Issue Working Session
Quantification of Public Benefits Discussion

Topics to be Covered

- Quantification of public benefits framework
- Summary of likely requested benefits information
- Conceptual and numerical examples
  - Conjunctive use
  - Surface Storage
- Summary of cost allocation principles

Framework for Quantifying Public Benefits

How do quantified benefits help Commission decisions?

- Addresses specific requirements
  - Ecosystem benefits at least 50% of public benefits funded for any project [79756(b)]
  - Public benefits cost share no more than 50% pf project cost [79756(a)]
  - Benefits to a party consistent with its share of cost [79755(a)(2)]
- Helps assess other criteria:
  - Expected return for public investment [79750(c)]*
  - Cost-effectiveness [79750(b)]

Note that benefits must be compared to cost shares!

Benefits Quantification/Cost Allocation Process

1. Define future conditions without project
2. Assess future condition with project
3. **Calculate physical changes created by or caused by the project**
   a. Quantify as change relative to without project
   b. Spread over the project life
4. Estimate the economic value of physical benefits
5. Compare present value of benefits and costs
6. Allocate costs to public and non-public benefit categories

Potentially Proposed Benefits Information

Requested Information	Example
The most probable without-project future	Most likely population forecast
Avoided costs: reduction of without-project costs	Project provides SW instead of GW: pumping cost savings
Targeted physical benefit: desired result	% change juvenile survival or # salmon adults
Physical action needed to obtain targeted benefit	AF water supply released for fish, degree temperature reduction
Monetary value of targeted physical benefit	Dollar value of salmon produced
Alternative cost associated with physical action	Dollar cost of water supply for fish if bought by transfers, temperature control device

Cost-effectiveness and alternative cost

- Targeted benefits are often hard to quantify in physical and economic terms
- Physical action can be easier to quantity and alternative cost can be estimated
- Alternative cost is meaningless if targeted physical benefit will not be achieved
- The applicant will be asked to provide physical and monetary targeted benefits AND alternative cost of action
- Quantified economic benefit should be lesser of the two
- Assures cost-effectiveness criteria is met

Why are Common Assumptions Necessary?

- The Commission must be able to compare one project to another using the magnitude of public benefits provided by a project.
- **Use of Common Assumptions will ensure the evaluation of expected benefits and costs are consistent across projects and the results are comparable.**

Importance of Using Common Assumptions for Evaluating Projects

- Ensures project benefits and costs are comparable across projects
- Supports determination of how a storage project may improve operation of the system – also allows for comparison of potential improvements for projects with benefits in the same area
- Supports determination of "net" and "measurable" improvements
- Supports accounting of benefits and costs – ensures calculations are complete and considers all potential physical changes
- Supports assurances for providing public benefits over time

What is the Scope of the Common Assumptions Development Effort?

- Develop appropriate **with and without project common conditions/assumptions** for determining physical changes and calculating monetized benefits and impacts
- Develop common **physical** conditions/assumptions
- Develop common **economic** conditions/assumptions

Physical Common Assumptions/Methods

- Physical common assumptions will include:
  - Hydrology and climate change
  - Surface water and groundwater operations (e.g., SWP/CVP operations)
  - Riverine conditions (e.g., geomorphology)
  - Delta conditions (e.g., hydrodynamics)
  - Surface water and groundwater quality
  - Aquatic and terrestrial resources (e.g., biology, habitat, processes, etc.)
  - Energy (e.g., hydropower, GHG emissions)
  - Recreation resources
  - Other resources, as appropriate

Economic Common Assumptions/Methods

- Discount Rate
- Planning Horizon
- Constant Dollar Year
- Construction Contingencies
- Future Population Levels
- Real Energy Costs
- Unit Values of Water

Items Being Discussed at August SAC Meeting

- How flexible or prescriptive should requirements for Common Assumptions be?
- What should requirements include?
- What other information should be provided to applicants?

Economic Unit Values

- Technical team is working to develop unit monetary values for water – for example, $/AF, $/visitor day
- Unit monetary values will be provided for different water year types, development conditions, and locations
  - Unit values can be used by the applicants in their economic analysis
  - Other ways to estimate monetary value are allowed
  - Approach must be justified and documented

Example Projects – Public Benefits

Conjunctive Use: Potential Types of Ecosystem Physical Benefits

Water supply for ecosystem improvement

- Groundwater/surface water interactions, timing and water quality
- Monetary value of physical benefit and alternative cost

Increased stream flow or habitat acreage

- If groundwater levels are increased relative to without-project

Percolation ponds or increased flow may have habitat value

- If water is recharged by percolation or flow

Reduced Delta diversion or increased inflow

- If conjunctive use will replace some other supply, supply benefit limited
- Avoided ecosystem damages?

