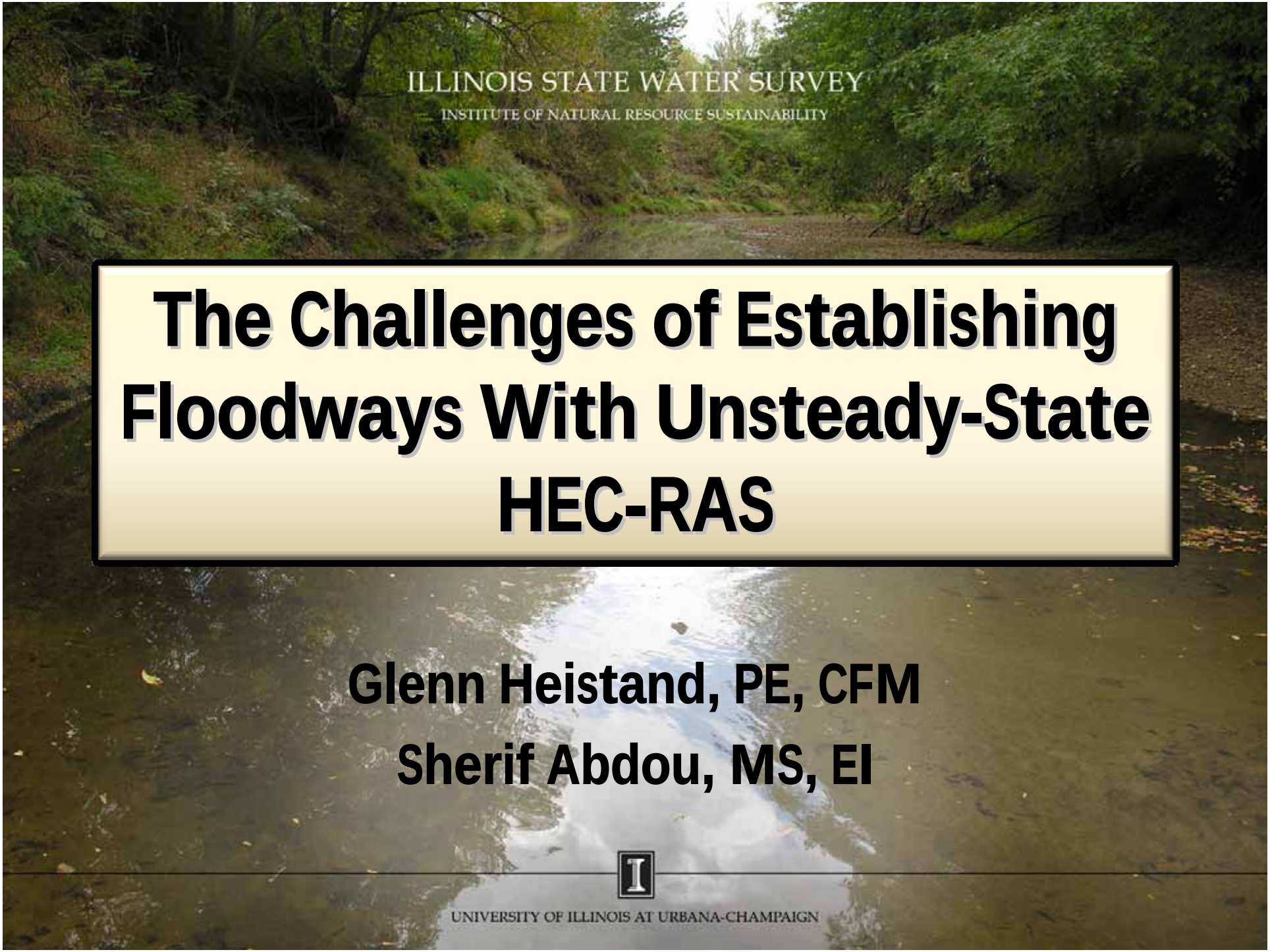

ILLINOIS STATE WATER SURVEY

INSTITUTE OF NATURAL RESOURCE SUSTAINABILITY

The Challenges of Establishing Floodways With Unsteady-State HEC-RAS

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Presentation Overview

Glenn

- Why is ISWS working with Unsteady FWs?
- Official Guidance for Unsteady FWs
- Dual-Model Approach

