Levee Management

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Public Works
THE GARDEN CITY
MISSOULA
HUB OF FIVE VALLEYS
Storm Water Utility

Introduction

Per Chapter 13.27 Missoula Municipal Code: Storm Water Management

"Storm water system" in this chapter also includes the City's flood control devices, such as levees, floodwall, high-hazard dams, and their appurtenances.

Four Accredited Levees sponsored by the City

- Clark Fork Area III
- Clark Fork Area V
- Grant Creek
- Pattee Creek
  - Spartan and Playfair Park Detention Basins
  - Grit Chamber

One Non-accredited Levee formerly sponsored by the City

- McCormick Levee

One Accredited Levee sponsored by Missoula County that protects some City properties

- Orchard Homes

Maintenance Requirements

Certification Process

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Accredited Levees

The Federal Emergency Management Agency (FEMA) has determined it meets the requirements of National Flood Insurance Program (NFIP) regulations (44 CFR 65.10) and that FEMA has recognized on a Flood Insurance Rate Map (FIRM) as reducing the flood hazards posed by a base (1-percent-annual-chance/100-year) flood.

Properties located in the floodplain behind an accredited levee receive reduced flood insurance rates.

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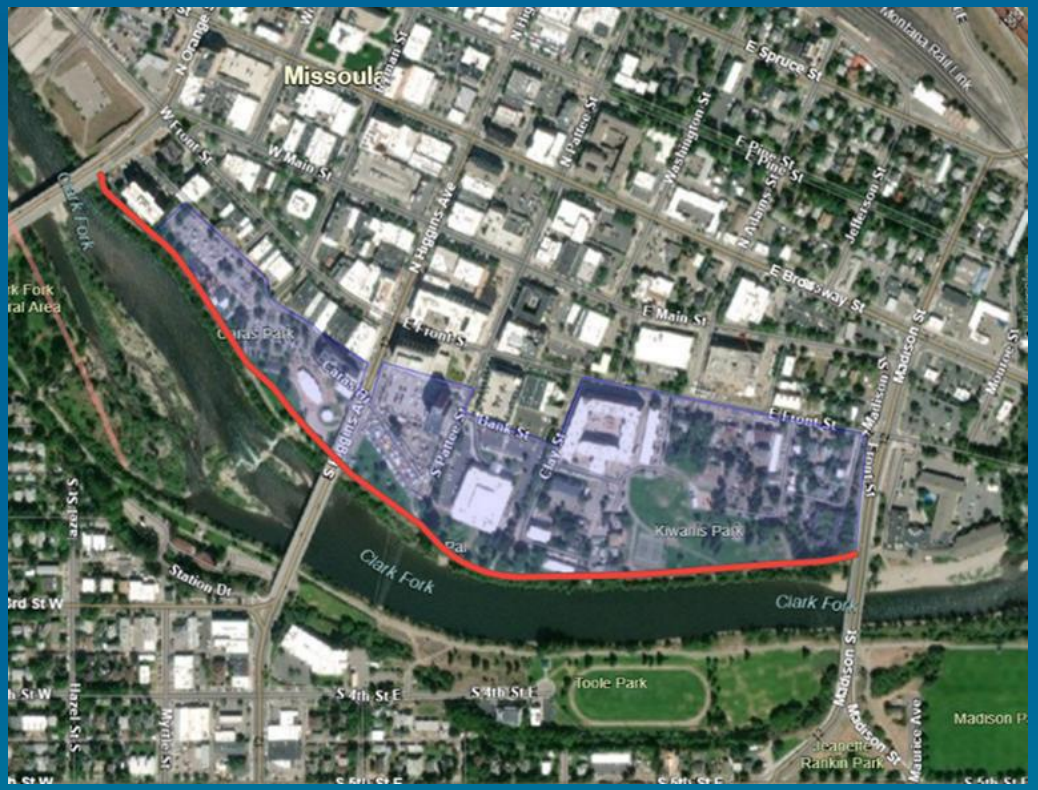
Clark Fork Area III

- Built: 1966
- Accredited
- Federally authorized levee (built by
- the U.S. Army Corps of Engineers)
- Locally sponsored by the City
- Length: 0.54 miles of embankment
- and 0.17 miles of floodwall
- Population: 303
- Structures protected: 86
- Estimated property value:
- $48 million to $14 billion
- Extent: North bank
  Madison to Orange



Annual inspection by USACE and City
USACE Rating: Minimally Acceptable
Majority of recommendations include repairing cracking and spalling on the floodwall and maintaining vegetation.

