Brazos Basin Stakeholders Committee

Testing Flow Regimes for Two Hypothetical Projects

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April 24, 2012

Overview

- ✓ Geomorphology Concepts
- ✓ Brazos River Alluvial Processes
- ✓ Testing Scenarios

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Principles of Geomorphology

- ✓ **Geomorphology:**

  "The study of the earth's forms and processes."

- ✓ **Fluvial Geomorphology**

  "The study of geomorphology as it is applied to rivers and streams."

- ✓ **Fundamental concept: energy and power**

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What controls how a river looks?

- ✓ **Typical channel characteristics:**
  - **Slope**
  - **Geometry (area, top width, depth)**
  - **Roughness**
- ✓ **Factors that influence channel characteristics:**
  - **Discharge**
  - **Sediment size**
  - **Sediment quantity**

Dynamic Equilibrium

$$Q_w * S \sim Q_s * D$$

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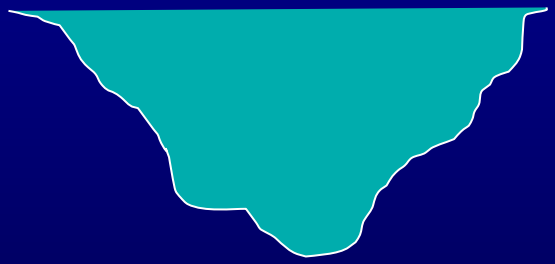
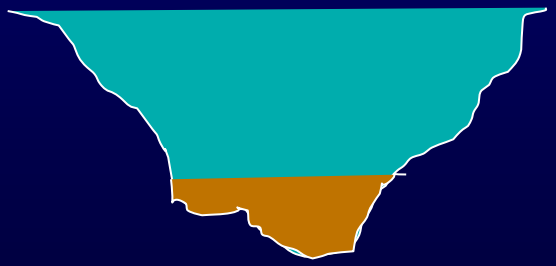
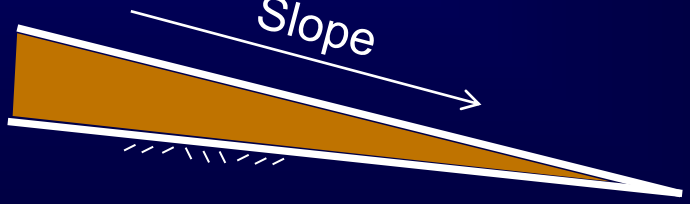
River Adjustments

$$\downarrow Q_w * S \sim Q_s * D$$







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Why is this important?

- ✓ **The river channel provides the habitat for aquatic species.**
- ✓ **Lateral connectivity:**
  - **Floodplain**
  - **Oxbow lakes**

