



South Dakota Large Scale (Automated) Engineering & Base Level Engineering

AMFM March 2017



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Why are we here?

Consider these areas...



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Agenda

- ▶ **What is Large Scale Automated Engineering (LSAE) and Base Level Engineering**
- ▶ **Methodology**
- ▶ **Mapping**
- ▶ **Options for Community**
- ▶ **Outreach and Meetings**



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New Risk Assessment Methodology

- ▶ Large Scale Automated Engineering (LSAE) with regulatory upgrades to achieve Base Level Engineering (BLE)
- ▶ 2 Dimensional modeling (HEC-RAS 5.0.1)
- ▶ Rain on Grid
- ▶ Base Flood Elevations (BFEs) are available for multiple return periods as water surface elevations grids
- ▶ Resulting floodplains meet FEMA G&S for Approximate-level studies (Zone A – ready)
- ▶ Enhanced products to facilitate better decisions at the community level.



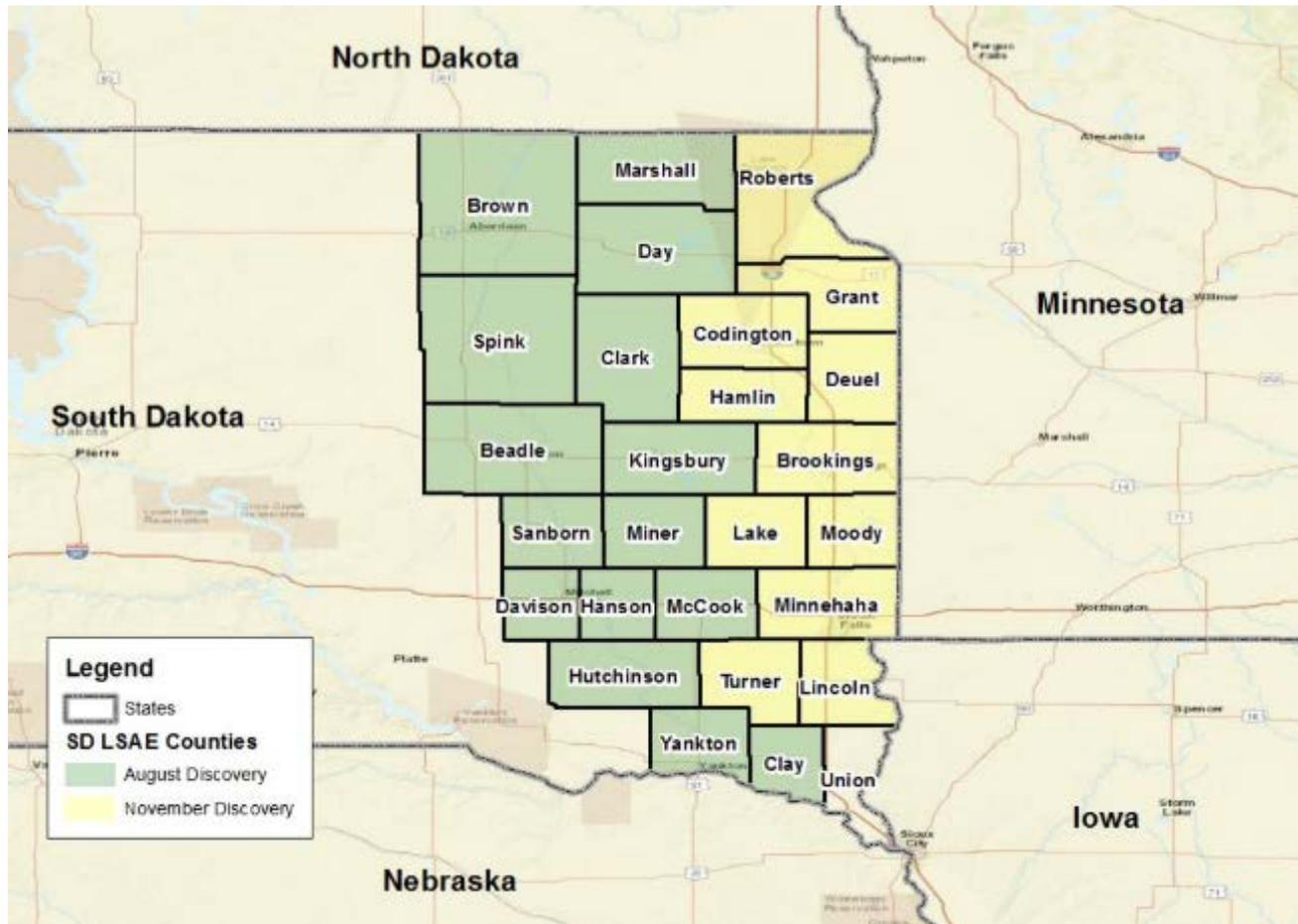
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RiskMAP
Increasing Resilience Together

South Dakota Project Area

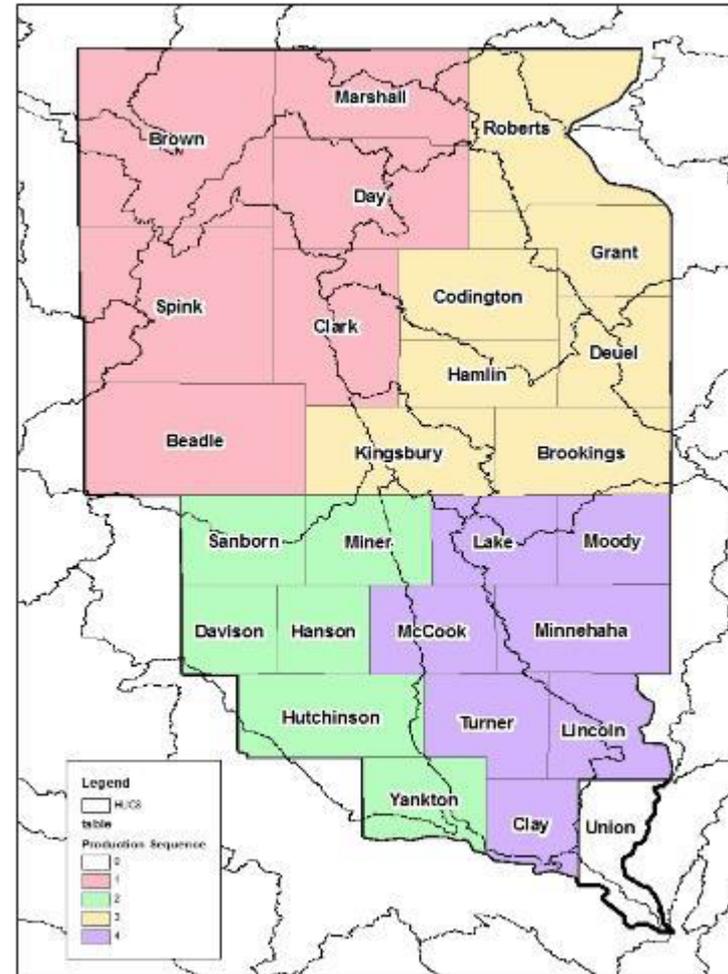
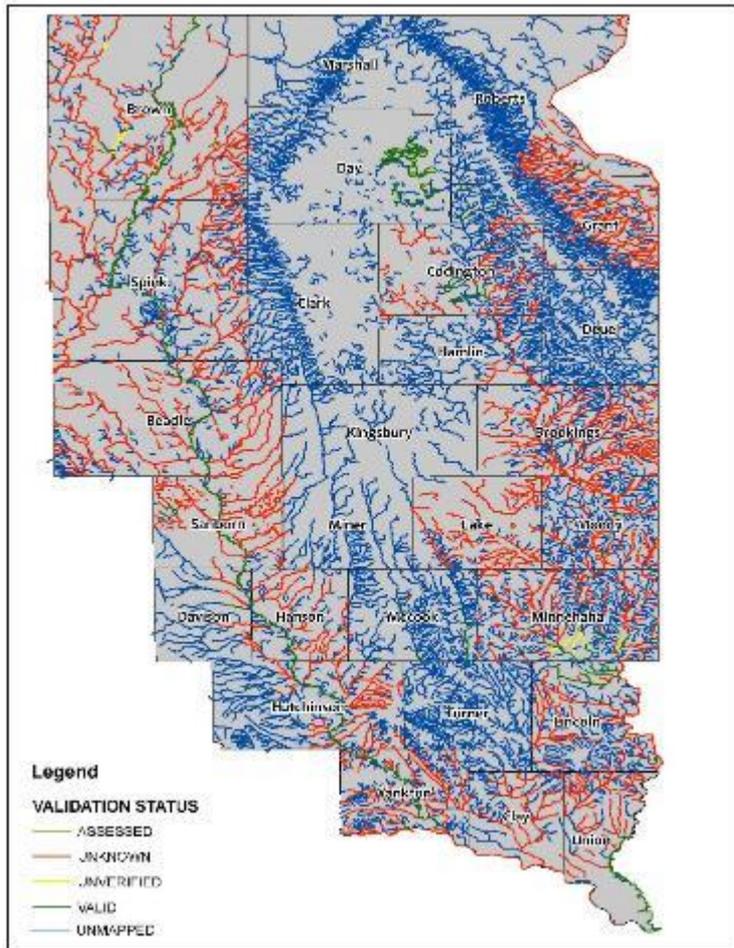


