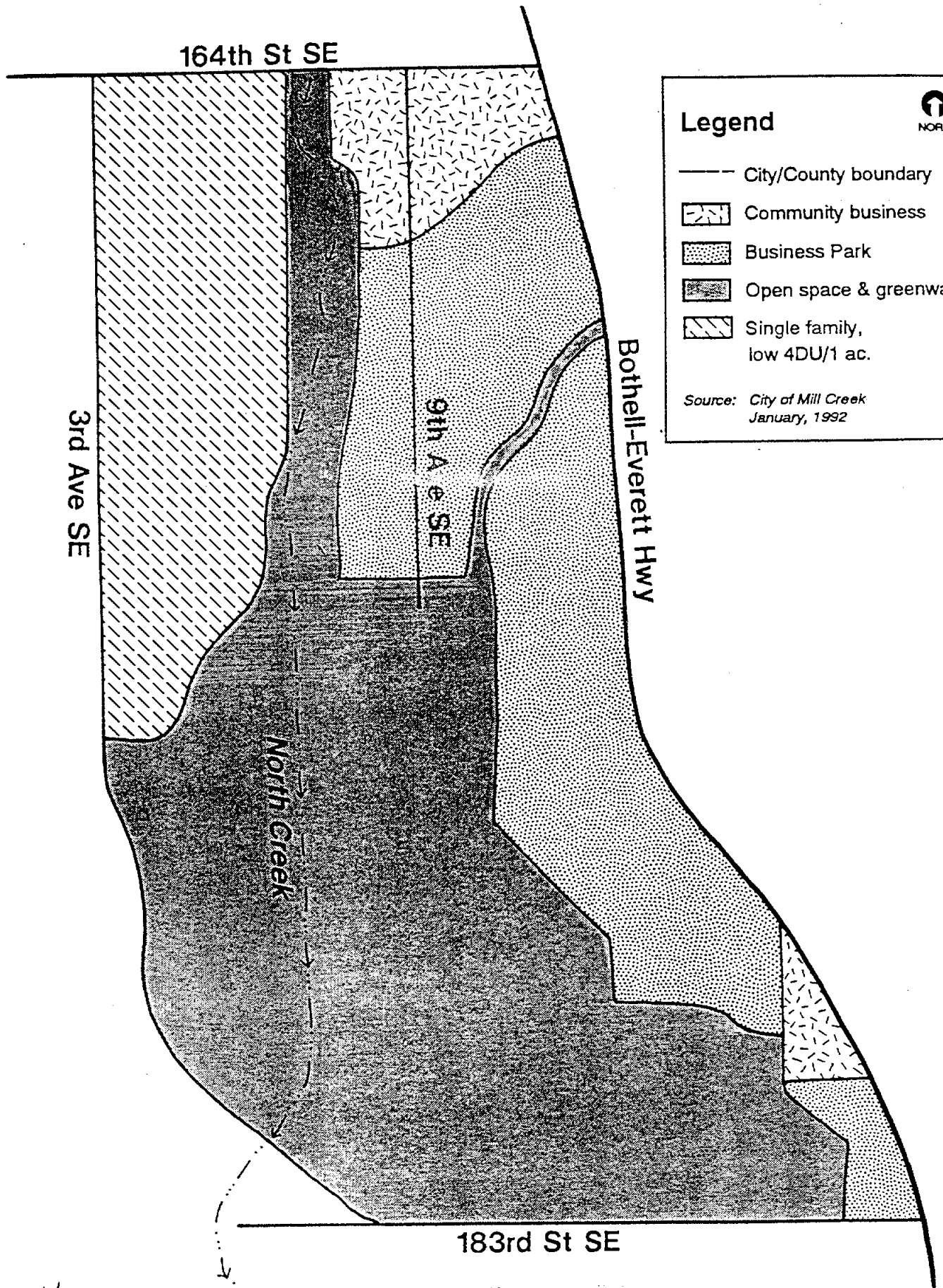
Land immediately north and south of the proposed project area is occupied by rural residential homes and is also used for small-scale agricultural purposes. The land adjacent to the east side of State Route 527 is occupied by homes and commercial businesses. Of particular historic interest is the 110-year old Bailey homestead which is located immediately southeast of the project area (See Cultural Resources Section). The land immediately west of the project area and North Creek is mostly undeveloped. The west floodplain is also occasionally grazed by cattle. The Rhody Ridge Arboretum, to which County Parks has a life estate title, is located west of John Bailey Road/3rd Avenue Southeast (See Recreation Section).

Current Land Use Designations

In January 1992, the City Council of Mill Creek formally adopted the City of Mill Creek Comprehensive Plan. Passage of the Mill Creek Plan repealed land use designations within the geographic area contained within the Urban Growth Area previously governed by the North Creek Area Comprehensive Plan (Figure ?). The Urban Growth Area "defines the logical geographic area that the City may consider expanding into



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 Figure X. Land Use Designations, North Creek Area Comprehensive Plan



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Figure X. Land Use Designations, City of Mill Creek Comprehensive Plan

through annexation within a twenty year planning period." It is considered an interim growth boundary pursuant to the Growth Management Act until the interlocal growth management planning process between the south Snohomish County cities and Snohomish County is completed and a final Urban Growth Area boundary is established.

The entire project area is contained within this Urban Growth Area boundary and could eventually be administered by the City of Mill Creek or jointly administered by the City and the County through an interlocal agreement.

Most of the project area is designated as Open Space and Greenway in the Mill Creek Plan. This land use designation is intended for areas "where natural amenities such as streams, wetlands, natural vegetation areas and large open spaces can be utilized for pedestrian (hiker/bicycle) linkages and as separators between urban land use forms."

The east portion of the project area, between Nickel Creek and State Route 527, is designated as Business Park. This area is intended for "campus style development and on large tracts of land that are planned, developed and operated as integrated facilities for a number of individual light industrial type uses." This area, referred to as "South Business Park" in the Plan, is one of three business parks planned for Mill Creek.

Environmental Impacts

Alternatives A, B, C and D: Regional Stormwater Facility/County Park

Generally speaking, land use impacts do not vary much between the four design alternatives that include the stormwater detention facility and county park. All of the design alternatives would preclude the use of up to 145 acres of land in the project area for water-intolerant uses, including residential and commercial development. Under each of these alternatives, the floodplain could be temporarily flooded to the Elevation 219 contour (see Water Resources Section).

The project would require the purchase of up to 77 additional acres of undeveloped land up to and in some cases beyond the Elevation 220 contour (Figure ?). Land acquisition in excess of the Elevation 219 contour is necessary to allow for one foot of freeboard and because parcels are defined by straight lines instead of by topographic contours. Use of the land for this purpose would preclude use for residential or commercial development.

Public use of the passive recreation area would generally not be affected by the temporary storage of floodwaters within the floodplain. Walking trails within the floodplain would be designed and constructed to float above a rising water table. Viewpoints would be constructed on piles.

Property along North Creek and in low-lying areas downstream of the project area that now experience flooding from North

Creek would benefit from the proposed project. Flooding would be reduced in these areas, minimizing potential for property loss from erosion and/or property damage from flooding.

Alternative E: County Park Only

The primary difference between this alternative and the alternatives described above with respect to land use, is that this alternative would provide no flood control benefits to property owners downstream of the project area.

Like the above-mentioned alternatives, Alternative E would require up to 145 acres of land, but the land would be used only for a passive recreation area. Use of the land for this purpose would preclude use for residential or commercial development.

Alternative F: No Action

Under the No Action alternative, there would be no additional land acquisition, and no construction activities related to the stormwater detention facility or passive recreation area. Homes and buildings in the project area above the Elevation 219 contour would experience the same propensity for flooding as they would under any of the design alternatives.

Sixty-eight acres of the site would be retained by the Snohomish County Surface Water Management and County Parks and Recreation Divisions and managed for the natural flood control and open space amenities inherent in the floodplain landscape.

Downstream of the project area, land use impacts associated with the No Action Alternative include continued flooding, erosion and scour of the North Creek riparian corridor. Continued development upstream of the project area would intensify these impacts, increasing the propensity for downstream property damage.

Mitigation:

Property needed for this project would be appraised and purchased by the County at fair market value. If an agreement could not be reached between the property owner and the County, condemnation proceedings would be required. A court of law would place a value on any disputed property.

