

# PIERCE COUNTY FLOOD RISK ASSESSMENT

## Executive Summary

### ES.1 Summary Of Findings

This document is an assessment of flood hazard risk in unincorporated Pierce County, Washington. This assessment was prepared in compliance with the Federal Emergency Management Agency's (FEMA) "Community Rating System" (CRS) Program.

This *Flood Risk Assessment* contains no goals, no action plan, and no budget recommendations. These are all included in each individual basin plan developed by Pierce County.

Rather, this Risk Assessment contains the raw data that can be used to measure the net benefit of actions that will reduce flood risk, be compared against the cost of the no action, and determine if the action is cost-effective. This concept is the backbone of hazard mitigation grant programs sponsored by FEMA, DHS and other state and Federal Agencies involved in hazard mitigation.

The following tables summarize some of the key risk-based components identified by this Risk Assessment. *Table ES-1* summarizes the estimated exposure to improved property within the floodplain. *Table ES-2* illustrates the number of identified critical facilities estimated to be exposed to the flood hazard. *Table ES-3* illustrates important flood insurance statistics that can be used to gauge vulnerability, while at the same time identifying target areas for flood hazard mitigation. Some key findings are:

- ***Approximately 40,355 acres of floodplain are currently reflected on the Flood Insurance Rate Maps (FIRMs) produced by FEMA.*** This represents approximately 4.83% of the area within the basin planning areas. It should be noted that these areas and percentages are anticipated to increase significantly with the release of new FIRMs for Pierce County by FEMA in the near future.
- ***Pierce County has identified approximately 77,219 acres of areas subject to flooding (Channel Migration Zones, Coastal "A" Zones, and potholes) not reflected on the FEMA maps that are subject to regulation and mitigation actions identified by the Pierce County Water Program's "Basin Planning Program."*** This, combined with the area mapped by FEMA, represents approximately 14% of the area within the basin planning area.
- ***The estimated value for the property*** exposed to flooding within unincorporated Pierce County represents approximately 21.87% of the total of assessed property values for the entire county.
- ***There are at least 29 identified "Critical Facilities"*** in FEMA's regulated floodplain.
- ***Since 1978, there has been no less than \$69,052,011 in reported flood damages within Pierce County*** (between disaster assistance and flood insurance claims). This averages out to approximately \$2.4 million per year over the past 30 years.
- ***There are 29 identified "Repetitive Loss Properties"*** within four Repetitive Loss Areas within Pierce County.

**TABLE ES-1  
BUILDINGS WITHIN 100-YEAR, FEMA MAPPED FLOODPLAIN**

Basin Planning Area	Structure type				Market Improvement Value	% of Total Assessed Value <sup>a</sup>
	Commercial	Dwelling	Other	Total		
Hylebos Browns/Dash Point Basin	25	382	9	<b>416</b>	\$34,730,500	2.02
Clear/Clarks Creek Basin	137	1457	120	<b>1714</b>	\$96,035,291	5.28
Clover Creek Basin	114	977	45	<b>1136</b>	\$106,310,800	5.84
Muck Creek Basin	1	109	14	<b>124</b>	\$8,606,300	0.47
Gig Harbor Basin	26	317	4	<b>347</b>	\$99,700,600	5.48
Carbon and Upper Puyallup River Basins	0	80	11	<b>91</b>	\$9,173,271	0.50
Key Peninsula/Islands Basin	16	205	10	<b>231</b>	\$42,096,041	2.31
Mid-Puyallup Basin	29	612	79	<b>720</b>	\$81,231,400	4.47
Nisqually River Basin	13	167	80	<b>260</b>	\$26,449,200	1.45
White River Basin	42	83	6	<b>131</b>	\$134,324,107	7.38
<b>Total</b>	<b>407</b>	<b>4398</b>	<b>378</b>	<b>5183</b>	<b>\$638,657,510</b>	<b>35.12</b>

a. This value is in comparison to the total assessed valuation for improvements with “unincorporated” Pierce County as of July 1, 2007. This value does not include the cities.

