CITY OF ASHLAND

DRAINAGE MASTER PLAN

November 1985

City of Ashland
20 E. Main Street
Ashland, Oregon 97520

Kramer, Chin & Mayo, Inc.
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EXECUTIVE SUMMARY

1. INTRODUCTION

The City of Ashland, like many urban areas that have experienced high population growth rates and associated levels of development, realizes that stormwater drainage cannot be left to take care of itself. New development increases impervious area and hence increases peak stormwater runoff with its associated problems of flooding, water quality degradation, erosion and sedimentation.

One of the goals of Ashland's 1982 Comprehensive Plan was "to provide an adequate stormwater drainage system throughout the entire City of Ashland". This drainage master plan is a first step which will provide the City with a tool to guide the improvement and expansion of the existing storm drainage system. As the cornerstone of the City's drainage management program, it will guide the installation of new drainage systems to accommodate future growth without causing problems in already developed areas.

2. EXISTING CONDITIONS

Study Area

The study area for this plan includes all land located within the Ashland Urban Growth Boundary. This boundary follows Bear Creek on the north, Crowson and Dead Indian Roads on the east, and the city limits of Ashland on the south and southwest. Five identifiable streams drain the study area: Wrights Creek, Ashland Creek, Clay Creek, Hamilton Creek, and Tolman Creek.

Drainage normally occurs from south to north toward Bear Creek. Stormwater is typically channeled into one of the five natural streams which terminate in Bear Creek. Channeling is generally through closed conduits and in open roadside ditches. Many of the existing conduits are either undersized for handling future flows, subject to abrasion which reduces their capacity, or in disrepair. A majority of open ditches used to convey runoff are located in public rights-of-way. However, many are located on private property. These latter ditches are maintenance problems which result in flooding of private property. The Talent irrigation canal located in the southern portion of the study area is of benefit to the City, but, because it was not designed as a combined drainage/irrigation structure, it has detrimental effects on routing of storm runoff. Runoff which is intercepted by the canal is frequently discharged at points which are not capable of handling increased flows.

3. RECOMMENDED PLAN

Recommendations for improving the Ashland drainage system have a total cost of $16.1 million. Of this total, $14.2 million have been identified as improvements within the existing developed area of Ashland. The remaining $1.9 million worth of improvements are located in areas yet to be developed.

These recommendations were developed from computer analyses of the existing system under build-out conditions and are based on policies that the City would like to see implemented in their drainage management program.

Closed Conduit System

One of the major goals of the City is to provide an all-pipe drainage system. Some natural streams would be maintained, but the majority of all stormwater would be diverted into and channeled in closed conduits.

Ditch Improvements

This policy would hasten the implementation of a closed conduit system. In developed areas, ditches would be replaced with closed conduits, except where natural streams occur. In undeveloped areas, ditch improvements would be made to improve hydraulic efficiency, prevent siltation and erosion, and allow routine maintenance to be done. As development occurs, open channels would be replaced with closed conduits.

Relocate Drainage System Improvements in Public Rights-of-Way

Problems associated with routing stormwater in drainageways located on private property have been a maintenance problem and a public nuisance. Relocating improvements in public rights-of-way would improve maintenance of the system, enhance private property which now may be bisected by a public right-of-way, and facilitate attainment of an all-conduit system.

Improvements Along Talent Irrigation Ditch

These improvements would reduce the volume of runoff into the canal, control where overtopping of the canal would occur, and channel runoff into downstream systems that would have adequate capacity. The improvements would involve building a berm on the uphill side of the canal, constructing piped diversions under the canal, and building overflow structures at critical locations along the canal's length.

Abrasion Resistant Pipe Materials

All improvements would require use of abrasion resistant concrete pipe. Some conduits in the existing system have been subject to abrasion which creates maintenance problems and reduces their efficiency. All pipes should be a minimum of 10 inches in diameter.

Catchbasins

Due to topographic relief and local subsurface conditions, runoff volumes occur soon after rainfall events. Improvements would require installation of catchbasins that are designed to intercept larger volumes of runoff with less chance of clogging due to surface debris. Maximum spacing requirements of 250 feet, or at every street intersection, would be required on slopes greater than 15 percent.

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SECTION 1

INTRODUCTION

1.1 PROJECT BACKGROUND

One of the goals of Ashland's 1982 comprehensive plan is "to provide an adequate stormwater drainage system throughout the entire City of Ashland." The City maintains a storm drainage system consisting of closed conduits, open ditches and culverts throughout most of the City. Drainage problems that now occur are associated with overflowing pipes, manholes, and ditches which result in the flooding or undermining of streets and damage to private and public property. As infilling of land within the Citys' Urban Growth Boundary (UGB) occurs in the future, a drainage master plan will be needed to provide for the design and implementation of a storm drainage system which addresses the present and future needs of the City. To address existing drainage problems and to plan for growth throughout the City's urban area, the Ashland City Council authorized Kramer, Chin, & Mayo, Inc. to prepare this drainage master plan.

