Chapter 3. Drainage

Overview

Drainage-related issues, including glaciation, erosion, and flooding, are a chronic and growing problem, particularly in the southeastern, steeper portions of the Hillside District. All development on the Hillside, existing and future, has some impact on drainage. As everyone knows, water runs downhill, so problems in one place are often the result of unrelated activities uphill.

During this and previous planning processes, a number of acute and chronic drainage problems were identified. Causes of these problems may be diffuse but cumulative effects lead to specific instances of property damage and safety concerns. Although not everyone experiences these problems, for those who do they are frustrating and costly.

Because drainage issues are the result of disconnected actions uphill, a new, better coordinated approach is required, both to fix existing problems and to proactively prevent future problems. As with so many aspects of land development, prevention is much cheaper than repair. This plan establishes three broad policies to address Hillside drainage issues:

1. Establish standards to reduce and better direct runoff from individual lots and subdivision development (for example, through retention of native vegetation).
2. Manage runoff on a watershed basis by developing and implementing watershed drainage plans. Emphasize the use of natural drainage ways and wetlands (green infrastructure); but where necessary, use ditches, retention basins, and storm drain pipes (built infrastructure). Incorporate these plans as municipal-wide master drainage plans.
3. Create a new Hillside drainage funding and management entity, to provide a new district- or watershed-wide means to solve existing and future drainage issues. This entity would enforce drainage policies, fund and implement construction of watershed-based drainage solutions and maintain drainage systems on the Hillside. Continuing to rely on the existing system of Local and/or Rural Road Service Areas is not adequate to solve drainage issues. Chapter 6. Implementation describes this policy in more detail.

Public concerns expressed during the planning process include:

- Removal of native vegetation leads to higher amounts of runoff.
- Excavation for roads and buildings causes discharge of shallow groundwater; this leads to increased surface drainage and winter glaciation problems.
- Disruption of historic flow paths and diversion of flows creates problems in areas that didn't have problems before.
- Lack of adequate planning for drainage results in ice on roads, water in basements, and degradation of water quality, especially in receiving waters such as Potter Marsh.
- A built drainage system to augment natural drainage should be considered, for certain problem areas and to address water quality concerns.

A major sentiment expressed was a willingness to pay for solutions if the work was managed properly, including enforcement of stronger standards, and if costs were equitably distributed.

The "do-nothing" approach to addressing Hillside drainage concerns is no longer a practical option. Unless a new management and maintenance approach to Hillside drainage is adopted, existing drainage-related problems will worsen and new problems will be created, particularly in the steeper, higher elevation areas of the Hillside.

Cutbacks on road edges increase runoff on the road and adjacent property (above). Glaciation is a problem on some Hillside roads.

Context: Planning Issues Summary

Hillside Watershed Basics

A watershed is the entire land area that catches runoff and drains it into a particular water body, such as a stream or wetland. Runoff is the result of rainfall, snowmelt, and discharge of groundwater exposed during excavation. Runoff in developed areas of the Hillside is typically conveyed in roadside ditches, culverts, and small natural streams. Most of these drainage systems were constructed to serve a single project and few, if any, are sized to convey runoff from adjoining development. Most of the existing subdivisions were not built to drainage standards now required in Anchorage. In some established areas of the Hillside, these systems work well. In others, particularly those in higher elevation areas and/or with higher densities, inadequate drainage structures (such as ditches and culverts) cause significant problems. Solving drainage problems by allowing all runoff to flow off site decreases the amount of water that formerly was taken up by plants, evaporated, or infiltrated to recharge aquifers. Lack of aquifer recharge in specific areas may cause localized problems.

Causes of Drainage Problems

Development affects runoff by disrupting natural drainage systems. Some natural drainage ways and wetlands have been damaged or diverted by land development. Remaining wetland, streams, and natural drainage ways provide vital storm water management functions but currently are not managed to serve this function on a sustainable basis. The roadside ditches and other drainage conveyance systems associated with existing development are often undersized and lack connectivity.

