BEFORE THE METRO COUNCIL

FOR THE PURPOSE OF APPROVING A REFINEMENT PLAN FOR THE NEWELL CREEK CANYON TARGET AREA AS OUTLINED IN THE OPEN SPACE IMPLEMENTATION WORK PLAN	))))	RESOLUTION NO. 96-2309 Introduced by Mike Burton Executive Officer

WHEREAS, in July 1992, Metro completed the Metropolitan Greenspaces Master Plan which identified a desired system of natural areas interconnected with greenways and trails; and

WHEREAS, at the election held on May 16, 1995, the electors of Metro approved Ballot Measure 26-26 which authorizes Metro to issue $135.6 million in general obligation bonds to finance land acquisition and capital improvements pursuant to Metro's Open Spaces Program; and

WHEREAS, Newell Creek Canyon was designated as a Greenspace of regional significance in the Greenspaces Master Plan and identified as a regional target area in the Open Space, Parks and Streams Bond Measure; and

WHEREAS, in November 1995, the Metro Council adopted the Open Space Implementation Work Plan, which calls for a public "refinement" process whereby Metro adopts a Refinement Plan including objectives and a confidential tax lot specific map identifying priority properties for acquisition; and

WHEREAS, Resolution No. 95-2228 authorizes the Executive Officer to purchase property with accepted acquisition guidelines as outlined in the Open Space Implementation Work Plan, now therefore,

BE IT RESOLVED,

That the Metro Council adopts the Newell Creek Canyon Refinement Plan, consisting of objectives and a confidential tax-lot-specific map identifying priority properties for acquisition, authorizing the Executive Officer to begin the acquisition of property and property rights as detailed in the Open Space Implementation Work Plan adopted in November 1995 and in Resolution No. 95-2228.

ADOPTED by Metro Council this 11th day of April, 1996.

Jon Kvistad, Presiding Officer

Approved as to Form:

Daniel B. Cooper, General Counsel

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Staff Report

CONSIDERATION OF RESOLUTION NO. 96-2309 FOR THE PURPOSE OF APPROVING A REFINEMENT PLAN FOR THE NEWELL CREEK CANYON TARGET AREA AS OUTLINED IN THE OPEN SPACE IMPLEMENTATION WORK PLAN

Date: March 21, 1996 **Presented by:** **Charles Ciecko**
Jim Desmond

BACKGROUND AND ANALYSIS

The Target Area description in the Bond Measure Fact Sheet (authorized by Council Resolutions 95-2113, 94-2050 and 94-2029B) is as follows:

> "Newell Creek Canyon. Acquire 370 acres for natural area park."

In the 1992 Greenspaces Master Plan, the Newell Creek Canyon area is described as follows:

> "Nearly pristine canyon area including large old trees and great habitat diversity. One of the highest quality stream canyons in southeast portion of metropolitan area."

Target Area Description

Newell Creek Canyon lies in the transition zone between Clackamas County and the eastern most limits of Oregon City. The canyon is roughly bounded on the north by Abernethy Road and Redland Road and on the south by Beaver Creek Road. Oregon Highway 213 bisects the canyon in a north/south direction, forming a barrier within the canyon from east to west. Newell Creek Canyon is an important visual asset to the Highway 213 corridor.

Newell Creek Canyon is a relatively intact upland forested habitat that has been logged in the past and is presently dominated by deciduous trees (mostly red alder and bigleaf maple) with scattered conifers (mostly Douglas fir and western red cedar). Various age classes of trees are present in the canyon because of past disturbances and timber harvest activities, including recent harvest on some parcels. Unique and important features of the canyon from a biological perspective include the size of the contiguous undeveloped land within the canyon and the presence of native populations of resident and anadromous fish.

The steep forested slopes of the upper canyon provide an intact canopy for Newell Creek and its tributaries, except in the vicinity of the powerline route which traverses the canyon in the southern portion. It is believed that flow in the upper canyon may be augmented by point sources of discharge such as springs or seeps (Watershed Applications, 1994). The downstream reaches of Newell Creek are less steep and provide spawning and rearing habitat for native anadromous fish such as coho salmon and steelhead. Newell Creek's fishery value has diminished over the last 20 to 30 years as water quality within the watershed has been degraded due to development in the upper watershed. Development

has increased peak stormwater discharges into the canyon, allowing siltation/scouring to occur, and changing the hydrology and subsurface drainage patterns into the canyon.

Refinement Process

The Open Space Implementation Work Plan adopted by the Metro Council in November 1995, required that a Refinement Plan be submitted to the Council for approval for each target area. The Refinement Plan will contain objectives and a confidential tax lot specific map identifying priority properties for acquisition, enabling Metro to begin the acquisition of property and property rights as detailed in the Open Space Implementation Work Plan and in Resolution No. 95-2228. Resolution No. 95-2228 "authorizes the Executive Officer to acquire real property and property interests subject to the requirements of the *Acquisition Parameters* and *Due Diligence* guidelines of the Open Space Implementation Work Plan."

- During the refinement process, available information about the target area was compiled, maps analyzed and biological field visits conducted. Fourteen individuals were interviewed representing various governmental agencies, property owners, interested friends groups, and natural resource experts. The key issues regarding land acquisition are summarized in Appendix A.

General objectives to guide Metro's land acquisition efforts throughout the target area include:

- Preserve large blocks of contiguous forested land along Newell Creek and its tributaries for wildlife habitat, water quality, scenic and recreational values.
- Preserve springs, seeps, beaver ponds and wetland areas associated with Newell Creek.
- Establish pedestrian and wildlife linkages between two sides of the canyon split by Highway 213.
- Protect views of the canyon as seen from Highway 213.
- Provide a transition or buffer zone between Newell Creek Canyon and urbanizing areas.
- Where feasible, link the canyon to dedicated open space land within adjacent developments.

Findings

Refinement process activities clearly indicate that land acquisition in the canyon will not be sufficient to protect Newell Creek and its associated fishery value. An integrated storm water management plan for developing lands upstream and adjacent to the canyon will be a critical factor in avoiding continued decline in water quality and subsequent loss of resident and anadromous fish resources. Approximately three quarters of the edge of the canyon rim and a large portion of the upper watershed lies within developed or developing lands within the city limits of Oregon City. Since the Oregon City land use laws do not include provisions for post-construction on-site stormwater detention facilities, and the recently drafted Oregon City Erosion Control Ordinance is not fully enacted, a key component of protecting the Newell Creek Canyon target area will involve working with Oregon City to coordinate stormwater management efforts.

The area identified for acquisition/protection (approximately 900 acres) is a regionally significant natural area due to its wildlife, fish, water quality, scenic and recreational values. Metro's land acquisition efforts must be prioritized to provide the most effective protection

possible with the available resources. Given the situation with Oregon City and the finding that all lands within the canyon are critical for protection, one approach to land selection for acquisition may involve acquiring those lands currently under developmental pressure.

However, complete protection of the natural resources will require a combination of strategic purchases and partnerships with agencies and private land owners adjacent to the canyon. Prioritized specific objectives for land acquisition efforts within the Newell Creek Canyon target area are enumerated in this report.

Regional Parks and Greenspaces Advisory Committee

A presentation of the staff report was given by Metro staff and consultants at a public meeting in Room 370A of Metro Regional Center on March 19, 1996. The Committee stated a strong concern regarding Oregon City's stormwater management policies, their impact on Newell Creek Canyon, and the need for further study of the issue. This analysis and the resulting objectives were approved by a unanimous vote of the Regional Parks and Greenspaces Advisory Committee.

GOAL:

Create a future regional park site of approximately 900 acres located within Newell Creek Canyon, that will protect the unique natural features and water quality of Newell Creek.

OBJECTIVES:

The following are prioritized specific objectives of the Newell Creek Proposed Refinement Plan.

Tier I Objectives:

(370 acres)

- Acquire large blocks of contiguous forested land along Newell Creek and its tributaries for protection of wildlife habitat.
- Acquire steeply sloped canyon land and upper canyon lands for water quality protection.
- Acquire parcels with springs, seeps, beaver ponds and wetland areas associated with Newell Creek.

Tier II Objectives:

- Establish pedestrian and wildlife linkages between the two sides of the canyon split by the Highway 213 bypass.
- Protect views of the canyon as seen from Highway 213 by acquiring lands adjacent to the road.

Partnership Recommendations:

- Work with Oregon City and Clackamas County to coordinate stormwater management in the Newell Creek watershed.
- Acquire parcels in key locations for their potential future use in establishing remedial stormwater treatment facilities constructed by others.
- Pursue partnership opportunity with the State of Oregon, school district, and Oregon City for coordinated management of public lands.
- Work with Oregon City and local homeowners' associations to secure dedicated open space lands within adjacent developments.
- Work with private landowners to explore opportunities for easements or acquisition to protect steeply sloped upper ravines within residential zones (primarily on western side of the canyon within Oregon City).

