The Mid Columbia Projects
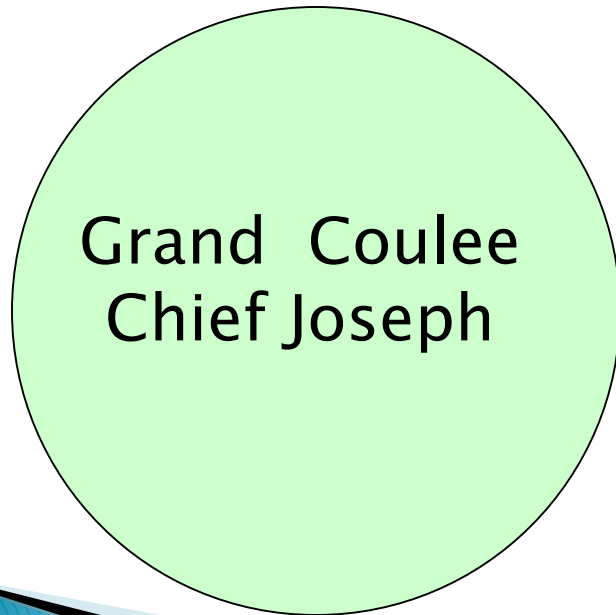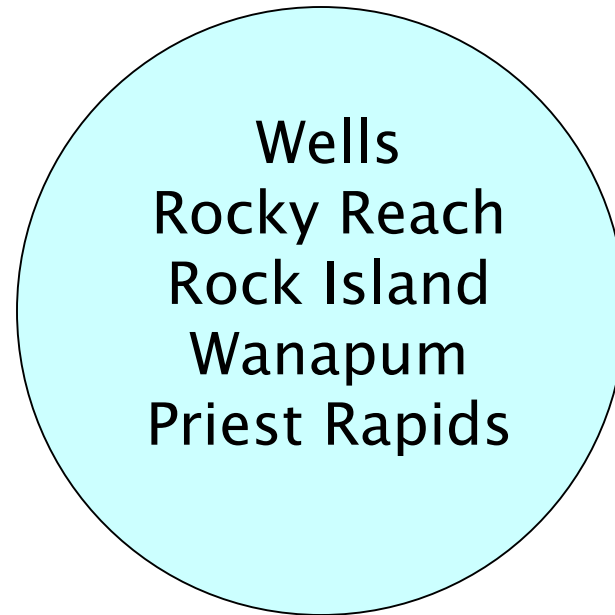
The projects are commonly referred to as Non-federal Projects:

Federal Projects

PUD Projects, Non Federal

Grand Coulee
Chief Joseph

Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids

The Mid Columbia System

The Mid Columbia system consists of seven multi-purpose projects:

- Grand Coulee
- Chief Joseph
- Wells
- Rocky Reach
- Rock Island
- Wanapum
- Priest Rapids

Rocky Reach a Run of River Project
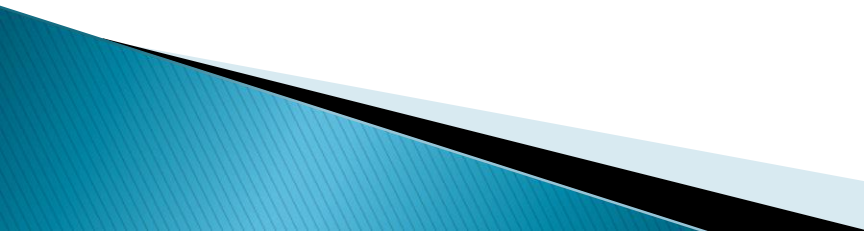
▸ **Definition**:

