Channel Migration & SMP Updates

Shorelands and Environmental Assistance Program
Washington Department of Ecology

Patricia L. Olson, LHG, PhD

WASHINGTON STATE DEPARTMENT OF ECOLOGY

- If things don’t make sense...
- Please interrupt and ask questions

The Shoreline Management Administrative Code requires that SMP updates address channel migration

Shoreline Master Programs
WAC 173-26

- WAC 173-26-201(3)(c)(vii)
  WAC 201(3)(d)(i)(D) — Inventory & Analysis
- WAC 173-26-221(2)(c)(iv)(A): — Critical freshwater habitat
- WAC 173-26-221(3)(b): — Flood Hazard Reduction
- WAC 173-26-231(3): — Modifications

What is the SMP channel migration zone?

WAC 173-26-020(6): "Channel migration zone (CMZ)" means the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surroundings."

What is channel migration?

Shoreline habitat, resources, critical areas

- WAC 173-26-201(3)(d)(i)(D): channel migration included as one of the ecosystem functions and processes of overall condition

Shoreline habitat, resources, critical areas

- WAC 173-26-221(2)(c)(iv): Critical areas
  - CMZ included as a critical freshwater habitat
  - New development in the CMZ limited to that which does not:
    - Cause net loss of ecological functions
  - Requires that SMPs include standards to implement principles described above.

WAC 173-26-221: Flood Hazard Reduction

- WAC 173-26-221(3)(b-c): limit development, shoreline modifications that may
  - interfere with the channel migration process
  - cause significant adverse impacts to property or public improvements and/or
  - result in a net loss of ecological functions

WAC 173-26-221: Flood Hazard Reduction

- WAC 173-26-221(3)(b): Failing to recognize the [channel migration] process often leads to damage to, or loss of, structures and threats to life safety

WAC 173-26-221(3)(b): Exemptions

The SMP guidelines recognize that previous human actions may deter channel migration. Areas may be removed from the channel migration area if:

- Within incorporated municipalities and urban growth areas,
  - Publicly maintained levees, revetments
  - Public transportation facilities that can withstand the one hundred-year flood
- Outside incorporated municipalities and urban growth areas, only channel constraints built above the 100-year flood elevation and maintained by public groups

But do artificial structures really deter channel migration?

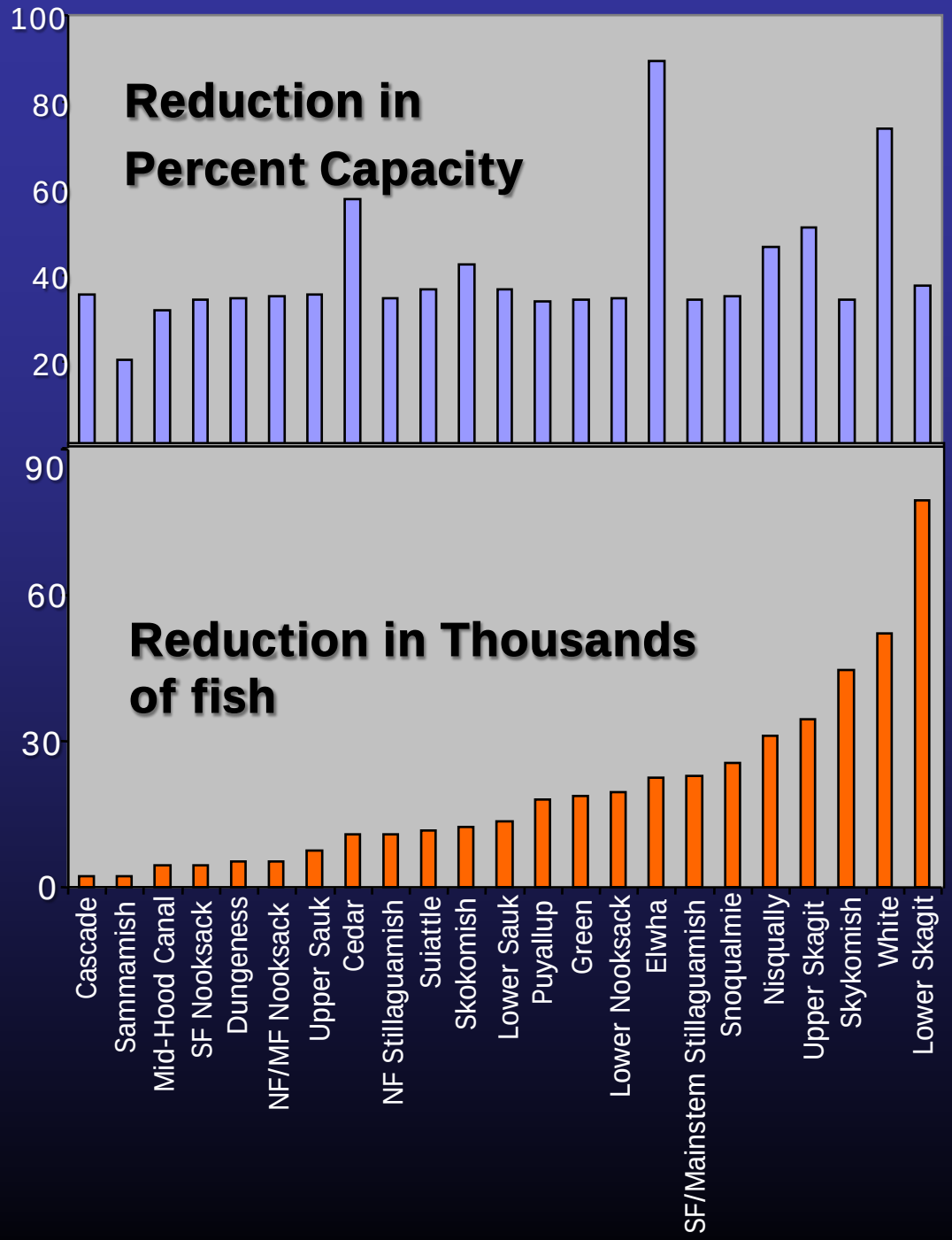
Why regulate channel migration areas?

