Cost-Sharing Agreement
Levee Certification

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STORM WATER
City of Missoula

Review

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

Accredited Levees

2018 Flooding (4% Annual Chance or 25-year flood)
Target Range/Orchard Homes

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.

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.

March 2021
Removed unacceptable vegetation

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 and March 2021
Removed unacceptable vegetation

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.

Floodplain Mapping

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.

Floodplain Mapping

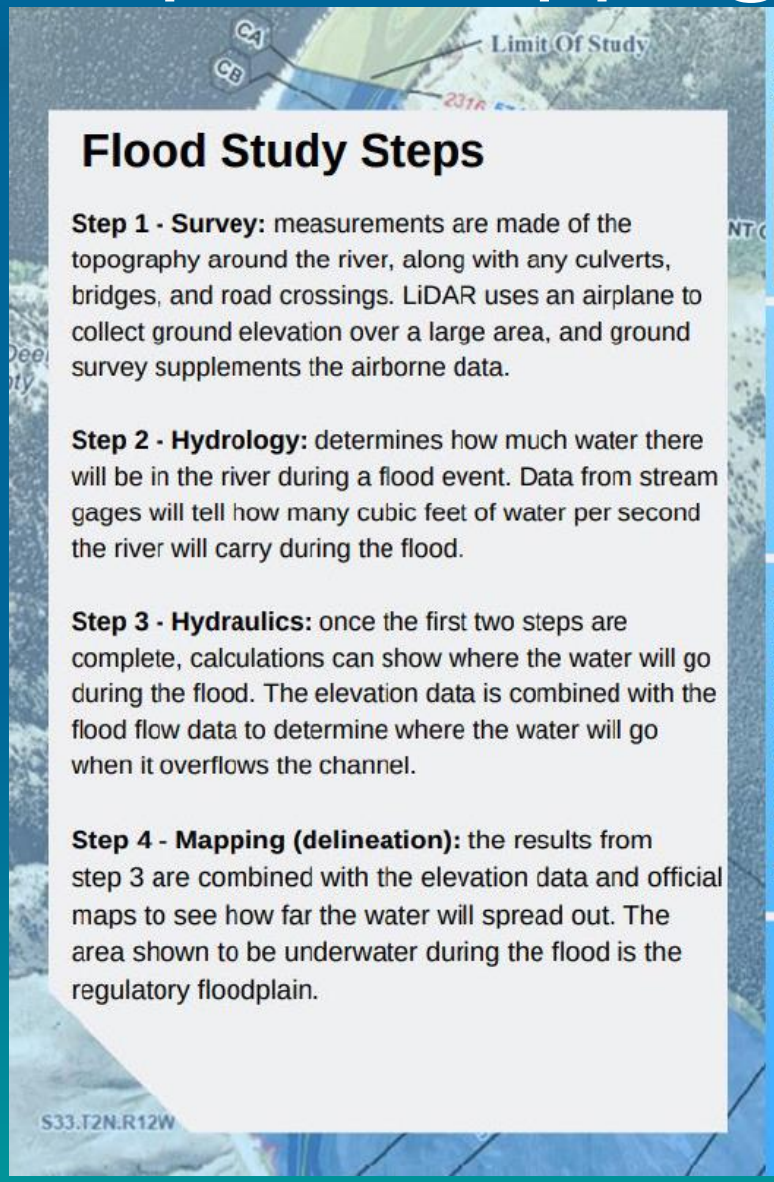
Flood Study Steps

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.

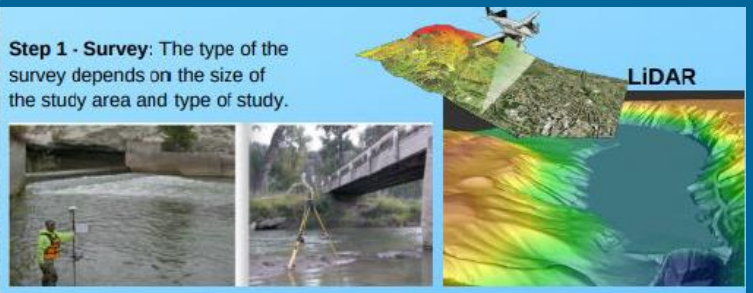
Step 2 - Hydrology: determines how much water there will be in the river during a flood event. Data from stream gages will tell how many cubic feet of water per second the river will carry during the flood.

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.

