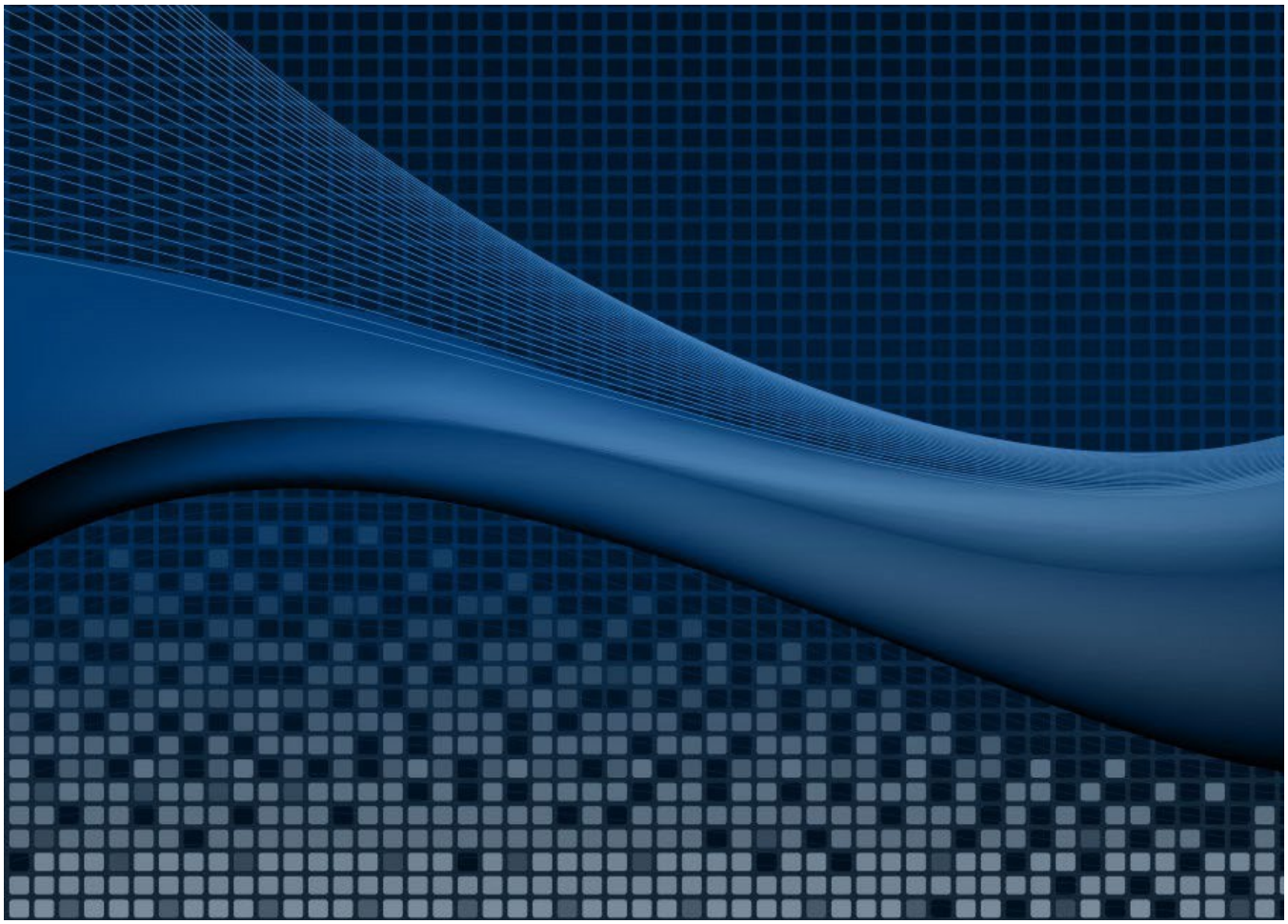
2024 Repetitive Loss Area Analysis

Public Document



May 1, 2024

TETRA TECH

DRAFT

City of Snoqualmie, Washington 2024 Repetitive Loss Area Analysis

May 1, 2024

PREPARED FOR

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PART 1—PLANNING PROCESS AND PROJECT BACKGROUND

1. INTRODUCTION

1.1 REPETITIVE LOSS PROPERTIES AND THE COMMUNITY RATING SYSTEM

A repetitive loss property is defined by the Federal Emergency Management Agency (FEMA) as a property for which two or more National Flood Insurance Program (NFIP) losses of at least $1,000 each have been paid within any 10-year rolling period since 1978 (FEMA 2017). From 1978 through 2020, about a quarter of all claims paid under the NFIP nationwide were for repetitive loss properties, even though such properties make up fewer than 2 percent of all NFIP insurance policies (FEMA 2017).

Federal programs such as the Community Rating System (CRS) encourage communities to identify and mitigate the causes of repetitive losses. The first step is to map repetitive loss areas, which are contiguous areas that include one or more properties on FEMA's list of repetitive loss properties and all nearby properties with exposure to the same or similar flooding conditions. FEMA considers listed repetitive loss properties to be indicative of an overall repetitive loss problem that may affect other nearby properties. Designation of repetitive loss areas around listed repetitive loss properties allows an evaluation of actual or potential flooding problems at properties that may not have flood insurance or may have had only a single previous claim. This ensures that all properties with the same exposure to a flood risk are addressed equally.

1.1.1 Requirements for Category C Communities

The CRS, which provides for reduced flood insurance premiums in communities that carry out various flood mitigation activities, requires the following from participating communities with 50 or more repetitive loss properties (Category C communities):

- Prepare a map of repetitive loss areas.
- Review and describe each area's repetitive loss problem.
- Prepare a list of the addresses of all properties in the repetitive loss areas with insurable buildings, which are defined to include the following (FEMA 2020):
  - A structure that is affixed to a permanent site and has two or more outside rigid walls and a fully secured roof
  - A manufactured home (also known as a mobile home) built on a permanent chassis, transported to its site in one or more sections, and affixed to a permanent foundation
  - A travel trailer without wheels, built on a chassis and affixed to a permanent foundation, that is regulated under the community's floodplain management and building ordinances or laws.
- Undertake an annual outreach project to those addresses.
- Prepare a floodplain management plan or area analysis for the repetitive loss areas.

1.1.2 The Repetitive Loss Area Analysis

FEMA prescribes the following five-step process for conducting an area analysis for repetitive loss:

- Step 1—Advise all the property owners in the repetitive flood loss area that the analysis will be conducted.
- Step 2—Contact agencies or organizations that may have plans that could affect the cause or impacts of the flooding.
- Step 3—Collect data on the analysis area and each building in it to determine the causes of the repetitive damage.
- Step 4—Review alternative mitigation approaches and determine whether any property protection measures or drainage improvements are feasible.
- Step 5—Document the findings in a report.

As required under Step 5, it provides the following information:

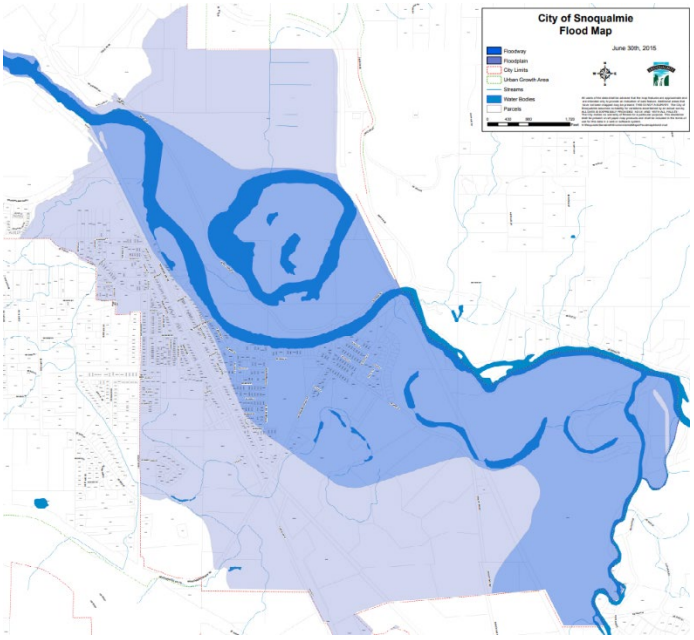
- A summary of the process followed
- Problem statements with maps for each area
- A table of basic information about each building in the area
- A description of alternative approaches considered to address the problem
- A set of recommended action items to address the problem

1.2 CITY OF SNOQUALMIE REPETITIVE LOSS AREA ANALYSIS

King County, Washington (County) prepared a King County Regional Hazard Mitigation Plan (RHMP) in 2020. The county in partnership with the City of Snoqualmie (City) along with local governments within the county, participated in the RHMP. The City of Snoqualmie, as a planner partner, is represented in Volume 2 of the RHMP. The plan addressed general flooding problems and identified possible solutions for individual homeowners. However, the plan did not include all required procedures for CRS Step 5c as outlined in the *2017 Community Rating System Coordinator's Manual*.

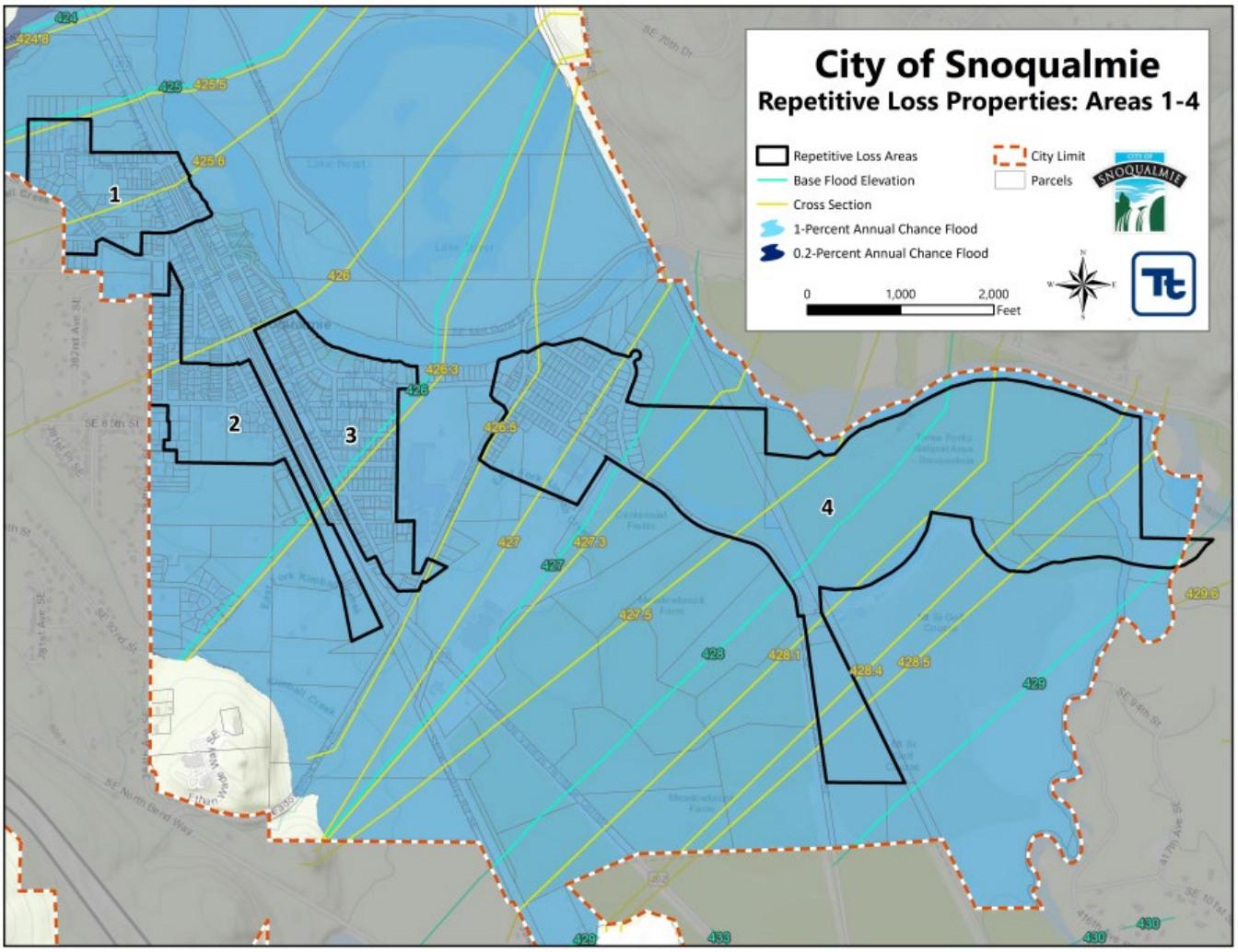
This report documents the fulfillment of the CRS requirements for Category C communities, following the five-step area-analysis process for a CRS Activity 510- Repetitive Loss Area Analysis (RLAA). It is the goal to include the RLAA under the City's RHMP Appendix in partnership with the King County 2024/2025 plan update.

Individual properties and structures are counted and described in the RLAA, but specific address information is withheld under the Federal Privacy Act of 1974. A separate document on file with the City for internal use only correlates the property ID numbers presented here with specific address information.



FEMA's last report on November 14, 2022, designated 198 repetitive loss properties (RLPs) within the City RL database. Upon review of each RL parcel, the following represents the current RL status:

- 198 repetitive loss properties identified from FEMA Region 10 CRS RL data.
- 38 repetitive loss properties are identified as "mitigated" from King County Tax Assessor's records by permitting demolition, new construction, and structural elevation.
- 22 addressed on the RL data are within King County corporate limits.



The updated RL properties have been remapped into 4 existing CRS program repetitive loss areas, and an analysis has been conducted for each area. Table 1-1 summarizes the total 198 properties, along with the dates of flooding events and the flood insurance claims filed for each since 1978. This includes RLP within the City's corporate limits and within neighboring King County. For reporting purposes, the King County RL data is for reference and represents the reach of the flooding sources within the area.

King County's RHMP summarizes the source of flooding associated with the large data set of claims based in 2006 and 2009.

> *Flooding is a prevalent threat during the fall and winter months due to atmospheric rivers, heavy rain, and king tides. Major floods occur on average every two to five years. Major river flooding has typically not caused fatalities, but rather significant property damage.* ***Flooding along multiple rivers in 2006 and 2009 were the most recent major floods to cause many millions of dollars in damage****. Flooding in 1990 is considered the largest flood of record for most of the county except for the Lower Snoqualmie and Tolt Rivers. There have been 28 flooding events since 1965 that have resulted in federal disaster declarations. At least minor flooding occurs every winter. Climate change is likely to have a significant effect in changing the patterns of flooding in the river basins.*

All of the RLPs suffered flooding damage at least twice in the defined CRS RL data provided by FEMA Region 10. Table 1-1, represents the total 198 RLPs represented in the 2022 RLP data. Specific to the RLPs data provided by FEMA, a majority of the date of losses coordinate with specific historical flood events 2006 and 2009 that impacted the City and County. FEMA Repetitive loss properties identification numbers were utilized in Table 1-1. These are unique identifiers to protect specific data under PII. The table represents the RL areas where parcels are located. Where an RL area is not identified, it is a parcel identified to be within the corporate limits of King County.