Estimate to remove unacceptable vegetation along the flood wall: $45,000

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Clark Fork Area V

- Built: 1964
- Accredited
- Federally authorized levee (built by
- the U.S. Army Corps of Engineers)
- Locally sponsored by the City
- Length: 0.24 miles of embankment
- Population: 312
- Structures protected: 120
- Estimated property value: $36.4 million
- Extent: North bank
  California to Russell

Annual inspection by USACE and City
USACE Rating: Minimally Acceptable
Majority of the recommendations include maintenance of vegetation and riprap.

February 2020
Unacceptable vegetation removed from riverward side of levee
$29,000

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Grant Creek

- Built: 1991
- Accredited
- Locally funded, non-federal levee
- Sponsored by the City
- Length: 0.59 miles of embankment
- Population: 528
- Structures protected: 24
- Estimated property value:
  - $9 million to $29.3 million

Annual inspection by City
Periodic inspection by USACE every 5 years
USACE Rating: Minimally Acceptable
Majority of recommendations include removing excess vegetation and repairing locations of scour and erosion.

Estimate to removed unacceptable vegetation: $700,000

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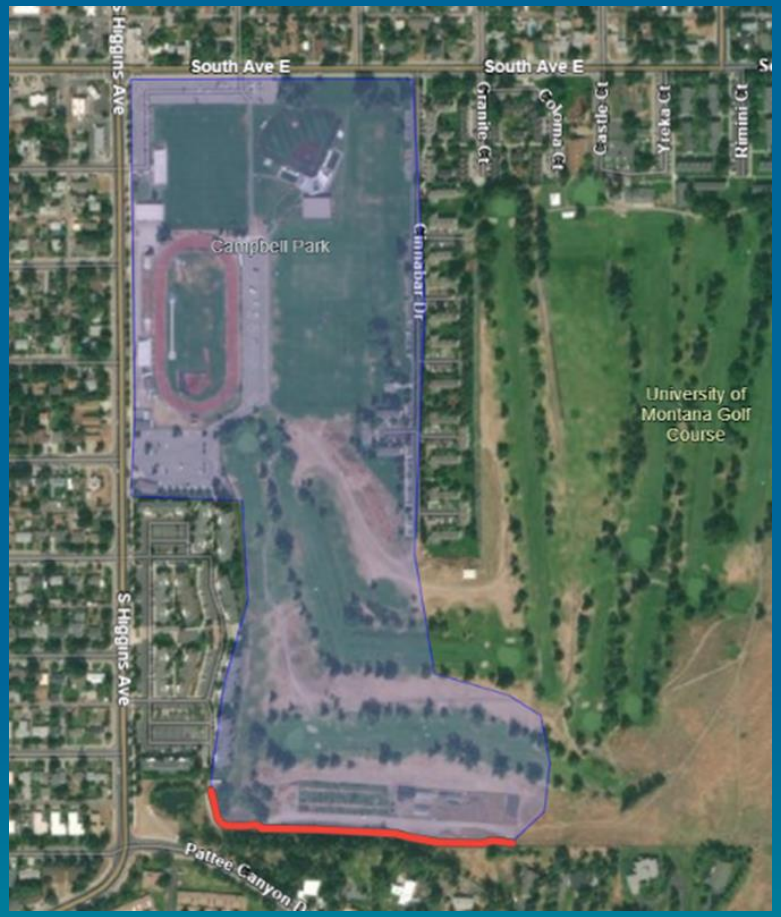
Pattee Creek

- Built: modified 2004
- Accredited
- Locally funded, non-federal levee
- Sponsored by the City
- Length: 0.21 miles of embankment
- Population: 165
- Structures protected: 11
- Estimated property value:
  $900,000 to $2.86 million

Part of the South Hills Storm Drain System
Spartan and Playfair Park Detention Basins
Grit Chamber

Annual inspection by City
Periodic inspection by USACE every 5 years
USACE Rating: Acceptable
Majority of recommendations include maintaining vegetation to comply with USACE standards and monitoring/controlling burrowing animal activity.