Water Quality Improvements That Clean Up and Restore Groundwater Resources

- Economic benefits from improved quality of groundwater can be monetized as a water quality public benefit
- Conjunctive use projects improve aquifer water quality if
  - Recharge water is better quality or extracted water is worse quality than average
  - Project includes components that will clean groundwater or slow intrusion
- Economic benefits may include
  - Reduced costs (treatment cost or salinity damage cost)
  - Increase in usable water supply

Conceptual Conjunctive Use Project

- A river that is tributary to the delta has low flow and high temperatures in critical years
- Construct groundwater pumping and recharge capacity adjacent to river
- In wet years, divert flow into recharge or in-lieu storage
- Additional diversion is fully mitigated by improved fish screens
- Use some of the stored groundwater instead of river diversions in critical periods
- Water users increase supply in dry years

Assumptions Used for Numerical Examples

- Project life: 30 years
- Discount rate: 3.5%
- Unit values, including
  - $500/AF critical, $400/AF dry
  - Recreation $20/day
- Example unit values only – unit values for economic analysis have not been proposed yet

Conceptual Conjunctive Use Project for Ecosystem and Water Supply

Conceptual Conjunctive Use Project for Ecosystem and Water Supply				
Critical years are 10% of years, dry years are 20% of years				
Project component	**$1000 NPV Cost**	**Ann. Avg Physical Benefit**	**Annual Benefit $1000**	**NPV Benefit $1000**
Construct 10 new agricultural wells, 1000 gpm	$1,000			
Operate wells in critical years, 2 months, 2,700 AF, avg 270 AFY, cost $50/AF, unit benefit $500/AF	$248	270 AFY	$135	$2,483
Produce an annual average of 100 more salmon annually, value $5,000 per fish		100 fish	$500	$9,196
Construct SW conveyance to existing GW users	$2,000			
Provide recharge averaging 900 AF/year, net 810 AF/year after losses, $100/AF	$1,490			
Mitigation cost, improved fish screens	$500			
Operate wells in dry years, 2 months, 2,700 AF, avg 540 AFY, cost $50/AF, benefit $400/AF	$497	540 AFY	$216	$3,973
Total NPV Costs and Benefits	$5,735			$6,456

Conceptual Surface Storage Multi-purpose Project Example

- 500,000 AF reservoir in-stream
- Benefits:
  - Public – Ecosystem, flood damage reduction (FDR), recreation
  - Nonpublic – Water supply
- Monetary benefit of targeted species is less than alternative cost
- Adverse impacts not fully mitigated

Conceptual Multi-Purpose Project

Conceptual Multi-Purpose Project				
Project component	**$million NPV Cost**	**Ann. Avg Physical Benefit**	**Annual Benefit $million**	**NPV Benefit $million**
Construct 500,000 AF reservoir	$2,000			
Reservoir O&M costs, $1 million/year	$18			
Produce an annual average of 2,000 more salmon annually, value $5,000 per fish		2,000 fish	$10	$184
Could get same temp reduction and flow benefits using transfers & mgmt, cost $20 M/yr		3 degree F	$20	$368
Downstream flood control benefit using EAD			$80	$1,471
Recreation benefit, 100,000 new visitor-days, $20/day			$2	$37
Provide 50,000 AF Ag/M&I, average unit value is $350/AF	$0	50 TAFY	$18	$322
Mitigation costs	$200			
Total NPV Costs and Benefits	$2,218			$2,382

* All values are provided as illustrative examples, applicants will conduct their own analysis

Cost Allocation Principles

Cost Allocation

- Required component of feasibility study
- Necessary step to go from benefits to cost shares to public funding share
- Required to rank "potential projects based on the expected return for public investment"
- Conventional cost allocation methods are preferred, ***but may need adjustment to provide cost shares that meet WSIP requirements***

What's Next?

1. Develop unit water values using economic models and water transfer price information
2. Complete work for economic common assumptions/methods/metrics
3. Revise Tool and Methods report
4. Incorporate final quantification methods into draft regulations

Questions?

Extra Slides

Yakima Basin Integrated Plan Projects, WA

- Long analysis history
- Range of opinions regarding measurement and use of non-use values for special status salmonids
- "Economics Technical Report" (2008) applied federal NED standards, B/C ratios of 0.07 to 0.33
- "Four Accounts" study (2012)
- Non-use values of fish benefits, based mostly on survey methods, range from $3.0 to $7.1 billion PV
- "Benefit-Cost Analysis of the YBIPP" (2014) WSU team found fish benefits of $1.0 to $2.0 billion PV.
- **Shows why requested information includes benefits of physical action**
- **Fair example of how economic benefits should affect cost allocation**

Howard Hansen Dam Water Supply and Ecosystem Restoration Project, Tacoma WA

- Includes M&I water and ecosystem (fisheries) benefits. No public access, no recreation
- M&I benefit based on cost of implementing most likely alternative
- Selection of fish features based on "cost-effective and incremental cost analysis"
- Least-cost way to "increase the likelihood of achieving the goal of self-sustaining runs"
- Most costs could be assigned based on separable costs
- **A good example for cost-effectiveness applied to physical action that achieves ecosystem physical benefits**

Central Utah Project Completion Program

Includes many types of benefits and cost allocation

Benefit Type	Benefits ($2004)	Share of Benefits	How Estimated
Flood Control	$1.4	0.9%	USACE modeling and average cost of storage
Irrigation	$6.5	4.4%	Crop budgets, net return on new irrigated lands
Recreation	$11.5	7.8%	Recreation days and value per day ($8.27)
Power	$7.5	5.1%	Alternative cost base load coal-fired power plant
Fish and Wildlife	$16.3	11.0%	Angler days and expenditure per angler day ($35.35)
M&I	$105.0	70.9%	Most likely, least cost alternative
Total	$148.2	100.0%	

Central Utah Project Completion Program

- Fish and wildlife benefits include use values only
- Not applicable for most special status species
- Cost allocation based on share of dedicated space and share of water supply, not economic benefits
- Recreation had neither, so no cost allocated to recreation

In summary:

- **Fish and wildlife use values would be a small share of values for special status species**
- **Use of facilities approach to cost allocation is not compliant with WSIP requirement**