2007 Stormwater Needs Assessment Program

Allen Canyon Creek
Subwatershed Needs Assessment Report

Clark County Public Works Clean Water Program

May 2008

For other formats
Clark County ADA Office, **Voice** (360) 397-2000
Relay (800) 833-6384, **E-mail** ADA@clark.wa.gov

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Responsible County Officials

Program Name:	Stormwater Needs Assessment Program
Project Code:	SNAP
Department:	Clark County Public Works Water Resources
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Reporting Category:	4420 000 531 534 245 011403
Client:	Earl Rowell, Clean Water Program manager
SNAP manager:	Rod Swanson, Senior Planner Contact: 360-397-6118 x4581 rod.swanson@clark.wa.gov
Subwatershed Lead:	Jeff Schnabel, Natural Resource Specialist III Contact: 360-397-6118 x4583 jeff.schnabel@clark.wa.gov

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Acronyms and Abbreviations

B-IBI	Benthic Macroinvertebrate Index of Biological Integrity
BOCC	Board of County Commissioners
BMP	Best Management Practices
CCD	Clark Conservation District
CIP	Capital Improvement Program
CPU	Clark Public Utilities
CRFPO	Columbia River Fisheries Program Office
CWA	Clean Water Act
CWC	Clean Water Commission
CWP	Clean Water Program
EIA	Effective Impervious Area
EDT	Ecosystem Diagnostic and Treatment model
EMAP	Environmental Mapping and Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FPIA	Focused Public Investment Area
FWS	Fall, Winter, Spring
GCEC	Gee Creek Watershed Enhancement Committee
GIS	Geographic Information System
GMA	Growth Management Act
HPA	Hydraulic Project Approval
IDDE	Illicit Discharge Detection and Elimination
LCFEG	Lower Columbia Fish Enhancement Group

LCFRB	Lower Columbia Fish Recovery Board
LID	Low-Impact Development
LiDAR	Light Detection and Ranging
LISP	Long-term Index Site Project
LWD	Large Woody Debris
MS4	Municipal Separate Storm Sewer System
MOP	Mitigation Opportunities Project
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Unit
NWIFC	Northwest Indian Fisheries Commission
ODEQ	Oregon Department of Environmental Quality
OWQI	Oregon Water Quality Index Scores
SCIP	Stormwater Capital Improvement Program
SCIPIT	Stormwater Capital Improvement Program Involvement Team
SCMP	Salmon Creek Monitoring Project
SCWC	Salmon Creek Watershed Council
SNAP	Stormwater Needs Assessment Program
SWMP	Stormwater Management Program
SWMMWW	Stormwater Management Manual for Western Washington
TIA	Total Impervious Area
TIP	Transportation Improvement Program
TIR	Technical Information Report
TMDL	Total Maximum Daily Load

TP	Total Phosphorus
UGA	Urban Growth Areas
UIC	Underground Injection Control
USFWS	U.S. Department Fish and Wildlife Services
VBLM	Vacant Buildable Lands Model
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area
WSDOT	Washington Department of Transportation

Executive Summary

Study Area

This Stormwater Needs Assessment report includes the Allen Canyon Creek subwatershed in northwestern Clark County, a tributary to the Lewis River.

Intent

Stormwater Needs Assessment reports compile summary information relevant to stormwater management, propose stormwater-related projects and activities to improve stream health, and assist with adaptive management of the county's Stormwater Management Program. The assessments are conducted at a subwatershed scale, providing a greater level of detail than regional Water Resource Inventory Area (WRIA) or Endangered Species (ESA) plans. Stormwater Needs Assessments are not comprehensive watershed plans or stormwater basin plans.

Findings

Watershed Conditions

The table on the following page summarizes conditions in the Allen Canyon Creek watershed based on available data, including water quality, biological health, habitat, hydrology, and the stormwater system.

Ongoing projects and involvement

There are no Clark County Clean Water Program stormwater projects in Allen Canyon Creek under the 2007-2012 Stormwater Capital Improvement Program.

The Clark County Legacy Lands Program and Conservation Futures are active in the subwatershed through property acquisition projects near Mud Lake.

There are currently no major projects sponsored by other regional entities such as Lower Columbia Fish Recovery Board, Clark Public Utilities, Clark County Transportation Improvement Program, and the Department of Ecology.

Category	Status
Water Quality	
Overall	• Poor (based on model prediction)
Fecal coliform bacteria	• Unknown
Temperature	• Unknown
Sediment	• Unknown
Biological	
Benthic macroinvertebrates	• Unknown
Anadramous fish	• Presumed presence of Coho and winter steelhead, below Mud Lake only; low regional recovery priority
Resident fish	• Unknown
Habitat	
Reference condition	• No available reference habitat data
NOAA Fisheries criteria	• Forest cover, road density, and impervious area percentage fall into the Non-Functioning category
Riparian	• Riparian forest canopy largely intact from mouth to 289th Street • Invasive vegetation predominant as understory • Uplands largely cleared
Wetland	• Primarily limited to narrow, near-stream floodplains
Hydrology and Geomorphology	
Overall hydrology	• No hydrology data available • Often dry or very low summer flows above Mud Lake
Channel stability	• Generally stable, with simplified stream geometry
Future condition	• Projected impervious area in headwater areas will cause increased rate of channel incision unless adequate runoff controls are in place
Stormwater (Unincorporated areas)	
System description	• Infrastructure is minimal; primarily field drains and road-side ditches • I-5 and NW 289th Street contribute a significant percentage of overall stormwater
Inventory status	• 8 stormwater facilities currently mapped, all private • Complete (estimated >95 percent)
System adequacy	• Adequate control and inadequate treatment • Projected impervious area indicates need for updated control standards with considerable investment in new infrastructure, particularly in headwater areas
Condition	• Condition largely undocumented, presumed good

Opportunities

Projects listed in the SNAP report represent only a small part of those required to protect and restore Allen Canyon Creek. Immediate priorities based on current conditions and local program capabilities are listed. Numerous opportunities exist for stormwater-related watershed improvement, including the following:

- Focused stormwater outreach and education to streamside landowners, particularly along NW 41st Avenue north of 289th Street, regarding livestock access, riparian enhancement, and limitation of vehicle crossings
- Consider use of WSDOT Clean Water fees to address a failing outfall within the I-5 corridor.
- Evaluation of potential wetland enhancement or advanced mitigation projects within tax-exempt parcels
- Evaluation of one potential stormwater detention facility location
- Technical assistance visits to landowners with potential source control and water quality ordinance issues.
- Promotion of riparian enhancement projects

Non-project stormwater management recommendations address areas where county programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems. Management recommendations relevant to the Allen Canyon Creek watershed include:

- Encourage the use of Low Impact Development techniques for new development
- Confirm that county ditch maintenance practices minimize vegetation removal; provide education for private landowners on appropriate ditch maintenance.
- Replace missing or deteriorated stream name signs at road crossings.
- Encourage removal of invasive plants and riparian restoration through education, technical assistance and/or financial assistance.
- Emphasize conservation of undeveloped and forested areas
- Promote protection of first-order tributary streams. Consider the use of habitat buffers, establishment of conservation easements, and increased control of existing stormwater and agricultural runoff.
- Encourage soil conservation practices to reduce sediment and nutrient loads to the MS4 from agricultural lands.

Introduction

This report is a Stormwater Needs Assessment for the Allen Canyon Creek subwatershed. The Clean Water Program (CWP) is gathering and assembling information to support capital improvement project (CIP) planning and other management actions related to protecting water bodies from stormwater runoff.

Purpose

The Stormwater Needs Assessment Program (SNAP), initiated in 2007, creates a system for Water Resources to focus activities, coordinate efforts, pool resources, and ensure the use of consistent methodologies. SNAP activities assess watershed resources, identify problems and opportunities, and recommend specific actions to help meet the Water Resources mission of protecting water quality through stormwater management.

The overall goals of the SNAP are to:

- Analyze and recommend the best and most cost effective mix of improvement actions to protect existing beneficial uses, and to improve or allow for the improvement of lost or impaired beneficial uses consistent with NPDES objectives and improvement goals identified by the state GMA, ESA recovery plan implementation, TMDLs, WRIA planning, flood plain management, and other local or regional planning efforts.
- Inform county efforts to address the following issues related to hydrology, hydraulics, habitat, and water quality:
    - Impacts from current or past development projects subject to lesser or non-existent stormwater treatment and flow control standards.
    - Subwatershed-specific needs due to inherent sensitivities or the present condition of water quality or habitat.
    - Potential impacts from future development.

Water Resources recognizes the need to translate assessment information into on-the-ground actions to improve water quality and habitat. Facilitating this process is a key requirement for the program's long-term success.

Results and products of needs assessments promote more effective implementation of various programs and mandates. These include initiating wetland banking systems, identifying mitigation opportunities, and providing a better understanding of stream and watershed conditions for use in planning county road projects. Similar information is also needed by county programs implementing critical areas protection and salmon recovery planning under the state Growth Management Act (GMA) and the federal ESA.

Scope

This report summarizes and incorporates new information collected for the SNAP as well as pre-existing information. In many cases it includes basic summary information or incorporates by reference longer reports which may be consulted for more detailed information.

SNAP reports produce information related to three general categories:

- Potential stormwater capital projects for county implementation or referral to other organizations.
- Management and policy recommendations.
- Natural resource information.

Descriptions of potential projects and recommended program management actions are provided to county programs, including the Public Works CWP and Stormwater Capital Improvement Program (SCIP), several programs within the Department of Community Development, and the county's ESA Program. Potential project or leveraging opportunities are also referred to local agencies, groups, and municipalities as appropriate.

Assessment Approach

Priorities for Needs Assessment in Allen Canyon Creek

Clark County subwatersheds were prioritized into a five year schedule for the 2006 through 2011 SNAP using the procedures described in Prioritizing Areas for Stormwater Basin Planning (July 2006).

The Allen Canyon Creek subwatershed falls into the "Rural Residential with UGA fringe" category established in the above document. Subwatersheds in this category typically include both city and county jurisdictions. The level of SNAP implementation depends to some extent on coordination between municipalities. Priority for stormwater basin planning is often high in this category, leading to the use of a fairly wide range of SNAP tools.

Assessment Tools Applied in Allen Canyon Creek

The SNAP utilizes a standardized set of tools for subwatershed assessment, including desktop mapping analysis, modeling, outreach activities, and a variety of field data collection. Tools are based on existing protocols where feasible, and cover a range of information important to stormwater management. Though not every tool is applied in every subwatershed, the use of a standard toolbox ensures the consistent application of assessment activities county-wide.

Table 1 lists the set of tools available for use in the SNAP. Tools marked with an asterisk (*) are those for which new data or analyses were conducted during the course of this needs assessment. The remainder of the tools were assessed based on pre-existing information.

Table 1: Stormwater Needs Assessment Tools	
Stakeholders *	Geomorphology And Hydrology*
Outreach And Involvement *	Riparian Assessment
Coordination with Other Programs *	Floodplain Assessment
Drainage System Inventory *	Wetland Assessment
Stormwater Facility Inspection *	Macroinvertebrate Assessment
Review Of Existing Data *	Fish Use And Distribution
Illicit Discharge Screening *	Water Quality Assessment
Broad Scale GIS Characterization *	Hydrologic Modeling
Rapid Stream Reconnaissance *	Hydraulic Modeling
Physical Habitat Assessment	

Assessment Actions

Outreach Activities

Outreach activities were limited to general materials designed to increase awareness about the SNAP effort. The following activities were completed:

- July 2007 -- press release to local media
- August 2007 – article in "Planning Stormwater Projects" flyer distributed at Clark County fair and other public events.
- September 2007 – article in Clean Water Program E-Newsletter
- Clean Water Program web pages updated to include the SNAP and SCIP
- March 31 of each year – a description of the SNAP is included in Clark County's stormwater management program plan submitted to Ecology

Clark County Clean Water Commission members were also updated periodically on SNAP progress.

Review of Existing Data

Data and information review is incorporated throughout this report in pertinent sections. A standardized list of typical data sources created for the overall SNAP effort is supplemented by subwatershed-specific sources as they are discovered. Data sources consulted for this report include, but are not limited to those listed below:

- LCFRB 6-Year Habitat Workplan
- Salmon Recovery Plan
- Ecology 303(d) list
- WRIA 27/28 Plan
- CC consproj GIS layer (conservation projects)
- CC 6-Year and 20-Year TIP
- Ecology EIM data
- CC Mitigation Opportunities Project
- CC 2004 Subwatershed summary
- CC 2003 Stream Health Report
- City of LaCenter 2007 Parks master plan

Coordination with Other Programs

Purpose

Coordination with other county departments and with local agencies or organizations helps to explore potential cooperative projects and ensure that the best available information is used to complete the assessment.

Coordination is a two-way relationship; in addition to bringing information into the needs assessment process, coordinating agencies may use needs assessment results to improve their programs.