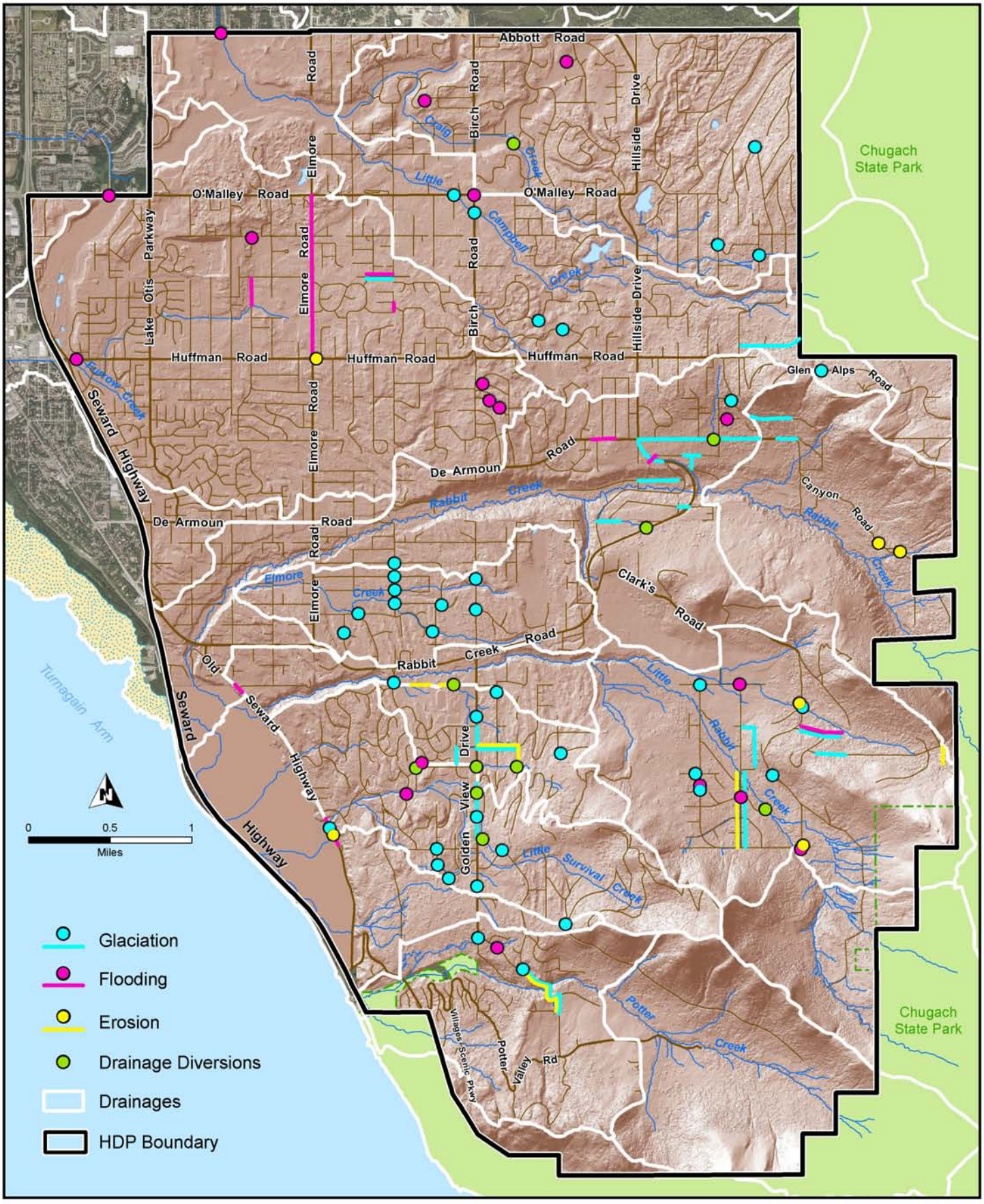
Development of the natural landscape also affects runoff by replacing permeable land with less permeable surfaces for buildings, roads, driveways, and landscaping. The character of residential development on the Hillside is changing, resulting in larger buildings, larger areas of impermeable surfaces, and larger areas cleared for landscaping. As natural land is developed and replaced by impermeable surfaces, the potential for runoff-related problems increases.

Parts of the Hillside have shallow groundwater that creates surface flows. In addition to naturally occurring seeps, groundwater is exposed during excavation for roads, buildings, and other development, through removal of vegetation and from extensive cut-slopes. In some of these areas, this groundwater continues to discharge as surface water seasonally or even year

Map 3.1

Drainage Issues on the Hillside

Hillside District Plan



round after construction is completed. These surface water discharges must either be diverted or handled by an adequate drainage system to prevent impacts on others, including flooding and winter icing conditions.

Existing regulations and drainage design criteria do not adequately address these and other unique conditions of the Hillside and are not always adequately enforced. Existing development built to old standards in conjunction with newer, denser development has a cumulative effect on downstream drainage and the potential to create or exacerbate drainage problems. Both existing and new development have a stake in managing drainage and solving drainage problems within a given watershed.

Previous Attempts to Address Drainage Issues

Drainage issues on the Hillside are not new and have been studied before. Between 1987 and 1995, the Municipality of Anchorage Department of Public Works conducted a Hillside Drainage study. The southern boundary of that study was Rabbit Creek Road. During the study process, an inventory of problems was compiled, a series of public workshops was carried out, and a drainage atlas was produced. Feasibility-level engineering solutions were developed for specific problem areas. The lack of a coordinated authority to perform construction was recognized and recommendations for forming a management authority were outlined. The study did not produce an implementation plan.