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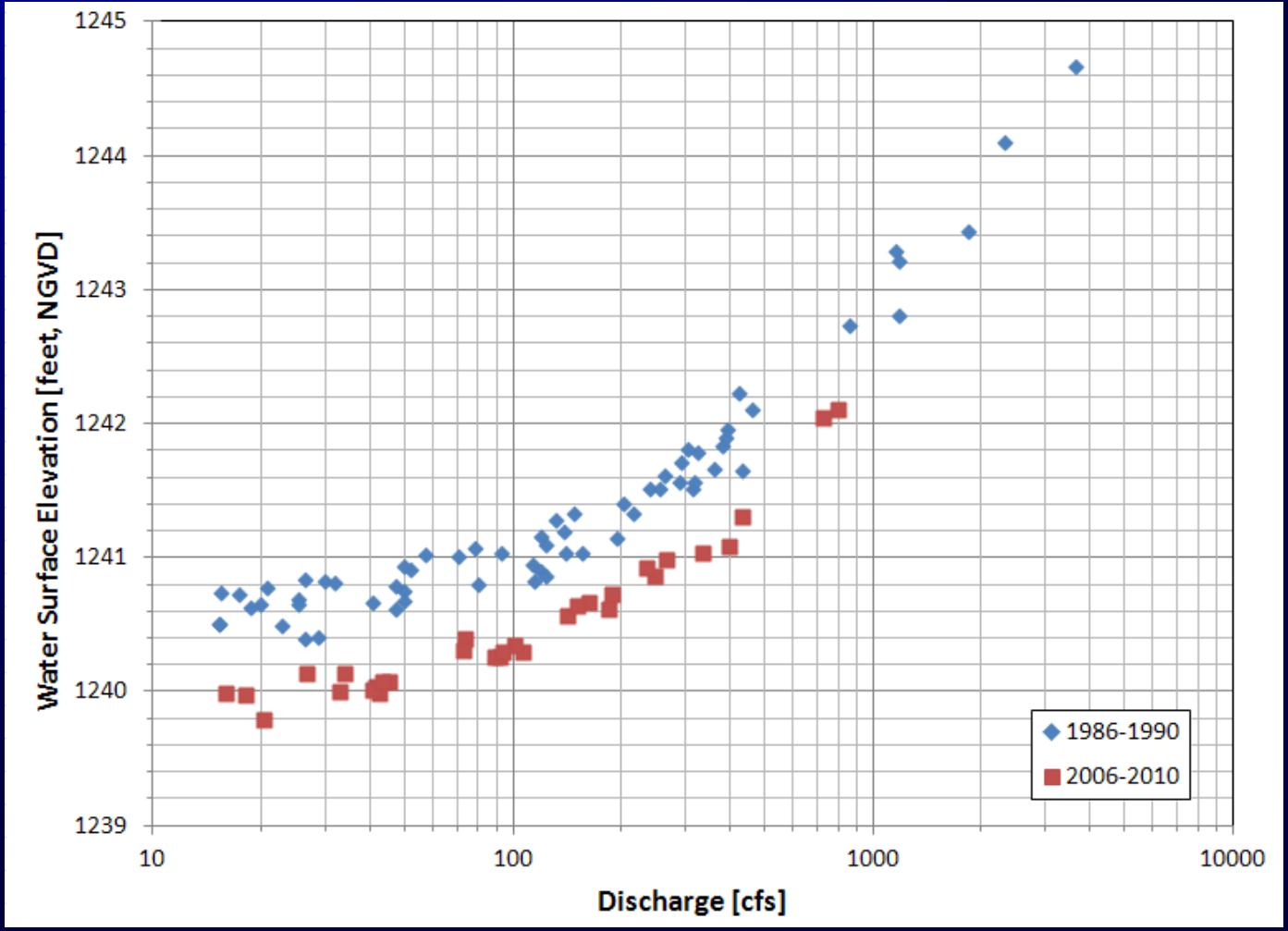