Executive Officer's Recommendation

The Executive Officer recommends passage of Resolution No. 96-2309.

APPENDIX A

Summary of Comments from Stakeholder Interviews

- Water quality of Newell Creek and Abernethy Creek is being impacted by development in the upper watershed.
- There are inadequate stormwater detention requirements within the Oregon City jurisdiction coupled with an increase in the development of impervious surfaces within the watershed. Clackamas County now requires stormwater detention with strict regulations (they require on-site detention of a 25-year storm).
- There was a high degree of consensus that all of the undeveloped land within the canyon should be considered for protection.
- Many voiced the opinion that two key parcels Metro should acquire are the Newell Creek Apartment site and a commercially zoned 2.2 acre parcel along Beaver Creek Road west of the apartment site.
- Metro may be able to protect ravines by securing easements or purchasing portions of residential lots.
- Some key (and large) parcels within canyon may not have willing sellers.
- There is a significant (large) land holding within the canyon that is owned by ODOT.
- Within developments surrounding the canyon, there are lands that will be dedicated as open space to Oregon City or remain under the control of homeowners' associations. It may be possible for Metro to secure linkages to these open spaces or in some cases work with Oregon City to have the dedicated open space lands transferred to Metro ownership.
- The confluence of Newell Creek and Abernethy Creek was identified as a key area for protection.
- Both Abernethy Creek and Tour Creek were mentioned as important drainages and wildlife corridors for potential linkages to the canyon target area.
- Several suggested that Metro consider acquiring parcels in key locations for the construction of future remedial stormwater treatment facilities. So much development has already occurred in the upper watershed without proper stormwater management that remedial efforts will have to be taken to correct past mistakes.
- There may be some partnership opportunities with Clackamas Community College in education, monitoring, management and stewardship of the canyon once land is secured. No land acquisition opportunities exist with the college.
- Some voiced the opinion that future trails allowing public access into the canyon would not be desirable because of the steep slopes and the need to let the natural system heal.
- A trail system which does not impact the core of the canyon may be possible along old RR corridor to east.

APPENDIX A

STAKEHOLDER LIST

Name	Project Association
Dan Zinzer Dept. of Transportation & Development Clackamas County 902 Abernethy Road Oregon City, OR 97045-1100 Phone: 650-3320 Fax: 650-3351	WN, CB, NC, CR
Judie Hammerstad County Commissioner Board of Commissioners Clackamas County Courthouse Annex 906 Main Street Oregon City, OR 97045 Phone: 655-8581	NC, CR
Michael Jones, Curator Cascade Geographic Society PO Box 398 Rhododendron, OR 97049 Phone: 503-622-4798	CB, WN, CR
Sue Doroff Riverlands Conservancy Director PO Box 8787 Portland, OR 97207-8787 Phone: 241-3506 Fax: 241-9256	CR, CB, WN
Wilmer Gardner Local Resident (Historian) 18512 Abernethy Lane Milwaukie, OR 18567 Phone: 656-2737	CB
Charlotte Lehan Wilsonville City Council 29786 SW Lehan Ct. Wilsonville, OR 97070 Phone: 682-09901	CB, WN

Key

WN= Willamette Narrows
NC= Newell Creek
CB= Canemah Bluffs
CR= Clackamas River

Name	Project Association
Gary Miniszewski Oregon Parks and Recreation Dept. 1115 Commercial St. N.E. Salem, OR 97310-1001 Phone: 503-378-6378 Ext. 276 Fax: 503-378-6447	WN, CB
Dick Vandershaff/Cathy Macdonald Nature Conservancy 821 SE 14th Portland, OR 97214 Phone 230-1221	CB, WN
Jimmy Cagen Natural Heritage Program 1115 Commercial St. N.E. Salem, OR 97310-1001 Phone: 503-731-3070 Ext. 332 Fax: 503-378-6447	CB, WN
Linda Dobson Office of Public Utilities City of Portland 1220 S.W. Fifth Ave. Portland, OR 97204 Phone: 823-4145 Fax: 823-3017	WN
Don Oakley Oakley Engineering 700 N. Hayden Island Drive Portland, OR 97217 Phone: 289-7411 Fax: 289-7656	CB
Mike Houck Portland Audubon Society 5151 N.W. Cornell Road Portland, OR 97210 Phone: 292-6855 Fax: 292-1021	WN

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Name	Project Association
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Bernie and Elaine Newland Farwest CPO 26850 Pete's Mountain Road West Linn, OR 97068 Phone: 656-6621	WN
Bob Rindy Oregon Dept. of Land Conservation and Develop. 1175 Court St. N.E. Salem, OR 97310 Phone: 503-373-0050	WN
Scott Nelsen Parks Director City of Canby PO Box 930 Canby; OR 97013 Phone: 266-2761 Fax: 266-9316	CB
Mike Butts Planning Director City of West Linn PO Box 651 West Linn, OR 97068 Phone: 656-4211 Fax: 656-4106	WN
Ken Worster Parks Director City of West Linn 4100 Norfolk St. West Linn, OR 97068 Phone: 557-4700 Fax: 657-3237	WN

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Name	Project Association
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Gary Spanovich PO Box 1067 Canby, OR 97013 Phone: 266-8996 Fax: 263-3742	WN, CB
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Tom Kaffun / Diane Campbell North Clackamas Parks & Recreation District 11022 SE 37th Milwaukie, OR 97222 Phone: 794-8002 Fax: 794-8005	CR

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Name	Project Association
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Norm Scott Clackamas County Planning & Urban Renewal 902 Abernethy Road Oregon City, OR 97045 Phone: 650-3355	CR

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Name	Project Association
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Riz Bradshaw Sheriff's Marine Patrol 22234 Kaen Road Oregon City, OR 97045 Phone: 656-0668	CR
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Name	Project Association
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Wayne Lei, Boardmember John Inskeep Environmental Learning Center Portland General Electric 121 SW Salmon Portland, OR 97204 Phone: 464-8000	NC
Patrick Wright U.S. Fish & Wildlife Service Oregon State Office 2600 SE 98th, Suite 100 Portland, OR 97266 Phone: 231-6179 Fax: 231-6195	CR
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Name	Project Association
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Randy Roop, Vice Chair Friends of Barton Parks and the Scenic Clackamas River PO Box 2177 Clackamas, OR 97015-2177 Phone: Work- 669-3273 Phone: Home- 631-2827	CR
Hazel Stevens Friends of Barton Park and the Scenic Clackamas River Friends of Clackamas River 27001 SE Suttle Eagle Creek, Oregon 97022 Phone: 637-3223	CR

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Appendix B

Newell Creek Proposed Refinement Plan Public Workshop
Carnegie Center, Oregon City
March 14, 1996

Comments and Questions:

Is there any large wildlife left in Newell Creek Canyon?

Metro staff said that it had heard of a resident elk herd, but that no one has reported any sightings recently.

Tour Creek (on the map) is also called Livesy Creek.

Metro staff stated that Metro maps usually conforms with the USGS maps, which call it Tour Creek.

An Oregon City planner wanted the audience to know that some areas in the #2 Area on Metro's map are not included in any of the city's sewer service plans, due to difficulty of terrain.

Metro Staff explained the prioritization of the different numbered areas on the refinement plan map.

A comment was made from the audience that Area 1 is where acquisition priorities should be because Area 2 faces less development threat - hard to build due to topography, soils, etc. Newell Creek is where Metro should concentrate.

A comment was made that Area 2, for the above reasons, may be less expensive, therefore larger acreages may be purchased, so Metro should also consider that factor.

Has the city indicated if they want to sell their property in Area 1?

Metro staff indicated that there has been no dialogue with Oregon City on that and that Metro would not purchase public property, but partnership opportunities may certainly exist. An Oregon City planner indicated that they have had some discussion with Metro Greenspaces about dedicated lands and would be happy to work with Metro on acquired parcels.

A member of the audience cited a 1990 questionnaire circulated by Oregon City Parks and Recreation and stated that a majority of the respondents support a large park in Newell Creek Canyon.

Is there anyone in your group working on the FEMA project and is there a chance of using the funds for stormwater erosion damage?

Metro staff explained Metro's involvement in the project and said that Oregon City may be the more appropriate entity to address the stormwater issue.

A comment was made that if no one can see or use the acquired lands, it does not make sense to purchase it. They suggested a trail from the Oregon Interpretive Center to Abernethy Creek and then Newell Creek. A member from a Newell-Abernethy committee said they were already working on that and invited everyone to their next meeting, and asked for a mailing list from the public workshop.

A member of the audience suggested that a vacant restaurant site called the Copper Kettle (or TD's) overlooks the parcels Metro owns and would make a good acquisition.

How would partnership opportunities work on commercial properties?

Metro staff responded that we would most likely not purchase commercial properties but they will figure in the overall strategy and easements may be more appropriate in some cases.

What do you mean by greenspaces? What will we do with them?

Metro staff discussed the parks and openspace policy, including stabilization, landbanking and partnerships.