A project with a reservoir having a small amount of useable storage to augment daily outflow, such that daily outflow from the dam closely approximates daily inflow into the project reservoir.
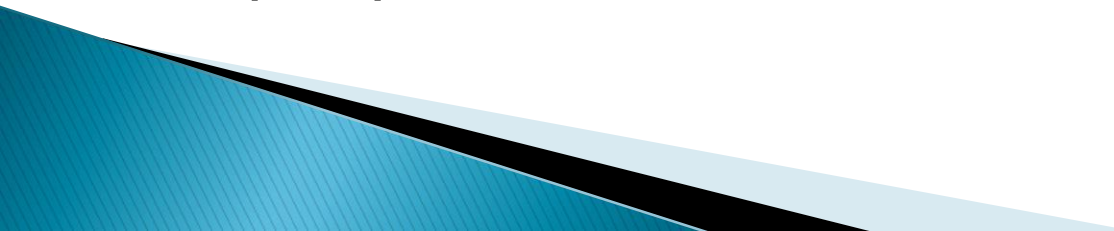
Run of River Project Hydrodynamic Characteristics

- Relies primarily on daily inflow for generation
- Daily inflow ≈ daily outflow
- Small useable reservoir storage volume
- Small daily reservoir fluctuations
- Shorter water particle residence time
- faster reservoir flushing rates
- faster flow-through water velocity
- No seasonal draft/storage operational changes
- Minimal seasonal thermal stratification

Primary Goal of Mid-Columbia Hourly Coordination

➢ Increase hydraulic head at all projects below Grand Coulee above what would have occurred without Hourly Coordination.

➢ Allow projects to operate at higher forebay elevations than otherwise would have been possible for a given level of risk of wasted energy.

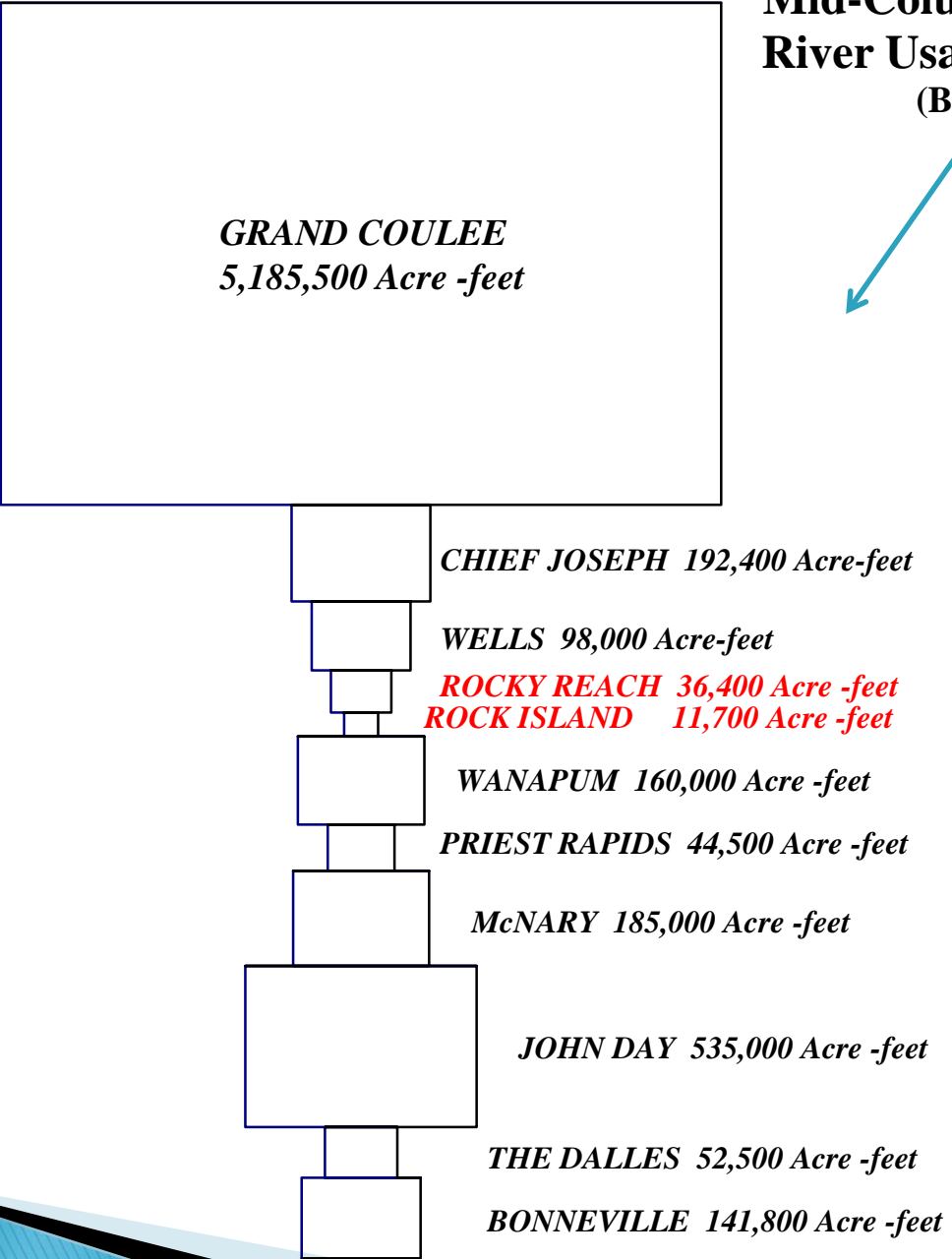➢ Lower the risk of overdraft of a project.