Methods

The CWP maintains a list of potential coordinating programs for each subwatershed area. The list was reviewed in early 2007 and general communications were planned. Coordination took the form of phone conversations, meetings, or electronic correspondence, and was intended to solicit potential project opportunities, encourage data and information sharing, and promote program leveraging.

Potential opportunities for coordination exceeded the scope of CWP and SNAP resources; therefore, not all potentially relevant coordination opportunities were pursued. Coordination was prioritized with departments and groups thought most likely to contribute materially to identifying potential projects and compiling information to complete the needs assessment.

Results

See Analysis of Potential Projects for an overall list and locations of potential projects gathered during the needs assessment process. Projects suggested or identified through coordination with other agencies are included.

The following list includes departments, agencies, and groups contacted for potential coordination during the course of the Allen Canyon Creek needs assessment:

- Clark County Endangered Species Act program
- Lower Columbia Fish Recovery Board
- Clark County Transportation Improvement Program
- Clark County Legacy Lands Program
- Vancouver/Clark Parks and Recreation
- Washington Department of Ecology
- Clark County Weed Management
- City of LaCenter (Parks master plan)
- Large private landholders

Broad-Scale GIS Characterization and Metrics

The broad-scale characterization is a GIS-based exercise providing an overview of the biophysical setting for each subwatershed, background information for use in implementing other SNAP tools, and identification of potential acquisition or project sites. GIS data describes many subwatershed characteristics such as topography, geology, soils, hydrology, land cover, land use, and GMA critical areas. A standard GIS workspace including shape files for over 65 characteristics forms the basis for the characterization.

GIS data is generally used as a tool to complete the report and not presented in the report itself. Summary metrics are taken from existing reports and data; for example, Wierenga (2005) summarized many GIS characteristics for Clark County subwatersheds.

Many of these characteristics are described in greater detail in later sections. For example geology and soils form the cornerstone of the Geomorphology and Hydrology section.

The characterization includes three components:

- A set of three standard map products as paper maps for SNAP use
- A summary table of selected subwatershed-scale metrics
- A brief narrative including comparison of metrics to literature values, conclusions about general subwatershed condition and potential future changes, and potential mitigation or improvement site identification.

Map Products

Three standard SNAP map products are: 1) Stormwater Infrastructure and Hydrologic Soil Group, 2) Critical Areas information, and 3) Vacant Buildable Lands within UGAs. These maps are printed out for tabletop evaluations.

General Conditions and Subwatershed Metrics

General Geography

Allen Canyon Creek is a tributary to the Lewis River, entering just below the East Fork Lewis River (Figure 1). Allen Canyon Creek subwatershed covers six square miles, receiving on average 46 inches of precipitation annually. The upper portions of the subwatershed are relatively subtle terrain and have been converted from forest to a mix of agricultural, forest and residential uses. Interstate 5 cuts across the uppermost part of the basin and includes the Ridgefield exit, where significant commercial and industrial development is envisioned by the Comprehensive Plan. Average parcel size is nine acres. Population density is 106 people per square mile. Approximately 1.75 square miles of the upper basin is located within Urban Growth Areas (UGA) for Ridgefield and LaCenter.

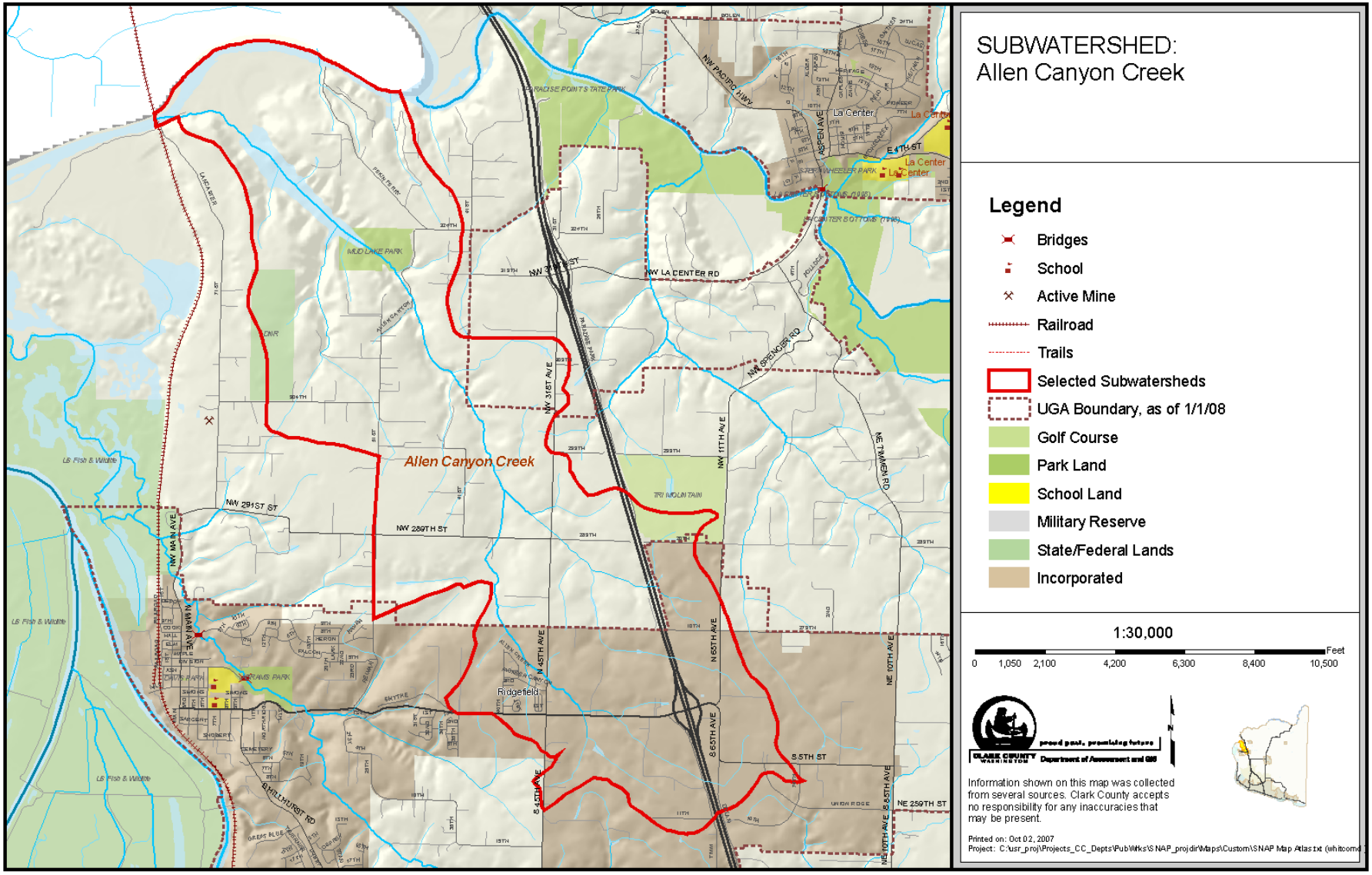

Figure 1: Subwatershed Map: Allen Canyon Creek

Topography
Allen Canyon Creek has upland of subtle rolling hills, about 250 feet above sea level, broken by Allen Canyon and its tributaries cutting up from the Lewis and Columbia River flood plain.

Geology and Soils
Geology and soils influence stream channel type, the size and amount of sediment in the channel, wetland formation, and overall hydrologic framework. Allen Canyon Creek subwatershed is underlain by two geologic units: older semi-consolidated sandy gravel commonly referred to as the Troutdale Formation or Troutdale gravels and; sandy to silty catastrophic Ice Age flood deposits. Only small amounts of alluvium are found in the lowermost portion of Allen Canyon. Geology is described in greater detail in the geomorphology and hydrology section

The fine grained Ice Age flood deposits mantle most of the study area, ranging in depth from a few feet to perhaps 70 feet thick. Fine-grained catastrophic flood deposits are easily eroded in steep headwater streams. These deposits are about 14,000 to 12,000 years old and were deposited by a succession of giant floods of the Columbia River caused by ice dam failures near Missoula, Montana.

The Troutdale Formation is sandy gravel deposits from an ancestral Columbia River that at depth underlies the entire watershed. Where streams have eroded into the Troutdale Formation, it forms steep valley walls and hard gravely substrate under stream channels. Any gravel in Allen Canyon Creek is eroded material from the Troutdale Formation. The upper surface of the Troutdale formation underlies the Ice Age flood deposits at about 190 to 200 feet elevation. The Troutdale Formation is much older than the Ice Age flood deposits causing the uppermost beds to be deeply weathered to clay and silt.

Soils formed on the Troutdale Formation and fine-grained catastrophic flood deposits tend to be fairly clayey. Soil types influence erosion potential and the availability of sediment routed to stream channels. The predominant soil types (85 percent) found in the Allen Canyon Creek subwatershed are hydrologic Group C and D soils, which have relatively low permeability and are often associated with wetter areas.

Hydrology
The Allen Canyon Creek hydrologic framework is determined by geology and topography. Allen Canyon Creek has its headwaters in commercial and industrial land near I-5. It soon drops into Allen Canyon which terminates at Mud Lake. The lowermost part of Allen Canyon Creek exits Mud Lake and enters the Lewis River. Allen Canyon Creek often dries up during summer with little or no flow above Mud Lake. The geomorphology and hydrology report section describes hydrology in greater detail.

No stream flow data is available for Allen Canyon Creek.

Subwatershed Metrics
Subwatershed scale metrics provide a simple way to summarize overall conditions. Metrics are calculated from Landsat land cover analysis and current GIS data. Benchmarks for properly functioning, and not properly functioning, are based on NOAA fisheries standards for salmon protection and restoration (1996 and 2003).

Overall, these metrics suggest that the Allen Canyon Creek habitat is impacted due to forest loss and possibly the amount of impervious area (Table 2). Future development in this area could have a significant impact if not properly mitigated due to the added effective impervious area estimated for full build out under the Comprehensive Plan.

Table 2: Allen Canyon Creek Metrics

Metric	Value	Functioning Criteria	Non-Functioning Criteria
Percent Forested (2000 Landsat)	28	> 65 %	< 50 %
Percent TIA (2000 Landsat)	20	< 5 %	> 15 %
Road Density 2007 data (miles/mile2)	7	< 2/mile	> 3/mile
Stream Crossing Density (crossings per stream mile)	2.1	< 3.2/mile	> 6.4/mile
Percent EIA estimated from the Comprehensive Plan	25	< 10 %	> 10 %

Forest Cover
The proportion of a watershed in forest is known to have a profound influence on watershed processes. Forest cover estimates are taken from a report summarizing land cover for Clark County (Hill and Bidwell, January 2003). Research in the Pacific Northwest has shown that when forest cover declines below approximately 65 percent, watershed forming processes become degraded (Booth and Jackson, 1997). These include reduced riparian shade, less wood debris delivery to streams, increased stormwater runoff, and increased fine sediment delivery due to mass wasting. The same research indicates that when forest cover drops below 50 percent watershed forming processes are non-functioning.

The Allen Canyon Creek subwatershed has relatively little (28 percent) intact forest cover, and is categorized as “non-functioning”. Most of the forest is found in canyons and several scattered tracts of woods in upland areas. More level lands in the headwater areas are largely cleared for agriculture and home sites. A review of 1955 aerial photos suggests that forest area was about the same or possibly slightly less in the mid-20th Century.

TIA (Total Impervious Area)
Total impervious area is one of the most widely used indicators of urbanization and coincident watershed degradation (Center for Watershed Protection, March 2003). Total impervious area is estimated from land cover data in Hill and Bidwell (January 2003). While various organizations and publications categorize stream condition based on TIA, the NOAA fisheries standard of less than five percent as fully functional and greater than 15 percent as non-functional habitat is a reasonable indicator of habitat quality. The 20 percent TIA estimate for Allen Canyon Creek basin suggests an impaired condition. In some cases, the interpretation of the satellite images tends to overestimate the level of urbanization and the actual amount of TIA could be lower.

Road Density
Road density, including all public and private roads, is an easily calculated development measure. Based on criteria set by NOAA Fisheries to protect salmon habitat, almost all of Clark County is non-functioning. Urban streams have road densities approaching 15 to 20 miles per square mile. Allen Canyon Creek subwatershed road density is seven miles per square mile. This is less than many other watersheds in Clark County but still above the NOAA Fisheries standard of three miles per square mile for non-functioning habitat.

Stream Crossing Density
Stream crossing density is easily measured using available road and stream channel data. The salmon protection standard considers larger fills over 60 feet wide, which would be approximately five to ten foot high road fill. According to NOAA Fisheries standards Allen Canyon Creek is functional for salmon habitat.

Future Effective Impervious Area
Effective impervious area is the amount of impervious area that actually drains to a water body. Depending on factors such as soil types and level of development, effective impervious area is about half (lower intensity development) to almost equal (high intensity development) the TIA value.

