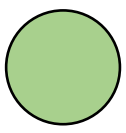
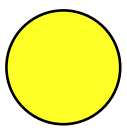
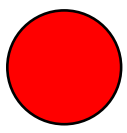
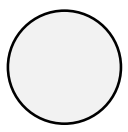
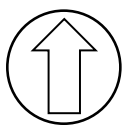
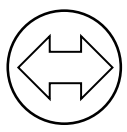
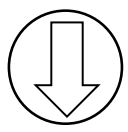
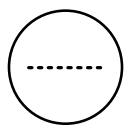
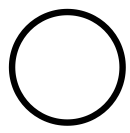
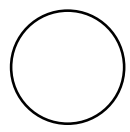
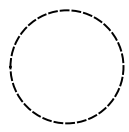
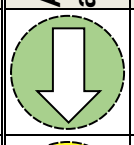
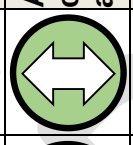
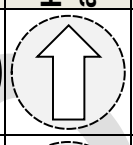
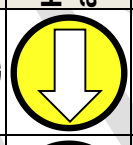
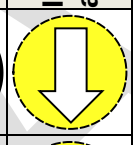
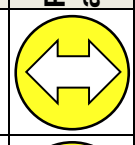
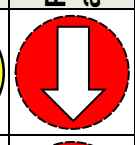
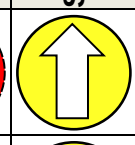
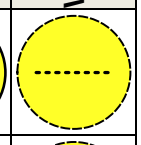
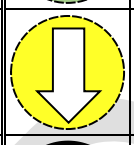
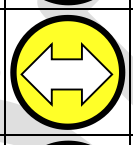
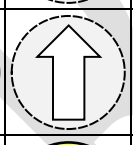
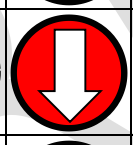
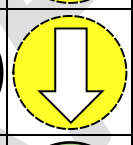
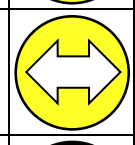
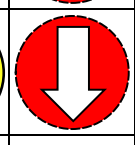
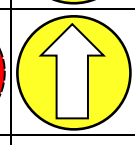
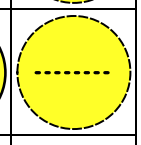
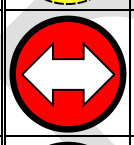
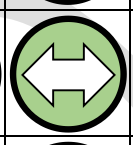
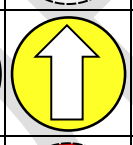
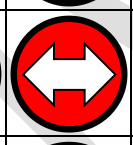
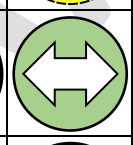
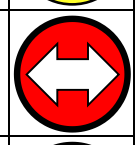
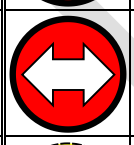
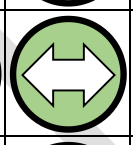
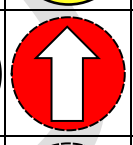
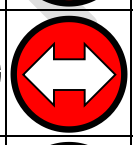
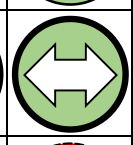
GCDAMP FY2017 Knowledge Assessment Summary: Experimental & Management Actions