TRANSPORTATION

The project area is generally bounded by 183rd Street Southeast (south), State Route 527 (east) and 164th Street Southeast (north) and 3rd Avenue Southeast (west). Ninth Avenue and 183rd Street are the only direct access roads to the project site. Ninth Avenue extends south from 164th Street to north project boundary. One Hundred Eighty-third Street is accessed from State Route 527, also known as the Bothell-Everett Highway. State Route 527 and 164th Street are major travel corridors in south Snohomish County.

Traffic volumes on 183rd Street and 9th Avenue are minimal; these roads are mainly used by the few local residents. Average daily traffic volume on 164th Street in the vicinity of 9th Avenue intersection is around 23,000. Average daily traffic volume on SR 527 in the vicinity of 183rd Street intersection is around 18,000. These high traffic volumes have prompted the County and the State to widen both of these roadways.

The proposed project includes provisions for park access areas on 183rd Street, SR 527 and 9th Avenue. The 183rd Street access is the only access area proposed for development by the County. The SR 527 and 9th Avenue accesses would be developed by the Wileywood Nursery and the City of Mill Creek, respectively.

No major transportation impacts are anticipated as a result of project construction or operation.

Studies and Coordination

Traffic volume information for County roads was obtained from the Engineering Operations Division of the Snohomish County Department of Public Works and from the Transportation Planning Group of the Department of Planning. The Washington Department of Transportation provided traffic information for SR 527.

Relevant publications are cited below:

CH2M Hill. November 1985. Engineering and Conceptual Design Report: 164th Street SE/SW Roadway Improvement Project. Department of Public Works, Snohomish County, Everett, WA.

Department of Public Works, Snohomish County. n.d. Historical Traffic Counts: 1983-1988. Everett, WA.

Parks and Recreation Division, Department of Community and Educational Services, Snohomish County. September 1986. Snohomish County Comprehensive Park and Recreation Plan.

Everett, WA.

Puget Sound Council of Governments. January 1986.
Alderwood-North Creek Transportation Study. Seattle, WA.

Snohomish County Transportation Authority (Sno-Tran). June 1990. High Occupancy Vehicles on Arterial Roads: 164th Street Example. Lynnwood, WA.

The Transp Group. June 1981. 1990 Transportation Plan: Snohomish Subregional Transportation Study. Puget Sound Council of Governments, Seattle, WA.

Washington State Department of Transportation. n.d. 1990 Annual Traffic Report. Olympia, WA.

Voorhees & Associates, Inc. January 1972. Snohomish County Transportation Study. Puget Sound Council of Governments, Seattle, WA.

Affected Environment

9th Avenue Southeast

The south terminus of 9th Avenue Southeast intersects the north boundary of the project area. This roadway extends approximately one-half mile south from its intersection with 164th Street Southeast. The 9th Avenue/164th Street intersection is signalized. Ninth Avenue is paved with asphalt and has two travel lanes. Its use is limited to the small number of residences south of 164th Street. The City of Mill Creek, which is responsible for maintaining the roadway, has plans to eventually widen it.

164th Street Southeast

One Hundred Sixty-fourth Street currently has five lanes from Ash Way to the Mill Creek city limits. The center lane provides nearly continuous left-turn access to both sides of the roadway. Sidewalks are present on both sides of the street throughout most of the corridor, however they are outside of the existing right-of-way. There are no bike lanes or special provisions for buses or high occupancy vehicles.

Snohomish County Public Works has proposed widening 164th Street from Spruce Way to the Mill Creek city limits. The environmental review of this project is now in progress. The preferred alternative proposes to widen 164th Street to seven lanes from Ash Way to 10th Avenue Southeast and to increase the width of the existing five-lane road segment from 10th Avenue Southeast to the Mill Creek city limits. Bike lanes, sidewalks and bus pullouts are also proposed.

Average daily traffic volume between 3rd Avenue and 9th Avenue SE was 22,500 in 1990. Traffic volume in this area is projected to increase to nearly 31,000 by the year 2000.

183rd Street Southeast

One Hundred Eighty-third Street Southeast parallels the south boundary of the project area. It extends approximately 0.7 miles west of its intersection with State Route 527. This intersection is not currently signalized. The first 0.13 miles of this two-lane road is paved with asphalt; the remainder is covered with gravel. The road is used by only a small number of local residents. Snohomish County Public Works is responsible for maintaining this roadway.

State Route 527

State Route 527, administered by the Washington State Department of Transportation, parallels the east boundary of the project area. This roadway is in the process of being widened from two to five lanes. The segment from 180th Street SE to 164th Street SE will be widened in summer 1992. The center lane will allow left-turn access to both sides of SR 527. Average daily traffic volume in the vicinity of 183rd Street was 18,000 in 1990. The Washington State Department of Transportation projects average daily weekday traffic volumes to increase to nearly 32,000 by the year 2000.

3rd Avenue Southeast

Third Avenue Southeast parallels the west boundary of the project area. It extends less than one-half mile south of its signalized intersection with 164th Street Southeast. The roadway is paved with asphalt and serves a small number of local residences.

Mass Transit

Community Transit provides daily bus service along 164th Street (Bus Number 160) and SR 527 (Bus Number 442). Bus Number 160 serves the Mill Creek community, Swamp Creek Park and Ride, Alderwood Mall, and the Lynnwood Park and Ride. Bus Number 442 travels between the City of Redmond and the Everett Mall Park and Ride via Interstate 405 and SR 527.

Bus pullouts are proposed as part of the road widening projects for both 164th Street and SR 527.

Bicycle and Pedestrian Traffic

Bike lanes and sidewalks are proposed for both sides of 164th Street as part of the road widening project. Sidewalks are proposed for the SR 527 road widening project.

The bike lanes and sidewalks on the 164th Street corridor would contribute a 1.8-mile segment of the Meadowdale to Milltown urban trail, as described in the Snohomish County Comprehensive Park and Recreation Plan. An urban trail is a high volume bike and walking path that connects major environmental park sites.

Environmental Impacts

Alternatives A, B, C and D: Stormwater Control Facility/County Park

Alternatives A through D include provisions for a stormwater facility and a County park. Construction activities related to these facilities would be confined to the project area and should not result in traffic delays on any of the above-mentioned roadways.

Three access areas are proposed for development as part of the park. Snohomish County would be responsible for developing the 183rd Street access area. The County would pave 183rd Street with asphalt from SR 527 to the entrance of the access area in conjunction with this portion of the project. The asphalt paving would eliminate nuisance dust from vehicles traveling to and from the park. No other transportation impacts are anticipated.

The proposed 183rd Street access area would provide parking for only 12 cars and 1 school bus. Traffic to and from the access area should be limited and should not pose congestion or safety problems at the 183rd Street/SR 527 intersection. A signal light is not currently planned for this intersection, but the road widening will improve sight distance in this area.

Alternative E: County Park Only

Transportation impacts from Alternative E would be identical to those discussed under Alternatives A through D.

Alternative F: No Action

Under the no action alternative, none of the proposed facilities would be constructed. Consequently, there would be no road improvements in conjunction with the development of park access areas.

Mitigation

No mitigation measures are proposed.

RECREATION

There are three existing public recreation areas within the project vicinity: the Rhody Ridge County Arboretum, the Lively Environmental Center, and the Silver Creek County Park. These facilities provide passive recreation and environmental education opportunities. In addition to the recreational facility proposed as part of this project, a new County park is also planned for the south end of Martha Lake at the site of the former Martha Lake Tavern. The new Martha Lake park will be located immediately southwest of an existing public boat launch, operated by the Washington Department of Wildlife.

As described earlier in this document (see Alternatives), the proposed North Creek County Park would be located on the east side of North Creek and consist of up to three access and parking areas, walking trails, interpretive signs and restrooms. The entire facility could eventually occupy up to 145 acres, all but 41 acres of which would be simultaneously used for the regional stormwater detention facility.

From a recreational standpoint, implementation of the preferred or any of the other alternatives would result in mostly positive benefits to local and County residents. A new County park would provide passive recreation and environmental education opportunities. Additionally, it would increase awareness of and visitation to nearby passive recreation areas.

Because the proposal would provide mainly positive recreation benefits, no mitigation for recreation impacts is proposed.

Studies and Coordination

As part of this proposal, Snohomish County Parks and Recreation initiated a park master planning process to bring neighboring residents together to address issues related specifically to the park component of this proposal. The master planning process for the park was completed in January 1992 and is included as an appendix to this document. In addition to this public involvement process, Public Works staff contacted the Rhody Ridge Arboretum and Lively Environmental Center to solicit comments and concerns about the recreational aspects of the proposed project. Relevant recreation documents are cited below.