Sherif

- Converting HEC-RAS from Unsteady to Steady
- Steady Model Calibration
- FW Analysis in Steady Model

Glenn

- Unsteady Floodway Challenges and Problems
- Questions/Answers

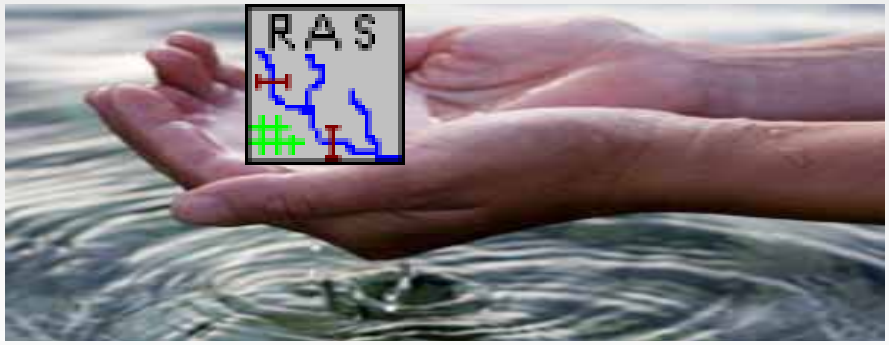
Why Unsteady?

Illinois State WATER SURVEY

Physical Map Revision (PMR)

Detailed Watershed Plan (DWP)

FEMA



MWRDGC

MWRDGC HEC-RAS Models:

- Developed for storm water management analysis and design
- 321 Linear miles of streams

Watersheds:

- Calumet Sag Channel
- Little Calumet River
- Upper Salt Creek
- North Branch Chicago River

Cook County

Unsteady FW Modeling Guidance

1. FEMA Guidelines and Specifications for Flood Hazard Mapping Partners (November 2009), Section C.4.4.1, Floodway Determination Using Unsteady State Modeling.

