CONSIDERATIONS WHEN SCOPING FLOODPLAIN RELATED PROJECTS.

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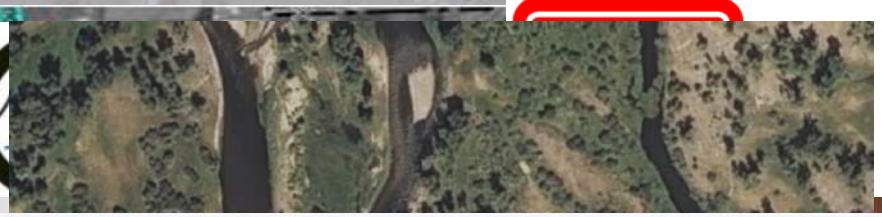
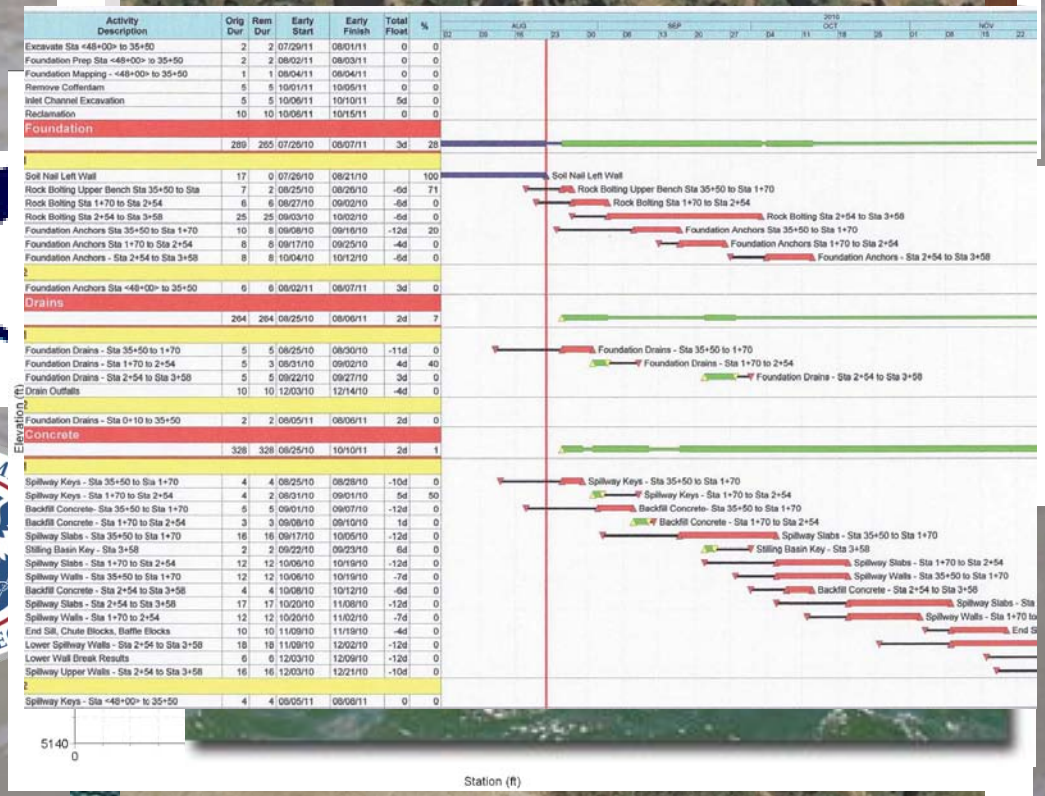
Learning Objectives

- Recognizing the regulatory requirements when scoping work in the floodplain.
- Recognizing the hidden costs associated with floodplain work.
- Knowing the components of an acceptable floodplain submittal.

Outline

- Location
- Communities
- Agencies
- Timelines
- Office Investigation
- Field Investigation
  - Surveying
  - Collecting Other Data
- Modeling
- Stability Analysis
  - Particle Transport
  - Deposition
  - Scour
  - Peripheral Effects
  - River Avulsion
- Report
- Misconceptions
- Responsibilities





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Foundation Prep Sta <48+00> to 35+50	2	2	08/02/11	08/03/11	0	0
Foundation Mapping - <48+00> to 35+50	1	1	08/04/11	08/04/11	0	0
Remove Cofferdam	5	5	10/01/11	10/05/11	0	0
Inlet Channel Excavation	5	5	10/06/11	10/10/11	5d	0
Reclamation	10	10	10/06/11	10/15/11	0	0
Foundation						
	289	265	07/26/10	08/07/11	3d	28
Soil Nail Left Wall	17	0	07/26/10	08/21/10		100
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Rock Bolting Sta 1+70 to Sta 2+54	6	6	08/27/10	09/02/10	-6d	0
Rock Bolting Sta 2+54 to Sta 3+58	25	25	09/03/10	10/02/10	-6d	0
Foundation Anchors Sta 35+50 to Sta 1+70	10	8	09/08/10	09/16/10	-12d	20
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Foundation Drains - Sta 1+70 to 2+54	5	3	08/31/10	09/02/10	4d	40
Foundation Drains - Sta 2+54 to Sta 3+58	5	5	09/22/10	09/27/10	3d	0
Drain Outfalls	10	10	12/03/10	12/14/10	-4d	0
Foundation Drains - Sta 0+10 to 35+50	2	2	08/05/11	08/06/11	2d	0
Concrete						
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Wildlife & Parks

Location, Location, Location

- The location of a project drives everything
- Know what communities are involved.
- Know the all additional agencies involved.
- Know where in the river or stream the project is located.
- There are no one size fits all solutions.

Location, Location, Location

Everyone wants a piece

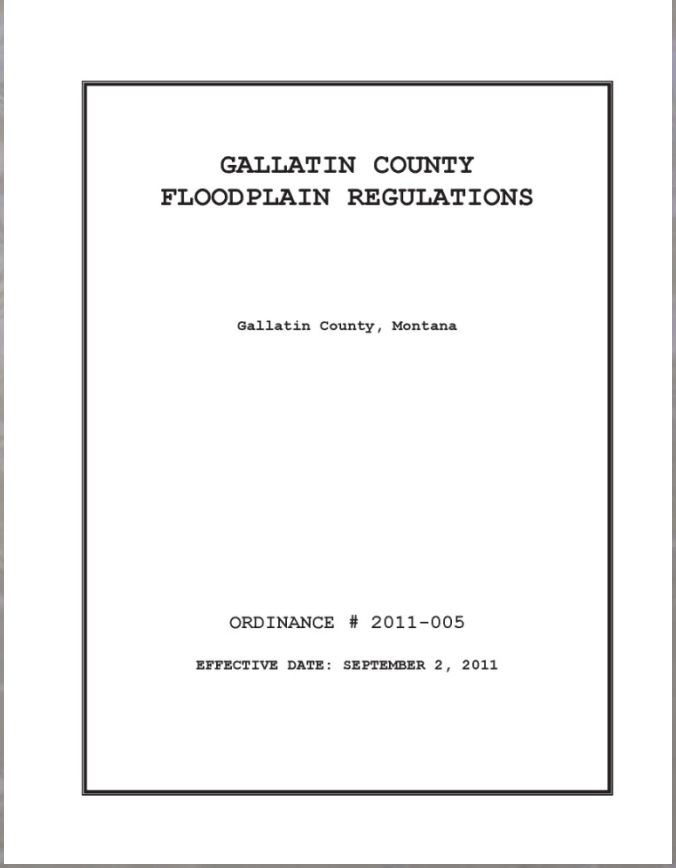
- There are many different agencies involved:
  - Community Floodplain Manager
  - FEMA
  - DEQ
  - ARMY CORPS
  - Conservation District
  - FWP
  - DNRC
- Sometimes, with certain designs, the requirements from the various agencies conflict with one another.
- Don't develop a design that meets one agency's criteria but then cannot be permitted by another.