Lack of Management Authority

Today, the majority of Hillside roads and associated drainage ditches are located in, and maintained by, a patchwork of Limited Road Service Areas, homeowners associations, or informal neighborhood maintenance groups, who generally do not have the authority or resources to solve drainage issues. (See LRSA sidebar on this page and Map 6.1.) No single entity is responsible for managing drainage throughout each watershed, from top to bottom. Each of these entities – subdivisions, homeowners, and service area managers – independently attempt to convey runoff through or around their properties. This has resulted in disjointed, inadequate drainage systems, the inefficient use of funds being spent on repeat maintenance efforts, and overall higher maintenance costs. In addition, adjacent LRSAs may not agree on

Limited Road Service Areas (LRSAs)

LRSAs do not have the legal authority to take on capital improvement projects. While Hillside LRSAs spend a significant portion of their annual budget coping with drainage issues, these entities only have authority to do maintenance, primarily for roads. The two RRSAs on the Hillside (the Glen Alps and Goldenview Rural Road Service Area) do have legal authority to collect fees to construct capital improvement projects, including drainage-related improvements. However, drainage problems and solutions extend beyond the capability of any single LRSA or RRSA.

how to manage drainage, leading to an impasse on resolution of problems or a situation where one entity works at cross-purpose to another. The current uncoordinated approach offers no practical means to solve persistent problems caused by existing poorly designed or inadequate drainage facilities, nor means to plan for or construct new or upgraded systems to control increased runoff from upstream development.

Goal and Policy Summary

Background

The Hillside District Plan establishes a new approach to managing and maintaining drainage on the Hillside, focused on the use of natural systems. Natural systems are emphasized for several reasons:

- Natural systems offer a relatively low-cost approach, particularly compared to retrofitting the Hillside with a piped stormwater system.
- Retention and responsible use of natural drainage systems, of streams, wetlands, recharge areas and other natural water systems, also helps protect water quality and habitat and reduce flood risks.

To be successful, the approach recommended here requires the successful realization of this full set of policies. For example, relying primarily on natural drainage ways will only work if runoff from individual lots is minimized.

While the plan emphasizes the use of natural systems, there may be some locations on the Hillside where such systems alone are insufficient to handle anticipated runoff. In these situations, natural systems will be augmented by the use of roadside ditches and, in some instances, stormwater pipes.

Goal and Policy Summary

Goal 8. Drainage Management

Develop a functional, watershed-based drainage management system for the Hillside District to achieve the following:

- Create a practical, effective approach to manage the drainage needs of new and re-development.
- Ensure existing residents and landowners are protected when new development occurs.
- Resolve existing drainage problems and mitigate hazards and adverse impacts associated with inadequate drainage controls in existing developed areas.
- Protect existing stream and wetland functions by maintaining the natural quantity, quality, and periodicity of recharge to natural waterbodies and wetlands.

Primary Policy	Implementation
8-A. For steep areas, areas above timberline, lots with an unusually high percentage of developed impervious area, and important recharge areas, develop standards to reduce runoff from individual parcels and subdivisions. Such standards may include increasing retention of vegetation, using rain gardens, and retaining natural stream corridors.	Objectives are established by the Hillside District Plan; codification by MOA Planning Department and MOA Project Management and Engineering Department.
8-B. Manage runoff on a watershed basis. Define an integrated system of drainage features at the watershed scale (built/green infrastructure) by preparing and following watershed drainage plans for all watersheds within the Hillside. Identify parts of drainage corridors that are privately owned and implement an easement acquisition program.	Watershed drainage plans prepared by MOA Project Management and Engineering Department-Watershed Management Services.
8-C. Develop Hillside-wide and Anchorage Bowl-wide background material to enhance watershed drainage planning and built/green infrastructure mapping.	Cooperative effort of MOA Parks and Recreation Department and MOA Project Management and Engineering Department, in consultation with the Alaska Department of Fish & Game (ADF&G) or other habitat specialists.
8-D. Establish a new Hillside drainage management entity to help fund and manage needed drainage improvements for existing and future development and watershed protection and aquifer recharge efforts.	See HDP Chapter 6.
8-E. No net increase in runoff beyond existing peak flows for up to the 10-year event from development will be permitted unless regional facilities are in place and are adequate to accept the drainage.	Cooperative effort of MOA Planning Department, MOA Project Management and Engineering Department, and the MOA Development Services Department.