2. HEC-RAS User's Manual (HEC, 2010), Chapter 10, Floodway Encroachments with Unsteady Flow.

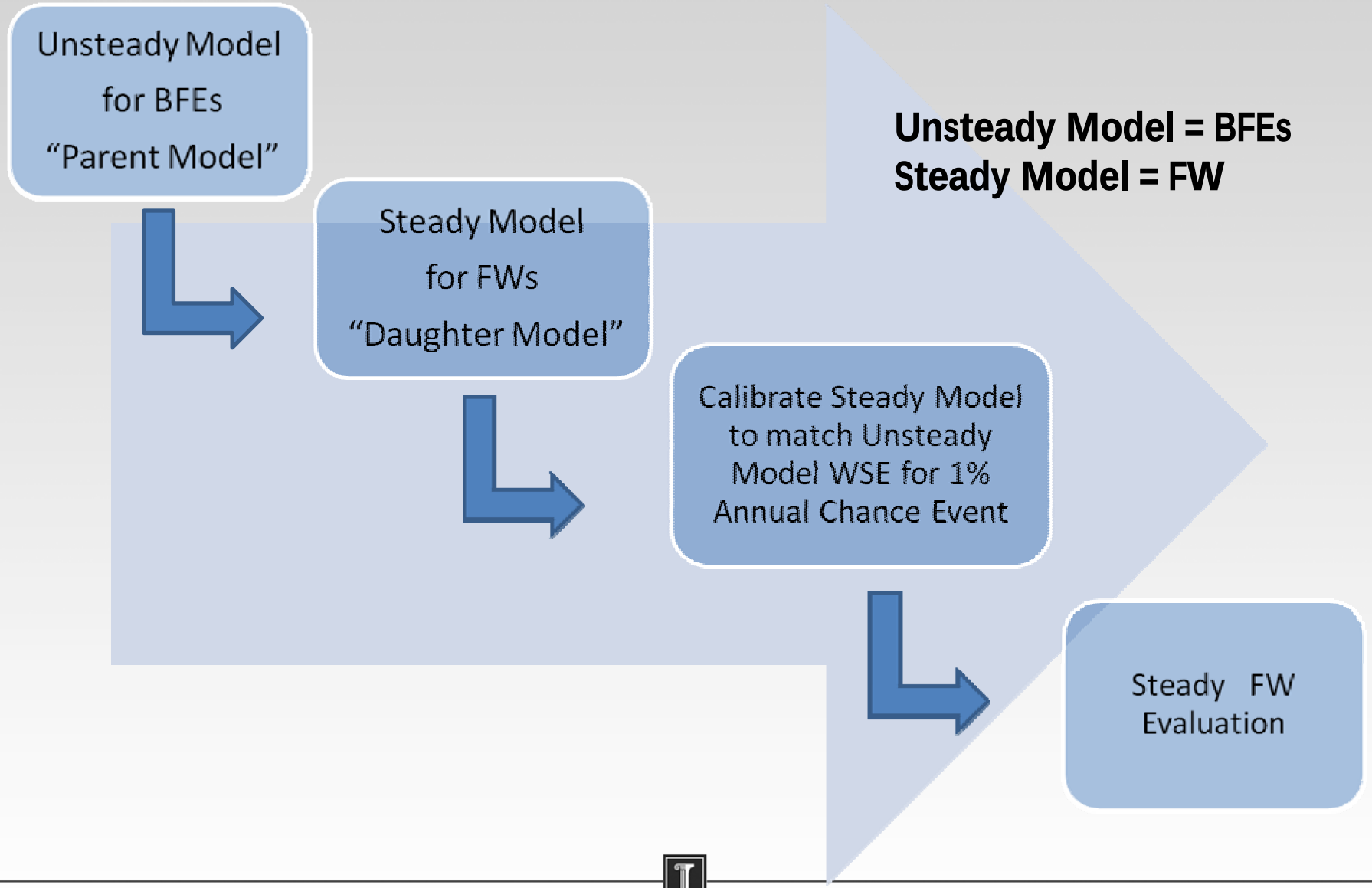
3. USGS Water-Resources Investigations Report 97-4037 (1997), Section 4.7.

Unsteady FW Modeling Guidance

"Another type of problem in the determination of a floodway is that the concept of a floodway, at least as implemented in practice, **is unequivocally a steady-flow concept**. A floodway is defined in terms of the reduction in flow capacity only, and any changes in storage are ignored. This greatly simplifies the analysis and may be adequate in many cases. The true efficacy of this simplification is unknown because no detailed study of the effects of storage change has been completed. The steady-flow concept is simple because a unique meaning can be assigned to the average 100-year return-period flow, and all that is required for a steady-flow analysis is a flow rate. However, for unsteady-flow analysis, further requirements include one or more hydrographs to determine the water-surface elevation that will be exceeded on the average only once in 100 years. In principle, no single hydrograph can be utilized to determine the 100-year water-surface elevations everywhere in the watershed. The assumption made in the steady-flow analysis is that the flows used represent all possible flow interactions; therefore, a simple analysis can be made. The problem in unsteady-flow analysis is that it is unlikely that an observed hydrograph is available for which the peak or volume approaches a reasonable range for the 100-year flood level."

