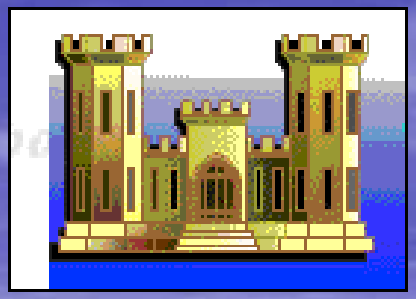

MEKONG DELEGATION
COLUMBIA RIVER STUDY TOUR

COLUMBIA RIVER SYSTEM OVERVIEW

By

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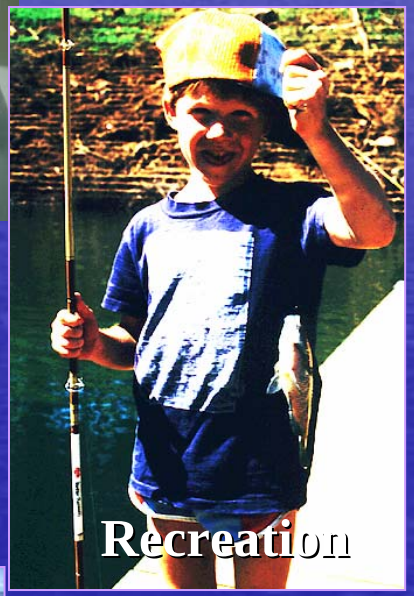
Portland, Oregon
April 2008

COLUMBIA BASIN

Multiple Purposes



$750 Million

Navigation

Columbia River

- Serves 36 ports and carries 40% of U.S. wheat
- More than 485 miles of navigable water
- Transports 35 million tons of cargo each year
- Export & import traffic exceed $12 billion annually

Hydropower

- In Columbia Basin, 21 Corps hydroelectric dams produce 12,900 MW.

Flood damage reduction

$3,900 TAXES '96

DECKHAND SURVIVES FALL IN WILLAMETTE

BUSINESSES SCURRY FOR VALENTINE'S DAY

ALL-STAR BRANDON REMEMBERS HIS ROOTS

ALL IN THE FAMILIES

MONDAY February 12, 1996 35¢

The Oregonian

final

HOW THEY SAVED DOWNTOWN

The Army Corps of Engineers manipulated the water flow of 60 dams to keep the Willamette from flooding Portland

THE FLOOD OF '96

- NWD projects prevented $32 billion in cumulative damages
- Columbia Basin drains 259,000 square miles
- Missouri Basin drains 539,000 square miles
- Flood control space ranges from 25% of Columbia's seasonal volume to 200% of Missouri's seasonal volume.