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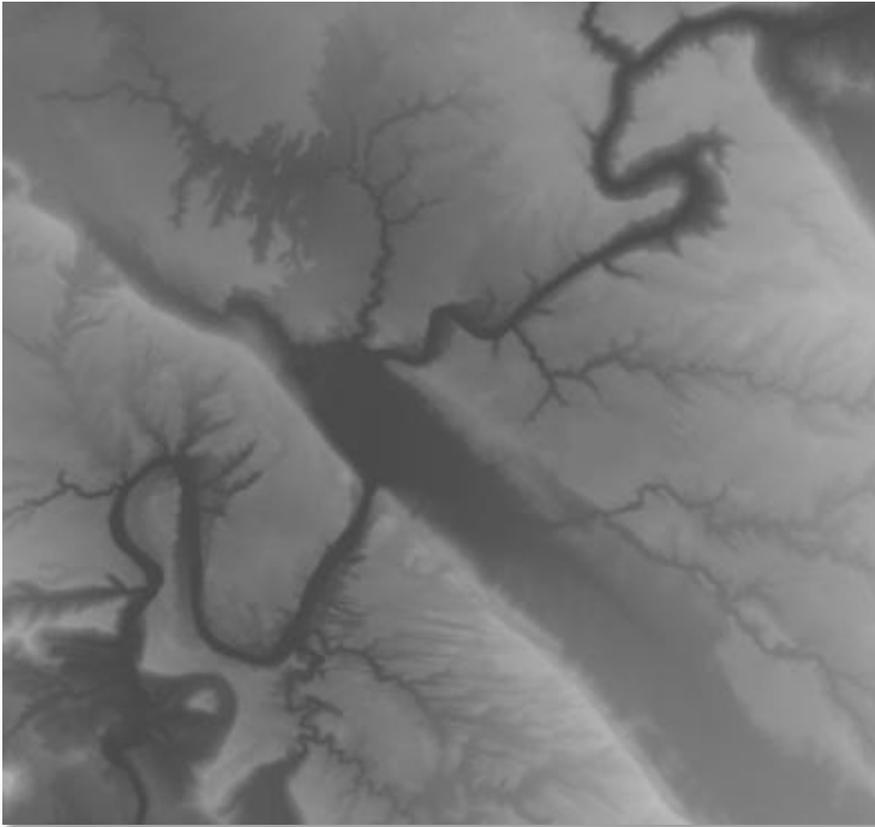
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South Dakota project area and sequencing



Base Level Engineering Methodology

Non-model backed Zone A's on 10m DEM



2D HEC-RAS 5.0.1 on high-res LiDAR



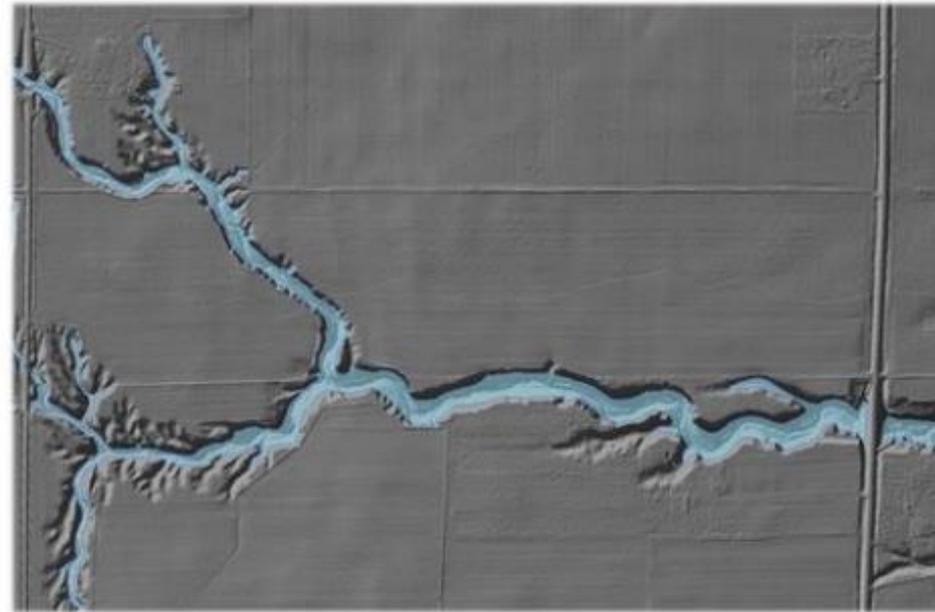
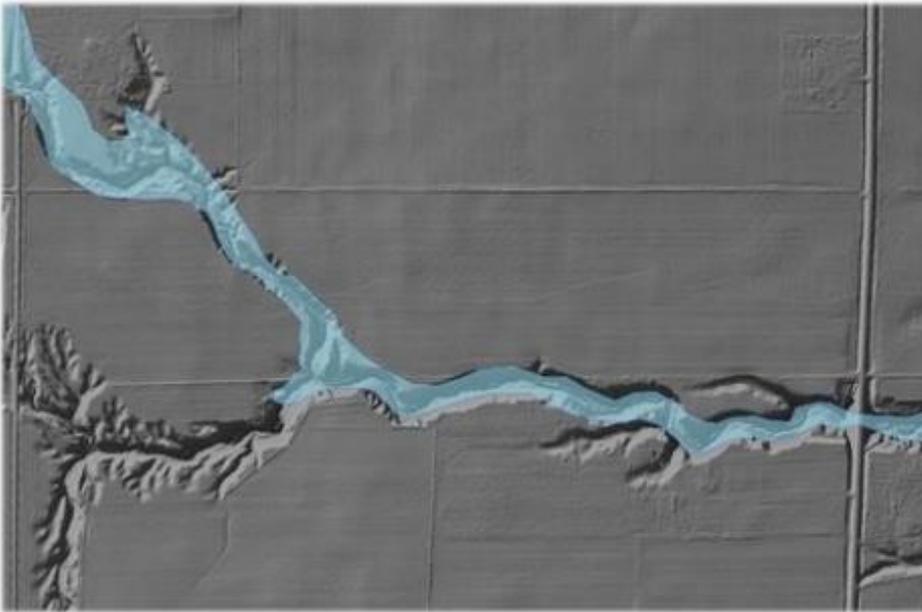
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Base Level Engineering Methodology

