JUDICIAL RESOLUTION OF RESOURCE-USE CONFLICTS ARISING FROM SEDIMENTATION MANAGEMENT IN DAM/RESERVOIR PROJECTS: A LAW AND ECONOMICS APPROACH

by,

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Chair
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SEDIMENTATION MANAGEMENT IN DAM/RESERVOIR PROJECTS:
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Abstract

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The loss of the world’s reservoir capacity to sedimentation is catalyzing a paradigm shift toward managing dam/reservoir projects as renewable resources. This requires altering dam operations to stabilize storage capacity by releasing sediment downstream. Legal uncertainty regarding whether dam owners are liable for damages to surrounding property interests due to altered dam operations provides a significant disincentive for dam owners to engage in sustainable sedimentation management. We formulate an analytical framework that considers who courts should entitle, or give a right to prevail, to generate the greatest social-economic benefits from sedimentation management.
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CHAPTER 1

INTRODUCTION

Construction of dam/reservoir projects produces a number of social benefits. These include hydroelectric-power generation, storage of drinking water, flood control, barge transportation, recreation, and commercial development due to these benefits. In producing these benefits, dam-reservoir projects alter the natural balance of sediment flow in rivers by impounding sediment within and upstream of the reservoir and discharging clear water downstream (Hotchkiss and Bollman 1996). Downstream of the dam, the blockage of natural sediment flow leads to scouring of the river bed, degradation of tributaries, and undercutting at diversions. Upstream of the dam, the accumulation of sediment causes aggradation of tributaries, deposition at diversions, reduction in navigational clearance, and increased flood frequency. The operation of the dam itself is compromised by the loss of reservoir storage capacity, the obstruction of intakes, and the abrasion of turbomachinery (Morris and Fan 1998).

Conventional practice has been to prolong project life by constructing reservoirs with large storage capacities relative to the volume of incoming sediment (Morris and Fan 1998). Unfortunately, the consequences of sedimentation are proving to be more severe than previously contemplated for two major reasons (Hotchkiss and Bollman 1996; Durgunoglu & Singh 1993). First, the ‘future is now’ for some reservoirs that have become completely strangulated by sedimentation. For example, two of a system of three
hydroelectricity reservoirs on the Susquehanna River have already filled with sediment, and the third is expected to fill within the next 20 years (U.S.G.S.). In another example, the Welbedacht dam/reservoir project on the Caledon River in South Africa—the main water source for Bloemfontein—has lost 86 percent of its original storage capacity since completion in 1973. Another was lost in the first three years (South African Water Research Commision 2001). Second, while large projects may be spared complete strangulation by sedimentation in the near future, they may suffer significantly reduced capacity after only a small percentage of storage capacity is lost (Morris and Fan 1998).

Several commentators recommend mitigating sediment-related problems by managing existing projects as renewable resources (Palmieri, Shah & Dinar 2001). This requires adopting management strategies that achieve the sediment balance promoting sustainable reservoir use. These strategies fit into three general categories (Morris and Fan 1998): Inflow-reduction strategies control erosion in the catchment area. Routing strategies run sediment through the dam before it can settle in the storage pool. Removal strategies eliminate the sediment after it has settled in the storage pool. Traditional examples are hydraulic flushing (the dam’s low-level outlet is opened during a flood event), hydraulic dredging (a barge is used to break-up consolidated sediments and pump out sediment-entrained water), and dry excavation (the reservoir is drained and heavy machinery is used to excavate and remove sediment). The specific sediment management strategy chosen depends on site-specific hydrology, hydrogeology, morphology, and dam engineering (Palmieri, Shah & Dinar 2000).

The need to manage sedimentation places dam owners between a legal ‘rock and a hard place.’ Failure to control sediment accumulation may expose them to legal
liability for increased flooding of upstream lands. Alternatively, proactive sedimentation management may render them liable for damages to downstream property owners caused by bursts of released sediment. For example, clear-water recreational trout fisheries on the Colorado River (and the regional commercial development accommodating anglers) may suffer when sediment-entrained water is released from dams.

Uncertainty over the potential legal costs of managing reservoir sedimentation acts as a significant disincentive for dam owners around the world to manage reservoir sedimentation in a sustainable manner. Under these conditions, dam owners reasonably can be expected to invest in management efforts at lower than socially-optimal levels. As a result, society foregoes several benefits of sedimentation management that can offset damages to downstream properties. Such benefits include lower hydroelectricity prices resulting from increased reservoir capacity (Palmieri, Shaw & Dinar 2001), a stable water supply to meet agricultural and municipal demands, maintenance of navigational clearance, preservation of the ability of reservoirs to provide flood protection, decreased scouring around downstream structures and diversions (Morris & Fan 1998), reestablishment of downstream beaches, improvements to downstream pre-dam ecosystem values (Schmidt et al. 1998), and increased efficiency of downstream irrigation ditches (U.S.B.R. 1985).