Fish / ESA

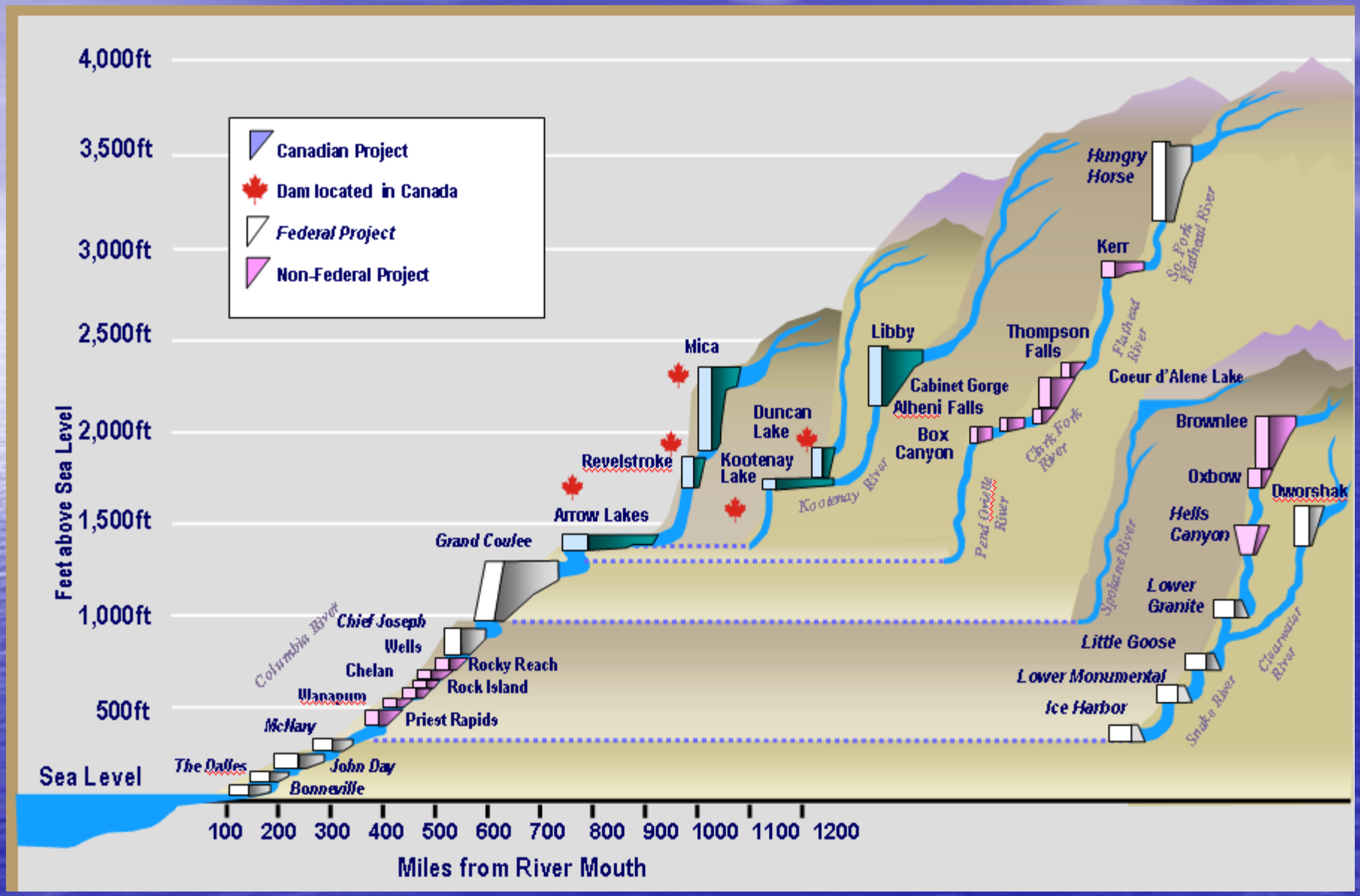
Irrigation

- Millions of acres of cropland benefit from water behind Corps projects.

Recreation

- **Corps projects in NWD host more than 46 million visitors annually.**

COLUMBIA RIVER SYSTEM HYDRO PLANT ELEVATIONS



Characteristics

- 4th Largest river in North America
- Most powerful (35,000 MW)
- Drainage area = 259,000 mi^2 (669,500 km^2)
  219,000 (84% in 7 US states) + 39,500 (Canada)
- Source in British Columbia, Canada; L= 1,214 mi. (1,950 km)
- Major Sub-basins: Kootenay, Pend d'Oreille; Snake; Willamette

- Climate: winter (wet, mild); summer (dry, warm)
- Temperature: maritime Jan 36-Jul 62 (2-17C) to desert (Jan 32-Jul 76)
- Precip: 6 – 180" (1500 – 4600 mm); max. in winter
- Snow: 400" (10,000 mm) in fall - early spring
- Evaporation: 35 – 55" (900-1,400mm)
- Runoff (Cascade: East=snow; West=rain)

Runoff

(Source: Columbia River System Inside Story)

- Annual Runoff @ Mouth
  Discharge: 275 kfs (7,787 m^3/s); Vol.: 198 maf (244 km^3)

- Annual Runoff @ The Dalles
  Discharge: 178 kfs (5,038 m^3/s); Vol.: 134 maf (165 km^3)
  - peak floods (kcfs) (UnReg/Reg): 1948: 1,101/1,010; 1972:1,053/618; 1974:1,007/588; STP=1,560/850; PMF= 2,720/2,120
  - highest recorded flow (1894) : 1,240 kfs (35,113 m^3/s)
- min Vol.=78 maf (96 km^3); max Vol.=193 maf (237 km^3)

