STORAGE REALLOCATION ISSUES IN FEDERAL MULTIPURPOSE RESERVOIRS

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INTRODUCTION

The U.S. Army Corps of Engineers (Corps) operates Lakes Lanier and Allatoona, two large multipurpose reservoirs in the metropolitan Atlanta area. Releases from these dams regulate the greatest share of draws to meet municipal and industrial uses in the region. These dams also produce hydroelectric power, provide flood control, and elevate lake levels to enable recreational use by visitors from within and outside the region, as well as by nearby residents.

The Lanier and Allatoona reservoirs were originally designed primarily for power and flood control, albeit with significant attention leveled to municipal and instream flow water uses. Because these dams were developed to provide maximum National Economic Development (NED) benefits, there have historically been no charges assessed to any other use except hydropower. With the advent of cost-sharing in the 1980s, new additional uses of storage that reduced hydropower benefits were expected to reimburse the federal treasury for benefits foregone, either directly or by purchasing the equivalent amount of storage reallocated from hydropower to the new uses. The separable and joint-use costs of storage allocated to hydropower have historically been recaptured through charges to the power customers. Joint-use costs are average costs of facilities serving multiple uses, assessed in proportion to the benefits remaining after separable costs.

The concern of this paper is twofold: First, the cost-sharing rules that allocate expenses in the initial formulation of a project often fail to remain equitable once demands for water and storage change. Second, where demands have changed, reallocating storage behind the dam along lines traditionally followed by the Corps may fail to capture the true costs and benefits of resources currently allocated to marginal uses in comparison to storage that, if reallocated, might better serve the new uses. One such example may be storage currently allocated to hydropower—of diminishing utility in a deregulated market with abundant and inexpensive thermal substitutes—which might be far more valuable when reallocated to uses for which no good substitutes are available, such as municipal water supply. This paper explores institutional impediments to storage reallocation in multipurpose federal reservoirs to achieve their highest and best uses.

In initial dam design, the Corps details a list of the benefits of multiple-use coordination. The size of the project is allowed to expand as long as adding another use continues to make it cheaper for everyone involved to participate. Known as 'subadditive costs' or 'returns to scale,' project size is determined so that it would be more expensive for any individual use to go-it-alone to meet its needs than for all to collectively participate in a multiple-use project. This principle guides the Corps in establishing project size as well as recovering the costs of construction, operation, and maintenance. The Corps' objective in establishing 'fair' charges for access to these services is to assure that every use benefits from participation above any independent, go-it-alone strategy.

The fairness objective is relatively easy to assure if the size of the project is chosen such that it initially conforms to a cost-efficient scale. In time, however, uses of storage may shift from those originally contemplated, in which case competitive pressures are exerted to convert storage historically used to supply original demands that have become less valuable to new demands that are becoming more valuable. It is just this sort evolution of demands that has launched the current Georgia, Alabama and Florida water conflict – ostensibly over the reallocation of storage in federal reservoirs in the Apalachicola-Chattahoochee-Flint (ACF) and Alabama-Coosa-Tallapoosa (ACT) River Basins. The use and potential reallocation of storage in Lakes Lanier and Allatoona lies at the heart of this conflict.

Separable Costs – Remaining Benefits

To understand the foundation of the reallocation issue, it is necessary to introduce the basic cost allocation principles guiding the Corps in financing multipurpose reservoirs. The most widely used cost allocation

mechanism is the Separable Costs – Remaining Benefits (SCRB) method [Inter-Agency Committee on Water Resources, 1950]. By this method, each user of storage is assessed charges according to the following general rule. So called 'separable costs' are assessed first. These charges reflect the increase in overall project cost attributable to adding a particular use or purpose to the project. Some purposes may drive the costs up appreciably while others might require more modest increases, but in no case can the separable costs exceed the benefits supplied by the use – else that purpose would not be included in the project because it would increase rather than reduce the costs to the other participants. Thereafter, so-called joint-use or non-separable costs – costs for facilities serving multiple uses and/or required to meet remaining project costs – are distributed in proportion to the benefits remaining each purpose after its separable costs have been deducted. While a number of mechanisms exist for sharing joint-use costs [Driessen and Tijs, 1985], if project size is chosen to maximize the benefits from multiple-use coordination, the SCRB cost allocation method supplies net benefits to each purpose above any go-it-alone strategy. Simply stated, SCRB ensures that all purposes share equitably in the benefits of multipurpose development, the implied assumption being that large multipurpose dams are more cost-effective than several smaller dams serving fewer or even single purposes.