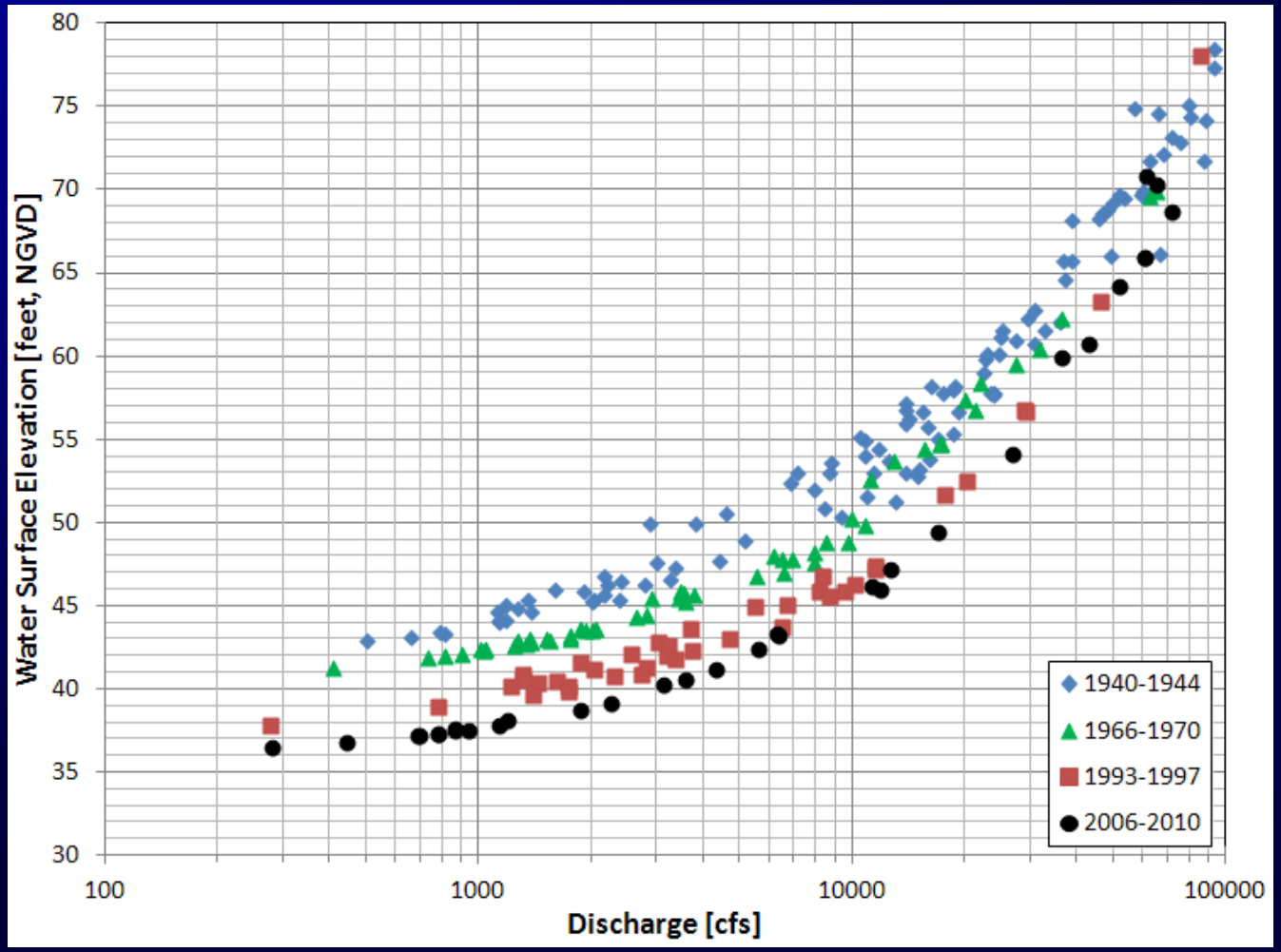
Brazos River Alluvial Processes