Non-model backed Zone A's on 10m DEM

2D HEC-RAS 5.0.1 on high-res LiDAR

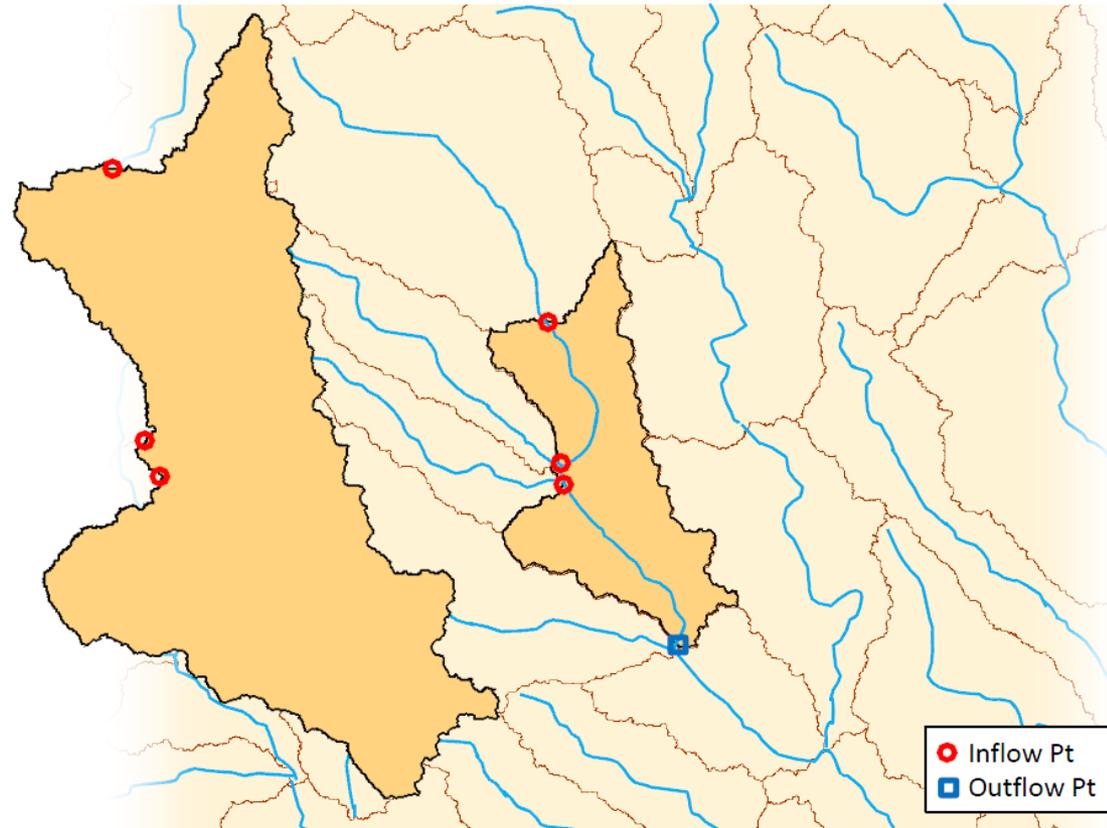


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Base Level Engineering Methodology

Identify Study Area

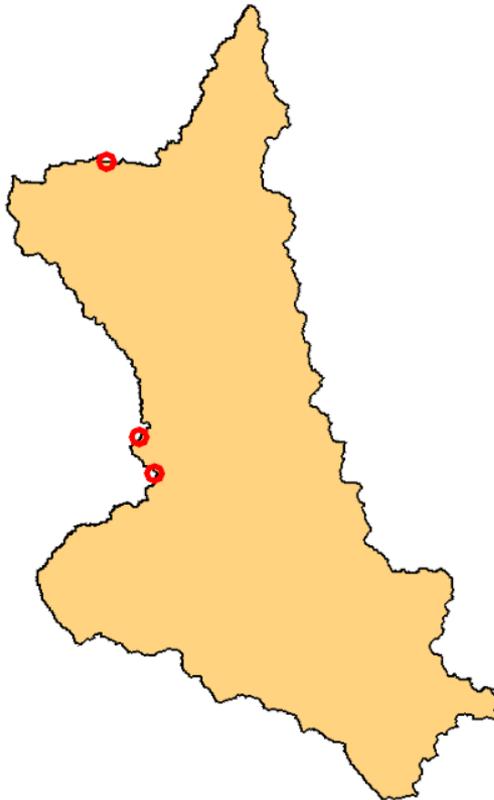


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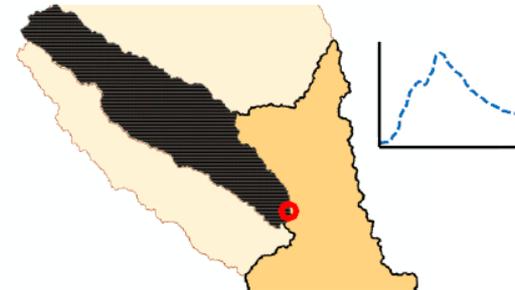
Base Level Engineering Methodology

Model Inputs (Hydrology)



INFLOW HYDROGRAPHS

- Option 1: Use outflow hydrographs from upstream 2D model as inflow



- Option 2: Generate hydrographs from simple HEC-HMS models

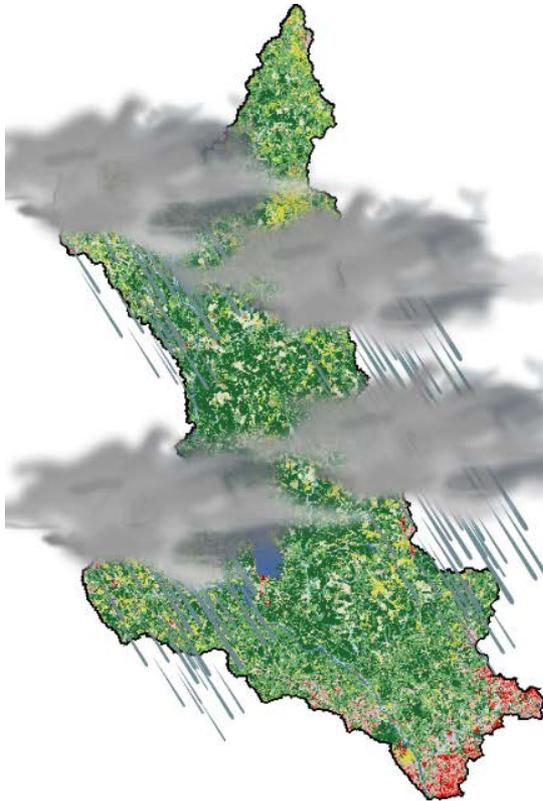


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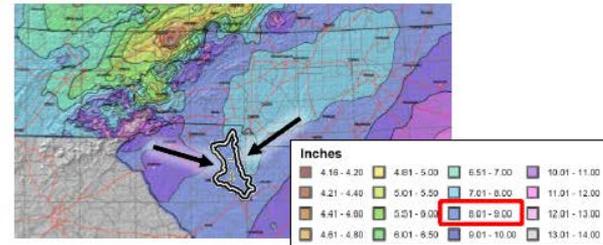
Base Level Engineering Methodology

Model Inputs (Hydrology)

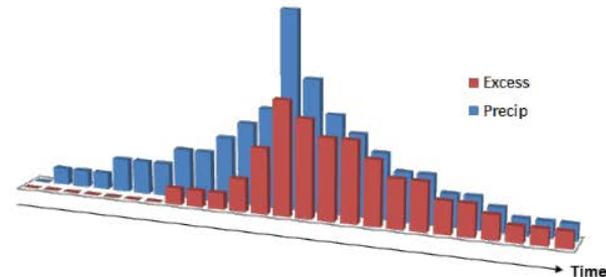


PRECIPITATION (RAIN-on-GRID)

- NOAA Precipitation Frequency Data Server or Atlas 14



- Simple HEC-HMS model developed to determine excess rainfall to apply within the 2D model (HEC-RAS 5.0)