Money, Money, Money

- Cost considerations
  - Army Corps- mitigation credits
  - NFIP- 100 year flood event design criteria
  - The potential for a CLOMR/LOMR
  - Alternative designs

Knowing the community involved

- Are you located in a regulatory floodplain?
- Know the requirements of the community, i.e., the governing ordinance.
- Always contact the floodplain administrator.
  - Sometimes they regulate to maps other than those provided by FEMA



GALLATIN COUNTY
FLOODPLAIN REGULATIONS

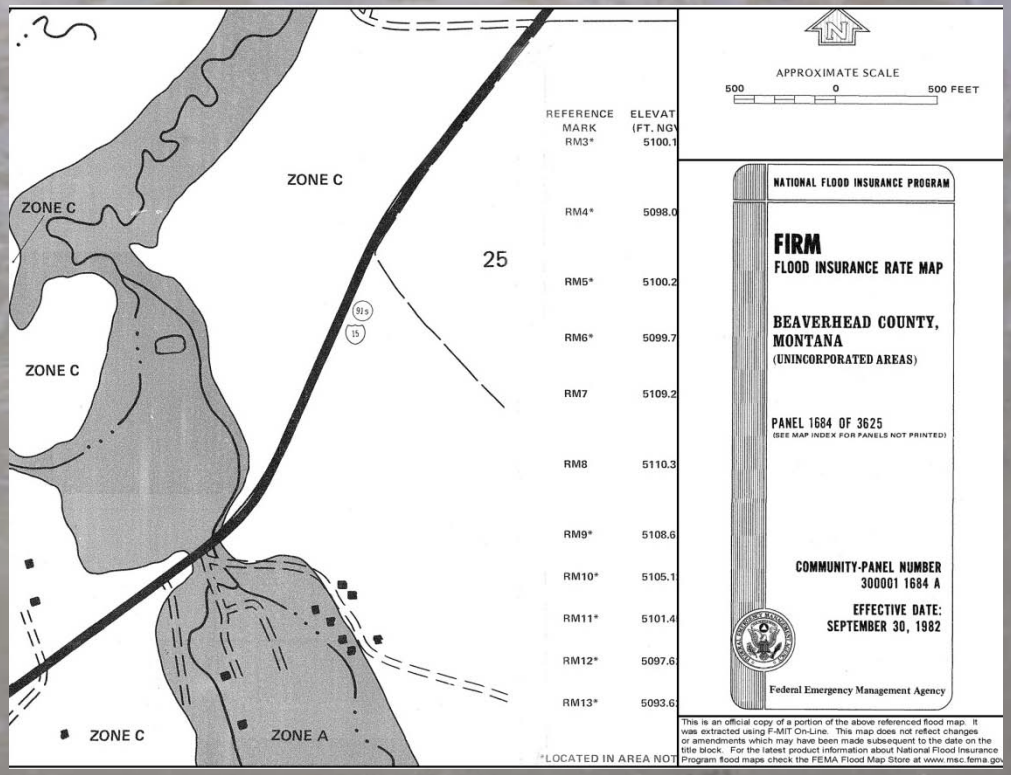
Gallatin County, Montana

ORDINANCE # 2011-005

EFFECTIVE DATE: SEPTEMBER 2, 2011

Approximate A Zones

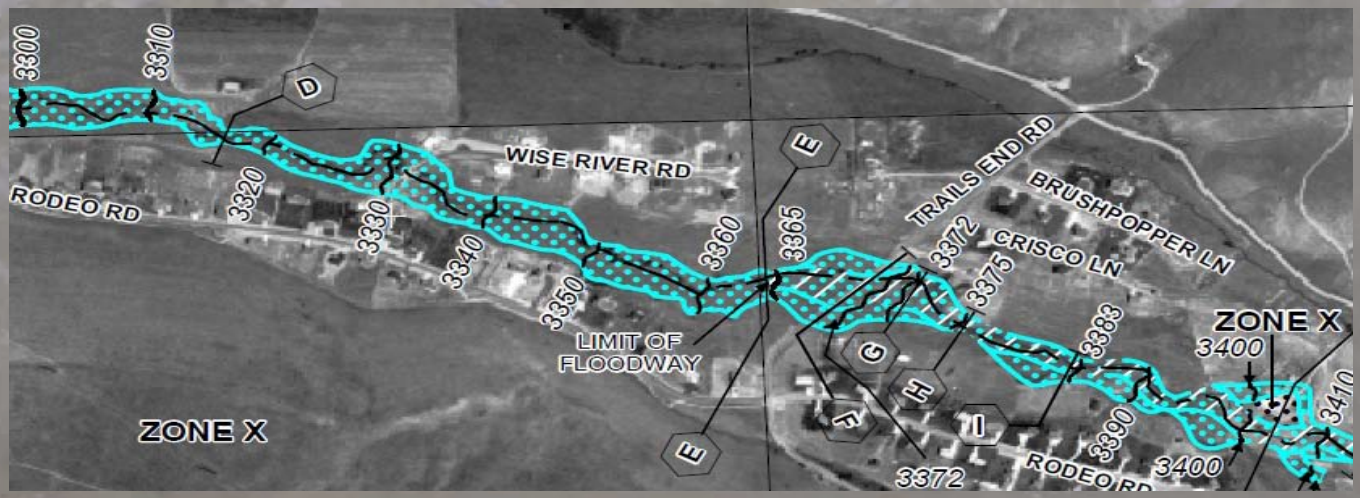
- No BFE's or Hydrology.
- Time and Cost Considerations
  - Developing hydrology data
  - Acquiring survey data
  - Developing model
  - Potential CLOMR/LOMR if design increases BFEs by more than 0.5 feet.



Limited Detail Areas

Zone AE

- BFEs, hydrology, models, and other data likely available.
- Time and Cost Considerations
  - Acquisition of new survey data
  - Acquisition of effective model and FIS report used to generate the FIRM
  - Development of models using data from effective model
  - Potential CLOMR/LOMR if design increases BFEs by more than 0.5 feet.



Detail Areas

Zone AE

- BFEs, hydrology, models, and other data likely available.
- Floodway needs to be considered.
- Time and Cost Considerations
  - Acquisition of effective model and FIS report used to generate the FIRM
  - Acquisition of survey data.
  - Development of models using data from effective model.
  - Potential CLOMR/LOMR if design increases BFEs by more than 0.00 feet in the floodway.

The dreaded CLOMR/LOMR

- Current approach of closing your eyes, plugging your ears and stomping your feet until someone says you don't have to do it may have worked in the past, but as communities become more savvy it is becoming less effective.
- This is the community's responsibility.
- The community has the choice whether they want to pass this responsibility on to the applicant.

INSTRUCTIONS FOR COMPLETING THE APPLICATION FORMS FOR CONDITIONAL LETTERS OF MAP REVISION AND LETTERS OF MAP REVISION

GENERAL

In 1968, the U.S. Congress passed the National Flood Insurance Act, which created the National Flood Insurance Program (NFIP). The NFIP was designed to reduce future flood losses through local floodplain management and to provide protection for property owners against potential losses through flood insurance.

As part of the agreement for making flood insurance available in a community, the NFIP requires the participating community to adopt floodplain management ordinances containing certain minimum requirements intended to reduce future flood losses. The NFIP regulations for floodplain management are the minimum criteria a community must adopt for participation in the NFIP. The community is responsible for approving all proposed floodplain development and for ensuring that permits required by Federal or State law have been received. State and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If the State or Community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

The community is also responsible for submitting data to the U.S. Department of Homeland Security - Federal Emergency Management Agency (DHS-FEMA) reflecting revised flood hazard information so that NFIP maps can be revised as appropriate. This will allow risk premium rates and floodplain management requirements to be based on current data.

