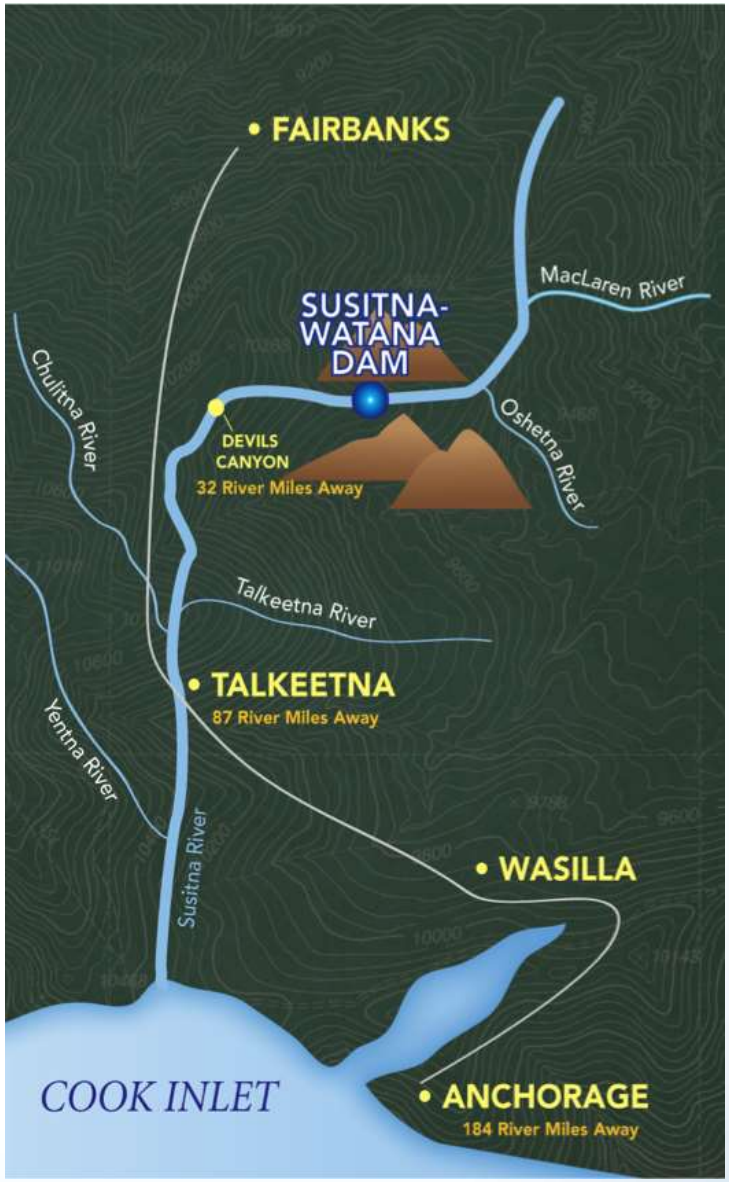
2012 Technical Memorandum:

Reconnaissance Level Assessment of Potential Channel Change: Lower Susitna River Segment

Technical Workgroup Meeting
March 28, 2013

Prepared by: Tetra Tech
Prepared for: Alaska Energy Authority



SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

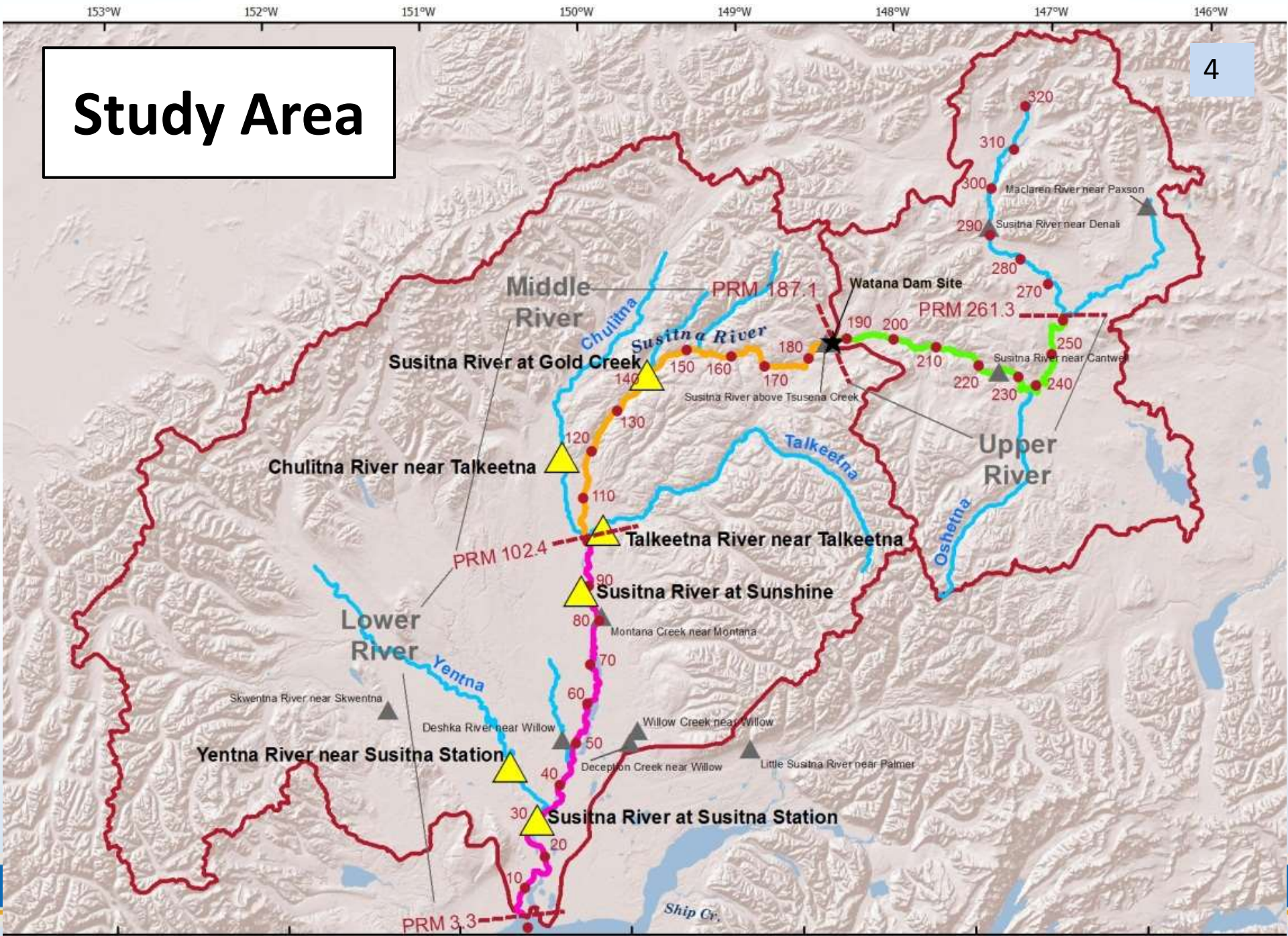
2012 Study Technical Memorandum: *Reconnaissance Level Assessment of Potential Channel Change: Lower Susitna River Segment*

- Part of 2012 Study - G-S4: Reconnaissance-Level geomorphic and Aquatic Habitat Assessment of Project Effects on Lower River Channel
- Date Filed with FERC: 3/1/2013
- Date Posted to AEA website: 3/1/2013

Purpose and Objectives

- Integrate results of the preliminary Geomorphic Assessment, Sediment Balance, and Flow Assessment investigations.
- Perform an initial assessment of potential Project-related changes in channel morphology of the Lower River.
- Determine whether the Fluvial Geomorphology Modeling Study and other studies need to be extended downstream in the Lower River.