- Social/economic benefit
  - Hazard reduction
  - Economic
  - Water quality /quantity

- Salmon Recovery Efforts
  - Channel reaches that migrate have the highest diversity of aquatic habitats
  - Public costs are high

Economics: Loss of resources

- Salmon Recovery costs estimated at $5 billion for the PNW region

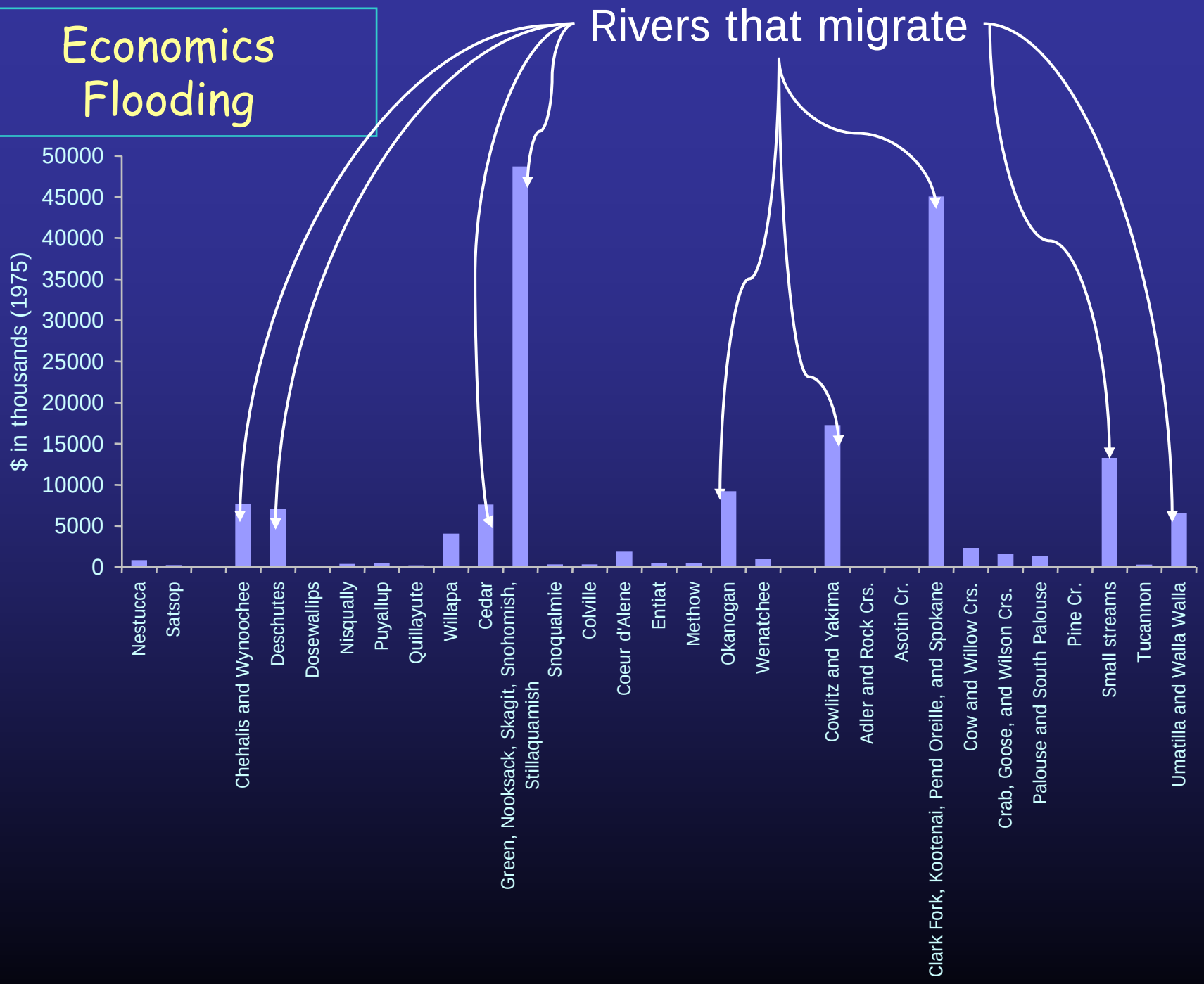


Economics: Because it costs the public

- SF Stillaguamish
- 10/03

- 11/05
- Public $$

Economics Flooding



Back to the inventory…

WAC 173-26-201(3)(c): Inventory shoreline conditions.