Policies and Policy Background

GOAL 8. Drainage Management

Develop a functional, watershed-based drainage management system for the Hillside District to achieve the following:

- **Create a practical, effective approach to manage the drainage needs of new and redevelopment.**
- **Ensure existing residents and landowners are protected when new development occurs.**
- **Resolve existing drainage problems and mitigate hazards and adverse impacts associated with inadequate drainage controls in existing developed areas.**
- **Protect existing stream and wetland functions by maintaining the natural quantity, quality, and periodicity of recharge to natural waterbodies and wetlands.**

Policy 8-A

Development Standards

For steep areas, areas above timberline, lots with an unusually high percentage of developed impervious area, and important recharge areas, develop standards to reduce runoff from individual parcels and subdivisions.

Background

HDP Policy 8-A is necessary to manage Hillside drainage issues by reducing runoff from new and redeveloped individual parcels and new subdivisions. Reducing runoff from new and redevelopment and the exposure of springs and shallow groundwater will decrease the size, cost, and maintenance of downstream conveyance systems. Less runoff will also help protect the quality of water and, at higher elevations, recharge underground aquifers that are the source of much of the Hillside's drinking water. Controls on the location and extent of cuts for roads, driveways, and buildings will reduce the exposure of shallow groundwater and springs.

The following list below describes the general objectives for these new standards; the specific standards are presented in Chapter 6. Implementation. As is stated in that chapter, incorporating these standards will require both Hillside-specific standards, and perhaps changes to the Design Criteria Manual and Title 21.

Figure 3.2
Runoff Controls

ADEQUATE RUNOFF CONTROLS

INADEQUATE RUNOFF CONTROLS

Minimizing impermeable surfaces and retaining natural vegetation reduces the amount of runoff from new development. These can decrease the cost of downstream water conveyance systems and help to protect water quality too.

To manage drainage, new developments could be required to include control measures to reduce runoff. Adequate drainage systems could be designed and installed up front, greatly reducing ongoing operations costs.

Runoff conveyed in roadside ditches.

Glaciation on a Hillside road.

- Retain native vegetation based on lot size and slope for individual parcels, and based on drainage and greenbelt continuity for larger tracts of land.
- Reduce allowed impermeable surface coverage such as driveway and building footprints.
- Capture roof runoff; for example, by using "rain gardens" or other features that infiltrate runoff using planted, gravel-filled retention areas.
- Connect driveway runoff to greenbelts or other infiltration sites, rather than an adjoining road swale.
- Require controls on cut-and-fill for building foundations; for example, requiring site-responsive stepped foundations versus cut pads.
- Develop new standards and procedures to address drainage issues associated with shallow groundwater.

Policy 8-B

Watershed Plans

Manage runoff on a watershed basis. Define an integrated system of drainage features at the watershed scale (built/green infrastructure) by preparing and following watershed drainage plans for all watersheds within the Hillside. Identify parts of drainage corridors that are privately owned and implement an easement acquisition program.

Background

The watershed approach is intended to:

- Provide continuity and capacity for drainage by systematically identifying solutions to existing drainage-related problems. Solutions may involve using a combination of natural features, new structures, and easement acquisition.
- Identify natural drainage corridors for preservation and acquisition.
- Present regional control structures within each watershed and provide developers with a clear understanding of the requirements.
- Protect and supplement natural drainage systems and high-quality wetlands with piped drainage systems (where necessary and cost-effective).

- Provide economies of scale and therefore overall lower costs to residents compared to the lot-by-lot or subdivision-by-subdivision approach.
- Manage road drainage and snow melt in a manner consistent with other drainage goals.

To carry out this approach, watershed drainage plans are needed for all watersheds within the Hillside District. These plans will identify integrated watershed-wide systems of drainage features at the watershed scale (built/green infrastructure) or all watersheds within the Hillside. The plans would identify solutions for existing drainage-related problems, plan for the adequate conveyance of flows associated with new development and redevelopment, and protect valuable resources such as streams and high-quality wetlands.

To demonstrate this watershed drainage planning process in a practical approach, a pilot watershed drainage plan (Map 3.3) has been developed for the Little Rabbit Creek and Little Survival Creek watersheds (an approximately 7.5-square-mile area). Work is now underway to develop a similar drainage plan for the Potter Valley watershed (Map 3.4).

For these and other watersheds, a rainfall-runoff model is developed which identifies drainage deficiencies under future land use conditions. Preliminary drainage solutions are ranked and assigned concept-level costs. Solutions include requirements for runoff controls from all new development, as well as existing system upgrades and controls to mitigate runoff from all new development. Map 3.3 graphically displays the recommended system upgrades and mitigation measures for the Little Rabbit Creek and Little Survival Creek drainages.

The following watershed drainage plans should be prepared and implemented:

- Little Rabbit Creek and Little Survival Creek Watersheds Drainage Plan (completed),
- Potter Creek Watershed Drainage Plan (completed),
- Little Campbell Creek (includes Craig Creek) Watershed Drainage Plan (underway),
- Rabbit Creek (includes Elmore Creek) Watershed Drainage Plan (not yet scoped), and
- Furrow Creek Watershed Drainage Plan (not yet scoped).