Table 1-1. 2022 Historical Repetitive Loss Properties Represented in the City of Snoqualmie's FEMA Data (City and County)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
93570		2	9699.99	Y	N	Vacant	
183038	4	3	176096.13	Y	N	Crawl Space	Golf Course
185243	2	3	213951.57	Y	Y	Basement	Single Family(Res Use/Zone)
289011	3	2	55632.33	Y	N	Crawl Space	Single Family(Res Use/Zone)
56211		2	8174.28	Y	N	Basement	Single Family(Res Use/Zone)
7493	2	5	179364.51	Y	Y	Crawl Space	Single Family(Res Use/Zone)
82028	3	5	68654.56	Y	Y	Vacant	Single Family(Res Use/Zone)
184107	3	2	6637.87	Y	N	Basement	Single Family(Res Use/Zone)
183961	3	2	15031.66	Y	N	Vacant	Single Family(Res Use/Zone)
184618	3	2	86111.56	Y	N	Crawl Space	Single Family(Res Use/Zone)
184978	3	2	8482.9	Y	N	Crawl Space	Single Family(Res Use/Zone)
288598	3	2	24344.99	Y	N	Crawl Space	Single Family(Res Use/Zone)
184025	3	2	125216.12	Y	Y	Crawl Space	Single Family(Res Use/Zone)
185043		2	222183.11	Y	N	Basement	Single Family(Res Use/Zone)
184452	3	2	35255.05	Y	N	Crawl Space	Single Family(Res Use/Zone)
183863	3	2	47724.76	Y	N	Basement	Single Family(Res Use/Zone)
85770	3	4	58758.01	Y	N	Basement	Single Family(Res Use/Zone)
184924		2	121601.97	Y	N	Crawl Space	Single Family(Res Use/Zone)
85767	3	4	138359.85	Y	Y	Basement	Single Family(Res Use/Zone)
75578	3	4	93606.15	Y	N	Basement	Single Family(Res Use/Zone)
54726	3	6	89852.36	Y	Y	Basement	Single Family(Res Use/Zone)
73788		3	37149.7	Y	N	Vacant	Single Family(Res Use/Zone)
75560	3	4	22496.8	Y	N	Crawl Space	Single Family(Res Use/Zone)
75586	3	4	92948.54	Y	Y	Basement	Single Family(Res Use/Zone)
184083	3	2	88873.6	Y	N	Basement	Duplex
183520	3	2	55730.68	Y	N	Basement	Duplex
184053	3	2	120176.98	Y	N	Crawl Space	Single Family(Res Use/Zone)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
83878		2	31013.62	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184055	3	2	69462.85	Y	N	Crawl Space	Single Family(Res Use/Zone)
184387	3	2	79656.3	Y	N	Crawl Space	Single Family(Res Use/Zone)
183895	3	2	26573.42	Y	N	Crawl Space	Single Family(Res Use/Zone)
184439	3	2	188428.66	Y	Y	Basement	Single Family(Res Use/Zone)
169177		3	111281.22	Y	N	Basement	Single Family(Res Use/Zone)
69307	2	4	36491.01	Y	N	Basement	Single Family(Res Use/Zone)
185120	4	2	75922.6	Y	N	Basement	Single Family(Res Use/Zone)
169181		3	68045.24	Y	N	Basement	Single Family(Res Use/Zone)
168812	3	3	78510.36	Y	N	Crawl Space	Single Family(Res Use/Zone)
184056	3	2	70238.75	Y	N	Crawl Space	Single Family(Res Use/Zone)
184670	3	2	15174.05	Y	N	Basement	Single Family(Res Use/Zone)
296971		1	9171.69	N	Y	Basement	Single Family(Res Use/Zone)
184106	4	2	66247.41	Y	N	Crawl Space	Single Family(Res Use/Zone)
184478		3	120917.62	Y	N	Basement	Single Family(Res Use/Zone)
183003	4	3	17680.56	Y	N	Basement	Single Family(Res Use/Zone)
184571	2	2	31112.44	Y	N	Crawl Space	Single Family(Res Use/Zone)
69305	3	2	32993.85	Y	N	Vacant	4-Plex
184152	2	2	52664.6	Y	N	Crawl Space	Single Family(Res Use/Zone)
184029	3	2	75830.41	Y	N	Crawl Space	Single Family(Res Use/Zone)
182088	4	3	26148.03	Y	N	Basement	Single Family(Res Use/Zone)
184639	4	2	11337.79	Y	N	Crawl Space	Single Family(Res Use/Zone)
184447	4	2	159667.61	Y	N	Basement	Single Family(Res Use/Zone)
184103	2	2	47043.27	Y	N	Basement	Single Family(Res Use/Zone)
184390	4	3	11520.57	Y	N	Basement	Single Family(Res Use/Zone)
168822	4	3	137174.18	Y	N	Basement	Single Family(Res Use/Zone)
184620	2	2	103210.11	Y	N	Basement	Single Family(Res Use/Zone)
184641	4	2	16220.88	Y	N	Basement	Single Family(Res Use/Zone)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
184051	2	2	34278.73	Y	N	Basement	Single Family(Res Use/Zone)
183869	2	3	92211.06	Y	N	Basement	Single Family(Res Use/Zone)
184603	3	2	39074.85	Y	N	Vacant	Daycare Center
80560	2	4	261976.45	Y	Y	Crawl Space	Single Family(Res Use/Zone)
11308		6	117008.07	Y	N	Basement	Single Family(Res Use/Zone)
184588	4	2	189309.11	Y	Y	Basement	Single Family(Res Use/Zone)
75567		2	34066.72	Y	N	Vacant	Vacant(Single-family)
81814		2	23519.13	Y	Y	Vacant	Vacant(Single-family)
184489		3	68571.52	Y	N	Basement	Single Family(Res Use/Zone)
183917		2	61500	Y	N	Crawl Space	Single Family(Res Use/Zone)
168523		3	99037.69	Y	N	Crawl Space	Single Family(Res Use/Zone)
168819	4	3	89611.41	Y	N	Basement	Single Family(Res Use/Zone)
80556	2	5	76557.85	Y	Y	Basement	Single Family(Res Use/Zone)
183320	4	3	22554.22	Y	N	Basement	Single Family(C/I Zone)
184964	2	3	35543.26	Y	N	Crawl Space	Single Family(Res Use/Zone)
84882	4	5	21651.29	Y	N	Basement	Single Family(Res Use/Zone)
85695	4	5	48903.63	Y	N	Basement	Single Family(Res Use/Zone)
184565	3	2	56649.34	Y	Y	Basement	Single Family(Res Use/Zone)
299493	3	2	65721.04	Y	N	Crawl Space	Single Family(C/I Use)
184945	3	2	54025.54	Y	N	Crawl Space	Single Family(Res Use/Zone)
168965	4	3	19265.09	Y	N	Crawl Space	Single Family(Res Use/Zone)
184094	3	2	221167.41	Y	N	Basement	Single Family(Res Use/Zone)
184145	2	2	36270.66	Y	N	Basement	Single Family(Res Use/Zone)
184388	3	2	46426.87	Y	N	Crawl Space	Single Family(Res Use/Zone)
182117	4	3	48475.17	Y	N	Basement	Single Family(Res Use/Zone)
183866	4	3	194528.36	Y	N	Basement	Single Family(Res Use/Zone)
307890	4	2	9985.75	Y	N	Basement	Single Family(Res Use/Zone)
82007	4	6	38638.07	Y	Y	Basement	Single Family(Res Use/Zone)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
75579	4	3	21550.5	Y	N	Basement	Single Family(Res Use/Zone)
69312	3	3	129034.9	Y	N	Crawl Space	Single Family(Res Use/Zone)
316	3	4	69130.53	Y	Y	Basement	Single Family(Res Use/Zone)
73908	4	2	65509.18	Y	N	Basement	Single Family(Res Use/Zone)
184384	3	2	15253.13	Y	N	Crawl Space	Single Family(Res Use/Zone)
73839	4	5	25825.54	Y	N	Basement	Single Family(Res Use/Zone)
184987	2	2	18193.98	Y	N	Crawl Space	Single Family(Res Use/Zone)
80811	3	6	61100.52	Y	Y	Crawl Space	Single Family(Res Use/Zone)
77813	4	3	54991.56	Y	N	Basement	Single Family(Res Use/Zone)
183909	3	2	59314.73	Y	N	Basement	Single Family(Res Use/Zone)
184153	3	3	218225.39	Y	Y	Basement	Single Family(Res Use/Zone)
183910	2	2	4826.04	Y	N	Basement	Single Family(Res Use/Zone)
181128	4	4	31931.06	Y	N	Basement	Single Family(Res Use/Zone)
74189	3	4	104930.69	Y	N	Crawl Space	Single Family(Res Use/Zone)
186174	2	2	4510.22	Y	N	Basement	Single Family(Res Use/Zone)
184633	4	2	6785.22	Y	N	Basement	Single Family(Res Use/Zone)
184488		2	103794.3	Y	N	Basement	Single Family(Res Use/Zone)
184163	2	2	5149.71	Y	N	Crawl Space	Single Family(Res Use/Zone)
168945	3	3	64409.4	Y	N	Crawl Space	Single Family(Res Use/Zone)
88181	4	4	13337.36	Y	N	Basement	Single Family(Res Use/Zone)
184104	4	2	75185.75	Y	N	Crawl Space	Apartment(Mixed Use)
82350	3	4	554367.47	Y	Y	Crawl Space	Church/Welfare/Relig Srvc
184662	3	2	38711.93	Y	N	Crawl Space	Single Family(Res Use/Zone)
318100	3	2	25209.16	Y	Y	Vacant	Single Family(Res Use/Zone)
77839	3	5	174914.99	Y	Y	Basement	Single Family(Res Use/Zone)
80555	3	4	137059.18	Y	Y	Basement	Single Family(Res Use/Zone)
80652	4	6	352329.52	Y	Y	Basement	Single Family(Res Use/Zone)
80554	4	3	19210.42	Y	N	Vacant	Vacant(Commercial)
184065	4	2	60172.18	Y	N	Vacant	Vacant(Commercial)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
184082	4	2	8885.37	Y	N	Basement	Single Family(Res Use/Zone)
83308	4	2	6842.2	Y	N	Basement	
28377	4	2	42440.18	Y	N	Basement	
48559	4	2	34485.55	Y	N	Vacant	
184627	4	2	16569.05	Y	N	Basement	Single Family(Res Use/Zone)
184033	2	2	12463.61	Y	N	Basement	Single Family(Res Use/Zone)
184385	4	2	10462.48	Y	N	Crawl Space	Single Family(Res Use/Zone)
56942	4	4	103813.26	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184500	2	2	16500.64	Y	N	Basement	Single Family(Res Use/Zone)
69306	3	5	198553.39	Y	Y	Crawl Space	4-Plex
184982	4	2	33923.04	Y	N	Basement	Single Family(Res Use/Zone)
181347	2	3	54117.92	Y	N	Basement	Single Family(C/I Zone)
183039	3	5	35418.62	Y	N	Basement	Single Family(Res Use/Zone)
184671	3	2	29544.22	Y	N	Crawl Space	Single Family(Res Use/Zone)
184142	2	2	8942.49	Y	N	Crawl Space	Single Family(Res Use/Zone)
2457	4	3	58426.76	Y	N	Basement	Single Family(Res Use/Zone)
28378	4	5	53594.58	Y	N	Basement	Single Family(Res Use/Zone)
56990	4	3	48728.52	Y	N	Basement	Single Family(Res Use/Zone)
184164	4	2	28489.76	Y	N	Basement	Single Family(Res Use/Zone)
183897	2	2	73361.39	Y	N	Basement	Single Family(Res Use/Zone)
184157	4	2	36113.41	Y	N	Basement	Single Family(Res Use/Zone)
69310	4	10	96864.63	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184134	4	2	13668.13	Y	N	Basement	Single Family(Res Use/Zone)
184440	4	2	17851.48	Y	N	Basement	Single Family(Res Use/Zone)
80558	4	5	18792.08	Y	N	Basement	Single Family(Res Use/Zone)
80913	4	2	9156.72	Y	N	Vacant	
184009	2	2	6502.6	Y	N	Crawl Space	Single Family(Res Use/Zone)
75589	4	2	2655.99	Y	N	Basement	Single Family(Res Use/Zone)

184802	4	2	163739.63	Y	N	Crawl Space	Single Family(Res Use/Zone)
286885	4	2	29316.23	Y	N	Basement	Single Family(Res Use/Zone)
73909	4	2	31902.72	Y	N	Basement	Single Family(Res Use/Zone)
88180	3	2	23983.48	Y	Y	Crawl Space	Park, Public(Zoo/Arbor)
184086	2	2	87801.9	Y	N	Basement	Single Family(Res Use/Zone)
74147	4	4	22419.09	Y	N	Basement	Single Family(Res Use/Zone)
183865	3	3	70240.92	Y	N	Crawl Space	Single Family(C/I Zone)
184227	2	2	73487.73	Y	N	Crawl Space	Single Family(Res Use/Zone)
183829	2	2	69270.88	Y	N	Basement	Single Family(Res Use/Zone)
183843	2	2	11245.28	Y	N	Crawl Space	Single Family(Res Use/Zone)
184389	3	2	113276.52	Y	N	Crawl Space	Apartment
184584	2	2	59208.24	Y	N	Basement	Single Family(Res Use/Zone)
75572		3	93461.07	Y	N	Basement	Single Family(Res Use/Zone)
184095	2	2	23045.51	Y	N	Basement	Single Family(Res Use/Zone)
184665	1	2	10890	Y	N	Basement	Single Family(Res Use/Zone)
28312	1	5	333910.35	Y	Y	Basement	Single Family(Res Use/Zone)
184117	1	2	11889.41	Y	N	Vacant	4-Plex
69311	1	4	52200.37	Y	N	Basement	Single Family(Res Use/Zone)
184144	1	2	74920.25	Y	N	Basement	Single Family(Res Use/Zone)
84746	1	2	34146.12	Y	Y	Basement	Single Family(Res Use/Zone)
7817	1	4	25803.03	Y	N	Basement	Duplex
184979	1	2	11546.23	Y	N	Basement	Single Family(Res Use/Zone)
184386	1	3	72226.42	Y	N	Basement	Single Family(Res Use/Zone)
184579	1	2	10639.38	Y	N	Crawl Space	Single Family(Res Use/Zone)
184049	1	2	36398.65	Y	N	Basement	Single Family(Res Use/Zone)
183874	1	2	48719.91	Y	N	Crawl Space	Single Family(Res Use/Zone)
184625	1	2	11577.49	Y	N	Crawl Space	Single Family(Res Use/Zone)
288603	1	2	13524.23	Y	N	Basement	Single Family(Res Use/Zone)
75559		2	13250.66	Y	N	Basement	
184951	1	2	73251.15	Y	N	Crawl Space	Single Family(Res Use/Zone)
183877	1	3	230795.95	Y	Y	Basement	Single Family(Res Use/Zone)
11316		2	30917.93	Y	N	Basement	Single Family(Res Use/Zone)
85753		3	129976.12	Y	N	Basement	Single Family(Res Use/Zone)

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
184068	1	2	42687.99	Y	N	Vacant	Daycare Center
316816	1	2	9724.24	Y	N	Vacant	Daycare Center
316857	1	2	9448.5	Y	N	Vacant	Daycare Center
75561	1	4	45171.92	Y	Y	Basement	Single Family(Res Use/Zone)
169180	1	3	123127.7	Y	N	Basement	Single Family(Res Use/Zone)
77182	1	2	17331.68	Y	Y	Basement	Single Family(Res Use/Zone)
85984	1	3	26565.59	Y	N	Basement	Single Family(Res Use/Zone)
184093	1	2	10350.4	Y	N	Basement	Single Family(Res Use/Zone)
185042	1	2	203999.45	Y	Y	Basement	Single Family(Res Use/Zone)
78064	1	5	32122.95	Y	N	Basement	Single Family(Res Use/Zone)
73802	1	4	193660.96	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184605	1	2	5112.98	Y	N	Basement	Single Family(Res Use/Zone)
53181	1	6	132837.18	Y	Y	Crawl Space	Single Family(Res Use/Zone)
6958	1	5	30575.06	Y	N	Crawl Space	Single Family(Res Use/Zone)
183815	1	2	10331.62	Y	N	Crawl Space	Single Family(Res Use/Zone)
75558	1	3	84662.9	Y	N	Basement	Single Family(Res Use/Zone)
80557	1	2	27495.21	Y	N	Basement	Single Family(Res Use/Zone)
81804	1	4	81985.78	Y	N	Basement	Single Family(Res Use/Zone)
183831	1	2	89634.32	Y	N	Basement	Single Family(Res Use/Zone)
168524	1	3	147516.27	Y	N	Crawl Space	Single Family(Res Use/Zone)
184681	1	2	56077.39	Y	N	Basement	Single Family(Res Use/Zone)
184937	1	3	53952.44	Y	N	Crawl Space	Single Family(Res Use/Zone)
183789	1	2	47839.32	Y	N	Basement	Single Family(Res Use/Zone)
169025	1	3	25828.05	Y	N	Crawl Space	Single Family(Res Use/Zone)
184169	1	2	10407.09	Y	N	Crawl Space	Single Family(Res Use/Zone)
44463		2	21249.9	Y	N	Vacant	Vacant(Commercial)

2. REPETITIVE LOSS AREA ANALYSIS METHODOLOGY

2.1 BASIC REQUIREMENTS

There are two key sets of requirements to be met for a repetitive loss area analysis (RLAA):

- **Repetitive loss area mapping** requirements contained in Section 503 of the *CRS Coordinator's Manual* and in the supplemental publication, *Mapping Repetitive Loss Areas* (FEMA 2015).
- **Building data collection** requirements contained in Section 512.b of the CRS Coordinator's Manual (FEMA 2017):
  - Review each building in the repetitive loss area and collect basic data.
  - Collect data that is sufficient to make a preliminary determination of the cause of the repetitive flooding and of mitigation measures that would be appropriate to address the problem. This usually includes a review of drainage patterns around the building, the condition of the structure, and the condition and type of foundation.
  - The person conducting the review should not have to enter the property—adequate information should be collected from observations and other data.
  - Floor elevations or historical flood levels are not required, but can be helpful if available.
  - The date of each building's insurance claim can help identify the cause of flooding (e.g., rainfall, hurricane or overbank flooding). The amount of the claim can help determine the amount of damage. Every community should request repetitive loss data including its historical insurance claims. This includes single-claim properties.

More information on building data can be found in *Selecting Appropriate Mitigation Measures for Floodprone Structures* (FEMA-551).

2.2 REVERSE DAMAGE FUNCTION METHODOLOGY (INITIAL IDENTIFICATION)

Rationale for Alternative Approach

For the City's RLAA, building data collection requirements were met using an alternative to the approach outlined in the CRS Coordinator's Manual. The RLAA planning team selected the alternative approach—a "reverse damage function" methodology—for initial identification of repetitive loss areas for the following reasons:

- The City received a formal update of its repetitive loss data from FEMA in November 2022 from FEMA Region 10. This was the last official dataset available for this RLAA.
- A Level 2, user-defined flood model using Hazus-MH, version 6.1 was constructed using State data. The County Assessor's data provided key building attributes to model flood risk, such as date of construction, foundation type, occupancy class, and permit history. The detailed model data allowed the use of the selected alternative approach.

Description of Selected Approach

The selected reverse damage function approach used available data and capabilities to prepare the RLAA. The alternative approach achieves the same objectives as the approach prescribed in the 2017 CRS Coordinator's Manual (Section 512b), while providing the City a better protocol for maintaining data in the future to identify properties in a defined repetitive loss area and determine the cause of repetitive flooding. This data can then be used for possible grant opportunities.

The reverse damage function approach is a quantitative process. It uses an existing model to apply the principles of the "depth-damage function," which is the cornerstone of risk assessment in FEMA's Hazus-MH and Benefit-Cost Analysis programs. Both of these programs estimate damage using curves that show the percentage of asset value that will be damaged as a function of the depth of floodwaters. These depth-damage curves are well-established as a basis for estimating losses caused by flooding.

The reverse damage function methodology uses known values of damage from a flood event, based on filed claims, to estimate what the floodwater depth was for that event. The following protocol was followed:

- The City redefined their CRS Activity 503- Repetitive Loss Areas. The 4 previously identified RL areas remain with a reduction of parcels to each RL area inventory. The City has a proactive outreach program with social media efforts, mailers, and messaging. Updating the RLA inventory reduced the substantial cost of hard copy mailing. The City applied a 100' buffer to each RL parcel and captured the data within the buffer to create an updated RL inventory and updated RL mailing list.
- Each repetitive loss property from the FEMA 2022 data set was mapped in GIS to look for possible groupings based on proximity. The GIS mapping was based on the LiDAR-generated digital elevation model. This digital elevation model has a 3-foot resolution.
- The average loss for each repetitive-loss (RL) property was determined by taking the average of all claims for that property.
- Replacement cost for each structure was calculated by applying the size and construction class for each RL property to the construction-cost-per-square-foot tables in *2015 BNi Home Builder's Costbook* (Building News International, 2015).
- The percent damage "X" was calculated as:

  $X = Z \div Y$
  where:
  X is the percent damage (to be determined)
  Y is the replacement cost of the structure (based on assessor information)
  Z is the estimated loss (based on the flood insurance claim)
- Once the percent damage was determined, the corresponding flood depth was determined by looking at the U.S. Army Corps of Engineers 2003 *Generic Depth-Damage Relationships for Residential Structures* (see Appendix A). These are the same damage functions contained in FEMA's Hazus-MH and BCAR platforms. They represent projected flood depths above the top of the finished floor.
- The determined flood depth was applied to the repetitive loss structure. Using the foundation type determined using Google Street View Pro and assuming crawl space foundations for any structures not visible in that application, the depth was added to the top of the finished floor. For a structure with a slab foundation, the top of the finished floor was set at 8 inches above adjacent grade. For a structure with a crawlspace foundation, the finished floor was set at 24 inches above adjacent grade. These parameters are based on standard building practices.
- Once the depth was applied to the finished floor, it was extended across the digital elevation model until it ran to zero depth (high ground) and a boundary was delineated. These boundaries were projected north, south, east and west for each property. In areas with multiple RL properties, the property with the highest

depth above finished floor was used for this exercise.