Bruce Dees & Associates. February 1992. North Creek Park and Stormwater Detention Facility: Master Plan Report. Parks and Recreation Division, Department of Community and Educational Services, Snohomish County, Everett, WA.

David Evans and Associates, Inc. March 1991. A Plan for Public Access for Martha Lake. Surface Water Management Division, Department of Public Works, Snohomish County, Everett, WA.

Department of Community Development, City of Mill Creek.
January 1992. City of Mill Creek Comprehensive Plan. Mill
Creek, WA.

Parks and Recreation Division, Department of Community and
Educational Services, Snohomish County. September 1986
Amended October 1989. Snohomish County Comprehensive Park
and Recreation Plan. Everett, WA.

Affected Environment

Existing Recreation Areas

The Rhody Ridge Arboretum is located about one-quarter mile west of North Creek and is accessed from Clover Road. The arboretum is open to the public from 10:00 a.m. to 7:00 p.m., seven days per week. Community groups are given tours by appointment. The arboretum, organized as a display garden of woody plants within a larger natural setting, is particularly popular among horticultural groups and classes. Walking trails wind throughout this passive recreation area. Parking is mainly provided on Clover Road. The arboretum receives an estimated 1,650 visitors annually. Visitation is concentrated in the spring and fall.

The Lively Environmental Center is located about one mile northeast of the project area, and is accessed from Seattle Hill Road. This passive recreational facility is operated by Everett School District Number 2 and is used by this School District and community groups for environmental education. Because it is located at the headwaters of Nickel Creek, stream ecology has been an important educational focus of the Center since the mid-1970s. In the spring of 1975, the Center, in coordination with the Washington Department of Fisheries, began annually releasing approximately up to 50,000 coho fry into Nickel Creek. Salmon returning to spawn in Nickel Creek have been documented in 1986, 1987 and 1989. In 1989, a high of 16 coho salmon returned to Nickel Creek.

The Center is open to students and community groups by appointment. Visitation is concentrated at the beginning (September to mid-October) and end (March to mid-June) of the school year. Approximately 6,000 people visited the site last year, including students, teachers and community group members. The Center's facilities include a fish hatchery, pond, interpretive trails, historical museum, science classrooms, restrooms and a parking area.

Silver Creek County Park is located in the midst of a residential subdivision approximately one-half mile east of the project area. The park is just south of 180th Street Southeast and accessed from 22nd Drive Southeast. Silver Creek, a major tributary to North Creek, flows through the center of the park. The park was constructed in the mid-1980s as mitigation for the residential subdivision. For this reason, several small stormwater detention ponds

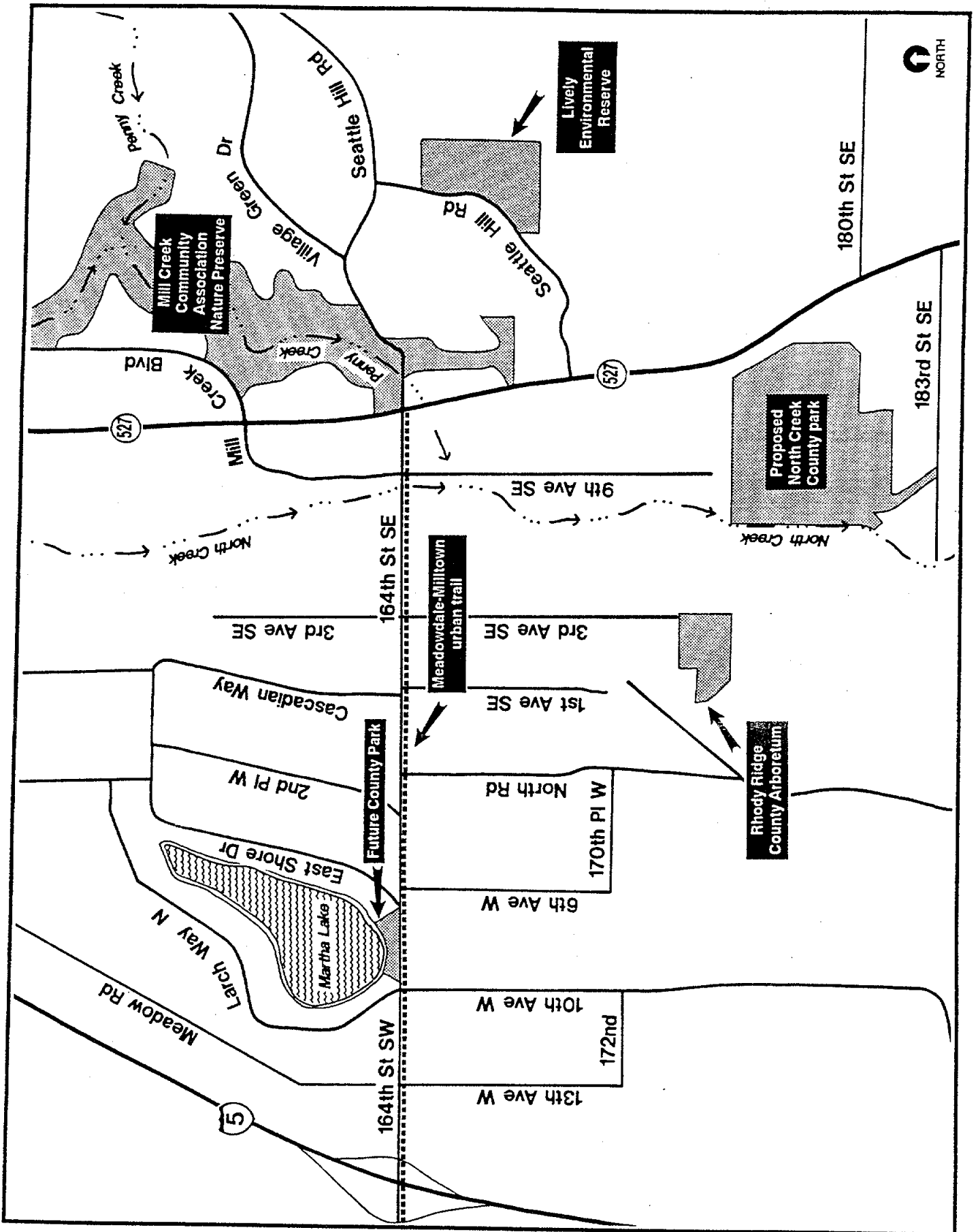


Figure 4 Existing, Planned and Proposed Recreation Areas

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are located adjacent to the creek. Approximately ??? people visit the park. Most park visitors live in the adjacent residential community.

Planned Recreation Areas

In addition to these existing facilities, Snohomish County Parks recently acquired the Martha Lake Resort and Tavern to develop a 6.7-acre County Park at the south end of Martha Lake. The future park will adjoin the north side of 164th Street between East Shore Drive and Larch Way. A Plan for Public Access for Martha Lake (David Evans and Associates, Inc., March 1991) includes a proposal for a day use recreation area and 25-car parking lot at this site. This access study will serve as a starting point for the master planning process scheduled for 1992. The master planning process relies heavily on the participation of neighborhood residents and will reexamine issues concerning access, park capacity, visitor uses and capital improvements. Phased construction will begin in summer 1993.

Environmental Impacts

Alternative D: Bottomless Box Culvert\County Park

The proposed County Park would provide passive recreation opportunities for local and County residents. The park could be used for walking, picnicking, nature observation and environmental education. As described in Appendix A, the major recreation features of the proposed park would include: floating boardwalk trails in wetland areas; compacted crushed rock trails in upland areas; pile-supported bridges and viewpoints; picnic facilities; and interpretive signs. Use of the project site for a passive recreation facility is consistent with and complimentary to recreation land uses described in the City of Mill Creek Comprehensive Plan.

Proposed trail connections from the North Creek park to the Rhody Ridge County Arboretum and to Mill Creek and McCollum Park (via a North Creek trail) would help to further the goal of a regionally connected recreation system for south Snohomish County. Connecting trails would lead to an increase in awareness of and visitation to nearby passive recreation areas.

The environmental interpretation opportunities incorporated into the Master Plan for the proposed park would help to educate park visitors about: floodplains, wetlands and wildlife habitat; cultural resources in the project area; recreational/ecological relationships with the Rhody Ridge Arboretum, Lively Environmental Center, and Silver Creek County Park; the function and multiple purposes of the regional stormwater detention system; and, if relevant, any ecological research that might be underway related to the operation of the stormwater detention facility.