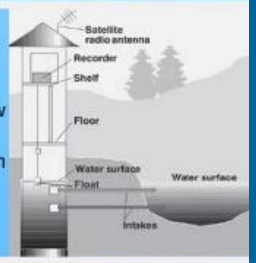
Step 4 - Mapping (delineation): the results from step 3 are combined with the elevation data and official maps to see how far the water will spread out. The area shown to be underwater during the flood is the regulatory floodplain.



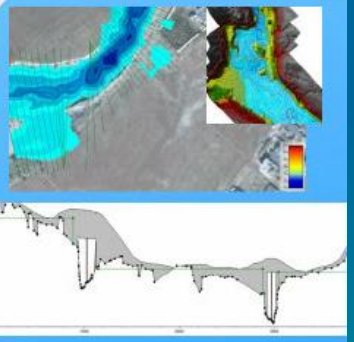
Step 1 - Survey: The type of the survey depends on the size of the study area and type of study.



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.

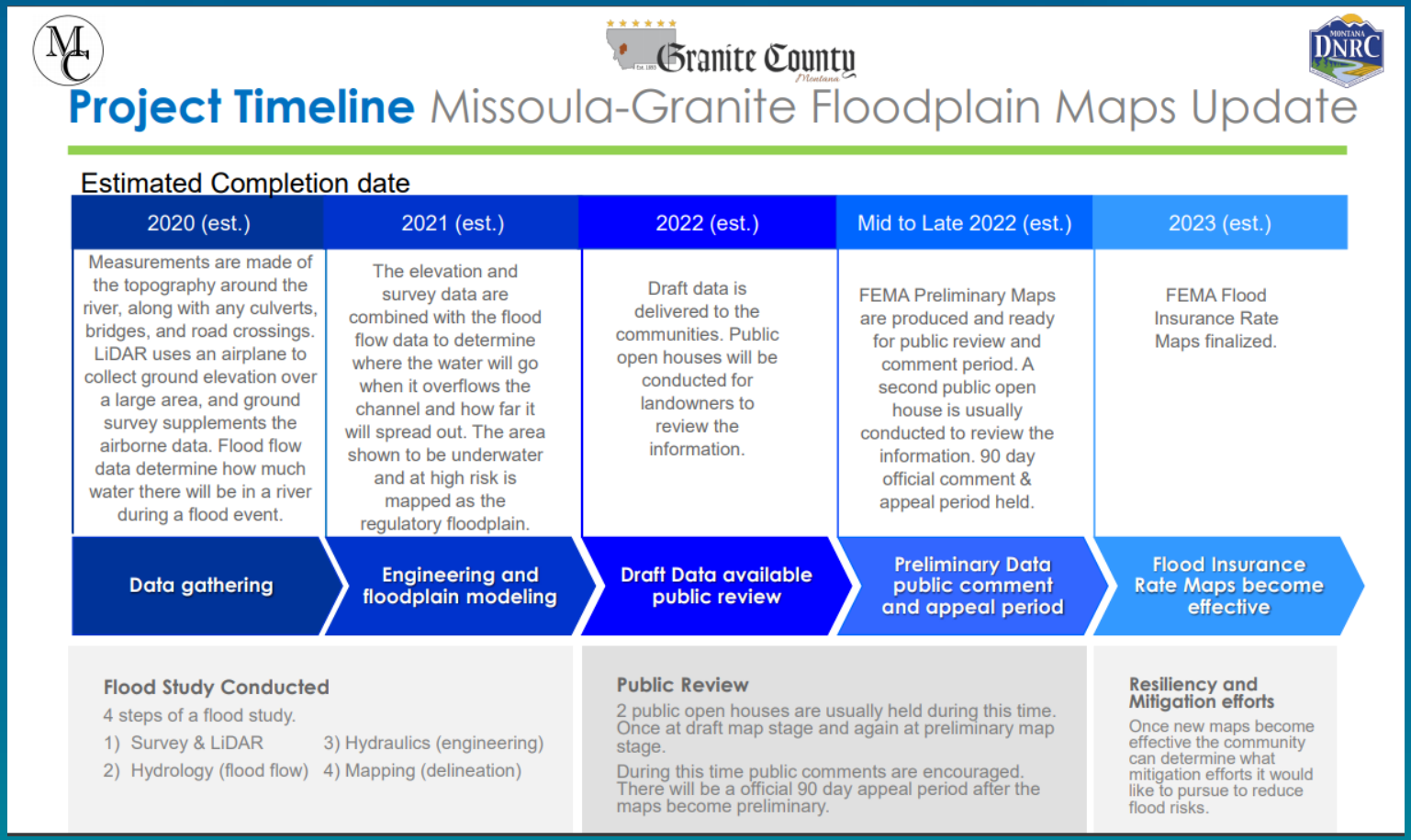


Step 3 - Hydraulics:
5 main components to the model
1) Hydrology (stream flow data)
2) Cross Sections (measurements of the river bottom at key locations)
3) Roughness (thickness of vegetation, land cover, etc determined by surveyors)
4) Structures (road crossings, culverts, bridges, etc.)
5) Downstream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



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

Floodplain Mapping Timeline



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

USACE Risk Assessment		Consultant	