- The boundary for each repetitive loss area was intersected with an ortho-photo and parcel boundary map. Each parcel with a structure within the delineated boundary was determined to be a property potentially subjected to repetitive flooding.
- Property condition assessments were included in existing assessor's data, which were used for this RLAA.

The final step was to determine the cause of flooding, considering the following findings from the initial identification, mapping, and historical flooding source. Utilizing this methodology and City guidance, 4 repetitive loss areas were reconfirmed. Water surface elevation 411.0 was identified as a common factor across the 4 repetitive loss areas. A combination of high annual precipitation and melting snow in the upper Snoqualmie River basin contributes to the potential for seasonal flooding. Floodwaters collect on the flat valley floor where Snoqualmie is located. Flooding is rooted at the main stem and the south fork of the Snoqualmie River and Kimball Creek. Downstream of the city, the main stem of the Snoqualmie River is forced through a narrow opening before discharging over Snoqualmie Falls. Kimball Creek, a tributary to the Snoqualmie River, runs through the city. Kimball Creek backs up and floods its drainage area as a result of the high water level in the river.

2.3 SECONDARY IDENTIFICATION

Once the initial identification of the repetitive loss areas was completed using the reverse-damage-function methodology, the planning team performed a secondary review of each repetitive loss area based on three questions about each area:

- Is there really a repetitive loss problem in this area, based on local knowledge?
- Does the list of properties make sense based on what we know about the area?
- Does the City have any additional qualifying data on the area to justify adding or removing properties?

This secondary review included the following aspects of each structure considered for inclusion in a repetitive loss area:

- **Structure condition**—To assess the condition of the structures in the repetitive loss areas, the planning team relied on the King County Assessor's data.
- **Foundation type**—There are generally four types of foundations (see Figure 2-1):
  - A slab foundation is usually concrete poured directly onto the ground. This type of foundation uses concrete rather than wood to help support the weight of the home.
  - A crawlspace, or raised foundation, is built above the ground, with just enough room to crawl underneath. There are stem walls on the perimeters, pierced in-between, with a girder system and floor joists on top of that. The foundation is high enough to leave at least 2 feet below to crawl into for access to the home's mechanical systems.
  - Basement, any area of the building having its floor subgrade (below ground level) on all sides.
  - Elevated structure supporting beams and columns with lowest floor above the FEMA elevation.
  - Elevated structure with enclosure (allowed based on zoning and enclosure size).

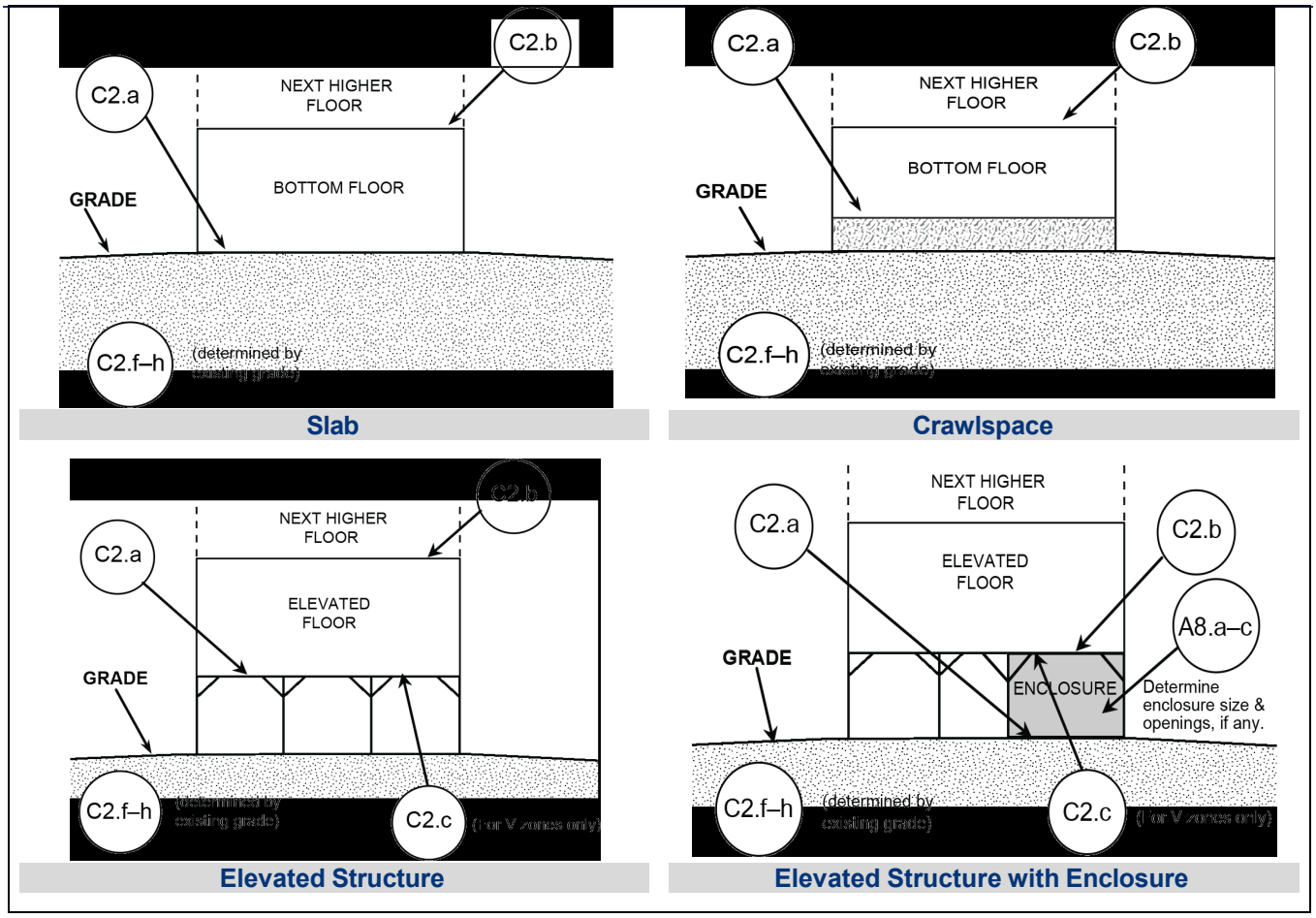


Figure 2-1. Foundation Types

Adjustments were made after applying this review to each repetitive loss area. Based on the analysis, there are **373 properties in 4 repetitive loss areas**. This became the final repetitive loss area mailing list for the City of Snoqualmie.

Many properties outside the special flood hazard area do not have flood insurance and are not required to do so. However, structures identified in the analysis as having conditions similar to those of FEMA-identified RL properties will be encouraged to seek insurance as part of the City outreach efforts.

3. REPETITIVE LOSS AREAS OUTREACH

3.1 CRS OUTREACH REQUIREMENTS FOR RLAA

RLAA Step 1 (2017 CRS Coordinator's Manual Section 512.b) requires notification that an analysis is being conducted to all properties in the repetitive loss areas, with a request for input on the hazard and recommended actions. The notice (or any public document) must not identify which properties are on FEMA's repetitive loss list. There are no restrictions on publicizing what properties are in repetitive loss areas that have more than one property and there are no restrictions on publishing aggregate data, such as how many properties received claims or the average value of those claims. Planning staff may share insurance claim information with the owner of a property but may not make it available to anyone else.

- The notice can be sent to owners OR residents, at the community's discretion, as long as a representative of each property is notified.
- The notice cannot be done via a newspaper or newsletter notice or article.
- The notice must advise the recipients when and how copies of the draft report can be obtained and ask for their comments on the draft.

Several methods were deployed to engage repetitive loss area property owners during the course of this RLAA process. This chapter highlights those efforts.

RLAA Step 2 requires contact with agencies or organizations that may have plans or studies that could affect the cause or impacts of the flooding. The analysis report must identify contacted agencies and organizations.

3.2 RLAA OUTREACH EFFORT

This Repetitive Loss Area Analysis is considered by the City of Snoqualmie to meet the prerequisite of the CRS. After consulting with ISO and the courtesy review of the hazard mitigation plan, it was determined the RLAA was required. Further discussion with the CRS contractor, Tetra Tech made a coordinated effort with properties within the 4 RLAs and the below-listed agencies for their input to satisfy RLAA Step 2. All precautions had been taken to observe and follow the Privacy Act.

Contact with Agencies and Organizations

The following agencies were identified as direct stakeholders within the planning area and were invited to participate in the planning process by providing studies or plans related to the Snoqualmie River Basin that may be pertinent to the RLAA development.

1. City of Snoqualmie Community Development Department
2. King County Flood Control District
3. King County Water and Land Resources Division
4. Haulie Insurance
5. Army Corp of Engineers, Seattle District
6. Salmon Recovery Manager, Snoqualmie Watershed Forum
7. Washington State Military Department, State Hazard Mitigation Officer

3.3 REPETITIVE LOSS AREA SPECIFIC OUTREACH

Properties identified within the redefined 4 repetitive loss areas were notified by RLA letter that upon the completion of a draft of this report, the City would make available the RLAA on the Community Development webpage. Residents in each repetitive loss area were informed where and how they would be able to review it, and where and how they might submit comments regarding it. Comments associated with the 2024 RLAA will be utilized in the annual progress report. In addition to the RLAA letter, the City utilized Survey Monkey to collect data from citizens, social media posting, and an RLAA information flier with the Survey Monkey link was made available at the library as static material. The communication document is shown in Appendix B.

4. RELEVANT PROGRAMS AND REGULATIONS

Existing laws, ordinances and plans at the federal, state and local level can support or impact hazard mitigation initiatives identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process, as stated in 44 CFR, Section 201.6(b)(3). Pertinent federal, state, and local laws are described below.

4.1 RELEVANT FEDERAL AND STATE AGENCIES, PROGRAMS AND REGULATIONS

State and federal regulations and programs that need to be considered in hazard mitigation are constantly evolving. For this plan, a review was performed to determine which regulations and programs are currently most relevant to hazard mitigation planning. The findings are summarized in Table 4-1 and Table 4-2. The summary is not all-inclusive of State and Federal regulatory programs and regulations.

Table 4-1. Summary of Relevant Federal Agencies, Programs and Regulations

Agencies	Hazard Mitigation Area Affected	Relevance
Americans with Disabilities Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Bureau of Land Management	Wildfire Hazard	The Bureau funds and coordinates wildfire management programs and structural fire management and prevention on Bureau lands.
Civil Rights Act of 1964	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Clean Water Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Community Development Block Grant Disaster Resilience Program	Action Plan Funding	This is a potential alternative source of funding for actions identified in this plan.
Community Rating System	Flood Hazard	This voluntary program encourages floodplain management activities that exceed the minimum National Flood Insurance Program requirements.
Disaster Mitigation Act	Hazard Mitigation Planning	This is the current federal legislation addressing hazard mitigation planning.
Emergency Relief for Federally Owned Roads Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Emergency Watershed Program	Action Plan Funding	This is a possible funding source for actions identified in this plan.
Endangered Species Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
Federal Energy Regulatory Commission Dam Safety Program	Dam Failure Hazard	This program cooperates with a large number of federal and state agencies to ensure and promote dam safety.

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
Federal Wildfire Management Policy and Healthy Forests Restoration Act	Wildfire Hazard	These documents mandate community-based collaboration to reduce risks from wildfire.
Hazard Mitigation Assistance Grant Programs	Action Plan Implementation	These programs are potential sources of funding for the implementation of mitigation actions recommended in this plan
National Dam Safety Act	Dam Failure Hazard	This act requires a periodic engineering analysis of most dams in the country
National Environmental Policy Act	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable federal acts.
National Fire Plan (2001)	Wildfire Hazard	This plan calls for joint risk reduction planning and implementation by federal, state and local agencies.
National Flood Insurance Program	Flood Hazard	This program makes federally backed flood insurance available to property owners in exchange for communities enacting floodplain regulations
National Incident Management System	Action Plan Development	Adoption of this system for government, nongovernmental organizations, and the private sector to work together to manage incidents involving hazards is a prerequisite for federal preparedness grants and awards
Presidential Executive Order 11988, Floodplain Management	Flood Hazard	This order requires federal agencies to avoid long and short-term adverse impacts associated with modification of floodplains
Presidential Executive Order 11990 (Protection of Wetlands)	Action Plan Implementation	FEMA hazard mitigation project grant applications require full compliance with applicable presidential executive orders.
U.S. Army Corps of Engineers Dam Safety Program	Dam Failure Hazard	This program is responsible for safety inspections of dams that meet size and storage limitations specified in the National Dam Safety Act.
U.S. Army Corps of Engineers Flood Hazard Management	Flood Hazard, Action Plan Implementation, Action Plan Funding	The Corps of Engineers offers multiple funding and technical assistance programs available for flood hazard mitigation actions
U.S. Fire Administration	Wildfire Hazard	This agency provides leadership, advocacy, coordination, and support for fire agencies and organizations.
U.S. Fish and Wildlife Service	Wildfire Hazard	This service's fire management strategy employs prescribed fire throughout the National Wildlife Refuge System to maintain ecological communities.

Table 4-2. Summary of Relevant State Agencies, Programs and Regulations

Agency, Program or Regulation	Hazard Mitigation Area Affected	Relevance
State Building Code and Design Standards	Action Plan Implementation	Mitigation actions need to comply with all state building code requirements
State of Washington Hazard Mitigation Plan	Mitigation Plan development	The state hazard mitigation plan provides information that is useful in developing local hazard mitigation plans
Washington State Office of the Attorney General	Action Plan Implementation	Mitigation actions need to comply with all state land use requirements

4.2 LOCAL

4.2.1 Hazard Mitigation Planning and Plan Development

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, evaluates existing measure and identifies gaps, and implements actions to further reduce risks. Since November 1, 2003, local governments seeking Pre-Disaster Mitigation (PDM) funds through a state application must have an approved local mitigation plan prior to the approval of local mitigation project grants. Since November 1, 2004, states must also have an approved standard State Mitigation Plan in order to receive PDM funds for state or local mitigation projects. The standard State Mitigation Plan also is required for non-emergency assistance, including Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program (HMGP) funding. Therefore, state and local multi-hazard mitigation plans are keys to maintaining eligibility for future FEMA mitigation and disaster recovery funding. City plans must be updated every five years to continuously maintain funding eligibility. Figure 4-1 shows the planning process.

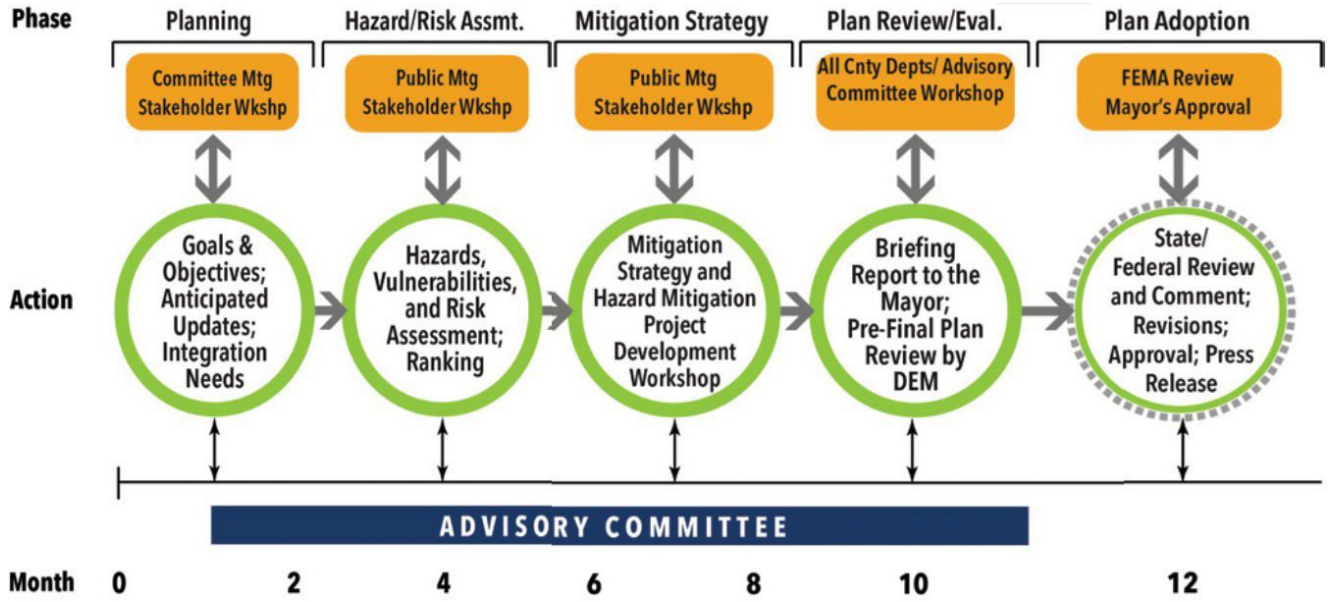


Figure 4-1. Hazard Mitigation Planning Process

Hazards are physical conditions or events that have the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of losses. The intent is to present the current state of knowledge of the following significant natural hazards within the City of Snoqualmie:

- Climate Change Effects
- Strong Winds
- Floods
- Earthquakes

- Landslides and Rockfalls
- Droughts
- Wildfire
- Hazardous Materials
- Dam Failures

Land Use Planning and Development in the City of Snoqualmie

The City guides and directs land use and growth through policies, planning principles, guidelines, and regulations. City goals and policies are organized into Comprehensive Plan elements, some of which are required by the Growth Management Act (GMA) in Washington State. Under the GMA, plans must address land use, housing, capital facilities, utilities, and transportation.