Submissions to DHS-FEMA for revisions to effective Flood Insurance Studies (FISs), Flood Insurance Rate Maps (FIRMs), or Flood Boundary Floodway Maps (FBFMs) by individual and community requesters will require the signing of application forms. These forms will provide DHS-FEMA with assurance that all pertinent data relating to the revision are included in the submittal. They will also ensure that: (a) the data and methodology are based on current conditions; (b) qualified professionals have assembled data and performed all necessary computations; and (c) all individuals and organizations affected by proposed changes are aware of the changes and will have an opportunity to comment on them.

If the submission involves revisions to multiple flooding sources, then separate forms should be completed for each flooding source.

NFIP regulations can be accessed at http://www.access.gpo.gov/nara/cfr/waisidx_02/44cfrv1_02.html or can be obtained by calling DHS-FEMA's Map Information eXchange (FMIX) at 1-877-FEMA MAP (1-877-336-2627). DHS-FEMA's Internet site at http://www.fema.gov/plan/prevent/fhm/dl_mt-2.shtm provides access to the forms and latest fees and revision procedures. DHS-FEMA is preparing online tutorials to assist users of the NFIP maps. The tutorials for revisions to the NFIP maps are currently being prepared and will be available soon. Other online tutorials are available at http://www.fema.gov/plan/prevent/fhm/ot_main.shtm.

WHEN TO USE THESE FORMS

This package is applicable for requests of the following:

Conditional Letter of Map Revision (CLOMR)	A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would meet minimum NFIP standards or proposed hydrology changes [see 44 Code of Federal Regulations (CFR) Ch. 1, Parts 60, 65, and 72].
Letter of Map Revision (LOMR)	A letter from DHS-FEMA officially revising the current NFIP map to show changes to floodplains, floodways, or flood elevations (see 44 CFR Ch. 1, Parts 60, 65, and 72).

Instructions MT-2 Forms 1

Timeline

- What time delays should be considered?
  - Data acquisition
  - Field Conditions
  - Time spent developing appropriate design
  - Review time
  - Other agencies' requirements
  - CLOMR submittal

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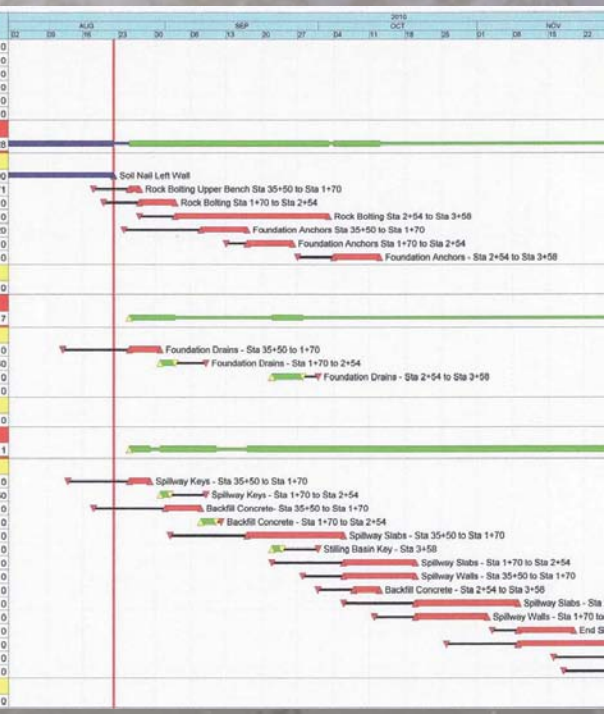


Emergency Projects

- In the applicants mind every project is an emergency.
- Does your project fit the definition of an emergency?
- The determination is at the community's discretion.
- Lack of planning does not constitute an emergency.
- Emergency projects still require all applicable permits and associated analysis.

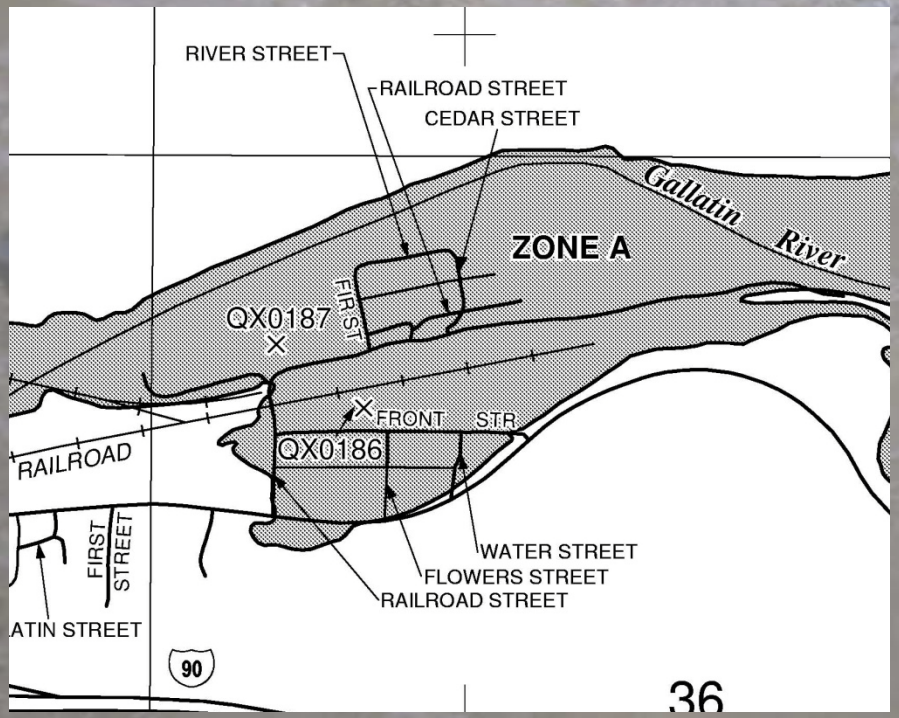
- If a project does not meet permitting requirements it could require modification or removal.

