

GCDAMP FY2017 Knowledge Assessment Summary: Drivers & Constraints


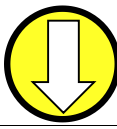
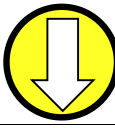
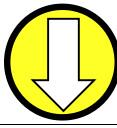





April 3, 2017

Symbol Key										
Strength of Effect				Direction of Effect				Confidence		
Strong	Moderate	Weak	Unknown	Positive	Neither	Negative	Unknown	High	Medium	Low

AQUATIC FOOD BASE

Resource Characteristic →	Food base diversity	Secondary production
Driver or Constraint ↓		
Algae and aquatic macrophyte quantity and quality		
Cool water temperatures		
Fall flood disturbance (HFEs)		
Flow fluctuation		
High sustained discharges (e.g., equalization)		
Leaf litter and similar inputs (allochthonous input)		
Low dissolved oxygen (<5mg/L) in water column and/or substrate		
Nutrients		
Spring flood disturbance (HFEs)		
Substrate quality		
Turbidity and suspended sediment		

ARCHAEOLOGICAL & CULTURAL RESOURCES

Resource Characteristic →	Depositional Integrity (Arch site stability)	National Register Integrity
Driver or Constraint ↓		
Destruction of feature		
Displacement of feature/artifact		
Human visitation		
Loss of matrix		
Sand bar erosion (versus deposition)		
Vegetation encroachment		
Water erosion		
Wind erosion		





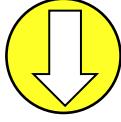


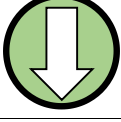
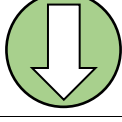

HUMPBACK CHUB

Resource Characteristic →	Adult population in western Grand Canyon	Adult population that spawns in the LCR	Juvenile chub population in CR near the LCR	Juvenile chub population in LCR and CR near the LCR	Juvenile chub population in western Grand Canyon
Driver or Constraint ↓					
Aquatic food base					
HFE frequency					
High-sediment floods in LCR					
Humpback chub recruitment from LCR					
Humpback chub recruitment from smaller size classes					
Predation and displacement by rainbow trout					
Temperature in CR in western Grand Canyon					
Temperature in CR near the LCR regularly < 12°C					
Temperature in CR near the LCR regularly > 15°C					
Temperature in CR near the LCR regularly 12-15°C					
Turbidity					




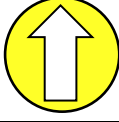
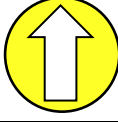
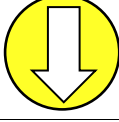
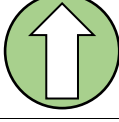
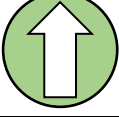


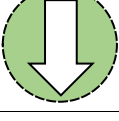



HYDROPOWER & ENERGY

Resource Characteristic →	Electric generation (capacity)	Electric generation (energy production)	Electric generation (energy value)	Emissions	Hydro-mechanical equipment	Load following capability	Net firming purchases
Driver or Constraint ↓							
Daily fluctuation limits							
Declining reservoir elevation							
Equalization events							
Experimentation (HFES, LSFs, etc.)							
Maintenance constraints							
Minimum and maximum release caps							
Monthly volume distribution							
Ramp rate limits							
Transmission constraints							












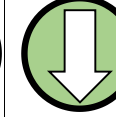









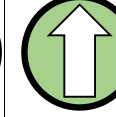


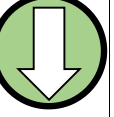
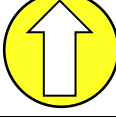
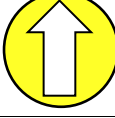
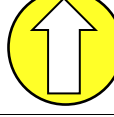
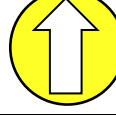

INVASIVE FISH SPECIES

Resource Characteristic →	All non-native coldwater fish	All non-native coolwater fish	All non-native warmwater fish	Brown Trout at Lees Ferry Reach	Brown Trout below Lees Ferry Reach	Green Sunfish	Smallmouth Bass	Walleye
Driver or Constraint ↓								
Brown trout recruitment in Lees Ferry Reach								
Brown trout spawning habitat and recruitment below Lees Ferry Reach								
High flow event(s)								
Increasing temperature								
Increasing temperature 1-3 degrees								
Increasing temperature 3-5 degrees								
Increasing temperature 5-10 degrees								
Smallmouth bass numbers in Lake Powell								
Walleye numbers in Lake Powell								