Snoqualmie Comprehensive Plan 2032 addresses those elements as well as elements for community character and the environment, with a separate Open Space Parks and Recreation plan and a separate Shoreline Master Program. The Comprehensive Plan also guides development regulations in the Snoqualmie Municipal Code, carrying out City policy and implementation programs.

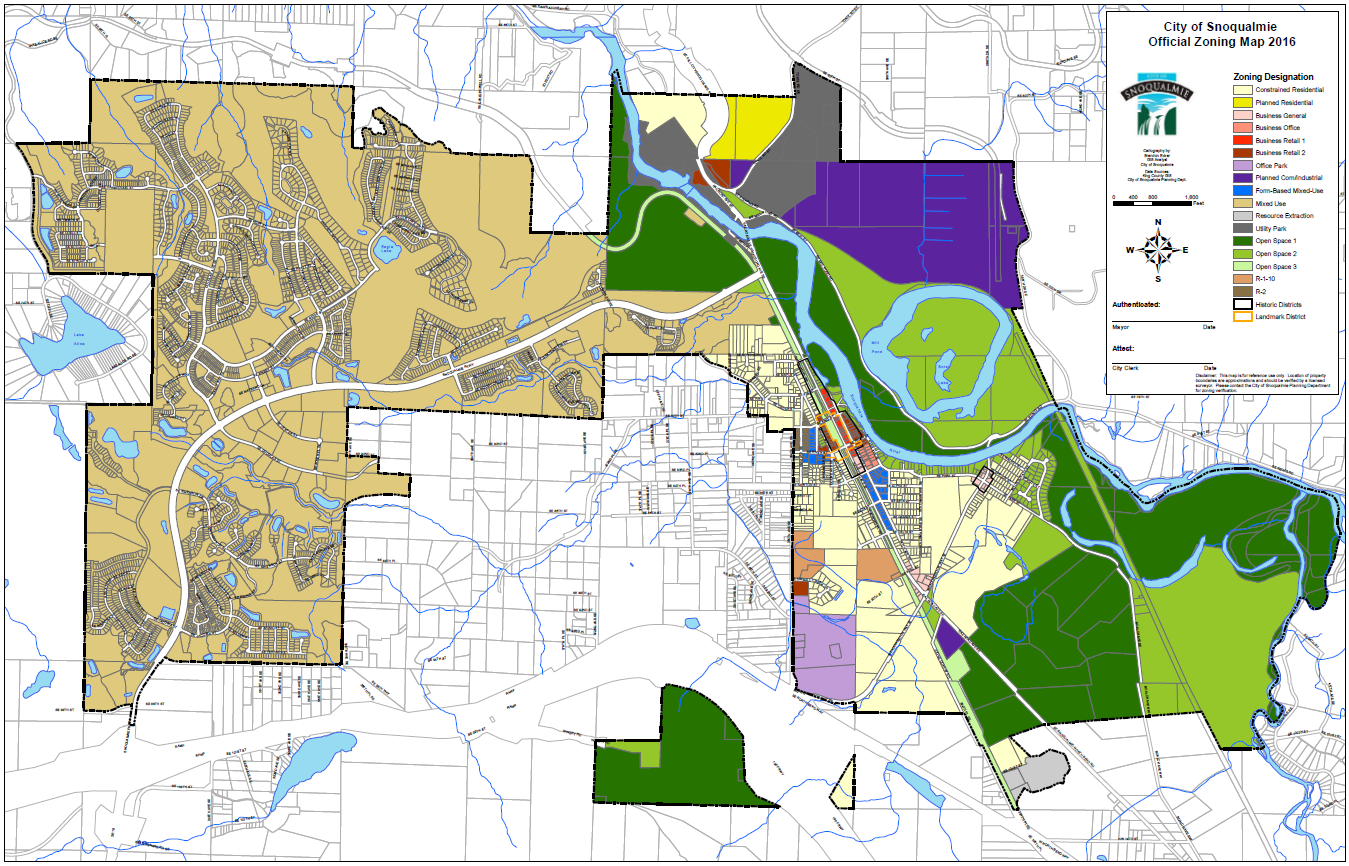


Figure 4-2. Zoning Districts

5. MITIGATED REPETITIVE LOSS PROPERTIES

5.1 REPETITIVE LOSS LIST CORRECTION

CRS-participating communities are required to review their lists of repetitive-loss properties for accuracy, for correct addresses, to determine whether the properties are actually in the community's corporate limits, and to determine whether the insured buildings have been removed, retrofitted, or otherwise protected from the cause of the repetitive flooding. The result of this review is recorded on a Repetitive Loss Update Worksheet (AW-501; see Figure 5-1). A community with repetitive losses must sign the Repetitive Loss List Community Certification (CC-RL), certifying that each address has been checked. If there are updates, the submittal must include corrected Repetitive Loss Update Worksheets with any required supporting documentation. The community must note the following situations in which the form should be updated:

1. The property is not located in the community's jurisdiction. The property may be outside the community's corporate limits, it may be in another city, or it may have been annexed by another community. If it can be determined in which community the property belongs, the property will be reassigned to the correct community. If a property is not in the community, it will not be reassigned unless the community in which the property does belong can be definitely identified.
2. There was an error in the repetitive loss data base, such as a duplicate listing or an incorrect address.
3. The property has subsequently been protected from the types of events that caused the losses. Buildings that have been acquired, relocated, retrofitted, or otherwise protected from the types of frequent floods that caused the past damage are not counted in determining the community's CRS requirements.
4. The property is protected from damage by the base flood shown on the current Flood Insurance Rate Map (FIRM). For example, the community may demonstrate that the building is elevated or flood-proofed above the base flood elevation but was flooded by a higher level. If the property is outside the Special Flood Hazard Area, the community may show that all of the repetitive losses were caused by events with recurrence intervals of over 100 years.

The City will reference current guidance to update the RLA list with qualifying factors as listed at www.CRSResources.org.

REQUESTED UPDATES

MARK ALL UPDATES BELOW THAT APPLY (IMPORTANT - SEE INSTRUCTIONS)

1. ☐ **INFORMATION PROVIDED NOT SUFFICIENT TO IDENTIFY PROPERTY.**
   Choose this update if all attempts to locate the property fail. Please describe the steps you took to locate the property in the comments section below.

2. ☐ **COSMETIC CHANGES REQUIRED TO THE ADDRESS:**
   Update the address shown above and/or add our local alternative property identifier such as a Tax Assessor #.

3. ☐ **PROPERTY NOT IN OUR COMMUNITY OR JURISDICTION:**
   Choose this update if you have positively determined that the property shown is not located in your community. Please provide the correct NFIP community name and if known the NFIP community ID Number. If available, please attach a map showing the property location.
   ASSIGN TO NFIP COMMUNITY NAME: _____ NFIP COMMUNITY ID#: _____

4. ☐ **FLOOD PROTECTION PROVIDED.**
   Choose this update only if some type of structural intervention has occurred to the building, prop-erty or the source of flooding that protects the building from future events similar to those that occurred in the past. The update must be supported by documentation such as an Elevation Certifi-cate and the Mitigation action and funding below must be provided.
   (Mitigation Action 1.) (Source of Primary Mitigation Funding 3.) (Secondary Source of Funding 3.)

5. ☐ **NO BUILDING ON PROPERTY.**
   Choose this update only if the property in question can be positively identified as the site of the previously flooded building and documentation is available to support that an insurable building no longer exists at this site. The update must be supported by documentation such as a Demolition or Relocation Permit and the Mitigation action and funding information below must be provided.
   (Mitigation Action 2.) (Source of Primary Mitigation Funding 3.) (Secondary Source of Funding 3.)

6. ☐ **DUPLICATE LISTING WITH RL NUMBER:** _____ COMBINE AS ONE LISTING.
   Choose this update to identify two or more separate listings that are for the same building. List all other RL numbers that are duplicates to this property. Please indicate which address shown is the correct address to use.

7. ☐ **HISTORIC BUILDING:**
   Choose this update if you know the building is or would be eligible to be listed on a State or National Historic Registry.

COMMENTS SECTION:

A signed RL transmittal sheet must accompany this form for approval of the update!

Figure 5-1. Example NFIP Update Form

5.2 MITIGATED REPETITIVE LOSS PROPERTIES

The City of Snoqualmie will submit the NFIP Repetitive Loss Update Form/ correction worksheet with supportive documentation for the following RL parcels summary based on the 2022 RL data list provided by FEMA:

- 38 structures with qualifying mitigation actions
- 21 parcels not within the corporate limits of the City
- 2 unable to determine location

These properties are proposed to be subsequently removed from FEMA's list of repetitive loss properties for the following reasons (see below example):

- Property not in Snoqualmie
- Structure demolished, vacant lot
- Structure demolished; post-firm structure built to current elevation
- Unable to determine location

6. MITIGATION ALTERNATIVES CONSIDERED

Although this report presents separate analyses for each identified repetitive loss area in the City of Snoqualmie, the list of potential mitigation measures to address repetitive flooding problems was the same for each area. This chapter summarizes the alternatives that were identified for consideration. These mitigation measures can be implemented by the City, the homeowner, or other entities. The selection of suitable measures for each at- risk property in the repetitive loss areas is described in the chapters presenting individual repetitive loss area analyses.

Many types of flood hazard mitigation exist, and there is not one mitigation measure that fits every case or even most cases. Successful mitigation often requires multiple strategies. The CRS Coordinator's Manual (FEMA 2017) breaks the primary types of mitigation down as follows:

- **Preventive** activities keep flood problems from getting worse. The use and development of flood-prone areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices.
- **Property protection** activities are usually undertaken by property owners on a building-by- building or parcel basis.
- **Natural resource protection** activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations.
- **Emergency services** are measures taken during an emergency to minimize its impact. These measures are usually the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.
- **Structural projects** keep floodwaters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by public works staff.
- **Public information** activities advise property owners, potential property owners, and visitors about hazards and ways to protect people and property from them, as well as the natural and beneficial functions of local floodplains. They are usually implemented by a public information office.

6.1 PREVENTIVE

The City of Snoqualmie regulates residential and commercial development through its building code, planning and zoning requirements, stormwater management regulations, and floodplain management ordinances. Any project located in a floodplain, regardless of its size, requires a permit from the City.

6.2 PROPERTY PROTECTION

Property protection measures are generally performed by property owners or their agents. FEMA has published numerous manuals to help property owners determine appropriate property protection measures:

- FEMA 259, Engineering Principles and Practices of Retrofitting Floodprone Residential Structures
- FEMA 312, Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding
- FEMA 551, Selecting Appropriate Mitigation Measures for Floodprone Structures
- FEMA 348, Protecting Building Utilities from Flood Damage
- FEMA 511, Reducing Damage from Localized Flooding
- FEMA 102, Floodproofing Non-Residential Structures
- FEMA 84, Answers to Questions about the NFIP
- FEMA 54, Elevated Residential Structures Book
- FEMA 268, Protecting Floodplain Resources: A Guidebook for Communities
- FEMA 347, Above the Flood: Elevating Your Floodprone House
- FEMA 85, Protecting Manufactured Homes from Floods and Other Hazards

The manuals listed above are available for review at FEMA's website. For a complete guide to retrofitting homes for flood protection, see FEMA P-312, *Homeowner's Guide to Retrofitting 3rd Edition* (FEMA 2014). The primary methods of property protection in the City are:

- Demolition/relocation.
- Elevation (structure or damage prone components such as furnace or AC unit)
- Dry flood-proof (so water cannot get in).
- Direct drainage away from the building.
- Drainage maintenance.
- Sewer Improvements.

Acquisition

One of the most effective approaches to preventing further flood damage to a building is the acquisition and relocation or clearing of the structure. The property would then serve as an open space or recreation area. Property owners retain the right to select this as a mitigation method. They may sell their property to a government agency or an agency dedicated to the preservation and management of local open space. The property owner can also relocate the building to another property. Alternatively, the building can be moved to another area of the same property, if that area is outside the flood hazard. The property owner can also take advantage of federal funding for such mitigation.

For the City of Snoqualmie's RLAA, it has been determined that acquisition would not be a cost-effective alternative for structures. "Cost-effective" means that the benefits of the action would equal or exceed the costs to implement the action. For this RLAA, a benefit is considered to be an avoided loss. The high value of property in the City of Snoqualmie makes it unlikely that acquisition projects can be cost-effective.

Home Elevation

Sometimes dry or wet flood-proofing are not enough and greater measures must be taken. For example, if the floodwaters are too high for dry flood-proofing and the inhabited area is too low for wet flood-proofing, it may be necessary to raise the structure. Whenever the floor of a home is below the 100-year flood elevation, physically elevating the structure is often recommended as it is one of the most effective means to prevent flood damage. Financial assistance may be available for floodproofing. The City requires all substantially improved residential buildings to have their lowest floor elevated 1 foot above the 100-year elevation.

Dry Flood-Proofing

Dry flood-proofing consists of completely sealing around the exterior of the building so that water cannot enter the building. Dry flood-proofing is not a good option for areas where floodwater is deep or flows quickly. The hydrostatic pressure and/or hydrodynamic force can structurally damage the building by causing the walls to collapse or causing the entire structure to float. However, in areas that have minimal velocity and low depth, dry flood-proofing can be a good option.

Many flood hazards can be mitigated with various forms of dry flood-proofing. Properties that do not have adequate protection of their low opening (window or basement door) can effectively raise the low opening height with a window well or a flood gate. The ultimate height of the low opening depends on several factors, such as: the level of flood protection desired, the appearance, and cost. The flood protection elevation could be set 1-foot higher than the existing low opening elevation, or it could be set to match the elevation of the lowest opening into a home that cannot be raised. This might be the elevation of the threshold of a door, for example.

The NFIP only allows dry flood-proofing for residential retrofits that are not classified as a substantial improvement. A substantial improvement is any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the “start of construction” of the improvement.

Wet Flood-Proofing

Wet flood-proofing consists of modifying uninhabited portions of a home, such as a crawlspace, garage, or unfinished basement with flood-damage resistant materials, to allow floodwaters to enter the structure without causing damage (see Figure 6-1). Wet flood-proofing requires portions of the building to be cleared of valuable items and mechanical utilities. A key component of wet flood-proofing is providing openings large enough for the water to flow through the structure such that the elevation of the water in the structure is equal to the elevation of the water outside of the structure. This equilibrium of floodwater prevents hydrostatic pressure from damaging structural walls.

Source: FEMA P-312, June 30, 2014

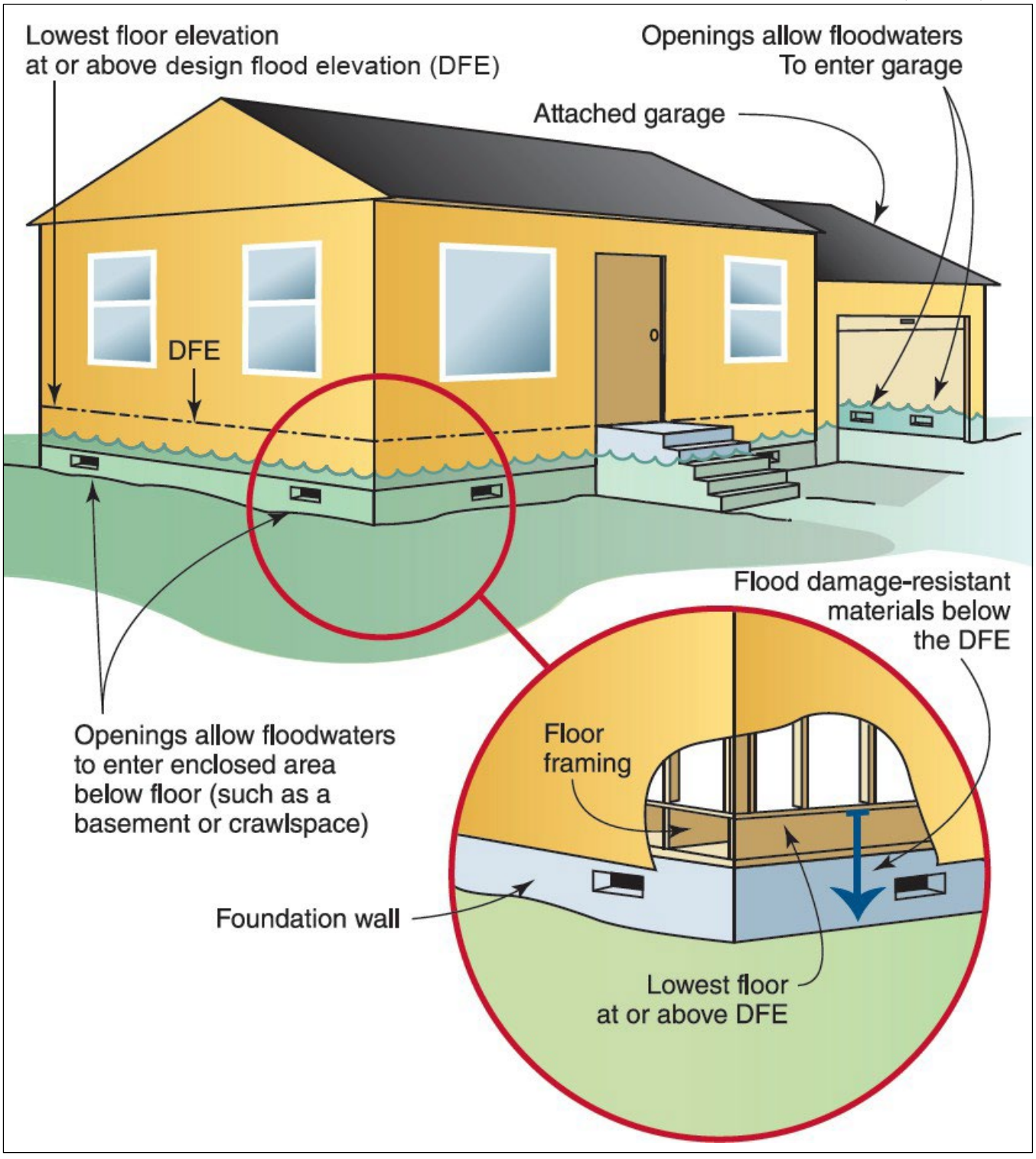


Figure 6-1. Wet Flood-Proofing Example

Direct Drainage Away from the Building

In some cases, there are activities that the property owner can do on-site such as directing shallow floodwater away from a flood-prone structure. Shallow flooding can often be kept away from a structure if some simple improvements are made to the yard. Sometimes structures are built at the bottom of a hill or in a natural drainage way or storage area, so that water naturally flows toward them.