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McCormick Park

- Built: repaired 1964
  (unclear when it was originally constructed)
- Non-accredited since 1990
- Locally funded,
  non-federal levee
  (likely, but not confirmed)
- Length:
  0.49 miles of embankment
- Population: 275
- Structures protected: 107
- Estimated property value:
  $80.8 million

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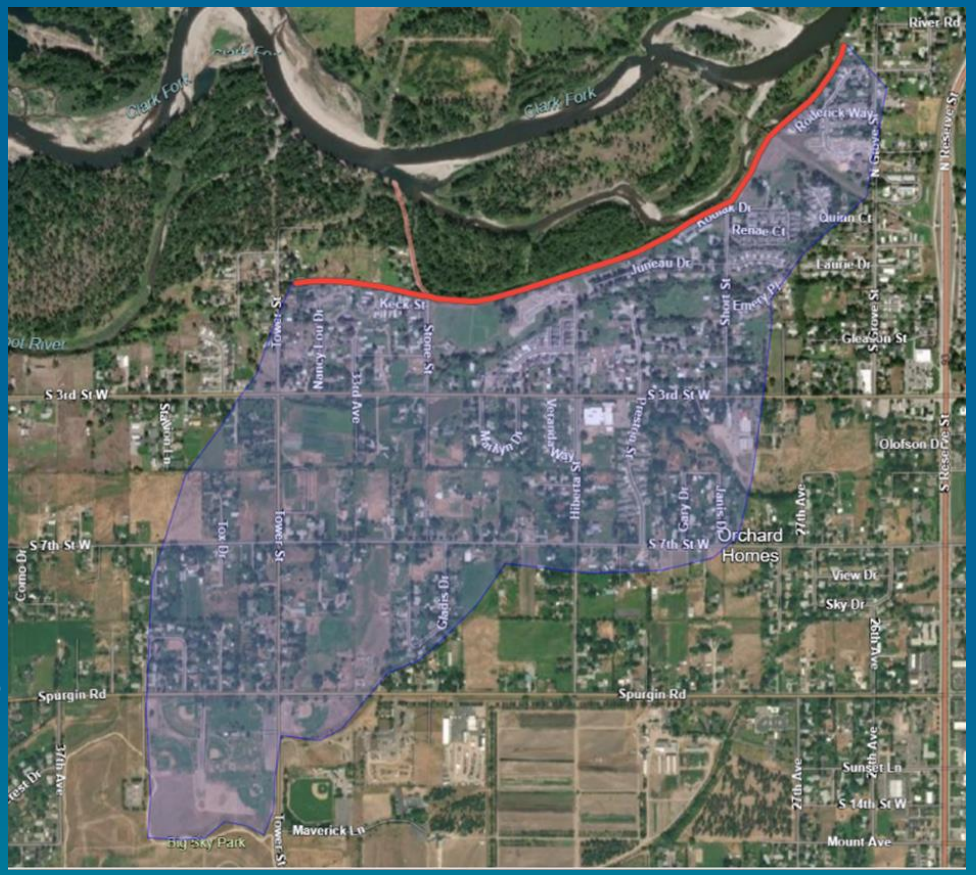
Orchard Homes

- Built: 1949
- Accredited
- Locally funded, non-federal levee
- Sponsored by the County
- Length: 1.1 miles of embankment
- Population: 751
- Structures protected: 329
- Estimated property value:
  $73.9 million

Annual inspection by County
Periodic inspection by USACE every 5 years
USACE Rating: Minimally Acceptable
Majority of recommendations include removing excess vegetation and repairing locations of scour and erosion.