The 2008 Comprehensive Plan guides development for the next few years and when used to estimate effective impervious area it can provide a metric for expected hydrologic impacts due to development. Future effective impervious area estimated for Allen Canyon Creek under the 2008 Comprehensive Plan is estimated to be 25 percent, mainly as businesses develop the area near the Ridgefield interchange. This is well above the defined standard of 10 percent for functioning habitat. Development in this area will require a substantial investment in stormwater control facilities to fully mitigate for future development.

Estimated Channel Stability Based on Forest and EIA
In a recent publication by Booth, Hartley, and Jackson (June 2003), a relationship between forest and percent EIA was presented as a graphic (Figure 2). According to this figure, Allen Canyon Creek may have unstable channels under both current conditions and future conditions.

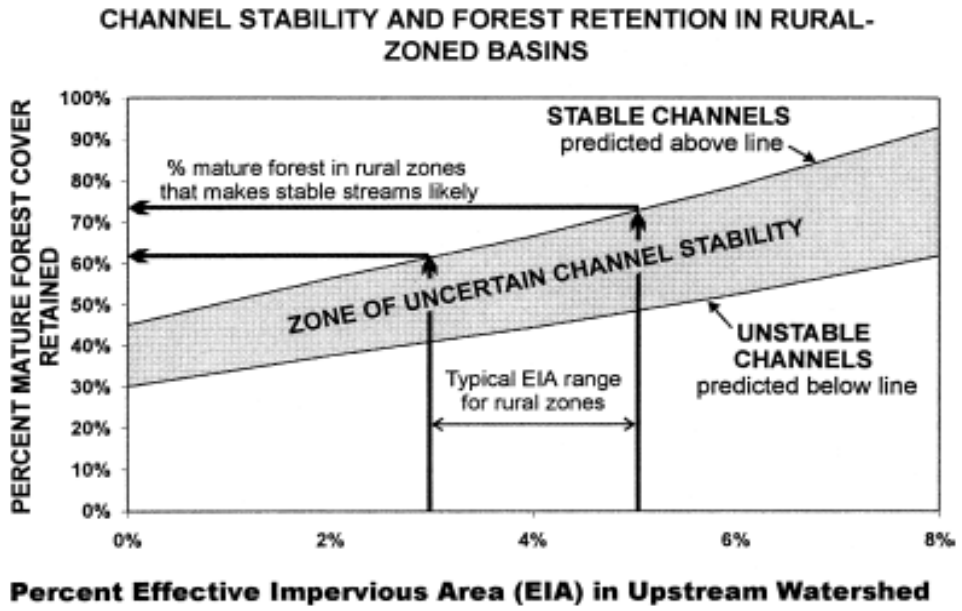

Figure 2: Channel Stability in Rural Areas (Booth, Hartley, and Jackson, June 2002)

Water Quality Assessment

This section briefly summarizes and references available water quality data from the Allen Canyon Creek subwatershed. A description of applicable water quality criteria is included, along with discussions of beneficial use impacts, likely pollution sources, and possible implications for stormwater management planning.

Water Quality Criteria

For a full explanation of current water quality standards see the Ecology website at:

http://www.ecy.wa.gov/programs/wq/swqs/index.html

Under current Washington State water quality standards, Allen Canyon Creek is to be "protected for the designated uses of: Salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values" (WAC 173-201A-600).

Table 3 summarizes currently applicable water quality criteria for Allen Canyon Creek.

303(d) Listed Impairments

The 2002/2004 303(d) list of impacted waters may be found on the Ecology website at:

http://www.ecy.wa.gov/programs/wq/303d/index.html

Allen Canyon Creek is not listed on the 2002/2004 303(d) list.

Clark County Stream Health Report

In 2004, Water Resources compiled available data and produced the first county-wide assessment of general water quality.

Allen Canyon Creek was assessed collectively with Whipple, Flume, and Gee Creeks as the West Slope area. Based on a limited available dataset including fecal coliform bacteria, general water chemistry (temperature, pH, and dissolved oxygen), and benthic macroinvertebrate scores, overall stream health in the West Slope Watershed scored in the poor to very poor range. Though data were available for only 10 percent of the stream miles in the watershed, a simple land-use model predicted poor stream health in the remainder of the watershed.

No stream data were available specifically for Allen Canyon Creek.

The 2004 Stream Health Report may be viewed on the county website at http://www.clark.wa.gov/water-resources/stream.html.

Table 3: Applicable Water Quality Criteria for Allen Canyon Creek (November 2006)

Characteristic	2006 Ecology criteria
Temperature	≤ 17.5 °C (63.5 °F)
Dissolved Oxygen	≥ 8.0 mg/L
Turbidity	shall not exceed 5 NTU over background when background is 50 NTU or less
pH	6.5 – 8.5 units
Fecal coliform bacteria	Geometric mean fecal coliform concentration not to exceed 100 colonies/100mL, and not more than 10 percent of samples exceeding 200 colonies/100mL.
Aesthetics	Aesthetic values must not be impaired by the presence of materials or their effects… which offend the senses of sight, smell, touch, or taste
Toxics	Toxic substances shall not be introduced… which have the potential…to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health

Source: Washington Department of Ecology (http://www.ecy.wa.gov/programs/wq/swqs/index.html)

Available Data

Measured water quality data are virtually non-existent for Allen Canyon Creek. Data and information sources reviewed or summarized as part of this water quality characterization are listed in Table 4.

Table 4: Data and Information Sources

Source	Data and/or Report
Clark County Water Resources	2004 Stream Health Report and draft reports
Ecology	303(d) List of impaired water bodies Station MUDCL11 data (MUD (Clark) 1)
Volunteer (Rhidian Morgan)	1997 and 1998 notes

Water Quality Summary

Very few water quality data points were located for the Allen Canyon Creek subwatershed. Fourteen fecal coliform data points collected during 1997 and 1998 (Morgan, personal comm) indicated a summer (June through September) geometric mean of 33 CFU/100mL (based on five samples), and a winter (October through May) geometric mean of 38 CFU/100mL (based on nine samples). Both values are well below the Ecology criteria of 100 CFU/100mL, though individual samples ranged up to 1148 CFU/100mL.

Department of Ecology ambient monitoring in May 1992 at Mud Lake near the bottom of the subwatershed indicated total phosphorus at 0.094 mg/L, chlorophyll-a at 3.08 mg/L, and total persulfate nitrogen at 0.640 mg/L.

The most valuable predictor of current stream health in Allen Canyon Creek may be a simple land-use model utilized by the CWP for the 2004 Stream Health Report. Based on that model, it is likely that water quality in Allen Canyon Creek is impaired by similar pollutants as Whipple and Gee Creeks (which may include temperature, sediment, fecal coliform bacteria, nutrients, and flow extremes). The actual extent of impairment is unknown.

Based on limited field observations, low summer flows appear to be an issue at least some of the time in Allen Canyon Creek. CWP staff noted a lack of surface flow at Mud Lake Park on at least one occasion in the past few years.

Implications for stormwater management

Table 5 lists likely water quality concerns in Allen Canyon Creek and potential solutions for each. Solutions listed in bold indicate areas where Clean Water Program activities can have a positive impact. It should be noted that Clean Water Program activities, though important, are not likely to achieve water quality improvement goals on their own. Other county departments, local agencies, and not least of all, the public must all contribute to water quality improvement.

Among the CWP activities most likely to have a positive impact on water quality are:

- Effective stormwater system designs, retrofitting, and maintenance
- Source detection and removal projects; and
- Public education programs

Stormwater system design, retrofitting, and maintenance include a range of activities that can address specific pollutants of concern. Source detection and removal projects help eliminate specific contributions of pollutants. Education programs, though they rarely have a direct impact on water quality, are a critical element in modifying behavior and promoting better public stewardship of water resources.

Table 5. Likely Water Quality Concerns, Sources, and Solutions for Allen Canyon Creek				
Characteristic	**Beneficial Use Affected**	**Potential WC Sources**	**Mechanism**	**Solutions (bold indicates direct Clean Water Program involvement)**
Fecal coliform bacteria	Primary contact recreation	failing septic systems	groundwater seeps	**Storm sewer screening for source identification and removal** **Education programs** Agricultural Best Management Practices Septic system inspection and maintenance
		livestock, wildlife	overland runoff storm sewers/ditches direct access	
Water temperature	Salmonid rearing (anadromous) Salmonid spawning and rearing (resident)	vegetation removal	direct solar radiation	**Stormwater infiltration to increase baseflow** **Streamside planting/vegetation enhancement/riparian preservation through acquisition** **Education programs** Pond removal or limitation
		ponds	direct solar radiation stagnation	
		low summer flows	decreased resistance to thermal inputs	
Turbidity	Salmonid spawning, rearing, and migration; Aesthetic enjoyment	erosion *(development projects; land clearing; cropland; impervious surfaces; channel erosion)*	overland runoff storm sewers/ditches channel dynamics	Erosion control regulations **Storm water facility designs/retrofits to optimize settling and removal of suspended silt/clay** Agricultural Best Management Practices Stream bank stabilization/rehabilitation **Storm water outfall/facility retrofits to reduce flow-induced channel erosion**
		algae	in-stream growth due to excess nutrients	
Total phosphorus	Aesthetic enjoyment	natural groundwater	groundwater seeps	Erosion control regulations Septic system inspections and maintenance **Storm water facility designs/retrofits to optimize settling and removal of suspended silt/clay** Agricultural Best Management Practices **Education programs (reduced fertilizer use)**
		fertilizers (Tri-Mtn golf course and other sources)	overland runoff storm sewers/ditches	
		erosion	(see turbidity)	
		livestock, wildlife	(see bacteria)	
		failing septic systems	(see bacteria)	

Drainage System Inventory

Clark County's drainage system inventory resides in the StormwaterClk GIS database and is available to users through the county's Department of Assessment and GIS, or through the Digital Atlas located at:

http://gis.clark.wa.gov/imf/imf.jsp?site=digitalatlas&CFID=56651&CFTOKEN=98300052

The drainage system inventory is an ongoing CWP programmatic element focused on populating and updating the StormwaterClk database to include all existing stormwater drainage infrastructure

Stormwater infrastructure in the Allen Canyon Creek watershed is limited and consists primarily of roadside ditches. Mapping was nearly complete at the conclusion of 2007 SNAP implementation. Inventory completion and quality checks are ongoing in 2008 and 2009 as part of a county-wide inventory update.

Table 6 indicates the number of features previously inventoried in StormwaterClk prior to 2007 SNAP work, and the number of features added to the database as a result of 2007 SNAP implementation.

Table 6: Drainage System inventory Results, Allen Canyon Creek Watershed

Database Feature Category	Previously Inventoried	Added to Database during 2007 SNAP
Inlet	2	0
Discharge Point	2	12
Flow Control	3	0
Storage/Treatment	9	0
Manhole	0	0
Filter System	0	0
Channel	64	16
Gravity Main	31	18
Facilities	2	6

Stormwater Facility Inspection

At the time of the assessment, there were no publicly owned stormwater facilities within the Allen Canyon Creek watershed.

Illicit Discharge Detection and Elimination (IDDE) Screening

Illicit discharge screening was not conducted in the Allen Canyon Creek watershed. Screening activities in this rural area are not required under the NPDES permit, and Allen Canyon Creek is a low overall priority for screening due to a very limited amount of stormwater outfalls.

Stream Reconnaissance and Feature Inventory

Reach Reconnaissance Survey

No rapid reach assessment was completed for Allen Canyon Creek

Feature Inventory Summary

Purpose

The Feature Inventory records the type and location of significant stream impairments, potential environmental and safety hazards, and project opportunities in selected stream reaches. Feature Inventory results are used primarily to document conditions and identify potential improvement projects or management actions for implementation by the CWP or other agencies.

Methods/Limitations

The Feature Inventory project is not intended to be an exhaustive inventory of all human alterations to the stream corridor. Rather, the project seeks to identify the most significant features pertaining to stormwater management and potential stormwater mitigation projects.

The County, with input from Herrera Environmental Consultants, established geographic scope of the Feature Inventory by taking into consideration projected TIA, DNR water types, stream gradient, zoning, Clark County development permitting authority, and land ownership.

The Feature Inventory recorded significant conditions in the stream corridor relevant to SNAP components. Feature types are listed in Table 7.

The in-stream assessment approach allowed investigators to observe stream corridor features that are not always identifiable through other desk methods, such as analysis of existing aerial photographs and GIS data.

A GPS position, one or more digital photos, and relevant attribute information were collected for each logged feature. All data and linked photos are stored in the Feature Inventory Geodatabase located on the Clark County server at: W:\PROJECT\011418, Stream Reconnaissance SNAP\GIS\Data\Geodatabase. Feature data includes field observations, estimated measurements, and/or notes describing important feature characteristics or potential projects.

Feature dimensions and other attribute data are estimates, and should not be utilized for quantitative calculations.

For additional information pertaining to the Feature Inventory SNAP tool, see Volume 1 of the SNAP.