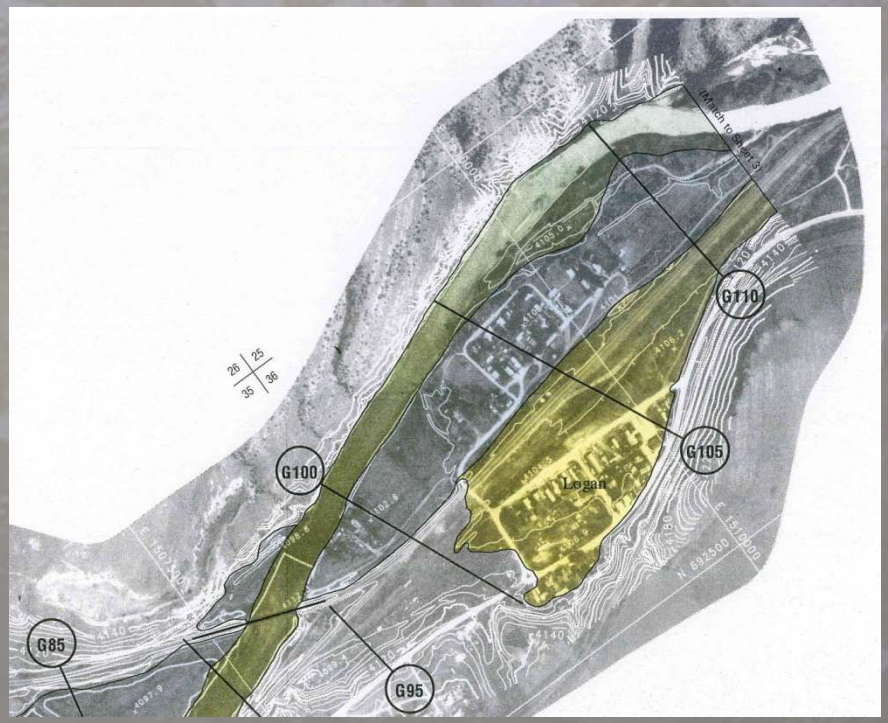
Office Investigation

- What information can be gathered before going to the site?
- Talk to the floodplain administrator.
- Contact the various agencies that may require a permit
- Set up a site walk with the agencies involved.
- Review aerial photos and/or CMZ maps to determine floodplain characteristics and channel migration potential in the area.
- Review topo data to get rough determinations of slope and other factors that may influence the number of cross sections needed.
- Determine apparent extents of floodplain so field surveyed cross sections extend across entire floodplain.
- Lay out cross section to optimize field time.

Office Investigation

- Contact the Community's Floodplain Administrator and other applicable agencies.



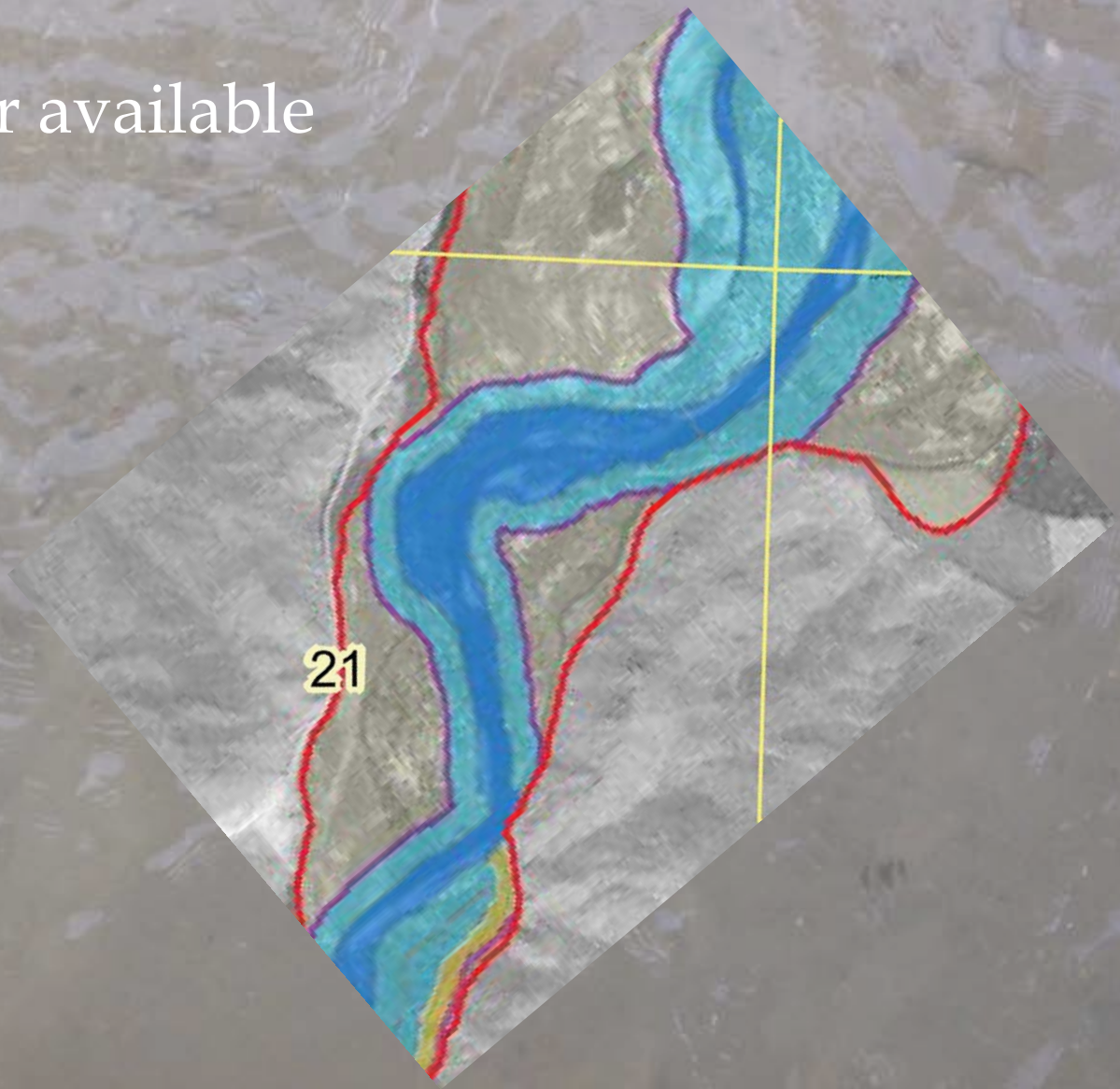


Office Investigation

- Review aerial photos.

Office Investigation

- Review other available data.