1.2 OBJECTIVES AND GUIDELINES

The drainage master plan prepared by KCM will guide the improvement and expansion of the storm drainage system within the Ashland urban area. Plan objectives include:

- Solutions to the City's existing drainage problems over the next twenty years.
- A design and planning tool to guide the installation of new drainage systems which will accommodate future growth without causing problems in already developed areas.
- A guide to assist in the management and maintenance of the storm drainage system.
- Estimated costs for the recommended improvements.

1.3 PURPOSE AND SCOPE

The purpose of this drainage master plan is to provide the City with a planning tool to assist and guide the improvement and expansion of the Ashland storm drainage area. The scope of work for this drainage master plan consisted of the following elements:

1.3.1 Review Existing Conditions

KCM, in cooperation with the City, collected and reviewed all available data that were relevant to the drainage characteristics of the study area. Data included mapping and detailed information of the existing drainage system, topography, soils and geology, precipitation patterns and climate, and proposed land use from the City's Comprehensive Plan. City maps with contour information were used predominantly. USGS topographic maps were used to supplement information not provided on City maps. Rainfall information recorded by the U.S. Weather Service at the Ashland rain gauge and Jackson County Airport in Medford, Oregon, were used to update intensity-duration curves and develop design storm hyetographs.

1.3.2 Analyze the Existing System

KCM utilized a computerized hydrologic model, known as the Stormwater Management Model (SWMM), to analyze the existing drainage system (6 inches in diameter and larger). This involved reviewing future land use requirements from the Comprehensive Plan, analyses of the existing drainage system with future flows that can be expected from these areas once they develop, and development of the recommended plan for upgrading and expanding the existing system. The model was calibrated using regression equations that were developed for ungauged watersheds in western Oregon.

1.3.3 Recommend a Drainage Plan

The recommended plan was selected based on consideration of cost, ease of maintenance, location, environmental impact, aesthetic impact, and design features.

1.3.4 Develop Cost Estimates

This involved development of costs for the recommended system to assist in the evaluation, recommendation, and implementation of future drainage improvements and development of future funding.

1.3.5 Funding Options

Ten funding options for storm water management are introduced in Section 6 of this text. Selection of the optimum combination of the options will require detailed review by City staff and Council, with outside technical assistance as needed.

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SECTION 2

STUDY AREA CHARACTERISTICS

2.1 STUDY AREA

The study area for the Ashland Area Drainage Master Plan (See Figure 2.1, Regional Setting/Vicinity Map) is the area within the City of Ashland's Urban Growth Boundary. This area contains approximately 8 square miles. Its borders are: Bear Creek on the north, Crowson and Dead Indian Roads on the east, and the City limits of Ashland on the south and southwest. Figure 2.1 depicts the 17 drainage basins which were identified by KCM for detailed analyses. No basin was identified as Basin 1. In this Drainage Master Plan, discussion of recommendations and improvements has been organized based upon these basins. Three of these basins, 16, 17 and 18, were combined and are presented as a single basin.

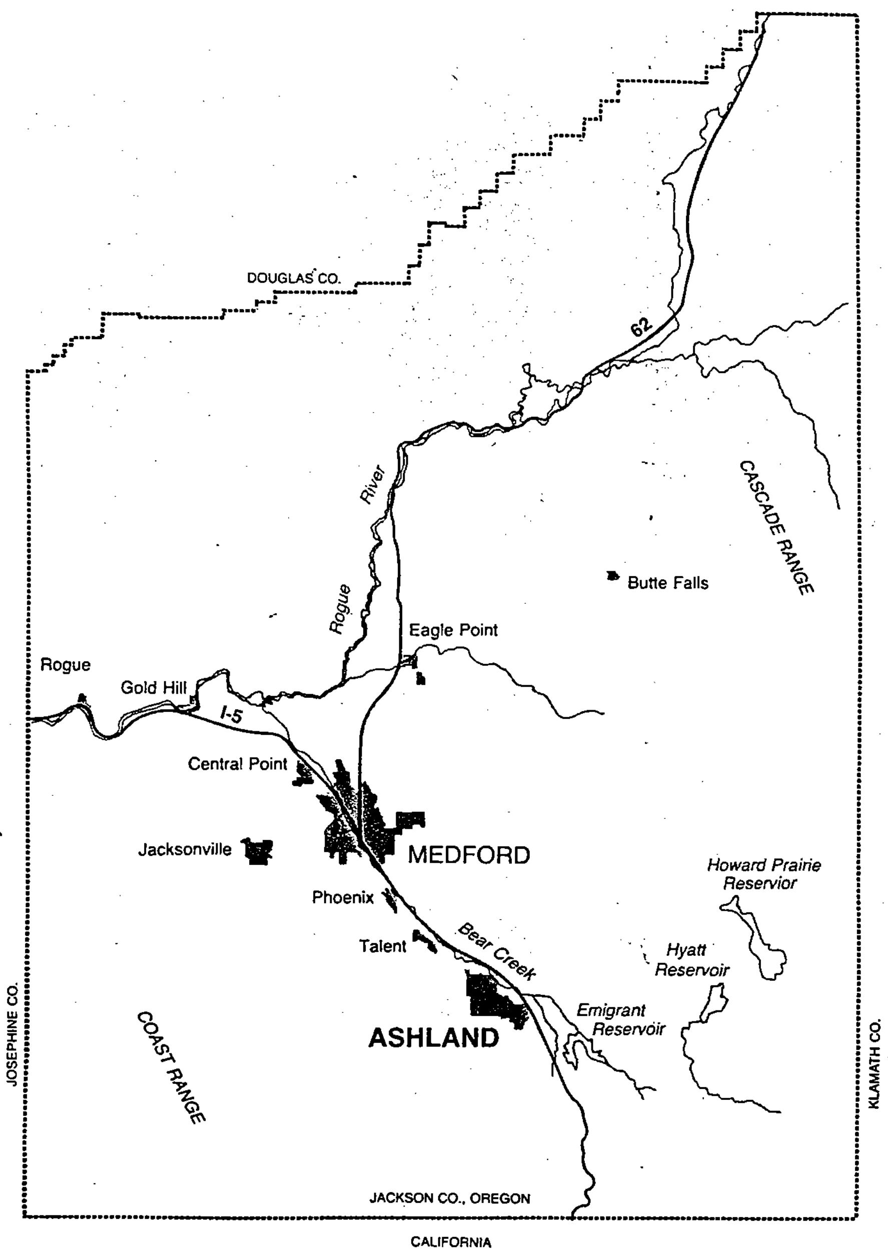
Not included in this study is the drainage basin located south of the study area above Reeder Reservoir.