- Local governments shall, at a minimum, and to extent information is relevant and reasonably available, collect the following information:
  - (ii) Information on freshwater critical areas
  - (vii) General location of channel migration zones and flood plains.

Draft Web CMZ Guidance

- Developed to help local communities during SMP updates
  - Other possible uses:
    - CAO updates
    - Comprehensive Flood Management Plans
    - Restoration Planning

- Abbreviated description
  - http://www.ecy.wa.gov/programs/sea/sma/cma/index.html

- Draft document so if you would like to comments do so to:
  - Patricia Olson: patricia.olson@ecy.wa.gov

CMZ Guidance

- Methods suggested during workshop emphasize the stream in context with the other factors that influence fluvial processes
  - Geologic processes
  - Sediment processes
  - Hydrologic regimes and processes
  - Land use

What's relevant and reasonably available?

To determine potential migration

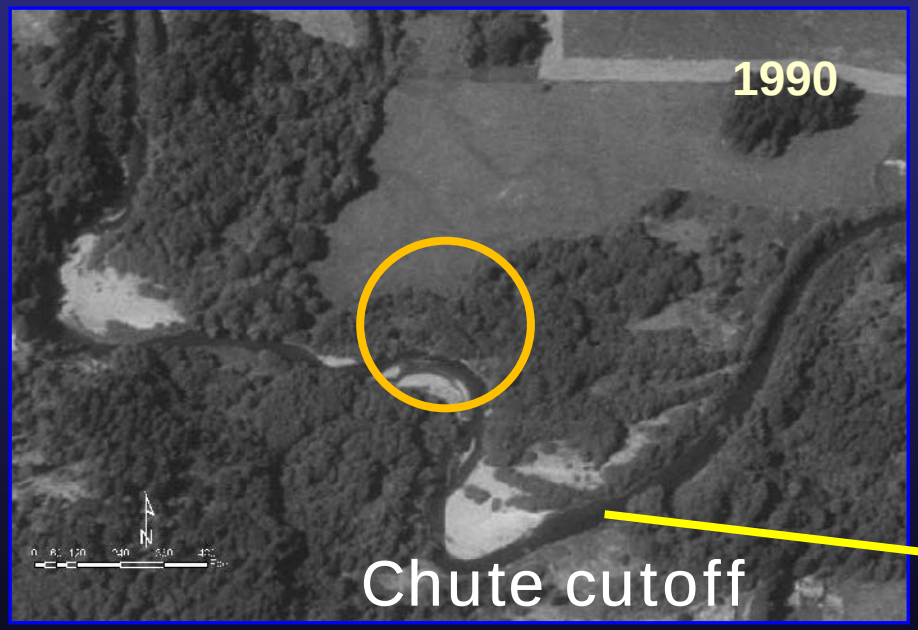
- Information on channel characteristics such as channel gradient and confinement.

What's relevant and reasonably available?

- Existing GIS geology and soils data to evaluate erosion potential
  - WAC 173-26-221(3)(b): based on the historic record, geologic character and evidence of past migration over the past 100 years

What's relevant and reasonably available?

- Evidence of past migration: 2 to 3 time series of aerial photographs, maps, LiDAR
  - ix) Already states that aerial photographs may be necessary to identify cumulative impacts



Other Indicators

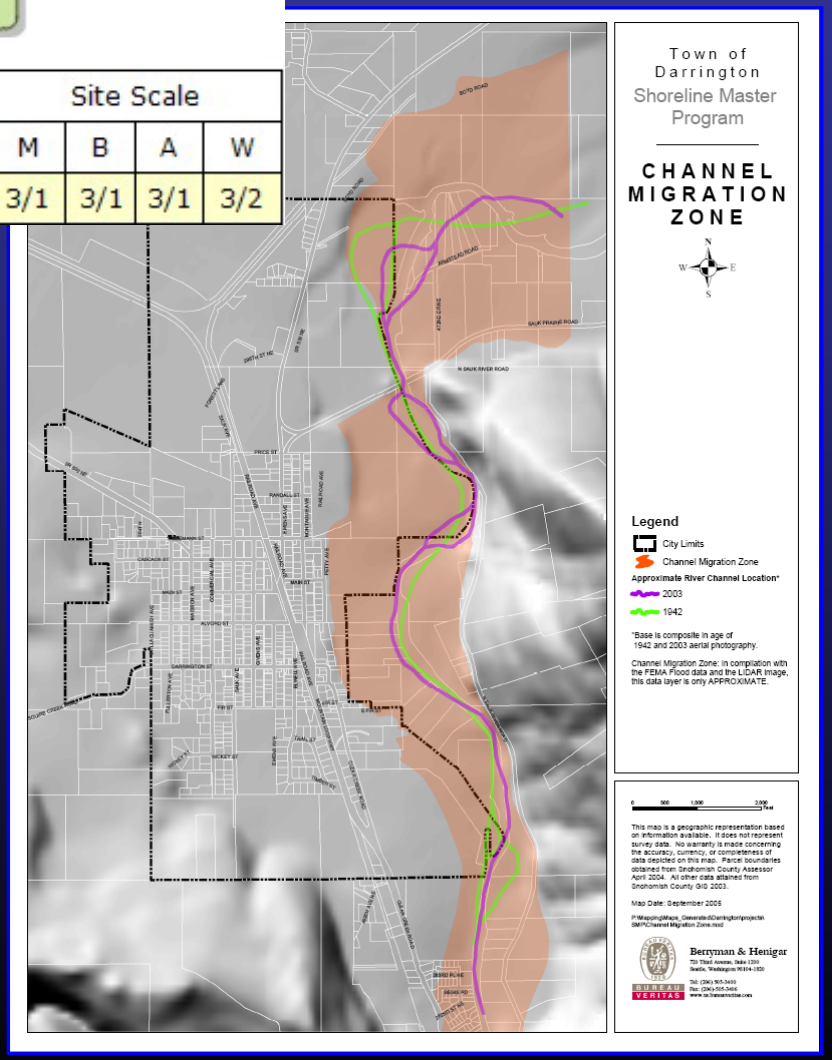
1. Multiple channels
2. Gravel bars, multiple bar forms
3. Meandering form
4. Secondary channels --
5. Young disturbance vegetation
6. Wood jams