April 7, 2017

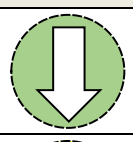
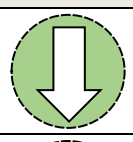
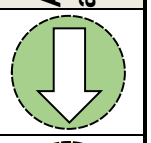
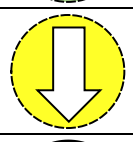
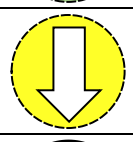
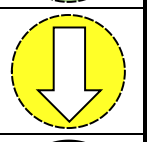
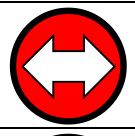
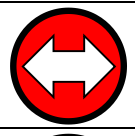
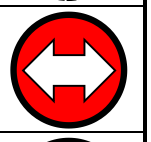
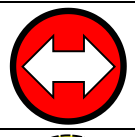
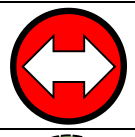
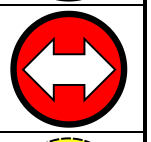
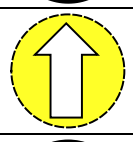
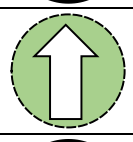
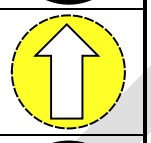
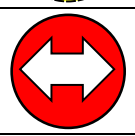
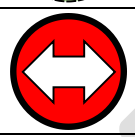
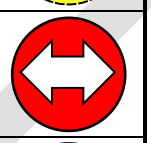
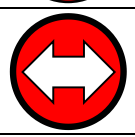
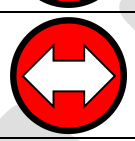
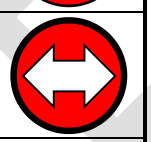
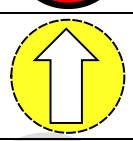
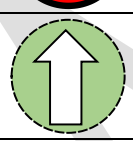
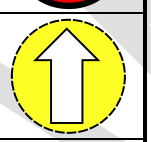
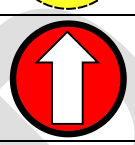
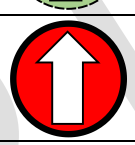
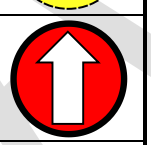
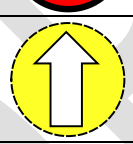
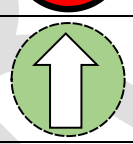
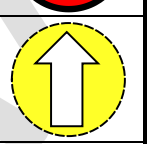
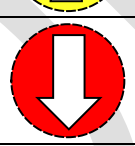
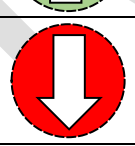
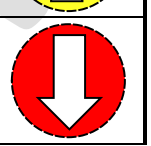
This document tabulates the results of the FY2017 Knowledge Assessment (KA) concerning the expected effects of LTEMP Experimental and Management Actions on the resources on which the KA has focused. In particular, this tabulation addresses each resource topic separately, to show the expected effects of the LTEMP Experimental and Management Actions on each individual characteristics of each resource. The expected effects of the LTEMP Experimental and Management Actions may differ among the several characteristics of a resource (resource characteristics). Averaging these expected effects across all individual characteristics for a single resource (shown in the first table for comparison) may sometimes give a distorted picture of the available knowledge.

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

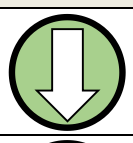
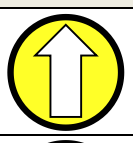
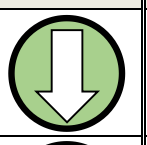
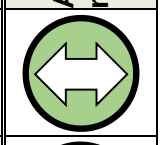
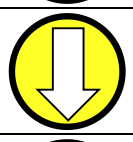
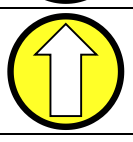
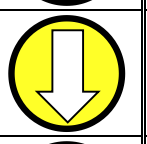
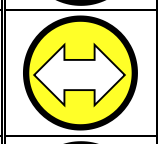
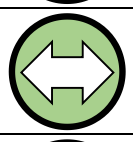
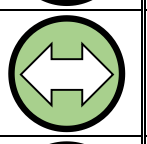
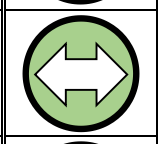
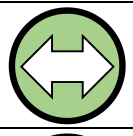
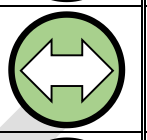
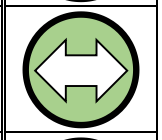
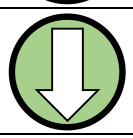
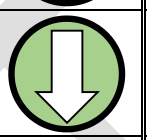
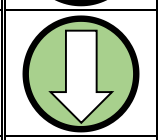
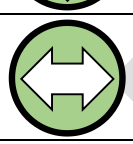
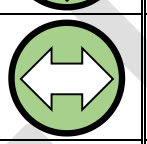
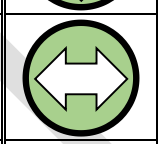
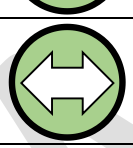
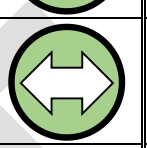
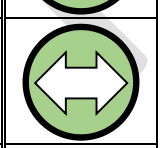
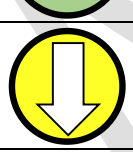
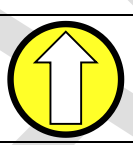
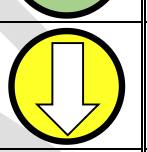
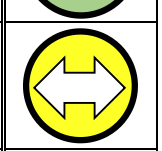
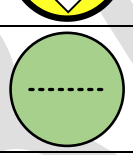
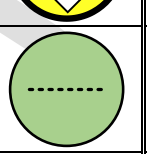
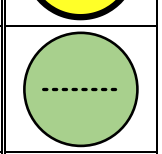
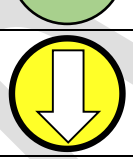
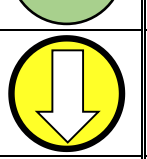
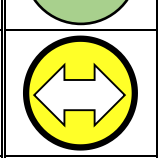
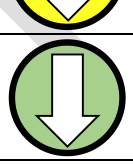
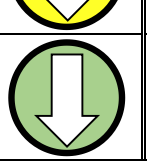
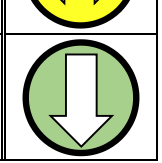
AVERAGE EXPECTED EFFECT BY RESOURCE TOPIC