One solution is to regrade the yard. If water flows toward the building; a new swale or wall can direct the flow to the street or a drainage way. Filling and grading next to the building can also direct shallow flooding away. Although water may remain in the yard temporarily, it is kept away from the structure. When these types of drainage modifications are made, care must be taken not to adversely affect the drainage patterns of adjacent properties. Over time, the swales along the lot lines or in the back yard may get filled in. Property owners build fences, garages, sheds, swimming pools, and other obstructions up to the lot line. These drainage problems can be fixed by removing the obstructions and restoring the swales so they will carry water away from the building.

Drainage Maintenance

Dumping into the drainage system is a violation under the City of Snoqualmie's Chapter 21 Code. Debris can accumulate and restrict the flow of stormwater, increasing the potential of localized flooding.

Heavy rains can saturate the soil and infiltrate the sanitary sewer system through leaky joints or cracks in the pipes. The inflow of stormwater floods the sanitary sewer system causing water to back-up into the home through lower level plumbing fixtures. This occurrence can be prevented by installing a sewer backflow preventer. A backflow preventer will allow the sanitary sewer water to flow freely from the home to the sewer, but restrict the reverse flow. Backflow preventers do require maintenance and can fail if debris in the sewer prevents the valve seating properly. An overhead sewer system pumps wastewater from basement level plumbing fixtures up to an elevation near the ground level, where it can drain by gravity into the sewer service line. This higher sewer makes it unlikely that water will back-up into the building.

Temporary Barriers

Several types of temporary barriers are available to address typical flooding problems. They work to direct drainage away from structures with the same principles as permanent barriers such as floodwalls or levees, but can be removed, stored, and reused in subsequent flood events.

6.3 NATURAL RESOURCE PROTECTION

Care should be taken to maintain the streams, wetlands and other natural resources within a floodplain or repetitive loss area. Removing debris from streams and channels prevents obstructions. Preserving and restoring natural areas provides flood protection, preserves water quality and provides natural habitat. King County and the City of Snoqualmie are proactive in natural resource protection and restoration.

6.4 EMERGENCY SERVICES

Advance identification of an impending storm is only the first part of an effective Flood Warning and Response Plan. To truly realize the benefit of an early flood warning system, the warning must be disseminated quickly to floodplain occupants, repetitive loss areas and critical facilities. Appropriate response activities must then be implemented, such as: road closures, directing evacuations, sandbagging, and moving building contents above flood levels. Finally, a community should take measures to protect public health and safety and facilitate

recovery. These measures may include: cleaning up debris and garbage, clearing streets, and ensuring that that citizens have shelter, food, and safe drinking water.

6.5 STRUCTURAL PROJECTS

Structural projects keep floodwaters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by appropriate staff. The City of Snoqualmie Department of Public Works develops and implements capital projects.

6.6 PUBLIC INFORMATION

One of the most important, and often overlooked, aspects of mitigation is public awareness. Awareness starts with recognition of the flood risk. FIRM panels, which designate areas of a community according to various levels of flood risk, can be viewed at www.FEMA.gov. Also, real estate transactions require disclosure of known flood hazards. The next level of awareness is related to flood hazard mitigation measures. Often homeowners can greatly reduce their risks with mitigation efforts if they are aware of the risks. For that reason, as part of this analysis, every resident in the repetitive loss area has been contacted and informed of the opportunity to review this Report. In addition, the City of Snoqualmie Floodplain Administrator sends an annual outreach letter to every resident in each repetitive loss area.

6.7 MITIGATION MEASURE GROUPINGS

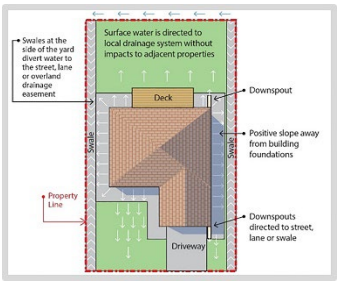
The 4 RL areas were reviewed by appropriate mitigation alternatives to provide a better understanding of current and future repetitive loss claims, options for outreach, and grant opportunities for residents. Based on the analysis performed for this report, three mitigation groupings were identified:

- Properties suitable for mitigation that includes drainage maintenance and/or elevation
- Properties identified for buyout and open space preservation under current Master Plans
- Properties where property owners are interested in elevation with a funding source

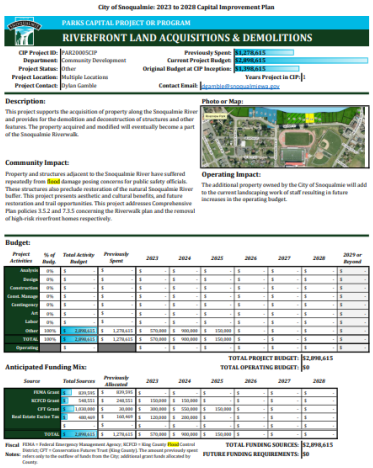
PART 2—ANALYSIS OF INDIVIDUAL REPETITIVE LOSS AREAS

7. DRAINAGE MAINTENANCE AND/OR ELEVATION, ACQUISITION

Mitigation actions such as drainage maintenance, elevation, and or acquisition align with the goals and plans of the City when addressing repetitive loss areas. In each of the 4 repetitive loss areas, property damage was determined to have contribution elements from low-lying/flat ground elevations, localized drainage, storm and snowmelt contributors, and the Snoqualmie River Basin. Mitigation for the RLA properties includes improved drainage maintenance to address increased run-off from new development or lack of capacity from underground storm sewer. Most structures would also benefit from elevation to recent FEMA mapping requirements or to levels determined by increased flood heights caused by recent development.



Where structural elevation is the primary recommendation for mitigation, structures with crawlspaces and/or basements, and where utilities such as HVAC, air conditioners, and water heaters are at the lowest elevation or at flood risk elevations, qualifying techniques such as wet floodproofing, elevating or relocating utilities, and or levels of dry floodproofing techniques may support reduced risks in limited capacities. Additional actions from property owners may include installing a backwater valve to prevent sewer water from entering if the city's lines are full. Property owners can consider adding additional fill around their foundation walls to enhance the slope (positive drainage) from their foundations, diverting the water away from the foundation wall. Considerations for diverting water from the structure may also include elongating downspouts and/or French drains.


City of Snoqualmie: 2023 to 2028 Capital Improvement Plan

PARKS CAPITAL PROJECT OR PROGRAM

RIVERFRONT LAND ACQUISITIONS & DEMOLITIONS

Description:

Photo or Map:

Community Impact:

Operating Impact:

Budget:

Anticipated Funding Mix:

Open space preservation efforts identified in the City's Master Plan and Capital Improvement Plan discuss the community impact of the Riverfront Land Acquisition and Demolitions project. Parcels identified on this buyout list include multiple RL parcels. The City remains proactive in applying for local, State, and Federal funding sources to support acquisition and demolition. In addition, the City actively pursues funding sources to support structural mitigation efforts for privately owned structures.

Citizens who have interests in structural elevation with a supportive funding source can elect to provide their contact information to the City. The City maintains the list and will contact the property owner if a funding source is available. There are multiple parcels on the RL list as a whole, where property owners have expressed interest in elevation with funding support.

Property owners are encouraged to contact the City to discuss potential mitigation efforts and building permit standards for development within the floodplain. For all properties in or out of the regulatory floodplain, flood insurance is recommended and continues to be promoted by the City. The City's strong floodplain management program has goals of improving their FEMA Community Rating System discount for NFIP flood insurance policyholders and active engagement with King County's Flood Control District.

Each section of this chapter describes the 4 repetitive loss areas, including a list of repetitive loss properties, a description of additional properties in the area, and a map of the repetitive loss areas. Maps are not included for single-property repetitive loss areas due to privacy concerns.

7.1 REPETITIVE LOSS AREA NO. 1

FEMA-Identified Repetitive Loss Properties

Table 7-1 lists the FEMA-designated repetitive loss property within this repetitive loss area 1.

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
184665	1	2	10890	Y	N	Basement	Single Family(Res Use/Zone)
28312	1	5	333910.4	Y	Y	Basement	Single Family(Res Use/Zone)
184117	1	2	11889.41	Y	N	Vacant	4-Plex
69311	1	4	52200.37	Y	N	Basement	Single Family(Res Use/Zone)
184144	1	2	74920.25	Y	N	Basement	Single Family(Res Use/Zone)
84746	1	2	34146.12	Y	Y	Basement	Single Family(Res Use/Zone)
7817	1	4	25803.03	Y	N	Basement	Duplex
184979	1	2	11546.23	Y	N	Basement	Single Family(Res Use/Zone)
184386	1	3	72226.42	Y	N	Basement	Single Family(Res Use/Zone)
184579	1	2	10639.38	Y	N	Crawl Space	Single Family(Res Use/Zone)
184049	1	2	36398.65	Y	N	Basement	Single Family(Res Use/Zone)
183874	1	2	48719.91	Y	N	Crawl Space	Single Family(Res Use/Zone)
184625	1	2	11577.49	Y	N	Crawl Space	Single Family(Res Use/Zone)
288603	1	2	13524.23	Y	N	Basement	Single Family(Res Use/Zone)
184951	1	2	73251.15	Y	N	Crawl Space	Single Family(Res Use/Zone)
183877	1	3	230796	Y	Y	Basement	Single Family(Res Use/Zone)

184068	1	2	42687.99	Y	N	Vacant	Daycare Center
316816	1	2	9724.24	Y	N	Vacant	Daycare Center
316857	1	2	9448.5	Y	N	Vacant	Daycare Center
75561	1	4	45171.92	Y	Y	Basement	Single Family(Res Use/Zone)
169180	1	3	123127.7	Y	N	Basement	Single Family(Res Use/Zone)
77182	1	2	17331.68	Y	Y	Basement	Single Family(Res Use/Zone)
85984	1	3	26565.59	Y	N	Basement	Single Family(Res Use/Zone)
184093	1	2	10350.4	Y	N	Basement	Single Family(Res Use/Zone)
185042	1	2	203999.5	Y	Y	Basement	Single Family(Res Use/Zone)
78064	1	5	32122.95	Y	N	Basement	Single Family(Res Use/Zone)
73802	1	4	193661	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184605	1	2	5112.98	Y	N	Basement	Single Family(Res Use/Zone)
53181	1	6	132837.2	Y	Y	Crawl Space	Single Family(Res Use/Zone)
6958	1	5	30575.06	Y	N	Crawl Space	Single Family(Res Use/Zone)
183815	1	2	10331.62	Y	N	Crawl Space	Single Family(Res Use/Zone)
75558	1	3	84662.9	Y	N	Basement	Single Family(Res Use/Zone)
80557	1	2	27495.21	Y	N	Basement	Single Family(Res Use/Zone)
81804	1	4	81985.78	Y	N	Basement	Single Family(Res Use/Zone)
183831	1	2	89634.32	Y	N	Basement	Single Family(Res Use/Zone)
168524	1	3	147516.3	Y	N	Crawl Space	Single Family(Res Use/Zone)
184681	1	2	56077.39	Y	N	Basement	Single Family(Res Use/Zone)
184937	1	3	53952.44	Y	N	Crawl Space	Single Family(Res Use/Zone)

183789	1	2	47839.32	Y	N	Basement	Single Family(Res Use/Zone)
169025	1	3	25828.05	Y	N	Crawl Space	Single Family(Res Use/Zone)
184169	1	2	10407.09	Y	N	Crawl Space	Single Family(Res Use/Zone)

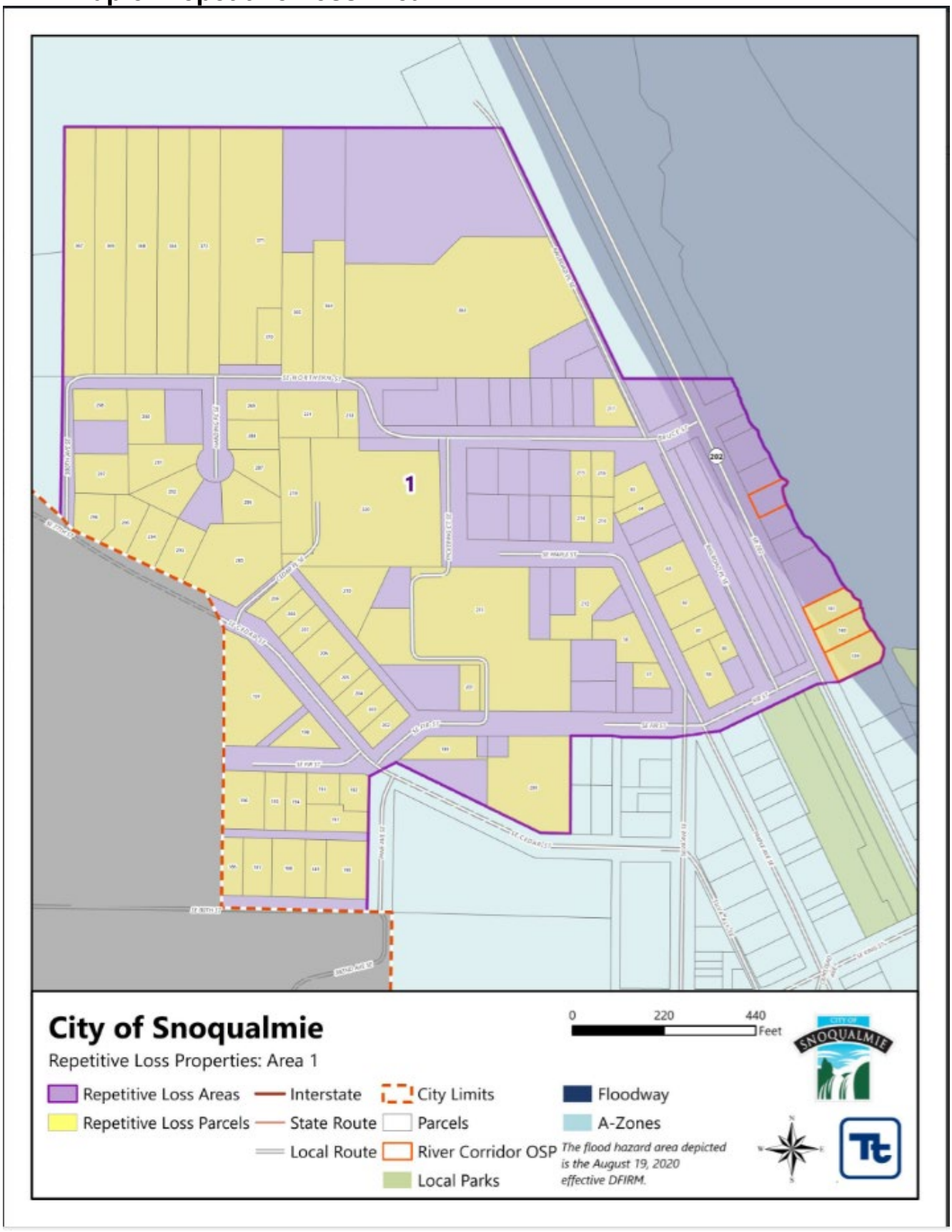
Probable Mitigation Measures- Repetitive Loss Area 1

Tetra Tech completed an assessment of each of the 373 properties within the 4 repetitive loss areas. King County Property Reports were last updated July 2022 and are considered the best available data for current parcel photos, present land use, condition assessment of structure, foundation type, and building data. All data was reviewed alongside aerial photography from Google Earth, King County Iparcel, and King County data sheets for site assessments.

Probable mitigation measures for the 373 properties within the 4 repetitive loss areas apply to RL-designated and non-RL-designated structures based on the identified sources of flooding.

Repetitive Loss Area 1 Summary		Probable Mitigation Measures
Foundation	**ALL Structures in RLA1**	
Crawlspace	Common foundation type in RLA1	Drainage maintenance and Elevation. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
Slab	Foundation type not common in RLA1	Drainage maintenance and Elevation. Structural elevation to current freeboard standards or freeboard requirements based on funding source. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration. Wet floodproofing techniques may be considered where allowed by regulations.
Basement	Common foundation type in RLA1	Drainage maintenance and Elevation. Elevation actions may include filling in the basement with an approved material to adjust the first-floor level for flood insurance and potential flood risk reduction. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
	Acquisition and Demolition – River Corridor	3 identified parcels within RLA1 are identified for future acquisition and demolition mitigation actions. These 3 parcels within the River Corridor would become greenspace and serve as open space preservation.
	Acquisition and Demolition – Master Plan	1 parcel within RLA1 that is identified for future acquisition and demolition under the City's Master Plan. This parcel will remain under the ownership of the city and support greenspace efforts.
	Capital Improvement Plan	The City's maintained Capital Improvement Plan includes a drainage system maintenance and replacement program, stormwater pond improvement program, drainage improvement projects, riverbank restoration, and other stormwater management and floodplain management projects.