2.2 TOPOGRAPHY

2.2.1 General

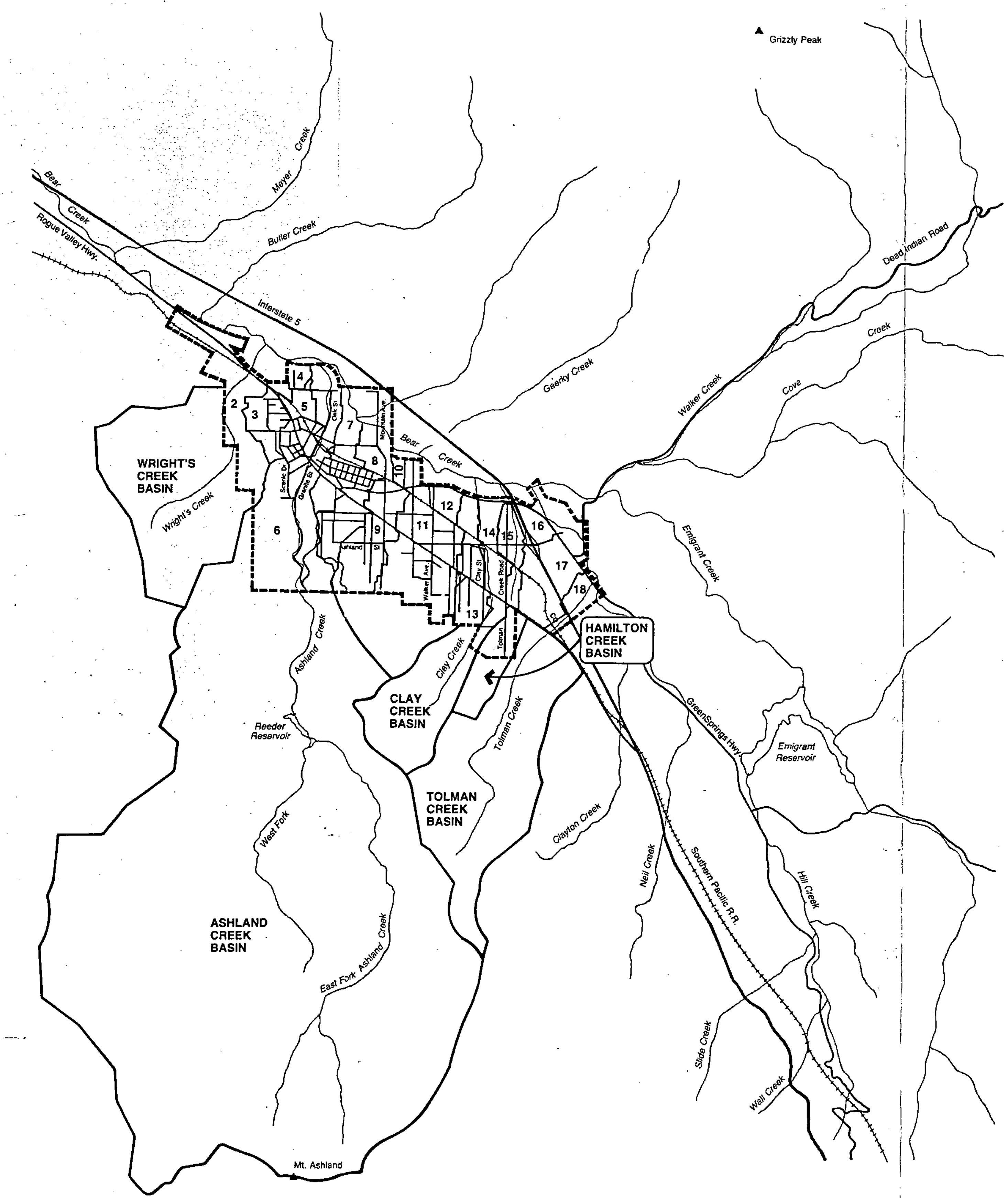
Topography, as it relates to natural drainage, flooding and surface slope, has directly influenced the existing and planned drainage facilities to serve the Ashland study area. These terrain features not only determine what drainage systems can be built, but also have direct bearing on land use, development and other factors associated with urbanization which affect runoff.