If you purchase and own Newell Creek Canyon, who will police it, fight fires, etc.?

Metro staff explained that fire management is one of the things considered in purchases, and that we will be in the same position as the current owner when it comes to policing, etc.

Are you aware of how the timber on the land and its management affects water quality?

Metro staff responded that we are, and discussed the need for individual management plans for each area.

A comment was made that we sometimes use the land wisely by leaving it alone and that Newell Creek Canyon especially needs time to heal. This would benefit the community.

An Oregon City planner discussed the problems with 4-wheel drive vehicles and dismantled vehicles in the middle of the creek. She said it was depressing.

Metro staff indicated that they would take action if 4-wheel drives were on Metro land.

A planner said that Oregon City is starting to require fencing on properties along the canyon rim to help them recover.

A member of the audience asked if Metro was involved in the Oregon City Urban Renewal Plan and discussed Dale's Wrecking Yard.

Metro staff indicated that we have not been involved in the local plan, but wrecking yards and such are one of the challenges we must address.

Is there a possibility of using Superfund money on the sites?

Metro staff explained that many designated Superfund sites have not been funded yet and the DEQ is the agency most involved.

A member of the audience asked about land around the cemetery.

Metro staff indicated that they will be meeting with the mayor of Oregon City on that.

A member of the audience asked about development problems such as dogs and their impact on wildlife.

Metro staff said that is addressed as a land management issue.

WILDLIFE DYNAMICS
3559 N.E. Stanton St.
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APPENDIX C

METRO - OPEN SPACES REFINEMENT PROCESS
Biological Resources Overview of Target Areas
NEWELL CANYON

Prepared for:

Metro - Open Spaces Program
600 Northeast Grand Avenue
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Prepared by:

Wildlife Dynamics, Inc.
David R. Smith
3559 Northeast Stanton Street
Portland, Oregon 97212

March 15, 1996

METRO - OPEN SPACES REFINEMENT PROCESS
Biological Resources Overview of Target Areas
NEWELL CANYON

March 15, 1996

INTRODUCTION

This report documents findings of the initial biological resources investigation of the Newell Canyon target area where land acquisition is proposed as part of the Metro - Open Spaces Program. The target area for this investigation was intentionally identified by general location only. This strategy allows Metro the flexibility to assess a relatively large number of parcels in a given region for the possibility of selecting the most desirable land in a willing-seller program.

Wildlife Dynamics, Inc. (WDI) conducted the preliminary biological resources investigations on the general target area. Objectives of the investigation were to gather existing biological information, interview individuals with knowledge of the area, perform a general habitat evaluation (using a target area perspective), identify unique or important habitat features (using a narrower perspective), and identify specific sections within the target area that should be investigated in greater detail. Criteria established in the Greenspaces Master Plan, bond documents, and Metro Council resolutions were used as guidelines for target area assessments. The results of the initial study were utilized to prepare for public meetings and to assist Metro in their land acquisition refinement process.

The following is the results of the initial biological resources investigations for the **Newell Canyon**.

Newell Canyon is a relatively intact upland forest habitat that has been logged at least once and is presently dominated by deciduous trees (mostly red alder and bigleaf maple) with scattered conifers (mostly Douglas-fir and western red cedar). Various age classes of trees are present in the canyon because of past disturbances and logging activities, including logging on some parcels in the past few of years. Individual mature trees are found in only a few scattered locations.

The canyon, in its existing condition, easily meets all of the refinement process criteria for determining important target sites. The most unique and important feature of the canyon from a biological perspective is the size of the contiguous undeveloped land within the canyon. The maintenance of the contiguous forest should be one of the principle issues considered when selecting parcels to protect. The second important issue is water quality of the watershed. Increasing development in the watershed will contribute to the existing problems associated with

storm water runoff, i.e. sediment loading, slope failures, pollutants, modified hydrology, and degraded aquatic habitat. Maintaining undeveloped land within the canyon, particularly in headwater areas, will assist in alleviating some future water quality problems. However, without a comprehensive watershed management plan, the increasing development in and around the canyon will continue to degrade the aquatic resources.

All parties contacted about the study area stated that all undeveloped land within the canyon should be considered for protection.. Habitat features and areas of significance that were mentioned the most include:

- secure connection with those areas that are already set aside as open space (i.e. dedicated open space from recent residential developments, the city cemetery, etc.)
- existing forest habitat along drainages and unstable slopes
- the ODOT parcel appears to be significant to secure
- securing the forested habitat of the school and adding parcels to that portion (north side) of the canyon
- protect wetlands, seeps, and springs
- confluence of Newell and Abernathy creeks
- give priority to lands inside the UGB; and
- undeveloped headwater areas for water quality issues and possible storm water detention facilities.

Persons Interviewed and general comments:

Todd Moses, PGE Biologist

- is concerned with existing and future water quality and storm water issues and their affects on the Newell Creek watershed site (see Moses, September 1994, Appendix A)

Joe Pesek, ODFW Biologist

- states the whole canyon is important and all land should be considered for protection
- stresses looking at recently flooded parcels

Holly Michaels, ODFW Biologist

- agrees the whole canyon is important and all land should be considered

Greg Robard, ODFW Biologist

- states the whole canyon is important and all land should be considered; and

Sha Shady, Friends of Newell Canyon

- considers the whole canyon important
- a watershed management plan must be completed.

Appendix A

A Reconnaissance Assessment of Geomorphic and Riparian Zone Conditions, and Preliminary Rehabilitation Recommendations, Upper Newell Creek

A RECONNAISSANCE ASSESSMENT OF GEOMORPHIC AND RIPARIAN ZONE CONDITIONS, AND PRELIMINARY REHABILITATION RECOMMENDATIONS, UPPER NEWELL CREEK, OREGON CITY, OREGON

September 1994

The following narrative presents my findings concerning geomorphic and riparian zone conditions in and along the channel of Newell Creek in the vicinity of the Newell Creek Overlook Apartments site (hereafter referred to as the "apartment site"). A reconnaissance-level evaluation of this area was conducted on July 19 and August 3, 1994. The entire length of channel (including conditions along lower valley sideslopes) within the project area was evaluated. Immediately adjoining upstream and downstream channel segments within a few hundred feet of the property limits were also investigated.

LOCATION

The subject area conforms to the uppermost part of Newell Creek Canyon within Section 4, T.3 S., R.2 E., Clackamas County, Oregon (Figure 1). The upstream end of the study area is bounded by the junction of Beavercreek Road on the south and Highway 213 (bypass) on the east, although conditions immediately upstream of the culvert east of Highway 213 were also investigated. The study area is bounded on the downstream end by the BPA powerline easement (marked in the field by overhead powerlines); the stream reach immediately downstream of the easement was also assessed. Channel distance on the apartment site measures approximately 1700 feet on the large-scale site plan of the project area; actual channel distance is greater than this because of the presence of more than one channel in places and because of channel bends not shown on the map.

GENERAL CHANNEL AND WATERSHED CONDITIONS

Flow Conditions

The U.S. Geological Survey 7.5-minute quadrangle of this area (*Oregon City, Oreg.*, 1985) incorrectly shows a blueline (perennial) stream extending only about one-half of the distance upstream between the BPA easement and Beavercreek Road. In fact, a distinct channel extends all the way to the 48-inch corrugated metal culvert outfall under Highway 213 (at its junction with Beavercreek Road). Newell Creek, now channelized, continues upstream of the culvert along Beavercreek Road. Judging by conditions in late July and early August (in a very dry year), the entire length of stream that was evaluated supports perennial flow. Flow upstream of the culvert was estimated at no more than 1/2 cubic feet per second (cfs) on July 19.

While not actually measured, flow in Newell Creek appeared to be substantially greater downstream of the Highway 213 outfall than it was at the inlet to the culvert. This suggests that flow in the upper canyon may be augmented by point sources of discharge such as springs, seeps or even other stormwater outfalls.

The current (1994) planning document for the apartment site indicates that the contributing area upstream of the project area (upstream of Highway 213) is 435 acres (0.68 square mile). The 25-year peak flow in Newell Creek in the vicinity of the site, under existing conditions, is estimated at 173 cfs. Since the upstream area will continue to urbanize, the future peak flow from the 25-year storm event is estimated to be in the vicinity of 200 cfs. Upper Newell Creek can therefore be expected to experience more frequent and higher peak flows, and lower summertime base flows, as the watershed is developed. In my opinion, only increased reliance on source area re-infiltration of rainwater and reduction in impervious surfaces, practiced over the entire catchment, can moderate these interrelated impacts.

Valley Form

Upper Newell Creek at the apartment site flows through the head of a steep-sided, north-south trending canyon. This dissects an elevated, gently rolling surface reportedly underlain by the Boring Lava, Missoula

Flood deposits, Troutdale formation, and Sandy River Mudstone (Scott Burns, editor, *Environmental Assessment of Newell Creek Canyon, Oregon City, Oregon*, Portland State University unpublished report, January 1993; John McDonald, *Newell Creek Overlook Apartments Soil Investigation*, August 25, 1994). The transition from the canyon to the rolling upland occurs in the vicinity of the Highway 213 and Beavercreek Road intersection.