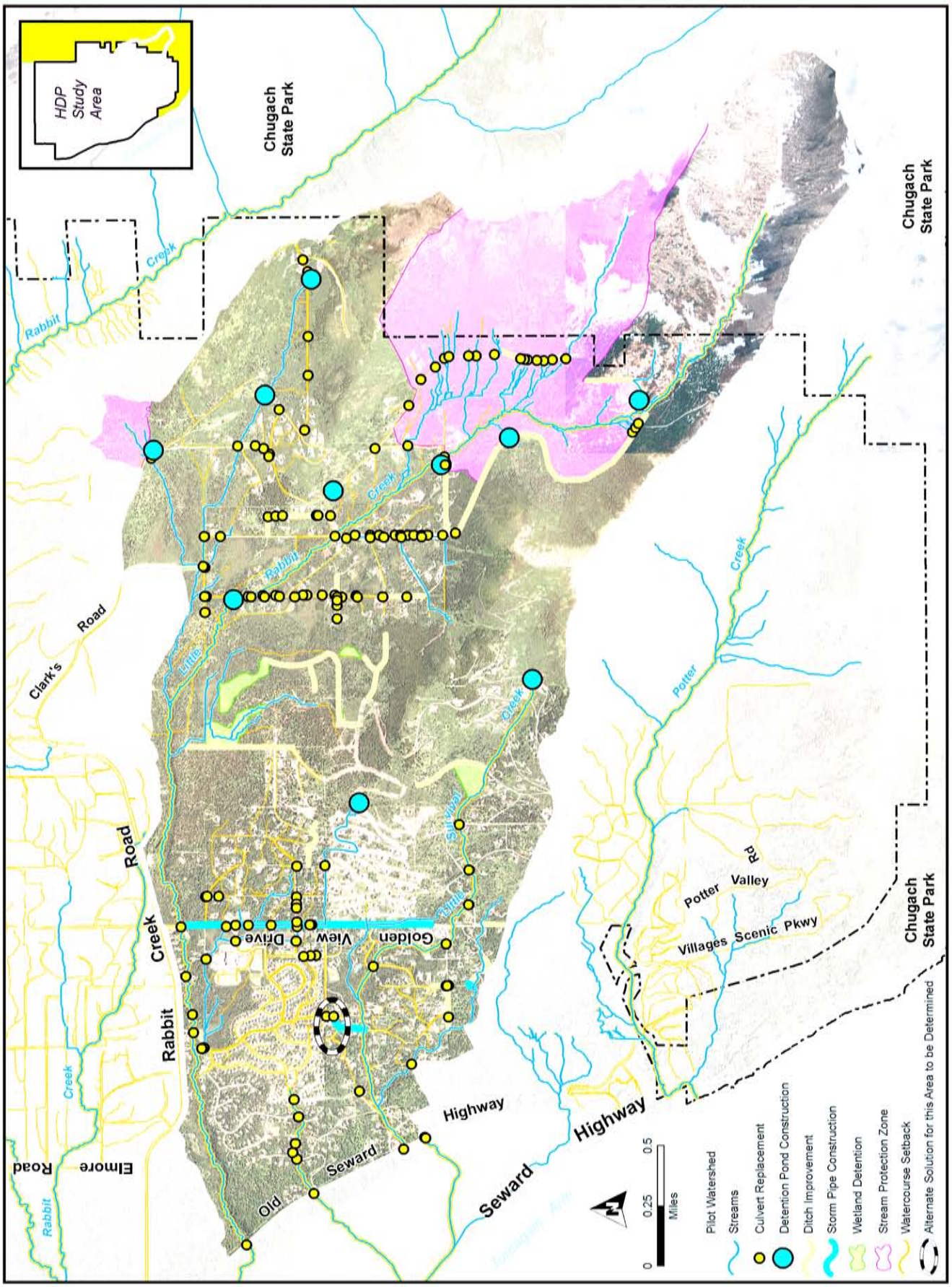
Evidence of the challenges of maintaining drainage infrastructure: culvert and drainage ditch along Clark's Road.

Map 3.3

Little Rabbit Creek and Little Survival Creek Watershed Drainage Plan

Hillside District Plan

A pilot watershed drainage plan has been developed for the Little Rabbit Creeek and Little Survival Creek watersheds to identify deficiencies under future land use conditions. Watershed drainage plans should likewase be developed for other Hillside watersheds in order to identify regional systems capable of fixing existing drainage-related problems, planning for adequate conveyance of future flows, and protecting valuable resources, such as streams and high-quality wetlands. The pilot watershed drainage plan prioritizes upgrades to deficient structures to guide phased implementation and recommends that future drainage infrastructure and controls be implemented as development occurs.