Within the study area, surface elevations range from 1,720 feet along Bear Creek, to 2,100 feet in the valley lowlands to the east of the study area along Interstate 5, and rise to a maximum of 5,600 feet in the upland and hillside areas to the west and south. The average surface slopes found throughout the study area range from 5 percent, along Bear Creek, to as much as 50 percent in the foothills to the southwest. Local slopes greater or less than these average values occur throughout the study area.



REGIONAL SETTING

NO SCALE



VICINITY MAP

NO SCALE

LEGEND

- Ashland Urban Growth Boundary (Study Area)
- Street/Highway
- Stream/Creek
- Drainage Basin Boundary
- 10 — Drainage Basic Identification Number

Basin Number	Name
1.	Not Used
2.	Wrights Creek
3.	Hospital
4.	Cambridge Street
5.	Laurel Street
6.	Ashland Creek
7.	Railroad Yard
8.	Mountain Avenue
9.	Beach Street
10.	Fordyce Street
11.	Walker Avenue
12.	East Main Street
13.	Park Street
14.	Clay Street
15.	Hamilton Creek
16.	I-5 Basins
17.	I-5 Basins
18.	I-5 Basins

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Figure 2.1
REGIONAL SETTING/ VICINITY MAP

2.2.2 Drainage Characteristics

Four major streams are located within the study area. These are, from north to south, Wildcat Gulch, Wrights Creek (north and south forks), Ashland Creek (below the lower reservoir) and Tolman Creek. Bear Creek and its two tributaries (Neil and Emigrant) border the study area on the north and northeast, but were not addressed in this study. Many seasonally active drainage ditches and open channels carry runoff from within the study area and discharge into Bear Creek. Drainage in the study area occurs predominantly from south to north.

Stream characteristics of drainage courses in the Ashland UGB have been addressed in Bulletin 94, published by the State Department of Geology as follows:

> "Drainage courses in the Ashland UGB are subject to high-velocity flows in the hillside areas where narrow canyons and steep gradients exist. Also there is a high potential for bank overflow and flooding in the valley lowlands. Significant bank and channel erosion occurs during torrents and sediments deposited are generally coarse (ranging from silt or sands to silty gravel/cobbles). The upper reaches of Wrights Creek, Bear Creek, and Ashland Creek have a high probability for torrential flows; Tolman Creek and Wildcat Gulch may also be subject to torrential flows. The areas prone to overbank flows and flooding (50 to 100 year frequency) are limited to the valley lowlands along Ashland Creek (downstream of Lithia Park), and near the northern UGB along Bear, Neil and Emigrant Creeks."

2.3 CLIMATE AND RAINFALL PATTERNS

Because of its location at the southern end of Bear Creek Valley and its close proximity to the Siskiyou Mountains, Ashland experiences four mild seasons throughout the year. The climate in Ashland is typical of the interior valleys of southwestern Oregon - summers have hot, dry days and cool nights; winters are mild. Fog, which frequently develops on the Bear Creek Valley floor during the winter, does not usually reach Ashland. Average seasonal temperature extremes range from near 32 degrees Fahrenheit to 90 degrees Fahrenheit. Rainfall usually occurs between the months of October and March, although intense late summer thunderstorms can occur in August and September. Rainfall in Ashland is usually of less magnitude than that experienced in Medford, Oregon, located to the northwest of Ashland. This phenomenon is attributed to Ashland being located in the rain shadow of the Siskiyou Mountains located west and south of the study area. The yearly average rainfall recorded at the weather service station in Ashland is approximately 20 inches.

The weather service station in Ashland has been collecting 24-hour precipitation and temperature data continuously for 106 years and is the oldest recording weather station in Oregon. These data are available from the National Oceanic and Atmospheric Administration (NOAA) located in Asheville, North Carolina.

KCM utilized these 24-hour precipitation totals to update the Citys' existing rainfall intensity-duration curves. KCM assumed a Log-Pearson Type III distribution for these 24-hour rainfall intensities and calculated the best fit of the rainfall data to that distribution. Products were 24-hour rainfall intensities for 2-, 5-, 10-, 25-, 50- and 100-year recurrence intervals.