Decision Framework: Step 2

Step 2a: Determine minimum approach and methods basd on physical attributes and scale for SMP characterization and inventory phase.

	Basin Scale				Reach Scale				Site Scale			
Channel Pattern	M	B	A	W	M	B	A	W	M	B	A	W
Watershed Characterization	1	1	1	1/2	2/1	2/1	2/1	2/3	3/1	3/1	3/1	3/2

- Reach, Low level, Method 3
- 2 sets of air photos
- No migration or erosion hazard rates



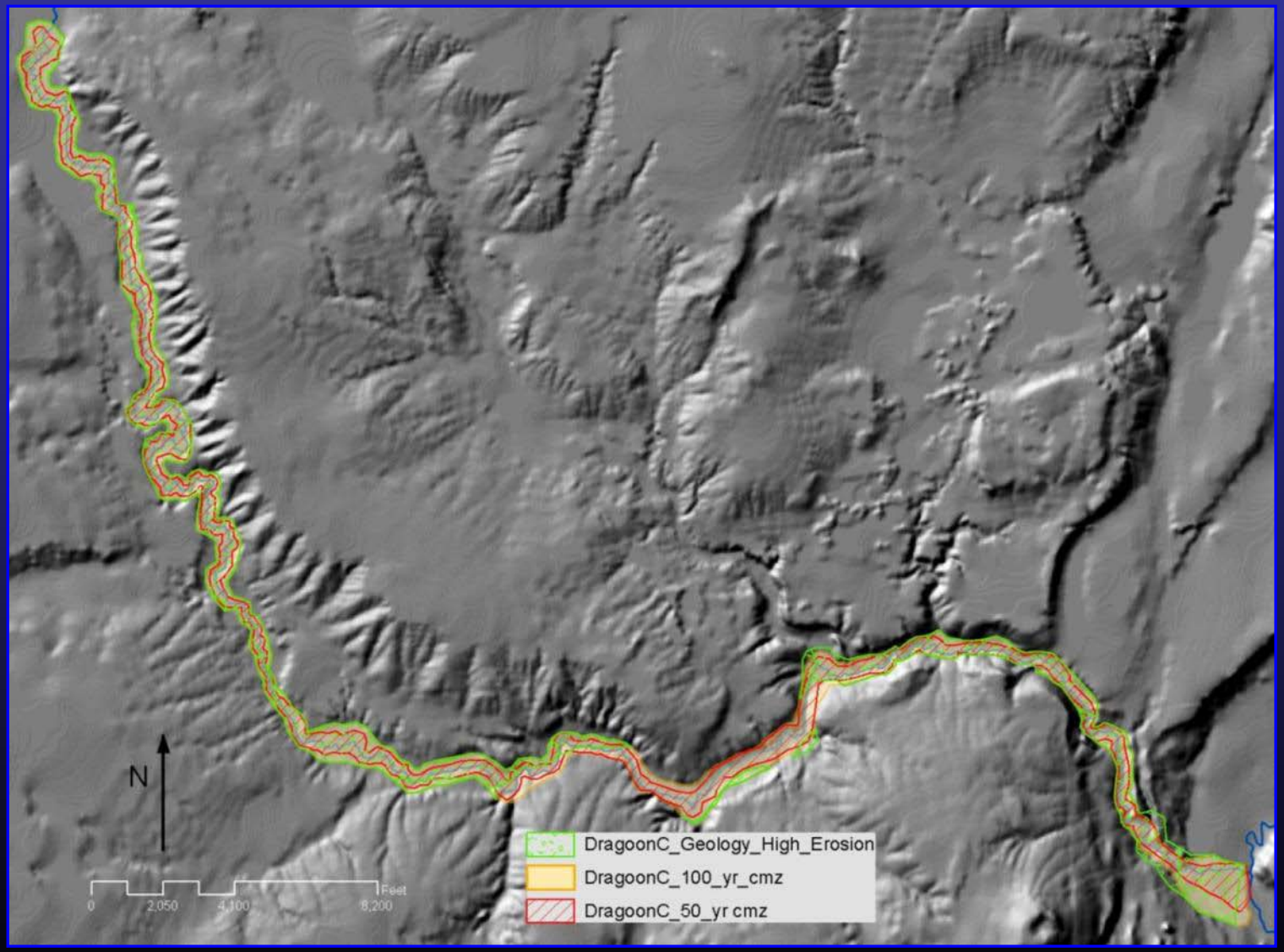
Example: Spokane County SMP Update

- Low level, basin approach outlined in CMZ web guidance
  - SMP inventory, characterization, WRIA reports, and Spokane County Conservation District (SCCD) shoreline inventories.
- GIS based with limited field verification
  - 24k hydrography, USGS 7.5' quadrangles, SHIAPP channel gradient, 10-meter DEM, 2004-2006 orthophotos, miscellaneous aerial photographs, SCCD shoreline inventory shapefiles, DNR geology, NRCS soil data.
- 3-day field verification

Basin/watershed scale	Most applicable to basin or watershed Scale: all stream types