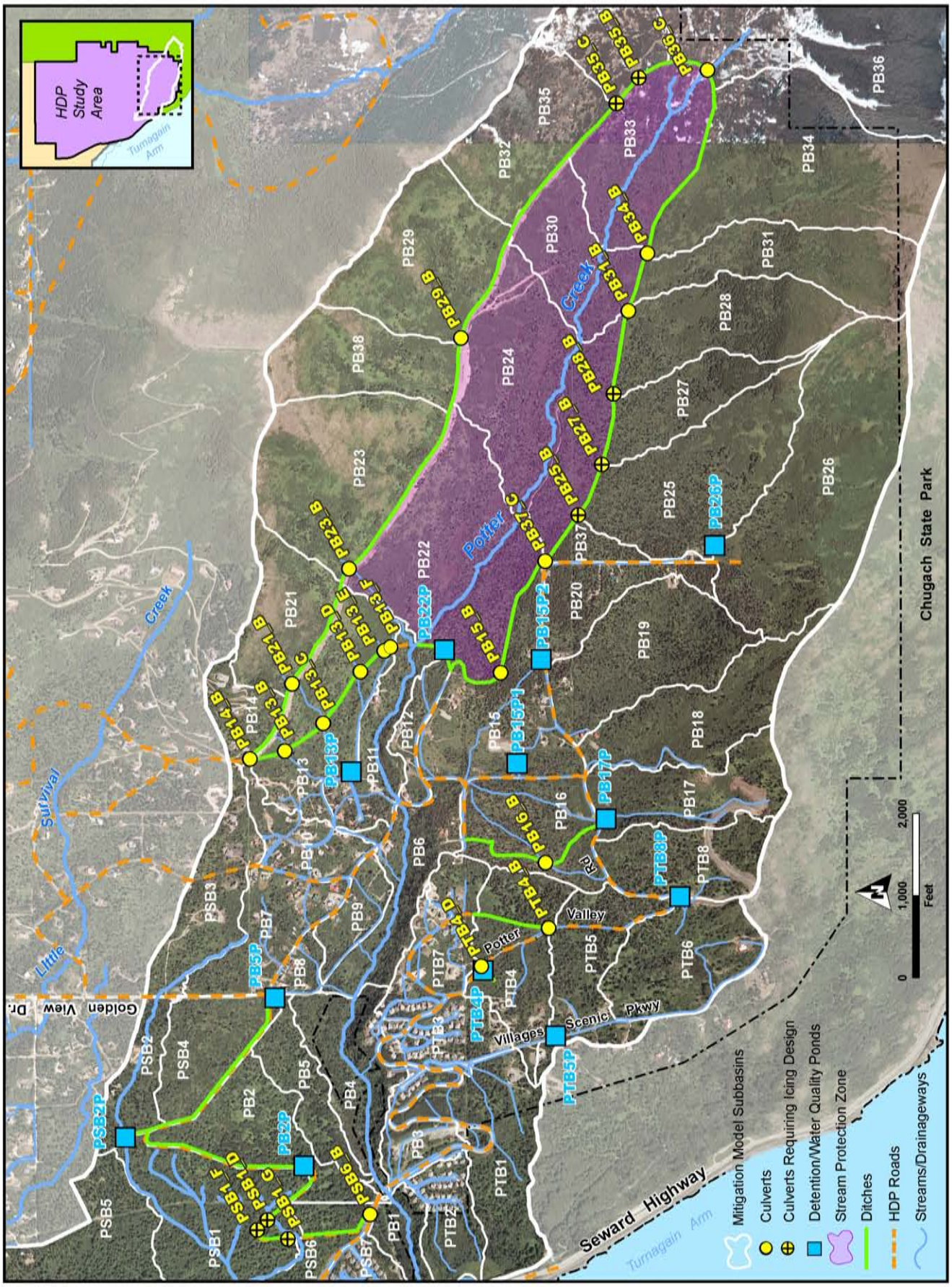


Map 3.4

Potter Valley Watershed Drainage Plan

Hillside District Plan

The Little Rabbit Creek and Little Survival Creek Pilot Watershed Drainage Plan is nearing completion, and the Potter Valley Watershed Drainage Plan is underway. The map below shows mapping of primary stream corridors and draft recommendations for watershed-wide drainage control.



Detention Ponds

Detention ponds have inherent problems of their own. The following must be considered:

- Who is responsible for maintenance?
- How will they be accessed?
- How will water be safely bypassed during winter snowmelt events when they are frozen?