Study Area


153°W
152°W
151°W
150°W
149°W
148°W
147°W
146°W
Middle River
Lower River
Upper River
Chulitna
Susitna River
Talkeetna
Oshetna
Yentna
PRM 187.1
PRM 261.3
PRM 102.4
PRM 3.3
Watana Dam Site
Susitna River at Gold Creek
Susitna River above Tsusena Creek
Chulitna River near Talkeetna
Talkeetna River near Talkeetna
Susitna River at Sunshine
Montana Creek near Montana
Skwentna River near Skwentna
Deshka River near Willow
Willow Creek near Willow
Yentna River near Susitna Station
Deception Creek near Willow
Little Susitna River near Palmer
Susitna River at Susitna Station
Maclaren River near Paxson
Susitna River near Denali
Susitna River near Cantwell
Ship Cr.
320
310
300
290
280
270
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
90
80
70
60
50
40
30
20
10

Background

- Grant et al. (2003) conceptual model for channel change below dams
  - Sediment supply ratio
  - Time ratio of bed-mobilizing flows
- Sediment transport supply and capacity
  - Initial Sediment Balance for the Middle and Lower Susitna River (Tetra Tech)
- Mobilizing flows based on USGS measurements and gage data

Background (Cont.)

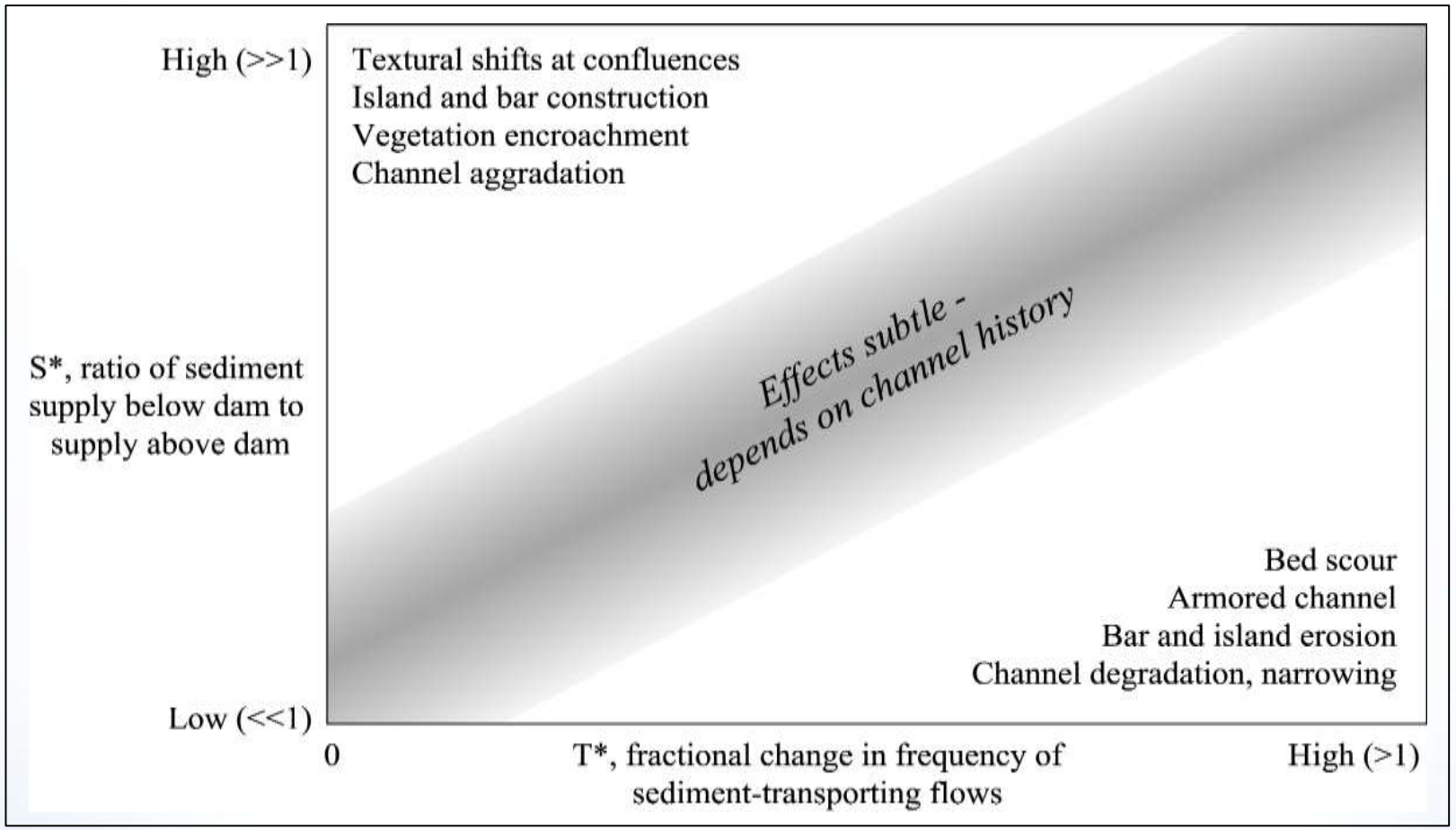
- Flow duration curves from USGS extended record
  - Stream Flow Assessment (Tetra Tech)
- Both Pre-Project and Maximum Load Following OS-1 conditions analyzed