**TABLE ES-2  
CRITICAL FACILITIES WITHIN 100-YEAR, FEMA MAPPED FLOODPLAIN**

Basin Planning Area	Facility Type					Total
	Medical	Government	Hazardous Materials	Schools	Other	
Hylebos Browns/Dash Point Basin	1	3	0	2	1	<b>7</b>
Clear/Clarks Creek Basin	1	0	0	3	0	<b>4</b>
Clover Creek Basin	0	0	0	1	0	<b>1</b>
Muck Creek Basin	0	0	0	0	0	<b>0</b>
Gig Harbor Basin	0	0	0	0	0	<b>0</b>
Carbon and Upper Puyallup River Basins	0	0	0	1	0	<b>1</b>
Key Peninsula/Islands Basin	0	0	0	0	0	<b>0</b>
Mid-Puyallup Basin	2	0	0	5	0	<b>7</b>
Nisqually River Basin	2	0	0	5	2	<b>9</b>
<u>White River Basin</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
<b>Total</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>17</b>	<b>3</b>	<b>29</b>

**TABLE ES-3  
FLOOD INSURANCE STATISTICS**

Basin Planning Area	Total # of Policies	% of Coverage <sup>a</sup>	% of policies located outside mapped floodplain	Total # of Claims	Amount of Claims Paid <sup>b</sup>	# of Identified repetitive Loss Properties <sup>c</sup>
Hylebos Browns/Dash Point Basin	82	9.83	52.5	11	\$208,075	0
Clear/Clarks Creek Basin	161	5.65	43.9	140	\$2,648,227	32
Clover Creek Basin	269	4.31	82.5	119	\$2,250,993	20
Muck Creek Basin	27	1.8	92.6	5	\$94,580	0
Gig Harbor Basin	72	1.75	91.6	22	\$416,150	18
Carbon and Upper Puyallup River Basins	109	62.5	54	8	\$151,327	0
Key Peninsula/Islands Basin	30	1.35	90	3	\$56,748	0
Mid-Puyallup Basin	358	27.8	50	40	\$756,636	0
Nisqually River Basin	74	3.3	92	19	\$359,403	12
White River Basin	<u>81</u>	<u>7.2</u>	<u>89</u>	<u>6</u>	<u>\$113,496</u>	<u>0</u>
<b>Total</b>	<b>1263</b>	<b>8.99%</b>	<b>65.9%</b>	<b>373</b>	<b>\$7,055,635</b>	<b>82</b>

a. % of coverage = the number of structures within a mapped floodplain with flood insurance in force.

b. Total claims paid from January 1, 1978 to June 30, 2007

c. Repetitive Loss Property equals the following:

- Four or more paid losses in excess of \$1,000;
- Two paid losses in excess of \$1,000 within any rolling 10-year period since 1978;
- Three or more paid losses that equal or exceed the current value of the insured property.

- Flood Insurance as a means to provide site specific property protection for “at-risk” properties is under utilized within Pierce County. **Only 8.9% of the properties located within a FEMA designated floodplain have a flood insurance policy.** This is well below the national average. According to a study being conducted for the National Flood Insurance Program (NFIP) by the Rand Corporation, approximately 49% of single-family homes in special flood hazard areas (SFHAs) nationwide are covered by flood insurance.
- **Approximately 65.9% of the current flood insurance policies in force within Pierce County are on properties located outside of the FEMA mapped floodplain.** This illustrates problems with the accuracy of FEMA’s mapping and supports Pierce County’s existing floodplain management program which targets areas outside of those mapped by FEMA.
- Historically, the majority of the historical flood insurance claims filed within Pierce County were for properties located outside of the FEMA mapped floodplain.

## ES-2 Background

The remainder of this summary describes the methods and data sources used in the development of this “Flood Risk Assessment.”

### *“What would happen if a natural disaster (flood) occurred in Pierce County?”*

A risk assessment answers this fundamental question, which is the cornerstone of the hazard mitigation planning process. Risk is considered a function of two components; the probability that an event will occur, and the impact the event will have on people, property, and economy. Risk Assessment is the process of measuring the potential impacts to these components from a single- or multiple-natural hazards. It focuses on the following parameters:

- Hazard identification
- The impact of hazards on physical, social and economic assets
- Vulnerability identification
- Estimates of the cost of damage or costs that can be avoided through mitigation