Brazos River at Seymour



Brazos River Alluvial Processes

Brazos River at Richmond



Purpose of Scenario Testing

- ✓ **Answer this question:**

  How would a project subject to the recommended e-flows impact flows and sediment transport?

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Evaluate Effects of Two Projects

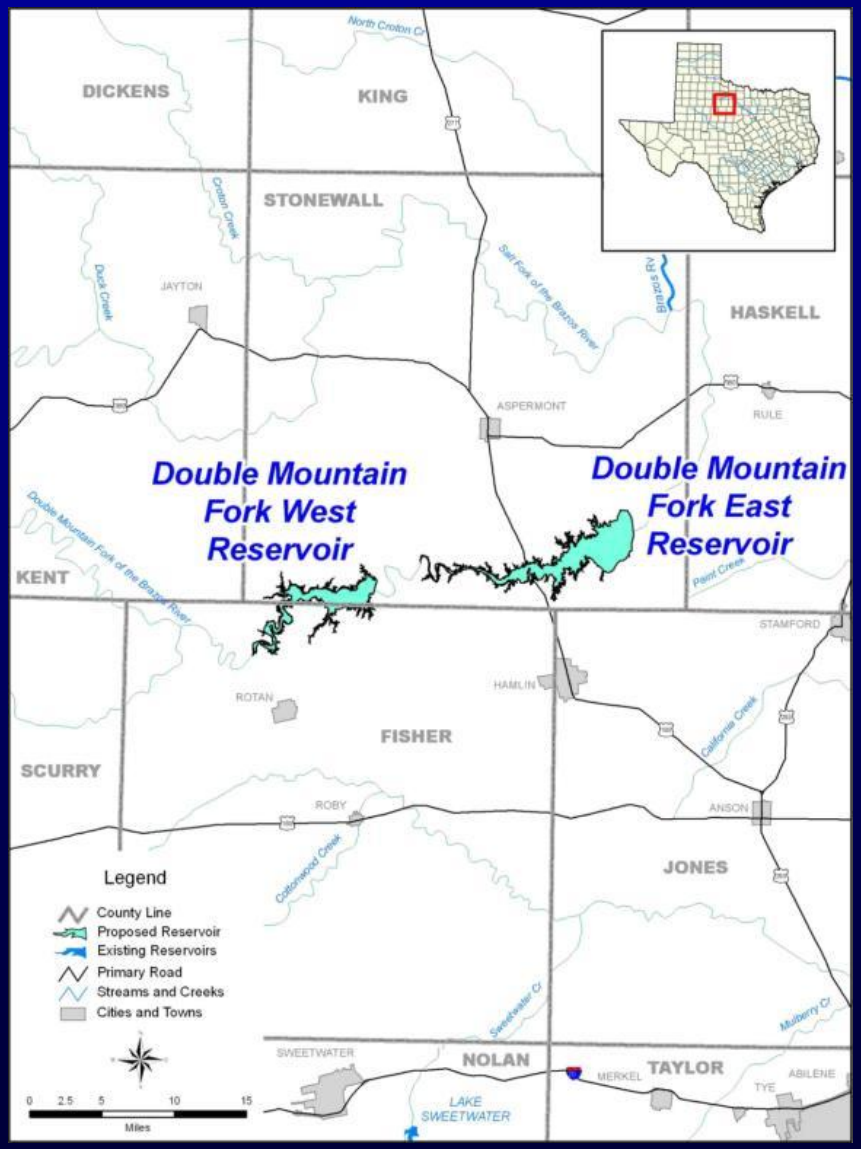
Seymour Gage

Double Mountain Fork Reservoir

Millican Reservoir

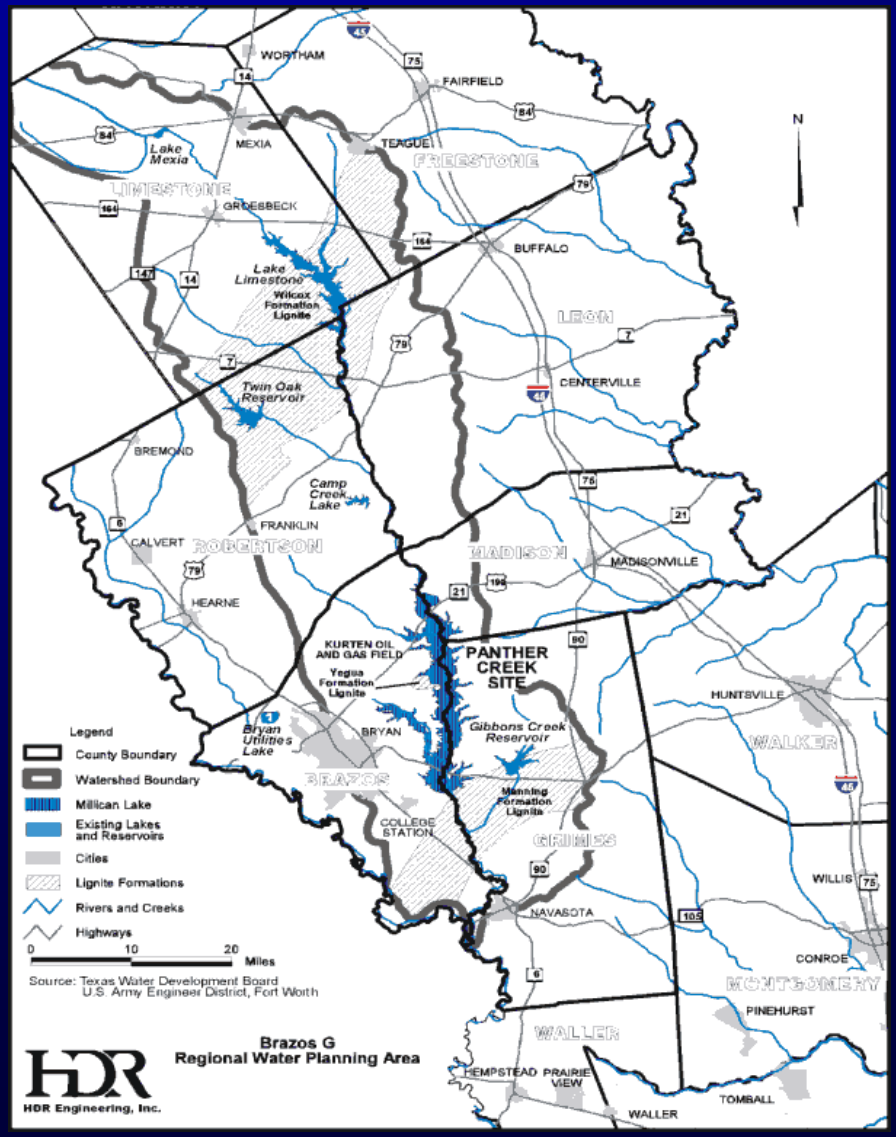
Richmond Gage

Double Mountain Fork Reservoir – West



Reservoir Characteristics	
Yield (Brazos G)	34,775 acft/yr
Capacity	215,254 acft
Surface Area	6,632 acres
Drainage Area	1,669 sq-mi

Millican Reservoir-Panther Creek Site



Reservoir Characteristics	
Yield (Brazos G)	194,500 acft/yr
Capacity	2,044,563 acft
Surface Area	71,032 acres
Drainage Area	1,821 sq-mi

Downstream Effects of Projects

- ✓ **Hydrology – What are changes in flow?**
- ✓ **Sediment transport capacity – Can we infer effects on channel morphology?**