The uppermost canyon segment of Newell Creek can be described as a channeled colluvial valley where the valley bottom width is approximately the same as the active (regularly flooded) channel width (there is essentially no floodplain). The steep hillsides generally impinge on the active channel. The valley floor is only slightly sinuous and valley gradient (map value) through this segment is on the order of 20% (11 degrees). Valley bottom and active channel width average roughly 10-15 feet, although there are wider and narrower areas and occasional multiple channels.

Valley gradient declines to about 10% (5-6 degrees) downstream and valley bottom width also generally increases in this direction; average channel width remains about 10-15 feet or so. In general, this lower part of the canyon within the apartment site is a steep alluvial valley where the stream flows through a valley fill of alluvium it has deposited and reworked, although in other areas the channel still trenches hillslope colluvium and occasionally clay- or silt-rich soft bedrock.

Valley sideslopes are for the most part steep although locally there are benched areas suggesting prehistoric landslides. Sideslopes are indented by broad or narrow hillslope hollows (steep draws) which are largely unchanneled.

Channel Type

USGS mapping indicates that upper Newell Creek is a first-order stream channel (it has no tributary channels). The local bedrock types have supplied substantial quantities of boulder, cobble and gravel-sized materials to the valley floor. Stream substrate therefore remains predominantly coarse-grained despite the modern influx of fine sediment (mainly silt). Modern silt deposits have overwhelmed or replaced coarse alluvium in places, especially downstream of the property boundary (downstream of the beaver dam, see below).

While there is no single, accepted stream channel typing scheme, two approaches are used here to characterize channel type. These are the system developed by Dave Rosgen ("A classification of natural rivers", *Catena* 22: 169-199, 1994) and that developed by David Montgomery and John Buffington for Washington's Timber/Fish/Wildlife (TFW) program (*Channel Classification, Prediction of Channel Response, and Assessment of Channel Condition*, report no. TFW-SH10-93-002, Washington Department of Natural Resources, June 1993). Definition of channel type has utility chiefly because general patterns of sensitivity to disturbance, sediment supply, and erosion potential – along with recovery and restoration potential – are associated with different stream types.

According to the Rosgen stream classification system, channel type in upper Newell Creek canyon changes from a steep, boulder-bed A2 channel in the uppermost part of the apartment site to a moderately steep cobble-bed B3 channel downstream to the vicinity of the beaver pond. These channel types are relatively stable and channel margins typically do not contribute much sediment to the stream. Localized areas within these channel types which have accumulated fine sediment deposits, or locally trenched colluvial toeslopes. do, however, remain prone to continued bank erosion.

The channel immediately downstream of the beaver pond area has incised into a relatively thick sequence of modern fine alluvium and would generally be described as an entrenched G6 or F6 type channel according to the Rosgen system. Such channels are quite sensitive to continued upstream disturbances such as changes in streamflow or sediment load, are subject to high channel bed or bank erosion, and have low recovery potential even if watershed conditions improve.

The TFW classification system would describe the uppermost, canyon-head reach of Newell Creek as a cascade channel, where gradient is very steep (8-30%), the substrate is dominated by boulders, the diameter of the largest particles is greater than bankfull depth, and flow tumbles between small, closely-spaced pools.

This is a highly stable channel type which accumulates little fine sediment but acts as a zone of transport for sediment from upstream and upslope sources. These channels are supply limited, meaning that local sediment supply is less than available transport capacity (because of the coarse substrate). Cascade channels are highly resilient to changes in discharge or upstream sediment supply because particles are essentially immobile during all but exceptionally high flows (which do not naturally occur in this headwater location).

As gradients flatten downstream, this channel type is replaced by the step-pool channel type. Step-pool channels are characterized by moderately steep gradient (3-8%) and exhibit a boulder/cobble substrate which is organized into channel-spanning accumulations leading to a pool spacing of roughly 1-4 channel widths. This is also a stable, supply-limited channel type, again because the large particle sizes dominating the channel bed and banks are immobile under most flow conditions. This type of channel also functions mainly as a zone of sediment transport and tends to reorganize itself relatively quickly into a new, stable configuration after channel disrupting events. Large woody debris (LWD) contributes substantially to a stepped morphology (now called a step-bed channel) in more or less intact systems under conifer forest cover. It is important to note that the stream segment of this general type on the subject site has been disturbed by land use practices during the recent past and, while essentially stable, does not everywhere exhibit the type morphology.

The incised channel downstream of the beaver pond appears to inexactly conform to what the TFW method would term a plane-bed channel type (or "glide" type channel) in that gradient is reduced, depositional bedforms and pools are essentially absent, and the streambed is armored with gravel-sized materials. Reduced gradient may reflect a stable downstream nickpoint and the streambed gravels in this area are here heavily embedded in a matrix of very fine sediment. Sluice-like plane-bed channels are typically not very resilient and may be subject to channel aggradation or degradation with changes in discharge or sediment supply.

Existing Vegetation Cover

Upper Newell Creek canyon is presently covered with regrown forest vegetation; the canyon has reportedly been logged more than once (Burns 1993). Overstory vegetation in the upper canyon area consists mainly of mature bigleaf maple and alder trees with scattered mature conifers, especially western red cedar. Understory woody vegetation consists of salmonberry, elderberry, vine maple, hazelnut, oceanspray, snowberry, salal and cedar saplings. Huckleberry occurs occasionally, growing mostly on large dead wood; red twig dogwood and ninebark also occur along the channel in the forested area. Groundlayer herbaceous vegetation is dominated by swordfern and saxifrages. While this groundcover superficially appears dense, considerable mineral soil remains exposed between individual plants.

Vegetation changes abruptly in the vicinity of the downstream end of the property. Vegetation clearance along the powerline route, possibly along with natural valley widening and flattening, has allowed beavers to colonize the area. Beaver activity has created a relatively large pond and upstream alluvial flat or delta which is mostly covered with reed canarygrass. Himalayan blackberry thickets and willow and young alder trees grow around the pond perimeter.

HISTORIC ALTERATIONS TO VALLEY MORPHOLOGY

Although this area is well wooded, stream channel and lower hillslope conditions within upper Newell Creek canyon are far from pristine or even stable. Conditions along the lower valley floor must be viewed in the context of past land practices.

Observed conditions in and around upper Newell Creek canyon indicate that land use alterations and impacts conform to the typical post-European settlement pattern for this region. Logging and early agricultural practices evidently resulted in a high level of upland erosion and valley sedimentation which is reflected in modern valley infills of fine sediment wherever valley gradient is sufficiently low to permit it. Upland erosion rates were subsequently reduced as vegetation regrew and somewhat better land management practices were implemented. Streams adjusted to these new circumstances (reduced sediment supply) by incising the

recently deposited valley fill. This has left the G6/F6 or "plane-bed" type channel found downstream of the property below the beaver dam.

Large cedar stumps as much as 6-7 feet dbh and a few very large downed logs as much as 5-6 feet in diameter indicate that upper Newell Creek canyon supported old growth forest before it was logged. This forest condition was probably accompanied by a very stable step-bed channel morphology in the upper canyon, with LWD providing much of this stable channel architecture. Large woody debris accumulations also must have buttressed colluvial toeslopes, which are now not as stable as they were previously. Loss of buttressing and the superficial bank protection by LWD would typically accelerate and exacerbate shallow sliding/soil creep processes and bank cutting, respectively.

Such a stable channel configuration would have required a very long period to evolve. Although landslides may have periodically disrupted the channel downstream of the project area, disequilibrium was probably rare in this headwater location because of small stream size (low stream power) and the absence of channel-altering floods and debris flows because of small watershed area and the gentle terrain upstream. The annual streamflow regime would have been relatively even (not flashy) because of the absence of overland flow -- storm runoff must have been routed almost entirely through subsurface pathways on the forest-covered hillsides.

Although landslides probably occurred rarely and episodically, the remnants of old growth forest suggest that hillslopes must have similarly been in a generally stable condition for a long period prior to European settlement. An important factor in the stability of both hillsides and the channel was the presence of a thick and continuous forest floor (humus, duff and litter layer), which promoted both infiltration and subsurface runoff and prevented surface water erosion by rainsplash and rilling.

Although woody vegetation has regrown, both the valley floor and hillsides in upper Newell Creek canyon reflect the legacy of land use practices from the recent past. Both the channel and hillsides have yet to recover the stabilizing influences of substantial quantities of instream LWD and a well-developed forest floor. This recovery would be an exceptionally slow process under the most favorable circumstances (no development in the basin). Because existing and continuing development have irrevocably altered basin conditions (especially hydrology), the speed or even trajectory of recovery processes can no longer be fully predicted.