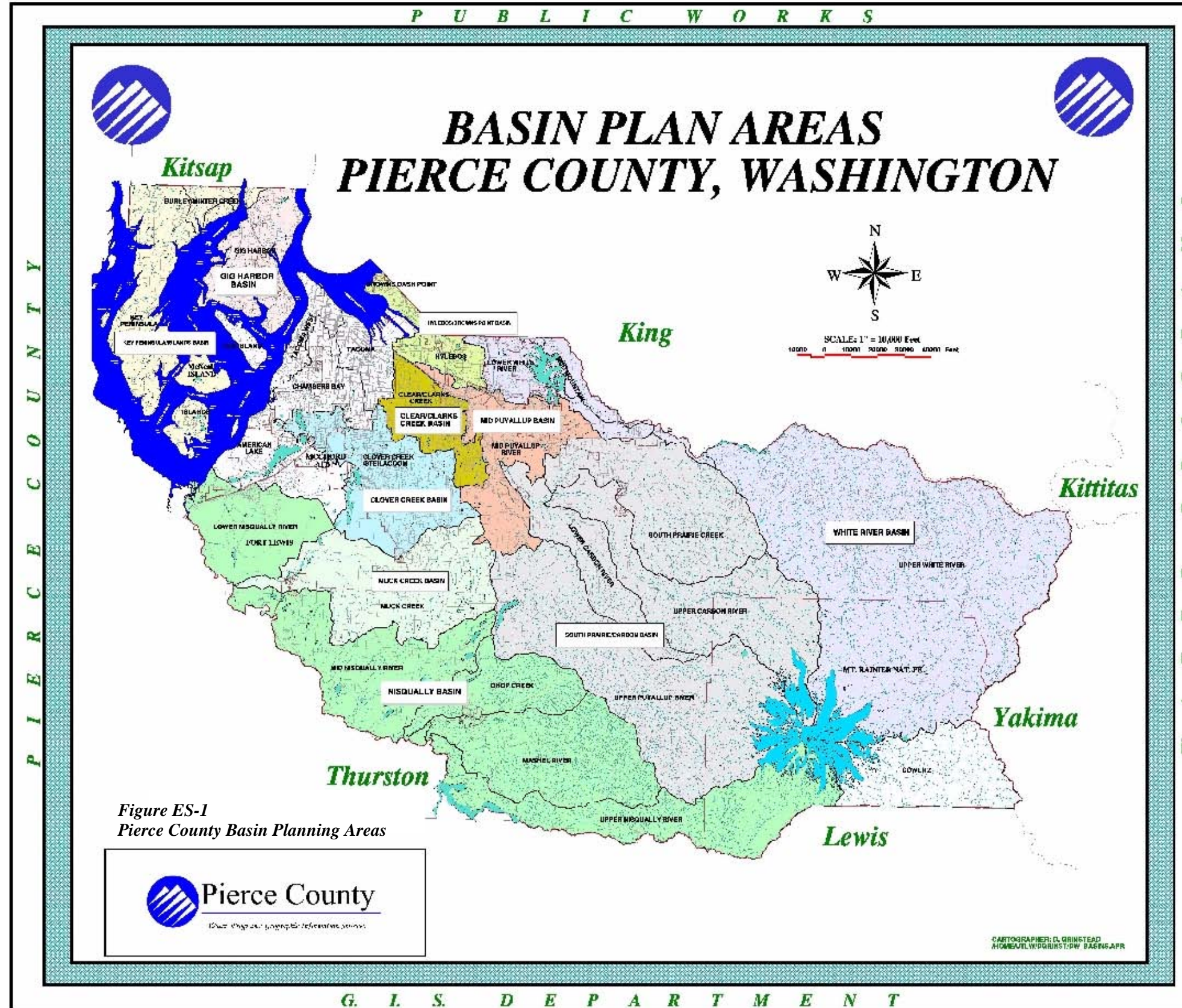
“Hazard Identification” is the systematic use of all available information to determine what types of disasters may affect a jurisdiction, how often these events can occur, and the potential severity of their consequences. “Vulnerability Analysis” is the process of determining the direct impact of these events and any collateral effects on the people, property, environment, economy and lands of a region.