7.1.1 Map of Repetitive Loss Area



7.2 REPETITIVE LOSS AREA NO. 2

FEMA-Identified Repetitive Loss Properties

Table 7-2 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
185243	2	3	213951.6	Y	Y	Basement	Single Family(Res Use/Zone)
7493	2	5	179364.5	Y	Y	Crawl Space	Single Family(Res Use/Zone)
69307	2	4	36491.01	Y	N	Basement	Single Family(Res Use/Zone)
184571	2	2	31112.44	Y	N	Crawl Space	Single Family(Res Use/Zone)
184152	2	2	52664.6	Y	N	Crawl Space	Single Family(Res Use/Zone)
184103	2	2	47043.27	Y	N	Basement	Single Family(Res Use/Zone)
184620	2	2	103210.1	Y	N	Basement	Single Family(Res Use/Zone)
184051	2	2	34278.73	Y	N	Basement	Single Family(Res Use/Zone)
183869	2	3	92211.06	Y	N	Basement	Single Family(Res Use/Zone)
80560	2	4	261976.5	Y	Y	Crawl Space	Single Family(Res Use/Zone)
80556	2	5	76557.85	Y	Y	Basement	Single Family(Res Use/Zone)
184964	2	3	35543.26	Y	N	Crawl Space	Single Family(Res Use/Zone)
184145	2	2	36270.66	Y	N	Basement	Single Family(Res Use/Zone)
184987	2	2	18193.98	Y	N	Crawl Space	Single Family(Res Use/Zone)
183910	2	2	4826.04	Y	N	Basement	Single Family(Res Use/Zone)
186174	2	2	4510.22	Y	N	Basement	Single Family(Res Use/Zone)

184163	2	2	5149.71	Y	N	Crawl Space	Single Family(Res Use/Zone)
184033	2	2	12463.61	Y	N	Basement	Single Family(Res Use/Zone)
184500	2	2	16500.64	Y	N	Basement	Single Family(Res Use/Zone)
181347	2	3	54117.92	Y	N	Basement	Single Family(C/I Zone)
184142	2	2	8942.49	Y	N	Crawl Space	Single Family(Res Use/Zone)
183897	2	2	73361.39	Y	N	Basement	Single Family(Res Use/Zone)
184009	2	2	6502.6	Y	N	Crawl Space	Single Family(Res Use/Zone)
184086	2	2	87801.9	Y	N	Basement	Single Family(Res Use/Zone)
184227	2	2	73487.73	Y	N	Crawl Space	Single Family(Res Use/Zone)
183829	2	2	69270.88	Y	N	Basement	Single Family(Res Use/Zone)
183843	2	2	11245.28	Y	N	Crawl Space	Single Family(Res Use/Zone)
184584	2	2	59208.24	Y	N	Basement	Single Family(Res Use/Zone)
184095	2	2	23045.51	Y	N	Basement	Single Family(Res Use/Zone)

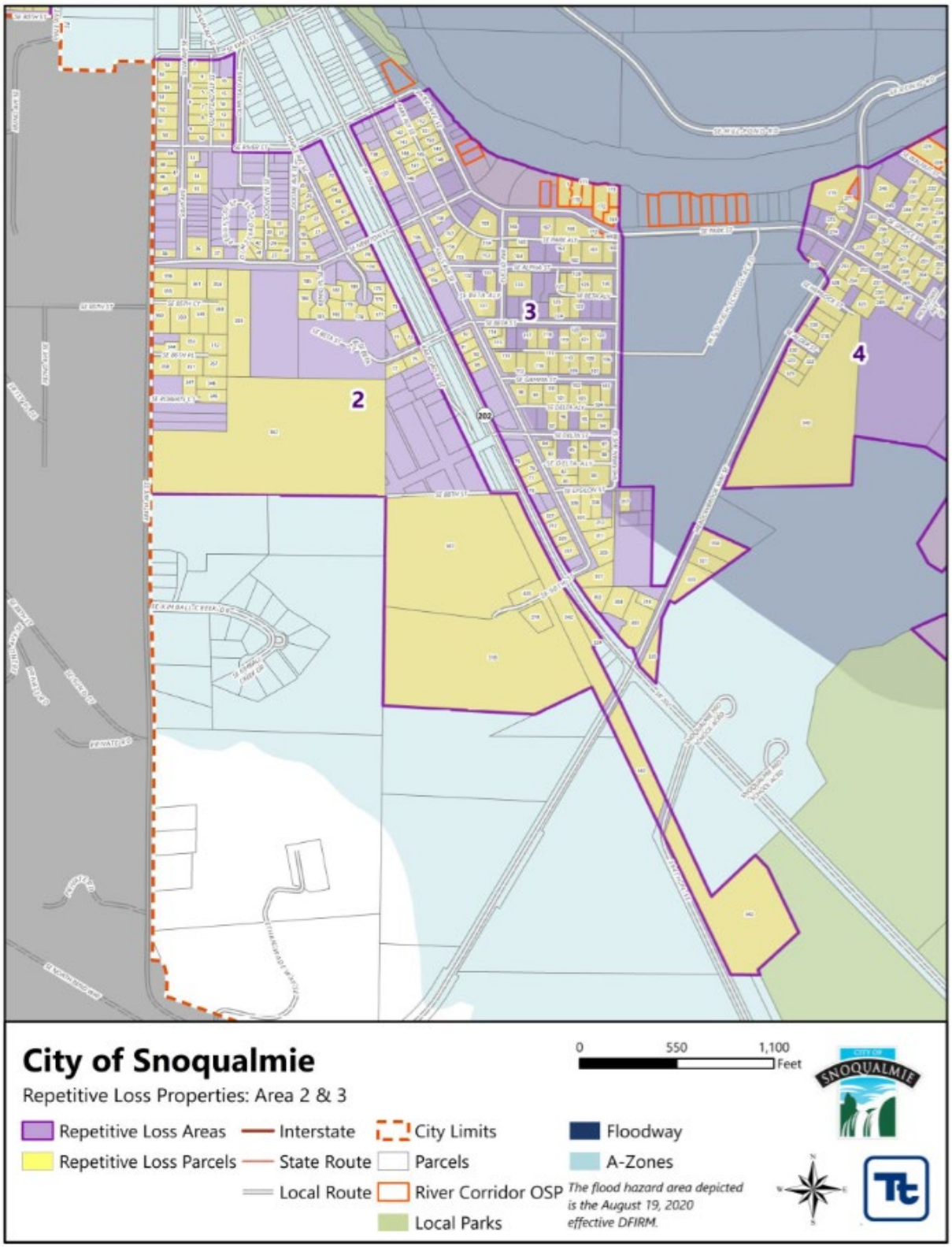
Additional Properties Included in Repetitive Loss Area

Tetra Tech completed an assessment of each of the 373 properties within the 4 repetitive loss areas. King County Property Reports were last updated July 2022 and are considered the best available data for current parcel photos, present land use, condition assessment of structure, foundation type, and building data. All data was reviewed alongside aerial photography from Google Earth, King County Iparcel, and King County data sheets for site assessments.

Probable mitigation measures for the 373 properties within the 4 repetitive loss areas apply to RL-designated and non-RL-designated structures based on the identified sources of flooding.

Repetitive Loss Area 2 Summary		
Foundation	**ALL Structures in RLA2**	**Probable Mitigation Measures**
Crawlspace	Common foundation type in RLA2	Drainage maintenance and Elevation. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
Slab	Foundation type not common in RLA2	Drainage maintenance and Elevation. Structural elevation to current freeboard standards or freeboard requirements based on funding source. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration. Wet floodproofing techniques may be considered where allowed by regulations.
Basement	Common foundation type in RLA2	Drainage maintenance and Elevation. Elevation actions may include filling in the basement with an approved material to adjust the first-floor level for flood insurance and potential flood risk reduction. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
	Acquisition and Demolition – River Corridor	N/A
	Acquisition and Demolition – Master Plan	N/A
	Capital Improvement Plan	The City's maintained Capital Improvement Plan includes a drainage system maintenance and replacement program, stormwater pond improvement program, drainage improvement projects, riverbank restoration, and other stormwater management and floodplain management projects.

7.2.1 Map of Repetitive Loss Area



7.3 REPETITIVE LOSS AREA NO. 3

FEMA-Identified Repetitive Loss Properties

Table 7-3 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
289011	3	2	55632.33	Y	N	Crawl Space	Single Family(Res Use/Zone)
82028	3	5	68654.56	Y	Y	Vacant	Single Family(Res Use/Zone)
184107	3	2	6637.87	Y	N	Basement	Single Family(Res Use/Zone)
183961	3	2	15031.66	Y	N	Vacant	Single Family(Res Use/Zone)
184618	3	2	86111.56	Y	N	Crawl Space	Single Family(Res Use/Zone)
184978	3	2	8482.9	Y	N	Crawl Space	Single Family(Res Use/Zone)
288598	3	2	24344.99	Y	N	Crawl Space	Single Family(Res Use/Zone)
184025	3	2	125216.1	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184452	3	2	35255.05	Y	N	Crawl Space	Single Family(Res Use/Zone)
183863	3	2	47724.76	Y	N	Basement	Single Family(Res Use/Zone)
85770	3	4	58758.01	Y	N	Basement	Single Family(Res Use/Zone)
85767	3	4	138359.9	Y	Y	Basement	Single Family(Res Use/Zone)
75578	3	4	93606.15	Y	N	Basement	Single Family(Res Use/Zone)
54726	3	6	89852.36	Y	Y	Basement	Single Family(Res Use/Zone)
75560	3	4	22496.8	Y	N	Crawl Space	Single Family(Res Use/Zone)
75586	3	4	92948.54	Y	Y	Basement	Single Family(Res Use/Zone)

184083	3	2	88873.6	Y	N	Basement	Duplex
183520	3	2	55730.68	Y	N	Basement	Duplex
184053	3	2	120177	Y	N	Crawl Space	Single Family(Res Use/Zone)
184055	3	2	69462.85	Y	N	Crawl Space	Single Family(Res Use/Zone)
184387	3	2	79656.3	Y	N	Crawl Space	Single Family(Res Use/Zone)
183895	3	2	26573.42	Y	N	Crawl Space	Single Family(Res Use/Zone)
184439	3	2	188428.7	Y	Y	Basement	Single Family(Res Use/Zone)
168812	3	3	78510.36	Y	N	Crawl Space	Single Family(Res Use/Zone)
184056	3	2	70238.75	Y	N	Crawl Space	Single Family(Res Use/Zone)
184670	3	2	15174.05	Y	N	Basement	Single Family(Res Use/Zone)
69305	3	2	32993.85	Y	N	Vacant	4-Plex
184029	3	2	75830.41	Y	N	Crawl Space	Single Family(Res Use/Zone)
184603	3	2	39074.85	Y	N	Vacant	Daycare Center
184565	3	2	56649.34	Y	Y	Basement	Single Family(Res Use/Zone)
299493	3	2	65721.04	Y	N	Crawl Space	Single Family(C/I Use)
184945	3	2	54025.54	Y	N	Crawl Space	Single Family(Res Use/Zone)
184094	3	2	221167.4	Y	N	Basement	Single Family(Res Use/Zone)
184388	3	2	46426.87	Y	N	Crawl Space	Single Family(Res Use/Zone)
69312	3	3	129034.9	Y	N	Crawl Space	Single Family(Res Use/Zone)
316	3	4	69130.53	Y	Y	Basement	Single Family(Res Use/Zone)
184384	3	2	15253.13	Y	N	Crawl Space	Single Family(Res Use/Zone)
80811	3	6	61100.52	Y	Y	Crawl Space	Single Family(Res Use/Zone)

183909	3	2	59314.73	Y	N	Basement	Single Family(Res Use/Zone)
184153	3	3	218225.4	Y	Y	Basement	Single Family(Res Use/Zone)
74189	3	4	104930.7	Y	N	Crawl Space	Single Family(Res Use/Zone)
168945	3	3	64409.4	Y	N	Crawl Space	Single Family(Res Use/Zone)
82350	3	4	554367.5	Y	Y	Crawl Space	Church/Welfare/Relig Srvc
184662	3	2	38711.93	Y	N	Crawl Space	Single Family(Res Use/Zone)
318100	3	2	25209.16	Y	Y	Vacant	Single Family(Res Use/Zone)
77839	3	5	174915	Y	Y	Basement	Single Family(Res Use/Zone)
80555	3	4	137059.2	Y	Y	Basement	Single Family(Res Use/Zone)
69306	3	5	198553.4	Y	Y	Crawl Space	4-Plex
183039	3	5	35418.62	Y	N	Basement	Single Family(Res Use/Zone)
184671	3	2	29544.22	Y	N	Crawl Space	Single Family(Res Use/Zone)
88180	3	2	23983.48	Y	Y	Crawl Space	Park, Public(Zoo/Arbor)
183865	3	3	70240.92	Y	N	Crawl Space	Single Family(C/I Zone)
184389	3	2	113276.5	Y	N	Crawl Space	Apartment

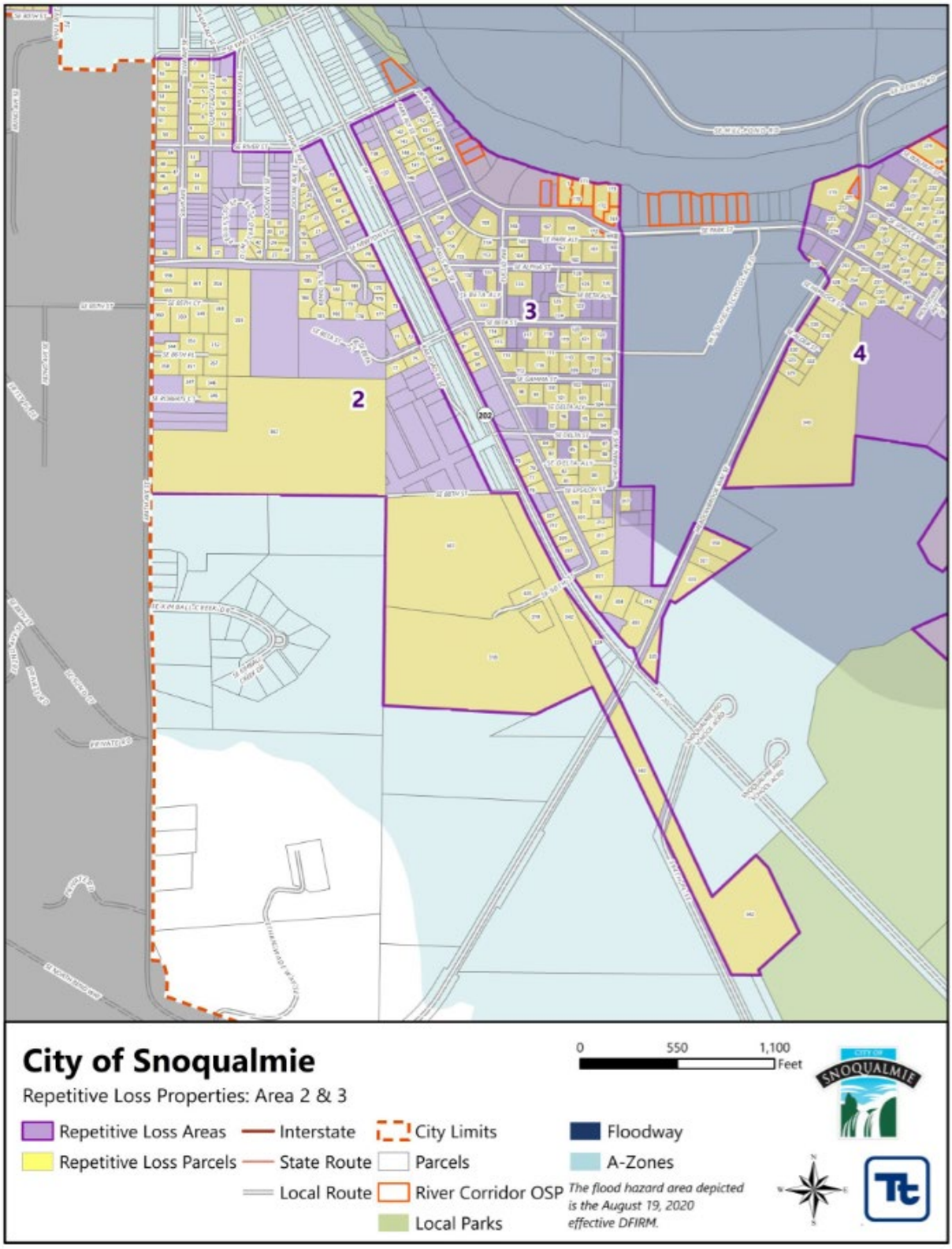
Additional Properties Included in Repetitive Loss Area

Tetra Tech completed an assessment of each of the 373 properties within the 4 repetitive loss areas. King County Property Reports were last updated July 2022 and are considered the best available data for current parcel photos, present land use, condition assessment of structure, foundation type, and building data. All data was reviewed alongside aerial photography from Google Earth, King County Iparcel, and King County data sheets for site assessments.

Probable mitigation measures for the 373 properties within the 4 repetitive loss areas apply to RL-designated and non-RL-designated structures based on the identified sources of flooding.

Repetitive Loss Area 3 Summary		
Foundation	**ALL Structures in RLA3**	**Probable Mitigation Measures**
Crawlspace	Common foundation type in RLA3	Drainage maintenance and Elevation. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
Slab	Foundation type not common in RLA3	Drainage maintenance and Elevation. Structural elevation to current freeboard standards or freeboard requirements based on funding source. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration. Wet floodproofing techniques may be considered where allowed by regulations.
Basement	Common foundation type in RLA3	Drainage maintenance and Elevation. Elevation actions may include filling in the basement with an approved material to adjust the first-floor level for flood insurance and potential flood risk reduction. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
	Acquisition and Demolition – River Corridor	6 identified parcels within RLA3 are identified for future acquisition and demolition mitigation actions. These 6 parcels within the River Corridor would become greenspace and serve as open space preservation.
	Acquisition and Demolition – Master Plan	N/A
	Capital Improvement Plan	The City's maintained Capital Improvement Plan includes a drainage system maintenance and replacement program, stormwater pond improvement program, drainage improvement projects, riverbank restoration, and other stormwater management and floodplain management projects.

7.3.1 Map of Repetitive Loss Area



7.4 REPETITIVE LOSS AREA NO. 4

FEMA-Identified Repetitive Loss Properties

Table 7-4 lists the FEMA-designated repetitive loss properties within this repetitive loss area.