USGS Water-Resources Investigations Report 97-4037, Section 4.7

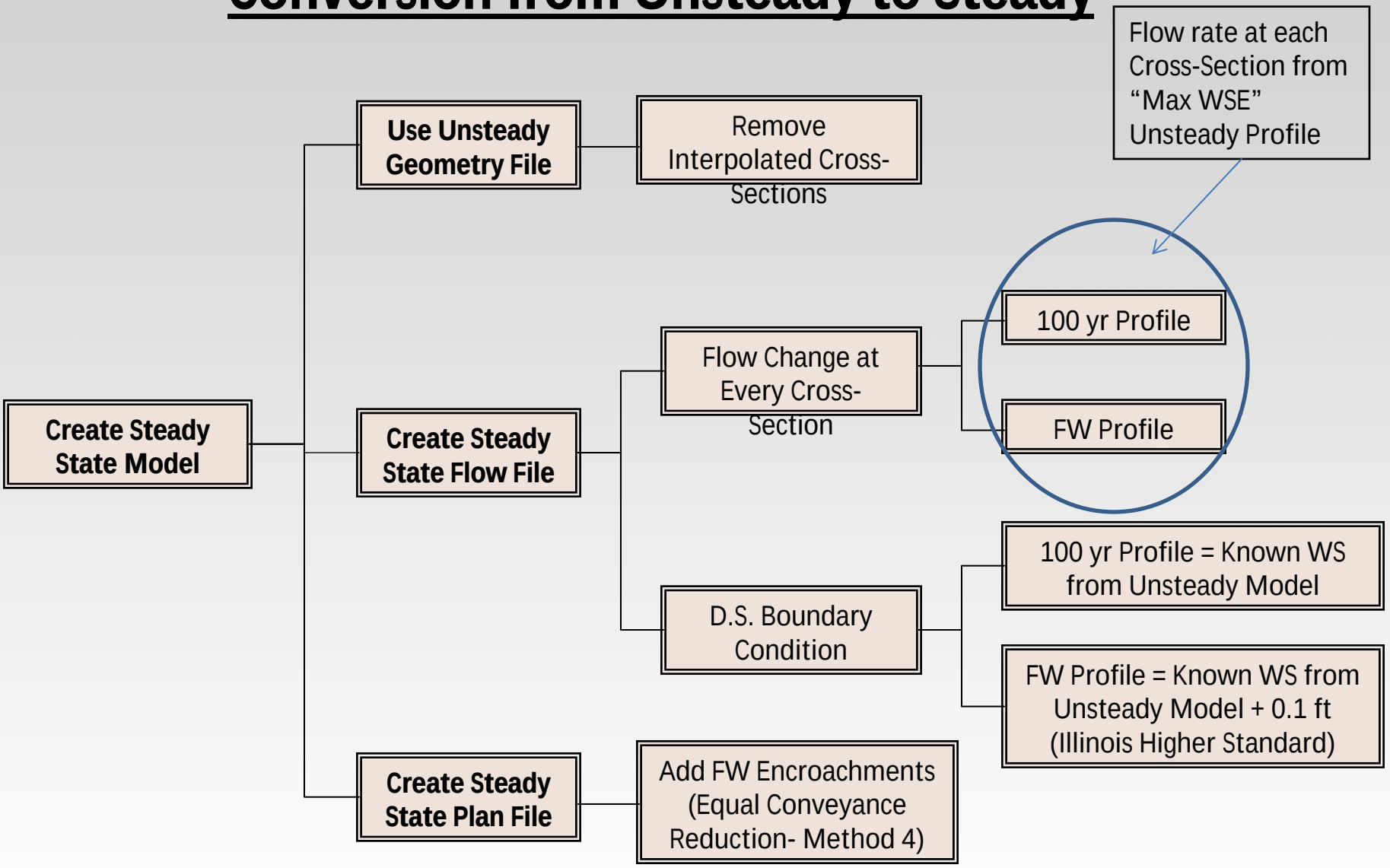
Dual-Model Approach



Dual-Model Challenges & Problems

1. Future users (CLOMR/LOMR)
   a. Dual effective models
2. Interpolated Cross Sections – FW Mapping and modeling .
   a. Geo-referencing/geoRAS - Stream Centerline, Xsec Stationing, Channel outside FW
   b. Model FW Top-Width doesn't agree with Topography
3. Steady Model Calibration