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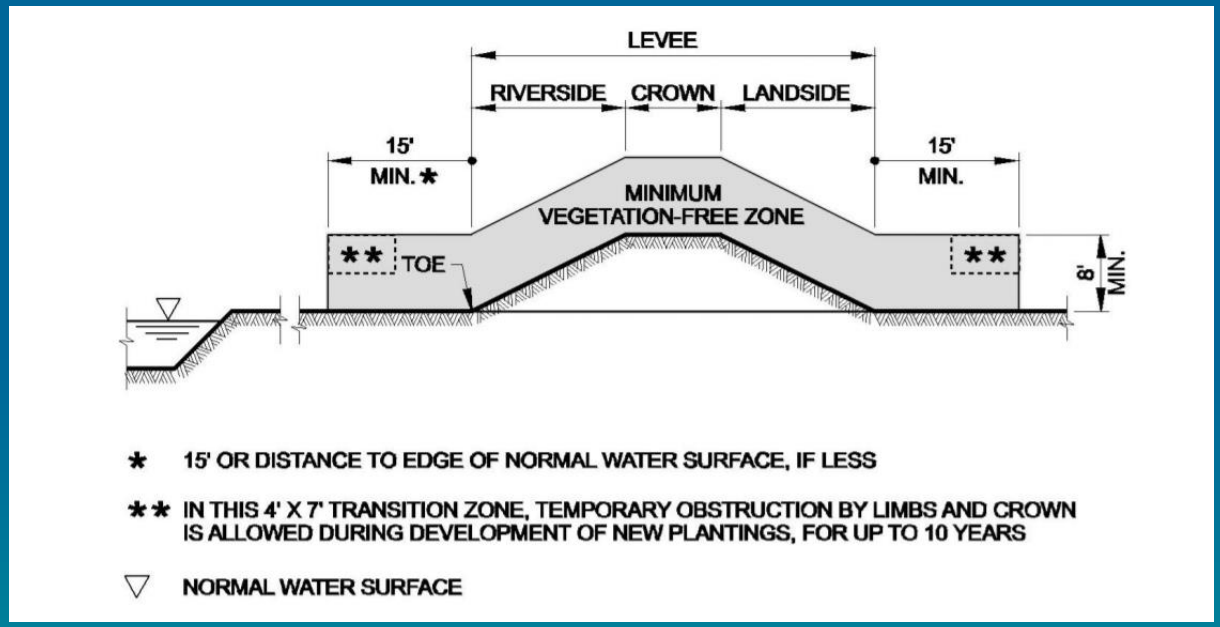
Vegetation Maintenance

Remove vegetation not in compliance with USACE vegetation standards. The crown, slopes, and 15 feet from the toe of the levee or floodwall should be clear of vegetation as the regulation originally stated in Engineering Technical Letter (ETL) 1110-2-583 (expired) and Engineering Pamphlet (EP) 1110-2-18.



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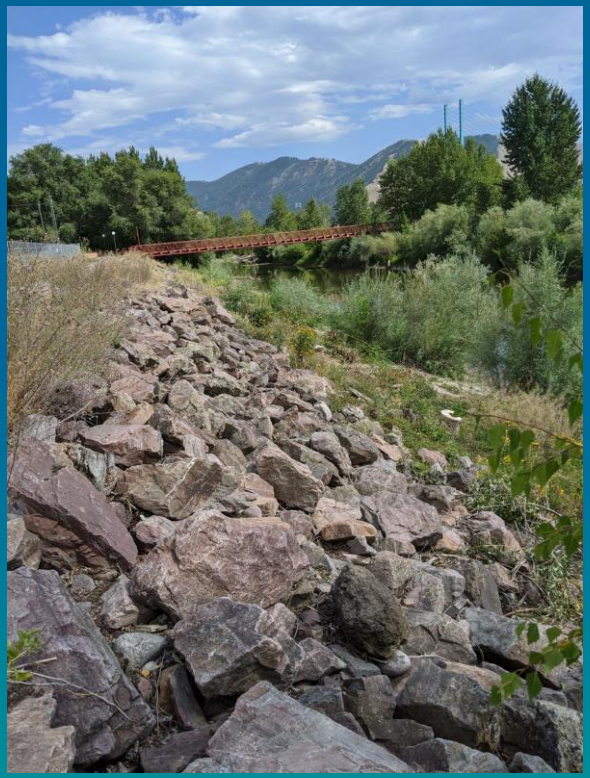

Vegetation Maintenance

USACE recognizes that the protections provided to threatened and endangered species, like bull trout, may supersede their vegetation guidelines.