The proximity of the proposed park to nearby passive

recreation areas would offer opportunities for many types of cooperative environmental education projects as well as opportunities for use by Snohomish County community groups.

The park would be open year-round except during and immediately following severe flood events. The closures should have little to no impact on annual park visitation because they would most likely occur during late fall and winter when environmental conditions discourage most visitors from using an outdoor park.

Alternatives A, B and C: Other Stormwater Design Alternatives

Similar to Alternative D, these stormwater design alternatives would also provide for construction of a new County Park. The park design would be essentially the same as it is for the preferred alternative.

Flooding impacts to the park would vary slightly with the preferred alternative due to variations in stormwater facility design (See Water Resources Section).

Alternative E: County Park Only

This alternative would provide only for construction of the County Park. No regional stormwater detention facility would be constructed. The impacts to recreation would be similar except that temporary closures resulting from flooding of the floodplain would be slightly shorter in duration than they would for the design alternatives.

Alternative F: No Action

Under the no action alternative, no passive recreation facilities or access areas would be constructed. There would be no additional land acquisitions.

The 68 acres of land already purchased by the Snohomish County would remain in County ownership and be retained for natural flood control and open space purposes. Public access to and use of County property within the floodplain would not be prohibited, but it would be difficult due to a lack of parking and access areas and trails designed for wetland areas.

Mitigation

The project proposal would provide recreation opportunities in an area that currently has little or no public recreational use. Hence, the project would provide an overall positive recreational benefit. For this reason, no mitigation measures are proposed for recreation purposes.

CULTURAL, HISTORIC, AND ARCHAEOLOGICAL RESOURCES

Studies and Coordination

The Washington State Office of Archaeology and Historic Preservation in the Department of Community Development and the historic preservation planning group in the Snohomish County Planning Department were contacted for information pertaining to cultural resources in the project area. The state maintains a list of properties on the State and National Registers of Historic Places. Snohomish County also maintains a local cultural resource inventory. Relevant information sources are cited below:

Bruce Dees & Associates. January 1992. North Creek Park and Storm Water Detention Facility Master Plan Report, Snohomish County, WA. Parks and Recreation Division, Department of Community and Educational Services, Snohomish County, Everett, WA.

Department of Planning, Snohomish County. n.d. Snohomish County Cultural Resource Inventory. Everett, WA.

"On this farm, time stands still." Seattle Times: North Times. 22 November 1989.

Affected Environment

Immediately southeast of the project area is one of the oldest farming homesteads in Snohomish County. Nearly 110 years old, the historic 27-acre Bailey farm is of cultural significance for its buildings and farm implements, and as a relict of the agricultural economy upon which Snohomish County was founded. The farm was homesteaded by the Bailey family in 1883 and originally used to raise dairy cows. In 1948, beef cattle were substituted for the dairy animals. A small head of beef cattle are still raised on the property today. The property is still owned by the Bailey family.

Environmental Impacts

Alternative A thru E: Design Alternatives

Establishment of the regional stormwater facility and County Park would preclude residential or commercial development north of the Bailey farm that could detract from the farm's inherent cultural values or pose potential land use conflicts.

In addition, one or more interpretive exhibits proposed for the County park could be developed with guidance from the Bailey family to educate park visitors about the cultural history of the area and the historic homestead. This type of interpretive exhibit would broaden the public appeal of

the proposed passive recreation area and enhance its value as a community resource.

Because the proposed park would lead to an increase in public awareness of the homestead, it could indirectly generate problems with security and privacy if facilities are not properly designed.

Alternative F: No Action Alternative

Under the no action alternative, existing County property north of the homestead would remain undeveloped as open space land. Other property immediately north of the Bailey farm, identified in the Master Plan as "potential acquisitions," would not be acquired by the County. This property would be available for residential or commercial development.

Mitigation

The Master Plan for the proposed park outlines several design criteria to protect the security and safety of neighboring properties, including the Bailey farm (Appendix ?). Snohomish County is open to working with the Bailey family throughout construction and operation of the project to ensure that the cultural resources of the homestead are protected and preserved.

UTILITIES

A 24-inch sewer line is the only utility in the project area. Construction of the preferred alternative would require ???.

To ensure that there is not a disruption of sewer services, Snohomish County would closely coordinate its construction activities with the Alderwood Sewer District.

Studies and Coordination

The Alderwood Water and Sewer Districts was contacted periodically for information relative to construction of the site and to discuss issues associated with construction of the preferred alternative.

Affected Environment

A 24-inch reinforced concrete gravity sewer line parallels North Creek through the project area. The sewer line is located directly underneath the existing east-bank dike. The top of the sewer line is typically 5.5 feet below the ground surface.

No other utilities are located in the project area.

Environmental Impacts

Alternatives D: Preferred Alternative: Bottomless Box Culvert/County Park

Alternative A: Bottomless Arch Culvert/County Park

Alternative B: Bioengineered Constriction/County Park

Alternative C: Off-Channel Storage/County Park

Alternative E: County Park Only

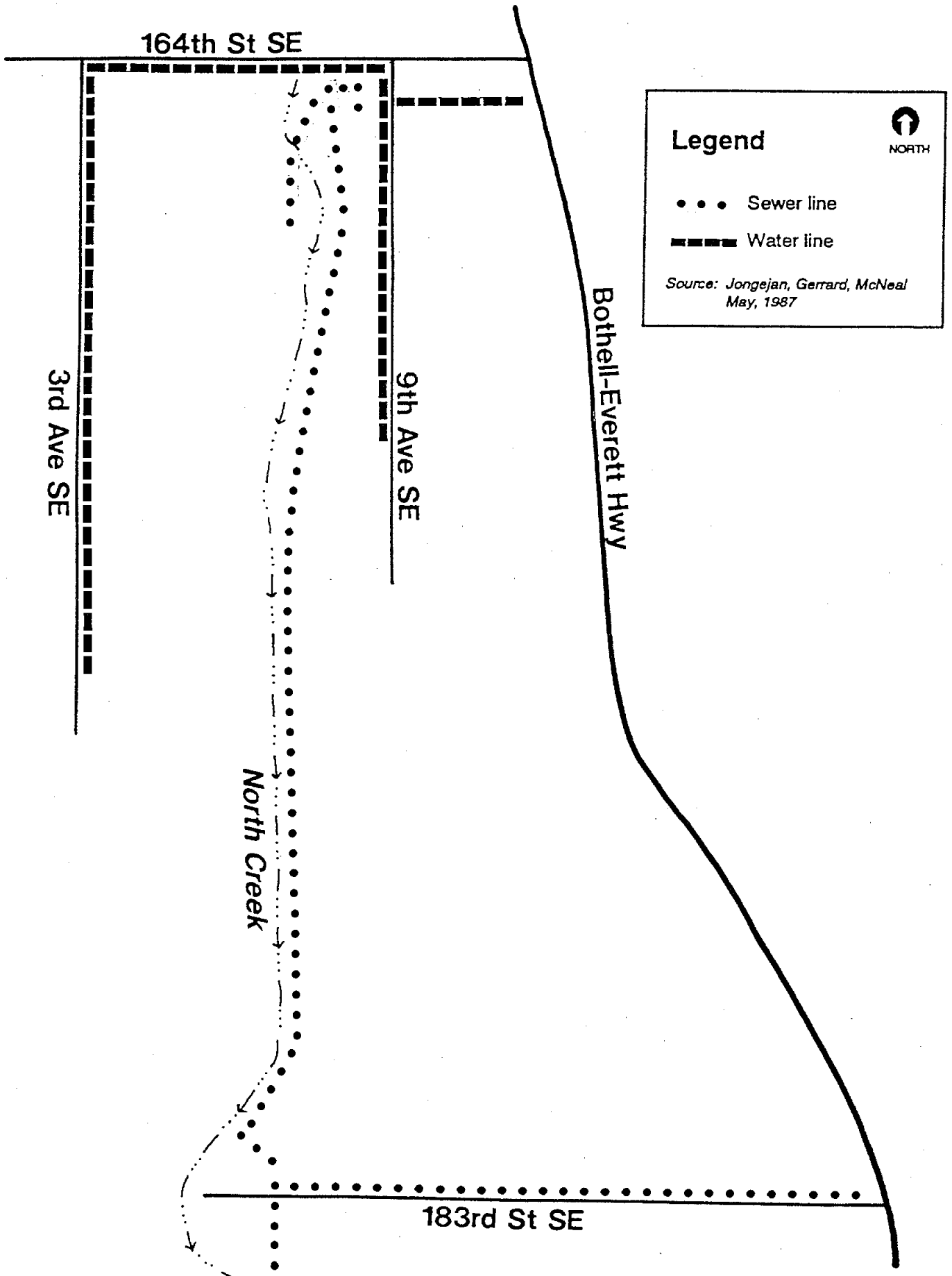
Alternative F: No Action

No impact to the sewer line would occur under the no action alternative.