To develop intensity-duration curves for durations less than 24-hours, KCM adjusted the intensity-duration (IDF) curves developed for the City of Medford, Oregon as part of its drainage master plan. This was accomplished by determining the percent difference between the 24-hour intensities at each station for a specific recurrence interval (e.g. 2-year, 5-year, 10-year, etc.) Each intensity-duration curve that was developed for Medford was then multiplied by the appropriate correction factor for a specified return frequency. The resulting curves are the revised IDF curves for Ashland. See Figure 2.2. Table 2.1 lists the correction factors for the Medford data and the recurrence interval curve to which they were applied.

TABLE 2.1

Correction Factors For Transposing Medford, Oregon Rainfall Intensity Curves Into Rainfall Intensity Curves for Ashland, Oregon

Return Frequency	Correction* Factor
2-year	.75
5-year	.82
10-year	.77
25-year	.80
50-year	.76
100-year	.74

* Correction Factor = (24-hour RF_{Med} - 24-hour RF_{Ash}) / 24-hour RF_{Med}

Limitations of the Medford curves, based on the amount of data used to develop them, also apply to the curves developed for Ashland. However, reasonable values of rainfall intensities for storms more probable than the 10 percent exceedance probability (10-year recurrence interval) may be expected.

The City of Ashland has used at least two other IDF rainfall intensity-duration curves for design of storm drains in recent years. Curves published by the Oregon Department of Transportation (1974) may have been used for drainage design in the Ashland area. These curves are intended for use throughout the State of Oregon and, as such, represent a regional average not intended specifically for use in Ashland. The City presently uses an intensity-duration curve for the design of storm drainage