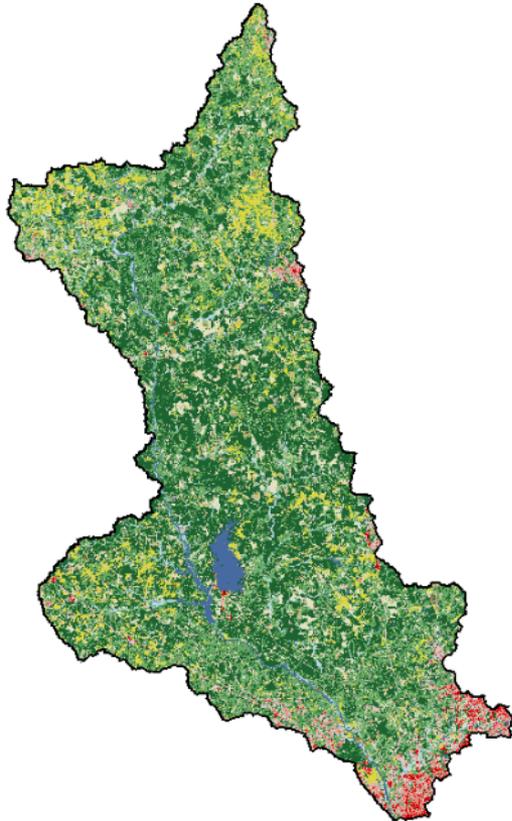


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Model Inputs (H&H)



LAND USE & SOILS

- Land Use: National Land Cover Database (2011)
- Soils: NRCS Web Soil Survey
- Used as an input in all HEC-HMS models to support the calculation of Curve Numbers and Lag Times
- Also used within the 2D model to estimate roughness values

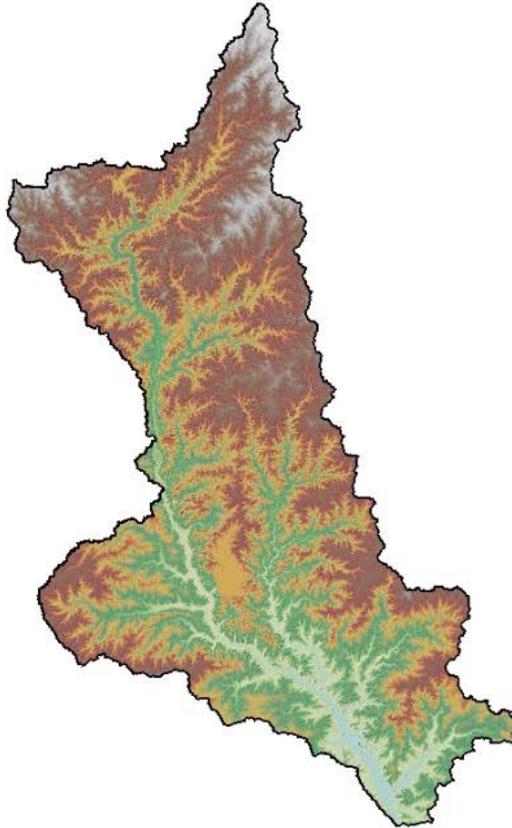


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Model Inputs (Hydraulics)



TERRAIN

- LiDAR most common source
- Terrain grid resolution used in 2D model preferably 10 ft or smaller

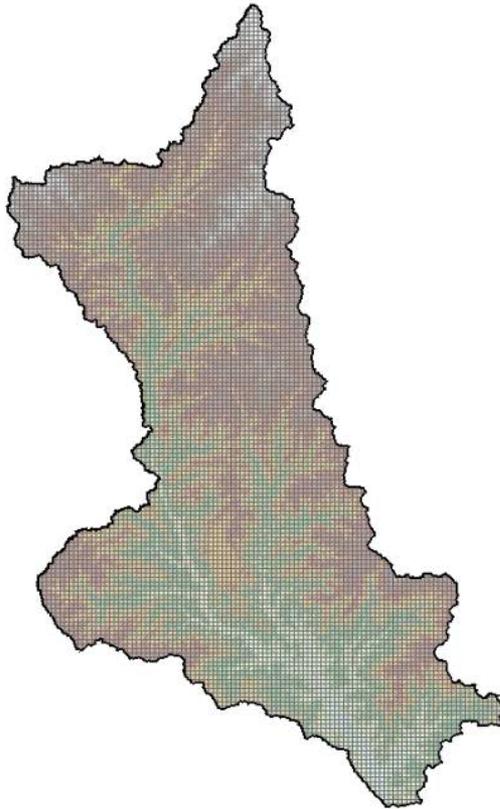


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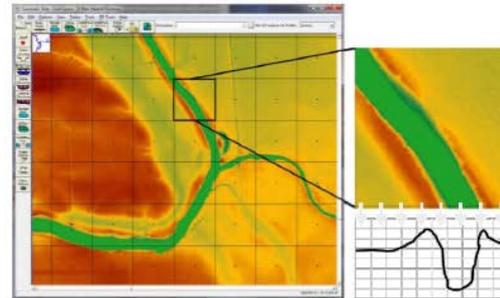
Base Level Engineering Methodology

Model Inputs (Hydraulics)



MODEL PARAMETERS

- Cell Size: Start at 200 ft and then decrease as necessary during model iterations



- Other parameters and settings may vary and be adjusted from model-to-model, or iteration-to-iteration, based on model specifics and stability

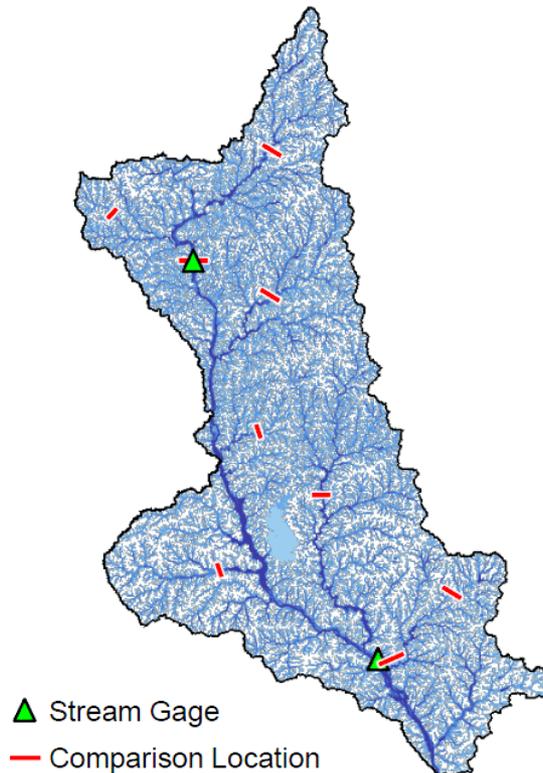


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Model Verification



REASONABILITY CHECKS

- Multiple comparison check locations added to the 2D model (at gages and other representative locations within the study area)
- 1% annual chance peak discharges, WSELs, and/or flood boundaries from 2D model compared with other available data at these locations (gage analysis, regression equations, effective study*, etc.)

*age and level of detail of effective study are taken into consideration when weighing comparisons

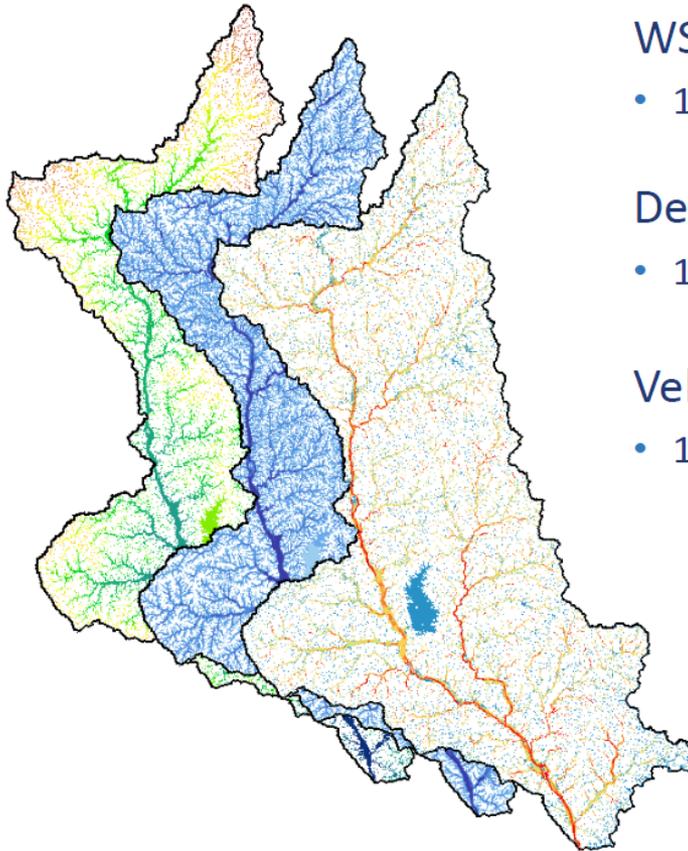


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Model Outputs



WSEL Grids

- 10%, 4%, 2%, 1%, 0.2%, 1%+, 1%-

Depth Grids

- 10%, 4%, 2%, 1%, 0.2%, 1%+, 1%-

Velocity Grids

- 1% (others as needed)