Experimental & Management Actions ↓ / Resource Topics →	Aquatic food base average	Archaeological and cultural resources average	Humpback chub average	Hydropower and energy average	Invasive fish species average	Other native fish species average	Rainbow trout fishery average	Recreational experience average	Riparian vegetation average	Sediment average	Water quality average
Fall HFEs > 96-hr duration											
Fall HFEs ≤ 45, cfs in October or November											
Humpback chub translocation											
Larval humpback chub head-start program											
Macroinvertebrate production flows											
Mechanical removal of invasive fish species											
Mechanical removal of rainbow trout from LCR reach											
Proactive Spring HFEs ≤ 45, cfs in April, May, or June											
Riparian vegetation restoration											
Spring HFEs ≤ 45, cfs in March or April											
Trout management flows											

AQUATIC FOOD BASE

Resource Characteristics ➔ / Experimental & Management Actions ⬇	Food base diversity	Secondary production	Aquatic food base average
Fall HFEs > 96-hr duration			
Fall HFEs ≤ 45, cfs in October or November			
Humpback chub translocation			
Larval humpback chub head-start program			
Macroinvertebrate production flows			
Mechanical removal of invasive fish species			
Mechanical removal of rainbow trout from LCR reach			
Proactive Spring HFEs ≤ 45, cfs in April, May, or June			
Riparian vegetation restoration			
Spring HFEs ≤ 45, cfs in March or April			
Trout management flows			

ARCHAEOLOGICAL & CULTURAL RESOURCES

Resource Characteristics ➔ / Experimental & Management Actions ⬇	Depositional Integrity (Arch site stability)	Depositional Integrity (Arch site stability) - GLCA	National Register Integrity	National Register Integrity - GLCA	Archaeological and cultural resources average
Fall HFEs > 96-hr duration					
Fall HFEs ≤ 45, cfs in October or November					
Humpback chub translocation					
Larval humpback chub head-start program					
Macroinvertebrate production flows					
Mechanical removal of invasive fish species					
Mechanical removal of rainbow trout from LCR reach					
Proactive Spring HFEs ≤ 45, cfs in April, May, or June					
Riparian vegetation restoration					
Spring HFEs ≤ 45, cfs in March or April					
Trout management flows					

HUMBPACK CHUB

Resource Characteristics ➔ / Experimental & Management Actions ⬇	Adult chub population in western Grand Canyon	Adult population that spawns in the LCR	Juvenile chub population in CR near LCR	Juvenile chub population in western Grand Canyon	Humpback chub average
Fall HFEs > 96-hr duration				⇧	⇧
Fall HFEs ≤ 45, cfs in October or November				⇧	⇧
Humpback chub translocation	⇔	⇧			⇧
Larval humpback chub head-start program		⇧			⇧
Macroinvertebrate production flows			--------		--------
Mechanical removal of invasive fish species					
Mechanical removal of rainbow trout from LCR reach			⇧		⇧
Proactive Spring HFEs ≤ 45, cfs in April, May, or June			--------	⇧	⇧
Riparian vegetation restoration					
Spring HFEs ≤ 45, cfs in March or April			--------	⇧	⇧
Trout management flows			⇧		⇧