The cost allocation and recovery rules serve an important social and economic function – that of securing commitment from every user of storage. Whenever participants pay their share of the capital needed to sustain project services, they perceive themselves to be enfranchised into the operation. The project is effectively 'purchased' by the users, thus freeing the Corps to re-invest these contributions into new projects. The national electrification program testifies to the success of leveraging initial resources and of involving local assurers in this way.

It is important to note that the Corps' objective is not cost recovery, but in maximizing National Economic Development (NED) economic benefits supplied by the project; this fundamental principle is most often overlooked by those users of storage in federal reservoirs required to reimburse their separable and joint-use costs, and who then feel entitled in perpetuity to storage allocated to their particular use. The unavoidable fact remains, however, that federal reservoirs are public works, owned by the public at large. As an example, for many of the older Corps projects constructed before non-federal cost-sharing became widespread – including Lanier and Allatoona – the only costs recovered have been the separable and joint-use hydropower costs, these through contracts with federal power marketing agencies distinct from the Corps. Federal hydropower has been sold rather than freely distributed as are recreation, flood control, minimum instream flows and navigation benefits, because hydropower benefits have traditionally reduced the capital and operating costs of individual private power producers, whereas the non-power amenities have typically been regarded as benefitting the public at large. The controversy arises when an emerging new use – municipal water supply, for example – seeks to use storage previously reserved for hydropower. Because considerable repayment of costs may have already been made by the power customers over the years, they consider themselves to be the rightful owners of storage in the federal projects, having lost sight of the fact they are in reality merely private beneficiaries of publicly-owned storage, who have been asked to repay only the costs of constructing and operating the storage supplying the benefit stream. This misperception exacerbates the competition between users of storage and greatly impedes the conversion of hydropower storage to more efficient public use, whether there is a surplus of storage allocated to power or whether sufficient benefits can no longer be generated justifying (under SCRB) the continued commitment of publicly-owned storage to the hydropower purpose.

Through the SCRB cost-allocation process the Corps shifts, in a meaningful sense, from a project owner to a project manager and regulator. There is a compelling prima facie case that the fixed cost recovery rules of SCRB outline an ethically fair and socially responsible mechanism to deliver services and share costs of large-scale water resource development. The cost allocation rules themselves reveal the traditional objectives and Congressional mandate of the Corps. When the assessment structure recaptures up-front investment costs, the Corps can be viewed as a facility builder for sale rather than as a service provider for hire. In its mission to on-going service, the Corps is responsible to oversee provision of the original project intent. In this role, the Corps serves an on-going function in adjudicating the rules for allocating and re-allocating access to the services derived from its projects. Once re-allocations stray too far from the original project design or from pre-authorized re-allocation limits, the Corps must consult Congress directly, presumably as a check to assure that changes in service allocations and assessments are still fair. As one example, the Corps has effected minor reallocations of storage in Lake Allatoona to supply municipal water needs that have not required Congressional action. On the other hand, an appeal to Congress to reallocate a substantial portion of conservation storage in Lake Lanier from hydropower to municipal water supply is the instrument that provoked the current water-use conflict.

With respect to the stated concerns of this paper, the issue is whether the rules applied in the above-mentioned administrative and Congressional reallocations do in fact ensure economic efficiency as well as the equitable sharing of benefits of multipurpose development.

The highest and best uses water and storage in Northern Georgia have shifted. It is not unreasonable to wonder if the original Lanier project, launched today, would have to be re-designed to accommodate current demands. It is likely, if the opportunity cost of foregone water supply storage were taken into account, that power would not produce benefits in excess of its separable costs and so would not have been included as a project purpose. Yet a facility already exists, is being regulated, and charges for power generated are being assessed. This introduces a complication. As reallocations are made, the cost assessments have to be amended to assure that each new use added still realizes a positive net benefit from the dam above its 'go-it-alone' options. However, the marginal yield of storage for each new added use approaches zero as the accumulated demands approach the average streamflow, so that the last user appears to require a much larger block of storage per unit of demand than the first. As a consequence of simply applying SCRB to the next increment of storage required by the new use, the costs of reallocation are typically determined to be the costs of additional storage required rather than the benefits foregone by converting the existing use(s) to another. The paradoxical consequence of diminishing yield of storage is that the last added user must pay more to be included in a large multipurpose reservoir than to build a separate smaller reservoir dedicated to his use alone, a contradiction to the fundamental premise of SCRB – that multipurpose development is more cost-effective than single-purpose development.