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Vegetation Maintenance

"Growth of sod and willows or brush on the levee slopes may be encouraged as it will increase bank stabilization and decrease erosion from flood flows. The growth of trees on the levee shall be prevented." *Clark Fork Area III and V Levees Operation and Maintenance Manual 1968, written by the U.S. Army Corps of Engineers*


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Long-Term Goal

Remove all non-native vegetation and cottonwoods, transition levee slopes to native shrub cover, where diameter at breast height < 4 inches.

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Certification Process

Missoula and Granite Counties are working with MT DNRC and FEMA to update and produce new Flood Insurance Rate Maps (FIRMS) for the Clark Fork River, Bitterroot River, Rock Creek, and Rock Creek Tributaries. Updated floodplain maps will depict the latest, most accurate flood risk data, and will eventually replace the existing floodplain maps which are based on data from the 1970s.

DNRC floodplain mapping updates
http://dnrc.mt.gov/divisions/water/operations/floodplain-management/missoula-granite

Due to the floodplain remapping effort, the Clark Fork Levees must be re-certified, to retain their accreditation status.

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Certification Process

Flood Study Steps

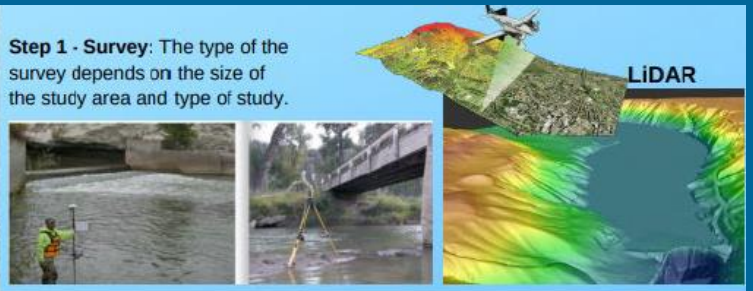
Step 1 - Survey: measurements are made of the topography around the river, along with any culverts, bridges, and road crossings. LiDAR uses an airplane to collect ground elevation over a large area, and ground survey supplements the airborne data.

Step 2 - Hydrology: determines how much water there will be in the river during a flood event. Data from stream gages will tell how many cubic feet of water per second the river will carry during the flood.

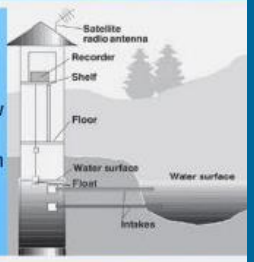
Step 3 - Hydraulics: once the first two steps are complete, calculations can show where the water will go during the flood. The elevation data is combined with the flood flow data to determine where the water will go when it overflows the channel.

Step 4 - Mapping (delineation): the results from step 3 are combined with the elevation data and official maps to see how far the water will spread out. The area shown to be underwater during the flood is the regulatory floodplain.

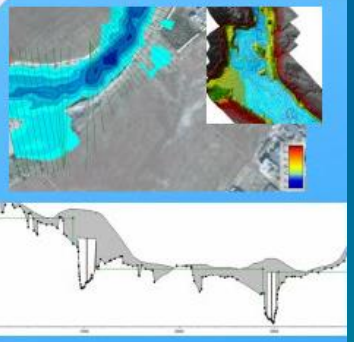
Step 1 - Survey: The type of the survey depends on the size of the study area and type of study.