Sediment Transport Quantity and Duration

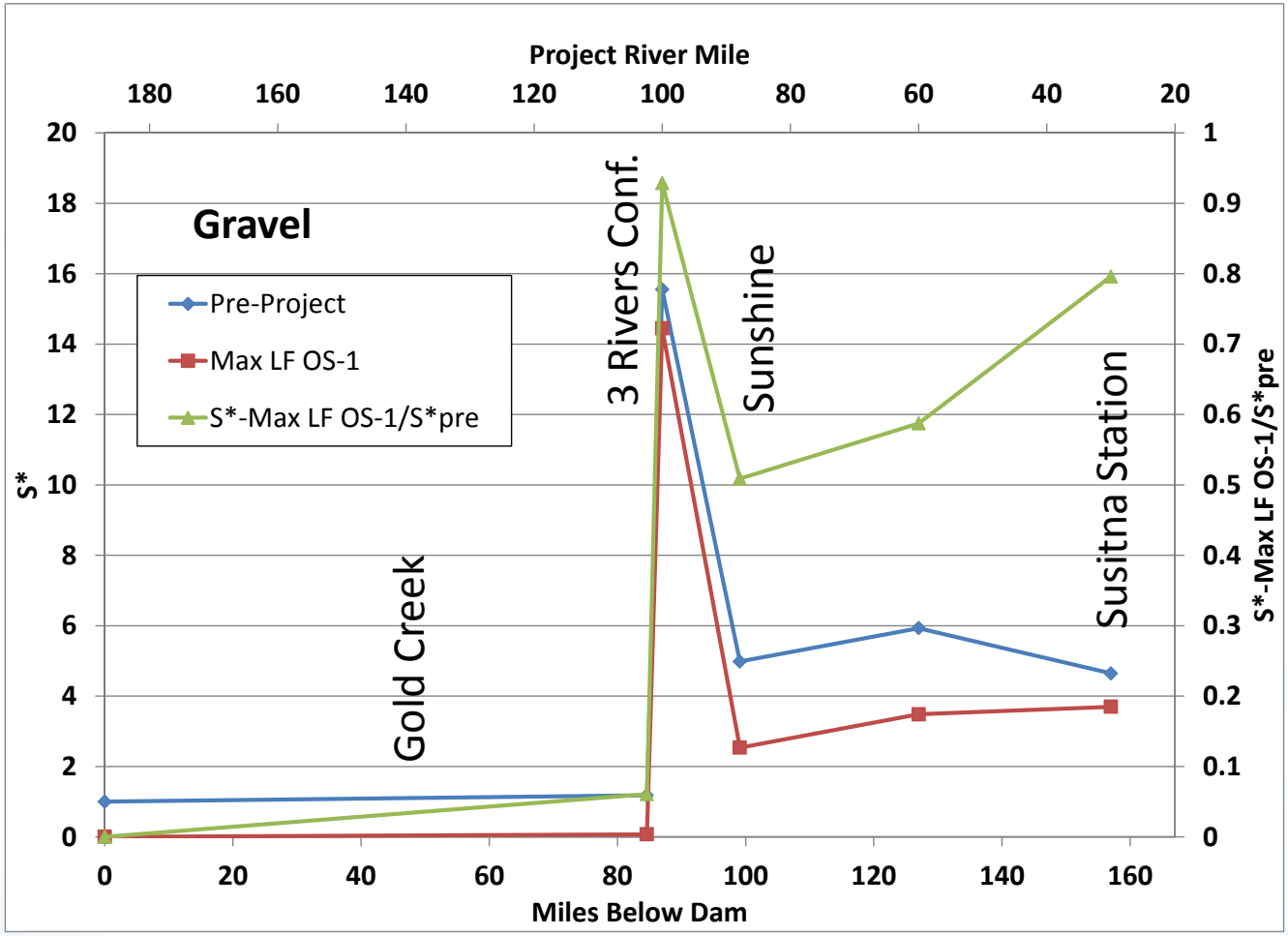
- $S^* = \frac{S_B}{S_A}$ Sediment supply below to above Dam
- $T = \frac{\sum t_{(Q>Qcr)}}{\sum t_Q}$ Proportion of time Q > Q_{cr}