1. Low accuracy method	Minimum Level of Effort • Used GIS, DEM, LiDAR and hydrologic data to minimize costs • Evaluated sources of sediment, climate and land use changes existing maps and historic stream flow and climate data • Much of this information was included in the WRIA and SCCD reports • Identify possible hazard areas using DEM, LiDAR or aerial photographs, topographic maps • Compared channel alignment between 2-3 time series using USGS 7.5' digital images, 2004-2006 orthophotos

2. Moderate accuracy method	Above plus the following
	• CMZ Hazard zone=average rate of bank erosion per year x 100 years
	• Mapped the 50 and 100 year buffers
	• Suggested maximum buffer for meander and braided patterns: The probable migration area over 100 years plus the erosion hazard width or FEMA 100-year floodplain, whichever is greater
	• Erosion hazard area included intersection between :
	  • 100-year CMZ buffer and geology with high erosion potential
	  • 50-year CMZ buffer and soil with > 35% sand

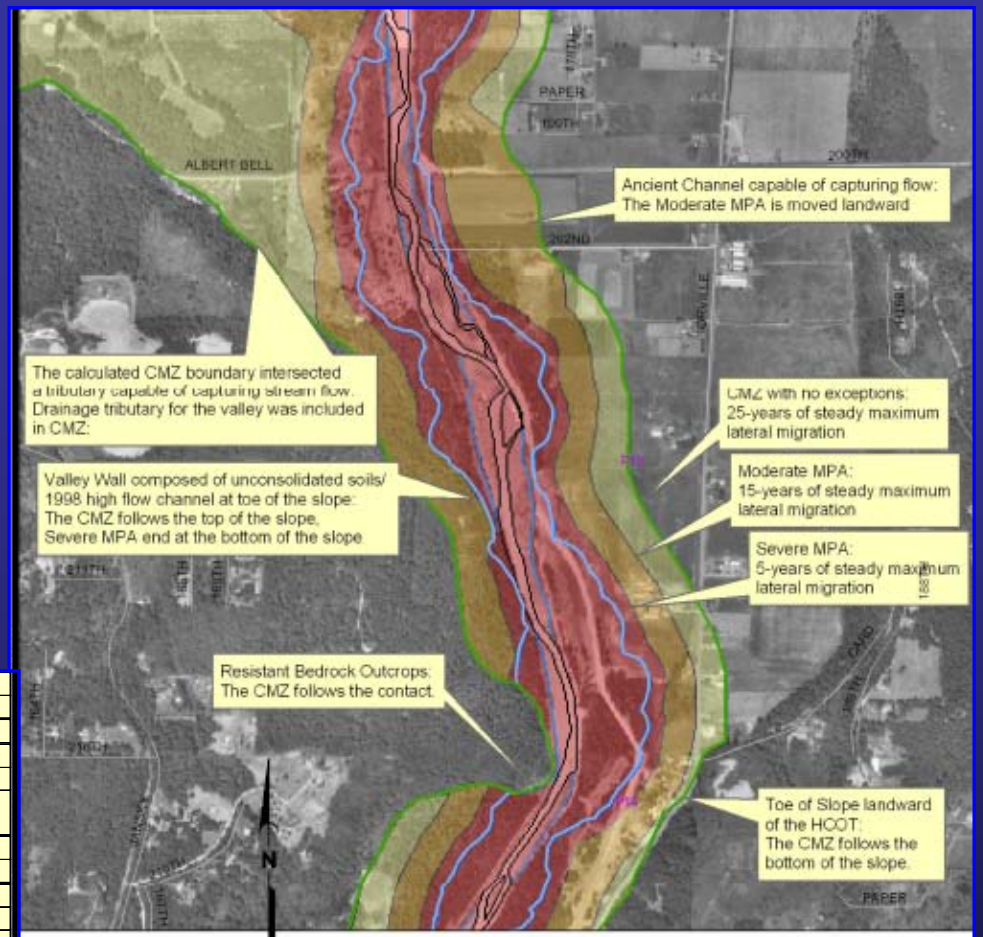
Example


N
0
2,050
4,100
8,200
Feet
DragoonC_Geology_High_Erosion
DragoonC_100_yr_cmz
DragoonC_50_yr cmz

Watershed/reach, High level, Method 5

- Multiple air photos, maps
- Watershed & reach hydrologic, geomorphic analysis
- Calculated migration, erosion rates
- Identified avulsion areas
- Identified hazard zones