- Canadian Impacts:
  - ✓ 15% of total watershed area
  - ✓ More mountainous
  - ✓ More precipitation (winter snow)
  - ✓ Canadian Contribution:
    - average annual runoff: 30% - 40% of total basin's runoff (50.2 maf)
    - flood run-off: 50% of runoff during highest floods

Mekong vs. Columbia

COLUMBIA RIVER BASIN

Comparable Mekong Data

Drainage: 760,000 km^2 (293,000 mi^2) at Mouth

(Overview of MK Hydrology–Nov. 2005)

L= 4,800 km (2,980 mi)
Ave. Ann. Runoff @ Kratie (646,000 km2):
418 km^3 (340 maf)
ave. Q= 13,200 m^3/s (466 kfs)
max. Q= 66,700 m^3/s (2,356 kfs)

ave. Ann. Runoff @ Mouth (760,000 km2)
V=457 km^3 (371 maf); Qav=14,500 m^3/s (512 kcfs)

Upper Basin: 24% of area; 15-20% of Q
AREA%/FLOW%: China 21/16
Burma 3/2; Laos 25/35;
Thailand 23/18; Cambodia 8/11

(1 Maf=1.23 Km^3) (1 Kcfs=28.3 m^3/s)

Mekong vs. Columbia

(Source: Columbia River System Inside Story)

Drainage:	760,000 km^2	vs.	669,300 km^2	ratio: 1.11
River Length:	4,800 km	vs.	1,954 km	ratio: 2.14
Ann. Runoff Vol:				
Kratie/ The Dalles	418 km^3	vs.	165 km^3	ratio: 2.53
Mouth/Mouth	457 km^3	vs.	244 km^3	ratio: 1.87
Average Discharge:				
Kratie/ The Dalles	13,200 m^3/s	vs.	5,038 m3/s	ratio: 2.62
Mouth/Mouth :	14,500 m^3/s	vs.	7,790 m^3/s	ratio: 1.86

(1 maf=1.23 km^3) (1 kcfs=28.3 m^3/s)

Mekong vs. Columbia (cont'd)

Location	SE ASia	NW North America
Countries	6	2
Basin Population, million	59	12
Basin %	25% Lao PDR; 23% Thailand; 21% PRD; 20% Cambodia; 8% Viet-Nam; 3% Myanmar	85% US; 15% Canada
Max. Elevation, m	5,224	3,901
Min. Elevation, m	0	0
Mainsteam Elec. Dams	3	14
Typical Annual Power Production, TWh	13	105