Though several reallocation mechanisms exist, as discussed below, the prevailing practice requires any added municipal water user to pay the share of replacement costs of storage to cover the fixed costs needed to rebuild the original dam corresponding to that storage allocation. This can create a distortion. The capitalization rules established to recover costs under one project design for Lake Lanier and Lake Allatoona might not satisfy the net beneficial cost allocation criteria for today's distribution of services from those same structures. Specifically, the growing shift in resource allocation away from hydroelectric power to municipal water and other instream flow demands may require a different pricing scheme than has been assumed.

Storage Allocation and Cost Recovery

It is important to recognize that the Corps does not sell instream flow rights to users of its reservoirs. Instead, the Corps typically manages new demands by reallocating storage capacity behind the dams from the existing to the new uses. This is consistent with its federally-mandated role as builder and regulator as opposed to fee-for-service contractor. By assessing charges to recover either storage replacement costs or benefits foregone (whichever is greater), the intent of reallocation is to legitimately enfranchise the new users and re-enfranchise the public at large by making the new beneficiaries compensate the federal treasury for the losses (benefits and/or storage) visited upon the original users.

This all seems fair – if a new use is economical, it should pay its own way against the use it replaces. Yet this provision embodies certain critical assumptions. Under the Corps' Principles and Guidelines, there are four measures of cost of reallocated storage, the highest of which determines the costs to be levied against the new use. These are briefly described as follows:

(1) Go-it-alone replacement cost for the existing uses displaced by the new use (replacement cost)
(2) Economic value of benefits foregone by the existing uses due to the new use (benefits foregone)
(3) Foregone revenues from existing users due to the new use (revenues foregone)
(4) Updated replacement cost of storage needed to accommodate the new use (updated replacement cost of storage)

In the case of hydropower, replacement cost equals (and is in fact identical to) benefits foregone, i.e., the benefits foregone by storage being reallocated from hydropower in a federal reservoir to another purpose are the costs of replacing the power in the private system. Revenues foregone are the value of the federal power marketing contracts unfulfilled as a result of the new use, but, since benefits must exceed the separable and joint-use costs of storage assigned to the hydropower purpose, benefits foregone should always exceed revenues foregone. Likewise, unless storage replacement costs have escalated more rapidly than the benefits provided by storage, benefits foregone should control as well. Thus in all cases if the project has been properly formulated initially and the economic benefits of the original uses have not changed significantly over time, benefits foregone should always predominate. If not, a strong indication is provided that the highest and best uses of storage are not being provided and a reallocation is needed.

In contrast, however, the reallocation processes at Lakes Allatoona and Lanier have resulted in the fourth provision (updated storage replacement cost) being

consistently reported by the Corps to be the highest cost calibrated to accommodate increased demand for municipal and industrial water supply.

One explanation for this inconsistency may lie in the diminishing yield of storage previously described, wherein the last user draws the reservoir down further per unit withdrawal than the first, principally because the marginal impact of the last user includes the accumulated impacts of all existing users as well. Yet the fundamental premise of SCRB is that the average unit cost of service provision (building the dam) decrease as the dam is built higher and the reservoir made deeper, i.e. costs are subadditive. So the last incremental increase should cost less than the previous uses if the project is made larger, i.e., total storage is increased. If not, SCRB dictates that the last incremental increase should at least not exceed the cost of a new reservoir serving only the new use. As we go the other direction, therefore, pricing smaller facilities serving fewer purposes, each block of conservation storage required to serve the new uses will be more expensive.

In cases where updated replacement costs actually do exceed benefits foregone, the previous explanation does not suffice, but it may then be suggested that the original project purposes are no longer viable, i.e., no longer sustain project replacement costs. The economic value of the benefits foregone of a block of conservation storage presumably justified building the dam originally at least to that storage scale. Simply, the reason a dam is built is because the estimated economic value of the benefits from the dam exceed the costs. So at least the sum of storage replacement costs should be smaller than the sum total of economic benefits provided by that amount of storage. This means that benefits foregone should exceed the costs of replacement if the original project purposes still rationalize rebuilding the project. If not, in the case of hydropower, this means that replacement power resources are relatively less expensive, and hydropower is less critical to the aggregate benefits produced by the project. Concurrently, as growth pressures place greater demands on municipal water supplies, asking the new uses to justify the updated cost of storage replacement when current uses do not generate sufficient benefits to cover this same cost indicates that the highest and best uses of the existing dam are not occurring. In this case, assessments levied against the new uses are likely to exceed the costs of independent go-it-alone options, threatening the primary fairness objectives of SCRB pricing that enfranchise users into federal water projects.