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Base Level Engineering Methodology

Regulatory Upgrades – County-based Deliverables

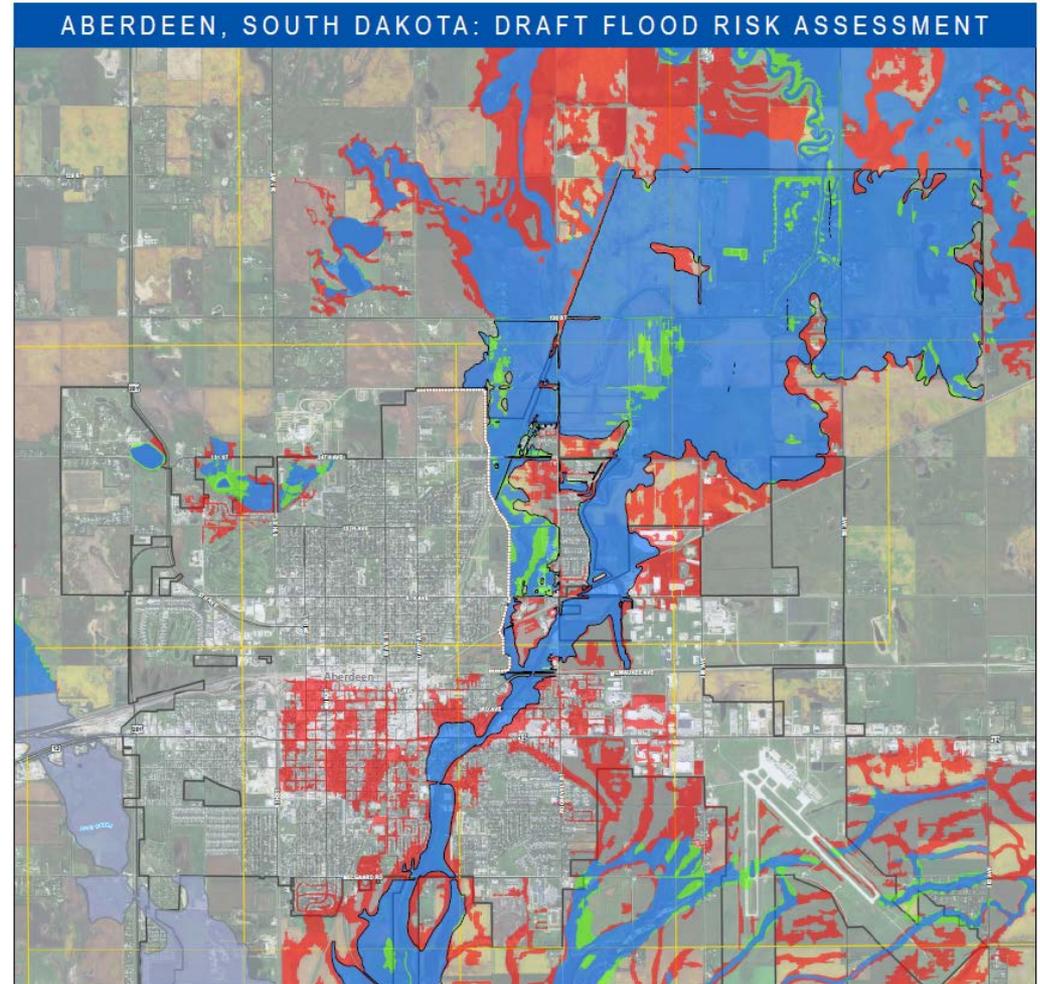
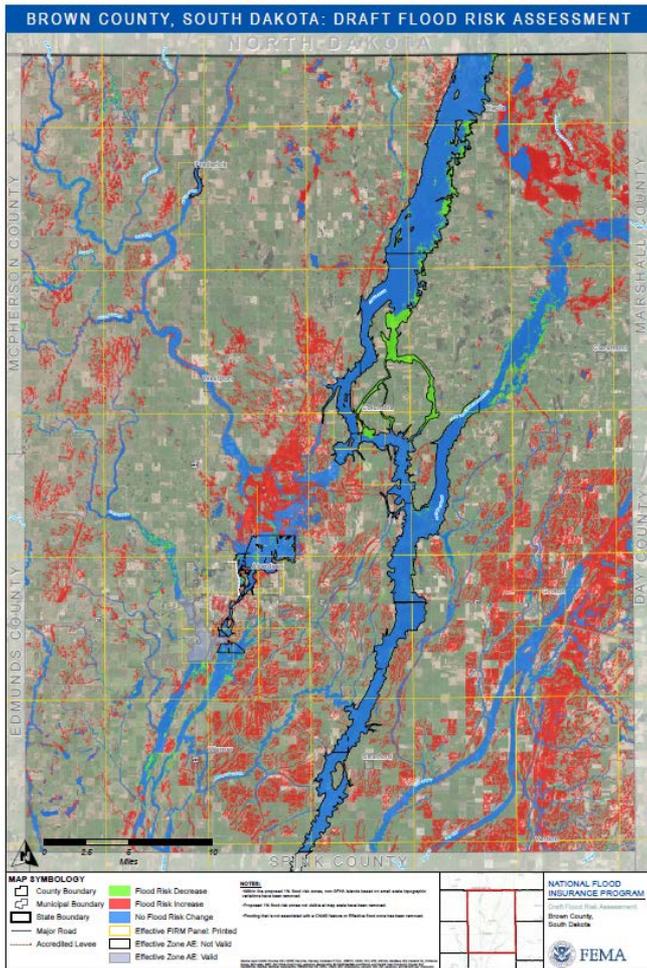
- Terrain DEM
- HEC-RAS model
- HEC-HMS model(s)
- GIS file geodatabase
 - WSEL grids (10%, 4%, 2%, 1%, 0.2%, 1%+, 1%-)
 - Depth grids (10%, 4%, 2%, 1%, 0.2%, 1%+, 1%-)
 - Velocity grid (1%)
 - SFHA polygons
 - Changes Since Last FIRM (where applicable)
 - Land Cover data used in model
- Report
 - Summary of Scope & Methods (CN, Lag, Manning's N Values, Precipitation, Boundary Conditions)
 - CNMS Validation