REACH-BY-REACH ASSESSMENT OF CHANNEL CONDITIONS

Upstream of Highway 213

Newell Creek extends upstream of the Highway 213 culvert as a ditch lined with young alder paralleling Beavercreek Road. The channel in the segment immediately upstream of the culvert is about 6-8 feet wide with steep channel banks (which are sloughing in places). The channel is floored with a substantial deposit of silt. Along with upstream sources, erosion from adjacent bank slopes (particularly around the culvert inlet) also contributes fine sediment to the channel.

Highway 213 Culvert Outfall Area

The actual culvert opening was not observed because of dense undergrowth but flow from what must be this culvert is discharged onto a chute-like concrete energy dissipator. This is undercut and suspended about 6 feet above a plunge pool. A concrete pipe (about 36 inches in diameter) emerges from the slope underneath the chute. This pipe outlets further downstream. Although broken near its end, this pipe also appears to be discharging flow, possibly from another source.

Uppermost Canyon -- Cascade Reach

Below the outfall(s), Newell Creek becomes the very steep boulder bed A2 or Cascade-type channel described previously. Root exposure, smaller areas which have been scoured to soft bedrock, and sediment and debris deposits indicate that high flows have scoured this area but have done little more than locally shift the coarse substrate.

This channel splits in places but soon reunites into a single dominant thread. While minor quantities of fine sediment from upstream intermittently accumulate behind boulders and other roughness elements in this reach, this sediment is moved on downstream during higher flow events.

Assuming the adjacent hillslopes remain vegetated and undisturbed, the channel through this area should remain stable even under anticipated, future peak flows because of the large size and packing of the substrate. Most high flows will only accomplish intermittent transport of gravel- and cobble-sized fragments. Larger boulders, which provide the dominant surface matrix through this reach, should remain immobile under virtually any anticipated flow event. This is demonstrated by the heavy moss growth on even relatively small boulders. Even the very large flow this past February, which was probably on the order of a 5-year or larger event, obviously failed to shift these rocks.

Apparently as a habitat enhancement measure, someone has locally imposed a stepped morphology in part of this area by cabling large rocks and logs together. However, because of the extremely steep gradient, the pools thus created are tiny and most of the drops between pools would be impassable to the fish capable of inhabiting the pools.

Step-Pool Reach (Cascade Reach to Beaver Pond)

Although disturbed, Newell Creek begins to assume the characteristics of a step-pool channel about 500 feet or so below the culvert outfall (distance not measured). Boulders and occasionally logs form channel-spanning structures and very small downstream pools in this reach. Large living roots also cross the streambed and form small pools in places. Large, complex pools with good overhead cover are absent.

Banks are generally stable through this reach, being protected by large particles, vegetation, or LWD. The streambed consists mainly of gravel, cobbles and small boulders which forms an armor layer which is stable under most flow conditions. The streambed is heavily embedded with fine sediment in most places. This further assists in increasing streambed resistance to erosion.

High flows are able to go out of bank in much of this area, reducing flow velocity and insuring stability. Localized bank erosion does occur in areas with minor infills of fine loose sediment which generally occur as low channel edge benches downstream of obstructions such as LWD. However, these areas are relatively small in size and are at least partially protected by standing trees, LWD, and understory vegetation. The channel impinges on steep, erodible toeslopes composed of colluvium in a few areas but channel banks are low and reasonably stable in most locations.

Temporary deposits of fine sediment veneers the streambed in places and some areas have accumulated a considerable thickness of silt, both upstream of structures and in downstream pools. This is an indication of a continuing high rate of fine sediment input during storm periods from the upper part of the basin (above the Highway 213 culvert). This material is awaiting easy remobilization by the increased flow this winter.

Only a few nickpoints occur in this reach, the largest (suggesting a headcut) within a tightly confined area. This drop consists of bedrock which has been augmented in height by large boulders and LWD. The drop is impassable to fish. The plunge pool downstream of this drop was the largest pool observed (about 400 square feet in surface area) but it lacks overhead cover and was loaded with loose silt.

Road Crossings. Two unsurfaced roads cross Newell Creek upstream of the beaver pond. The approach roads to both crossings are very steep and deeply rutted and must supply a large amount of sediment to the stream during rainstorms. Both roads were being used recreationally by four-wheel drive vehicles this summer.

The uppermost crossing is at least 500 feet upstream of the beaver pond. This is a Humboldt-type crossing consisting of large cedar logs laid side-by-side lengthwise in the creek in order to bridge the stream. This structure is trapping a large wedge of fine sediment at its upstream end and is also causing localized bank erosion adjacent to the structure.

The downstream crossing consists of a stream ford which crosses the creek at an acute angle just above the beaver pond area. By creating a low berm, the crossing has dewatered a portion of the cobbly natural channel immediately downstream, diverting the flow through an unstable, silt-floored new channel over a distance of nearly 50 feet. I observed a large amount of sediment released downstream when a vehicle crossed the stream at a high rate of speed (necessary because of deep mud in the ford as well as the steepness of the exit road). High flows will inevitably result in the downstream discharge of a large quantity of fine sediment from this area.

Beaver Pond

A large beaver pond occurs in the vicinity of the north property boundary and BPA easement. The dam forming the main pond is a substantial structure which is at least 6 feet high in places. The dam appears to be composed entirely of relatively small sticks and branches. A few much smaller beaver dams occur just downstream from the main structure. The delta of the main pond begins in the vicinity of the downstream ford just discussed. A large animal slipped unseen into the water when I first approached the pond and there was fresh evidence of beaver activity in the form of trails, gnawed green bark and wood chips.

It seems likely that vegetation clearance under the powerlines has been an important factor in allowing willows to thrive in this location, creating good conditions for beaver colonization. It is also possible (especially if the dam is not very well anchored) that only years of relatively low flood frequency conditions have allowed the beaver dam to persist here. On the other hand, the very large flow of this past February apparently failed to damage the dam.

While there was not sufficient time to make careful measurements, I believe that the open water portion of the main pond encompasses an area of at least 10,000 square feet. An equal size or larger area, mostly in the pond's delta, consists of saturated alluvium. This area is covered mainly with reed canarygrass. There are also a number of very large logs within the pond and delta complex.

Limited probing indicated a deep layer of silt within the flooded portion of the pond. The delta at the head of the pond also represents a huge wedge of unconsolidated, mostly fine sediment. I would conservatively estimate the amount of wet fine sediment trapped within this beaver dam complex to be on the order of at least 1500 cubic yards.

It may also be worth noting that this pond presents a considerable surface area to the sun. On a day when the ambient air temperature was only 74°F (August 3), I measured the water temperature in a shaded portion of the pond (at 6 inches depth) to be 65°F. Water temperature in the shaded channel upstream of the pond was 61°F at this time. Without speculating too much, it does appear that water heating in the pond could pose a potential impact to downstream water temperature with respect to fisheries, particularly as the pond continues to fill with sediment and shallow out. For now, water appears to discharge mainly from the lower part of the dam and this water may be somewhat cooler than the surface layer I measured.

The beaver pond represents mixed circumstances with respect to downstream sedimentation in Newell Creek. At the present time the pond is acting as a stilling basin and sediment trap, alleviating downstream sedimentation. However, as with all dams, if large quantities of fine sediment continue to be introduced to the canyon from upstream sources, this function has a definite (and probably rather short) lifespan. If the pond completely silts in it is likely to be abandoned by the beavers, increasing the risk of eventual dam failure. The beavers may also attempt to raise the height of the dam to maintain open water. This could result in both greater head from the backwater and a weakened structure.

Over the longer term, the beaver pond must pose a considerable risk with respect to downstream channel alterations and sedimentation. Breaching and failure of the beaver dam could result in a dam-break flood. The significance of this flood will depend in part on when it occurs with respect to background flow conditions, with the consequences being most severe if this occurs during a peak flow event. I've seen beaver dams which have failed during very high flows and this seems like a likely time for this to happen in this setting. No matter what countermeasures are taken within the watershed, both the magnitude and frequency of peak flows on Newell Creek are likely to increase in the foreseeable future, thereby increasing the risk of dam failure.

A dam-break flood would release a tremendous and concentrated slug of water and sediment downstream. Such a flow would cause channel scouring and the erosion of unconsolidated sediment deposits along the valley floor for a considerable distance downstream. A very high flow would also probably shift and perhaps transport any useful LWD in the downstream channel. The sudden discharge of a great quantity of sediment is likely to result in extensive aggradation and pool filling downstream, the effects of which could persist for a long period of time.

Channel Conditions Downstream of the Beaver Pond

Newell Creek downstream of the beaver dam complex was only briefly inspected over the first 500 feet or so because it is well beyond the downstream property line of the apartment site. The creek is deeply-entrenched and chute-like over the entire length examined. The stream follows a sinuous course through a relatively broad valley flat which is on the order of a hundred feet wide in some places. Channel banks are very steep to near vertical and are as much as 5 feet high. The active channel averages about 10-12 feet wide.