Study Area

The extent of the completed Feature Inventory in Allen Canyon Creek subwatershed is shown in Figure 3. Approximately 2.6 miles of the stream corridor were assessed in the subwatershed. Within the planned extent of the survey, one short reach immediately downstream of NW 31st Avenue was not accessible due to private property concerns.

Results/Findings

A total of 49 features were identified in the Allen Canyon Creek subwatershed. A breakdown of recorded features by type is presented in Table 7. Impacted stream buffers (primarily the result of invasive plant species) were the most prevalent feature type identified, followed by stream crossings and water quality impacts.

Table 7: Summary of Features Recorded in Allen Canyon Creek Subwatershed

Feature Type	Number of Recorded
AP – Access point	5
ER – Severe bank erosion	4
CM – Channel modification	1
IB – Impacted stream buffer	18
IW – Impacted wetland	0
MI – Miscellaneous point	1
MB – Miscellaneous barrier	1
OT – Stormwater outfall	2
SC – Stream crossing	9
TR – Trash and debris	1
UT – Utility impact	0
WQ – Water quality impact	7
Total	49

A map showing the location and type of all recorded features is shown in Figure 4. A larger, poster-sized version of the same map is on file at the County. In addition, specific information collected at each feature can be accessed by using the Feature Inventory Geodatabase.

The following subsections contain general descriptions of Allen Canyon Creek subwatershed conditions. The descriptions include observations, trends, and issues that were identified either during the field work or during subsequent review of collected information.

Stormwater Infrastructure

Due to the relatively undeveloped nature of the subwatershed, existing stormwater infrastructure is minimal. The stormwater conveyance to Allen Canyon Creek and its tributaries is mainly via roadside ditches and small open channels that drain agricultural land. Flow in the subwatershed is predominately southeast to northwest. The predominant sources of stormwater in the surveyed

areas of the subwatershed are agricultural land and road surfaces. These sources are primarily located in the upper watershed. Agricultural land use is common on the sloping terrain in the upper watershed. Tilled fields are likely the primary contributor of stormwater and fine sediment to Allen Canyon Creek. A significant percentage of the stormwater also originates from I-5 and NW 289th Street. No stormwater detention or treatment facilities were present.

Riparian Vegetation

The majority of surveyed stream reaches have established riparian forest canopy. Nevertheless, impacted stream buffers are prevalent in the Allen Canyon Creek subwatershed. While the riparian forest canopy is typically in good condition, undergrowth in much of the riparian corridor is dominated by invasive plant species. Blackberry and reed canary grass are the most prevalent invasive plant species. In general, blackberry is more common in areas with somewhat dense canopy cover and reed canary grass is more common in areas with less dense canopy cover.

Channel Condition

In the upper reaches of the watershed, the typical channel morphology is best described as an E-type channel (Rosgen 1996). In other words, it is a stable, single-thread, sinuous channel with typically vertical, fine-grained cohesive banks and a low width-depth ratio. The bed is composed primarily of cohesive clay. The lack of alluvial substrate indicates that sediment transport capability exceeds supply. Generally, stream channels within the surveyed reach are stable, but have a somewhat simplified cross-sectional geometry. The channel exhibits little diversity in bedforms and habitat. Sand and gravel deposition was observed in a limited number of locations where localized backwater conditions exist. Surveyed reaches are not experiencing significant bank erosion.

Near the upstream extent of Allen Canyon, the typical channel morphology transitions to a plane bed (Montgomery and Buffington 1997) with an alluvial bed consisting of gravel and small cobble. Generally the stream channel is stable, but has simplified cross-section geometry. Channel gradient is relatively steep and exhibits little diversity in bedforms and habitat. A limited number of forced-pool channel types were observed in areas where woody debris was present in the channel (Montgomery and Buffington 1997). Sand and gravel sorting and deposition were observed at a limited number of locations, specifically in the channel margins of forced-pool channel types. Surveyed reaches generally are not experiencing severe bank erosion. Isolated sections of eroding bank occur where the channel comes in contact with steeper valley walls. This erosion is natural, and is essential for recruiting spawning gravel into the system.

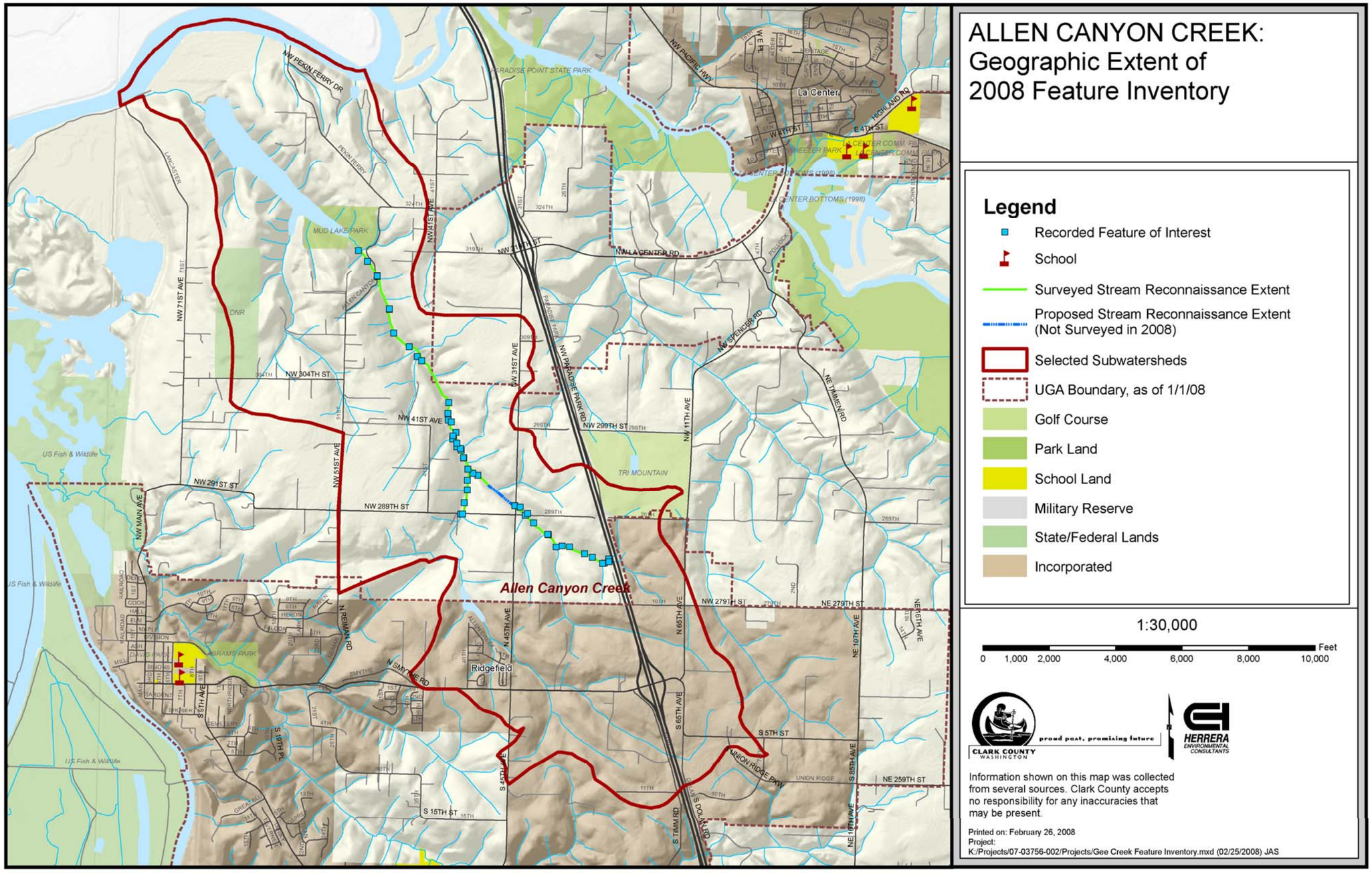

Figure 3: Extent of the Completed Feature Inventory in Allen Canyon Creek

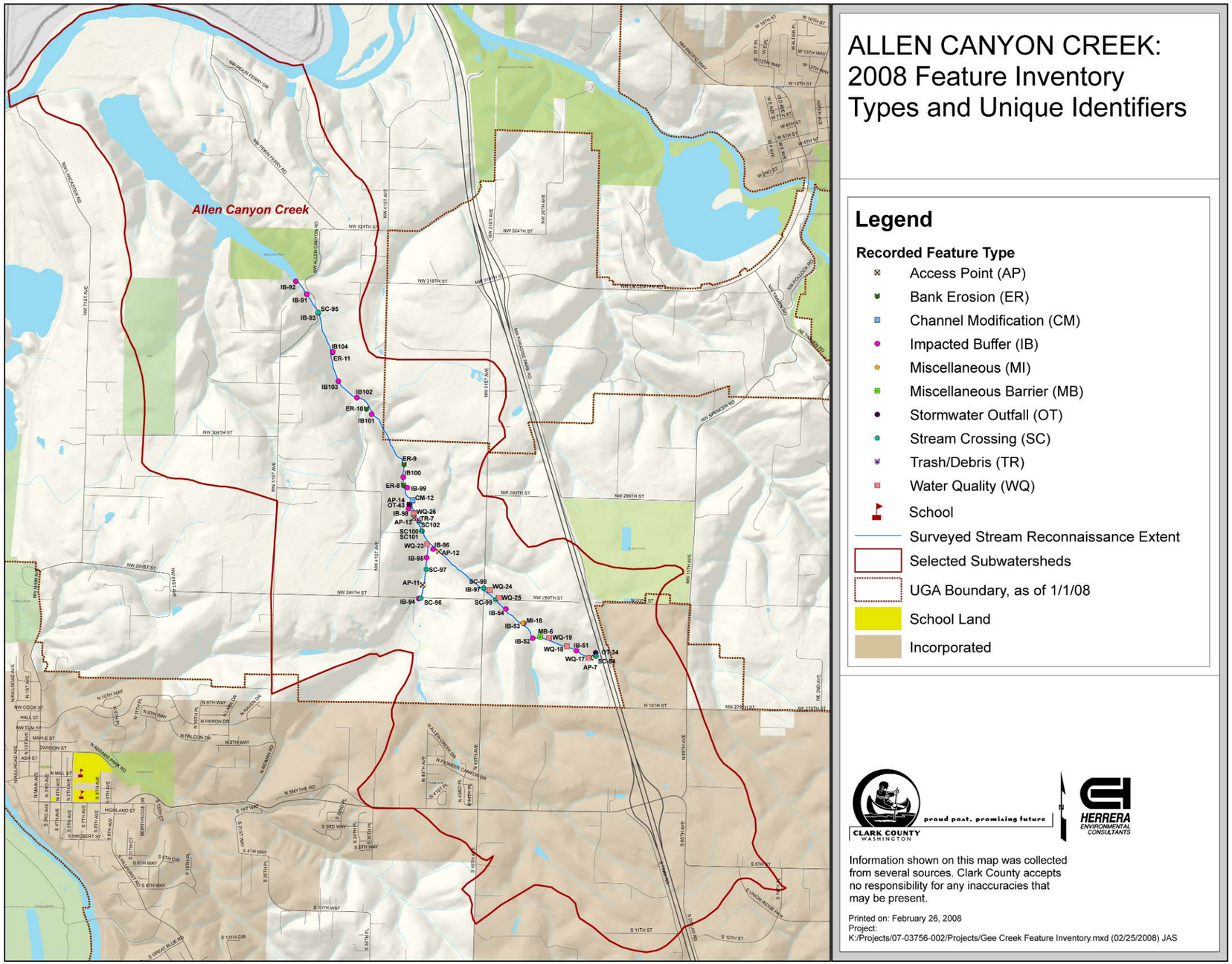

Figure 4: The Location and Type of All Recorded Features in Allen Canyon Creek

The best channel restoration potential exists in the forested reach of Allen Canyon Creek within Allen Canyon. The area is desirable for restoration because of the lack of development and other conflicting land uses within the floodplain. The area also represents a lengthy, contiguous reach where unfragmented habitat value may be greatly increased for a small investment. Engineered structures designed to facilitate bedform development and capture/sort gravels could improve conditions in the short-term, while the forest matures to the point where it can act as a significant source of natural woody debris. However, without reforestation and associated recruitment of woody debris from the riparian corridor, installation of engineered structures is not a self-sustaining solution in the long-term. In the upper watershed, channel conditions would benefit greatly from reforestation of the adjacent floodplain and riparian corridor to increase recruitment of woody debris.

Additional Results

In other surveyed subwatersheds, features of interest were often discovered when field crews ventured up small, first-order tributary channels outside of the area defined by the geographic scope of work. The discovery of numerous features of interest on small tributary channels within other subwatersheds indicates that significant stream impairments, potential environmental and safety hazards, and potential project opportunities may exist outside of the geographic scope of this Feature Inventory. Although this trend was not confirmed in the Allen Canyon Creek subwatershed (no first-order tributaries were surveyed), the topography of the subwatershed makes the presence of features of interest on small tributary channels a distinct possibility. Allen Canyon effectively limits residential and agricultural development adjacent to much of the mainstem of Allen Canyon Creek. However, the flat land above the canyon rims, where many of the tributaries to Allen Canyon Creek originate, is presently developed with rural residential or agricultural land use, and may be the source of many stream impairments. This observation may influence the CWP when determining the geographic scope of future stream reconnaissance efforts in the Allen Canyon Creek subwatershed.