Northwest Power System
Firm Generating Resources

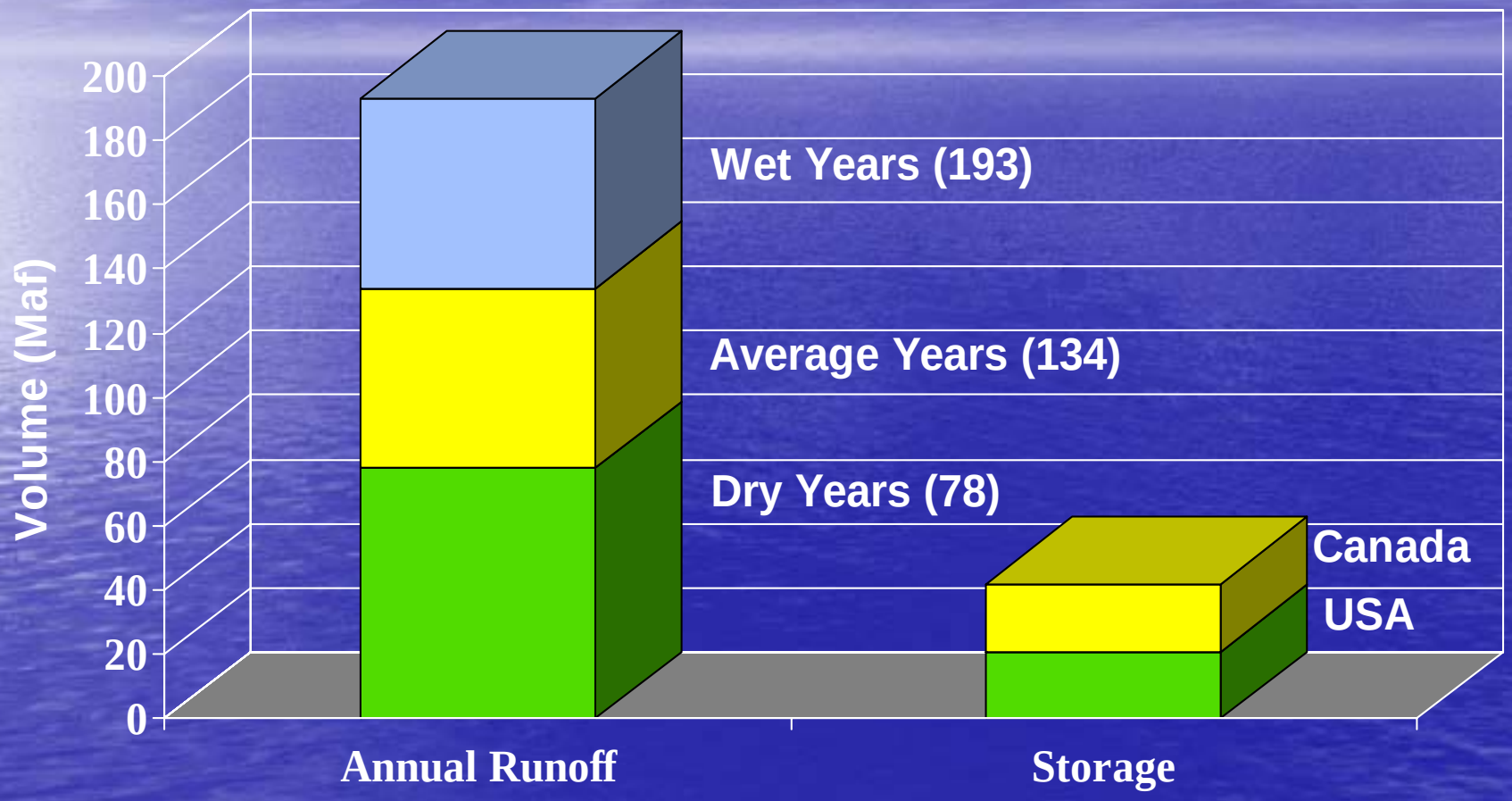
Resource	aMW	Percent
Firm Hydro	11,853	56
Coal	5,750	27
Combustion Turbine	2,070	10
Nuclear	880	4
Wind	23	<1
Other	60	<1
Biomass	520	2
Total Resources	21,156	100

Conservation (since 1980)	1,200	(6% of 21,156)

Resources & Demand
(aMW)

Total Firm Resources	21,156
NW Firm Demand	21,732
Firm Exports	1,959
Total Firm Demand	23,691
Net Deficit	2,538

Storage Volume vs. Runoff



Major Columbia Reservoirs

Mica (Canadian)	12.0
Arrow (Canadian)	7.4
Duncan (Canadian)	1.4
Libby	5.0
Hungry Horse	3.1
Grand Coulee	5.2
Dworshak	2.0
Others	5.9
Total Useable Storage	42.0 maf