Need info from Proj. Mgt. here.

Mitigation

Snohomish County would closely coordinate its construction activities with the Alderwood Sewer District to ensure that there is no disruption of service to customers in the area.



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SOIL AND GROUNDWATER CONTAMINATION

Snohomish County Surface Water Management and Parks Divisions identified land for potential acquisition in the project area. Prior to purchasing any property, the County must conduct a thorough environmental investigation of identified properties to ensure that it will not become liable for hazardous waste, or contaminated soil or groundwater that may be present as a result of past land use practices. In performing these investigations, the County meets the "due diligence" requirement established by the Washington State Model Toxics Control Act.

The results of the environmental investigations indicate that the project area is free of hazardous waste or contaminated soil or groundwater.

Because no evidence of contamination was found, no mitigation measures are proposed. If contaminated materials are found during construction, all activities would be immediately suspended and the County would proceed with additional investigations and cleanup in accordance with applicable environmental regulations.

Studies and Coordination

To meet the due diligence requirement, the Geotechnical Group of the Department of Public Works contracted with Applied Geotechnology Inc. (AGI) to perform an environmental risk assessment (ERA) on all parcels proposed for purchase in the project area. An ERA is a limited review of existing and historical information concerning past land use practices. The purpose of an ERA is to determine if further investigation is needed, and to evaluate the potential environmental risk to the County from purchasing the property. The ERAs included: 1) a site reconnaissance to observe existing conditions; 2) a review of historical aerial photographs and topographic maps; and 3) interviews with previous and adjacent property owners and occupants.

As a result of the ERA, AGI was again hired to perform a limited Phase II Environmental Site Assessment on one of the properties investigated in the ERA. The Phase II ESA included: 1) aerial photograph interpretation; 2) field evaluation of fill materials and methods of fill; and 3) interview with a local resident.

The results of these environmental investigations are contained in:

Applied Geotechnology Incorporated. November 1990. Risk Assessment: Proposed North Creek County Park, Snohomish

County, Washington. A.G.I Project No. 15,512.008. Design and Construction Division, Department of Public Works, Snohomish County, Everett, WA.

_____. May 18, 1992. "Limited Phase II Environmental Site Assessment, Parcel 7, Proposed North Creek Regional Detention Facility, Snohomish County, Washington." Design and Construction Division, Department of Public Works, Snohomish County, Everett, WA.

Affected Environment

Aerial photos of the project area indicate that the land was used primarily for pasture prior to at least 1947. Interviews with property owners adjacent to the project area corroborate this observation. They indicate that livestock grazing has been the predominant economic activity except for a brief period in the 1960s when a small peat mining operation was attempted (Figure ?). The peat mining operation was located in Parcel ? at the south terminus of 9th Avenue Southeast. The parcel was drained with a ditch, the location of which is shown in the Figure ?.

The small pond located west of North Creek was also investigated as part of the environmental review because it was believed to also be an artificial feature of the landscape. The pond was present in the 1955 photographs, but not in photographs from 1947. Photographs from 1978 showed the pond area filled and revegetated with grass. Because the source and nature of the fill material was unknown a Phase II ESA was conducted to evaluate possible fill contamination.

The results of the Phase II investigation indicate that the pond was heavily overgrown with vegetation and littered with a small amount of garbage (tires, buckets, cans and cups), but no fill material was observed. The contractor concluded that no further investigation was warranted.

Environmental Impacts

Alternatives A, B, C, D and E: Design Alternatives

The environmental investigations performed for the proposed regional stormwater detention pond and County park found no evidence of soil or groundwater contamination and indicate that the potential for contamination is low.

The possibility does exist, however, for contaminated materials to be discovered during construction. Because the design alternatives differ only slightly in the areas proposed for construction activity, they share an equal potential for environmental impact.

Alternative D: No Action

As discussed above, there is no evidence of soil or groundwater contamination in the project area and the likelihood for finding contaminated areas is low.

Under the No Action alternative the responsibility for investigation and cleanup of the parcels not yet acquired by the County would reside solely with existing property owners.

Mitigation

If evidence of potential contaminated areas are found during construction, any excavation or removal activities in the area would be immediately suspended. The Geotechnical Group of Public Works would be notified and would proceed in accordance with applicable environmental regulations.

Construction contractors would be responsible for ensuring that all potentially contaminated media is handled in a manner that limits contact and exposure of construction personnel and the public.

Snohomish County would remove or have removed all contaminated materials found within the County property. These materials would be removed only by properly trained and certified persons. Hazardous materials would be disposed of in accordance with applicable rules and regulations. Regular on-site inspections would assure conformance to all applicable rules and guidelines of federal, state and local agencies.

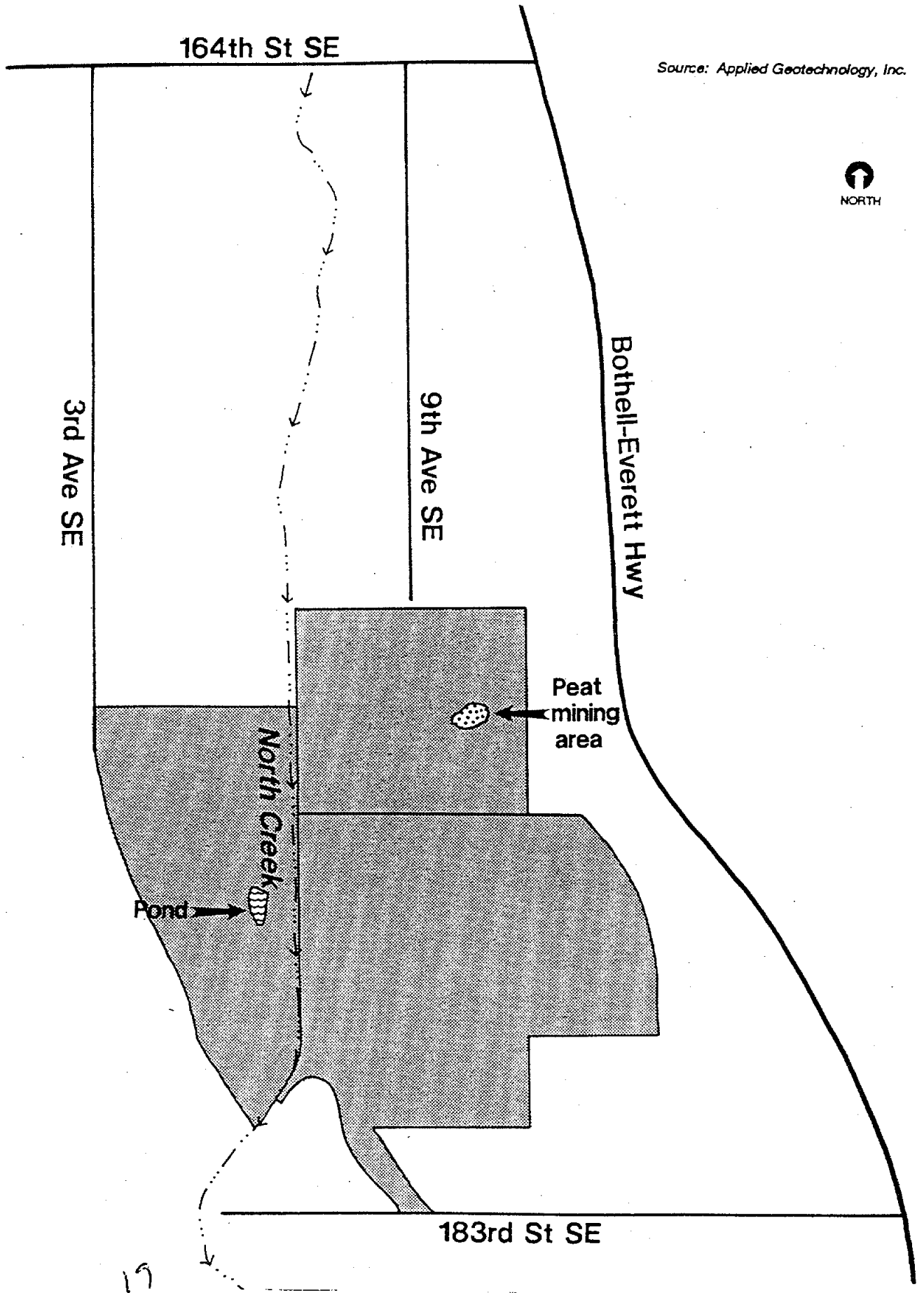


Figure X. Parcels Evaluated for Potential Contamination

Summary of Surface Water Management
Ambient Water Quality Monitoring Data
1990-1991