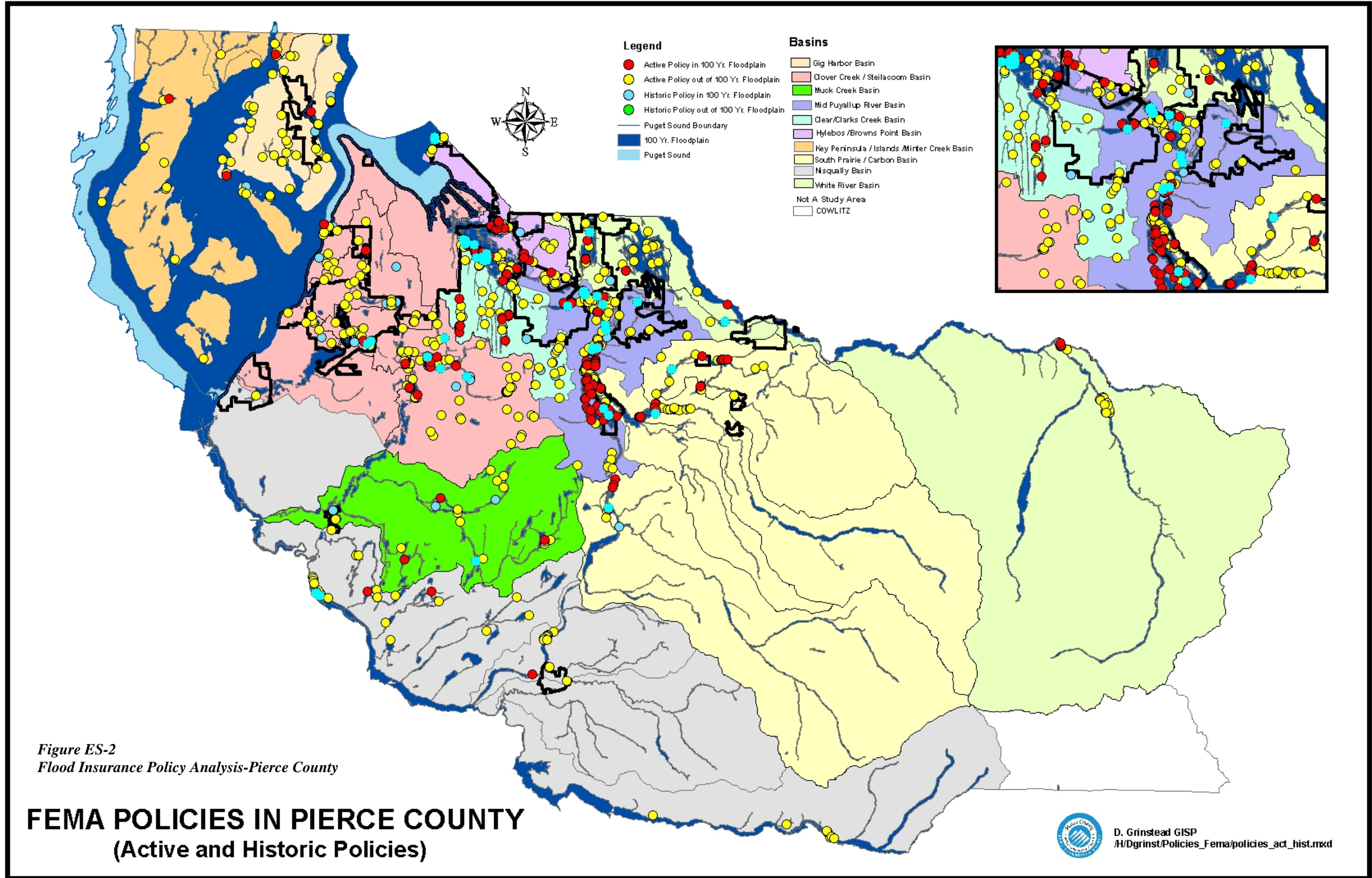
In addition to benefiting mitigation planning, Risk Assessment information allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets.

## ES.3 Pierce County’s “Basin Planning Program”

In addressing its public service, flood hazard reduction, water quality, floodplain habitat, and financial accountability responsibilities, Pierce County Water Programs employs a *Comprehensive Basin Approach*. This approach is based on multiple benefits of surface water management, employing environmentally-sensitive practices.