	Level of effort	Low				Moderate				High			
	Pattern	M	B	A	W	M	B	A	W	M	B	A	W
Basin scale													
Planning	Comprehensive	1	1	1	1	1	1	2	2	2	2	2	2
	Salmon Recovery	1	1	1	1	1	1	1	2	2	2	2	2
	Restoration	1	1	1	1/2	1	2	2	2	2	2	2	3
Hazard assessment	Flood hazard reduction	2	2	2	2	3	3	3	3	4	4	4	4
	Geo hazard	2	2	2	2	3	3	3	4	4	4	4	5
Regulatory	Infrastructure	3	3	3	4	4	4	4	5	5	5	5	6
	Mitigation	2	2	2	2	3	3	3	3	4	4	4	4
	Environmental	2	2	2	2	3	3	3	4	4	4	5	5
Reach scale													
Planning	Comprehensive	3	3	3	3	3	3	3	4	4	5	5	5
	Salmon Recovery	3	3	3	3	3	3	3	3	4	4	4	4
	Restoration	3	3	4	4	3	3	4	4	5	5	5	6
Hazard assessment	Flood hazard reduction	3	3	4	4	4	4	5	5	5	5	6	6
	Geo hazard	3	3	4	4	4	4	5	5	5	5	6	6
Regulatory	Infrastructure	3	3	4	4	4	4	5	5	5	5	6	6
	Mitigation	3	3	4	4	3	3	4	4	5	5	5	6
	Environmental	3	3	4	4	4	4	5	5	5	5	6	6
Site scale													
Planning	Comprehensive	3	3	3	3	3	3	3	4	4	5	5	5
	Salmon Recovery	3	3	3	3	3	3	3	3	4	4	4	4
	Restoration	3	3	4	4	3	3	4	4	5	5	5	6
Hazard assessment	Flood hazard reduction	3	3	4	4	4	4	5	5	5	5	6	6
	Geo hazard	3	3	4	4	4	4	5	5	5	5	6	6
Regulatory	Infrastructure	3	3	4	4	4	4	5	5	5	5	6	6
	Mitigation	2	2	3	3	3	3	4	5	5	5	5	6
	Environmental	2	2	3	3	3	3	4	4	4	4	5	5



NOT TO SCALE

EXPLANATION:

- 1998 ACTIVE CHANNEL
- 1998 HIGH-FLOW CHANNEL
- HCOT
- CMZ

MPA (COLOR CODED)

- SEVERE
- MODERATE
- LOW

Note: This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Reference: 1998 Washington DNR orthophotograph.