Pros	Cons	Pros	Cons
Certified by same agency that built the levees			Less Predictable
Robust scope	New process	Well-established process	Less-defined scope
Established relationship with the Seattle District			No local expertise; Requires out-of-state consultants
Seattle District willing to work with the City			Consultant stated it was a 'no brainer' to partner with the Corps
Potential to save a significant amount of money			Potential to cost more money

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Cost-Sharing Agreement

- September 2, 2020
  Mayor Engen signed a formal request for assistance to Colonel Bullock, District Commander of the USACE Seattle District
- Total cost to prepare Certification Package to FEMA for both Clark Fork Levees
  - $717,000
- U.S. Army Corps of Engineers and City of Missoula
  - $358,500 each

2018 Flooding (4% Annual Chance or 25-year flood)
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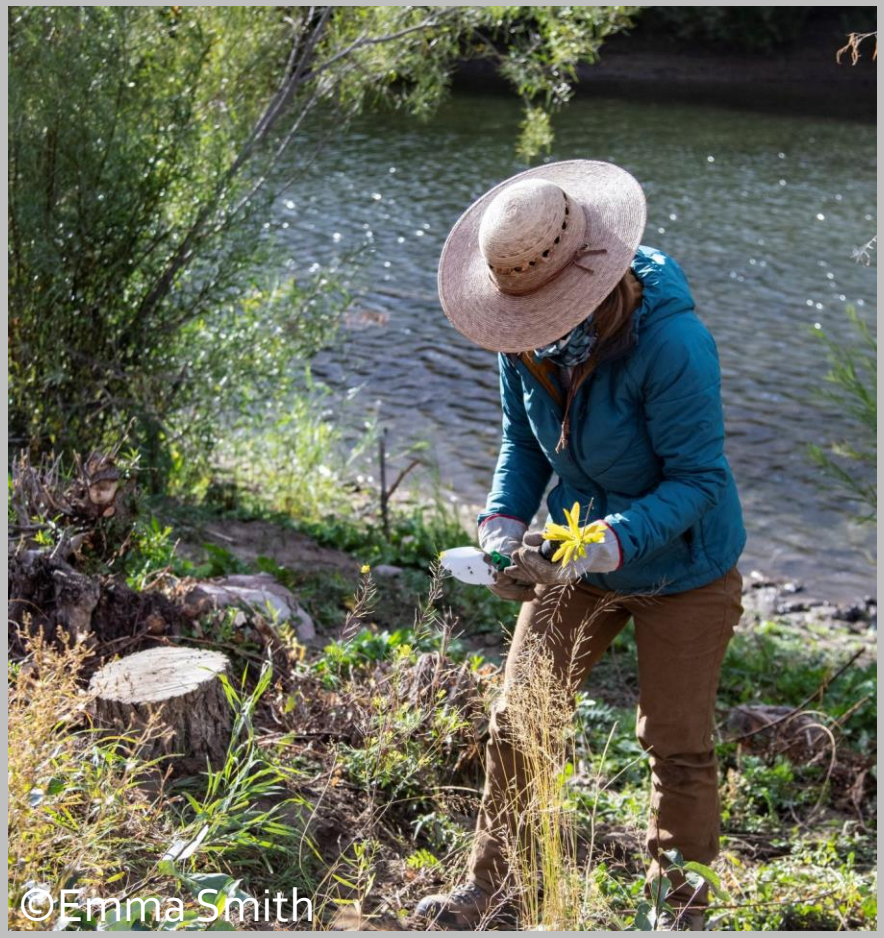
Questions?



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