The recommendations from the Little Rabbit Creek and Little Survival Creek pilot plan are summarized below. These illustrate the type of actions recommended in one watershed; other watersheds will each have their own unique drainage solutions. HDP Policy 8-D outlines the general strategy for managing and funding these improvements; Chapter 6. Implementation presents the specific development standards on these topics.

- **Culverts:** Replace existing culverts that are either undersized, severely damaged, or contribute to glaciation with appropriate structures. Construct new culverts to provide adequate conveyance for future flows.
- **Ditches:** Rehabilitate existing ditches that are undersized (not capable of conveying future runoff) or that contribute to glaciation in order to increase capacity or incorporate anti-glaciation features. Construct new ditches to provide adequate conveyance for future flows.

Figure 3.5 Rain Gardens

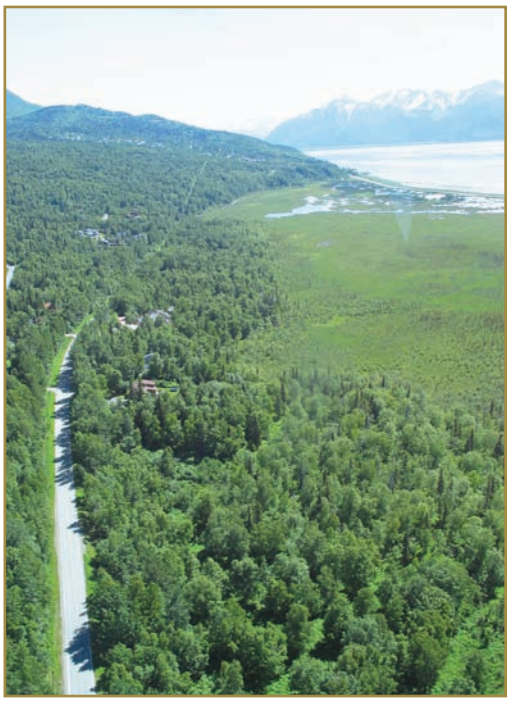
This image, by Garry Anderson of AnderDesigns, illustrates the "rain garden" concept. Runoff from buildings, driveways and other surfaces is directed to a planted infiltration area, which can be as simple as a shallow ditch filled with gravel and sand, and planted.

- **Storm Pipes:** Construct storm pipe systems to convey peak runoff in problem areas; for example, a system could be located along Golden View Drive. Consider long-term planning for a comprehensive piped system that may eventually take discharges of continual low and acute high flows and bypass them around the natural stream system.
- **Detention Ponds:** Construct storm water detention ponds regionally to detain the difference in peak flows between existing and future land use conditions for significant rainfall events (likely 2-year and 10-year events at minimum) and provide water quality improvement functions.
- **Wetland Detention Areas:** Protect areas identified as wetlands or potential wetlands that are strategically located to provide storm water detention and water quality enhancement. The sites will

likely require some modification, such as the construction of containment berms and the provision of runoff dispersal and collection systems.

- **Stream Protection Zones:** Designate areas with shallow groundwater, a dense system of streams, or other factors that make them unsuitable for regional detention ponds or other controls as stream protection zones. Avoid developing in these areas. If avoidance cannot be achieved, require development located in these areas to provide on-site controls to limit runoff to existing peak flows for up to the 10-year event or require lower density development than otherwise required by prevailing zoning.
- **Flood Hazard Evaluation:** Conduct a flood hazard study along a high-flood hazard risk section of Little Rabbit Creek located in Bear Valley to define the estimated flood limits for the 100- and 500-year flow events. These limits could then be used to develop mitigation measures to protect existing buildings located within the flood zone and protect future buildings from flood risk by establishing building setbacks.
- **Watercourses:** Establish policies to project the integrity and connectivity of water courses. The land immediately adjacent to watercourses (the riparian area) has the greatest potential to modify the character of storm water and shallow ground water flows before they enter receiving waters. A naturally vegetated riparian area detains storm water, buffers the stream from extreme flows, protects water quality by capturing and filtering pollutants, and aids in flood control and stream bank stabilization.
- **Drainage Easements:** Where drainage systems are discontinuous, acquire drainage easements through voluntary sales, or if necessary, through eminent domain. Drainage easements should be adequate for site access and at least ten feet wide on both sides of drainageways (HDP Policy 14-K).

The watershed management approach will provide the means to proactively manage drainage from the top to the bottom of the watershed.



Policy 8-C

Drainage Background Material

Develop Hillside-wide and Anchorage Bowl-wide background material to enhance watershed drainage planning and built/green infrastructure mapping.