  (Q_{cr} = bed-mobilizing flow)
- $T^* = \frac{T_{post}}{T_{pre}}$

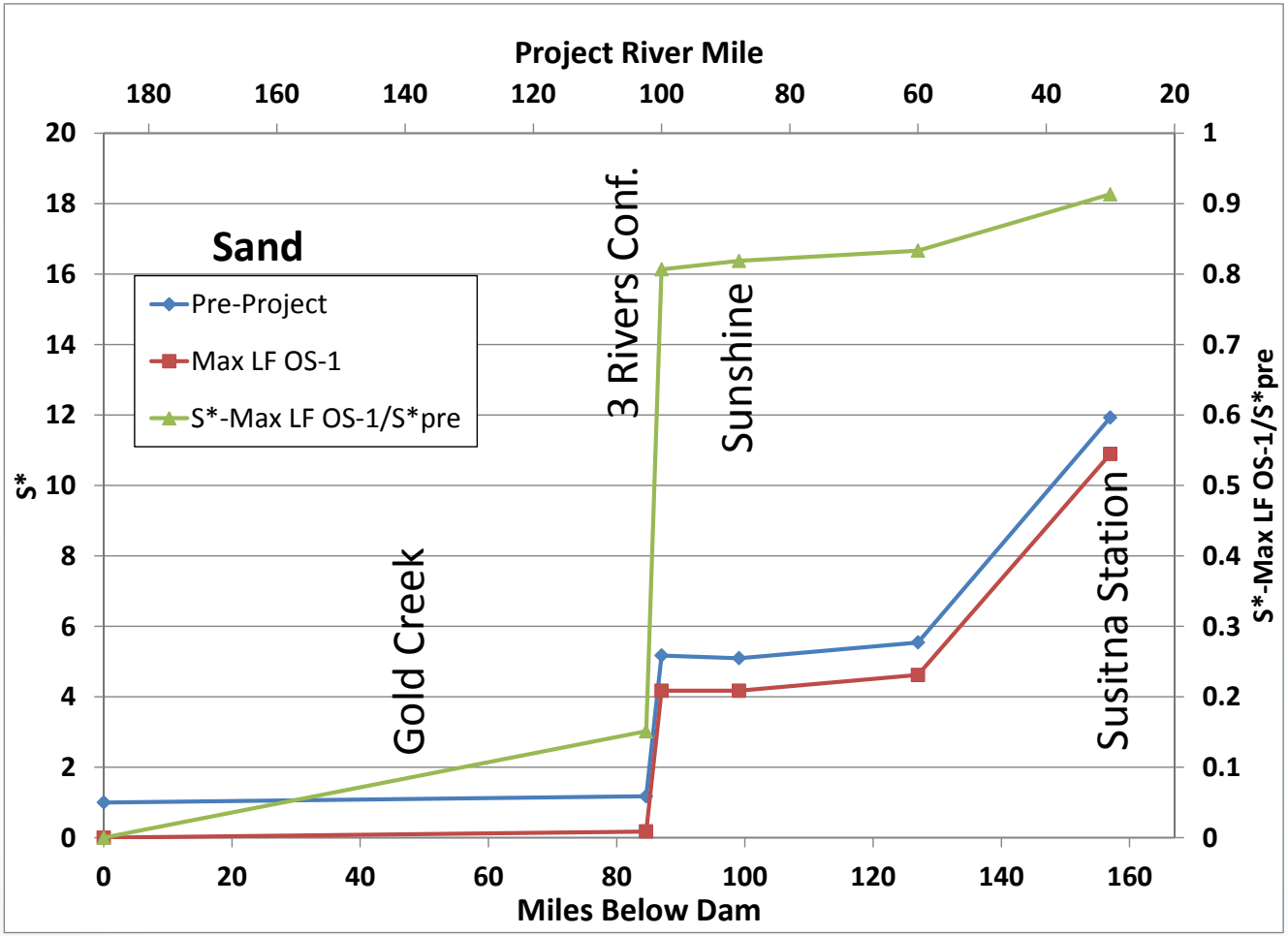
Grant et al. (2003) Downstream Effects



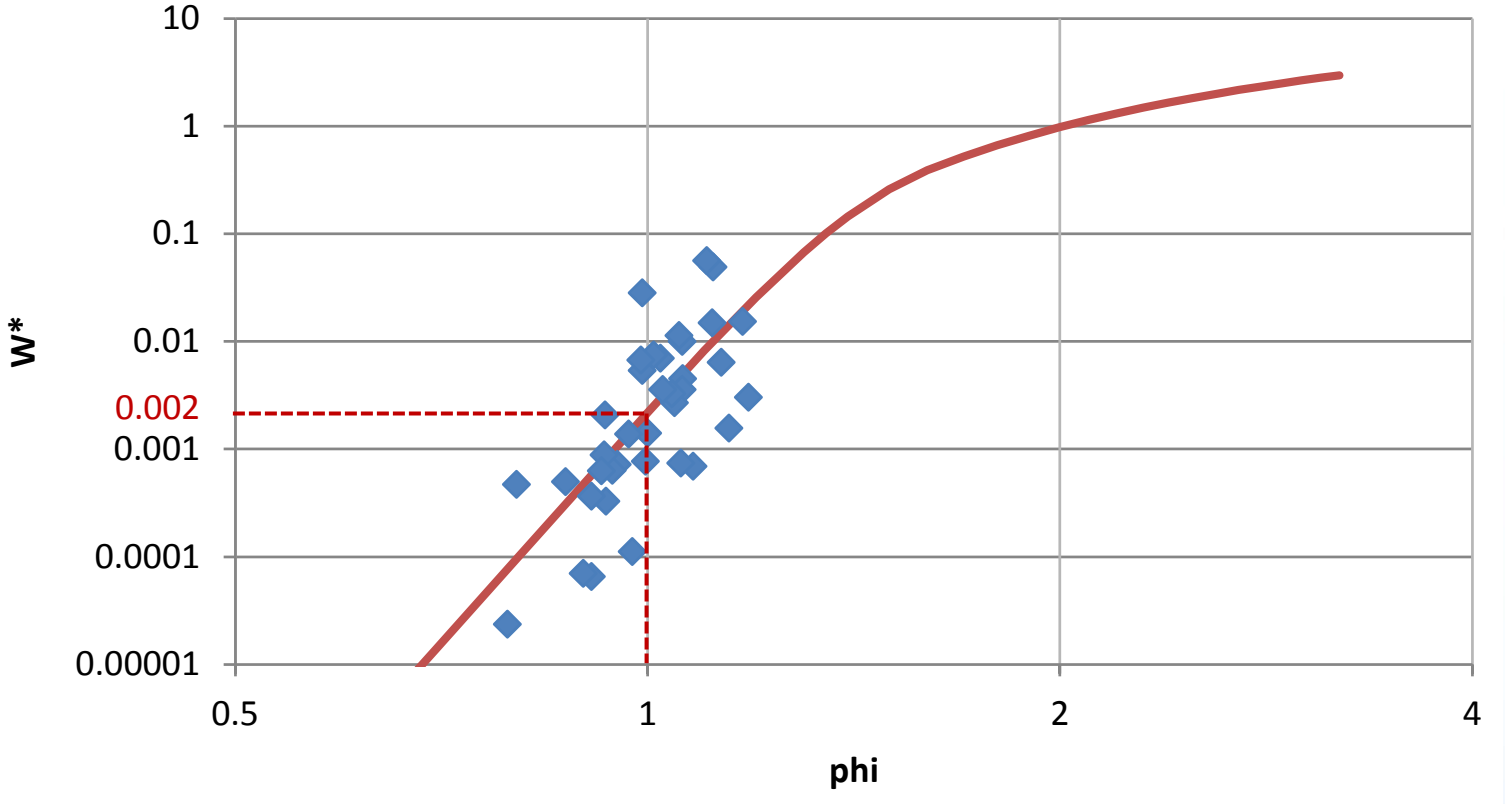
S* for Gravel Sizes Downstream of Dam



S* for Sand Sizes Downstream of Dam



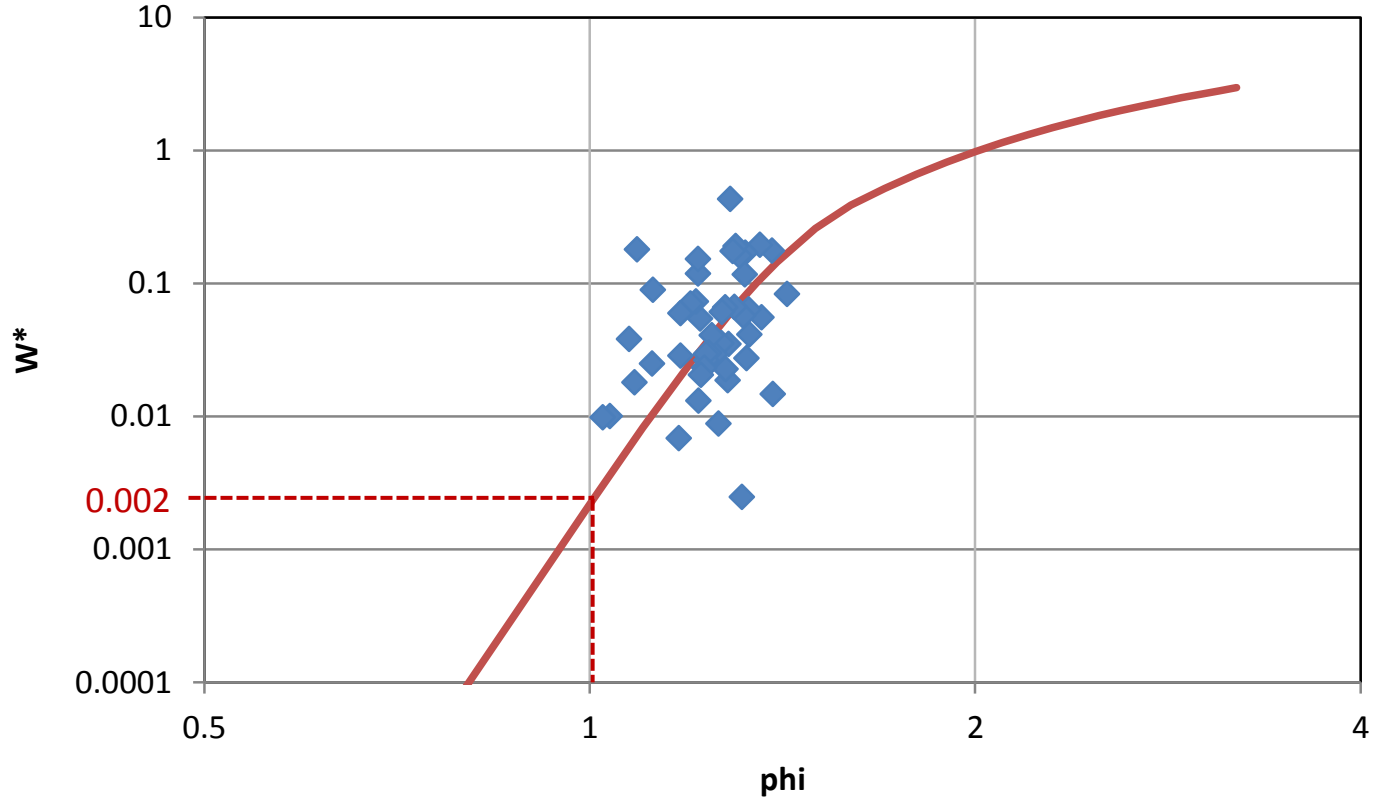
Gold Creek Gravel Transport
S = 10.5 ft/mile, D_{50} = 67 mm
Q_{cr} = 25,000 for W* = 0.002