Water Programs is developing ten basin plans that cover all 26 Pierce County basins (*Figure ES-1*). The basin plans are being developed to update the County's 1991 Surface Water Management Plan. That plan was developed prior to passage of the state's “Growth Management Act,” adoption of the County's “Comprehensive Land Use Plan,” issuance of the state's “National Pollutant Discharge Elimination System” (NPDES) municipal stormwater permit to Pierce County, and listing of Chinook salmon and bull trout under the federal “Endangered Species Act” (ESA). These events and others, including designations of numerous Pierce County water bodies on the state's polluted waters list (303d list) and status under the federal Community Rating System (CRS) for flood hazard reduction, have necessitated Water Programs' integrated basin approach. Finally, the basin plans ensure financial accountability of the program by directing expenditures collected within individual basins to the surface water management priorities in those basins.





These basin plans embody a new approach to surface water management. Historically, conventional stormwater drainage plans have had a single purpose: remove excess water from city streets and properties as rapidly as possible. With this single purpose in mind, stormwater drainage solutions have tended to rely on piped systems and lined channels that minimize the resistance to flow. However, this conventional approach has significant disadvantages. The value of natural water bodies as wildlife habitat and a public amenity is often lost, as is the water body's ability to remove and breakdown pollutants. Pierce County seeks to avoid these disadvantages by preparing basin plans that provide practical solutions to flooding problems without sacrificing environmental quality.

## ES.4 The “Flood Risk Assessment” Purpose

To further enhance the multiple tangible benefits of Pierce County's “Basin Planning Program”, the Pierce County Water Programs Division has created this Flood Risk Assessment document as a tool to augment and support the basin planning program. This tool will provide a key planning component that will create a bridge to other planning mechanisms within Pierce County that can maximize the net benefits of initiatives identified under the Basin Planning Program. This will be accomplished by assuring compliance with other Federal and State programs that can provide funding and other benefits for initiatives that have planning prerequisites. Federal programs such as the *Pre-Disaster Mitigation Grant Program (PDM)*, *Hazard Mitigation Grant Program (HMGP) Act of 2000 (DMA)*, *Community Rating System (CRS Program)*, and *Washington State's Flood Control Account Assistance Program (FCAAP)* all have prescriptive planning requirements to achieve compliance and program eligibility. A key component for this compliance and the missing link in Pierce County's “Basin Planning Program”, is a “flood risk assessment.”

This document has been created to provide required flood hazard risk assessment information that is missing from individual Pierce County basin plans published to date (December, 2007). This information will be utilized in future basin planning efforts (development of new plans and updates to existing plans) by:

- Providing the source, information and analysis; and
- Providing the format template for incorporation into future basin planning efforts.

Creation of this Flood Risk Assessment document entitles Pierce County to the following benefits:

- Assures that eligible projects identified in each basin plan are eligible for federal and state funding by providing linkage to the plans required under those programs.
- Maximizes potential discounts of flood insurance (NFIP) premiums for Pierce County property owners under the Federal Emergency Management Agency's (FEMA's) “Community Rating System” (CRS) Program by meeting prescriptive classification prerequisites.

## ES.5 Using Risk Assessments

As stated earlier, this Flood Risk Assessment is a stand-alone document that will be utilized as a tool to augment Pierce County Water Programs “Basin Planning Program.” This Assessment has been broken down in to ten components that will match each of the ten basin plans that will be completed:

- Hylebos Browns/Dash Point Basins
- Clear/Clarks Creek Basins
- Clover Creek Basin
- Muck Creek Basin
- Gig Harbor Basin
- Carbon River/Upper Puyallup Basins
- Key Peninsula/Islands Basins
- Mid-Puyallup Basin
- Nisqually Basin
- White River Basin

Each basin has been evaluated and assessed with an emphasis on the vulnerability of developed/improved property. The following chapters will discuss and illustrate key components of risk for each of the basins. The risk in each basin will be discussed under the following categories:

- Basin Characteristics
- Land use
  - Existing
  - Future
- Flood Characteristics
  - Known Flood Hazards
- Causes of Flooding
- Flood Hazard Impacts
  - Public health and Safety
  - Critical Facilities
  - Structures Impacted
  - Repetitive Loss Areas
  - Flood Insurance Analysis

This format can act as the template for future basin planning efforts. The Assessment can be incorporated into each basin plan as follows:

- A “Flood Risk Assessment” section can be written into the plan using data provided by this document; or
- A “Flood Risk Assessment” can be incorporated into a basin plan as an additional appendix.