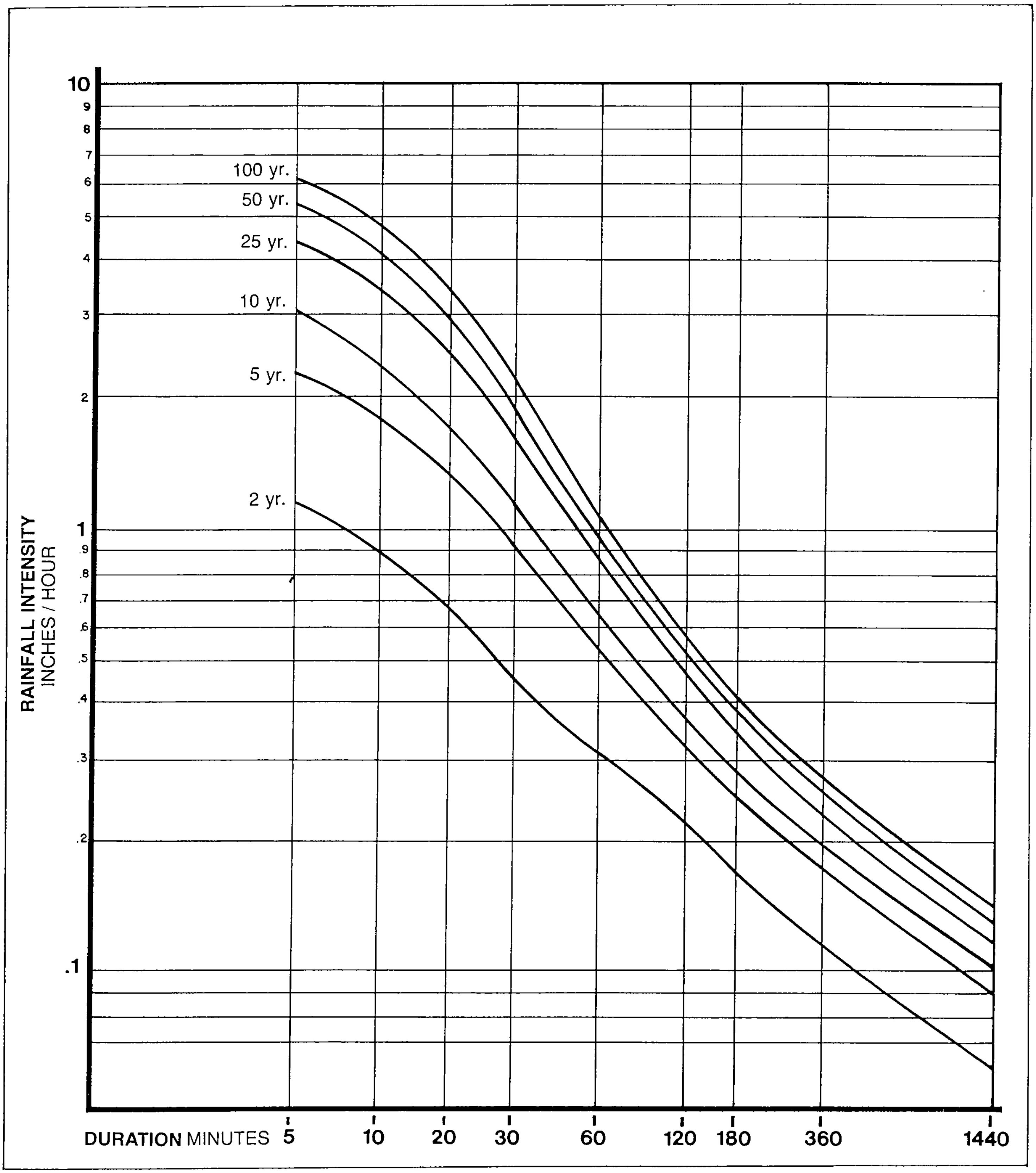

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Figure 2.2

INTENSITY-DURATION-FREQUENCY CURVES

improvements. This curve was prepared from rainfall data collected over several years from a rain gauge located in the City of Ashland. The rain gauge is presently maintained at the sewage treatment plant. In Table 2.2, the rainfall intensities for the 10-year recurrence interval storm as predicted from these sets of resources are presented. Previous IDF curves are, at best, based on only partial data. The curves in Figure 2.2 best represent local rainfall patterns. Their use is recommended for future storm drainage design in Ashland.

TABLE 2.2

Comparison of 10-year IDF Curves for Ashland
From Various Sources
(Exceedance Probability 0.10)

Time Interval (minutes)	Existing Ashland Curve	Regional ODOT Curve	Updated Ashland Curve (This Plan)
5	3.50	2.97	3.03
10	2.63	2.24	2.37
30	1.28	1.18	1.20
60	0.75	0.71	0.63

2.4 VEGETATION

Because of its location, the City of Ashland enjoys the potential for a large diversity of naturally-occurring vegetation. However, due to increased urbanization, evidence of original vegetative cover cannot be found except at scattered, protected locations throughout the study area. A general description of the vegetation to be found throughout the study area can be related to the topography of the area, although such simplification does not begin to address the complex interrelated factors which influence vegetation positioning.

Three general landscape types are found throughout the study area: valley lowlands, located north and northeast of Highway 99W; uplands, located south and southwest of Highway 99W to the edge of the City limits; and hillside areas, located south of the upland areas and extending into the heavily forested slopes of the Siskiyous. Within the study area valley, lowland and upland vegetative types predominate. In the lowlands areas, where development has not occurred, existing areas are covered with various grasses and other ground cover. The occurrence of isolated pockets of deciduous trees (predominantly oak and willow) are found along drainages. In the upland areas a variety of deciduous and conifer trees (pine, oak and cedar) are found in open and cleared areas. Further west within the hillside areas, a mixed Douglas Fir and pine forest is present.

2.5 GEOLOGIC SURVEY AND SOILS

Local geology plays a significant role in drainage master planning. Soil data are necessary in determining the feasibility and scope of proposed drainage facilities, in evaluation of land uses, in locating hazardous areas and in the identification of soil conditions. KCM worked with Kelly/Strazer Associates, Inc. (Geotechnical Consultants) to develop a general picture of the subsurface geology and surface soil conditions that affect drainage in the Ashland area. Utilizing published and unpublished data obtained from the USGS, the Oregon State Department of Geology and Mineral Industries, and the Soil Conservation Service (SCS), a general overview of the geologic and soil conditions in the study area was developed. That soil/geologic inventory is included as an appendix to this report and is summarized here.

The underlying geology is characterized by the presence of three geologic units found within the study area: alluvial fan deposits and stream alluvium; sedimentary rock consisting of conglomerate overlying sandstone and shales; and intrusive crystalline bedrock.

- Alluvium

  This unit, covering approximately 45 percent of the study area, is found only in the valley lowlands, occurring along Bear Creek and at the toe of drainages which cross the study area. Soil types found within this unit include clays overlying clays with lenses of gravel at depth. Thickness of these deposits ranges from 4 to 32 feet with the thickest deposits occurring along Bear Creek.

- Sedimentary

  Sedimentary rock is found at sporadic locations throughout the study area (less than 20 percent). Most of the identified unit is located in the southeastern portion of the study area near the foothills drained by Tolman and Hamilton Creeks. The majority of this unit underlies alluvium found in the valley lowlands. The makeup of this unit is alternating layers of sandstone and shale. Where it is found beneath alluvium, its upper 20 to 50 feet consist of conglomerate (cemented sand, gravel and cobbles).

- Granite

  Found through 35 percent of the study area, this unit is the predominant geologic unit underlying the hillside areas in the west portion of the study area. The surficial weathered zone of soils consists of clay/silts, with less weathered gravel to boulder-size rocks at depth. Depths of the weatherized zone range from 2 to 35 feet, depending on the surface slope.

2.5.1 Groundwater

Groundwater levels throughout the study area vary seasonally and locally throughout the year. In the valley lowlands, the regional groundwater level ranges from 5 to 40 feet below the surface. However, locally perched groundwater is found along stream beds during the wet months of the year. In the upland and hillside areas, regional groundwater levels range from 20 to nearly 100 feet below the surface. This wide variation of levels may be due to the physical condition of the granite aquifer which underlies these areas.