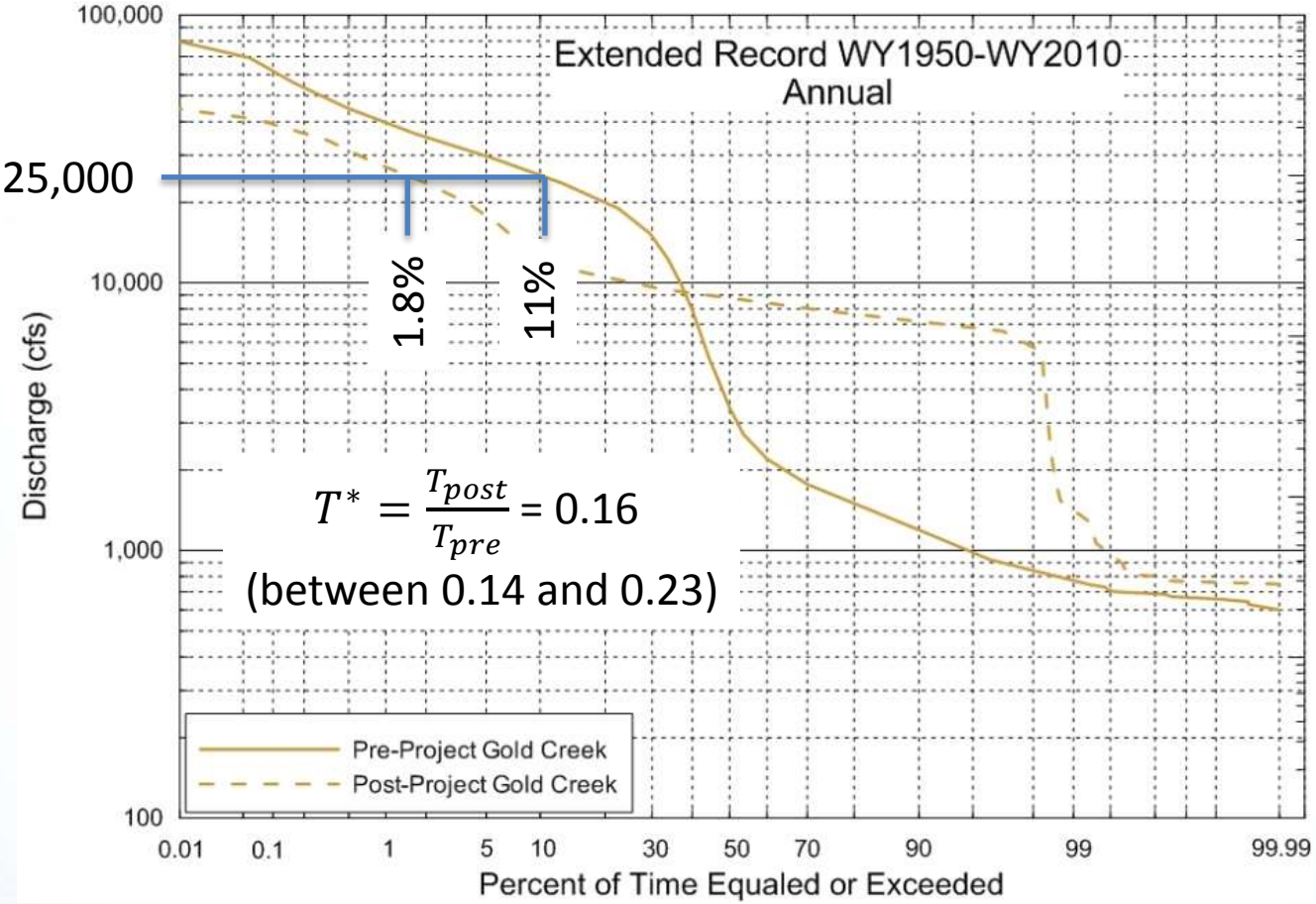
Sunshine Gravel Transport

S = 6 ft/mile, D_{50} = 40 mm

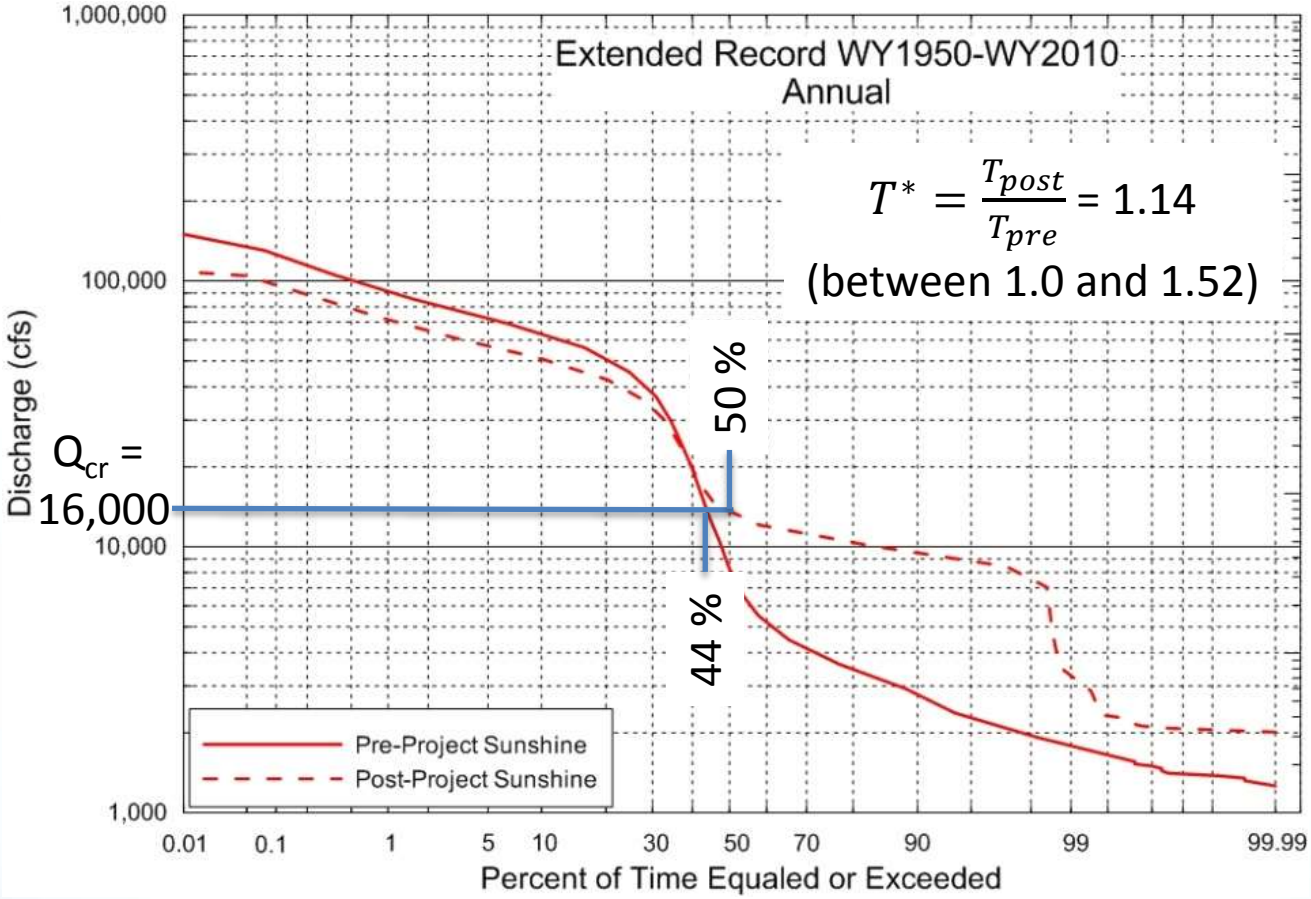