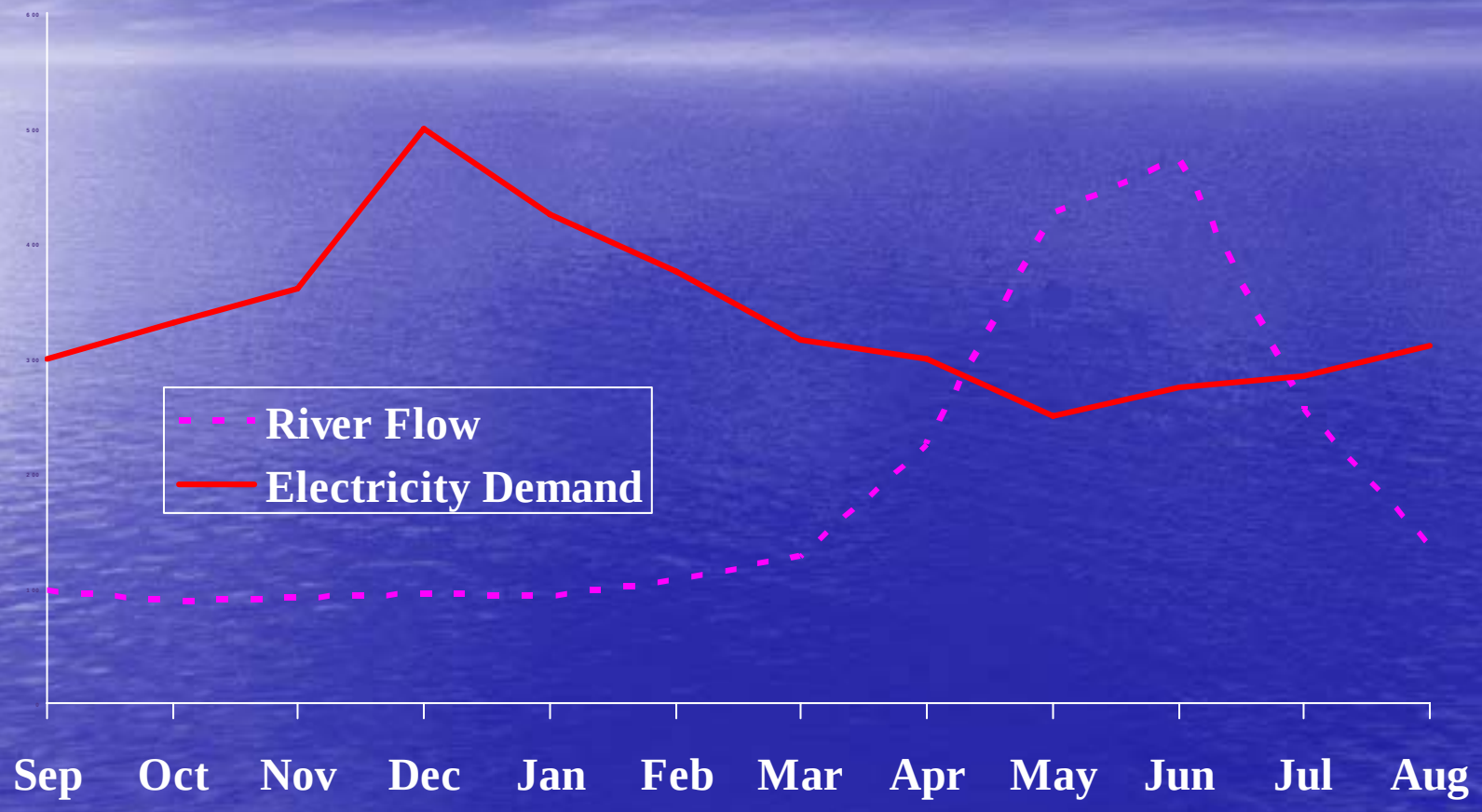
Average Annual Runoff Volume (The Dalles) 134.0 maf

Hydroelectric Energy (aMW)