GeoEngineers

EXAMPLE OF CMZ AND MPZ MAPPING

FIGURE A-1

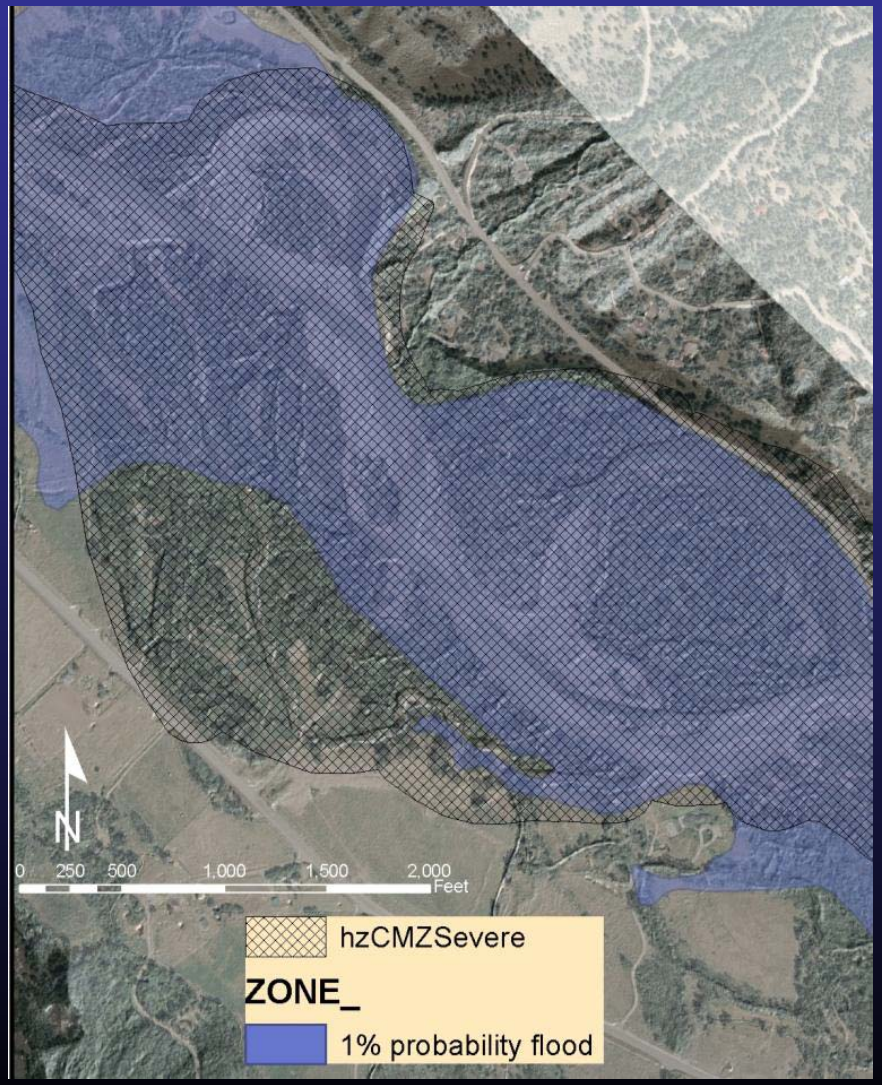
Lessons Learned: Legal versus Practice

Challenges

- Shoreline jurisdiction not sufficient to address CMZ extent
  - 200 feet from OHWM or
  - 200 feet from floodway if greater than above or
  - The 1% FEMA floodplain where there is no floodway
- Only require that CMZ is “generally” mapped
  - No methods other than those in definition are in the document
- Exclusions based on 100-year flood which is changing

Lesson 1: 1% FEMA floodplain should not be considered representative of CMZ

- 1% FEMA floodplain:
  - and CMZ not always synonymous
  - not updated frequently enough
  - does not include erosion hazards
  - does not include avulsion hazards



Lesson 2: Methods

- Diversity in stream environments requires more method flexibility to evaluate fluvial processes correctly
- Assessments need to consider the possible response and associated hazards by channel pattern, process and disturbance for past, current and future conditions
- Cross-check GIS assessments with field observations

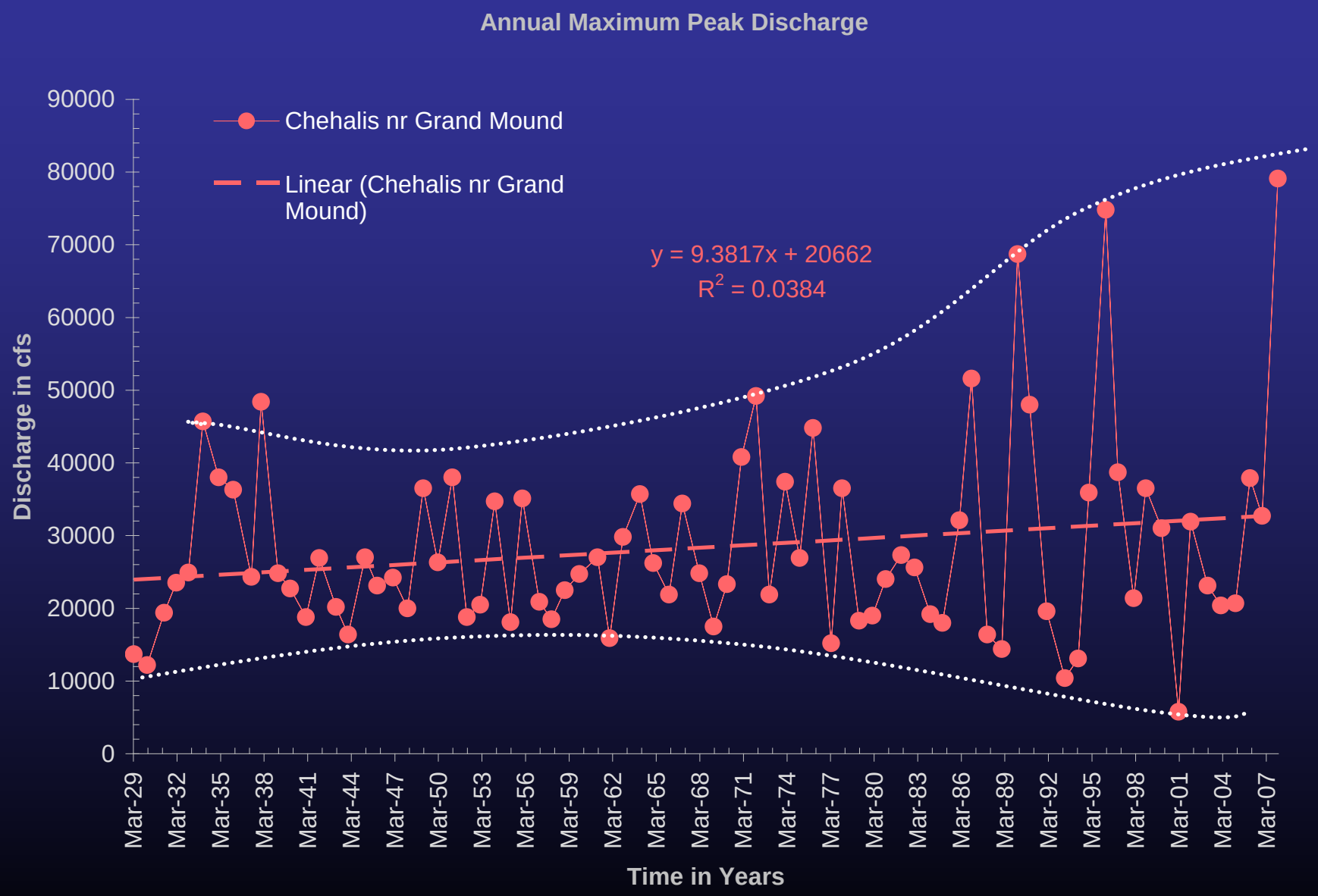
Lesson 2: Methods

- Have at least 1 person with a thorough understanding of fluvial processes
- The errors associated with each method not fully understood
- Hazard zoning—
  - What criteria to use
  - Is determining hazard zones appropriate management tool?