Logistics of Hourly Coordination

◦ Parties request generation.

◦ Central program optimizes generation requests by project, while respecting all constraints.

◦ Projects generate relative to their coordinated requests sent back from Central (as closely as possible).

◦ Central returns actual generation values to each party.

Logistics of Mid-C Hourly Coordination

◦ Coordination program runs every 4 seconds.

◦ Control program is a hydraulic optimizer;

◦ Any adjustment in generation between Projects is typically held constant during each hour.

◦ An Operator at Central is required to guide the operations at all times.

○ By adjusting mid-C generation between Federal and Non-federal projects, Central is able to better manage over filling or over drafting reservoirs (when compared to uncoordinated operations).

Mid-Columbia & lower Columbia River Usable Storage Comparison
(Box Diagrams to Scale)

GRAND COULEE
5,185,500 Acre -feet

CHIEF JOSEPH 192,400 Acre-feet

WELLS 98,000 Acre-feet

ROCKY REACH 36,400 Acre -feet
ROCK ISLAND   11,700 Acre -feet

WANAPUM 160,000 Acre -feet

PRIEST RAPIDS 44,500 Acre -feet

McNARY 185,000 Acre -feet

JOHN DAY 535,000 Acre -feet

THE DALLES 52,500 Acre -feet

BONNEVILLE 141,800 Acre -feet

Project Comparison

| Project	Turbine Capacity (cfs)	Max Vertical Draft (ft)	Volume Storage (acre-ft)	Flow volume In Storage (cfs/day)
Grand Coulee	280,000	81.5	5,185,500	2,614,314 cfs/d
Chief Joseph	205,000	26	192,400	97,000 cfs/d
Wells	220,000	10	98,000	49,408 cfs/d
Rocky Reach	220,000	4	36,400	18,352 cfs/d
Rock Island	220,000	4	11,700	5,898 cfs/d
Wanapum	178,000	11	160,000	80,667 cfs/d
Priest Rapids	187,000	6.5	44,500	22,435 cfs/d

Rocky Reach Reservoir Water *Residence Time*

- Definition: The average amount of time a water particle remains in the reservoir

- Calculation: The total volume of water in the reservoir, divided by either the inflow or the outflow (if inflow = outflow then the reservoir is in "hydraulic equilibrium")