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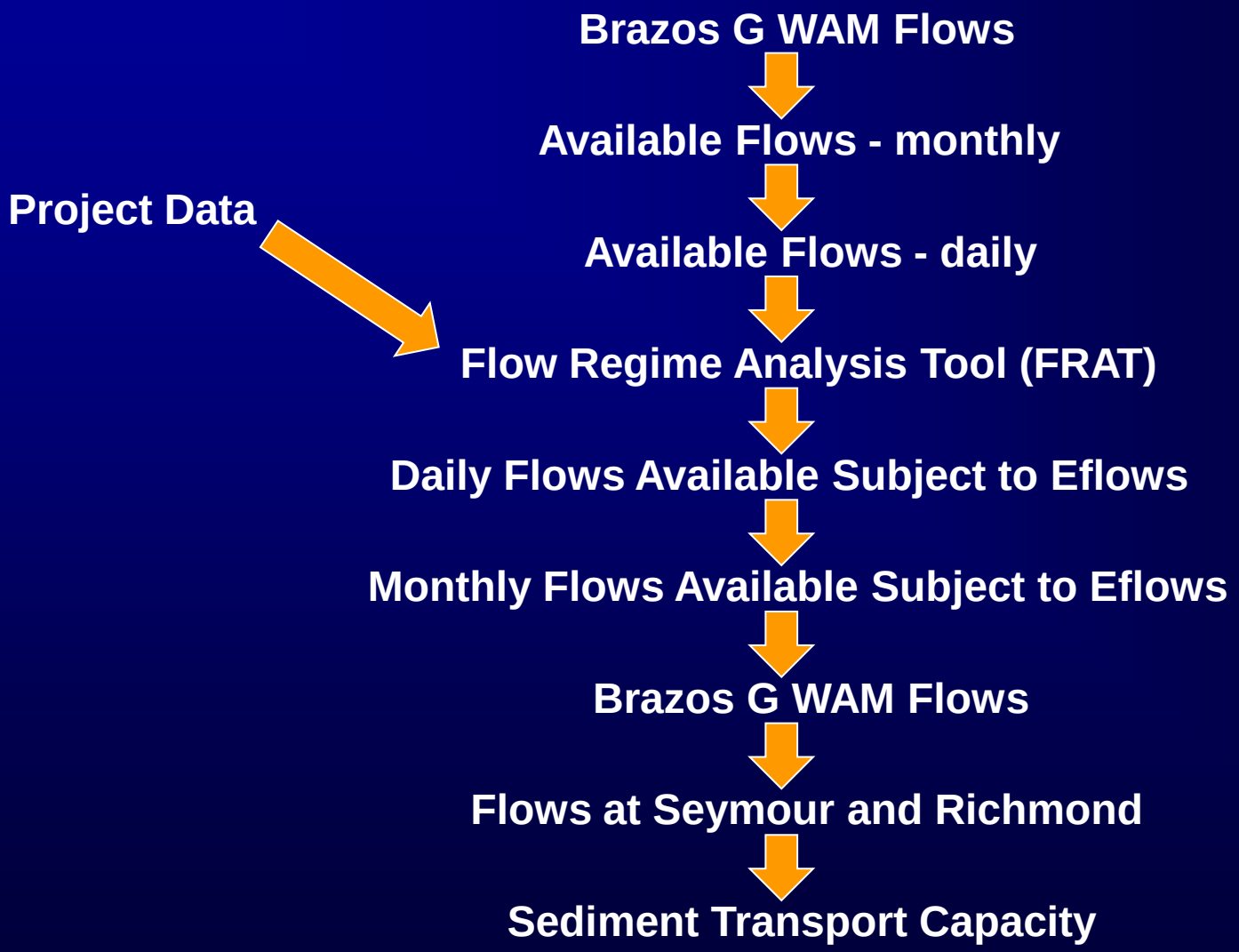
Modeling Approach



Scenarios Evaluated

- ✓ Gaged – reflects changing conditions over time
- ✓ Baseline – TCEQ WAM Run 8 (current conditions)
- ✓ Brazos G WAM – full use of rights, 2060 sediment and return flows
- ✓ Brazos G WAM w/projects
  - Dbl. Mtn. Fork – Seymour and Richmond gages
  - Millican – Richmond gage
  - Both projects combined – Richmond gage
- ✓ E-flows only – purple line flows