The potential liability of dam owners to surrounding property owners for damages related to sedimentation management is a new area of law that has neither received much attention from scholars, nor generated many court decisions (Engberg 2002). Because sedimentation management involves conflicts over economic interests in property, an

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1 Guernsey Reservoir is drawn down each year for the annual silt run, which increases silt in irrigation ditches and consequently decreases infiltration of water.
economic analysis of how judicial decisions might assign property rights in these controversies most efficiently is especially appropriate. Consequently, we consider the judicial assignment of property rights through the lens of ‘law and economics.’ This field of study evaluates court decisions on the basis of how well they might promote efficient resource allocation from a social perspective (Landes & Posner 1987). Innes (1995) provides the following useful definition of the social-economic-efficiency criterion:

“Economic efficiency requires that net economic benefits, the difference between benefits and costs across all people in an economy, be at the highest possible level. Net benefits include...costs of activities to persons other than those engaging in the activities,... and all private benefits of activities and uses.” (p. 6).

Individual court decisions cannot single-handedly achieve social-economic efficiency across all economic interests. Rather, they necessarily give rise to ‘partial’ analyses due to threshold requirements that controversies must satisfy to proceed to court. In particular, judicial cases require particular adversarial parties engaged in a live legal dispute (Kubasek & Silverman 1997). Consequently, a court’s decision binds only these parties, and the most that we can consider is how the decision might contribute most to (or best promote) social-economic efficiency. Evaluating the attainment of overall social-economic efficiency (e.g., by formulating the ‘social planner’s problem’ accounting for the costs and benefits of sediment management to all affected parties upstream and downstream of the dam/reservoir), while valuable, is beyond the scope of this study.
Specifically, we formulate an analytical framework that considers who courts should entitle, or give a right to prevail, to achieve the highest possible level of net social benefits in controversies that involve sedimentation management in dam/reservoir projects. For example, should courts entitle dam-owners to release sediment regardless of possible harm to downstream-property owners, or should courts entitle downstream-property owners to be free from such harm? We also consider how courts should protect such entitlements. For example, if courts entitle downstream-property owners to be free from harm, should courts require dam-owners desiring to release sediment to buy the downstream-property owner’s entitlement? Or, should courts allow dam-owners to release sediment but pay damages for harm caused to downstream property?

Alternatively, if dam-owners are entitled to release sediment, should courts force downstream-property owners desiring to avoid sediment-related damages to buy the dam-owner’s entitlement, or should courts allow downstream-property owners to enjoin the dam-owner’s sediment releases if the property owners paid the dam-owner “damages?”

For ease of exposition, our analytical framework focuses on resolving controversies between dam owners and downstream property owners due to controlled sediment releases. This focus comes without significant loss of generality because our analytical structure applies equally well to resolving property conflicts of sedimentation management with upstream property interests.

We apply our analytical framework to evaluate the social-economic efficiency of the few judicial cases of property conflicts between dam owners and property owners that have been decided to date. We conclude with some general guidelines that courts could
use to resolve property conflicts in a way that maximizes the social-economic efficiency of sedimentation management.
CHAPTER 2

PAST WORK

A ‘Liability Theory’ Approach

Scholars have only recently turned their attention to liability issues arising from the operation of dam/reservoir projects. Pioneering work by Engberg (2002) analyzes how courts might select the legal theories they use to resolve sediment release controversies arising from an owner’s decision to retire an obsolete dam. Although dam retirement and sediment management involve unique issues, they can cause similar downstream sediment controversies. Engberg’s analysis is therefore relevant to an analysis of torts caused by sediment management activities.²

Engberg contends the court’s assignment of liability in these torts pivots on the dam-owner’s intent in releasing sediment as inferred from the chosen method of dam retirement. Intent is found when “the actor desires to cause consequences of his act, or believes that the consequences are substantially certain to result from it.”³

According to Engberg, courts could infer intent to release sediment from a dam-owner’s decision to breach a dam because the dam-owner would be expected to know sediment would inevitably be released. In this case, a court might decide liability under either trespass or intentional nuisance. Intent might not be found if a dam-owner simply abandoned a dam without reason to believe that the sediment built up behind it would be

² Appendix A contains a more detailed explanation of Engberg’s ‘liability theory’ approach.
³ Second Restatement of Torts, Section 8A
released. In this case, a court might apply strict liability or negligence standards. On the other hand, a court might find that an owner retiring a dam, either by breach or abandonment, possessed intent because s/he should have known that sediment might be immediately, or eventually, released downstream.