Q_{cr} = 16,000 for W* = 0.002



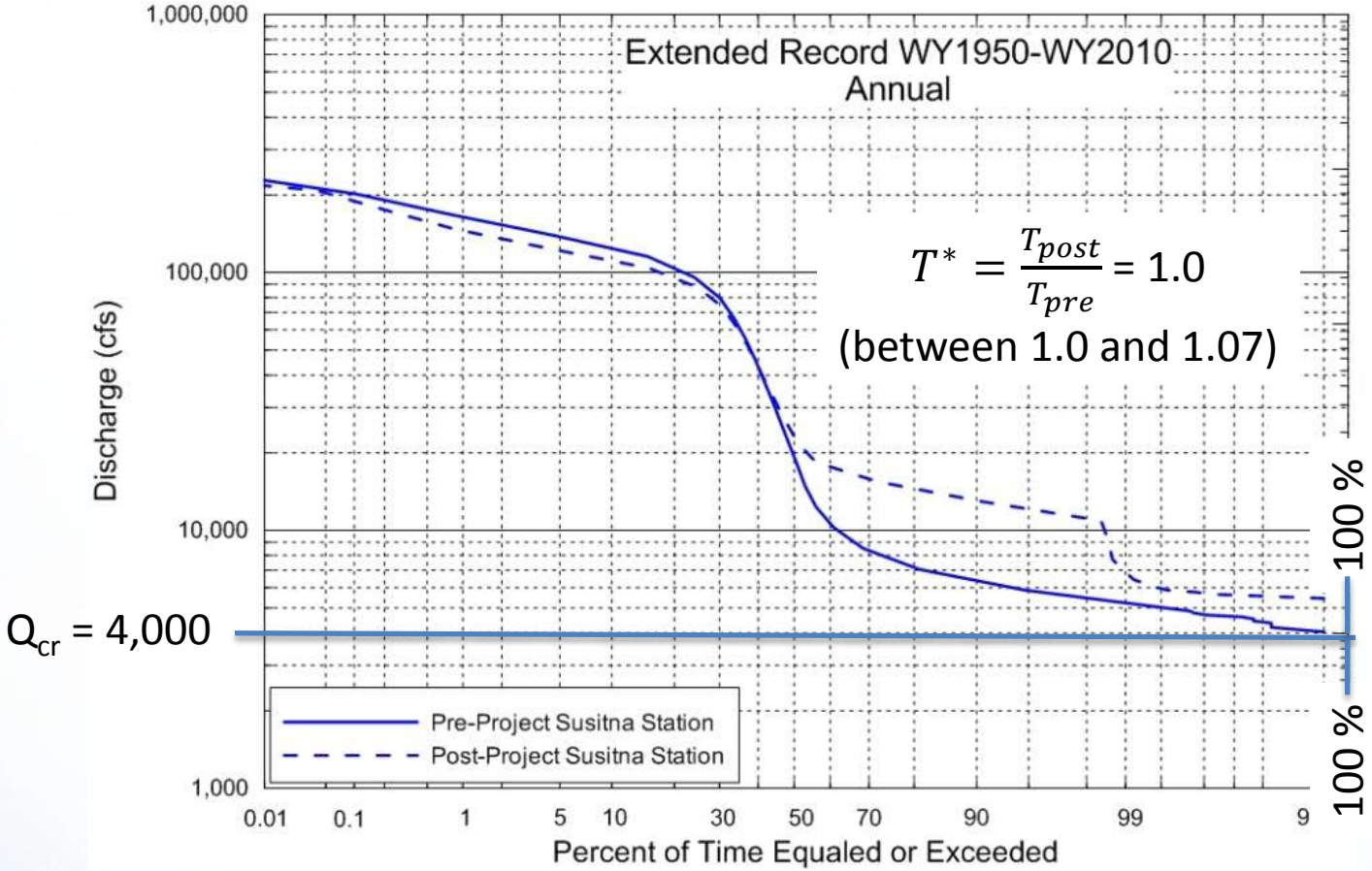
Annual Flow Duration – Q_{cr} Exceedance Gold Creek