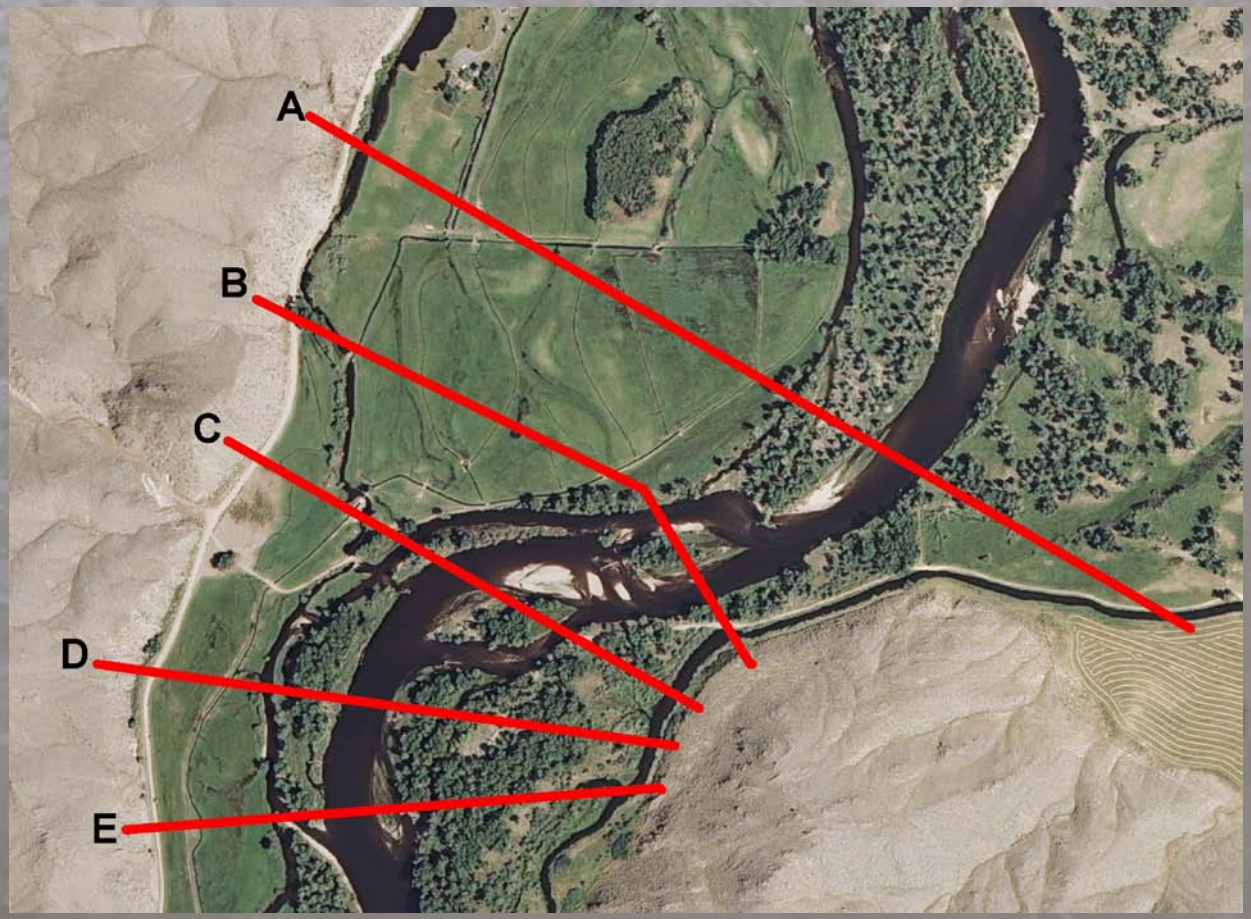


Office Investigation

- Review Topographic Data

Office Investigation

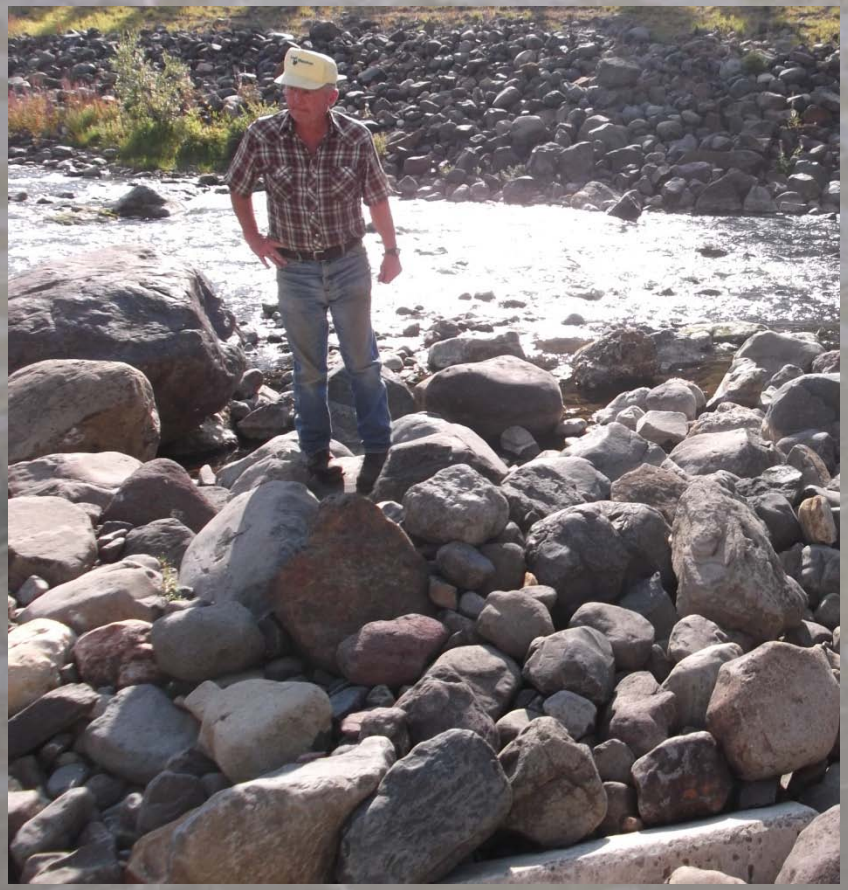
- Use data collected to layout cross sections and optimize field time.



Field Investigation

- What data needs to be collect during a field investigation.
  - Stream Bed Data
  - Manning's n values
  - Structure information
  - Surveyed Cross Sections

Stream Bed Data

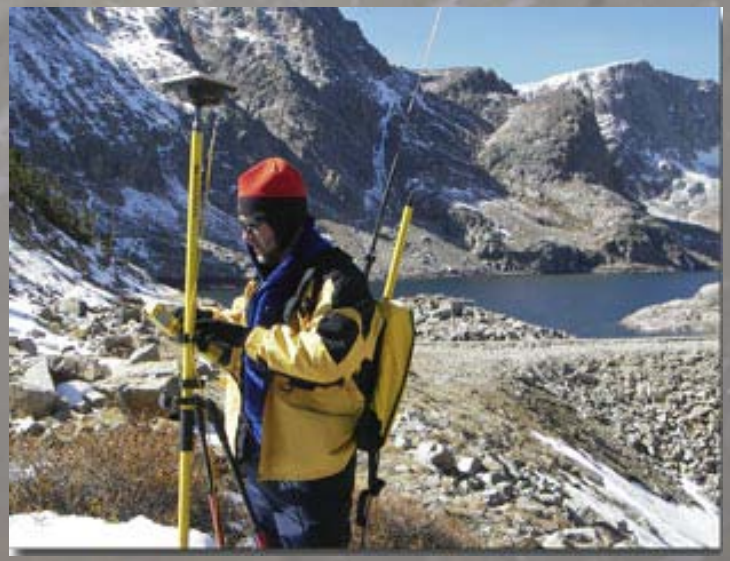


Manning's n

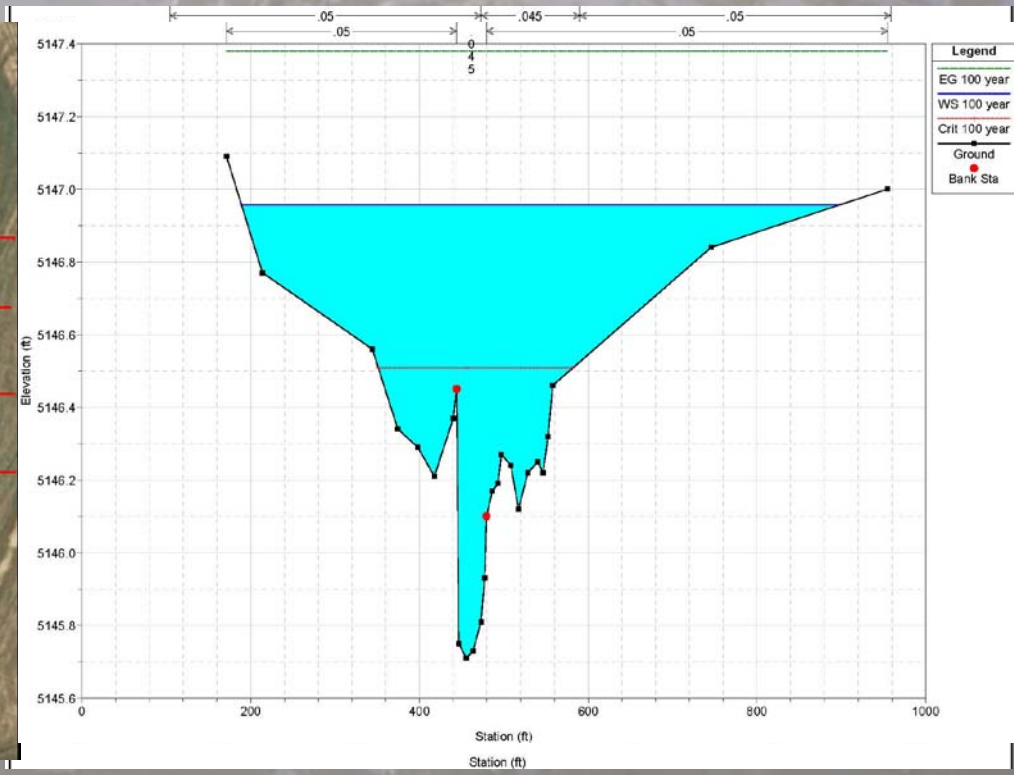
Structures

Cross Section Surveying

- What type of survey needs to be performed?
- Do I need to tie into an existing study?
- Do I have enough data to effectively model the floodplain.
- If I have problems with my model do I have enough budget to acquire additional cross sections.