Engberg found that, in the few cases to date, courts have not resolved controversies by relying principally on inferring a dam-owner’s intent from his/her actions. Instead, Engberg explains, courts tend to muddle” the liability theories “in order to reach equitable results” (2002:190). Despite this “muddling,” Engberg shows courts often provide relief, but not an injunction, to downstream parties harmed by sediment releases from reservoirs.

Engberg’s work includes a compilation of tort cases relevant to deciding liability for harm from sediment management activities. We analyze these cases with the ‘law and economics’ framework introduced in the next section to determine how well the decisions maximize net social benefits of reservoir sediment management.

A ‘Law and Economics’ Approach

The primary function of the law is to decide who initially should be given an entitlement, or ‘right to prevail’ (Calabresi & Melamed 1972). In the context of sediment management controversies, should a dam-owner be entitled to release sediment, or should the downstream parties potentially injured by released sediment be entitled to be free from harm? The secondary function of the law is to decide how the initial entitlement is protected. For example, should a dam-owner’s entitlement to release sediment be protected by a property right that downstream-property owners must purchase to avoid damages? Or, should a dam-owner’s entitlement be protected by a liability rule allowing
downstream owners to prevent sediment releases if they pay damages to the dam-owner to compensate for his/her costs of not releasing sediment from the reservoir?

Figure 1, adapted from Calabresi and Melamed (1972), generally shows how a court might assign entitlements and protect them in order to maximize net social benefits (to the highest extent possible) in controversies involving the release of sediment from reservoirs. The framework does this by asking a series of questions designed to place the initial entitlement into the hands of the user that maximizes net social benefits (the ‘most-valued’ user), and to provide a corrective measure for an erroneous initial entitlement assignment. Movement toward the end of the series of questions indicates that the court must expend more resources in order to make a socially efficient entitlement assignment, as well as to provide the opportunity for reallocation of an incorrect initial assignment.

In determining the initial entitlement, the court first asks if the transaction costs are too high for the dam-owner to buy an entitlement from downstream-property owners, and vice versa. Transaction costs include all “impediments” to a market transaction (Calabresi & Melamed 1972:34). If transaction costs are low in both directions, the court can achieve social efficiency by giving the entitlement to either the dam-owner or downstream-property owners, and allowing the market to reallocate a poor entitlement assignment via the property rule (number one in Figure 1). The property rule strictly uses voluntary market transactions as the instrument for entitlement reallocation. The costs of the transaction are borne by the parties. Although an incorrect entitlement allocation will

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4 Calabresi and Melamed discuss other goals for deciding entitlements and protection rules, but we purposefully focus on the objective of social efficiency.
5 Transaction costs include, but are not limited to, the cost of collecting relevant information, excluding non-payers, and negotiation.
have implications for distributional goals, it will have little effect on social efficiency (1972:43).

When the court uses the property rule, two scenarios are possible. First, the court might entitle downstream-property owners to be free from harm caused by sediment released from an upstream dam. If the upstream dam-owner wants to release sediment, s/he can pay the downstream-property owners to consent to harm from released sediment. Downstream-property owners who refuse to sell their entitlements have the power to enjoin the dam-owner’s release of sediments. The upstream dam-owner will only release sediment when the benefit of doing so is greater than the price of buying the entitlements of the downstream-property owners, plus the transaction costs associated with that transaction. Allowing downstream sediment releases under these economic circumstances maximizes the net social benefits of sediment management.

Second, the court might entitle the dam-owner to release sediment. The dam-owner is free to release sediment and, consequently, harm downstream-property owners. The property owners must pay the dam-owner in order to prevent harm caused by the release of sediment. The court will not enjoin sediment releases from the upstream dam, nor award damages to the downstream-property owners for harm caused by the released sediment. The downstream-property owners will buy the dam-owner’s entitlement if the costs of preventing sediment damage are greater than the price of the entitlement, plus the transaction costs of negotiating that price. Preventing downstream sediment releases under these economic circumstances maximizes the net social benefits of sediment management.
If transaction costs are high in only one direction, the court can entitle whichever party faces the highest transaction costs to buy the entitlement, but still protect this entitlement with the property rule (number two in Figure 1). If the non-entitled party values the entitlement more, this party can buy the entitlement with fewer transaction costs and the market will correct the incorrect initial entitlement assignment. Again, the costs of the transaction are borne by the parties.