The information contained in an Assessment represents the best information available at the time of this document’s preparation. It is intended that this document will be dynamic in its use and development. As new information becomes available that could enhance the usefulness of this “tool,” Pierce County Water Programs will update this “Flood Risk Assessment” document accordingly. Key occurrences that could trigger an update to this Assessment include:

- A major flood event;
- New mapping;
- New capabilities within Water Programs (i.e., new tools that could provide a better gauge of vulnerability); and
- New program requirements.

At a minimum, this Assessment will be evaluated every five years to determine its relevance to the Basin Planning Program and identify potential updates. This falls in line with CRS planning requirements for Plan updates.

## ES.6 Data Sources

All technical data utilized in the preparation of this “Flood Risk Assessment” was provided by Pierce County and/or the Federal Emergency Management Agency (FEMA) and represents the best data available at the time of the preparation of this document.

### ES.6.1 Mapping

The extent and location of the floodplain analyzed in this Assessment is the 100-year floodplain that has been mapped by FEMA for the administration of Pierce County’s “Floodplain Management Program” as required under the *National Flood Insurance Program* (NFIP). These maps are referred to as “Flood Insurance Rate Maps” (FIRM). This area represents the minimum area to be regulated as floodplain under the terms and conditions of the NFIP. All development that occurs within the mapped 100-year floodplain will be regulated according to provisions contained in Pierce County Code, *Title 18E, ”DEVELOPMENT REGULATIONS - CRITICAL AREAS.”*

The current effective FIRM for Pierce County is dated 08/04/1988. At the time of preparation of this Flood Risk Assessment, Pierce County was updating its floodplain maps under FEMA’s “Map Modernization Initiative.” This process utilized significant amounts of new hydraulic and hydrologic information prepared by Pierce County. The 100-year floodplain utilized for the purpose of this “Flood Risk Assessment” is the floodplain data Pierce County provided to FEMA to update FIRMs. Updated FEMA FIRMs are estimated to become effective in 2008. Pierce County is currently utilizing this data as the “best available data” for its regulatory program.

### ES.6.2 Hydrology

The hydrology utilized in this Flood Risk Assessment to represent stream flow characteristics was generated in the “Characterization Phase” of each basin plan. All basins have modeled using standard methodology consistent with the guidelines and specifications stipulated for floodplain mapping by FEMA. The hydrology utilized in this modeling represents the most current available data generated by the vast network of rainfall and stream flow gauges within Pierce County.

### ES.6.3 Building Counts

The building counts reflected in this Flood Risk Assessment were generated in one of two ways based on the data available. Pierce County Water Programs as well as all Pierce County departments have access to extensive GIS capabilities. Capability now includes the ability to count structures using “Planimetric” tools; unfortunately, this tool was not available for use in development of this Assessment. This tool was utilized in determining the buildings at risk in the following basins:

- Gig Harbor Basin
- Clover Creek Basin
- Muck Creek Basin
- Mid-Puyallup Basin
- Clear/Clarks Creek Basin
- Hylebos Browns/Dash point Basin
- Key Peninsula/Islands Basin

For the remaining basins, building counts were estimated using a combination of GIS data and Pierce County Assessor Data. Criteria used for this analysis is as follows:

- Parcels that had 50 % or greater land area within the floodplain; and
- Parcels that had an assessed value of \$25,000 or more.

Using Pierce County's GIS system, it was determined that parcels with 50 % or greater area of their land located within the floodplain, also had a greater likelihood of property structures being located within that floodplain area (structures with an assessed value of \$25,000 or more). The \$25,000 valuation threshold was determined based on an evaluation of the most likely housing values in Pierce County which are most likely covered by a flood insurance policy. These are also structures that would likely be the most impacted from the flood hazard. There is some level of error in this analysis, but is the most practical method available based on current information and technology available.