FEMA Repetitive Loss Property #	RLAA Area	Total Claims	Total Paid Building and/or Contents	NFIP Repetitive Loss	NFIP Severe Repetitive Loss	Foundation Type	Parcel Use Description
183038	4	3	176096.1	Y	N	Crawl Space	Golf Course
185120	4	2	75922.6	Y	N	Basement	Single Family(Res Use/Zone)
184106	4	2	66247.41	Y	N	Crawl Space	Single Family(Res Use/Zone)
183003	4	3	17680.56	Y	N	Basement	Single Family(Res Use/Zone)
182088	4	3	26148.03	Y	N	Basement	Single Family(Res Use/Zone)
184639	4	2	11337.79	Y	N	Crawl Space	Single Family(Res Use/Zone)
184447	4	2	159667.6	Y	N	Basement	Single Family(Res Use/Zone)
184390	4	3	11520.57	Y	N	Basement	Single Family(Res Use/Zone)
168822	4	3	137174.2	Y	N	Basement	Single Family(Res Use/Zone)
184641	4	2	16220.88	Y	N	Basement	Single Family(Res Use/Zone)
184588	4	2	189309.1	Y	Y	Basement	Single Family(Res Use/Zone)
168819	4	3	89611.41	Y	N	Basement	Single Family(Res Use/Zone)
183320	4	3	22554.22	Y	N	Basement	Single Family(C/I Zone)
84882	4	5	21651.29	Y	N	Basement	Single Family(Res Use/Zone)
85695	4	5	48903.63	Y	N	Basement	Single Family(Res Use/Zone)
168965	4	3	19265.09	Y	N	Crawl Space	Single Family(Res Use/Zone)

182117	4	3	48475.17	Y	N	Basement	Single Family(Res Use/Zone)
183866	4	3	194528.4	Y	N	Basement	Single Family(Res Use/Zone)
307890	4	2	9985.75	Y	N	Basement	Single Family(Res Use/Zone)
82007	4	6	38638.07	Y	Y	Basement	Single Family(Res Use/Zone)
75579	4	3	21550.5	Y	N	Basement	Single Family(Res Use/Zone)
73908	4	2	65509.18	Y	N	Basement	Single Family(Res Use/Zone)
73839	4	5	25825.54	Y	N	Basement	Single Family(Res Use/Zone)
77813	4	3	54991.56	Y	N	Basement	Single Family(Res Use/Zone)
181128	4	4	31931.06	Y	N	Basement	Single Family(Res Use/Zone)
184633	4	2	6785.22	Y	N	Basement	Single Family(Res Use/Zone)
88181	4	4	13337.36	Y	N	Basement	Single Family(Res Use/Zone)
184104	4	2	75185.75	Y	N	Crawl Space	Apartment(Mixed Use)
80652	4	6	352329.5	Y	Y	Basement	Single Family(Res Use/Zone)
80554	4	3	19210.42	Y	N	Vacant	Vacant(Commercial)
184065	4	2	60172.18	Y	N	Vacant	Vacant(Commercial)
184082	4	2	8885.37	Y	N	Basement	Single Family(Res Use/Zone)
83308	4	2	6842.2	Y	N	Basement	
28377	4	2	42440.18	Y	N	Basement	
48559	4	2	34485.55	Y	N	Vacant	
184627	4	2	16569.05	Y	N	Basement	Single Family(Res Use/Zone)
184385	4	2	10462.48	Y	N	Crawl Space	Single Family(Res Use/Zone)
56942	4	4	103813.3	Y	Y	Crawl Space	Single Family(Res Use/Zone)

184982	4	2	33923.04	Y	N	Basement	Single Family(Res Use/Zone)
2457	4	3	58426.76	Y	N	Basement	Single Family(Res Use/Zone)
28378	4	5	53594.58	Y	N	Basement	Single Family(Res Use/Zone)
56990	4	3	48728.52	Y	N	Basement	Single Family(Res Use/Zone)
184164	4	2	28489.76	Y	N	Basement	Single Family(Res Use/Zone)
184157	4	2	36113.41	Y	N	Basement	Single Family(Res Use/Zone)
69310	4	10	96864.63	Y	Y	Crawl Space	Single Family(Res Use/Zone)
184134	4	2	13668.13	Y	N	Basement	Single Family(Res Use/Zone)
184440	4	2	17851.48	Y	N	Basement	Single Family(Res Use/Zone)
80558	4	5	18792.08	Y	N	Basement	Single Family(Res Use/Zone)
80913	4	2	9156.72	Y	N	Vacant	
75589	4	2	2655.99	Y	N	Basement	Single Family(Res Use/Zone)
184802	4	2	163739.6	Y	N	Crawl Space	Single Family(Res Use/Zone)
286885	4	2	29316.23	Y	N	Basement	Single Family(Res Use/Zone)
73909	4	2	31902.72	Y	N	Basement	Single Family(Res Use/Zone)
74147	4	4	22419.09	Y	N	Basement	Single Family(Res Use/Zone)

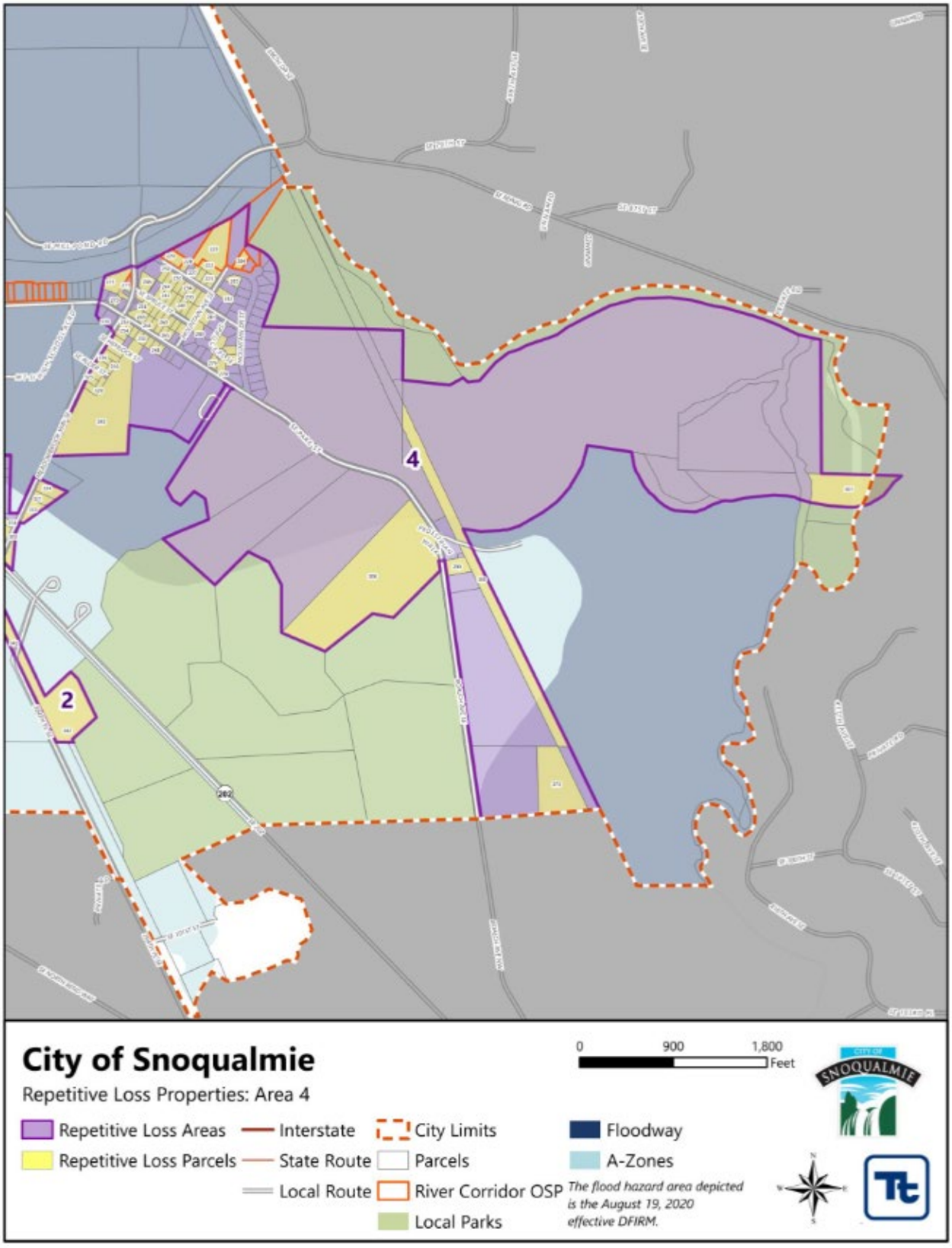
Additional Properties Included in Repetitive Loss Area

Tetra Tech completed an assessment of each of the 373 properties within the 4 repetitive loss areas. King County Property Reports were last updated July 2022 and are considered the best available data for current parcel photos, present land use, condition assessment of structure, foundation type, and building data. All data was reviewed alongside aerial photography from Google Earth, King County Iparcel, and King County data sheets for site assessments.

Probable mitigation measures for the 373 properties within the 4 repetitive loss areas apply to RL-designated and non-RL-designated structures based on the identified sources of flooding.

Repetitive Loss Area 4 Summary		
Foundation	**ALL Structures in RLA4**	**Probable Mitigation Measures**
Crawlspace	Common foundation type in RLA4	Drainage maintenance and Elevation. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
Slab	Foundation type not common in RLA4	Drainage maintenance and Elevation. Structural elevation to current freeboard standards or freeboard requirements based on funding source. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration. Wet floodproofing techniques may be considered where allowed by regulations.
Basement	Common foundation type in RLA4	Drainage maintenance and Elevation. Elevation actions may include filling in the basement with an approved material to adjust the first-floor level for flood insurance and potential flood risk reduction. Elevating the utilities of the property may support flood risk reduction. Levels of dry floodproofing may be an appropriate risk reduction technique. Enhanced levels of drainage improvements to reduce ponding along foundation walls and installing backwater valve are additional measures for property owners to take into consideration.
	Acquisition and Demolition – River Corridor	4 identified parcels within RLA4 are identified for future acquisition and demolition mitigation actions. These 4 parcels within the River Corridor would become greenspace and serve as open space preservation.
	Acquisition and Demolition – Master Plan	N/A
	Capital Improvement Plan	The City's maintained Capital Improvement Plan includes a drainage system maintenance and replacement program, stormwater pond improvement program, drainage improvement projects, riverbank restoration, and other stormwater management and floodplain management projects.

7.4.1 Map of Repetitive Loss Area



PART 3—REPETITIVE LOSS AREA ACTION PLAN

8. REPETITIVE LOSS AREA ANALYSIS

8.1 MITIGATION ACTIONS

This *City of Snoqualmie, Washington, Repetitive Loss Area Analysis* was created in accordance to the prerequisites for CRS participation. Mitigation Actions reviewed fall in the following categories:

- Preventive
- Property Protection
- Natural Resource Protection
- Emergency Services
- Structural Projects
- Public Information

Each repetitive loss property and similar property deemed to be adjacent were evaluated by the above six (6) actions. The decision that best fit the individual situation and was most feasible:

- Drainage Maintenance and/or,
- Elevation,
- Various levels of wet or dry floodproofing techniques where applicable

8.2 ANNUAL EVALUATION REPORT

The City will prepare an annual evaluation report for its area analyses to meet the credit criteria of CRS Activity 510- RLAA. The report will include a review of each action item, including a description of what was implemented or not implemented, and recommended changes to the actions items as appropriate. The report will be made available to the media and the public and will be submitted with the annual CRS recertification.

9. PLAN ADOPTION

The City of Snoqualmie governing board formally adopted the *City of Snoqualmie, Washington Repetitive Loss Area Analysis* on DATE – provided by Community. A copy of the resolution is provided in Appendix D.

REFERENCES

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TERMINOLOGY

ACRONYMS

CFR—Code of Federal Regulations CRS—

Community Rating System ESA—Endangered

Species Act

FEMA—Federal Emergency Management Agency FIRM—Flood Insurance Rate Map GIS—Geographic

Information System Hazus—MH—Hazards, United States-Multi Hazard NFIP—National Flood Insurance

Program NIMS—National Incident Management System RL—repetitive loss

RLAA—repetitive loss area analysis

DEFINITIONS

100-Year Flood: The flood that has a 1 percent chance of being equaled or exceeded in any given year. The 100-year flood does not necessarily occur once every 100 years. It is possible for a 100-year flood to occur more than once in a relatively short period of time.

Base Flood: Another term for the 100-year flood—the flood having a 1 percent chance of being equaled or exceeded in any given year. The base flood is used as a reference flood level to ensure that all properties subject to the National Flood Insurance Program are protected to the same degree against flooding.

Benefit-Cost Analysis: A systematic, quantitative method of comparing projected benefits to projected costs of a project or policy. It is used as a measure of cost effectiveness. For the purposes of benefit-cost analysis of proposed mitigation actions, benefits are limited to specific, measurable, risk reduction factors, including reduction in expected property losses (buildings, contents, and functions) and protection of human life.

Community Rating System (CRS): A voluntary program that provides flood insurance premium discounts to property owners in communities that exceed the minimum requirements of the National Flood Insurance Program and complete activities that reduce flood hazard risk.

Drainage Basin: A basin is the area within which all surface water—whether from rainfall, snowmelt, springs or other sources—flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains, and ridges. Drainage basins are also referred to as **watersheds** or **basins**.

Exposure: The number and dollar value of assets considered to be at risk during the occurrence of a specific hazard.

Flash Flood: A flood that occurs with little or no warning when water levels rise at an extremely fast rate.

Flood Insurance Rate Map (FIRM): The official map on which the Federal Emergency Management Agency delineates special flood hazard area for a given location.

Flood Insurance Study: A report published by the Federal Insurance and Mitigation Administration for a community in conjunction with the community's Flood Insurance Rate Map. The study contains such background data as the base flood discharges and water surface elevations that were used to prepare the FIRM. In most cases, a community FIRM with detailed mapping will have a corresponding flood insurance study.

Floodplain: Any land area susceptible to being inundated by flood waters from any source. A flood insurance rate map identifies most, but not necessarily all, of a community's floodplain as the special flood hazard area.

Goal: A general guideline that explains what is to be achieved. Goals are usually broad-based, long-term, policy-type statements and represent global visions. Goals help define the benefits that a plan is trying to achieve. The success of a floodplain management plan is measured by the degree to which its goals have been met (that is, by the benefits in terms of actual floodplain management).

Geographic Information System (GIS): A computer software application that relates data regarding physical and other features on the earth to a database for mapping and analysis.

Hazard: A source of potential danger or adverse condition that could harm people and/or cause property damage.

Hazard Mitigation Grant Program: A FEMA program that provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster

Hazards U.S. Multi-Hazard (Hazus) Loss Estimation Program: A GIS-based program used to support the development of risk assessments. The Hazus software program assesses risk in a quantitative manner to estimate damage and losses associated with natural hazards. Hazus is FEMA's nationally applicable, standardized methodology and software program and contains modules for estimating potential losses from earthquakes, floods, and wind hazards.

Inventory: A list of assets identified in a study region that could be lost when a disaster occurs and community resources are at risk. Assets include people, buildings, transportation, and other valued community resources.

Local Government: Any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments, regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Mitigation: A preventive action that can be taken in advance of an event that will reduce or eliminate risk to life or property.

Mitigation Actions: Mitigation actions are specific actions to achieve goals and objectives that minimize the effects from a disaster and reduce the loss of life and property.

Objective: A short-term aim that, when combined with other objectives, forms a strategy or course of action to meet a goal. Unlike goals, objectives are specific and measurable.

Preparedness: Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Repetitive Loss Property: Any NFIP-insured property that, since 1978 and regardless of any changes of ownership during that period, has experienced:

- Four or more paid flood losses in excess of $1000.00; or
- Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
- Three or more paid losses that equal or exceed the current value of the insured property.

Risk: The estimated impact that a hazard would have on people, services, facilities, and structures in a community. Risk measures the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Risk Assessment: The process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazards. This process assesses the vulnerability of people, buildings, and infrastructure to hazards and focuses on (1) hazard identification; (2) impacts of hazards on physical, social, and economic assets; (3) vulnerability identification; and (4) estimates of the cost of damage or costs that could be avoided through mitigation.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. This area is mapped as a Zone A in river situations and zone V in coastal situations. It may or may not encompass all of a community's flood problems

Stakeholder: Business leaders, civic groups, academia, non-profit organizations, major employers, managers of critical facilities, farmers, developers, special purpose districts, and others whose actions could impact floodplain management.

Vulnerability: An asset's susceptibility to damage during a hazard event. Vulnerability depends on an asset's construction, contents, and the economic value of its functions.

Watershed: An area that drains down-gradient from areas of higher land to areas of lower land to the lowest point, a common drainage basin.

Zoning Ordinance: An ordinance that designates allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

Appendix A. Generic Depth-Damage Relationships for Residential Structures

CECW-PG 10 October 2003

MEMORANDUM FOR: *SEE DISTRIBUTION*

SUBJECT: Economic Guidance Memorandum (EGM) 04-01, Generic Depth-DamageRelationships for Residential Structures with Basements.

1. Purpose. The purpose of this memorandum is to release, and provide guidance for theuse of, generic depth-damage curves for use in U.S. Army Corps of Engineers flood damage reduction studies.

2. Background. Proper planning and evaluation of flood damage reduction projects require knowledge of actual damage caused to various types of properties. The primary purpose of the Flood Damage Data Collection Program is to meet that requirement by providing Corps district offices with standardized relationships for estimating flood damage and other costs of flooding, based on actual losses from flood events. Under thisprogram, data have been collected from major flooding that occurred in various parts of the United States from 1996 through 2001. Damage data collected are based on comprehensive accounting of losses from flood victims' records. The generic functions developed and provided in this EGM represent a substantive improvement over other generalized depth-damage functions such as the Flood Insurance Administration (FIA) Rate Reviews.

3. Results. Generic damage functions are attached for one-story homes with basement,two or more story homes with basement, and split-level homes with basement. Genericdamage functions for similar structures without basements were published in 2000 andare included as enclosure 1 for ready reference.

a. Regression analysis was used to create the damage functions. While severalindependent variables, such as flood duration and flood warning lead-time, were examined in building the models, the models that were most efficient in explaining thepercent damage to structure and contents were quadratic and cubic forms with depth asthe only independent variable.

b. Content damage was modeled with the dependent variable being content damage as a percentage of structure value. This differs from the previous technique of first developing content valuations and then content damage relationships as a function ofcontent valuations. The generic content damage models are statistically significant and their use eliminates the need to establish content-to-structure ratios through surveys.

c. While the data collected include information on all aspects of National Economic Development (NED) losses, only results and recommendations related to thestructure and content damages for homes with basements are included in this EGM.

Direct costs for cleanup expenses, unpaid hours for cleanup and repair, emergency damage prevention actions, and other flood-related costs are not included in these damage functions. Information on other residential flood costs, beyond those included inthese damage functions will found the summary report, discussed in paragraph 5. These costs should be developed using site-specific historical information.