RAINBOW TROUT

Resource Characteristic →	LCR Inflow Area & Marble Canyon Rainbow Trout Fishery - Movement	LCR Inflow Area & Marble Canyon Rainbow Trout Fishery - Recruitment	Lees Ferry Rainbow Trout Sport Fishery - Age0 Growth	Lees Ferry Rainbow Trout Sport Fishery - Age0 Survival	Lees Ferry Rainbow Trout Sport Fishery - Growth and condition	Lees Ferry Rainbow Trout Sport Fishery - Recruitment	Lees Ferry Rainbow Trout Sport Fishery - RTELSS Age0 recruitment	Lees Ferry Rainbow Trout Sport Fishery - Spawning magnitude/hatch success	Rainbow Trout Maximum Size
Driver or Constraint ↓									
Algae and invertebrate production									
Controlled high and/or steady flows (incl. equalization)									
High annual, summer, and spring flow									
High winter flow and/or low spring flow									
Invertebrate drift availability									
Invertebrate drift size distribution									
Prey-size and abundance									
Rainbow trout density (# fish/km, >150mm)									
Spring 2008 HFE									
Temperature in CR									


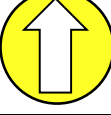



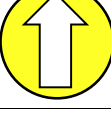
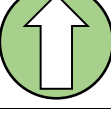

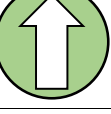
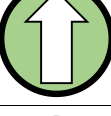
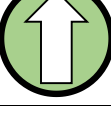
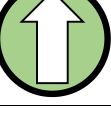
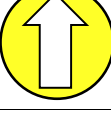



RECREATIONAL EXPERIENCE

Resource Characteristic →	Backpacking/day-use shore access	Backpacking/day-use shore availability	Backpacking/day-use usable campsite area	Flatwater floating in Glen Canyon NRA	Glen Canyon walk-in angling access and safety	Glen Canyon walk-in angling trout abundance	Glen Canyon walk-in angling trout condition	Glen Canyon watercraft angling access and safety	Glen Canyon watercraft angling trout abundance	Glen Canyon watercraft angling trout condition	Whitewater boat mooring (i.e., reduced beaching risk)	Whitewater navigational risk	Whitewater navigational risk Diamond down	Whitewater river crowding (i.e., rapids, beaches)	Whitewater river running experience (i.e., rapids)	Whitewater time on river	Whitewater usable campsite area	Wilderness experience
Driver or Constraint ↓																		
Annual whitewater and aircraft launches for recreational visitors																		
Annual whitewater & aircraft launches for resource mgt., research, and transport																		
Flow fluctuation																		
Flow magnitude																		
Past HFEs																		
Rainbow trout abundance																		
Rainbow trout condition																		
Riparian vegetation expansion																		

RIPARIAN VEGETATION

Resource Characteristic →	Area of herbaceous marsh habitats	Area of woody vegetation	Community heterogeneity	Functional group cover	Native to non-native ratio	Species richness	Total vegetation cover	Vegetation structure (vertical layering)
Driver or Constraint ↓								
Base flows								
Harvesting by beaver								
Inundation disturbance interval and timing								
Magnitude and duration of floods								
Past vegetation restoration								
Proportion of silt in substrate								
Sediment erosion/deposition disturbance interval and timing								
Tamarisk beetle								

SEDIMENT

Resource Characteristic →	Availability of sand for aeolian transport in support of archeological site preservation	Campsite area	Sand storage	Sandbar volume
Driver or Constraint ↓				
Annual release volume				
Short duration high flows				
Sustained high flows				
Sustained low flows				
Vegetation expansion				
Vegetation loss				

WATER QUALITY

Resource Characteristic →	GCD outflow concentrations of dissolved oxygen	GCD outflow concentrations of metals (e.g., selenium, mercury, uranium, etc.)	GCD outflow concentrations of nutrients (e.g., phosphorous, nitrogen)	GCD outflow concentrations of phytoplankton, zooplankton, chlorophyll a	GCD outflow salinity, TDS, specific conductance	GCD outflow temperature	GCD outflow turbidity/sediment load
Driver or Constraint ↓							
Lake Powell biological oxygen demand							
Lake Powell chemical oxygen demand							
Lake Powell inflow dynamics							
Lake Powell inflow: spring runoff or baseflow							
Lake Powell nutrient concentrations (e.g., phosphorous, nitrogen)							
Lake Powell thermal stratification regime							
Lake Powell water clarity/turbidity							
Lake Powell water surface elevation (high versus low)							