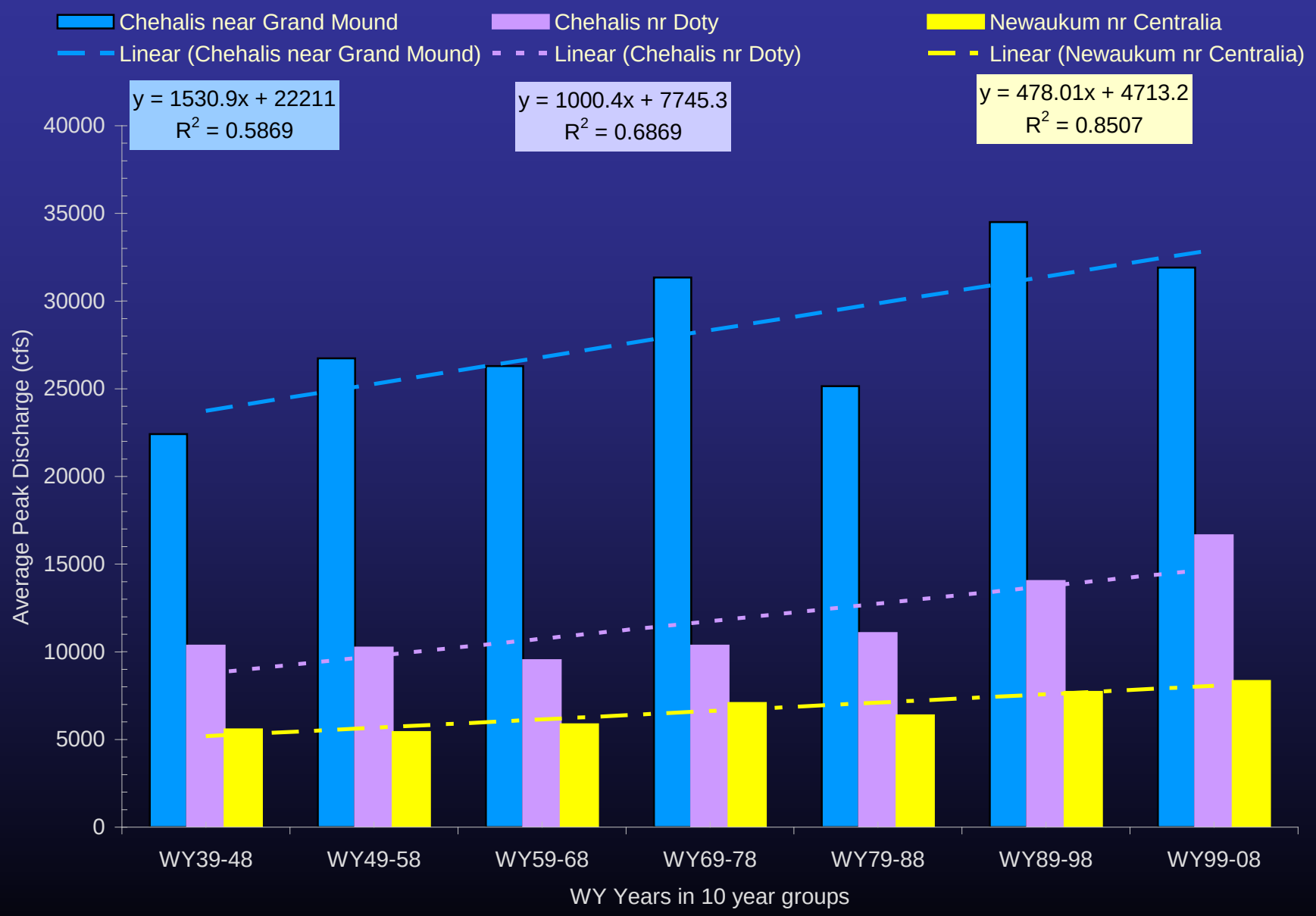
Historic Migration Analysis--Pitfalls

- Not considering:
  - Accuracy and completeness of historic information and analysis
  - Human caused changes
  - Vertical channel change
  - Regional climate differences
  - The past may be quite different than the present

Evidence of increasing floods?



Average Peak Discharge by Decade



Dynamic systems—may mean rapid change not evident in aerial photograph time series

Ecology's Role

- Review and approve SMP update documents
- Provide funding where available—SMP updates, FCAAP
- Provide technical assistance to local governments by developing tools to:
  - Make decisions on need for CMZ assessment
  - Determine approach, level of analysis and appropriate methods
  - Outline minimal acceptable standards of analysis
- Provide technical assistance for:
  - Implementing shoreland regulations where there are CMZs
  - Managing CMZs

Local government roles

- Identify where/if a CMZ assessment is needed
- Incorporate assessment costs into shoreline grant applications
- Identify and map general location of channel migration zones in characterization
- Identify levels of hazard
- Development standards
- Regulate actions in CMZs based on WAC language

Break