Common cross section survey mistakes



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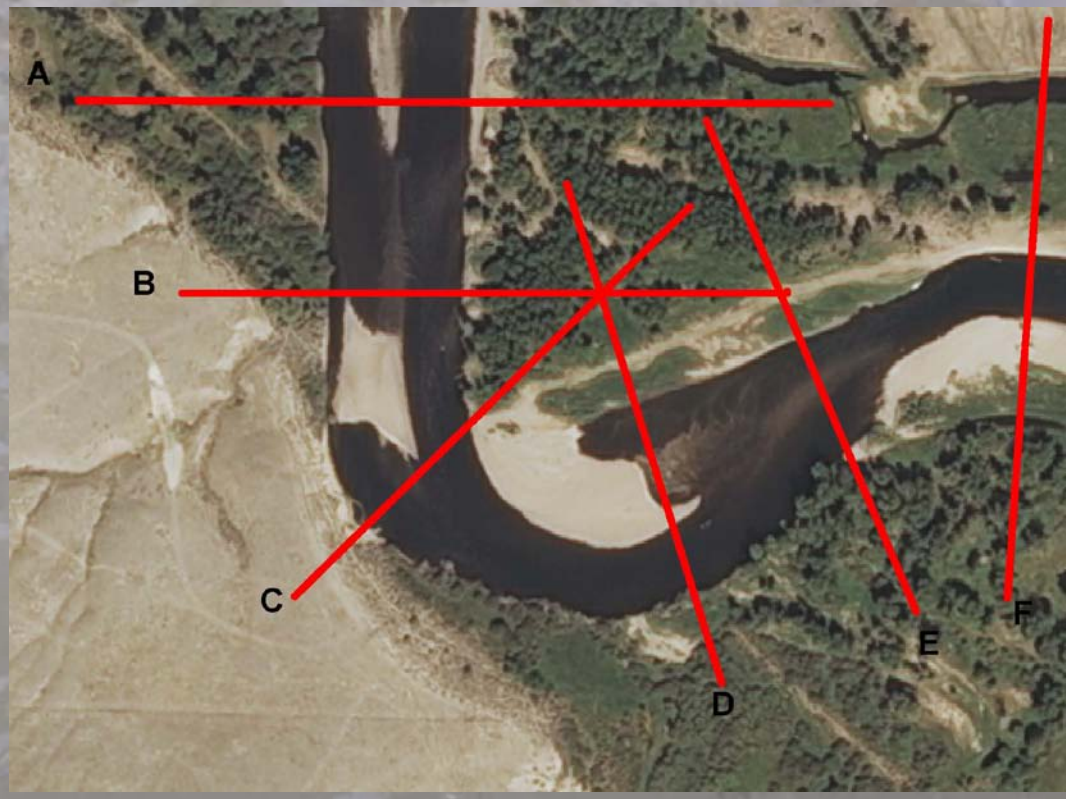
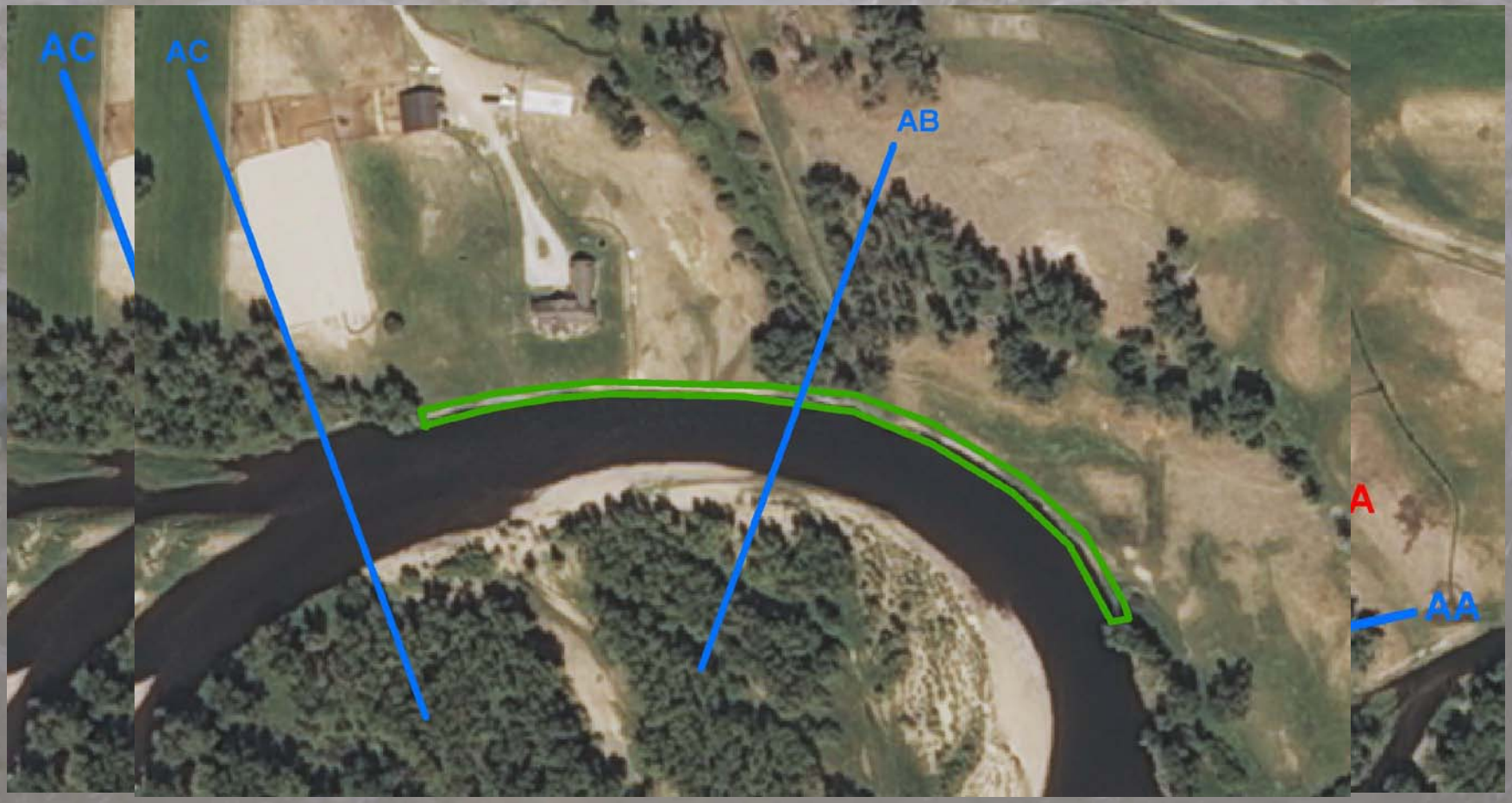