Streambanks throughout this area are essentially devoid of vegetation and are only rarely protected by LWD. Banks are generally composed of poorly consolidated silt or sandy silt representing the historic valley infill; sticks and logs embedded in this material attest to its relatively recent origin. Colluvium or cohesive clay form channel banks in smaller areas. I observed one small but fairly recent slide (involving at least 10 cubic yards of soil) in an area where the channel impinged on a steep slope cut in fine-textured colluvium.

Except for a few small LWD pieces and jams, the channel through this area is essentially devoid of structure. In confined areas, the substrate consists of heavily embedded gravel- and small cobble-sized material, although even in these areas there was often a thin veneer of loose fine sediment. Deep deposits of loose silt occur in somewhat less confined and lower gradient areas, completely burying any coarse substrate.

These conditions point to a chronic oversupply of fine sediment in this system which must continue into the foreseeable future. Fine sediments are unlikely to be flushed from substrate gravels in many places because these are so heavily embedded and tightly packed. Embeddedness results in a hydraulically smoother streambed surface, which is more resistant to erosion than the rock alone. Flows capable of flushing the silt from these surfaces would probably preferentially erode the streambanks composed of the unconsolidated modern fill which forms the valley flats.

This modern sandy and silty valley fill is highly erodible. The material has little strength when it is saturated (because of dilatancy) and it is not very well knitted together with plants roots. The valley flats are colonized mainly by stinging nettle, bracken, salmonberry, blackberry, along with a few shrubs, and these plants seem to form only very weak root structures. Deposits of loose silt collapsed from unconsolidated channel banks were also common in this reach. These deposits are in a highly erodible condition before the onset of higher flows in the fall because they become very friable as they dry out.

Although incised, the stream channel in this area does not now appear to be degrading vertically so much as horizontally (widening). (This overall tendency can only be confirmed by continuing this survey downstream.) The channel floor appears to be well armored in most places by heavily-embedded gravels and no small headcuts were observed. On the other hand, outer bend banks were on the verge of collapsing in places or were experiencing grain-by-grain erosion in others. Small points bars of loose sediment were present on inner bends. This reach, and any reach in this basic condition, is likely to remain a chronic source of fine sediment for the foreseeable future even if there were no further change in basin condition. Because of susceptible banks and high channel confinement (leading to high stream power), any increase in the number and magnitude of high flows on Newell Creek can only increase the erosion rate in this area.

RIPARIAN VEGETATION WITH RESPECT TO PHYSICAL SITE CONDITIONS

Among the principal functions of the riparian zone with respect to physical site conditions are: 1) the long-term supply of LWD for channel stability and sediment storage sites; and 2) the provision of shade for water temperature moderation. Canopy closure (overhead shade) with respect to the stream channel should exceed about 70% in lowland streams for stream temperatures to be effectively moderated (Washington Forest

Practices Board, *Standard Methodology for Conducting Watershed Analysis*, TFW/Department of Natural Resources publication, October 1993). Newell Creek upstream of the beaver dam is well shaded, with summertime canopy closure exceeding 90%.

Large woody debris can be considered to include logs over 4 inches in diameter and 6-7 feet in length, root wads (stumps), and sizable woody debris jams. The best LWD for channel stability consists of large logs at least 12 inches in diameter (preferably much larger) of conifer species, especially western red cedar. Hardwood logs are not only generally smaller than those from conifers but quickly decay in the stream. Most in-channel LWD is recruited from a zone less than 100 feet wide along both sides of the channel. This 100-foot wide zone on either side of the channel is also generally judged most important for channel shading, aquatic food supply, and potential for buffering sediment delivery from upslope sources.

Instream accumulations of LWD are currently inadequate in upper Newell Creek because of past logging practices and channel disturbance. However, western red cedars, including both mature individuals and saplings, do occur along lower valley sideslopes in locations where they will eventually be able to enter the channel. Nevertheless, the potential for future recruitment of useful LWD to the stream remains inadequate because of 1) the general scarcity of these trees, 2) the long delay until their eventual recruitment into the stream as large material, and 3) the limited quantity (with some notable exceptions) of large pieces of already down LWD in the immediate vicinity of the channel.

On the other hand, LWD is less critical to channel stability in most of the upper canyon because the channel is effectively armored with large particles in this area. Furthermore, LWD contributed to those portions of the channel which have deeply incised into fine alluvium, such as downstream of the beaver dam, would probably not provide useful instream structures. Large pieces are more likely to bridge sluice-like channels and could also locally accelerate erosion if distributed more or less parallel to the flow within an incised channel.

STABILITY OF LOWER HILLSLOPES ABOVE THE ACTIVE CHANNEL

Hillslopes in this canyon are quite steep, ranging between about 20% (11 degrees) and 60% (31 degrees). Slope facets locally exceed 70% (35 degrees; measured with a clinometer). Many of these steepest segments occur within a pit-and-mound microtopography (see below), are largely devoid of vegetation and litter, and are subject to erosion by rainsplash.

Hillsides are mantled with erodible colluvial soils with a silt loam surface texture and generally have only a poorly developed forest floor to protect the mineral soil from surface water erosion. Although incomplete, soil surface protection is still provided by groundlayer vegetation and the sparse litter cover. This is sufficient to protect most areas from significant surface erosion in the absence of concentrated use by people.

The "pistol-butt" growth form (tree trunks curved downslope) seen in some mature western red cedar trees growing on steep lower valley sideslopes is suggestive of active soil creep (although this indicator can be somewhat ambiguous). In addition, an undulating pit-and-mound microtopography found on hillsides in many areas may be indicative of either or both logging disturbances and mass failures. Studies have described evidence of prehistoric landsliding within the canyon (Burns 1993) but site-specific investigations suggest that this part of the canyon is quite stable with respect to deep-seated mass movements (McDonald 1994).

Unchanneled drainageways (hillslope hollows) in and near the apartment site are quite steep. All such areas tend to concentrate shallow subsurface stormflow and some may even develop shallow surface water flow during large storm events. These drainage features tend to accumulate colluvial materials and sediment discharge from these areas is transport limited (meaning the supply of erodible materials normally exceeds the ability of slope processes to move it). In the absence of further site alterations, such areas can be expected to fail only episodically, supplying sediment to the stream during infrequent, high magnitude events. (The drainageway penetrating the northwestern corner of the apartment site has reportedly been eroded and channeled by uncontrolled stormwater runoff from upslope development.)

MANAGEMENT AND REHABILITATION RECOMMENDATIONS

The desire to preserve and/or restore a coldwater fishery is perceived to be the chief conservation focus with respect to Newell Creek canyon. The desire on the part of many to maintain this area as a semi-natural greenspace and large, unfragmented wildlife preserve also appear to be important considerations with respect to future management.

The following recommendations are therefore offered mainly in the context of these concerns, although measures to reduce the flux of fine sediment within Newell Creek can also have a beneficial influence with respect to overbank flooding and bank erosion in areas far downstream. Recommendations are not listed in any particular order of preference or importance.

Upstream and Upslope Areas

The degree that precipitation is allowed to directly infiltrate the soil and the apportionment of surface runoff and sediment in any watershed influence streamflow characteristics and channel conditions. This influence extends to the watershed divide.

Sediment Control. Sediment control measures should be required at all construction sites within the Newell Creek watershed. Construction interests in particular need to be educated about the deleterious effects of fine sediment on stream ecosystems and regulations governing sediment control need to be diligently enforced. A concerned citizenry can help with both tasks.

An engineered and maintained sediment trap could be installed immediately upstream of the Highway 213 culvert. As upslope/upstream sediment control is likely to be imperfect, a sediment trap would greatly reduce the delivery of fine sediment to lower Newell Creek, especially in the near future as the basin continues to build out.

Minimizing the Number and Size of Peak Flows. Since channel bank erosion occurs primarily during and shortly after large discharge events, stream channel erosion can be expected to increase if the frequency and magnitude of high flows increases. The occurrence of peak flows should therefore be minimized to the greatest degree possible, either through protracted onsite detention or source area re-infiltration of precipitation (preferably the latter wherever possible).

McDonald's (1994) investigation of subsurface conditions at the apartment site suggest that it should be possible to re-infiltrate all stormwater generated by the development currently planned for this site. With respect to the attenuation of peak flows, re-infiltration and slowed subsurface drainage of stormwater is certainly preferable to rapid and direct discharge to the stream via a pipe. The delay imparted by any length of travel through the soil will tend to reduce the height of flood peaks, although this benefit increases with the length of the groundwater flow pathway. The maximum benefits with respect to peak flow reduction are therefore best realized in developments which are distant from channels. Nevertheless, with respect to the apartment site, plans to minimize the area of impervious surface (see below) represents the correct approach and should be duplicated by all other development sites within the basin.