Conversion from Unsteady to Steady



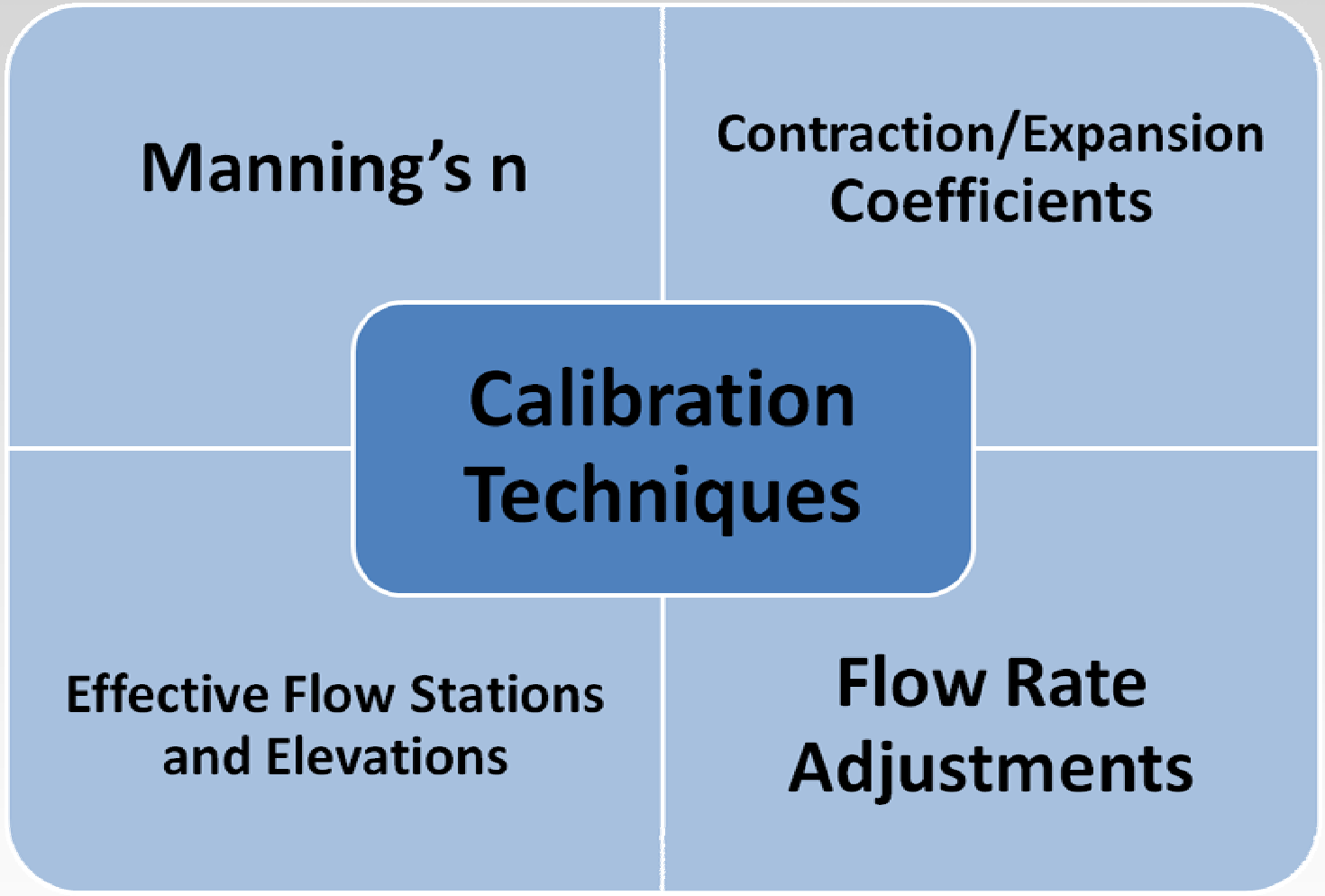
Steady-Flow Model Calibration

GOALS

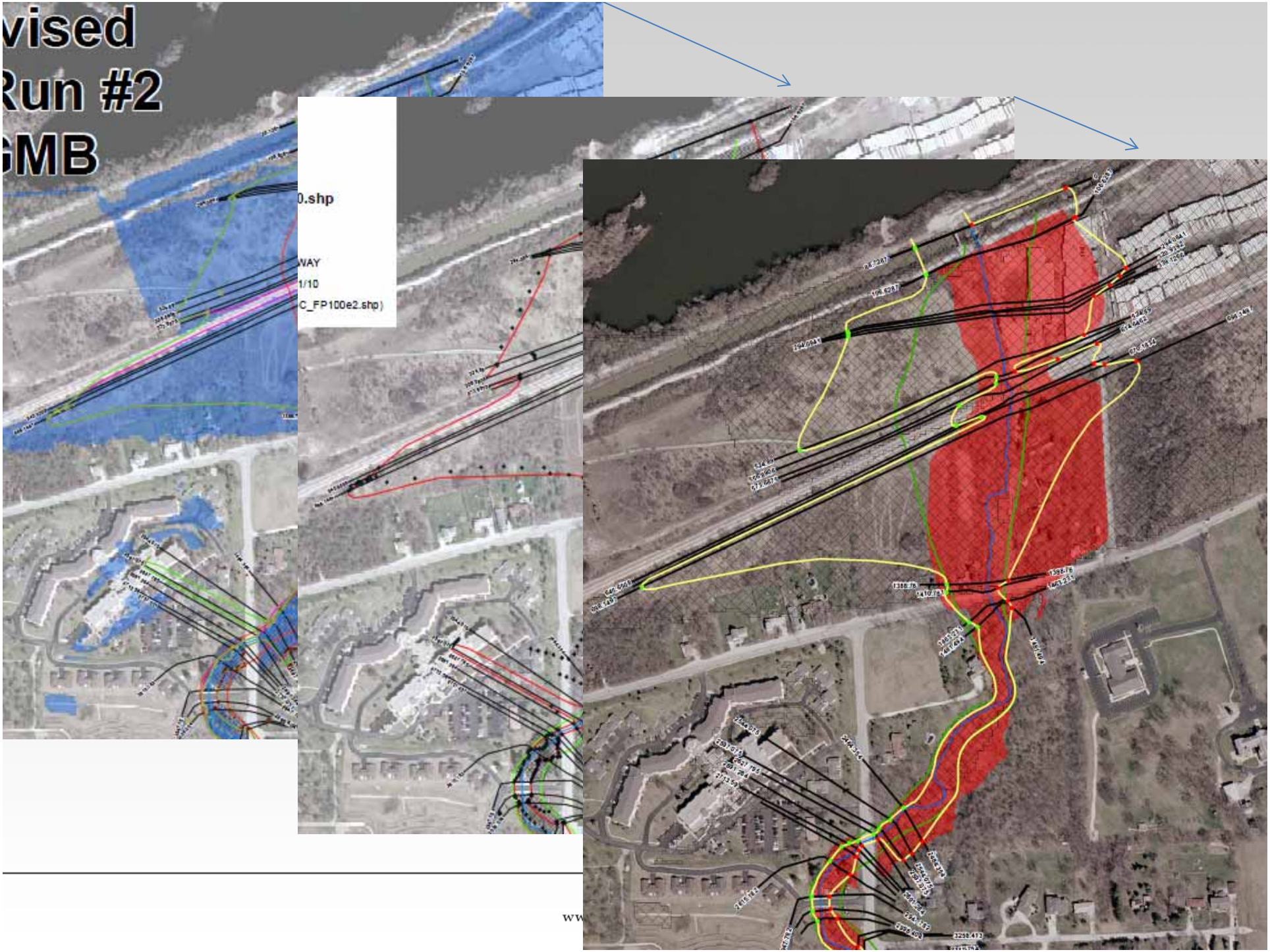
90% of Steady-State Cross-Sections within +/- 0.1 vertical feet of Unsteady 100yr Profile Elevations

Bridges/Culverts within +/- 0.5 vertical feet of Unsteady 100yr Profile Elevations.