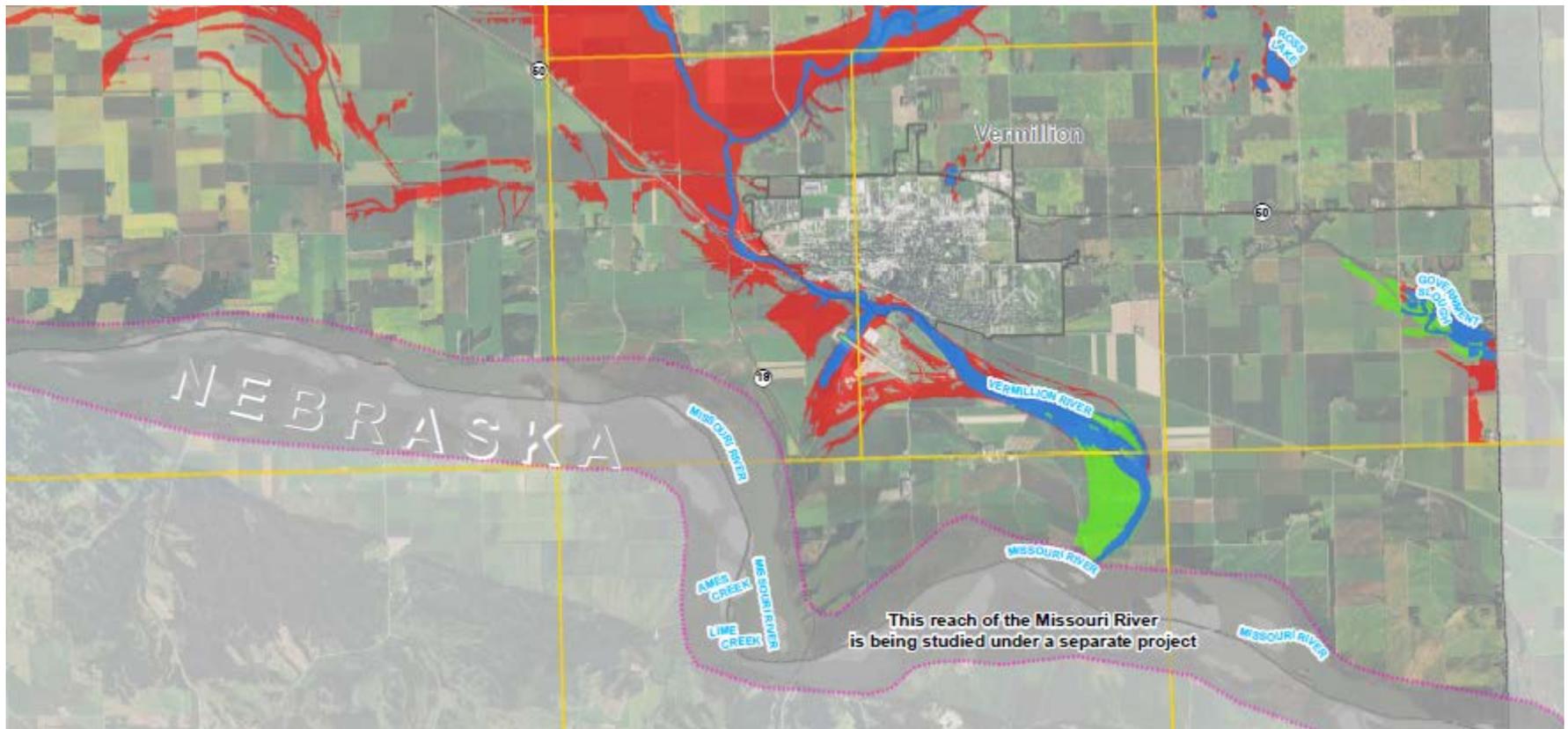
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Base Level Engineering Mapping



BLE & On-Going Existing Study Areas



There are three main options for communities to consider



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Mapping Process (Option #1)

Assessment
of existing

Discovery
Meeting

Refine the Results

Create Flood
Insurance
Products

Follow the Quality
Review Process

Provide the
Products to
Communities



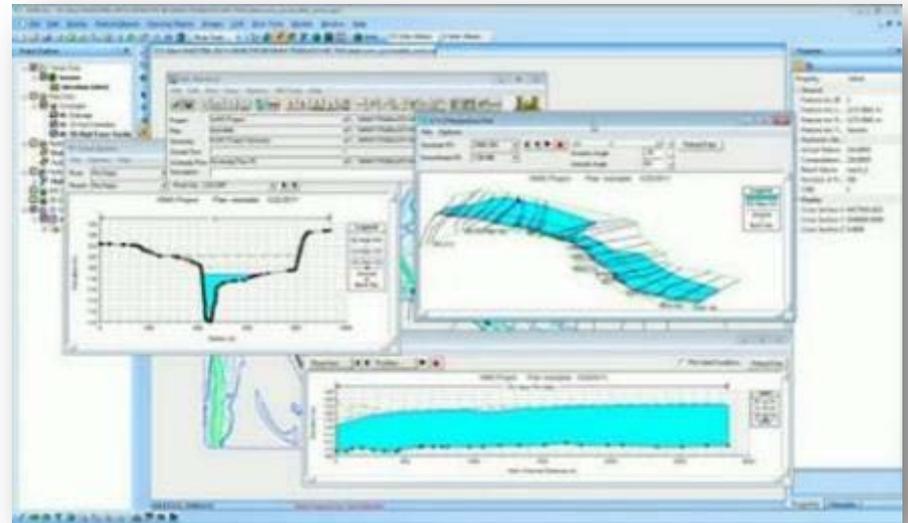
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Base Level Engineering Deliverables

- **Hydrologic Calculations for multiple events**
 - 10%, 4%, 2%, 1% and 0.2% water surface elevations
- **HEC-RAS Hydraulic modeling for these events**
 - Modeling for multiple return periods including the 10%, 4%, 2%, 1% and 0.2% profiles!

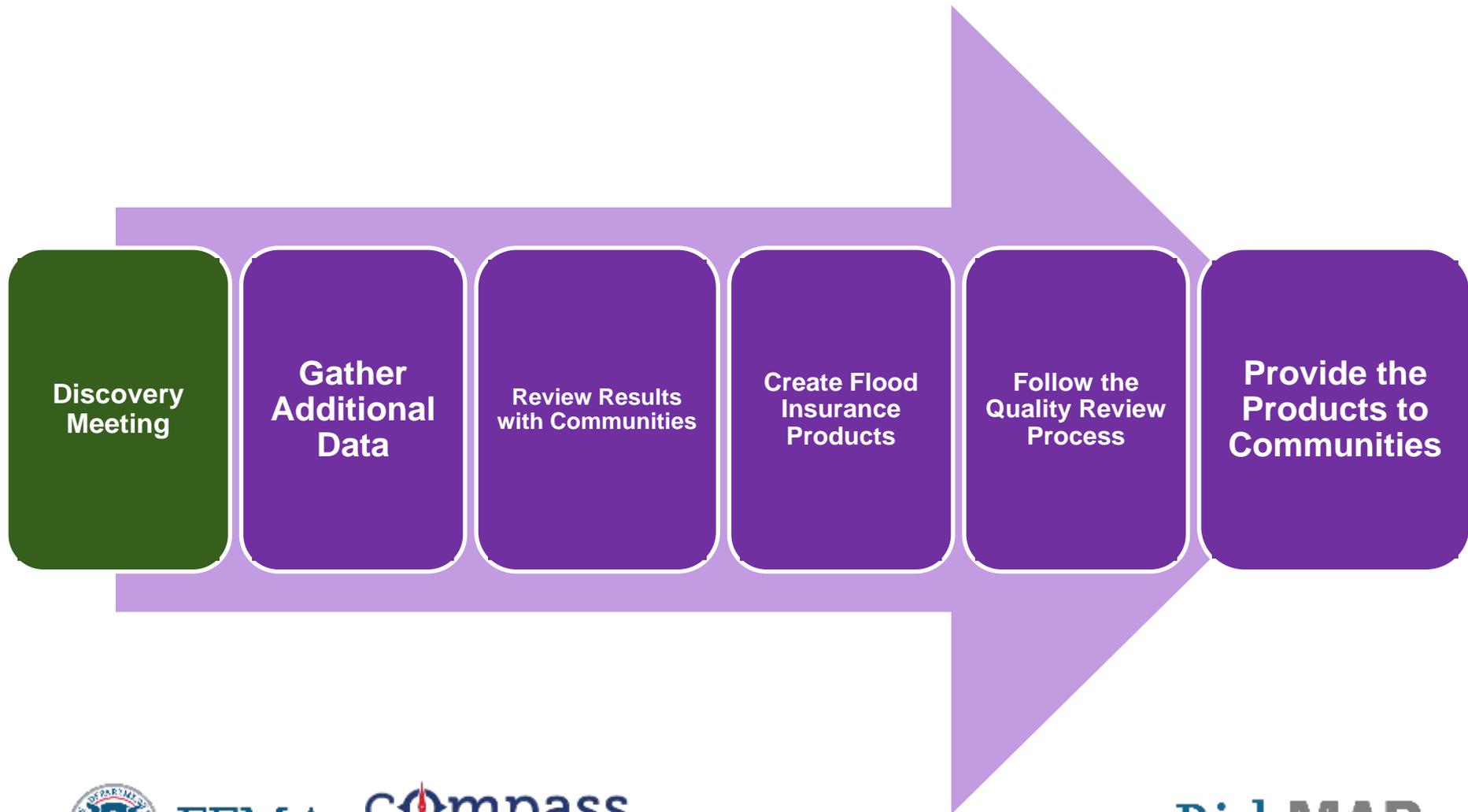


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Mapping Process (Option #2)