Annual Flow Duration – Q_{cr} Exceedance Sunshine



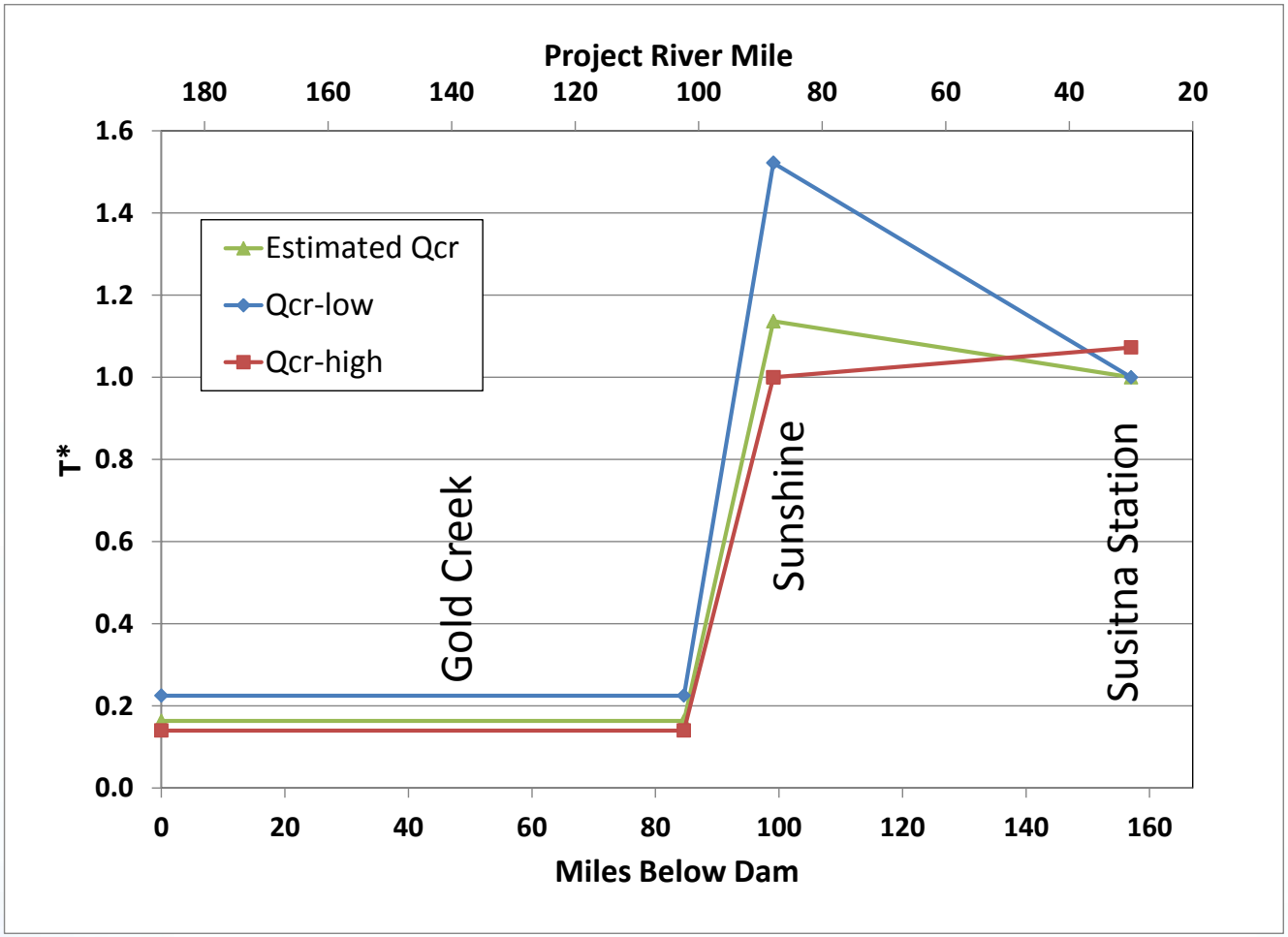
Annual Flow Duration – Q_{cr} Exceedance Susitna Station