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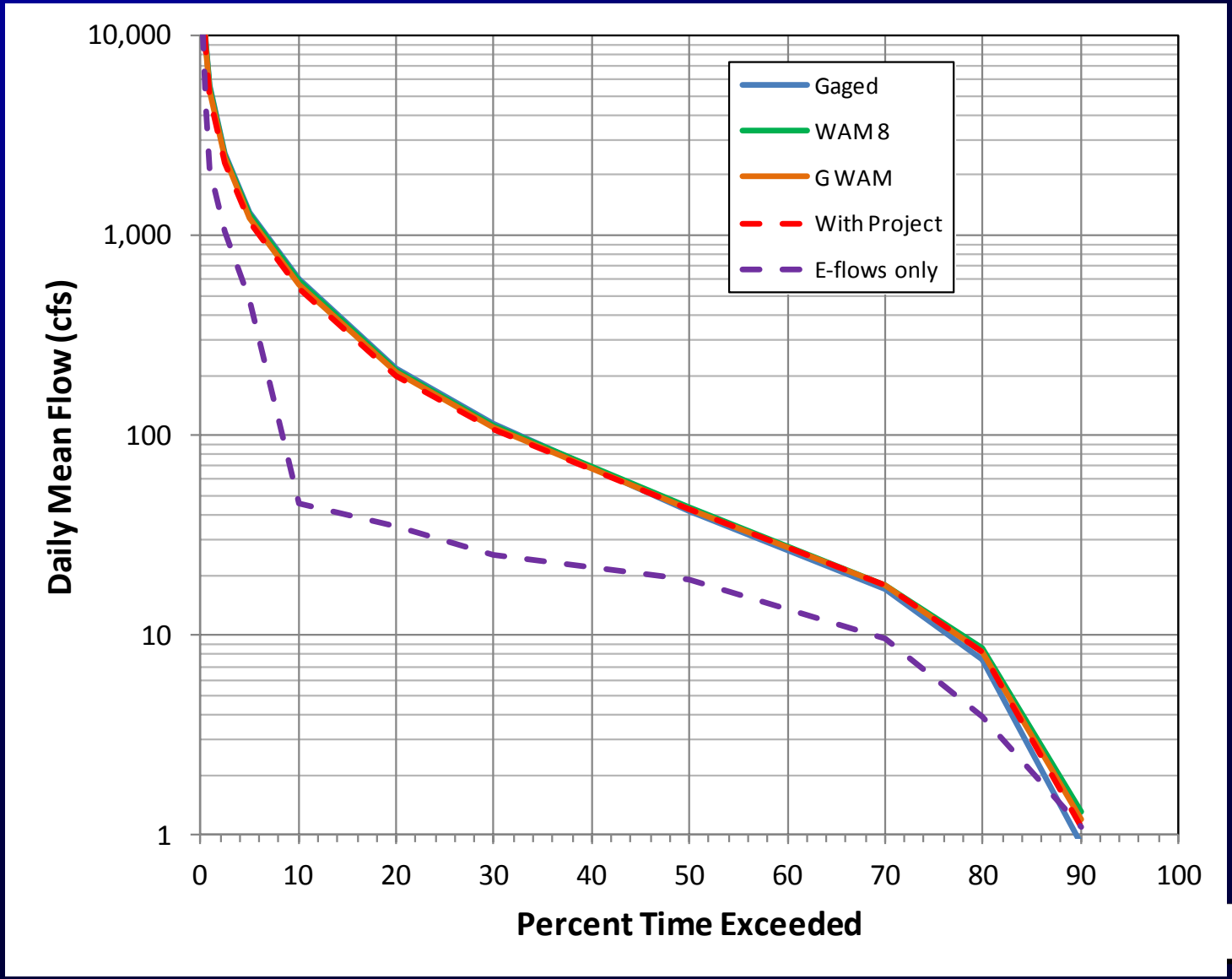