Potential Project Opportunities

Listed opportunities represent potential projects or project areas. They are not fully developed projects, and therefore require additional evaluation and development by Clark County or consultant staff prior to submittal to the SCIP process. Identifying them as potential projects in this document is the first step in the process of developing SCIP projects.

A total of 39 potential projects were identified. A summary of identified project opportunities by potential project category is shown in Table 8.

Table 8: Breakdown of Potential Project Opportunities by Category	
Potential Project Category	**Potential Projects Identified**
Emergency/Immediate Actions	0
Stormwater Facility Capital Improvement Projects	3
Stormwater Infrastructure Maintenance Projects	0
Habitat Restoration/Enhancement Projects	0
Property Acquisition for Stormwater Mitigation	0
Referral Projects for other Groups/Agencies	36

Emergency/Immediate Actions
Emergency/Immediate Actions require an immediate site response project to address a potential or imminent threat to public health, safety, or the environment. No projects of this type were identified in surveyed reaches of the Allen Canyon Creek subwatershed.

Stormwater Facility Capital Improvement Projects
Stormwater Facility Capital Improvement Projects are projects that create new or retrofit existing stormwater flow control or treatment facilities. Facility retrofits include projects that will increase an existing facility's ability to control or treat stormwater in excess of the original facility's design goals. Stormwater Facility Capital Improvement Projects identified based on the results of the Feature Inventory are described in Table 9.

Table 9: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
SC-84	The two culverts under I-5 originate in different areas. One or both culverts may be outfalls acting as the headwaters of Allen Canyon Creek. Discharge from northernmost culvert appeared stained (yellowish-brown) with some discernable odor present. Field crew was unable to determine the source of the water or odor.	Investigate source of water exiting both culverts under I-5 and construct new stormwater facilities to detain and treat runoff appropriately.
OT-34	A one foot-diameter corrugated metal outfall pipe drains stormwater into a badly eroding ditch for conveyance to the stream. The source of stormwater was not identified, but is likely I-5. Stormwater is likely untreated. No energy dissipater.	Investigate source of stormwater and construct a new stormwater facility to detain and treat runoff appropriately. At a minimum, recommend a Stormwater Infrastructure Maintenance Project to armor the existing outfall and stabilize the eroding ditch.
OT-43	A two inch-diameter PVC pipe delivering water from an unidentified source to the stream. Water is routed through a unique device which may be a rain barrel, artesian well cistern, or a submerged anaerobic filter treatment system.	Investigate source of discharged water and monitor water quality. Construct a new stormwater facility to detain and treat runoff appropriately if deemed necessary.

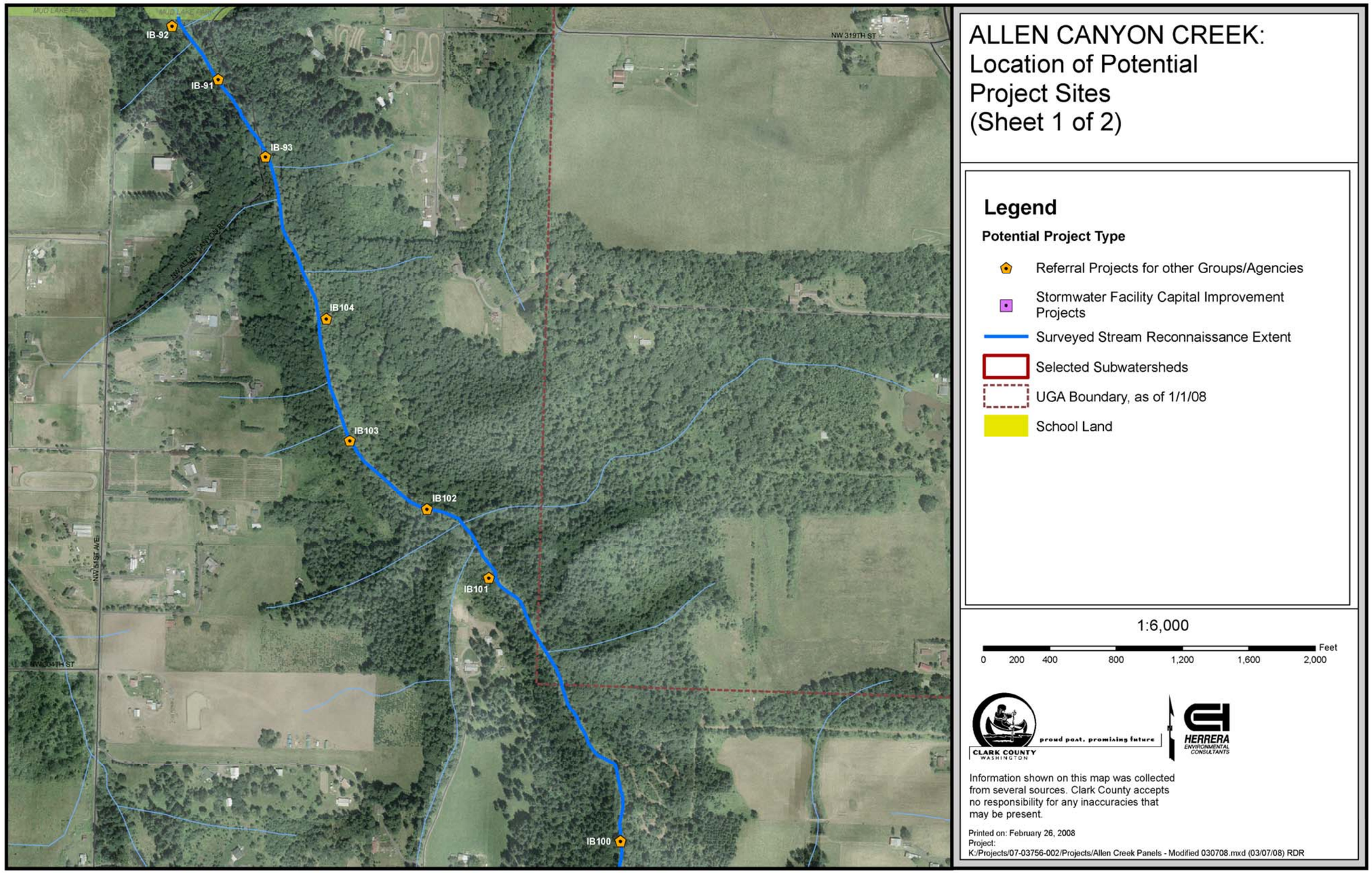

Figure 5: Potential Projects Noted in Feature Inventory

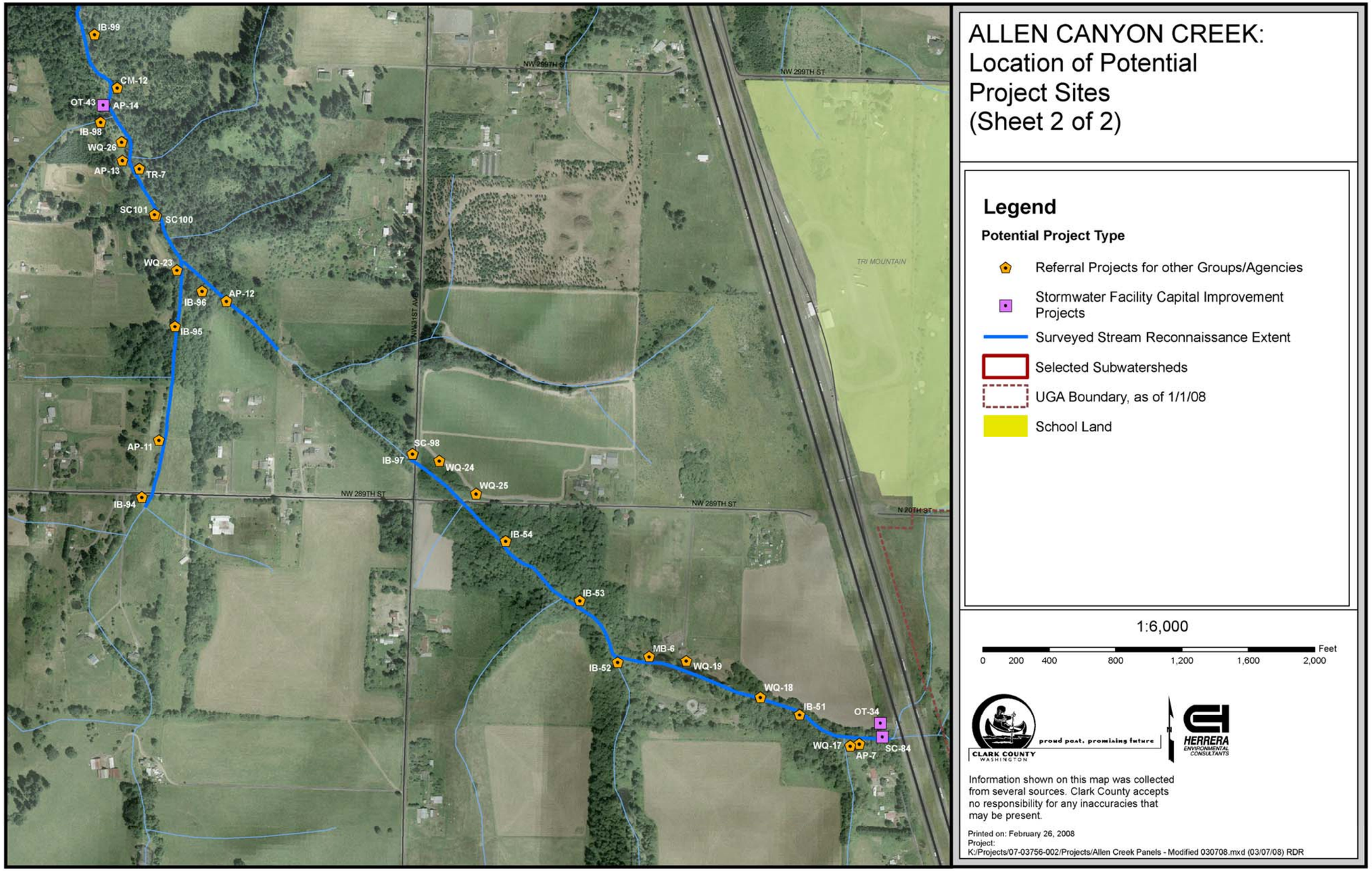

Figure 6: Potential Projects Noted in Feature Inventory

Stormwater Infrastructure Maintenance Projects
Stormwater Infrastructure Maintenance Projects include potential projects to address and repair maintenance defects affecting existing stormwater infrastructure. Infrastructure maintenance projects are required by the County NPDES municipal stormwater permit. Projects in this category with estimated costs exceeding $10,000 are considered under the SCIP process.

No projects of this type were identified in surveyed reaches of the Allen Canyon Creek subwatershed.

Habitat Restoration/Enhancement Projects
Habitat Restoration/Enhancement Projects include potential projects which result in the restoration or enhancement of wetlands, upland forest, or riparian habitat. In-stream channel habitat and bank protection projects do not fall within the scope of Clark County's CWP, and are placed under the category of Referral Projects for other Groups/Agencies.

No projects of this type were identified in surveyed reaches of the Allen Canyon Creek subwatershed.

Property Acquisition for Stormwater Mitigation
Property Acquisition for Stormwater Mitigation Projects includes potential acquisitions of properties for any purpose that meets permit requirements to mitigate for stormwater impacts. This includes preservation or restoration of upland forest and riparian habitat zones.

No projects of this type were identified in surveyed reaches of the Allen Canyon Creek subwatershed.

Referral Projects for other Groups/Agencies
Referral Projects for other Groups/Agencies include potential projects that do not fall within the defined scope of Clark County's CWP. This includes, but is not limited to, in-channel restoration, agricultural BMPs, fish passage barrier removals, and invasive plant management. It also includes referrals within Clark County departments for projects such as trash removal, stream culvert repairs/maintenance, and drainage projects. Referral Projects for other Groups/Agencies identified based on the results of the Feature Inventory are described in Table 10.