With respect to updated replacement cost of storage, it can be further argued that only the operating costs rather than the fixed costs of storage need be reimbursed by new users. In the language of economics, once the benefits of an existing facility change and no longer cover the fixed investment replacement costs, but continue to cover the operating or marginal costs, the facility should remain in operation. Although it would not be rebuilt, the facility's fixed expenses are already committed, or sunk. At this point, pricing strategies can no longer function as average cost pricing rules – it is only the operation costs that need to be recovered. Assessing fees intended to recover the sunk costs under such circumstances would overcharge for the services provided. Whether or not sunk costs are assessed, however, it is clear that the highest and best use of a facility is assured, even when the uses change, only when new allocations cover the economic value of services displaced rather than the updated costs of storage replacement.

The previous discussion presents a strong case for concluding that conservation storage reallocation, with updated costs of storage being assessed to the new users, is not an appropriate mechanism to assure that public funds are put to their the highest and best use. If the highest competing use of storage causes a reduction in benefits to the existing uses, economic efficiency dictates that the value of the foregone benefits should be assessed directly against the new user. Furthermore, marginal cost pricing should prevail over average cost pricing to prevent sunk costs from infecting the allocation process, and to ensure that the highest of the four costs will always be benefits foregone.

Reality Check

In the final analysis, it is worthwhile to question whether calculated storage requirements for new uses and pricing irregularities make much of a difference in the outcome of the storage reallocation process. After all, if the process is only a little inefficient or unfairly biased toward the existing uses of storage, the outcome may not differ materially from the outcome of the "correct" process.

Operational simulations performed using both the ACT/ACF Comprehensive Study STELLA and HEC-5 models [McMahon 1998] show that the storage requirements attributed to the last added use to be substantially overstated, to such a degree that it is likely that the Corps did not need to seek Congressional reallocation of storage in Lake Lanier to meet the metropolitan Atlanta-area's increased municipal water needs well into the next century. The situation is the same at Lake Allatoona, where municipal demands can easily be met for the foreseeable future without need of further reallocation of storage.

Replacement costs of storage being assessed to the new users under the SCRB cost allocation rule provides a clear indication that more storage is being allocated to the

new users than necessary, and that the highest and best uses of reallocated storage are not being attained.

SUMMARY AND CONCLUSIONS

The issues raised in the foregoing discussion are briefly listed and summarized as follows:

(1) Because the values of the various uses of storage change, the original storage allocations may fail to remain equitable over the lifetimes of federal multipurpose reservoirs. A social welfare loss occurs as a consequence of publicly-owned water resource development not being put to its highest and best use.

(2) Diminishing yield of storage under the accumulated burdens of existing and new additional uses of storage obscures the determination of the amount of storage needing to be allocated to the new uses and/or reallocated from the existing to the new uses. The misapplication of SCRB procedures in reallocation studies performed by the Corps typically overstates the storage requirement, resulting in storage replacement costs exceeding benefits foregone – a conclusion that favors existing, less efficient uses over emerging new, more valuable uses. Where storage requirement for a new use has been correctly calculated, it should always be less than the storage required in a single-purpose reservoir serving that use.

(3) In reallocating storage in existing federal reservoirs, the governing criterion of the four cost accounts of Principles and Guidelines should always revert to benefits foregone, based on the SCRB rationale that all project purposes should produce benefits in excess of their separable costs. Correctly-determined storage costs exceeding benefits foregone clearly indicates the need for reallocation, and in order not to impede reallocation to the highest and best use, sunk costs should not infect the storage pricing process.

(4) The errors made by the Corps in calculating the storage requirements for municipal water supply from Lakes Lanier and Allatoona have in the past been substantial. In the case of Allatoona, it is likely that municipalities have already been allocated sufficient storage to meet 2050 demands, so that no additional reallocation is necessary. In the case of Lanier, it is very possible that the Corps' reallocation request triggering the three-State water conflict was unnecessary, or at least premature, and that the Atlanta-region's increased water demands could have been supplied without significantly impacting any of the original Congressionally-authorized purposes.

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