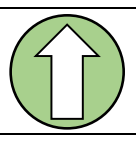
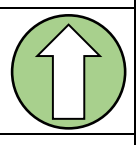
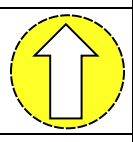
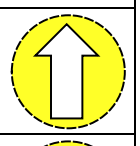
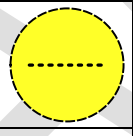
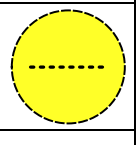
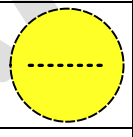
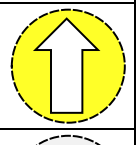
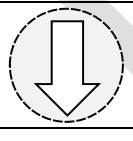
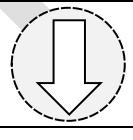
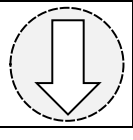
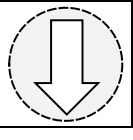
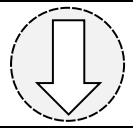
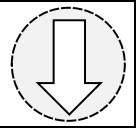
HYDROPOWER & ENERGY

Resource Characteristics ➔ / Experimental & Management Actions ⬇	Electric generation (capacity)	Electric generation (energy production)	Electric generation (energy value)	Emissions	Hydro-mechanical equipment	Load following capability	Net firming purchases	Hydropower and energy average
Fall HFEs > 96-hr duration	↔	↓	↔	↓	↓	↓	↓	↓
Fall HFEs ≤ 45, cfs in October or November	↔	↓	↔	↓	↓	↓	↓	↓
Humpback chub translocation	↔	↔	↔	↔	↔	↔	↔	↔
Larval humpback chub head-start program	↔	↔	↔	↔	↔	↔	↔	↔
Macroinvertebrate production flows	↑	↔	--------	↑	↔	↑	↑	↑
Mechanical removal of invasive fish species	↔	↔	↔	↔	↔	↔	↔	↔
Mechanical removal of rainbow trout from LCR reach	↔	↔	↔	↔	↔	↔	↔	↔
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	↔	↓	↔	↓	↓	↓	↓	↓
Riparian vegetation restoration		↔	↔					↔
Spring HFEs ≤ 45, cfs in March or April	↔	↓	↔	↓	↓	↓	↓	↓
Trout management flows	--------	↔	--------	--------	↔	--------	--------	↔

INVASIVE FISH SPECIES

Resource Characteristics ➔ / Experimental & Management Actions ⬇	All non-native coldwater fish	All non-native coolwater fish	All non-native warmwater fish	Brown Trout	Green Sunfish	Invasive fish species average
Fall HFEs > 96-hr duration	--------	--------	--------	⇩	--------	⇩
Fall HFEs ≤ 45, cfs in October or November	--------	--------	--------	⇩		⇩
Humpback chub translocation	--------	--------	--------	⇔	⇔	⇔
Larval humpback chub head-start program					⇔	⇔
Macroinvertebrate production flows	--------	--------	--------	⇩	⇩	⇩
Mechanical removal of invasive fish species						
Mechanical removal of rainbow trout from LCR reach	--------		--------	⇩	⇔	⇩
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	--------	--------	--------	--------	--------	--------
Riparian vegetation restoration						
Spring HFEs ≤ 45, cfs in March or April	--------	--------	--------	--------	--------	--------
Trout management flows	--------	--------	--------	⇧	--------	⇧

RAINBOW TROUT

Resource Characteristics ➔ / Experimental & Management Actions ⬇	LCR Inflow Area & Marble Canyon Rainbow Trout Fishery - Abundance	Lees Ferry Rainbow Trout Sport Fishery - Abundance	Lees Ferry Rainbow Trout Sport Fishery - Age0 abundance	Lees Ferry Rainbow Trout Sport Fishery - Age0 survival	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	Lees Ferry Rainbow Trout Sport Fishery - Survival	Rainbow Trout Maximum Size	Rainbow trout fishery average
Fall HFEs > 96-hr duration										
Fall HFEs ≤ 45, cfs in October or November										
Humpback chub translocation										
Larval humpback chub head-start program										
Macroinvertebrate production flows										
Mechanical removal of invasive fish species										
Mechanical removal of rainbow trout from LCR reach										
Proactive Spring HFEs ≤ 45, cfs in April, May, or June										
Riparian vegetation restoration										
Spring HFEs ≤ 45, cfs in March or April										
Trout management flows										