Table 10: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
AP-7	Failed wooden livestock/footbridge across creek.	Remove debris from creek. Segregate livestock from riparian area.
AP-11	Livestock access point and stream crossing with bare banks. Likely source of sediment and nutrients.	Segregate livestock from riparian area and restore riparian vegetation. Investigate quality of agricultural runoff, and apply source control, develop off channel watering, and/or construct appropriate facilities to enhance water quality.
WQ-17	Livestock access point. Lack of vegetation on left bank. Tributary stream from the south likely contributing significant agricultural runoff to the stream.	Segregate livestock from riparian area and restore riparian vegetation. Investigate potential sources of agricultural runoff to small tributary entering Allen Canyon Creek from the south, and apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-18	Small open channel drains untreated agricultural runoff from large field to the north of the stream.	Investigate source of runoff and apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-19	Open channel drains untreated agricultural runoff from large field to the north of the stream.	Investigate source of runoff and apply source control and/or construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-24	Open channel drains untreated agricultural runoff from large field to the north of the stream. Evidence of significant soil loss.	Investigate source of runoff. Apply source control to minimize/eliminate additional soil loss from fields and construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality BMP).
WQ-25	Open channel drains untreated agricultural runoff from large field to the north of the stream. Evidence of significant soil loss.	Investigate source of runoff. Apply source control to minimize/eliminate additional soil loss from fields and construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or agricultural water quality

Table 10: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
		BMP).
AP-12	Access point and washed out bridge contributing significant load of sediment to the stream.	Stabilize eroding banks, bare ground and floodplain with vegetation and coir fabric if necessary. Construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or water quality BMP) if necessary.
SC-101	Footbridge/livestock crossing over stream. Dirt road is a likely sediment source.	Stabilize bare ground with vegetation and coir fabric if necessary. Construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or water quality BMP) if necessary.
AP-13	Ford on private gravel road supplying sediment to stream.	Assess impact of stream crossing more thoroughly. Stabilize bare ground with vegetation and coir fabric if necessary. Construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or water quality BMP) if necessary.
AP-14	Ford on private gravel road supplying sediment to stream.	Assess impact of stream crossing more thoroughly. Stabilize bare ground with vegetation and coir fabric if necessary. Construct appropriate facilities to enhance water quality (new stormwater facility to detain and treat runoff or water quality BMP) if necessary.
MB-6	Large manmade dam impounding a shallow, on-channel pond. Backwater extends approximately 500 feet upstream. Pond is likely a thermal sink. Dam appears to be fairly new and in good structural condition.	Investigate thermal/water quality impact of on-channel pond. Remove dam and restore channel through reach. At minimum, attempt to decrease thermal loading by planting trees that shade water surface in summer.
WQ-23	Detention pond 60 feet from left bank. Does not appear to be a stormwater treatment facility. May be negatively influencing water quality.	Investigate thermal/water quality impact of pond. Construct appropriate facilities or take other steps to enhance water quality if necessary.
WQ-26	Manmade pond on left bank. Does not appear to be a stormwater treatment facility. May be negatively influencing water quality.	Investigate thermal/water quality impact of pond. Construct appropriate facilities or take other steps to enhance water quality if

Table 10: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
		necessary.
IB-51	Widespread invasive plant species within and immediately adjacent to the floodplain. Reed canary grass and blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-52	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-53	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-54	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-97	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry with some reed canary grass.	Eradicate blackberry and reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-96	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry with some reed canary grass.	Eradicate blackberry and reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-95	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry and reed canary grass.	Eradicate blackberry and reed canary grass. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-94	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-98	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily ivy and blackberry.	Eradicate ivy and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-99	Widespread invasive plant species	Eradicate ivy and blackberry.

Table 10: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
	within and immediately adjacent to the floodplain. Primarily ivy and blackberry.	Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-100	Widespread ivy.	Eradicate ivy. Reestablish native undergrowth and canopy vegetation.
IB-101	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-102	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-103	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-104	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-93	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily blackberry.	Eradicate blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-91	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
IB-92	Widespread invasive plant species within and immediately adjacent to the floodplain. Primarily reed canary grass with some blackberry.	Eradicate reed canary grass and blackberry. Reestablish native undergrowth and canopy vegetation on floodplain to shade out invasive plants and enhance riparian habitat.
CM-12	Channel spanning structure may act as a passage barrier at some flows.	Investigate purpose of structure/channel modification. Conduct additional barrier analysis to determine if removal or replacement of structure is required.
SC-98	Outlet end of concrete culvert under	Repair or replace culvert. Begin

Table 10: Description of Potential Project Opportunities		
ID	**Basis for Project**	**Project Description**
	NW 31st Avenue is severely damaged limiting hydraulic capacity and potential for fish passage. Widespread invasive plant species present in riparian buffer.	management of blackberry and other invasive plants. Reestablish native undergrowth and canopy vegetation to shade out invasive plants.
SC-100	Culvert at abandoned or unused road crossing may be acting as a fish barrier at some flows.	Conduct additional barrier analysis to determine if culvert retrofit or replacement is required.
TR-7	Campsite along river with a significant amount of trash and several drums.	Further investigate the nature of the debris. Remove hazardous debris if present. Work with landowner to minimize impact of campsite on riparian area.

Stormwater Management Recommendations

A number of general stormwater management measures should be implemented throughout the Allen Canyon Creek subwatershed:

- Educate private landowners concerning importance of invasive plant removal and suggest removal techniques.
- Educate private landowners on importance of native riparian vegetation and intact riparian forests for shading streams and preserving hydrology.
- Emphasize conservation of undeveloped and forested areas, especially within the riparian corridor and floodplain.
- Provide a list of suggested plants for stream revegetation and local nurseries that stock them for distribution to landowners.
- Encourage transmission of stormwater through open channels such as grass-lined conveyance ditches or bioswales rather than using piped systems to encourage filtration of suspended sediment.
- Confirm that county ditch maintenance practices minimize vegetation removal whenever possible.
- Post stream identification signs where roads cross streams. Repair or replace deteriorated signs if necessary.
- Do not overlook stormwater inputs to small tributary streams that were not surveyed as a part of this Feature Inventory. These inputs may be more numerous than originally anticipated, especially in Allen Canyon, where development is confined to the land outside of the canyon and mainstem riparian corridor.
- Protect first-order tributary streams from further stormwater impacts. Consider the use of habitat buffers, establishing conservation easements, and eliminating existing stormwater and agricultural runoff inputs.

- Educate agricultural land users and encourage soil conservation practices to reduce sediment and nutrient loads to streams.

Physical Habitat Assessment

No physical habitat survey information is available for Allen Canyon Creek.

Geomorphology and Hydrology Assessment

The geomorphology and hydrology assessment was completed as a stand-alone report after the bulk of this document was finalized. When available, this report will be attached as Appendix A.

Riparian Assessment

Purpose

The riparian assessment characterizes existing conditions based on available data to identify general riparian needs and potential areas for rehabilitation projects.

The need for riparian rehabilitation tends to be widespread and exceeds the scope and resources of the Clean Water Program mission of stormwater management. Therefore, many potential riparian projects are referred to agencies such as LCFRB, Lower Columbia Fish Enhancement Group (LCFEG), Clark Public Utilities, and the Clark Conservation District for possible implementation.

This section focuses on opportunities likely to be considered by the Clean Water Program SCIP, which are primarily on publicly owned lands within high priority salmon-bearing stream reaches as defined by LCFRB salmon recovery priorities.

Method

Where possible, the assessment is based on GIS data from existing reports, primarily the 2004 Watershed Characterization and Habitat Assessment reports prepared for the Lower Columbia Fish Recovery Board (R2, 2004 and SP Cramer, 2004). These reports apply primarily to salmon-bearing stream reaches and therefore, do not provide information for many smaller streams. Results are based on aerial photo interpretation using Washington Forest Practices Board methods for LWD delivery and channel shade estimates.

In streams where no data exists from the 2004 LCFRB characterization, an examination of current orthophotographs is used to make a general assessment of riparian condition.

Many riparian project opportunities are discovered through other SNAP activities including Rapid Stream Reconnaissance feature inventories and geomorphological assessments. Potential projects discovered through these activities are discussed in the respective sections and most are included on a final list for referral to outside agencies.

The 2004 LCFRB Habitat Assessment reports are also reviewed for specific project opportunities within each subwatershed.

Results

No habitat assessments were done by LCRFB in 2004 for Allen Canyon Creek subwatershed. An overview of orthophotographs indicates that there is forest cover from the mouth up to Mud Lake. The forest cover is heavy again upstream of Mud Lake until the Creek separates just north of NE 289th Street. For the remainder of its length there is some forested riparian vegetation, but to a lesser extent and width than occurs from the head of Mud Lake to 289th Street.

Large Woody Debris Delivery:
The observations made from the orthophotograph overview indicate that LWD recruitment potential could be moderate. Without stronger data or field surveys these observations are speculative and subjective.

Shade
The Forest canopy cover observed in the orthophotographs indicates that Allen Canyon Creek may have a moderate level of shade provided by the forest cover and riparian vegetation. Any cooling that may have resulted from riparian vegetation and forest cover shading may be offset by the open water segment of Allen Canyon Creek as it flows through Mud Lake.

Potential Projects
No specific projects are listed in the LCFRB 2004 report.

Floodplain Assessment

No floodplain assessment was conducted for the Allen Canyon Creek subwatershed.

Wetland Assessment

Purpose

Wetlands perform important hydrologic, water quality, and habitat functions. The primary reasons for the wetland assessments are to:

- Describe wetland conditions related to how they influence hydrology, water quality and habitat;
- Identify priority potential wetland projects to mitigate for stormwater impacts; and
- Make management recommendations for wetlands related to stormwater management

The primary objective of the wetland assessment is to identify sites containing modestly sized, degraded, or ditched wetlands where minor construction projects can be used to improve wetland hydrology. Improved wetland function can reduce peak storm discharges, increase groundwater recharge and improve habitat.

Methods

Detailed field evaluations and extensive review of existing data were not applied in the Allen Canyon Creek watershed. The assessment includes review of existing GIS data for wetlands. Primary information sources are the county wetlands atlas, Draft Watershed Characterization of Clark County Version 3 (Ecology, 2007), and personal communication with other county programs.

Stream Reconnaissance and Geomorphology/Hydrology assessments may also discover potential wetland-related project opportunities.

Tax-exempt parcels often indicate the presence of publicly owned land, schools, or churches where large parcel sizes and opportunities for leveraging may exist. Potential wetlands were overlaid with tax-exempt parcels and with county vacant buildable lands model (VBLM) information to identify possible wetland enhancement opportunities.

Results

Figure 7 shows potential wetland areas within the Allen Canyon Creek subwatershed based on data from the county wetlands atlas, including the Clark County wetland model, National Wetlands Inventory, and high-quality wetlands layer.

Potential wetlands are limited within the Allen Canyon Creek subwatershed. A well-drained geologic setting combined with stream morphometry consisting of steep, narrow channels descending from upland benches limit wetland areas to narrow near-stream floodplains. Most headwater wetlands in Allen Canyon Creek are within the Ridgefield urban growth boundary.

A few larger areas of potential wetland occur in the lower watershed in the vicinity of Mud Lake, and the area north of NW 289th Street and west of NW 41st Avenue.

The Clark County Regional Wetland Inventory and Strategy Study did not recommend any mitigation opportunities within Allen Canyon Creek. There are several tax-exempt parcels in the subwatershed that overlap with potential wetlands from the Clark County wetlands model, primarily State School Land and Columbia Land Trust properties.

Draft Watershed Characterization

The Draft Watershed Characterization may be found on the Clark County website at http://www.clark.wa.gov/mitigation/watershed.html. Results pertaining to Allen Canyon Creek are summarized below.

Allen Canyon Creek is part of both the Rain-dominated Mountainous hydrogeologic unit, characterized by rain-dominated precipitation, both shallow and deep patterns of groundwater flow, and moderate to steep topography; and the Terrace unit, characterized by rain-dominated precipitation, west to southwesterly trending groundwater flow, and a large delta (now a terrace) formed by glacial floods consisting of gravels, sand, silts and clay (Ecology, 2007).

Figure 8 depicts priority areas for protection and restoration of hydrologic processes county-wide based on an analysis of the relative importance and level of alteration in each subwatershed.

In general, green areas have higher levels of importance for watershed processes and limited alteration and should be considered for protection. Yellow areas have a higher level of importance for watershed processes and a higher level of alteration and should be considered for restoration unless watershed processes are permanently altered by urban development. Orange to red areas have lower levels of importance for watershed processes and higher levels of alteration and should be considered as more suitable for development. Because orange areas represent a transition from restoration areas, planning measures employing both restoration and appropriately sited development should be considered. (Ecology, 2007)

The highest ranked areas for protection (dark green) do not typically occur in the Terrace unit. Overall, results for the Terrace unit suggest focusing restoration activities east of Interstate 5, with particular emphasis on "siting and designing development in a manner that protects and maintains processes (i.e., through low impact development measures including clustering, density bonuses, transfer of development rights, and mitigation banking)", and concentrating development on the west side of I-5 in upland areas while protecting aquatic resources and discharge areas, such as slope wetlands. (Ecology 2007).