2.5.2 Soils

The SCS has prepared maps of the soils found in the Ashland area. In addition to the basic classification from the SCS report, other pertinent characteristics of the Ashland area soils as they relate to drainage are also included.

The near-surface soils within the Urban Growth Boundary project area range from clayey silts in the valley lowlands to gravelly, silty sand in the steeper hillside areas. Permeability ranges from very slow in the clayey silt soils to moderate in the gravelly sand soils. The groundwater table is shallow in the valley and of variable depth in the hillsides.

- Erosion Potential

  Soil erosion potential estimates are based primarily on soil characteristics, ground slope, runoff, and surface exposure. The areas within the study area range in erodibility from low, in the valley lowland, to severe, in the locally steep and/or exposed hillside slopes and stream channels. Soil erosion within the stream channels is primarily a function of bank and channel characteristics.

  In exposed hillside areas, erosion potential is considered moderate to severe depending primarily on slope and degree of surface exposure. In areas of dense forest cover erosion potential is considered moderate. Erosion hazards likely include deposition of silts and sands at the foot of slopes, gulley erosion, and possible contribution of turbidity and bed-load to major stream channels. These streams include Wildcat Gulch, Wrights Creek, Ashland Creek and Tolman Creek.

  In the hillside areas, stream bank erosion is considered the primary cause of excess turbidity and bed-load deposition. The potential for channel erosion is considered high in areas with high torrential flooding potential. Subject to erosion are artificial fills, bridge abutments and other engineered obstructions, as well as natural stream banks, especially in areas of mass-wasting.

  In the valley lowland, stream bank erosion potential is considered low in most areas, but moderate in segments where the stream channel has historically changed direction, on the outside of meander bends, or where the channel is constricted by natural or artificial barriers to flow.

SECTION 3

EXISTING DRAINAGE SYSTEM

3.1 DESCRIPTION OF THE EXISTING SYSTEM

Due to the occurrence of many natural drainage features throughout the study area and the complexity of the City of Ashland's storm drainage system, the study area was divided into 17 geographically defined basins. Basin boundaries were based primarily on the proximity of storm drainage facilities serving each area and topographic information. The following sections provide general descriptions of the existing system serving each area. The existing storm drainage system is shown in Figure 3.1.

3.1.1 Wrights Creek Basin

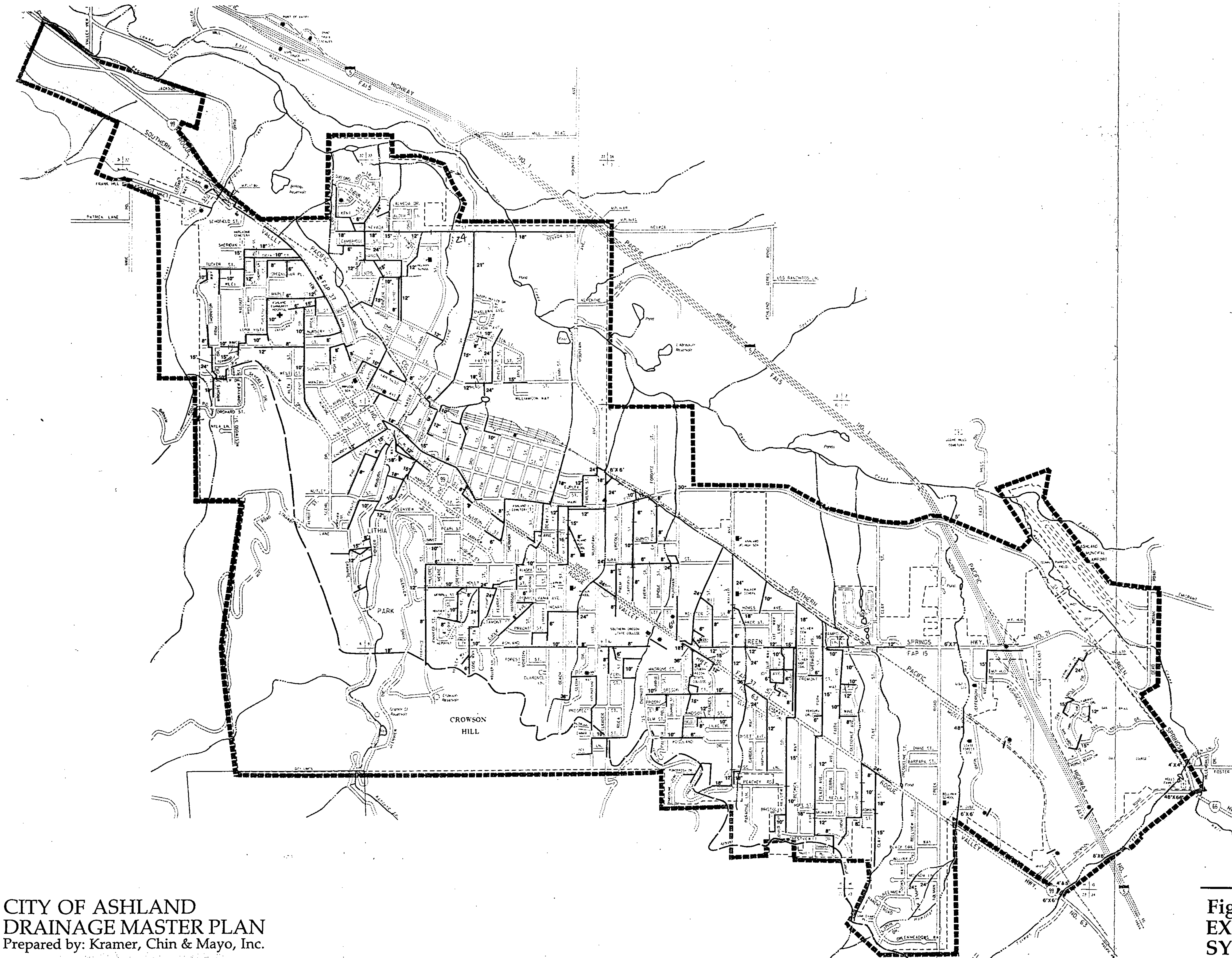
This is the most westerly basin found within the study area. It includes 2,200 acres. It is quite narrow with extremely steep slopes. Wrights Creek flows the entire length of the basin. Its southern, western, and northern boundaries are defined by the Urban Growth Boundary. The basin's eastern boundary is defined by a series of peaks and ridges which form a substantial geographic border. The basin is primarily undeveloped. Development which does exist is single-family residential and agricultural in nature.