Rocky Reach Reservoir
Inflow and Outflow by the Numbers
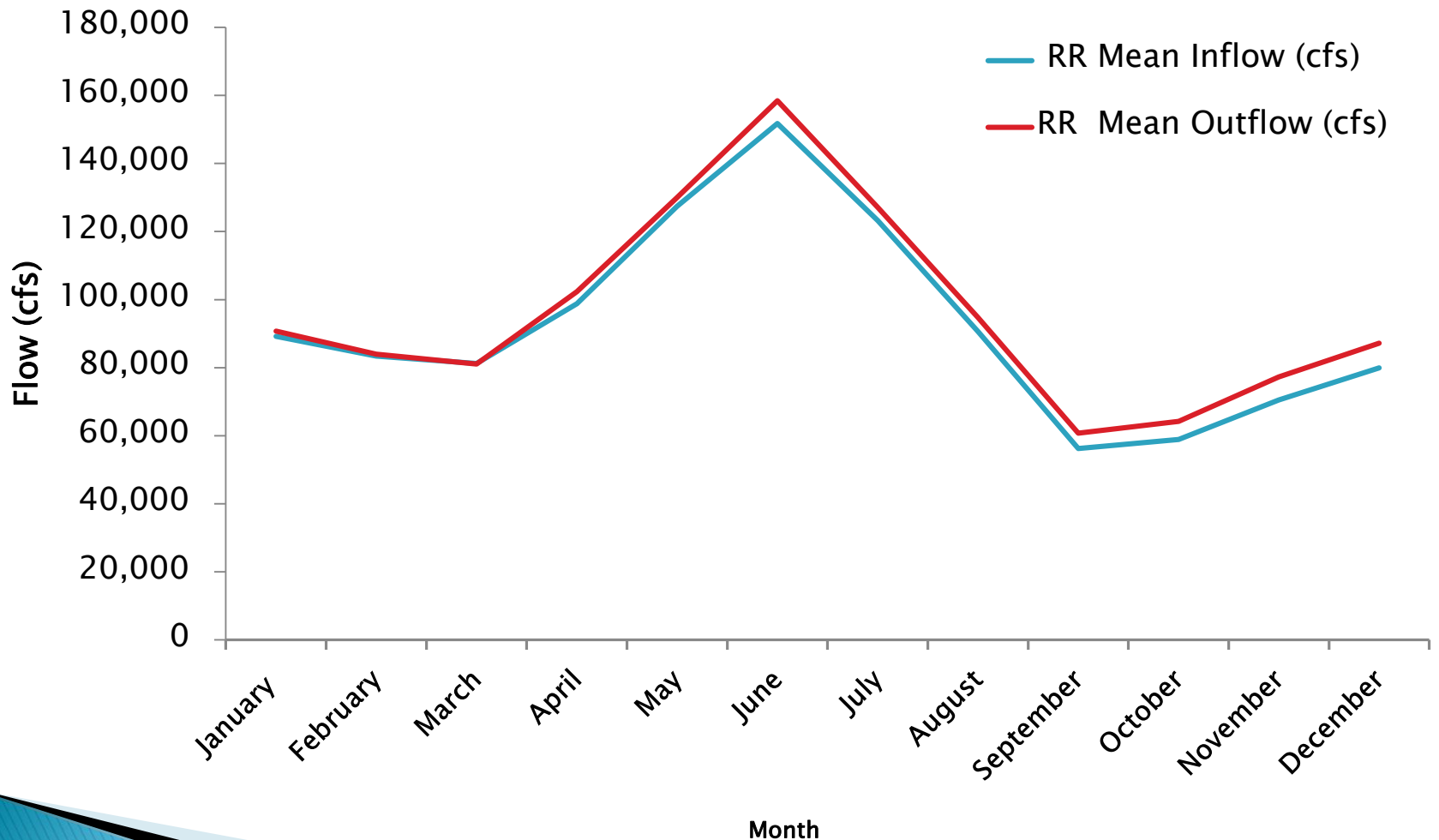
Rocky Reach Reservoir Residence time and Velocity
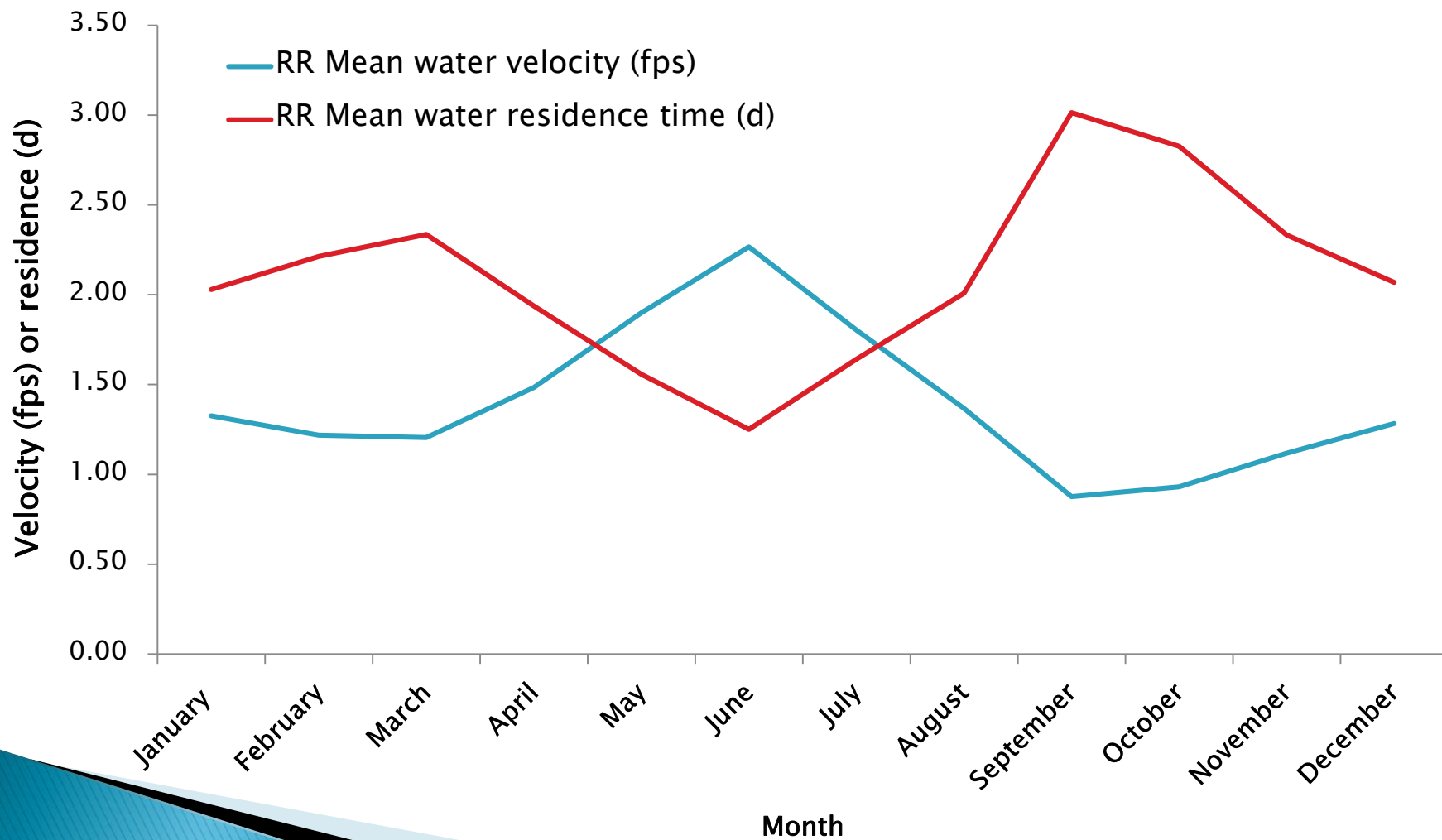
Summary
Rocky Reach Reservoir

- Reservoir more riverine-like than storage-like

- Daily inflow and outflow nearly equal

- Reservoir has little useable stored water: 4 ft max reservoir draft

- Daily outflow augmented only minimally by storage

- Very short water residence times

- Relatively fast water velocities