Step 2 - Hydrology:
Stream gage stations are an important tool to determine flow rates. If nearby stream gages aren't available, gage data from a similar location is used to determine the flow rate.

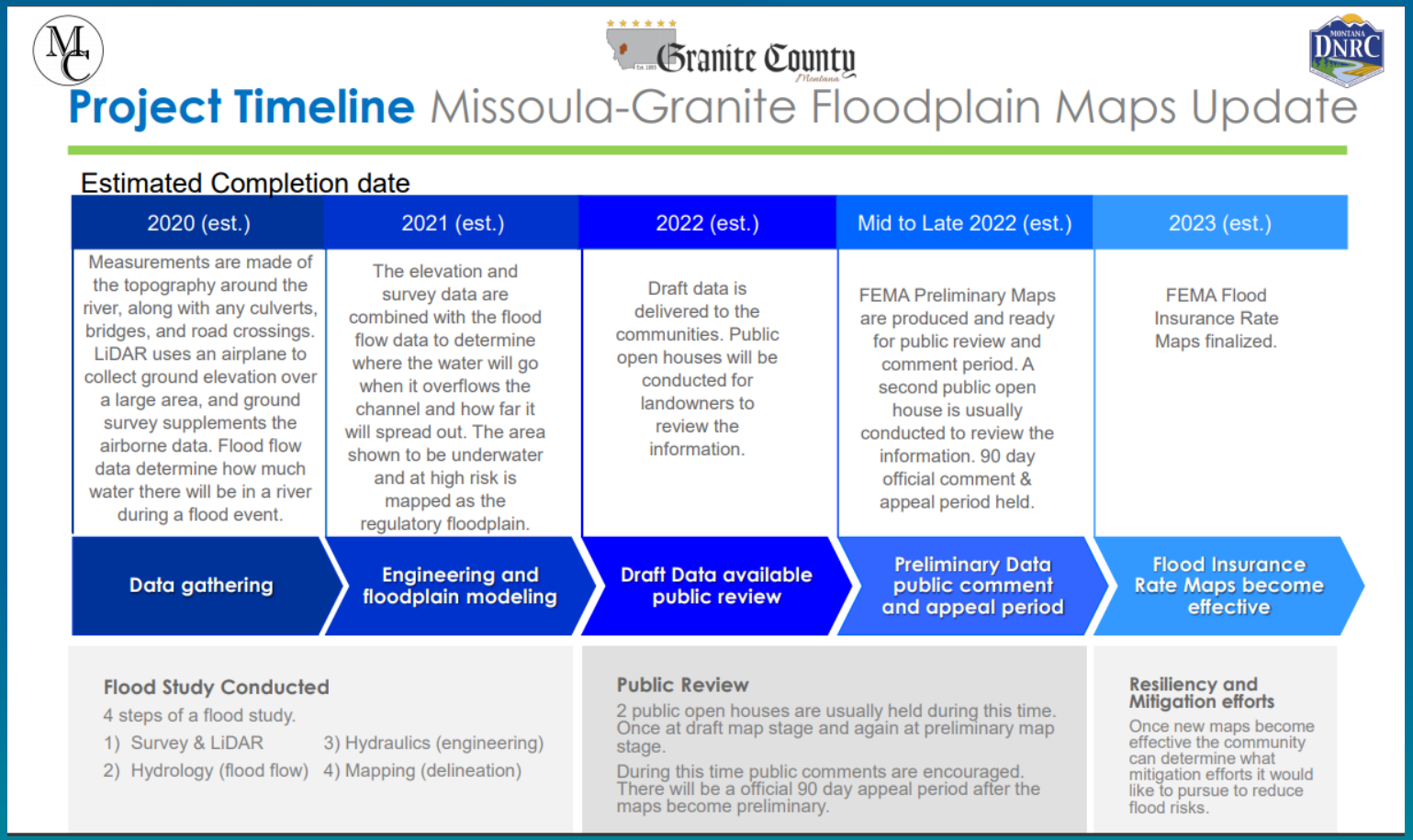


Step 3 - Hydraulics:
5 main components to the model
1) Hydrology (stream flow data)
2) Cross Sections (measurements of the river bottom at key locations)
3) Roughness (thickness of vegetation, land cover, etc determined by surveyors)
4) Structures (road crossings, culverts, bridges, etc.)
5) Downstream conditions



Step 4 - Mapping (delineation):
The result will be the floodplain boundary and a depth grid identifying the shallower and deeper areas of flooding.