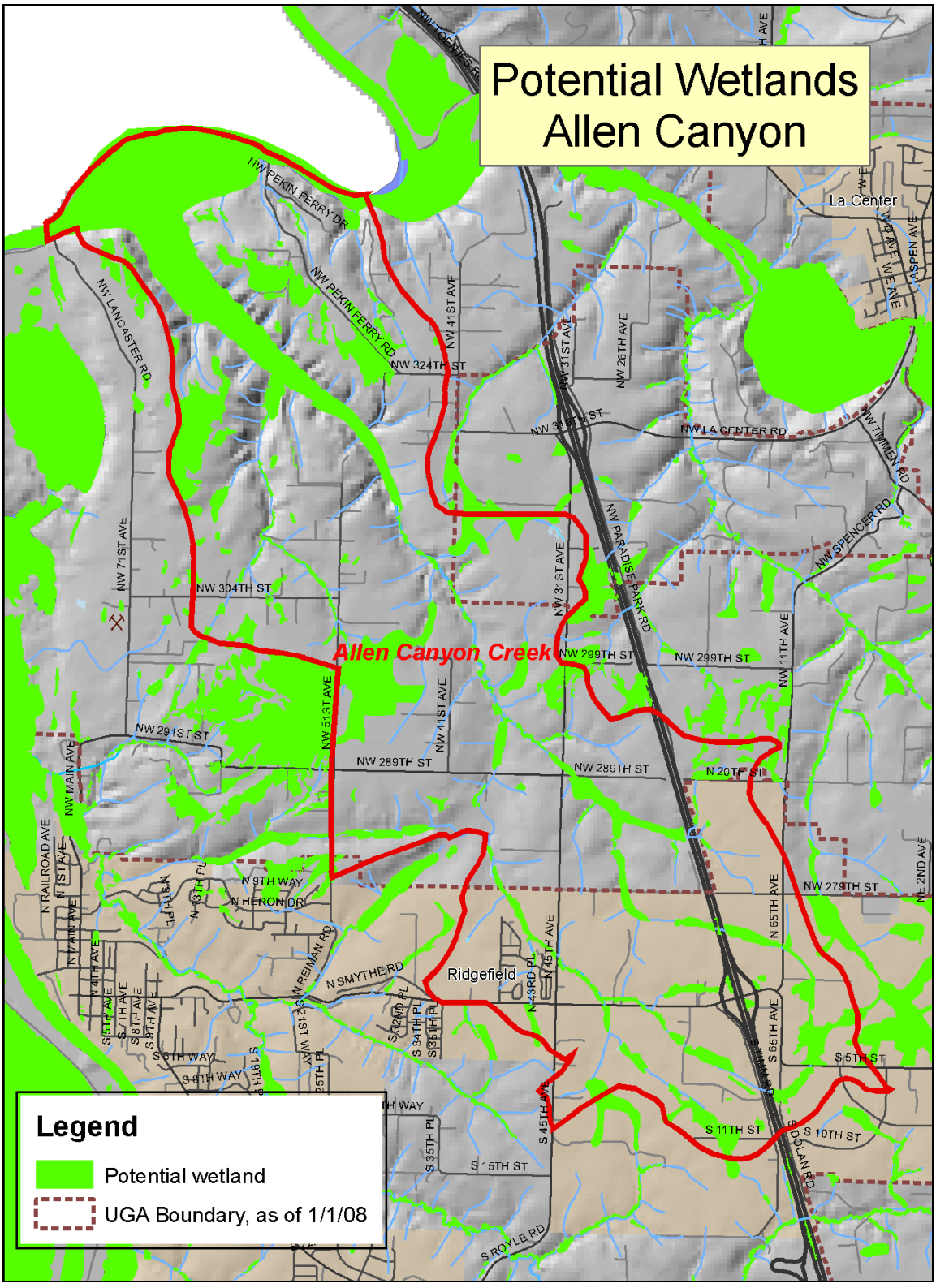

Figure 7: Potential Wetlands in Allen Canyon Creek subwatershed.

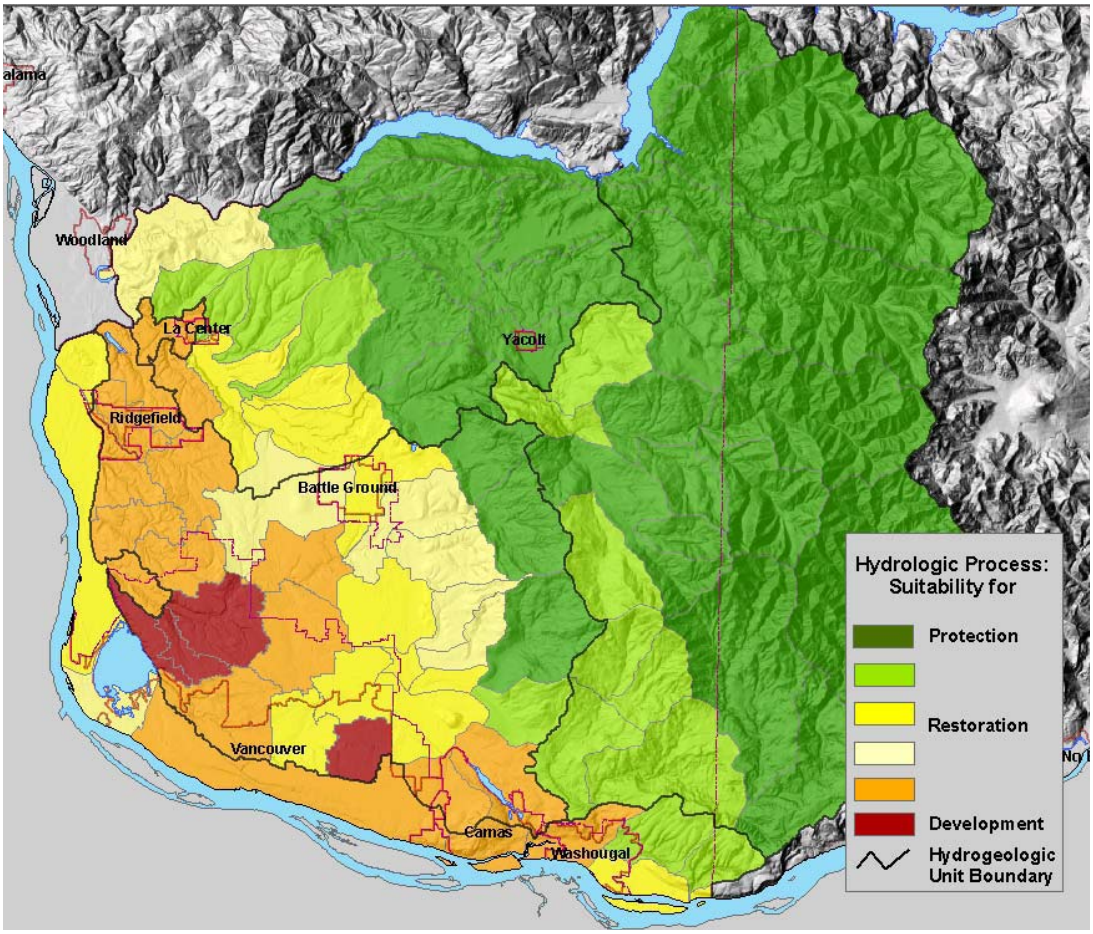

Figure 8: Priorities for suitability of areas for protection and restoration for the hydrologic process (from Draft Watershed Characterization of Clark County (Ecology, 2007)).

The Allen Canyon Creek subwatershed is indicated as suitable for both development and restoration (orange) due to a higher level of alteration and a lower level of importance for watershed processes.

Potential Projects

Potential project locations for further exploration based on this wetland assessment include the tax exempt parcels (Table 11) that overlap with potential wetlands from the Clark County wetlands model.

Table 11: Tax Exempt Parcels Overlapping Potential Wetlands				
ASSR_SN	**ASSR_AC**	**OWNER**	**PT1DESC**	**Description**
210343-000	21	Columbia Land Trust	Unused or vacant	High quality wetlands and forest
210342-000	19	Columbia Land Trust	Unused or vacant	High quality wetlands and forest
210155-000	24.83	Columbia Land Trust	Unused or vacant	High quality wetlands and forest
211014-000	4.08	Columbia Land Trust	Unused or vacant	High quality wetlands and forest
210782-000	40	State School Land	Unused or vacant	High quality wetlands and forest
210783-000	35	State School Land	Unused or vacant	High quality wetlands and forest
210785-000	5	State School Land	Unused or vacant	High quality wetlands and forest

Macroinvertebrate Assessment

No macroinvertebrate samples were collected in Allen Canyon Creek in the summer of 2007 because the creek had no flow. Allen Canyon Creek typically dries up above the wetlands at the upper end of Mud Lake.

Fish Use and Distribution

Purpose

Fish distribution refers to salmon and steelhead use. This information helps to identify stream segments where land-use changes may impact fish populations, informs management decisions, and aids in identifying and prioritizing potential habitat improvement and protection projects.

Methods

Fish distribution is mapped from existing Clark County GIS information, which reflect data collected and analyzed by the Northwest Indian Fisheries Commission (NWIFC). Fish distribution data for Clark County is available on the County's website.

Several sources of barrier assessment data are available and are briefly summarized here, including:

- WDFW passage barrier database
- Salmon Scape (http://wdfw.wa.gov/mapping/salmonscape/)
- Clark County 1997 passage barrier data clarkgis\avdata\shapes\resource\fishpass.shp)
- Clark Conservation District/LCFRB passage barrier dataset

Many stream crossings have not been assessed for passage barrier potential, and the extent of public and private road crossings is a good indicator of the potential for additional barriers. Road crossings were mapped by overlaying the county road layer (roads.shp) with LiDAR-derived stream data from StrmCntr.shp.

Results/Summary

Distribution

The available evidence suggests that Allen Canyon Creek has anadromous fish use by Coho salmon and winter steelhead (Figure 9). The fish use and distribution is limited within this subwatershed to approximately 1,500 feet of stream beginning at the confluence with the Lewis River. The LCFRB has not assigned a Tier ranking to Allen Canyon Creek. This may be due in part to a combination of factors including the relatively limited fish use and distribution, and the assessment of hydrologic, sediment, riparian conditions within the subwatershed as moderately impaired.

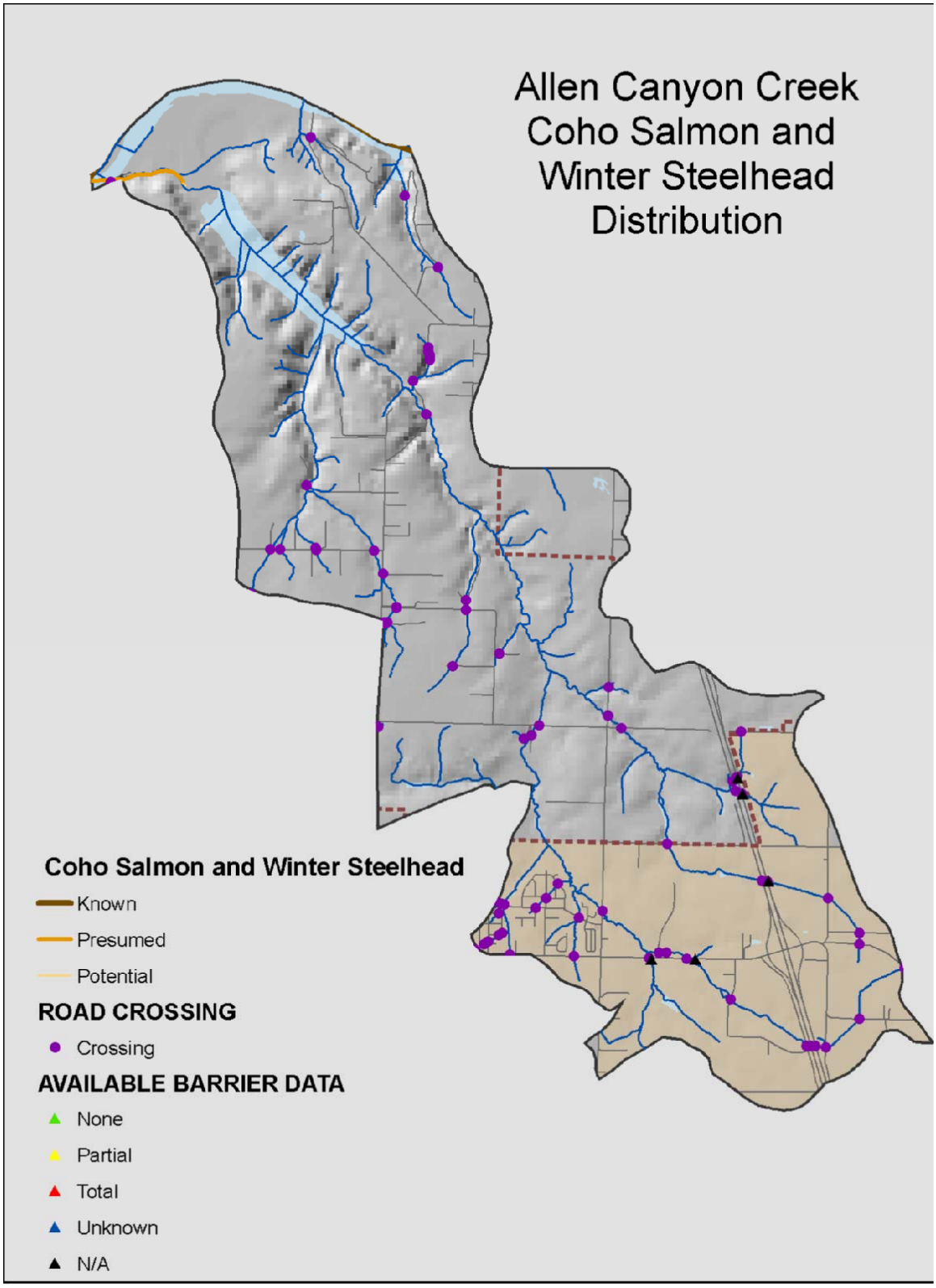

Figure 9: Fish Distribution and Barriers

Barriers

The WDFW barrier database and the 2007 LCFRB Regional Culvert Survey provide the most complete assessment of barriers in Allen Canyon Creek subwatershed (Figure X). According to this data there are no identified fish barriers in this subwatershed.