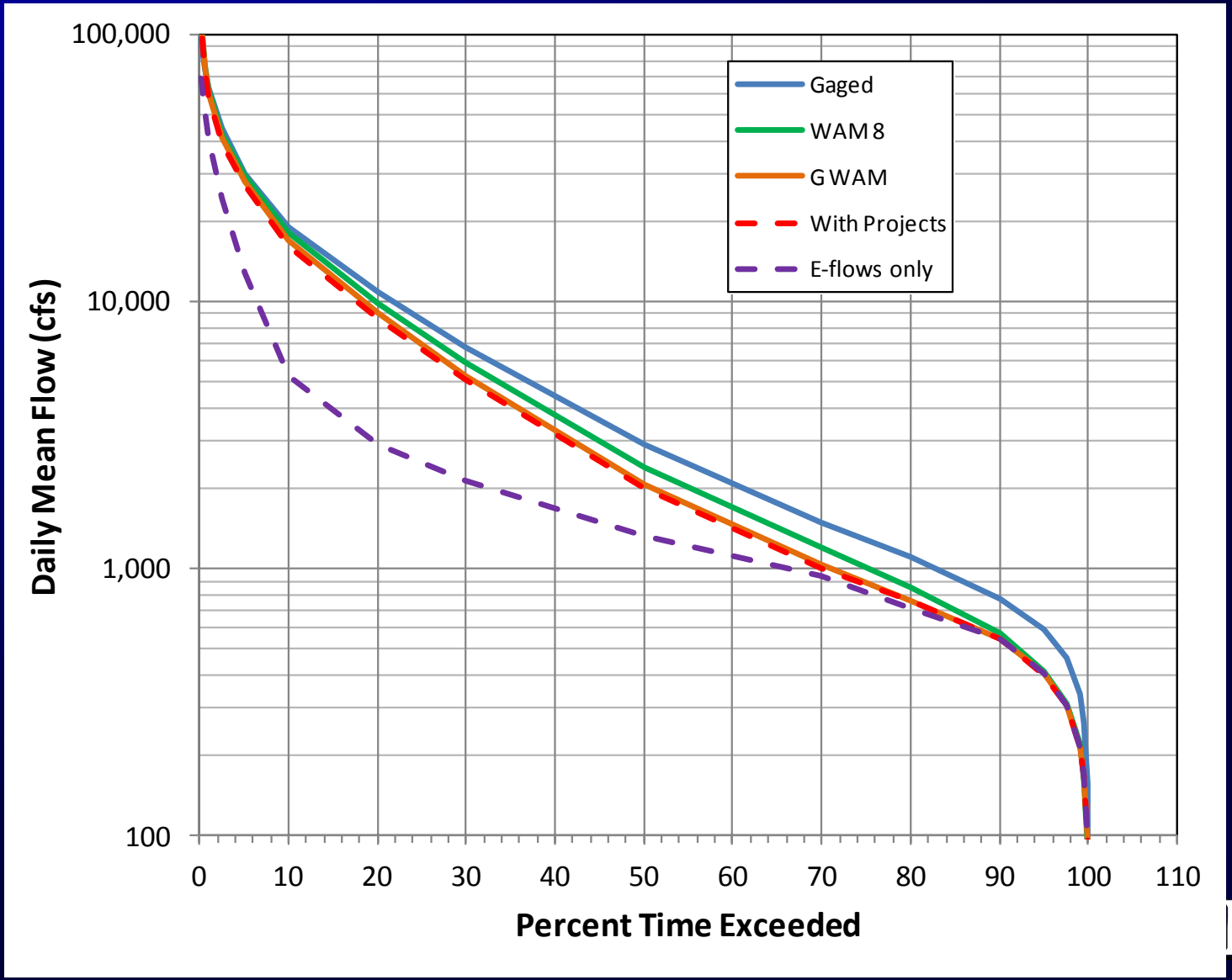
Flows – Brazos River at Seymour