New Detailed Study



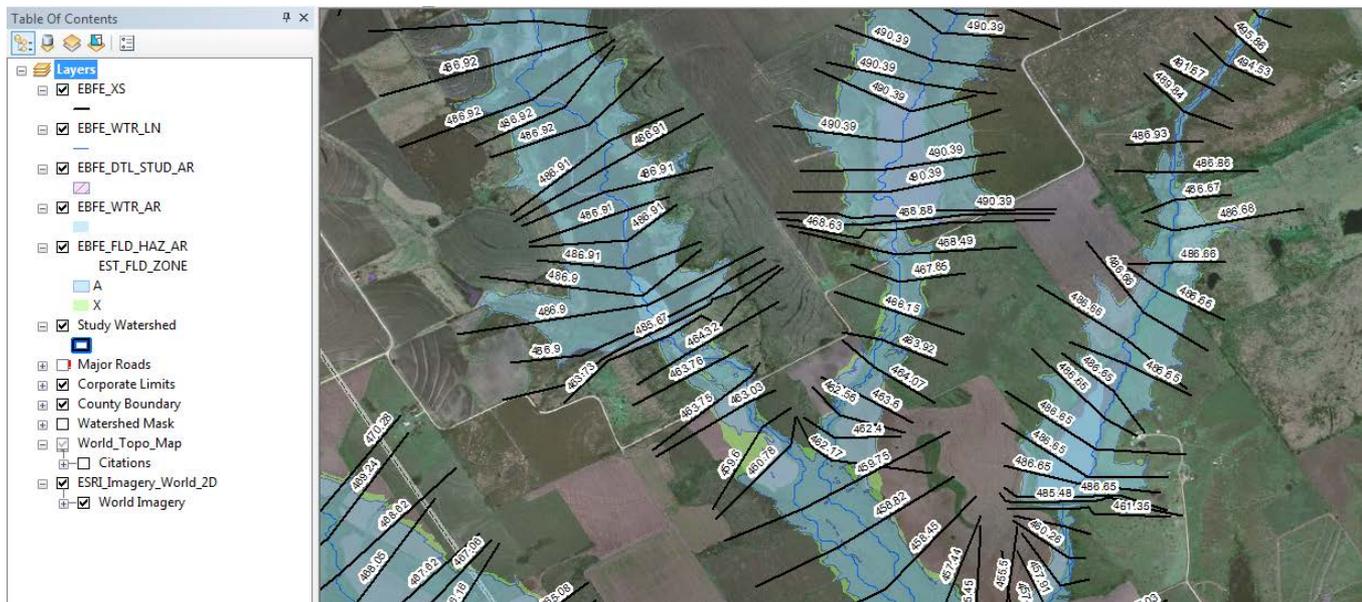
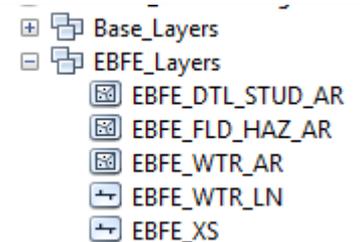
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Detailed Study?

- **Floodplains with annotated cross-sections**
 - 10%, 1% and 0.2% floodplains prepared and available in GIS format

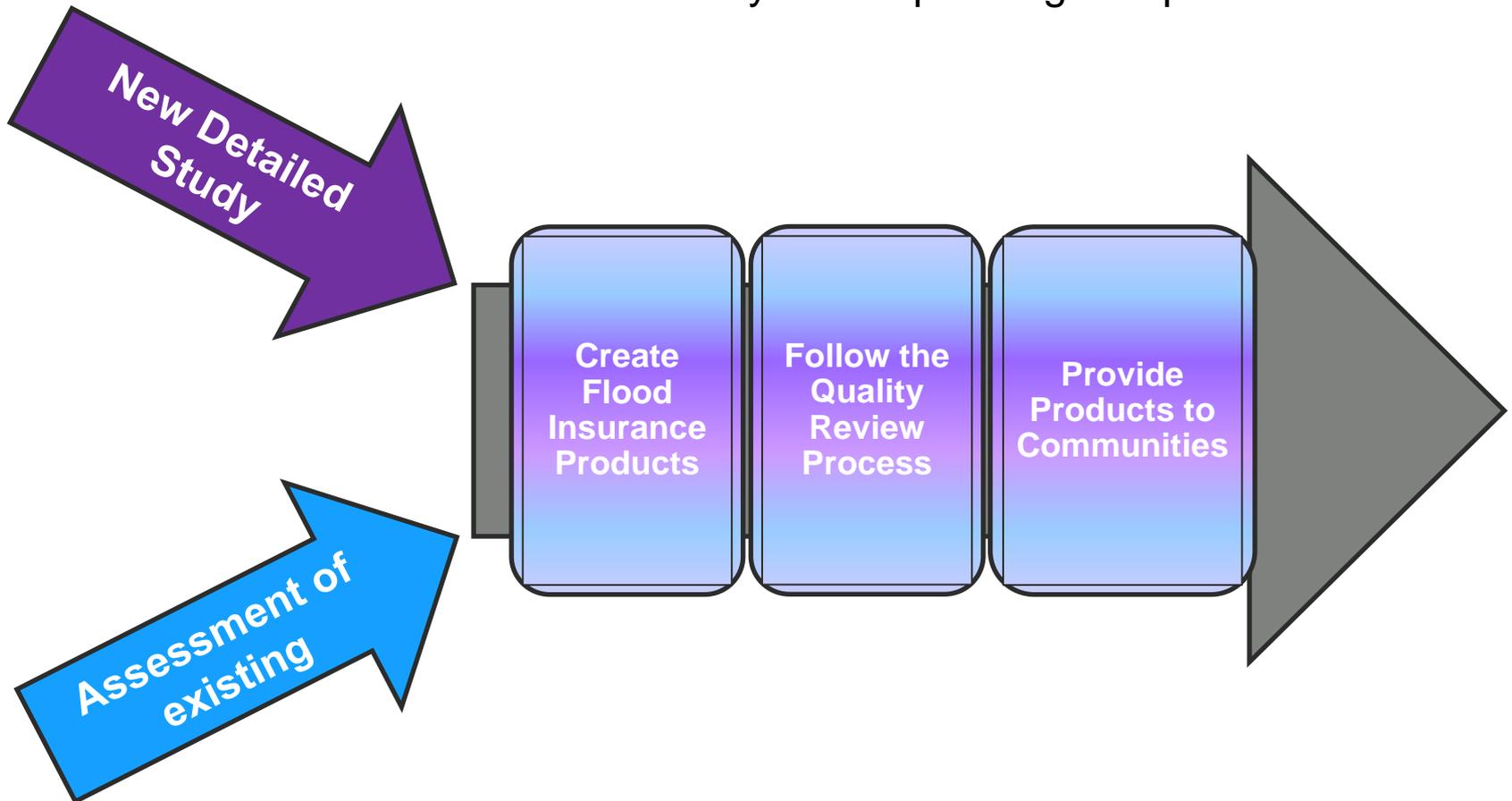


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Project Phases

Timeline: 3-7 years depending on option chosen



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Mapping Process (Option #3)