Steady-Flow Model Calibration



Floodway Iterations in Steady State Model
&
Mapping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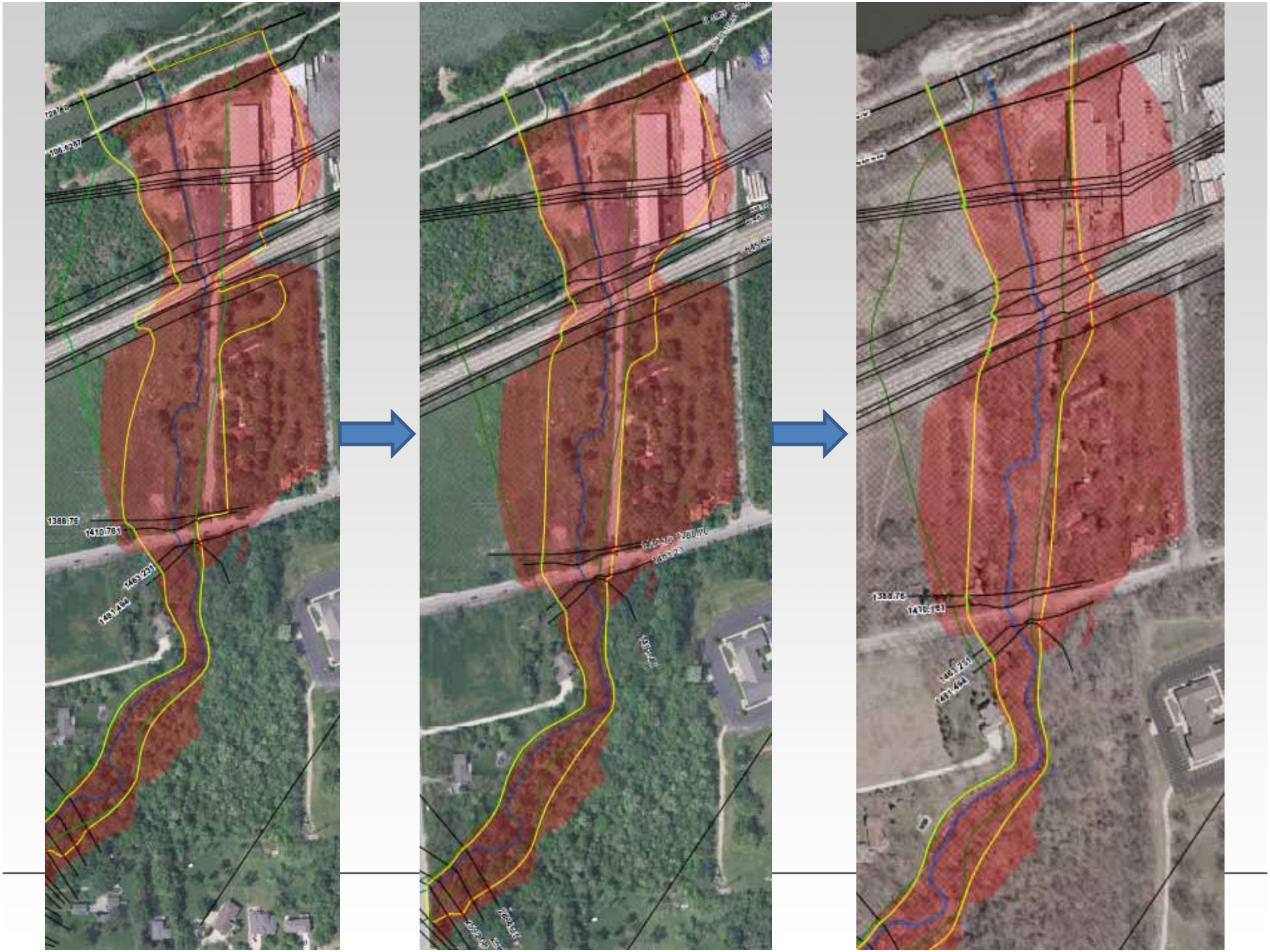
C_FP100e2.shp)