RECREATIONAL EXPERIENCE

Resource Characteristics ➔ / Experimental & Management Actions ⬇	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 (vs. off-river recreational time)	Whitewater usable campsite area	Wilderness experience	Backpacking/day-use shore availability	Recreational experience average
Fall HFEs > 96-hr duration	↔	↑	↓	↓	↓	↓	↓	↓	↓	↔	↑	↔	↑	↑	↑	↑	●	↔	↔
Fall HFEs ≤ 45, cfs in October or November	↔	↑	↓	↓	↓	↓	↓	↓	↓	↔	↑	↔	↑	↑	↑	↑	●	↔	↔
Humpback chub translocation	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	●	↔	↔
Larval humpback chub head-start program	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	●	↔	↔
Macroinvertebrate production flows	↓	↑	----	↓	----	↑	↓	----	↑	↑	↓	↔	↓	↓	----	↑	●	↓	↔
Mechanical removal of invasive fish species	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	●	↔	↔
Mechanical removal of rainbow trout from LCR reach	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	●	↔	↔
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	↔	↑	↓	↓	↑	↑	↓	↑	↑	↔	↑	↔	↑	↑	↑	↑	●	↔	↔
Riparian vegetation restoration	↑	↑	↔	↔	----	↑	↔	----	↑	↔	↔	↔	↔	↔	↔	↑	●	↑	↔
Spring HFEs ≤ 45, cfs in March or April	↔	↑	↓	↓	↑	↑	↓	↑	↑	↔	↑	↔	↑	↑	↑	↑	●	↔	↔
Trout management flows	↓	↓	----	↓	↓	↓	↓	↓	↓	↓	↑	↔	↑	↓	↑	↓	●	↓	↔

RIPARIAN VEGETATION

Resource Characteristics ➔ / Experimental & Management Actions ⬇	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)	Riparian vegetation average
Fall HFEs > 96-hr duration	-------	↓	-------	-------	-------	-------	↓	-------	↓
Fall HFEs ≤ 45, cfs in October or November	-------	↓	-------	-------	-------	-------	↓	-------	↓
Humpback chub translocation									
Larval humpback chub head-start program									
Macroinvertebrate production flows	-------	↑	-------	-------	-------	-------	↑	-------	↑
Mechanical removal of invasive fish species									
Mechanical removal of rainbow trout from LCR reach									
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	-------	↑	-------	↑	-------	↑	↑	-------	↑
Riparian vegetation restoration	↑	-------	-------	-------	↑	-------	-------	-------	↑
Spring HFEs ≤ 45, cfs in March or April	-------	↑	-------	↑	-------	↑	↑	-------	↑
Trout management flows	-------	↑	-------	↑	-------	-------	↑	-------	↑

The expert team also states, “We are confident that very large floods (>90,000 cfs) are capable of removing vegetation and that the current HFE's are not large enough or long enough to remove vegetation. We know that vegetation management has a large impact on vegetation immediately following treatment, but we do not know how long those management actions will remain intact without maintenance (e.g., vegetation regrowth after removal). We also don't have good data on how fall versus spring HFE's differ in their impacts on vegetation, but expect there would be significant differences. Please see the spreadsheet for more detailed information on what is known, unknown, and what work is in progress.”

SEDIMENT

Resource Characteristics ➔ / Experimental & Management Actions ⬇	Amount of topographic change indicative of archaeological site stability and preservation potential	Availability of sand for aoelian transport in support of archeological site preservation	Sand storage	Sandbar volume	Sediment average
Fall HFEs > 96-hr duration	↑	↑	--------	↑	↑
Fall HFEs ≤ 45, cfs in October or November	↑	↑	--------	↑	↑
Humpback chub translocation					
Larval humpback chub head-start program					
Macroinvertebrate production flows	↑	↑	↑	↑	↑
Mechanical removal of invasive fish species					
Mechanical removal of rainbow trout from LCR reach					
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	↑	↑	--------	↑	↑
Riparian vegetation restoration	↑	↑	↔	--------	↑
Spring HFEs ≤ 45, cfs in March or April	↑	↑	--------	↑	↑
Trout management flows	↓	↓	--------	↓	↓

WATER QUALITY

Resource Characteristics ➔ / Experimental & Management Actions ⬇	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	Water quality average
Fall HFEs > 96-hr duration	--------	--------	--------		--------	--------	--------	--------
Fall HFEs ≤ 45, cfs in October or November	--------		--------	--------	--------	--------	--------	--------
Humpback chub translocation								
Larval humpback chub head-start program								
Macroinvertebrate production flows	--------	--------	--------	--------	--------	--------	--------	--------
Mechanical removal of invasive fish species								
Mechanical removal of rainbow trout from LCR reach								
Proactive Spring HFEs ≤ 45, cfs in April, May, or June	--------		--------	--------	--------	--------	--------	--------
Riparian vegetation restoration								
Spring HFEs ≤ 45, cfs in March or April	--------		--------	--------	--------	--------	--------	--------
Trout management flows	--------	--------	--------	--------	--------	--------	--------	--------