Recommendations

When replacing, repairing or installing new road crossings ensure that these projects comply with county, state and federal fish passage requirements.

Hydrologic and Hydraulic Modeling

Hydrologic and hydraulic modeling was not conducted for the Allen Canyon Creek subwatershed.

Analysis of Potential Projects

This section provides a brief summary of stormwater problems and opportunities, notes recently completed or current projects within the study area that may be relevant to SNAP project selection, describes the analytical approach, and lists recommended projects and activities for further evaluation. Projects or activities are placed in one of six categories.

Summary of Conditions, Problems, and Opportunities

Conditions and Problems

This section briefly summarizes important results from the assessment and identifies overall stormwater-related problems.

Coordination with Other Programs:

Allen Canyon Creek is relatively sparsely populated and does not have an active watershed improvement group. However, local residents have taken on a watchdog role in matters pertaining to gravel mining near Mud Lake.

The Columbia Land Trust and Vancouver-Clark Parks and Recreation own several large parcels in the vicinity of Mud Lake in the lower watershed.

The Parks, Recreation and Open Space Master Plan for the City of La Center (2007) outlines potential parks and trails within the La Center UGA, parts of which are within the Allen Canyon Creek subwatershed.

Watershed-specific projects by regional entities including LCFRB, Clark Public Utilities, Clark County Transportation Improvement Program, and the Department of Ecology are not significant.

Broad-Scale Characterization:

Allen Canyon Creek soils tend to be fine-grained, have high clay content, and are easily eroded in steeper headwater areas. Predominant soil types are Group C and D, which tend to have low permeability and are often associated with wetter areas.

There is no stream gauge on the creek, so hydrologic conditions are inferred from land cover. However, the creek has been observed to dry up above Mud Lake during summer.

Standard metrics based on NOAA fisheries standards indicate significant human alteration and suggest Allen Canyon Creek stream habitat is likely significantly degraded. These metrics include forest cover, TIA and EIA, and road density.

Based on current and future predicted EIA and forest cover, it is likely that stream channels will be predominantly unstable. Most projected development is expected to occur in headwater areas near the Ridgefield interchange.

Water Quality Assessment:
Measured water quality data is almost non-existent in Allen Canyon Creek. Volunteer data provided by a watershed resident indicates that geometric mean fecal coliform concentration was relatively low during 1997 and 1998.

The county Stream Health Report (2004) predicted poor overall water quality in Allen Canyon Creek based on a simple land-use model.

Drainage System Inventory:
Drainage mapping is nearly complete. The drainage system consists almost entirely of roadside ditches and was mapped during 2007.

Stormwater Facility Inspection:
At the time of the assessment, there were no public stormwater facilities in the Allen Canyon Creek watershed.

Illicit Discharge Screening:
Illicit discharge screening was not conducted.

Stream Reconnaissance Feature Inventory:
Significant stream impairments, potential environmental and safety hazards, and stormwater project opportunities were recorded for approximately 2.6 miles of stream corridor. A total of 49 significant features were identified, primarily impacted stream buffers, stream crossings, and water quality impacts. Thirty-nine potential projects were identified in six categories; all but three were projects outside the scope of CWP activities and were recommended for referral to outside groups or agencies.

General observations from the feature inventory included:

- Predominant sources of stormwater are agricultural land and road surfaces. Existing stormwater infrastructure is minimal.
- Impacted stream buffers are prevalent; while the riparian forest canopy is typically in good condition, the understory is dominated by invasive species.
- Stream channels appeared to be stable but exhibit simplified geometry.
- Features of interest were often discovered along small first-order tributaries, many of which were not included in the survey scope. Thus, it is likely that additional features of interest exist in areas not assessed.

Physical Habitat:
No physical habitat data is available for Allen Canyon Creek.

Geomorphology and Hydrology:
See Appendix A for results of these assessments. Results were not available at the time of report completion.

Riparian Assessment:
The most reliable riparian assessment data in Clark County is limited to the areas assessed during the 2004 LCFRB Habitat Assessment. The Allen Canyon Creek subwatershed was not included in the assessment.

A qualitative review of 2007 aerial photography indicated that riparian forest is relatively intact between the mouth and Mud Lake, and from Mud Lake upstream to approximately 289th Street. Uplands are largely cleared in the upper watershed.

Wetland Assessment:
Based on available wetlands data, potential wetlands are limited to narrow, near-stream floodplains. There are some headwater wetlands within the Ridgefield urban growth boundary, and a few larger areas of potential wetlands in the vicinity of Mud Lake.

The Clark County regional wetlands inventory did not recommend any mitigation opportunities within Allen Canyon Creek.

Ecology's draft wetland characterization of Clark County places Allen Canyon Creek in a category suitable for both development and wetland restoration due to a higher relative level of alteration and lower relative importance to regional watershed processes.

There are seven tax-exempt parcels which overlap potential wetland areas. All of these are owned by either the Columbia Land Trust or the State of Washington.

Macroinvertebrate Assessment:
There are no macroinvertebrate data available for Allen Canyon Creek. Samples were planned but not collected in 2007 due to lack of water in the stream during the assessment period.

Fish use and Distribution:
Anadramous fish use is presumed by Coho salmon and winter steelhead, but only in the lower 1,500 feet downstream of Mud Lake. Barrier assessment has not been conducted in Allen Canyon Creek.

Allen Canyon Creek is not a regional priority for salmon recovery.

Hydrologic and Hydraulic modeling:
Modeling was not conducted for the Allen Canyon Creek watershed.

Recently Completed or Current Projects

There are no stormwater projects in Allen Canyon Creek under the 2007 through 2012 SCIP. The Gee Creek Enhancement Committee and City of Ridgefield are exploring opportunities for projects within the Ridgefield UGA in neighboring

Gee Creek. Additional opportunities could be discovered in the Allen Canyon Creek headwaters.

Analysis Approach

Purpose

The Analysis of Potential Projects narrows the initial list of possible projects to a manageable subset of higher priority opportunities. Listed opportunities in sections of the SNAP report include sites requiring immediate follow-up, possible stormwater capital improvement projects, referrals to ongoing programs, and potential projects for referral to other county departments or outside agencies.

Stormwater capital improvement project opportunities are recommended for further evaluation by engineering staff, and potential development into projects for consideration through the SCIP process. Referrals to ongoing programs such as IDDE screening, operations and maintenance, and source control outreach, receive follow-up within the context and schedules of the individual program areas. Referrals to other county departments, such as Public Health, or to outside agencies such as Clark Conservation District and Clark Public Utilities may lead to additional activities outside the CWP scope.

Methods

An initial review is conducted for all potential projects identified during the stormwater needs assessment. Field notes, descriptions, field photos, and other associated information are reviewed. In some cases additional field reconnaissance is performed.

In general, potential capital projects are evaluated by CWP staff on the basis of problem severity, estimated cost and benefits, land availability, access, proximity and potential for grouping with other projects, and potential for leveraging resources. Staff considers supporting data and information from throughout the SNAP report to assist in the initial project review.

Based on this review, lower priority opportunities are removed and higher priority projects are recommended for further consideration by the CWP.

Emergency/Immediate Actions

None discovered.

Potential Stormwater Capital Projects

Stormwater Capital Facility Improvement Projects

Identifier	Issue	Project	Action
SC-84	Discharge from north trib stained; no detention/treatment Opportunity for joint regional projects: CC, Ridgefield, 7th Day Adventists, WSDOT	Construct regional detention treatment facility; riparian enhancement	Evaluate for 2008 or 2010 SCIP

Stormwater Infrastructure Maintenance CIPs

No potential projects found.

Stormwater Class V Underground Injection Control projects:

None exist in Allen Canyon Creek.

Habitat Rehabilitation/Enhancement Projects.

None are recommended for SCIP.

Property Acquisition for Stormwater Mitigation

No specific acquisition sites were discovered, but significant public holdings already exist in the lower watershed. The CC Mitigation Opportunities Project lists most of the lower watershed as a conservation acquisition area. Future opportunities to protect or acquire additional lands in this area should be pursued.

Follow-up Activities for Referral within CWP

Private Stormwater Facilities Maintenance

None required.

Public Works stormwater infrastructure maintenance

None required.

CWP IDDE Screening

Identifier	Issue	Project	Action
SC-84	Discharge from north trib stained	Initial screening visit	Refer to IDDE

CWP Outreach/Technical Assistance

Identifier	Issue	Action
AP-11, WQ-17	Livestock access/stream crossing	Refer to CWP Outreach; contact to landowners about BMPs and CCD assistance
WQ-18, WQ-19, WQ-24, WQ-25	Open channel draining untreated agricultural runoff to stream	Refer to CWP Outreach; contact to landowners about BMPs and CCD assistance
AP-12, AP-13, AP-14	Stream ford on private gravel or dirt road	Refer to CWP Outreach; contact to landowners about BMPs and CCD assistance
OT-43	Unknown water source and device	Refer for possible site visit
Numerous IB locations	Widespread invasive plants	Refer to CWP Outreach

CWP Infrastructure Inventory

No features to add to inventory.

Projects for Referral to Other Departments/Agencies/Groups

Identifier	Issue	Action
OT-34	I-5 outfall in badly eroding ditch; no dissipater	Refer to WSDOT; consider as annual Clean Water fee project
SC-98	Outlet end of concrete culvert under NW 31st Ave severely damaged	Refer to PW Operations

Non-Project Management Recommendations

Non-project stormwater management recommendations address areas where county programs or activities could be modified to better address NPDES permit components or promote more effective mitigation of stormwater problems. Information of this type contributes to adaptive management strategies and more effective stormwater management during the permit term.

Management and programmatic recommendations in the Allen Canyon Creek subwatershed, by permit component, include:

Storm Sewer Mapping and Inventory

- None; being completed by CWP.

Coordination of Stormwater Activities

- Promote protection of first-order tributary streams. Consider the use of habitat buffers, establishment of conservation easements, and increased control of existing stormwater and agricultural runoff.

Mechanisms for public involvement

- Publish SNAP reports on CWP web page

Development Regulations for Stormwater and Erosion Control

- EIA is expected to increase to approximately 25 percent in the Allen Canyon Creek subwatershed under the current Comprehensive Plan. At this level, adverse changes to stream hydrology and stability will occur unless development standards effectively control the duration of erosive flows. Clark County is currently working to adopt standards equivalent to the 2005 Ecology stormwater manual.
- In developing areas, emphasize stormwater management that focuses on reduction of runoff and diffuse infiltration close to the source rather than in centralized facilities. LID practices should be encouraged.

Stormwater Source Control Program for Existing Development

- None

Operation and Maintenance Actions to Reduce Pollutants

- Confirm that county ditch maintenance practices minimize vegetation removal whenever possible.
- Promote the use of geomorphically-based performance standards when designing new or replacement hydraulic structures at road crossings.

Education and Outreach to reduce behaviors that contribute stormwater pollution

Areas where increased outreach could improve stream conditions include:

- Perform targeted technical assistance responding to results of field assessments.
- Invasive plants are ubiquitous in Allen Canyon Creek and Clark County; eradication and/or control of these plants is beyond the resources of public agencies and requires actions by private landowners. Increased education and

technical support would be beneficial, including removal techniques and lists of suggested plants for re-vegetation.

- Replace missing or deteriorated stream name signs.
- Develop a process to provide education about appropriate ditch maintenance practices to rural landowners.
- Encourage soil conservation practices to reduce sediment and nutrient loads to the MS4 from agricultural lands.

TMDL Compliance

- There are no TMDLs for Allen Canyon Creek.

Monitoring Stormwater Program Effectiveness

- Problems caused by stormwater are common and most severe on small tributary streams. Assessment of all streams is beyond the scope of SNAP work. Future SNAP reports may benefit by focusing more assessment resources on smaller tributary streams rather than mainstem reaches.

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Appendices

Appendix A — Geomorphology and Hydrology Assessment