Common cross section survey mistakes

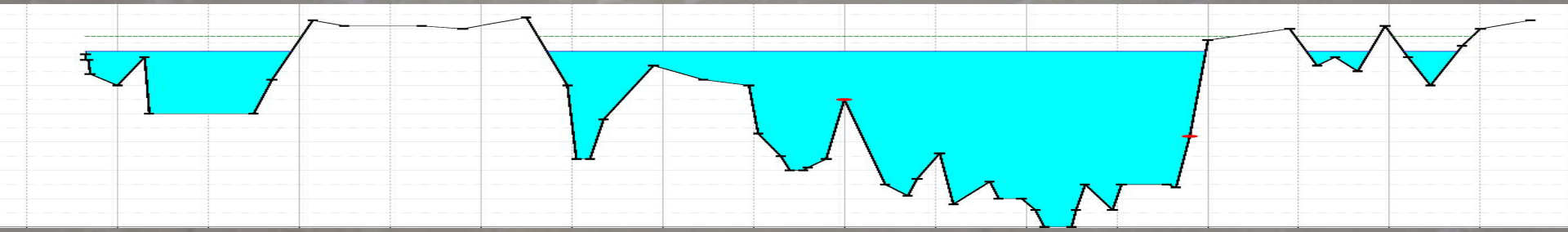
Common Cross Section Mistakes



Common cross section survey mistakes

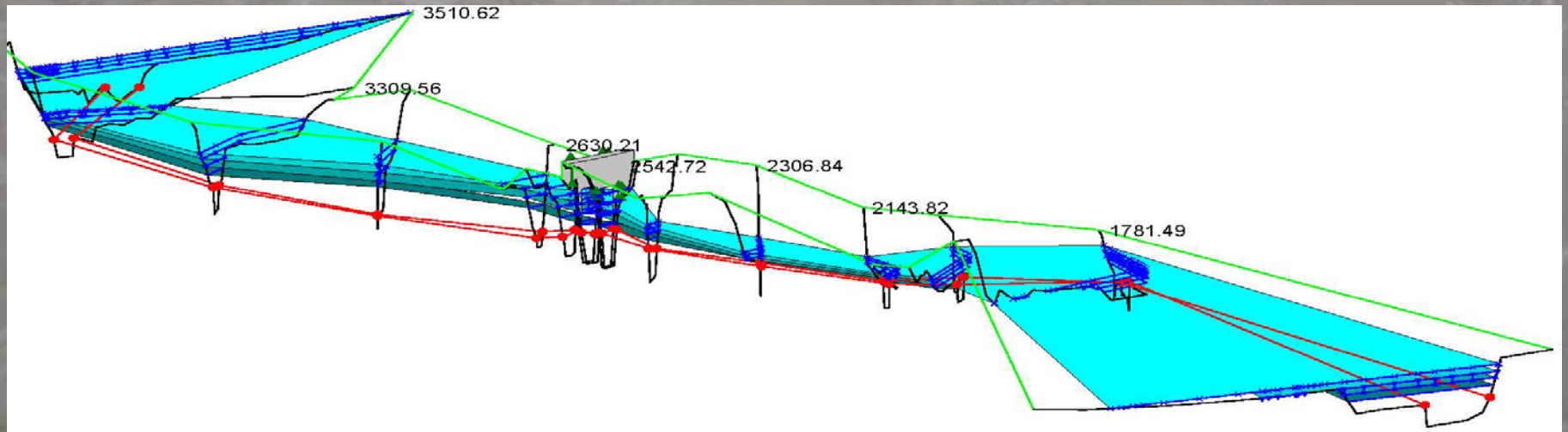
Modeling

- Why do I need to develop a model?
- A good model provides:
  - Information for stability calculations and other structural design criteria.
  - BFE comparisons
  - A method to evaluate various designs



Modeling

- It is very important as the modeler to have a grasp on how the project will likely be modeled even before performing the field surveys.
- Modeling efforts are very different between approximate A, limited detail, and detailed flood study areas.

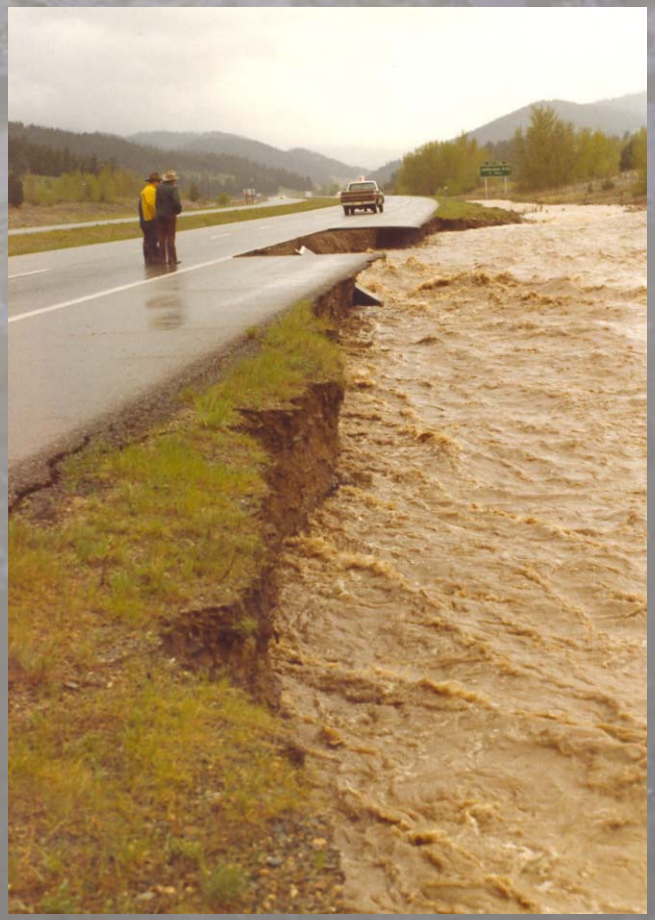


The feared CLOMR/LOMR

- If your design is causing a rise in the BFE, then to avoid having to submit for a CLOMR, modify the design accordingly. Remember the design still has to meet all required criteria for all involved communities and agencies.
- For some projects the CLOMR/LOMR submittal is unavoidable. If the applicant is aware of this during the scoping process then it should be less of a problem.
- This can be a tool the community can use to evaluate their flood hazards.

Stability

- Will this project withstand a 100-year flood event?
- Things to consider
  - Material Transport
  - Deposition
  - Scour
  - Peripheral Effects
  - River Avulsion



Material Transport

- Modes of Failure
  - Particle Erosion
  - Translational Slide
  - Modified Slump
  - Slump

Material Transport

- What analysis method should be used?
- Many different methods
  - ASCE
  - USBR
  - USGS
  - Isbash
  - Tractive Forces
  - Many Others
- Why should these analyses be performed?

$$D_{30} = S_f C_s C_v C_t K_1 d \left(\left(\frac{\gamma_w}{\gamma_s - \gamma_w} \right)^{0.5} \frac{V}{\sqrt{gd}} \right)^{2.5}$$

Where:

D_{30} = stone size, feet

S_f = Safety Factor (see description later in this section)
= 1.25 downstream of concrete channels, end of dikes, flow impingement

C_s = stability coefficient for incipient failure
= 0.30 for angular rock = 0.375 for rounded rock

C_v = vertical velocity distribution coefficient
= 1.0 for straight channels, inside of bends
= 1.283-0.2log(R/W), outside of bends (1 for R/W >26)
(see Figure 2.5 for a description of R/W)

C_t = thickness coefficient
= 1.0 for thickness = $1D_{100}$(max) or $1.5D_{50}$(max), whichever is greater

d = local depth of flow at same location as V, feet

g_s = unit weight of stone, lbs/ft^3

g_w = unit weight of water, lbs/ft^3

V = local depth averaged velocity, V_{ss} for sideslope riprap, ft/s

g = acceleration of gravity, ft/sec^2

K_1 = sideslope correction factor = 1 for bottom riprap
= $1.25 - 1.811/m + 3.343/m^2$ for sideslope riprap,
where m denotes the number of horizontal units per one vertical unit (?H:1V) of the sideslope.