The present storm drainage system consists of natural swales and streams in undeveloped areas with storm drains in portions of the developed areas. Much of the drainage in the developed area occurs as overland flow along streets and gutters. Wrights Creek passes through a 48-inch culvert beneath State Highway 99W and the Southern Pacific Railroad grade.

Proposed development in the basin will be single-family residential. Any future development will require storm drains to transport runoff into Wrights Creek. Increased runoff resulting from this development will impact the culverts which pass under the Southern Pacific Railroad grade and State Highway 99W.

3.1.2 Hospital Basin

Located in the northwesterly portion of the study area this basin contains 175 acres. Surface slopes are steep to severe. Drainage occurs to the northeast. The basin boundaries are North Main Street and Scenic Drive on the east, Ashland Creek drainage basin on the south, Wrights Creek basin on the west, and the Urban Growth Boundary on the north. It is moderately developed with single- and multi-family residences, and includes the Ashland Hospital facility.



BASE MAP SOURCE:
OREGON DEPARTMENT OF TRANSPORTATION 1985

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Figure 3.1
EXISTING DRAINAGE SYSTEM

The present drainage system is well developed and consists of closed conduits and open ditches. Many of the pipes are less than 10 inches in diameter - the minimum pipe size recommended for maintenance equipment. Replacement of these small-diameter pipes will be recommended. (See Chapter 5.)

Future development will be low density, single-family residential. Improvements to the existing drainage system will be required to handle increased runoff resulting from this development.

3.1.3 Cambridge Street Basin

This 60-acre basin, located near Bear Creek, is the most northerly found in the study area. Its boundaries are defined by Glendover and Nevada Streets on the east and south, and the Urban Growth Boundary on the west and north. It is essentially flat with little topographic relief. Drainage occurs toward Bear Creek. Existing development throughout the basin is single-family residential. Runoff is transported from the basin through a well-developed system of gutters and drainage pipes. Because no future development is anticipated within this basin, the existing storm drainage system should prove to be adequate.

3.1.4 Laurel Street Basin

This basin is located in the northwestern portion of the study area and contains 175 acres. Its boundaries are defined by Willow, Laurel, and Helman Streets on the east; Bush Street on the south; the Hospital basin on the west; and Cambridge Street basin on the north. Surface slopes across the basin range from moderate, in the north, to shallow in the south. Drainage occurs in a northeasterly direction. The basin is substantially developed. Land use is primarily single-family, with multi-family residences and commercial/industrial development occurring along State Highway 99W near the City's downtown area.

The present drainage system consists primarily of closed conduits with open ditches in undeveloped areas. A major drainage feature of this system is the open ditch located along the Southern Pacific Railroad. All surface runoff from areas north of the railroad is intercepted at this ditch and redirected into the storm drain in Willow Street. A significant amount of the existing system will require upsizing to accommodate increased runoff as development occurs.

3.1.5 Ashland Creek Basin

This basin contains 550 acres within the west central portion of the study area. It is drained entirely by Ashland Creek which flows through the entire length of the basin. Its boundaries are defined by the railroad yard and Eighth Street basins on the east; the Urban Growth Boundary on the south; Wrights Creek, Hospital and Laurel Street Basins on the west;