Baseflow Support. Efforts should be made to maximize the onsite infiltration of rainwater and groundwater recharge throughout the Newell Creek basin so that dry season flow can be maintained to the maximum degree possible. This function is also enhanced with a longer subsurface flow pathway between the point of re-infiltration to the ground surface and the stream channel. Minimizing groundwater withdrawal during all seasons, and reducing landscape watering during the summer, can also help to maintain dry season streamflow.

Because of its proximity to Newell Creek, this baseflow support function will be less effective at the apartment site than it would be at development sites which are more distant from channels. However the contribution here represents part of a cumulative improvement if duplicated basinwide. This site can serve as a model for stormwater management with respect to future development sites and the retrofitting of already developed areas within the basin.

The landscape plan for the Newell Creek Overlook Apartments site indicates that the preservation of native vegetation and open ground will be maximized and lawn area minimized. This strategy of maximizing the amount of area where rainwater can immediately infiltrate assists in both flood flow attenuation and baseflow support.

Water Quality. While the re-infiltration of relatively clean water from many developed surfaces (such as roofs) is certainly advisable, careful consideration may have to be given to alternative designs where water is to be re-infiltrated from contaminated surfaces such as parking lots. This possibility, and possible design alternatives, should be addressed by others with expertise in this area.

Hillside Erosion

Care should be taken to prevent substantially increased surface or subsurface water discharge to otherwise unaltered hillslope hollows. These areas are not adjusted to the extra water supply and are likely to respond to extra water by gullying or mass failure. Depending on location and downslope conditions (e.g. slope change, roughness elements), erosion within hollows has the potential to introduce large quantities of fine sediment to the stream channel.

If necessary for stormwater disposal, steep draws could be used as discharge sites if fitted with carefully designed structures. These could be masked with native vegetation plantings. (No large, deep-rooted plants should be planted in hollows because of the risk of toppling in wet soils.) Even though re-infiltration may be the primary means of stormwater disposal at the apartment site, it is possible that excess storm runoff may have to be discharged via surface pathways during very large storm events.

Trails. Even straight-contour valleyside slopes and spurs remain at least locally subject to surface water erosion because of the absence of a deep and continuous forest floor covering the slopes. Any constructed trails should therefore be sited well upslope of the channel, especially where slopes are very steep. Trails should traverse the hillside with a low gradient, minimizing switchbacks, and should be constructed with careful attention to surface drainage (e.g. frequent waterbars and energy dissipators below these cross drains). The number and surface area of trails should be minimized. If a trail has to be located closer to the stream than recommended (as, for example, at a stream crossing), it should be routed away from unstable banks, particularly outer bend banks in areas where the stream has entrenched itself in unconsolidated alluvium.

People will inevitably use the canyon in increasing numbers as the population in the watershed grows. A single well-designed trail could result in less overall damage than the absence of formal trails and uncontrolled access to the canyon.

Unsurfaced Roads and Stream Crossings

Both stream crossings represent chronic sediment source areas and should be eliminated. Logs from the Humboldt crossing can be used to rebuild and stabilize streambanks at both crossings.

The roads leading to these crossings should also be obliterated, especially within any designated buffer area (see below). It is particularly important that surface erosion countermeasures be applied to the steep road segments immediately upslope of the stream crossings. At a minimum, this should consist of deeply ripping the road surface to relieve compaction and installing closely spaced waterbars (possibly log-reinforced) to enhance local infiltration, reduce slope length, and divert water off the road. Soil decompaction should be accomplished using a bulldozer-mounted ripper on seasonally dry soils. Physical rehabilitation should be followed by planting with native woody vegetation (especially conifers for future litter and LWD supply) and heavy mulching (preferably with salvaged forest litter).

Although obviously requiring some heavy equipment, much of the watershed rehabilitation effort with respect to roads and stream crossings can be accomplished by volunteer conservation groups. Volunteers could assist in channel bank rebuilding, waterbar construction, replanting and forest floor renewal.

Streamside Vegetation

An undisturbed buffer or setback should be retained along the creek. To the extent feasible, stormwater control facilities, trails or other installations should not be sited within this buffer. In general, a minimum buffer width of 100 feet is recommended along each bank.

Replanting of conifer species (mainly shade-tolerant species such as western red cedar) along the valley sides could enhance future conditions in this area. The hardwood overstory in much of this area is aging and the older alders in particular will not live much longer. Conifer planting and possibly the release of existing young conifers by thinning could "jump-start" conifer regeneration, insuring the persistence of good canopy closure for stream channel shading and the future recruitment of LWD to the stream. Conifer plantings should be provided good aftercare if they are to be successful in this area. Conservation volunteers could accomplish both the planting and maintenance operations.

The site plan for the Newell Creel Overlook Apartments indicates that, in general, an undisturbed buffer of well over 100 feet will be maintained between the developed area (including unbuilt but regraded slopes) and the stream. The placement of seepage trenches for stormwater discharge may require some incursion into this area. While this should be minimized to the maximum extent possible, the locations of seepage trenches could readily be replanted with native vegetation.

Instream Habitat Improvements

The very steep cascade-type (A2) channel segment would generally not be considered a fish-bearing stream, making this an inappropriate location for the installation of instream "habitat improvements" (although this has already been done here). Channel spanning structures (rock or log weirs) as well as other structures can be used in B3 (step-pool) channels since, if properly placed, they mimic and reinforce the stream's natural tendencies. However, the presence of a number of high drops (including structural nickpoints) would appear to preclude fish passage into and through the upper canyon area. Low summertime flow in this area may also prevent the persistence of a stable fish population in this area.

Incised (G6/F6) channels are not good locations for instream structures since banks are unstable and/or provide little opportunity for secure anchoring. Flow confinement leads to high stream power during peak flows in entrenched channels. Structures placed in these areas are therefore likely to cause bank or bed erosion and "blow out" during high flows.

While I have not evaluated downstream conditions in Newell Creek, it is probable that limited instream habitat rehabilitation funds would be better spent in downstream areas. The proper role for a headwater channel is to act as a buffer to minimize downstream sedimentation and provide a conduit for organic debris. Higher flow volume downstream (especially with respect to dry season conditions) should also be more favorable for supporting viable fish populations. Structures may well be helpful in restoring channel complexity and providing low-energy holding water and dry season refugia for fish in lower Newell Creek.

Beaver Pond

The pond area presents a difficult situation with no easy solutions. While the area now acts as a sediment trap, the risk to downstream habitat conditions it poses is, in my view, significant and likely to increase over time.

The impacts associated with a dam failure are particularly great in the context of any salmonid fishery in Newell Creek. If the fishery were the main consideration, it might be advisable to carefully take down the dam, excavate and remove the accumulated sediment, recontour the valley floor and rebuild channel banks. apply aggressive erosion control measures, and replant the area. This treatment is offered here as a consideration, and not a firm recommendation, because a complex mix of factors must influence any decision with respect to the beaver dam. Evaluation of all these factors and a decision on an appropriate course of action was not the subject of this investigation.

CONCLUSIONS

Upper Newell Creek canyon in the vicinity of the Newell Creek Overlook Apartments site has been severely impacted by past land use practices. These practices have left a legacy of channel instability which continues to the present day and will continue into the foreseeable future. Although the area has regrown with forest vegetation and appears "natural", it does not represent a pristine or geomorphically stable setting.

Upper Newell Creek is presently a conduit for large quantities of fine sediment derived from the uppermost watershed. The channel and valley floor within the study area also represent chronic source areas of fine sediment, although this tends to be localized and the contribution from downstream reaches is probably much greater. This is because the channel is steep and well armored with large rock through much of the property and the deposition of modern, unconsolidated and highly erodible sediment infills appears to have occurred mainly in lower gradient areas downstream of this site.

Increases in the frequency and magnitude of flood events on Newell Creek are inevitable as the basin continues to urbanize because the area of impervious surface, and the network of pipes and gutters, will likewise increase. This tendency in alteration of the flow regime should promote an increased tendency for channel bank erosion within Newell Creek canyon, resulting in increased sediment supply to downstream areas. (Better understanding of the full extent of this tendency would require a more thorough investigation of the entire channel network.)

Continued and perhaps increasing levels of fine sediment supply to downstream areas will undoubtedly impact instream habitat conditions in Newell Creek. Localized sedimentation in the lowest gradient reaches of Newell Creek or Abernethy Creek could also result in local flooding or streambank erosion. Unfortunately, even the cessation of all further development in the basin would not reverse this process because the stream remains out of geomorphic adjustment and susceptible to accelerated erosion (mainly of channel banks) by even moderate flow events.

Improvements in the "style" of development within the basin can ameliorate these conditions somewhat. Emphasis should be placed on the re-infiltration of precipitation wherever possible in developing areas. This will tend to mitigate against larger and more frequent flood flows and will also promote groundwater recharge, which is vital to maintaining streamflow (particularly in small basins) during our dry summers.