Flows – Brazos River at Richmond



Sediment Transport Results

Average Annual Water and Sediment Yields		
	Average Annual Yield	
Hydrologic Scenarios	Water Acre-Feet (% of Baseline)	Sediment Tons per Year (% of Baseline)
BRAZOS RIVER AT SEYMOUR		
Historical Flows		
1940-1997 Gaged Flows	246,000 (102%)	296,000 (103%)
Simulated Flows		
WAM 8 Flows (Baseline)	242,000 (100%)	288,000 (100%)
G WAM	233,000 (96%)	262,000 (91%)
G WAM with Project	223,000 (92%)	233,000 (81%)
E Flow Only	93,400 (39%)	56,600 (20%)
BRAZOS RIVER AT RICHMOND		
Historical Flows		
1940-1997 Gaged Flows	5,480,000 (107%)	3,010,000 (85%)
Simulated Flows		
WAM 8 Flows (Baseline)	5,130,000 (100%)	3,530,000 (100%)
G WAM	4,780,000 (93%)	3,190,000 (90%)
G WAM with Projects	4,580,000 (89%)	2,930,000 (83%)
E Flow Only	2,340,000 (46%)	797,000 (23%)

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Assessment of Results

- ✓ Long-term changes in flow can change aquatic habitats because of changes in sediment transported.
- ✓ Brazos River channel likely in some kind of adjustment process – incising.
- ✓ Current, ongoing channel adjustment processes reduce our ability to draw inferences as to the long-term response of the Brazos River to a project.
- ✓ Results are sensitive to analysis methodology.

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Questions