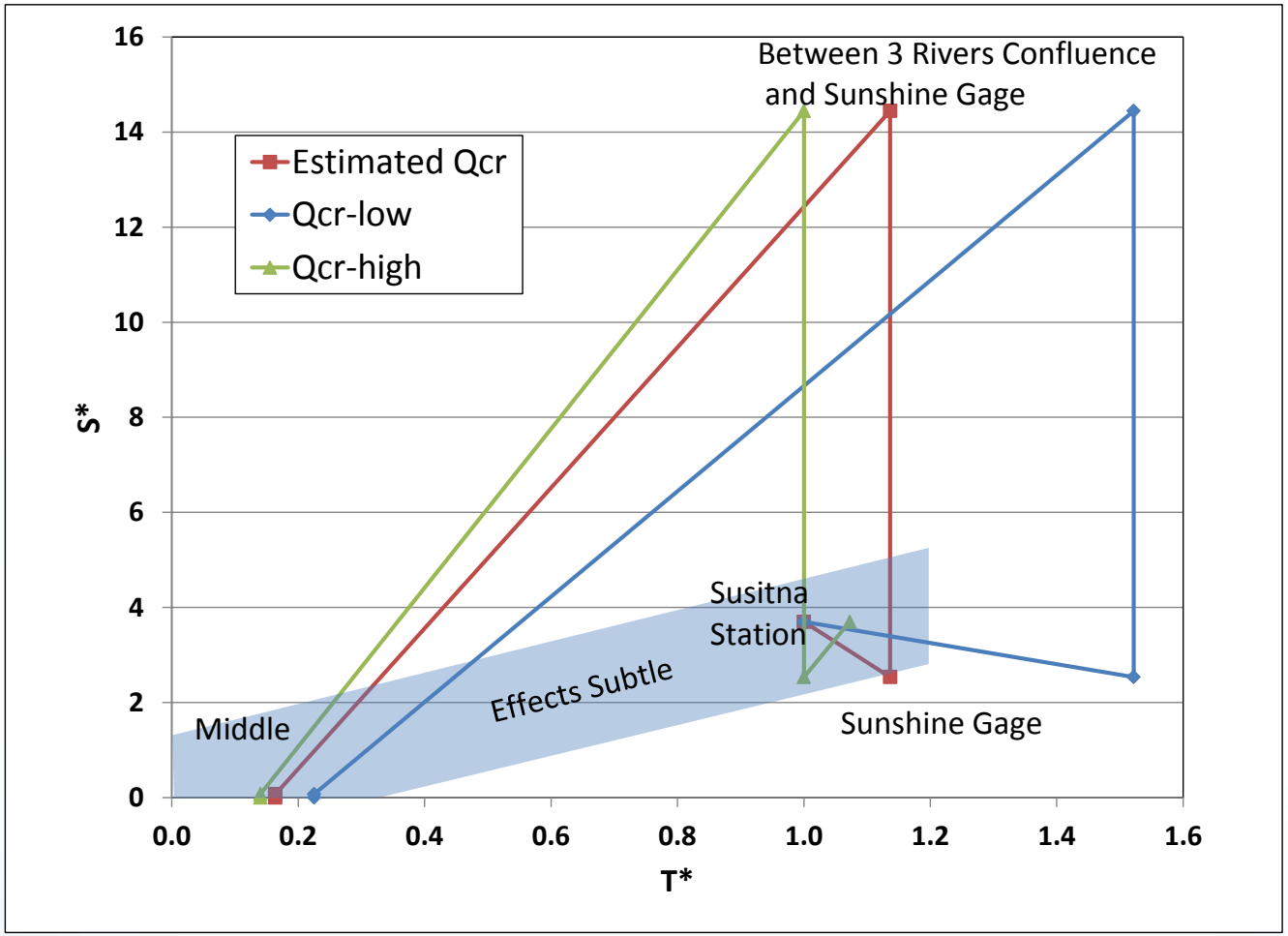
T* (Q_{cr} Exceedance) Summary

Location	Estimated Q_{cr} (cfs)	T_{pre}	$T_{Max\ LF\ OS-1}$	T*
Best Estimate				
Watana	25,000	11.0%	1.8%	0.16
Gold Creek	25,000	11.0%	1.8%	0.16
Sunshine	16,000	44.0%	50.0%	1.14
Susitna Station	4,000	100.0%	100.0%	1.00
Low Estimate				
Watana	20,000	20.0%	4.5%	0.23
Gold Creek	20,000	20.0%	4.5%	0.23
Sunshine	11,000	46.0%	70.0%	1.52
Susitna Station	2,000	100.0%	100.0%	1.00
High Estimate				
Watana	30,000	5.0%	0.7%	0.14
Gold Creek	30,000	5.0%	0.7%	0.14
Sunshine	21,000	38.0%	38.0%	1.00
Susitna Station	6,000	92.5%	99.2%	1.07

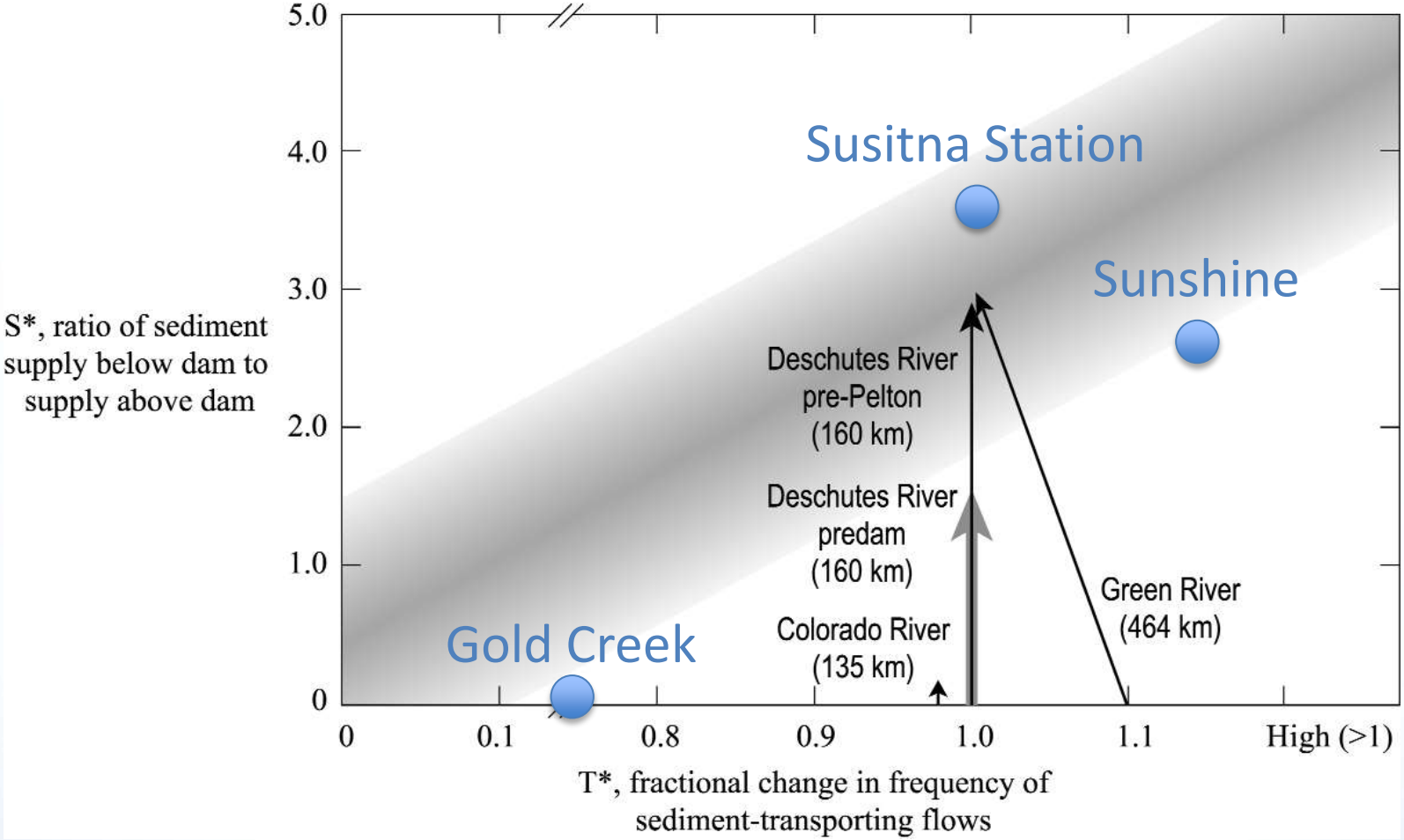
T* for Downstream of Dam



S* - T* for Downstream of Dam



Comparison of S* - T* with Grant et al. Example Application



CONCLUSIONS

- Sand transport less effected than gravel
- Middle Susitna River
  - Reduced sediment supply and frequency of mobilizing flows.
  - Tributary gravel supply may exceed transport capacity for Maximum Load Following OS-1 conditions.
- Lower Susitna River (LR 1)
  - Continued accumulation of gravel and sand

CONCLUSIONS

- Impacts downstream from Three Rivers Confluence could occur
  - Sunshine – Yentna: ~25% reduction in 1.5- to 5-year peak flows → >10% reduction in channel width (Flow Assessment)
  - Below Yentna: ~15% reduction in 1.5- to 5-year peak flows → < 10% reduction in channel width (Flow Assessment)
  - Lower River will remain aggradational but less so under Max Load Following OS-1 (Sediment Assessment and Channel Change)
  - Grant, et al (2003) Framework
    - Lower River below Sunshine could tend toward degradation and narrowing under Max Load Following OS-1 (Channel Change)

The Analysis is an Initial Assessment

- Performed to assess potential change in Lower Susitna River
- Altered hydrology affects sediment transport capacity and duration of mobilizing flows
- Additional analyses necessary to provide a more complete picture of potential change on channel morphology and habitat in lower Susitna River

END