If transaction costs are high in both directions, a beneficial entitlement transfer via a market transaction is infeasible. However, the court can still achieve social efficiency with the property rule if it knows which party is the ‘least-cost’ avoider. The least-cost avoider is the party that can most cheaply prevent, or protect itself from, harm caused by the sediment release. The court entitles the party facing the highest cost to guard against harm, and puts the cost of avoiding harm on the least-cost avoider (number three in Figure 1). For example, if downstream-property owners can more cheaply protect their property from sediment releases, the court maximizes net social benefits by entitling the dam-owner to release sediment. High transaction costs prevent the parties from reallocating the entitlement through the market, but Calabresi and Melamed argue that, when the least-cost avoider is known, social efficiency can be attained without recourse to an entitlement-reallocation mechanism.

When the least-cost avoider is unknown, the property rule is no longer socially efficient as a reallocation mechanism and must be abandoned in favor of the liability rule. The liability rule provides for reallocation of the entitlement via intervention by the courts. Under the liability rule, a non-entitled party can harm an entitled party, but the non-entitled party must pay the entitled party a value (i.e., damages) that is objectively
determined by the court. Because the court’s objective value is not determined by the market, it may “result in over or under compensation” (Calabresi & Melamed 1972:38). When courts use the liability rule, they bear the cost of deciding this objective value. Calabresi and Melamed call these the costs of “collective valuation” (p. 39). The costs associated with collective valuation include bringing all the parties affected by a tort into court, valuing an entitled party’s damages, deciding how damages should be spread over the non-entitled parties, guaranteeing compliance with its damage award, and, when necessary, deciding how the non-entitled party will induce a transfer of an entitlement from an unwilling party.

Two scenarios are possible when the court uses the liability rule. First, the court might entitle downstream-property owners to be free from harm caused by sediment released from an upstream dam. The upstream dam-owner now does not have to buy the entitlements of the downstream-property owners, but s/he must pay for downstream damages resulting from the sediment release. Downstream-property owners do not have the power to enjoin the upstream dam-owner from releasing sediment. The dam-owner will only release sediment if the benefits of doing so are greater than the damages the court will award to downstream-property owners. Under these economic circumstances, all other things equal, it is socially efficient for the dam-owner to release sediment.

Second, the court might entitle the dam-owner to release sediment that causes downstream harm. Downstream-property owners can stop the sediment releases by paying the court-determined “damages” to the dam-owner of not controlling sediment. Downstream-property owners will elect to pay the dam-owner’s damages, and prevent sediment releases, if the dam-owner’s damages are less than the sediment-related
damages inflicted on their properties. Under these economic circumstances, all other things equal, it is socially efficient to prevent the dam-owner from releasing sediment.

When the court applies the liability rule, the most socially efficient entitlement allocation results when society pays the lowest costs of collective valuation. The court now asks if the costs of collective valuation are the same for objectively valuing an entitlement to the dam-owner versus the sum of valuing the entitlements to all downstream-property owners. If the costs of collective valuation are the same for both parties, the court would entitle either party, because the court cannot decrease the cost to society by favoring one party over the other (number four in Figure 1). If the costs of collective valuation are not symmetrical, the court would grant the entitlement to the party for whom the cost is lower (number five in Figure 1). If the non-entitled party harms the entitled party, society pays the lowest costs of collective valuation, and social efficiency results.

In the next section, we apply this framework to evaluate some of the few existing judicial decisions resolving resource-use conflicts caused by dam operations.
Figure 2.1. Assignment of entitlements and protection rules to maximize net social benefits
CHAPTER 3

APPLICATION TO SEDIMENTATION-MANAGEMENT CASES

We now analyze the extent to which some real-world judicial decisions, attempting to resolve conflicts between the operation of dam/reservoir projects and surrounding property interests, promote social-economic efficiency. *Snohomish v. City of Everett* and *Natural Soda Products v. Los Angeles* entail potential liability when dam operations interfere with downstream economic activities. The seminal case, *McDaniel v. Greenville*, as well as *Gossner v. Utah Power and Light* exemplify potential liability when dam operations cause channel aggradation and consequently increase flooding.

We rely on each court opinion to reveal the facts of the controversy. Admittedly, there might be additional information that could change the way the case is analyzed under a ‘law and economics’ approach, but the material in each court opinion reflects the information that the court used to make its decision. Evaluating the social efficiency of the court’s decision based on the same information seems reasonable.