Background

The Hillside District encompasses developed, upper reaches of a number of watersheds and does not receive runoff from any

Watercourses, streams and drainageways

The Municipality uses the term "watercourse" to include all natural or man-made channels or conduits that have been formed as the result of flowing water, or that do or are intended to convey surface water flows. Watercourse features include two general types: "streams" and "drainageways." These can be distinguished by differences in the source and longevity of flow. Streams always have relatively prolonged and (at least in their original unmodified form) natural sources of flow. Conversely, drainageways convey only ephemeral storm water flows, or those flows resulting from drainage or other construction.

upstream development. However, portions of three watersheds (Potter, Little Campbell/Craig, and Furrow) are served by ARDSA. Runoff and associated problems from above are passed downstream and do not respect the boundaries of the Hillside District. The watershed drainage plans developed for the Hillside area must be integrated into the larger framework of municipal-wide drainage. In addition, watershed drainage plans, the built/green infrastructure mapping, and drainage plans prepared for new subdivision approval will need to rely on credible natural resources information. To meet these integration goals, this policy calls for the following additional planning efforts.

- **Comprehensive Municipal Master Drainage Planning:** A municipal-wide master drainage planning framework should be developed so that individual watershed drainage plans can be incorporated into them. The master drainage planning framework should adhere to drainage planning criteria developed by the Municipality.
- **Hillside Area Natural Resource Protection Planning:**
  - Inventory and prioritize natural resources such as physical habitats, wildlife corridors, and aquatic resources.
  - Use this inventory as a basis for implementing green infrastructure concepts into development plans, including conservation subdivisions.
  - Develop a plan to acquire, preserve, protect, and restore high-priority natural resources.

Policy 8-D

Management Entity

Establish a new Hillside drainage management entity to help fund and manage needed drainage improvements for existing and future development and watershed protection and aquifer recharge efforts.

Background

HDP Policy 8-D is essential to solve Hillside drainage issues. The existing collection of LRSAs, RRSAs, and independent maintenance areas do not have the capacity to carry out comprehensive solutions to drainage-related problems. The "do-nothing" alternative is not acceptable. Therefore, a Hillside-wide service area or drainage authority will be created to manage drainage. This entity would enforce drainage policies, implement construction of watershed-based drainage solutions, and maintain

drainage systems on the Hillside. The service area or the authority would be guided by an areawide board of Hillside residents.

A particularly important responsibility will be to acquire wetlands and drainage corridors that serve important drainage functions and easements in areas where drainage connectivity is lacking.

Another important aspect is to implement procedures to monitor and oversee activities that affect drainage and surface-water quality. Such a procedure, for instance, in the form of a watershed permit, would track a project from the first land disturbance or clearing through construction, and installation of storm water facilities and their ongoing maintenance.

A newly established drainage management entity will be essential to creating and managing the built/green infrastructure system outlined in this document, in particular to reserve an integrated system of drainage features that cross multiple parcels. This approach is not possible without management oversight to plan the system and to raise funds to reserve, construct, and maintain elements like a drainage corridor that serves multiple landowners.

Funding and management details are presented in the Implementation chapter of this plan.

Policy 8-E

No Net Increase in Runoff up to the 10-Year Event

No net increase in runoff beyond existing peak flows for up to the 10-year event from development will be permitted unless regional facilities are in place and are adequate to accept the drainage.

Background

This policy provides a quantitative target for the development standards called for in HDP Policies 8-A, 14-I, and 14-J. Limiting peak flows to existing levels for up to the 10-year event:

- Provides an equitable standard for development that reduces the need for enlarging downstream conveyance ditches;
- Potentially reduces the maintenance requirements of downstream conveyance ditches;
- Generates opportunities for control measures that maintain or enhance ground water recharge;
- Limits increases in the number of runoff events that lead to stream instability and stream changes, such as widening, bank erosion, and stream steepening;
- Reduces degradation of aquatic habitat in receiving waters.

Easements and setbacks

A setback is a strip of land defined by a perpendicular distance measured from a specific feature. A stream setback is measured landward on both sides of the stream, either from the ordinary high-water mark or from the centerline of the stream if the stream is less than five feet wide at ordinary high water. A setback places restrictions on what can be done on the land within the setback. Setback standards adopted through this plan will be established in Title 21 of the municipal code. When that is done, any legally existing structures, disturbances, or uses that would be in violation of the new setback would be considered legally nonconforming (i.e., grandfathered) as of the date of the setback ordinance and would have rights to exist into the future in their existing condition.

An easement is a right of use of another's land for a particular purpose; for example, a drainageway easement would allow access for maintenance and improvements. An easement has a grantor, grantee, legal description, considerations, and words of conveyance. In addition, it will have a description of the purpose of the easement and limitations on the use. The deed of easement will be signed and acknowledged, and recorded among the land records.

A setback is relative to the position of the stream; when the stream moves, the setback moves with it. An easement is tied to a particular piece of land; if the stream moves, the easement does not.