Kathy Thornburgh
March 17, 1992

Monthly sampling was conducted at 27 sites in Snohomish County from July 1990 through October 1991. Some sites were dry for several months in the summer and the number of samples collected per site ranged from 8 to 16. The samples were analyzed for fecal coliform bacteria, turbidity, alkalinity, conductivity, ammonia, nitrate-nitrite, total Kjeldahl nitrogen, total phosphorus, ortho-phosphate, oil and grease, total petroleum hydrocarbons, total suspended solids, hardness, and total organic carbon. Field measurements were made for dissolved oxygen, temperature, and pH. In addition, samples were analyzed every two months for the following metals: arsenic, antimony, aluminum, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc.

Sample sites were located in Watershed Management Areas (WMA'S) of Snohomish County with the majority of sites in the North and Swamp Creek watersheds (Appendix A). Five sites on the mainstem of North Creek and three sites on North Creek tributaries were sampled. On Swamp Creek, four mainstem sites and ten tributaries were sampled. Three of the streams draining the Marshland WMA were sampled. One site was located at Smokey Point on upper Quilceda Creek and another was at the mouth of Lund's Gulch Creek.

The Water Quality Standards for Surface Waters of the State of Washington classify Swamp and North Creeks and all tributaries as Class AA, extraordinary (WAC 173-201). Quilceda and the Marshland tributaries are classified as Class A, excellent. Lund's Gulch Creek flows into Puget Sound and has not been classified.

For this analysis, data were grouped into wet and dry seasons based entirely on the month of collection. The dry season was considered to be from May through October, and the wet season extended from November through April. At all sites, the mean dry season temperature never exceeded 16 C, the criteria for Class AA waters. However, temperatures from 17-19 C were measured during July or August at four of the mainstem North Creek sites (NEL, NCM, NCD, NCG), a North Creek tributary (NC4), a Swamp Creek mainstem site (SCC) and Scriber Creek (SBG), a tributary to Swamp Creek.

Data for many of the conventional parameters are summarized in Table 1. Only seven sites met the Class A or AA fecal coliform criteria of geometric means not exceeding 100 col/100 ml. With the exception of Lund's Gulch Creek (MPG)

and Scriber Creek (SBG), all sites had means higher in the dry season than the wet season. Sites with high fecal coliform levels were found in all watersheds. At several sites, samples exceeded 1600 col/100 ml multiple times. Sites at Swamp Creek Gage (SCG) and upper North Creek (NEL) each exceeded 1600 col/100 ml four times, Scriber Creek (SBG) and lower Swamp Creek (SCC) exceeded this level five times, and at Hilton Lake Drainage (HLD) six samples exceeded this level.

Mean values of dissolved oxygen met the Class AA criteria of at least 9.5 mg/l at all sites during the wet season. At most sites, mean values during the dry season also met the Class AA dissolved oxygen standard. The following sites met the Class A standard of 8.0 mg/l during the dry season: NEL, NC4, SPN, MPC, SPS, and SCTS. The remaining sites met the Class B standard of 6.5 mg/l during the dry season: NCM, NCD, LSO, MLC, and SPC. Measurements of pH were all in the range of 6.5-8.5.

The areas with the lowest nutrient levels were the mainstems of North and Swamp Creeks. Penny and Scriber Creeks which have fairly high flows also had low nutrient levels. The smaller tributaries to North and Swamp Creeks, the Marshland drainages, and Lund's Gulch Creek all had higher nutrient levels. Several of the smaller streams had seasonal nitrate-nitrite means exceeding 2.0 mg/l. Ash Way (AWC), Alder (SPS) and Underground (UGC) Creeks, which enter Swamp Creek in the wetlands area south of 164th St SW, had wet season nitrate-nitrite means ranging from 2.8-4.5 mg/l. Ammonia levels in Alder creek were the highest of the sampling sites, ranging from 0.1-0.5 mg/l. The unnamed creek in Marshland (MUC) had nitrate-nitrite levels exceeding 2.0 mg/l in both wet and dry seasons. Site MUC also had total phosphate levels exceed 0.2 mg/l in both seasons. In North Creek, site NCD at John Bailey Rd had total phosphate levels of 0.4 mg/l in the wet season. In North creek tributary NC4, both total phosphate and soluble reactive phosphorus exceeded 0.4 mg/l in the dry season.

Turbidity and total suspended solids (TSS) were chronic problems only in the Marshland drainages. Woods Creek (MWC) had wet season TSS levels of 150-200 mg/l with turbidities up to 200 NTU. Hilton Lake drainage (HLD) had a mean wet season TSS of 175 mg/l with turbidities from 100-200 NTU. The unnamed creek (MUC) had a wet season mean TSS of 145 mg/l and turbidities up to 240 NTU. Outside of the Marshland drainages, the worst problems occurred in Lund's Gulch Creek where November and December turbidities ranged from 200-400 NTU and TSS ranged from 200-500 mg/l.

Levels of oil and grease and total petroleum hydrocarbons (TPH) exceeded 10 mg/l at only two sites. In Martha Creek (MLC), levels of both TPH and oil and grease were 15 mg/l in

July 1991. In November 1990, Maple Creek (MPC) had TPH of 16 mg/l and oil and grease of 23 mg/l.

The water quality standards for the state of Washington (WAC 173-201-047) establish acute and chronic criteria for the following metals: cadmium, chromium, copper, lead, nickel, silver, zinc, and mercury. During the sampling, there were no violations of standards for chromium, silver, or nickel at any sites. It should be noted that the analytical detection limits for silver, lead, and cadmium are greater than the maximum contamination limits defined in the standards. The cadmium standard was violated only once in Quilceda Creek (SPC) with a level of 100 ug/l in June 1991. Levels of copper and lead in violation of the standards were found in all the watersheds sampled (Table 2). Violations of the mercury standard were found in all areas except the Marshland drainages and zinc violations were found only in the North and Swamp Creek watersheds.

Violations of copper levels noted in Table 2 usually exceeded acute criteria of 9.22 ug/l for a hardness of 50 mg CaCO₃/l. At several sites, copper levels exceeded 100 ug/l: North Creek at Everett (NEL), North Creek at John Bailey Rd (NCD), North Creek trib (NC4), Penny Creek (PCG), Swamp Creek Trib (SCT3), and Underground Creek (UGC). Acute zinc levels were exceeded twice in Penny Creek and once in Swamp Creek (SPN). Samples containing lead were found throughout all the watersheds, but most samples violated the chronic and not the acute standard.

The Department of Ecology proposed a standard for acute levels of aluminum of 750 ug/l (WSR 91-11-089). Levels of aluminum which violated the proposed standard were found in all watersheds except Quilceda Creek. Several sites had samples which exceeded 4000 ug/l of aluminum: North Creek trib (NC4), lower Swamp Creek (SCC), Hilton Lake drainage (HLD), Marshland unnamed Creek (MUC), and Lund's Gulch Creek (MPG).

The State of Washington has not set standards for levels of antimony in surface waters. However, antimony was never detected in the samples above the detection limit of 0.02 mg/l. The U.S.E.P.A. in the 1986 Quality Criteria for Water states that arsenic levels should be zero to provide maximum protection of human health. Arsenic was found in most water samples in levels ranging from .001 to .010 mg/l.

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Table 1. Results of sample analysis for conventional parameters by site.