Material Transport

Deposition

- Why should deposition be considered?
- Over time continued deposition can cause changes in the BFE's and/or affect surrounding land owners.
- Whose job is it to perform future maintenance on the project?

Deposition

Scour

- Why should I perform scour calculation?
- Scour is one of the most common failure modes.
- Scour repair is one of the most common types of bridge repair.
- Scour can occur upstream, downstream, above, below, in front of, and behind your project.

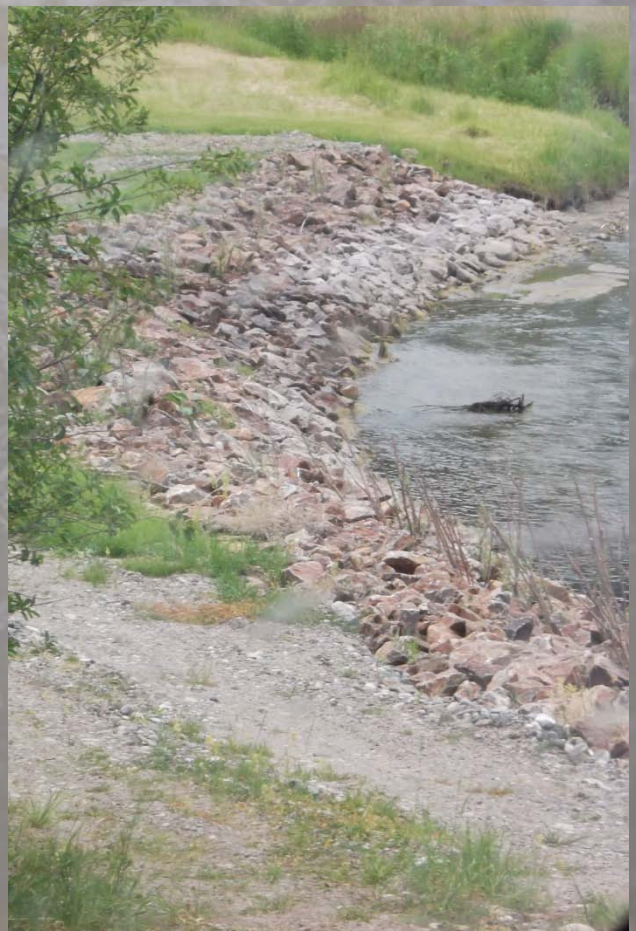
Scour

Scour

- There are many different analysis methods available.
- Analysis methods are specific to:
  - The size of the stream
  - The soils in and around the stream
  - Where on the stream a project is located
- It is the responsibility of the engineer to determine the appropriate method for a specific site.

Peripheral Effects

- How is the project going to affect conditions upstream, downstream and adjacent to the project?
- Bank stabilization projects can:
  - Increase or decrease stream velocities
  - Alter the stream's ability to transport sediments
  - Increase and/or decrease erosion and scour in the vicinity of the project.



Peripheral Effects

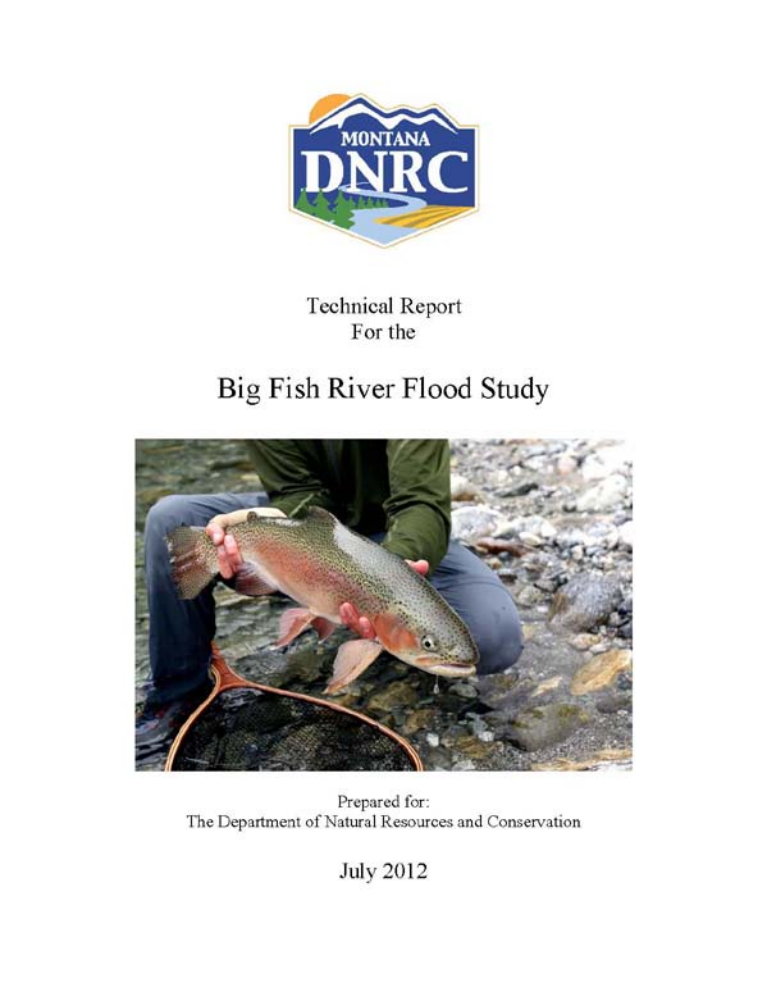
River Avulsion

- Why should avulsion of the river be considered?
- The river channel can migrate and cause damage to your project in the future.
- HEC-11 States: "In application, the depth of scour should be measured from the lowest elevation in the cross section. It is assumed that the low point in the cross section may eventually move adjacent to the riprap (even if this is not the case in the current survey)."

River Avulsion

Report

- What should a report for a floodplain related project include?
- A report should contain:
  - Project narrative
  - Design considerations
  - All Calculations
  - Modeling assumptions
  - Modeling Results
  - Electronic Copy of model
  - Certifications
  - Stamped copies of project drawings
  - Any other applicable information



Misconceptions

- There is a misconception that the DNRC only endorses hard bank stabilization techniques, i.e. rip rap.
- The DNRC does not endorse one type of design over another, in fact we encourage innovative designs that incorporate a variety of methods and materials.

Misconceptions

- The applicant and the consultant drive the type of design.
- The engineer works within the parameters set by the applicant and the requirements of the applicable regulations.

Responsibility

- The engineer is responsible for their design.
- The community is responsible for ensuring that a project meets the criteria in their ordinances and in the NFIP.
- If a community approves a permit that does not meet the criteria outlined in the NFIP they could be responsible for any costs associated with bringing that project into compliance.

Responsibility

- Why does an engineer need to stamp our project?
- By stamping a project an engineer is saying they have the appropriate experience to do the design, they have performed all the necessary analysis, and they are liable for any deficiencies associated with their design.

Code of Ethics for Engineers

National Society of Professional Engineers®

III. Professional Obligations

Engineers, in the fulfillment of their professional duties, shall:

2. Engineers shall perform services only in the areas of their competence.

b. Engineers shall not complete, sign, or seal plans and/or specifications that are not in conformity with applicable engineering standards. If the client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further service on the project.

signed and sealed only by the qualified engineers who prepared the segment.

Summary

- Know what you are getting into before you bid a project in the floodplain.
- Inform the client of all potential costs and timelines before you begin.
- Know your responsibility to the community, your self and the applicant.

Questions