4. Application. The following paragraphs provide information on the application of thegeneric curves within the HEC-FDA damage calculation program.

a. The economic section of HEC-FDA divides the quantification of flood damages into a direct method and an indirect method. The direct method allows the userto directly enter a stage-damage relationship for any structure. This approach is commonly used for large or unique properties such as industrial or pubic buildings. Theindirect method quantifies the stage-damage relationship for a group of structures that have significant commonality. Typically damage to residential structures is calculated using the indirect method. The procedures described in the following paragraphs apply only when using the indirect method to determine the stage-damage relationship.

b. The traditional approach to quantifying damage to contents by the indirect method relies on three pieces of information: 1) structure value; 2) content-to-structure value ratio; and 3) the content depth-damage relationship. The content-to-structure valueratio and content depth-damage relationship are unique to the structure occupancy type towhich a structure is assigned. The content depth-damage relationship provides the estimate of content flood damage as a percentage of content value. Thus, to calculate a content stage-damage function for an individual structure, the structure value for an individual structure is first multiplied by the content-to-structure value ratio to provide anestimate of the content value. This content value is then multiplied by each percent damage value of the content depth-damage relationship.

c. The new content depth-damage functions provided herein are different from those used by the Corps in the past in one important aspect. The new functions calculatecontent damage as a percent of structure value rather than content value. Using these functions within HEC-FDA requires care in specifying a content-to-structure value ratio.To understand the requirements for using the new content depth-damage functions requires a basic understanding of how HEC-FDA calculates content damage.

(1). To calculate damages by the indirect method, each structure must be assigned to a structure occupancy type. For each structure occupancy type a content-to-structure value ratio and content depth-damage relationship are defined. These data for calculating content damage within HEC-FDA is entered on the “Study Structure Occupancy Type” screen. As long as a content value is not entered for a structure in theStructure Inventory Data, HEC-FDA calculates the content stage-damage by first calculating content using the structure value multiplied by the content-to-structure valueratio.

In some instances, however, analysts develop unique estimates of content values for a structure, which are entered for the individual structure on the Structure Inventory Data screen. For each structure that has a content value entered, calculating a content value byusing the content-to-structure value ratio is ignored and the user entered content value is used to calculate content damage.

(2). The new content depth-damage functions do not require this intermediate step of calculating content values. Therefore, the content-to-structure value ratio for eachstructure occupancy type using the new content depth-damage relationships must be set to one hundred percent (100). This forces the content depth-damage function to be multiplied by the structure value as required. Also, the “Error Associated with Content/Structure Value” on the “Study Structure Occupancy Type” screen

should be leftblank. This implies that the error in content-to-structure value ratio is part of the new content depth-damage relationship.

(3). Because entering a content value on the Structure Inventory Data window overrides the content-to-structure value ratio, the new content depth-damage relationshipsshould not be used for structures that have separately entered content values.

(4). Questions concerning the use of the generic curves within the HEC-FDA model can be addressed to Dr. David Moser, Institute of Water Resources (IWR), (703)428-8066.

5. Report. A report summarizing the data collection effort and analyses performed to derive these curves will shortly be available on the IWR website. More information maybe obtained by contacting the program's principal investigator, Stuart Davis, (703) 428- 7086.

6. Waiver to Policy. These curves are developed for nation-wide applicability in flood damage reduction studies. When using these curves, the requirement to develop site- specific depth-damage curves contained in ER 1105-2-100, E-19q.(2) is waived. Additionally, the requirement to develop content valuations and content-to-structure ratios based on site-specific or comparable floodplain information, ER 1005-2-100, E- 19q.(1)(a), is also waived. Note these waivers currently apply only to single-family homes with and without basements for which generic curves have been published, and not other categories of flood inundation damages for which no generic curves exist. Feasibility reports must state the generic curves are being used in the flood damage analysis for residential structures with and/or without basements. Use of these curves isoptional and analysts should always endeavor to use the best available information to accurately quantify the damages and benefits in inundation reduction studies.

7. Point of Contact. Administrators of the Flood Damage Data Collection Program continue to collect and analyze flood-related damages to both residential and commercial properties. The HQUSACE program monitor is Lillian Almodovar, (202) 761-4233, whocan address any questions concerning the program.

FOR THE COMMANDER:

/s/

Encl

WILLIAM R. DAWSON, P.E.

Chief, Planning and Policy DivisionDirectorate of Civil Works

DISTRIBUTION:

North Atlantic Division, ATTN: CENAD-ET-PSouth Atlantic Division, ATTN: CESAD-ET-P

Great Lakes/Ohio River Division: ATTN: CELRD-E-PNorthwestern Division, ATTN: CENWD-PNP-ET-P Pacific Ocean Division, ATTN: CEPOD-ET-E

South Pacific Division, ATTN: CESPD-ET-P Southwestern Division, ATTN: CESWD-ET-P Mississippi Valley Division: ATTN: CEMVD-PM

DAMAGE FUNCTIONS

FOR SINGLE FAMILY RESIDENTIALSTRUCTURES WITH BASEMENTS

Structure Depth-Damage

Table 1 Structure One Story, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	0.7%	1.34
-6	0.8%	1.06
-5	2.4%	0.94
-4	5.2%	0.91
-3	9.0%	0.88
-2	13.8%	0.85
-1	19.4%	0.83
0	25.5%	0.85
1	32.0%	0.96
2	38.7%	1.14
3	45.5%	1.37
4	52.2%	1.63
5	58.6%	1.89
6	64.5%	2.14
7	69.8%	2.35
8	74.2%	2.52
9	77.7%	2.66
10	80.1%	2.77
11	81.1%	2.88
12	81.1%	2.88
13	81.1%	2.88
14	81.1%	2.88
15	81.1%	2.88
16	81.1%	2.88

Table 2 Structure Two or More Stories, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	1.7%	2.70
-7	1.7%	2.70
-6	1.9%	2.11
-5	2.9%	1.80
-4	4.7%	1.66
-3	7.2%	1.56
-2	10.2%	1.47
-1	13.9%	1.37
0	17.9%	1.32
1	22.3%	1.35
2	27.0%	1.50
3	31.9%	1.75
4	36.9%	2.04
5	41.9%	2.34
6	46.9%	2.63
7	51.8%	2.89
8	56.4%	3.13
9	60.8%	3.38
10	64.8%	3.71
11	68.4%	4.22
12	71.4%	5.02
13	73.7%	6.19
14	75.4%	7.79
15	76.4%	9.84
16	76.4%	12.36

Table 3 Structure Split Level, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8		
-7		
-6	2.5%	1.8%
-5	3.1%	1.6%
-4	4.7%	1.5%
-3	7.2%	1.6%
-2	10.4%	1.6%
-1	14.2%	1.6%
0	18.5%	1.6%
1	23.2%	1.7%
2	28.2%	1.9%
3	33.4%	2.1%
4	38.6%	2.4%
5	43.8%	2.6%
6	48.8%	2.9%
7	53.5%	3.2%
8	57.8%	3.4%
9	61.6%	3.6%
10	64.8%	3.9%
11	67.2%	4.2%
12	68.8%	4.8%
13	69.3%	5.7%
14	69.3%	5.7%
15	69.3%	5.7%
16	69.3%	5.7%

Content Depth-Damage

Table 4 Content One Story, With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0.1%	1.60
-7	0.8%	1.16
-6	2.1%	0.92
-5	3.7%	0.81
-4	5.7%	0.78
-3	8.0%	0.76
-2	10.5%	0.74
-1	13.2%	0.72
0	16.0%	0.74
1	18.9%	0.83
2	21.8%	0.98
3	24.7%	1.17
4	27.4%	1.39
5	30.0%	1.60
6	32.4%	1.81
7	34.5%	1.99
8	36.3%	2.13
9	37.7%	2.25
10	38.6%	2.35
11	39.1%	2.45
12	39.1%	2.45
13	39.1%	2.45
14	39.1%	2.45
15	39.1%	2.45
16	39.1%	2.45

Table 5 Content Two or More Stories-With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0%	0
-7	1.0%	2.27
-6	2.3%	1.76
-5	3.7%	1.49
-4	5.2%	1.37
-3	6.8%	1.29
-2	8.4%	1.21
-1	10.1%	1.13
0	11.9%	1.09
1	13.8%	1.11
2	15.7%	1.23
3	17.7%	1.43
4	19.8%	1.67
5	22.0%	1.92
6	24.3%	2.15
7	26.7%	2.36
8	29.1%	2.56
9	31.7%	2.76
10	34.4%	3.04
11	37.2%	3.46
12	40.0%	4.12
13	43.0%	5.08
14	46.1%	6.39
15	49.3%	8.08
16	52.6%	10.15

Table 6 Content Split-Level-With Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-8	0.6%	2.09
-7	0.7%	1.49
-6	1.4%	1.14
-5	2.4%	1.01
-4	3.8%	1.00
-3	5.4%	1.02
-2	7.3%	1.03
-1	9.4%	1.04
0	11.6%	1.06
1	13.8%	1.12
2	16.1%	1.23
3	18.2%	1.38
4	20.2%	1.57
5	22.1%	1.76
6	23.6%	1.95
7	24.9%	2.13
8	25.8%	2.28
9	26.3%	2.44
10	26.3%	2.44
11	26.3%	2.44
12	26.3%	2.44
13	26.3%	2.44
14	26.3%	2.44
15	26.3%	2.44
16	26.3%	2.44

ENCLOSURE DAMAGE FUNCTIONS

FOR SINGLE FAMILY RESIDENTIAL

STRUCTURES WITHOUT BASEMENTS

Structure One Story, No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	2.5%	2.7%
0	13.4%	2.0%
1	23.3%	1.6%
2	32.1%	1.6%
3	40.1%	1.8%
4	47.1%	1.9%
5	53.2%	2.0%
6	58.6%	2.1%
7	63.2%	2.2%
8	67.2%	2.3%
9	70.5%	2.4%
10	73.2%	2.7%
11	75.4%	3.0%
12	77.2%	3.3%
13	78.5%	3.7%
14	79.5%	4.1%
15	80.2%	4.5%
16	80.7%	4.9%

Structure Two or More Stories-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	3.0%	4.1%
0	9.3%	3.4%
1	15.2%	3.0%
2	20.9%	2.8%
3	26.3%	2.9%
4	31.4%	3.2%
5	36.2%	3.4%
6	40.7%	3.7%
7	44.9%	3.9%
8	48.8%	4.0%
9	52.4%	4.1%
10	55.7%	4.2%
11	58.7%	4.2%
12	61.4%	4.2%
13	63.8%	4.2%
14	65.9%	4.3%
15	67.7%	4.6%
16	69.2%	5.0%

Structure Split-Level-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	6.4%	2.9%
0	7.2%	2.1%
1	9.4%	1.9%
2	12.9%	1.9%
3	17.4%	2.0%
4	22.8%	2.2%
5	28.9%	2.4%
6	35.5%	2.7%
7	42.3%	3.2%
8	49.2%	3.8%
9	56.1%	4.5%
10	62.6%	5.3%
11	68.6%	6.0%
12	73.9%	6.7%
13	78.4%	7.4%
14	81.7%	7.9%
15	83.8%	8.3%
16	84.4%	8.7%

Content One Story, No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	2.4%	2.1%
0	8.1%	1.5%
1	13.3%	1.2%
2	17.9%	1.2%
3	22.0%	1.4%
4	25.7%	1.5%
5	28.8%	1.6%
6	31.5%	1.6%
7	33.8%	1.7%
8	35.7%	1.8%
9	37.2%	1.9%
10	38.4%	2.1%
11	39.2%	2.3%
12	39.7%	2.6%
13	40.0%	2.9%
14	40.0%	3.2%
15	40.0%	3.5%
16	40.0%	3.8%

Content Two or More Stories-No Basement		
Depth	Mean of Damage	Standard Deviation of Damage
-2	0%	0%
-1	1.0%	3.5%
0	5.0%	2.9%
1	8.7%	2.6%
2	12.2%	2.5%
3	15.5%	2.5%
4	18.5%	2.7%
5	21.3%	3.0%
6	23.9%	3.2%
7	26.3%	3.3%
8	28.4%	3.4%
9	30.3%	3.5%
10	32.0%	3.5%
11	33.4%	3.5%
12	34.7%	3.5%
13	35.6%	3.5%
14	36.4%	3.6%
15	36.9%	3.8%
16	37.2%	4.2%

Content Split-Level-No Basement		
Depth	**Mean of Damage**	**Standard Deviation of Damage**
-2	0%	0%
-1	2.2%	2.2%
0	2.9%	1.5%
1	4.7%	1.2%
2	7.5%	1.3%
3	11.1%	1.4%
4	15.3%	1.5%
5	20.1%	1.6%
6	25.2%	1.8%
7	30.5%	2.1%
8	35.7%	2.5%
9	40.9%	3.0%
10	45.8%	3.5%
11	50.2%	4.1%
12	54.1%	4.6%
13	57.2%	5.0%
14	59.4%	5.4%
15	60.5%	5.7%
16	60.5%	6.0%

Appendix B. Letter to Repetitive Loss Area Residents

C. Federal and State Agencies, Programs and Regulations

Existing laws, ordinances, plans and programs at the federal and state level can support or impact flood hazard mitigation actions identified in this plan. The following federal and state programs have been identified as programs that may interface with the actions identified in this plan. Each program enhances capabilities to implement recommended actions or has a nexus with a recommended action in this plan.

FEDERAL

National Flood Insurance Program

The NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in participating communities that enact floodplain regulations. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 100-year flood (or base flood) and the 500-year flood. Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program.

Participants in the NFIP must, at a minimum, regulate development in floodplain areas in accordance with NFIP criteria. Before issuing a permit to build in a flood-prone area, participating jurisdictions must, at a minimum, ensure that the project meets the following criteria (44 CFR Part 60, Section 60.3):

- Be designed (or modified) and adequately anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy,
- Be constructed with materials resistant to flood damage
- Be constructed by methods and practices that minimize flood damage
- Be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

Additional criteria apply depending on the availability of information about the flood hazard.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions to meet the CRS goals of reducing flood losses, facilitating accurate insurance rating and promoting awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 9 community would receive a 5 percent premium discount, a Class 8 community would receive a 10 percent premium discount, and so on, until reaching a 45 percent premium discount for a Class 1 community. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Flood preparedness.

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

Disaster Mitigation Act

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for state, local and Indian tribal governments as a condition of mitigation grant assistance. The DMA replaced previous federal mitigation planning provisions with new requirements that emphasize the need for planning entities to coordinate mitigation planning and implementation efforts. The DMA established a new requirement for local mitigation plans and authorized up to 7 percent of Hazard Mitigation Grant Program funds to be available for development of state, local, and Indian tribal mitigation plans.

Biggert-Waters Flood Insurance Reform Act of 2012 and Homeowner Flood Insurance Affordability Act of 2014

The Biggert-Waters Flood Insurance Reform Act of 2012 authorized and funded a national mapping program. It also authorized insurance premium rate increases to ensure the fiscal soundness of the NFIP by transitioning the program from subsidized rates, also known as artificially low rates, to offer full actuarial rates reflective of risk.

The Homeowner Flood Insurance Affordability Act of 2014 repealed parts of Biggert-Waters, restoring grandfathering, putting limits on certain rate increases and updating the approach to ensuring the fiscal soundness of the fund by applying an annual surcharge to all policyholders.

Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to conserve species facing depletion or extinction and the ecosystems that support them. The act sets forth a process for determining which species are threatened and endangered and requires the conservation of the critical habitat in which those species live. The ESA provides broad protection for species of fish, wildlife and plants that are listed as threatened or endangered. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The ESA outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions. It is the enabling legislation for the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Criminal and civil penalties are provided for violations of the ESA and the Convention.

In some parts of the country, including the Pacific Northwest and the Sacramento-San Joaquin Delta area, court rulings have found that floodplain management measures can be in conflict with the goals of the endangered species act. Those rulings have required FEMA and local governments to engage in a consultation process with federal wildlife agencies (Section 7 of the ESA) as they work to develop certain floodplain management programs, plans and projects.

Clean Water Act

The federal Clean Water Act (CWA) employs regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's surface waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."

Evolution of CWA programs over the last decade has included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach, equal emphasis is placed on protecting healthy waters and restoring impaired ones. A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving and maintaining water quality and other environmental goals is a hallmark of this approach.

National Incident Management System

The National Incident Management System (NIMS) is a systematic approach for government, nongovernmental organizations, and the private sector to work together to manage incidents involving floods and other hazards. The NIMS provides a flexible but standardized set of incident management practices. Incidents typically begin and end locally, and they are managed at the lowest possible geographical, organizational, and jurisdictional level. In other instances, success depends on the involvement of multiple jurisdictions, levels of government, functional agencies, and emergency-responder disciplines. These instances necessitate coordination across this spectrum of organizations. Communities using NIMS follow a comprehensive national approach that improves the effectiveness of emergency management and response personnel across the full spectrum of potential hazards (including natural hazards, terrorist activities, and other human-caused disasters) regardless of size or complexity.

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) seeks to prevent discrimination against people with disabilities in employment, transportation, public accommodation, communications, and government activities. The most recent amendments became effective in January 2009 (Public Law 110-325). Title II of the ADA deals with compliance with the Act in emergency management and disaster-related programs, services, and activities. It applies to state and local governments as well as third parties, including religious entities and private nonprofit organizations.

The ADA has implications for sheltering requirements and public notifications. During an emergency alert, officials must use a combination of warning methods to ensure that all residents have any necessary information. Those with hearing impairments may not hear radio, television, sirens, or other audible alerts, while those with visual impairments may not see flashing lights or visual alerts. Two stand-alone technical documents have been issued for shelter operators to meet the needs of people with disabilities. These documents address physical accessibility as well as medical needs and service animals.

The ADA also intersects with disaster preparedness programs in regards to transportation, social services, temporary housing, and rebuilding. Persons with disabilities may require additional assistance in evacuation and

transit (e.g., vehicles with wheelchair lifts or paratransit buses). Evacuation and other response plans should address the unique needs of residents. Local governments may be interested in implementing a special-needs registry to identify the home addresses, contact information, and needs for residents who may require more assistance.

Public Law 8499, Flood Control and Coastal Emergencies

Federal law that gives the U.S. Army Corps of Engineers the legal authority to conduct emergency preparation, response, and recovery activities and to supplement local efforts in the repair of flood damage reduction projects that have been damaged by floods. Under Public Law 8499, the Corps' Chief of Engineers is authorized to undertake activities including disaster preparedness, advance measures to prevent or reduce damage when there is an imminent threat of unusual flooding, emergency operations (flood response and post-flood response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provision of emergency water in the event of drought or contaminated source.

Appendix D. RLAA Adoption Resolution