Certification Process



Certification Process

Design Criteria
Freeboard**
Closures*
Embankment protection*
Embankment and foundation stability analysis*
Settlement analysis*
Interior Drainage

Interior drainage plan
Flood warning system
Plan of operation
Manual backup
Periodic inspection

Survey of the levee

Emergency Action Plan

Operation Plan
Flood warning system
Plan of operation
Periodic operation of closures

Maintenance Plan

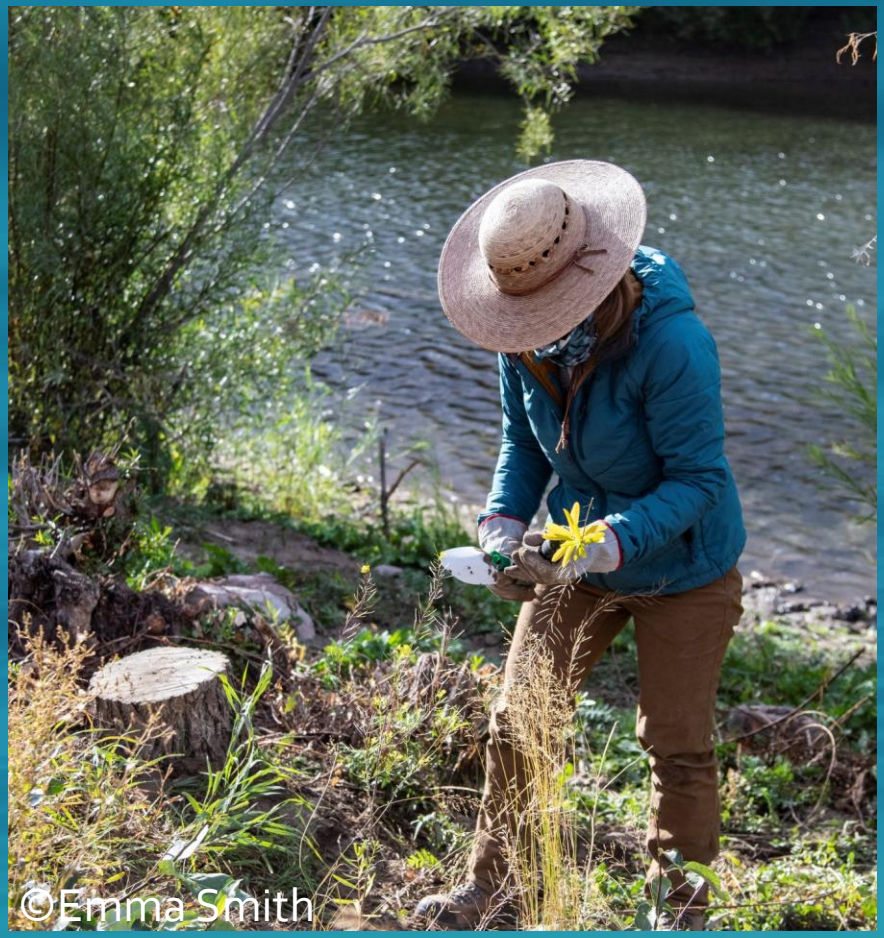
* May be covered by a corps of engineers risk assessment

Certification Process

The approximate cost is $25.70/foot of levee (2018 dollars). This does not include any maintenance/rehab work that would be needed.

Levee Name	Levee length	Floodwall length	Total length	Estimated Cost
Clark Fork Area III	2,900	900	3,800	$97,660
Clark Fork Area V	1,200	0	1,200	$30,840
McCormick	2,587	0	2,587	$66,485.90
		Total	**7,587**	**$194,985.90**

Questions?



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