### ES.6.4 Critical Facilities

This Flood Risk Assessment will identify those critical facilities considered to be "at risk" from flooding. To achieve consistency with other existing planning mechanisms in effect within Pierce County (*Comprehensive Plan* and the *Hazard Mitigation Plan*), this Assessment will utilize the definition established for "critical facilities" by the *Pierce County Hazard Mitigation Plan*. The Hazard Mitigation Planning Team determined that their plan should include, but not be limited to, the definition of critical facilities as expressed in the "Critical Area Regulations" of the *Pierce County Comprehensive Plan*. This broad definition identifies some disaster-critical facilities, but also large occupancy buildings, schools, and other congregate facilities. The definition is part of Pierce County's land use regulations; regulating or restricting development in hazardous or environmentally critical areas. It does not include all facilities that might be construed by FEMA as critical, and includes others which might be defined by FEMA as "essential". The adopted definition of "Critical Facilities" for Pierce County planning purposes is as follows:

*"Critical Facilities" means those facilities occupied by populations or which handle dangerous substances including, but not limited to, hospitals, medical facilities; structures and/or housing, supporting or containing toxic or explosive substances; covered public assembly structures; school buildings through secondary, including day-care centers; buildings for college or adult education; jails and detention facilities; and all structures with occupancy of greater than 5,000 people (18e.10.050 PCC).*

Although adopting this definition by reference, the Plan specifically focuses on mitigation of the following "Critical Facilities" as further defined by FEMA (*State and Local Mitigation Planning: Understanding Your Risks*, Publication # 386-2):

*"Critical Facilities: Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals".*

The inventory of "Critical Facilities" created during the development of the *Pierce County Hazard Mitigation Plan* was through development of this assessment. Using "GIS", this inventory was plotted against the mapped 100-floodplain to determine exposure. The vulnerability of each facility was not determined due to the lack of data on each facility (such as FEMA elevation certificates or estimates of

depth of flooding). Detailed inventories of “at-risk Critical Facilities” will not be published in this Flood Risk Assessment for security purposes.

### ES.6.5 Repetitive Loss

Repetitive loss properties require special attention in terms of flood mitigation planning. A repetitive loss property as defined by FEMA is a NFIP insured property that, since 1978 and regardless of changes in ownership during that period, has experienced any of the following:

- Four or more paid losses in excess of \$1,000; and/or
- Two paid losses in excess of \$1,000 within any rolling 10-year period since 1978; and/or
- Three or more paid losses that equal or exceed the current value of the insured property.

The main identifiers for repetitive loss properties are the existence of flood insurance policies and claims paid by those policies. The “Community Rating System” (CRS) Program, which Pierce County is a part of, requires that “repetitive loss” properties be identified. A *Repetitive Loss Area* is that portion of the floodplain where buildings have been subject to repetitive flooding and are clustered together. The basis in identifying these areas are those structures that FEMA has identified as meeting the definition of *Repetitive Loss* due to the existence of a flood insurance policy.

The repetitive loss data analyzed in this Flood Risk Assessment has been provided to Pierce County by FEMA. This data is provided to Pierce County annually so that *Repetitive Loss* requirements as stipulated under the CRS Program can be addressed. Like all flood insurance related data, this data is dynamic and can change significantly over periods of time. Flood events that occur within the planning area can cause new properties to be added and removed from this list. Pierce County has recognized the need and importance of addressing repetitive flooding through the development of the *Pierce County Repetitive Loss Plan*, developed and adopted in September of 2000. Analysis from that plan has been updated and included in this Flood Risk Assessment. The *Repetitive Loss Plan* is a partner document to this *Flood Risk Assessment*, and the Pierce County Water Programs Division “Basin Planning Program”.

### ES.6.6 Flood Insurance

An analysis of probable problem areas within each basin has been performed using flood insurance policy and claims data provided by FEMA, Region X. This data is based on policies in force and claims filed as of May 1, 2007. It should be noted that this data is considered as a snapshot in time. Flood insurance coverage and claims data are dynamic and can constantly change due to various factors that include:

- New flood mapping
- Changes in mortgage rates
- Increase in the sale/resale of real estate
- Annexation and/or Incorporation
- Flood Disasters

However, analyzing dynamic data can still prove to be highly beneficial in identifying risks by looking at trends up to a particular point in time. Flood Insurance data can validate risks you were already aware of, and at the same time provide an indicator of potential problem areas that you were not aware of..

The Flood Insurance data provided by FEMA was plotted on base maps within each basin in an attempt to estimate the following:

- Percent of “at risk” properties with insurance available for a possible means mitigation and recovery
- Percent of policies in force outside of a mapped floodplain, and their location
- The number of claims filed within the basin
- The percent of those claims filed outside of the 100-floodplain

This data is discussed in more detail in the basin chapters. *Figure ES-2* summarizes this information.