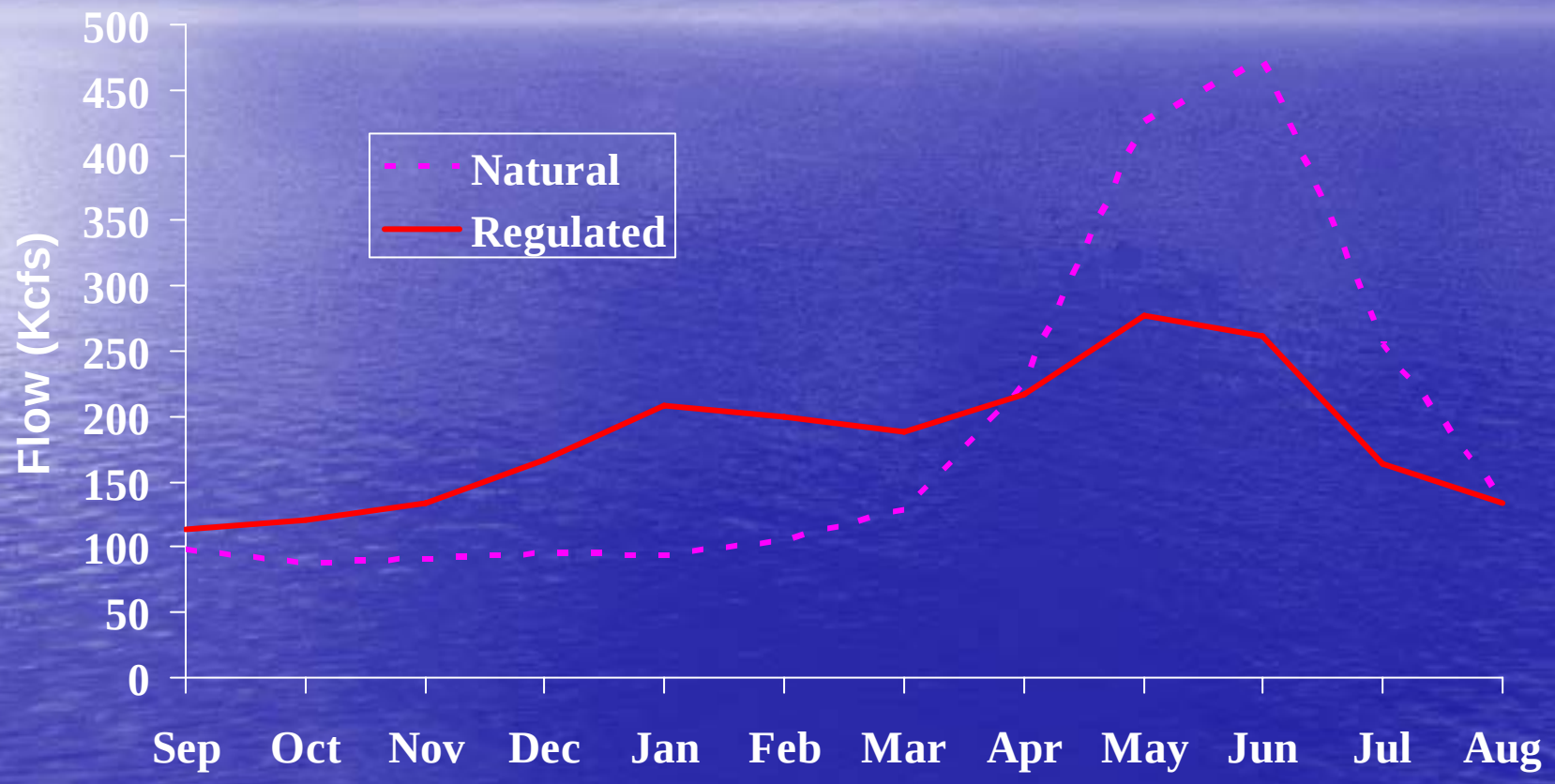
Water Conditions	Firm Energy	Non-Firm
Dry	12,000	0
Ave	16,000	4,000
Wet	20,000	8,000

- Highest Flows : Apr-Jun
- Highest Electricity Demand: Nov-Feb
- Spring Runoff Stored & Released in Fall & Winter
- Lowest Pools @ Start of Spring

Flows & Electricity Demand



Natural & Regulated Flows



Early Hydro Planning

- "308" Rep. Columbia & Trib. ('32): 10 mainstem dams
- Col. Riv. Review Rep. ('48): COE/USBR/BPA roles
- Col. Riv. Review Rep. ('58): Canadian storage
- Col. Riv. & Trib. Study: combined hydro-thermal; environment

Important Legislation

- Boundary Waters Treaty ('09): IJC, levees, pollution, disputes
- Rivers & Harbor Act of 1913/1917: navigation
- Flood Control Act of 1936/1944: national policy, COE as prime
- Bonneville Project Act of 1937: marketing; transmission
- Pacific NW-SW Intertie, 1964: high voltage AC/DC lines

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