Best Available

Discovery Meeting

Review Results with Communities

Follow the Quality Review Process

Provide the Products to Communities



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Outreach and Meetings

Week 1	Team #1			Team #2			Team #3		
	Location	County	Meeting Time	Location	County	Meeting Time	Location	County	Meeting Time
14-Jun	Sioux Falls	Minnehaha & Lincoln	10:00 AM	Sioux Falls	Minnehaha & Lincoln	10:00 AM	Sioux Falls	Minnehaha & Lincoln	10:00 AM
	Vermillion	Clay	2:00 PM	Parker	Turner	2:00 PM	Flandreau	Moody	1:30 PM
15-Jun	Yankton	Yankton	10:00 AM	Salem	McCook	10:00 AM	Brookings	Brookings	9:00 AM
	Parkston	Hutchinson	2:00 PM	Alexandria	Hanson	2:00 PM	Estelline	Hamlin	2:00 PM
16-Jun	Mitchell	Davison	10:00 AM	Howard	Miner	10:00 AM	Clear Lake	Deuel	9:00 AM
	Woonsocket	Sanborn	2:00 PM	De Smet	Kingsbury	2:00 PM	Watertown	Codington	2:00 PM
17-Jun	Huron	Beadle	9:00 AM	Madison	Lake	9:00 AM	Milibank	Grant	9:00 AM

Week 2	Team #4		
	Location	County	Meeting Time
21-Jun	Redfield	Spink	1:00 PM
22-Jun	Aberdeen	Brown	9:00 AM
	Britton	Marshall	2:00 PM
23-Jun	Sisseton	Roberts	9:00 AM
	Webster	Day	2:00 PM
24-Jun	Clark	Clark	9:00 AM



Questions?

Comments?

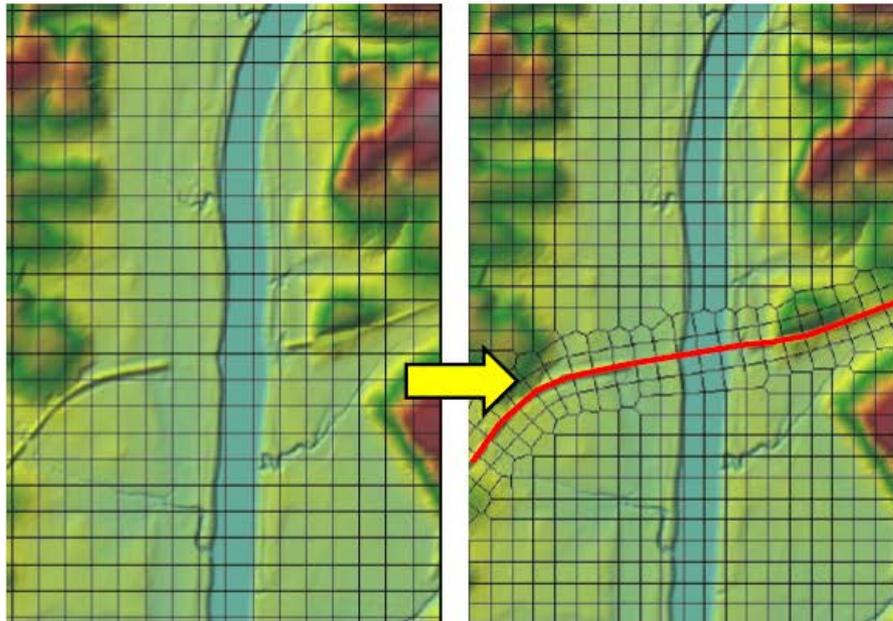


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Base Level Engineering Methodology

Regulatory Upgrades – 2D Model Enhancements



SIGNIFICANT HYDRAULIC CROSSINGS

- Breaklines added at select locations within the 2D mesh to improve hydraulic calculations
- Generally limited to large or significant features, as determined by the modeling engineer



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Regulatory Upgrades – 2D Model Enhancements



INTERNAL CONNECTIONS

- Internal connections with culverts added as needed to help water flow through large impoundments (e.g. dams, other embankments, etc.)



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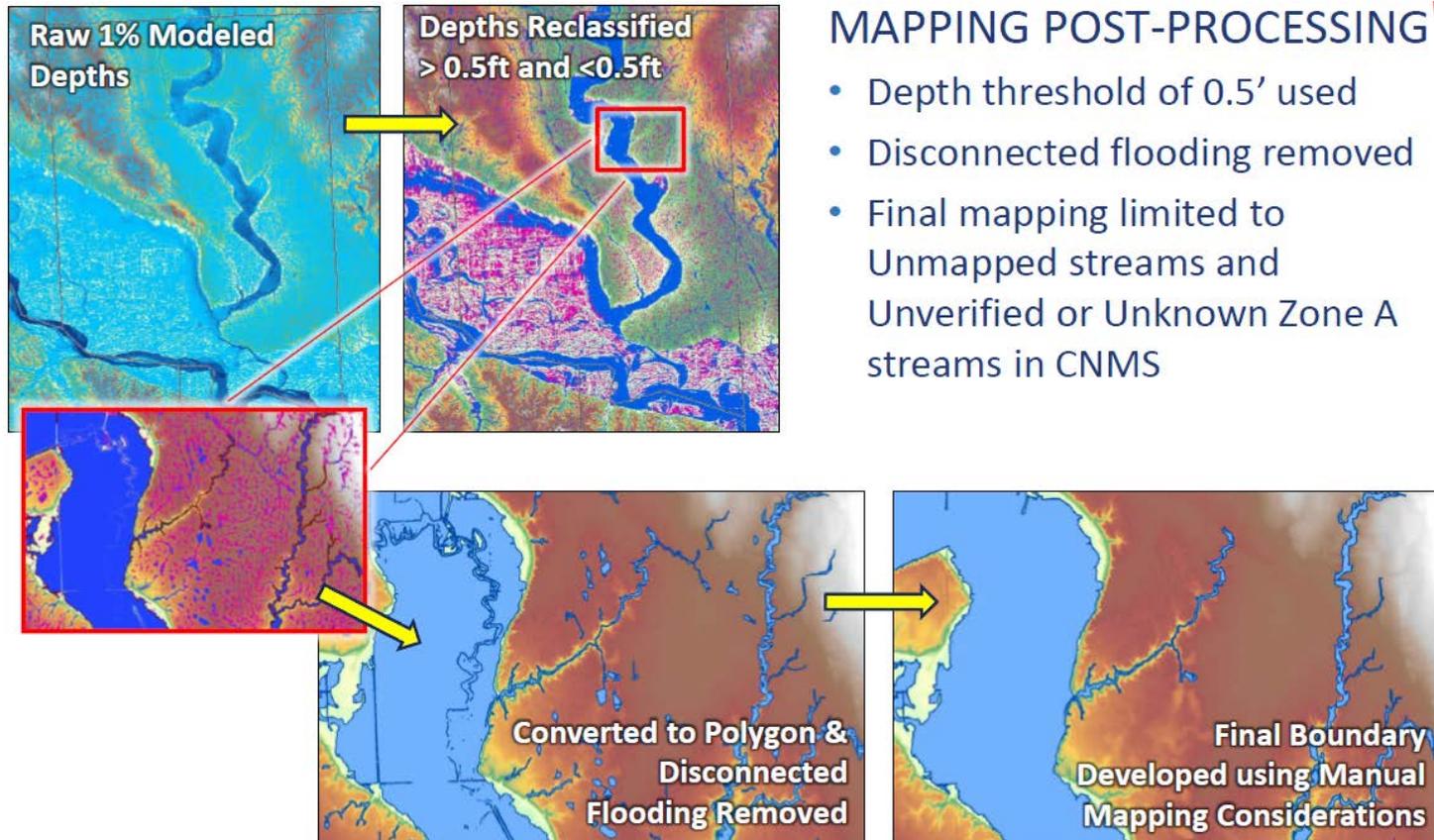
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Regulatory Upgrades – Floodplain Mapping



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