SITE	NO. OF SAMPLES	FECAL COLIFORM	DISSOLVED OXYGEN	NITROGEN TKN, NO2NO3	PHOSPHORUS SRP, TP	TURBIDITY/TSS
North Creek						
NEL	13	405	9.8	TKN	-	1
NCM	16	219	9.7	-	-	-
NCMC	14	72	10.8	-	-	-
NCD	16	138	9.3	-	TP	-
NCG	16	302	11.1	-	-	-
North Creek tributaries						
NC4	12	112	9.8	TKN	SRP, TP	1
PCG	16	92	10.8	-	-	-
SCN	16	168	10.8	NO2NO3	TP	-
Swamp Creek						
LSO	10	58	8.2	-	-	-
SPN	16	453	9.1	-	-	-
SCG	16	316	10.9	-	-	-
SCC	16	372	11.2	-	-	2
Swamp Creek						
SCTS	12	333	10.6	NO2NO3	-	1
SCT3	8	24	11.0	NO2NO3	-	-
AWC	12	239	10.5	NO2NO3	-	-
BSC	14	196	11.4	NO2NO3	-	-
UGC	14	47	10.1	NO2NO3	-	1
DWC	14	31	11.7	-	-	-
MPC	14	250	9.9	TKN	-	-
SPS	16	131	10.3	-	-	1
MLC	12	101	10.0	TKN	-	-
SBG	16	283	10.8	-	-	-
Marshland						
MWC	8	98	11.8	NO2NO3	TP	3
HLD	13	701	11.5	NO2NO3	TP	6
MUC	13	139	10.5	NO2NO3, TKN	TP, SRP	5
Lund's Gulch						
MPG	16	161	11.6	NO2NO3	TP	2
Quilceda Creek						
SPC	11	104	9.0	NO2NO3	-	-

Fecal coliform bacteria - geometric mean, col/100 ml

Dissolved oxygen - mean, mg/l

Nitrogen - noted if mean NO2NO3 or TKN exceeded 1.0 mg/l

Phosphorus - noted if mean TP or SRP exceeded 0.1 mg/l

Turbidity/TSS - number of samples when turbidity exceeded 100 NTU or TSS exceeded 100 mg/l

Table 2. Violations of acute and chronic criteria for metals by site (WAC 173-201-047).

SITE	TOTAL NO. OF SAMPLES	Number of samples in violation of standards				
		COPPER	MERCURY	LEAD	ZINC	ALUMINUM*
North Creek						
NEL	7	2	1	5	-	1
NCM	8	3	1	7	-	-
NCMC	8	1	1	6	-	1
NCD	9	2	1	6	-	-
NCG	8	2	1	6	-	1
North Creek tributaries						
NC4	7	4	-	6	-	1
PCG	8	3	-	4	2	-
SCN	8	1	2	6	1	-
Swamp Creek						
LSO	6	1	1	4	-	-
SPN	8	1	1	7	1	-
SCG	7	-	1	6	-	-
SCC	8	4	1	7	1	2
Swamp Creek tributaries						
SCTS	6	1	-	4	1	-
SCT3	4	2	-	3	-	-
AWC	8	2	1	5	1	-
BSC	8	2	1	6	-	-
UGC	8	2	2	7	-	1
DWC	8	-	1	5	-	-
MPC	8	1	1	6	-	2
SPS	8	2	2	6	-	-
MLC	6	1	1	4	1	2
SBG	8	1	-	8	2	3
Marshland						
MWC	3	-	-	2	-	-
HLD	8	2	-	6	-	5
MUC	5	2	-	5	-	2
Lund's Gulch						
MPG	8	2	2	7	-	2
Quilceda Creek						
SPC	5	-	2	4	-	-

* Standard proposed by Department of Ecology (WSR 91-11-089).

Appendix A. Ambient water quality monitoring sites.

North Creek mainstem

- NEL - Everett City limits at 116th St SE
- NCM - McCollum Park south of Extension Service Building
- NCMC - 164th St SE upstream of Penny Creek confluence
- NCD - John Bailey Rd off 183rd St SE
- NCG - County line at 240th St SE

North Creek tributaries

- NC4 - 4th Av SW and 124th St SW by Mariner High School
- PCG - Penny Creek at gage in Mill Creek Park
- SCN - Silver Creek at 208th St SE

Swamp Creek

- LSO - Lake Stickney outlet at Jefferson Way
- SPN - Swamp Pond north, staff gage on Ash Way
- SCG - Swamp Creek gage at Filbert and Magnolia
- SCC - County line at Lockwood Rd

Swamp Creek tributaries

- SCTS - Cedar Creek Apts, 117th and Hwy 99
- SCT3 - trib south of Lake Stickney at 136th Pl SW
- AWC - Ash Way Creek at Antioch Alliance Church
- BSC - Box Springs Creek at 16216 Ash Way
- UGC - Underground Creek at 17110 Ash Way
- DWC - Dogwood Creek at 17615 Ash Way
- MPC - Maple Creek at Ash Way and Maple (26th Av W)
- SPS - Alder Creek in backyard of 17227 Ash Way
- MLC - Martha Creek at Filbert and Larch Way
- SBG - Scriber Creek gage at 21st Av W

Marshland

- MWC - Wood Creek at 8003 Lowell-Larimer Rd
- HLD - Hilton Lake drainage at Lowell-Larimer Rd
- MUC - Unnamed creek at 10510 Lowell-Larimer Rd