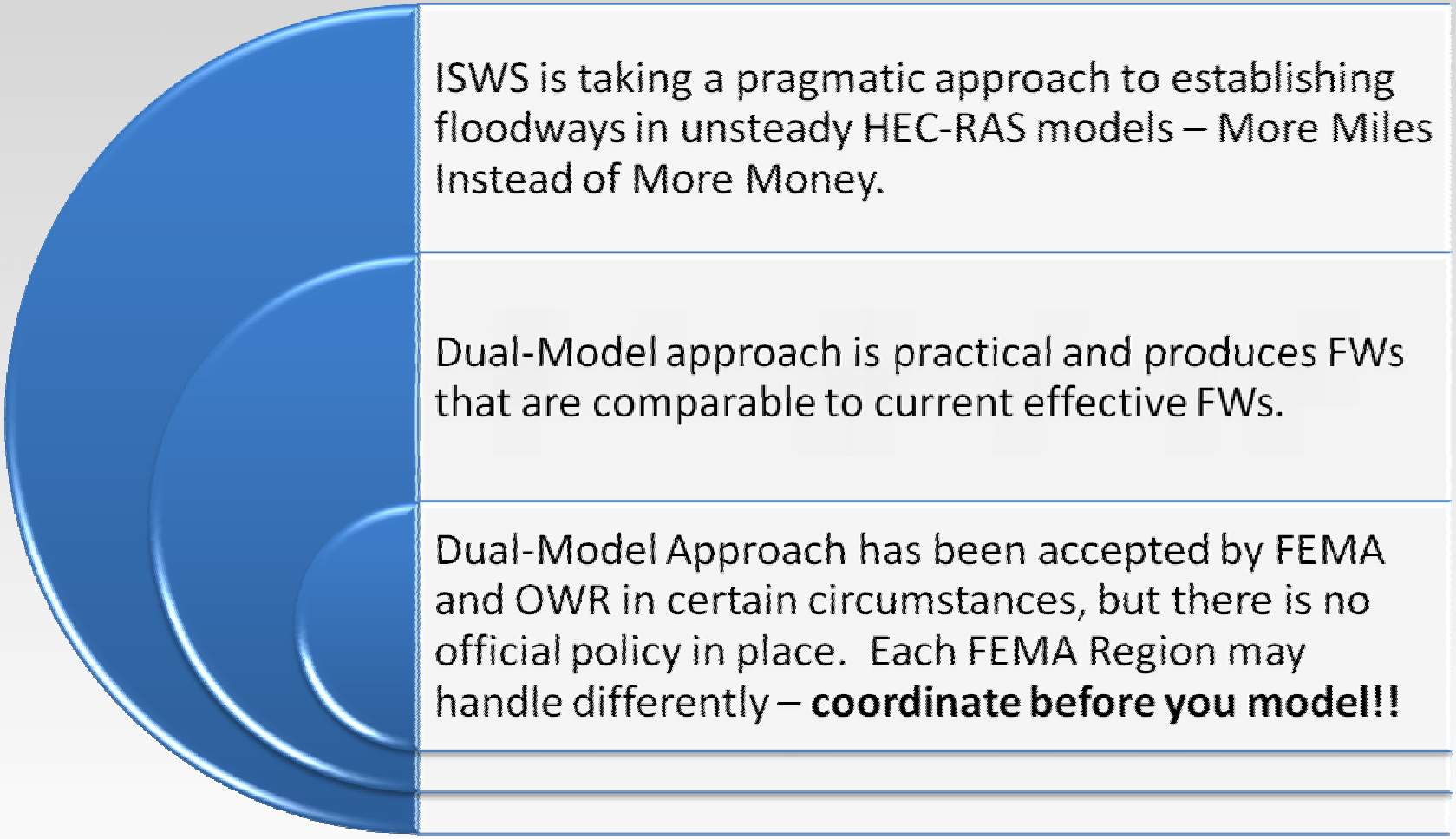
Unsteady Modeling Challenges & Concerns

1. • Extra Time/Expense May Not be Justified
2. • Unsteady FWs are Generally Wider Than Steady FWs
3. • Changes Upstream Affect Downstream & Vice-versa
4. • Future users of the models
5. • FW Iterations – No Method 4

Unsteady Modeling Challenges & Concerns

6. • Illinois Higher FW Standards – Iterations Galore
7. • Variability of Unsteady Models
8. • Computational Options and Tolerances Must Match
9. • Computational Intervals (Time-steps) Must Match
10. • Interpolated Xsec Must Have FW Encroachments

Summary


ISWS is taking a pragmatic approach to establishing floodways in unsteady HEC-RAS models – More Miles Instead of More Money.
Dual-Model approach is practical and produces FWs that are comparable to current effective FWs.
Dual-Model Approach has been accepted by FEMA and OWR in certain circumstances, but there is no official policy in place. Each FEMA Region may handle differently – **coordinate before you model!!**

Questions?

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