Re-infiltration as an approach to stormwater management requires the provision of engineered structures which accept stormwater running off impervious surfaces and allow it to slowly infiltrate into the ground. The low-intensity rainfall common to this region should facilitate this type of treatment. Re-infiltration is also promoted by minimizing the area of impervious surface in the first place. This is done by maximizing the area left in (or restored to) seasonally drought-tolerant native vegetation and litter cover as well as by minimizing the area of lawns, which can become relatively impervious as they age.

The preliminary design plan for the Newell Creek Overlook Apartments has incorporated re-infiltration as the primary means of managing stormwater generated by this development. The footprint of the developed area appears to represent about 15-20 acres and this includes landscaped areas which can still function as "soakaways." Even though groundwater flow pathways have been reduced because stormwater collected from roofs and road surfaces must be piped to downslope infiltration trenches closer to the stream. this treatment would appear to represent a large improvement over conventional designs with respect to minimizing impacts to the stream.

A wide protective setback will also be retained between the development site and stream. A number of other remedial measures for repairing stream conditions unrelated to this development can also be implemented on this property. These include the removal of dirt roads and road crossings from the valley floor, conifer planting, and efforts to minimize surface erosion on lower valley sideslopes (which remain susceptible to this in areas which might be disturbed by foot traffic).

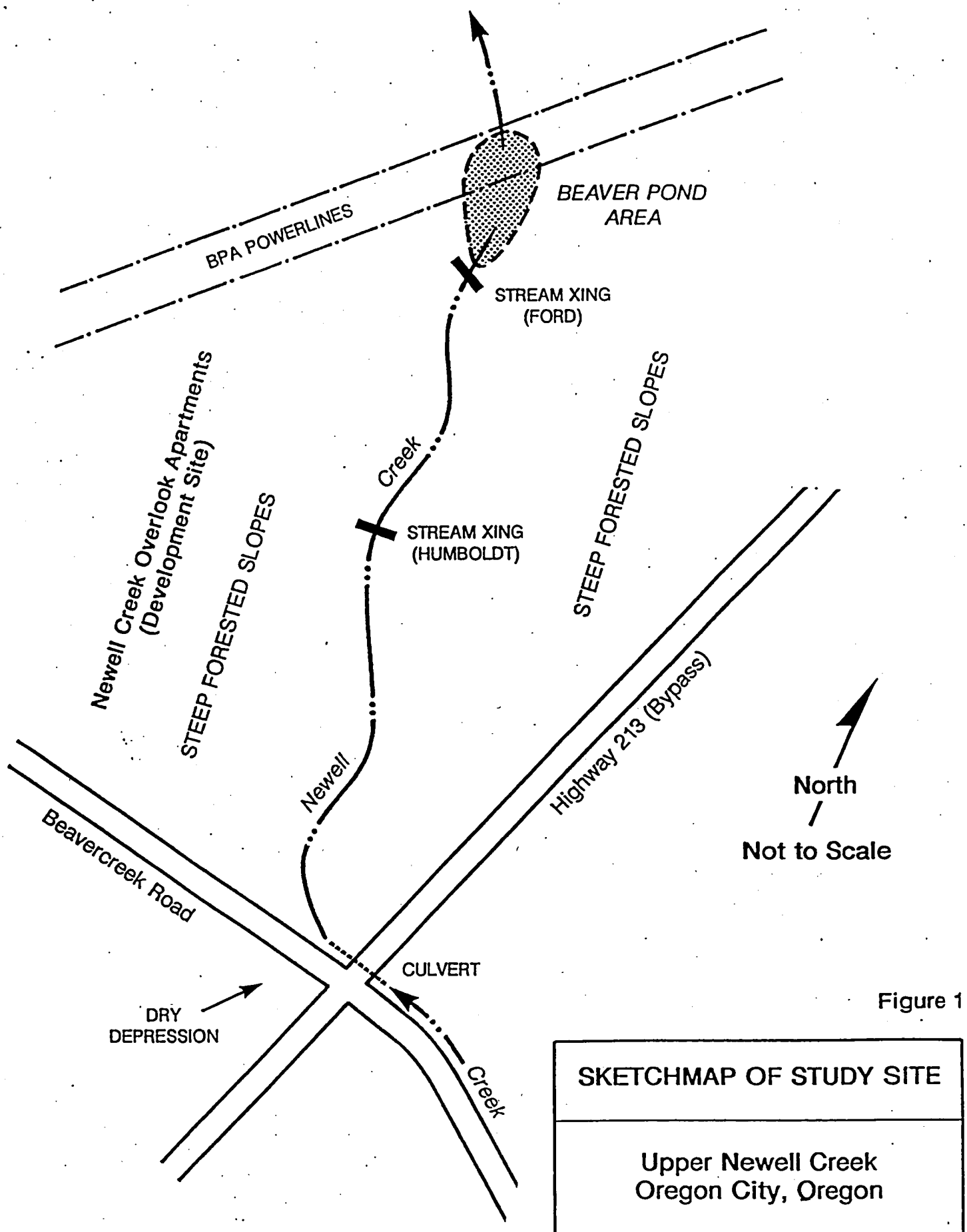
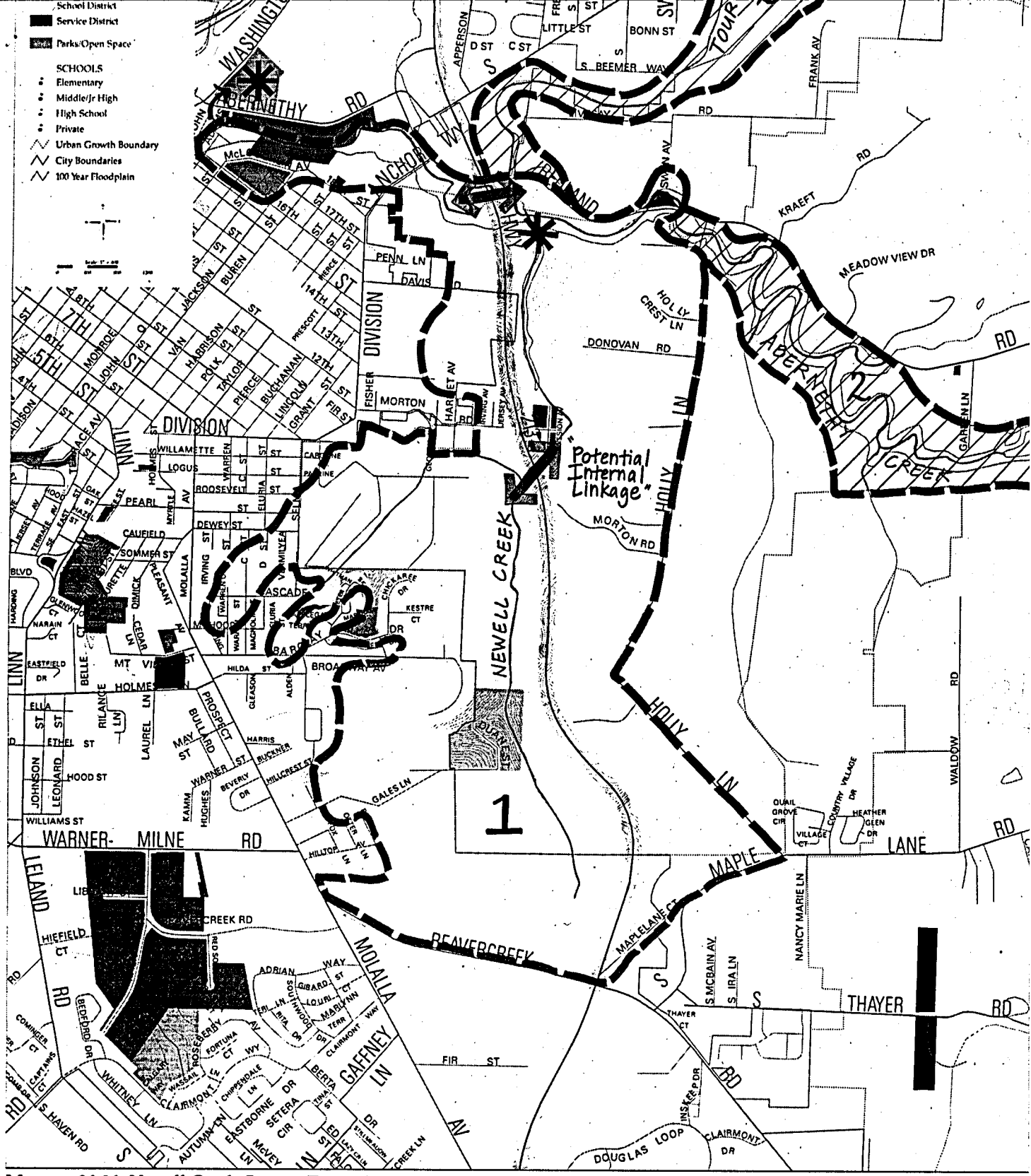


Figure 1

SKETCHMAP OF STUDY SITE
Upper Newell Creek Oregon City, Oregon September 1994

Watershed Applications



Measure 26-26: Newell Creek Canyon Target Area