Lund's Gulch

- MPG - Lund's Gulch Creek in Meadowdale Park

Quilceda Creek

- SPC - Smokey Point at 4422 136th St NE

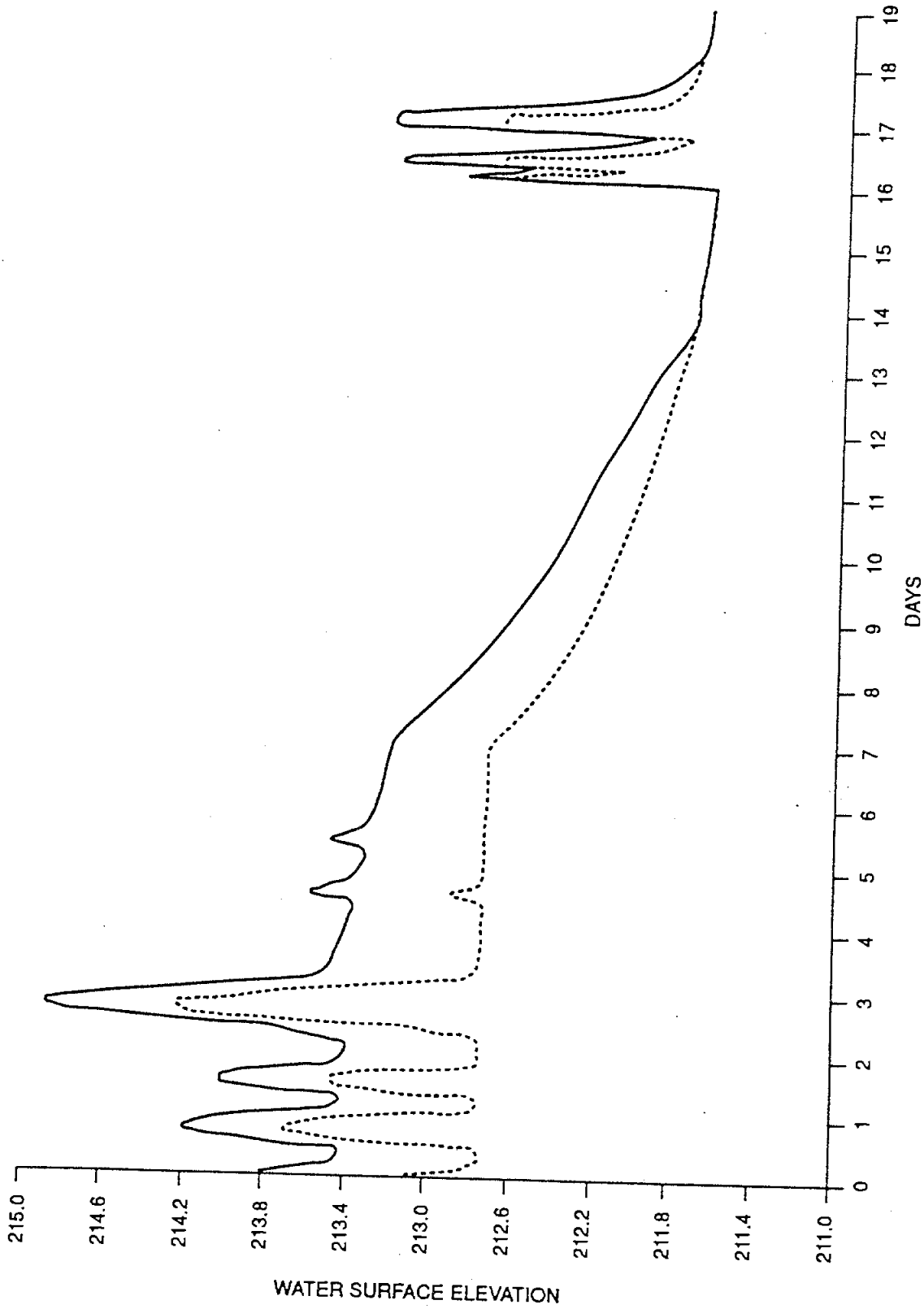
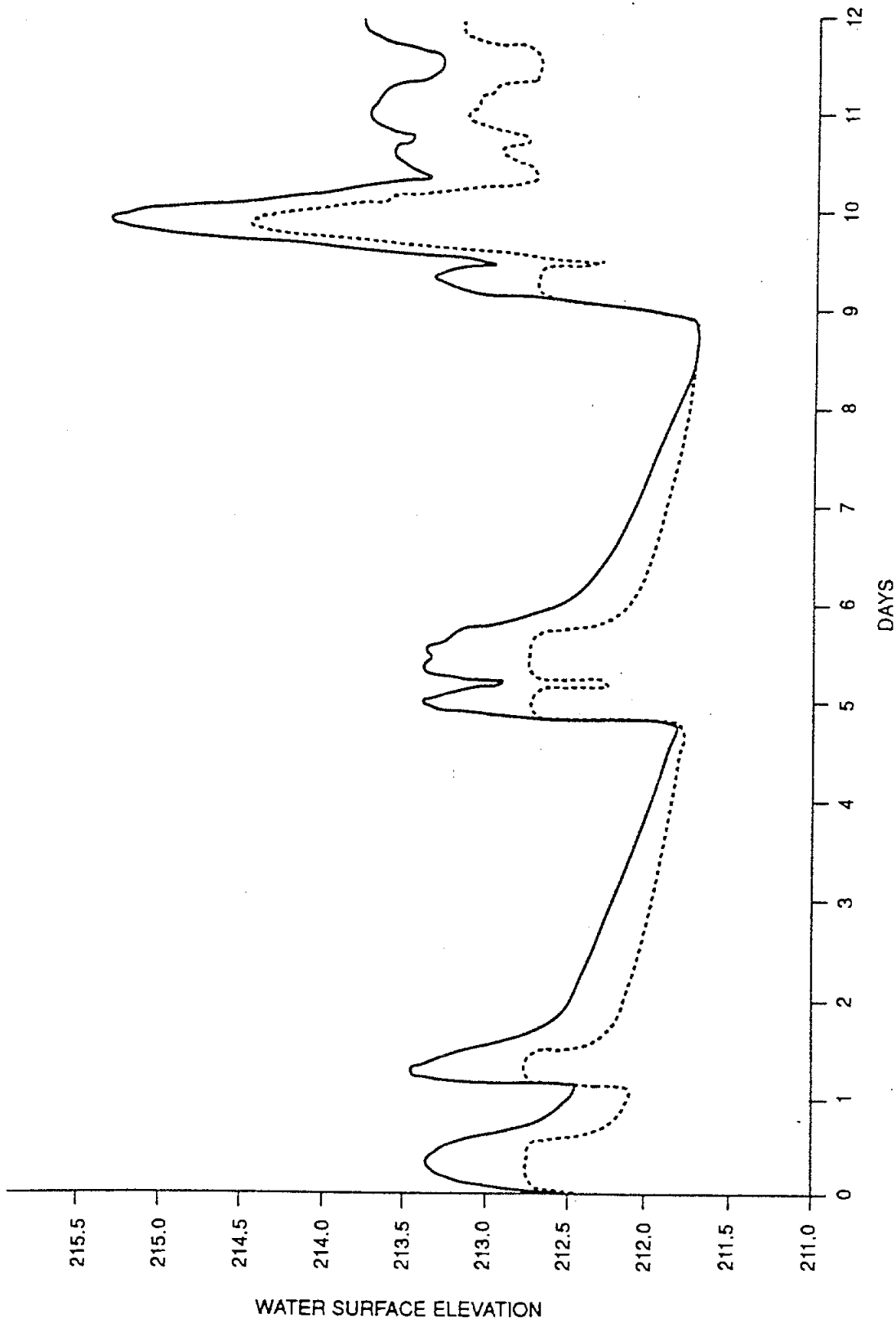


Figure 6.
 Estimated Water Surface Elevations at the
 Proposed North Creek Regional Detention
 Facility Following the Annual Storm

Alternative D
 No Facility



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Figure 5. Estimated Water Surface Elevations at the Proposed North Creek Regional Detention Facility Following Several Small Storms

Alternative D
 No Facility

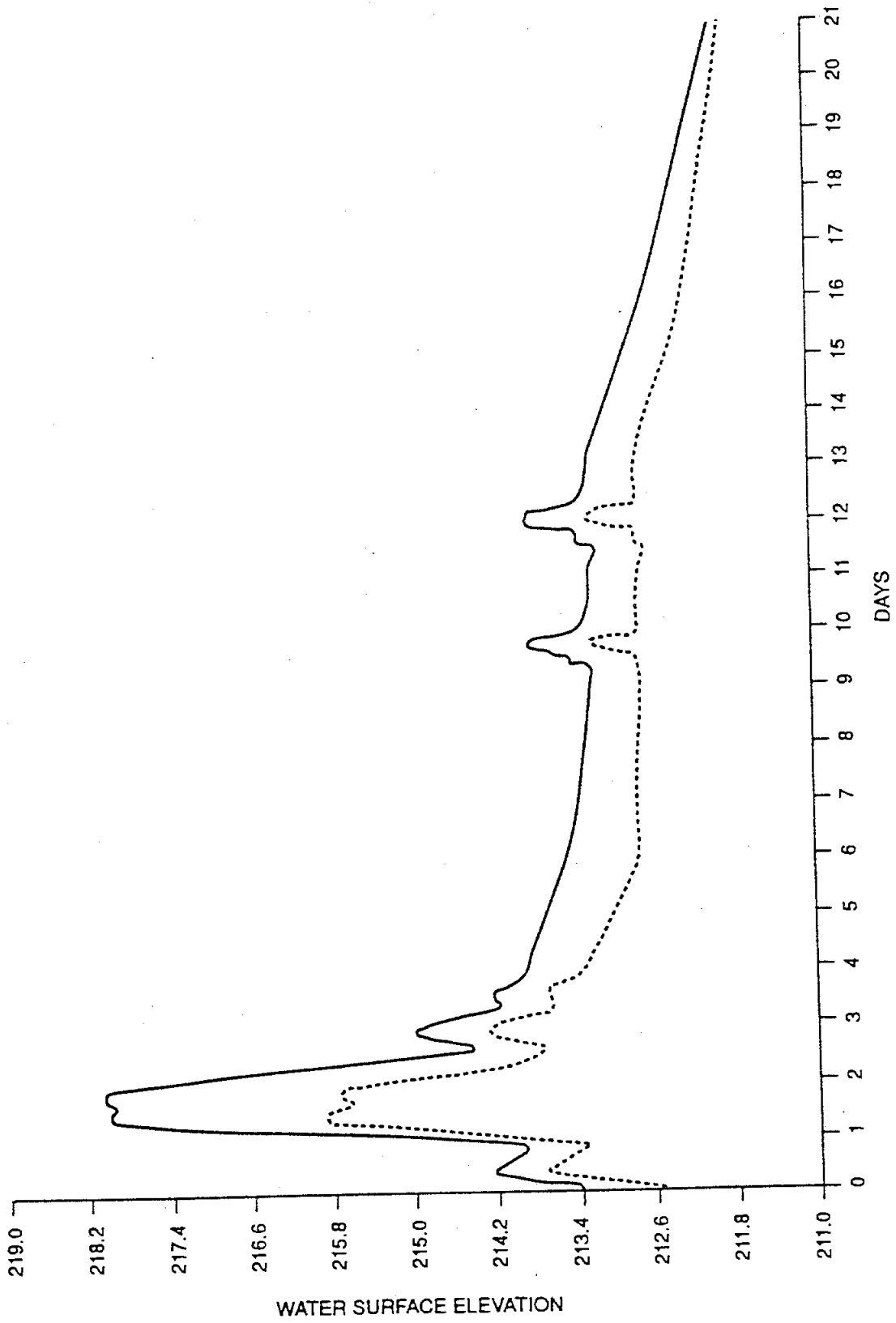


Figure 7. Estimated Water Surface Elevations at the East Branch of North Creek Regional Detention Facility