*Snohomish v. City of Everett*

The consequences incurred by downstream-property owners in *Snohomish* are similar to those that could occur when a dam-owner releases large amounts of water in order to flush or sluice sediment from a reservoir. These downstream consequences include damage caused by sediment and silt, and interference with downstream activities.
Engberg (2002) points out that another court has not cited this case since 1965, so it may have a limited effect on similar future cases.

In 1901, the State of Washington granted Everett Water Company a right to divert and use Woods Creek for the City of Everett. From then on, water only flowed through the old Woods Creek channel during storm events. Landowners downstream of Everett City’s diversion began using part of the old dry channel-bed for agriculture, and in 1911 they formed a drainage district and installed an extensive drainage system in order to keep the channel dry. The district claimed it believed Everett City would continue diverting the contents of Woods Creek for perpetuity. The drainage system’s design, consequently, did not have the capacity to handle the creek’s pre-diversion flow.

Everett City discontinued its diversion of Woods Creek in 1931. The city gradually spilled the contents of its reservoir into the channel bed, which had been dry for 30 years. The city opened the dam two weeks later and allowed the natural flow of the creek to pass through. The drainage district sued the city, claiming the natural flow of Woods Creek picked up sediment and silt from Everett City’s reservoir, deposited it downstream, and damaged the district’s drainage system. The drainage district asked the court to force the city to pay damages for the ruined drainage system, and to enjoin the city’s abandonment of its dam and diversion. In other words, the drainage district demanded it was “entitled to a continuance of that artificial condition” created by the city’s diversion (p. 477).

In stating the principle that should prevail in Snohomish, the Washington Supreme Court cited Lake Drummond Canal & Water Co. v. Burnham:

“…where the proprietor of an upper tenement constructs and maintains
on his own premises, and for his own convenience and advantage, an artificial waterway, or an artificial structure affecting the flow of water, and such structure invades no right of the lower proprietor and gives indication that it is for a temporary purpose, or a specific purpose which may at any time be abandoned, the upper proprietor comes under no obligation to maintain the structure and the conditions produced by it from lapse of time, though the incidental effect has been to confer a benefit on the lower tenant” (p. 481).

The court decided the drainage district gained no right to continue to benefit, at the expense of the city, from the artificial condition created by the city’s diversion. The court neither awarded damages to the drainage district for the sediment damage it incurred, nor enjoined Everett City’s abandonment of the artificial condition it created with its dam and diversion. Therefore, the court’s decision entitled Everett City to continue to harm the drainage district, and protected this entitlement with the property rule. The drainage district’s only recourse would be to pay the city to continue its diversion so that the district could continue operating its downstream drainage system.

According to our framework (Figure 2.1), the court’s decision to enforce the city’s entitlement with a property rule would be more socially efficient than applying the liability rule if two conditions existed. First, high transaction costs would not prevent the drainage district from acquiring the city’s entitlement if the district valued it more highly. The facts of the case do not offer sufficient information to justify the efficiency of the court’s decision on this basis. Second, the drainage district could avoid the damage caused by the city’s decision to abandon its diversion at less expense than the
cost to the city of continuing its diversion (i.e., the drainage district was the ‘least cost’
avoider).

The court was split regarding which party might be in a position to avoid damages at least cost. The majority opinion implied that the drainage district could have avoided damages if the district had initially designed its drainage system to drain the pre-diversion flow of Woods Creek. In addition, the majority argued the sediment damage to the drainage system would not have occurred if the district had not built the system in the first place. The court wrote “had that old channel [of Woods Creek] not been obstructed by respondent, the natural banks of the stream would have carried away that water, and there would not have been the deposit of sediment of which respondent complains” (p. 480).

The opinion of a dissenting judge indicates that, once the drainage system was built, the drainage district would not have been able to prevent damage from the diversion’s discontinuance at reasonable cost. The dissenting judge wrote that enlargement of the drainage system to handle the flow of Woods Creek could only be done “at great expense” (p. 482). This expense would have been in addition to the cost of repairing damages caused by sediment and silt.

The court opinion does not contain information about the cost that Everett City would have incurred if it were required to continue maintenance of its unwanted dam and diversion. Therefore, we cannot infer if, in comparison, the city’s costs of avoidance were higher than the district’s. Given disagreement within the court over whether the drainage district was the least cost avoider, the court’s use of a property rule may not have maximized net social benefits.
In such cases, our framework calls for applying a liability rule so that the efficiency of the entitlement can be tested with a party’s decision to pay damages. Assume for example, that the court’s entitlement to Everett City (allowing it to discontinue its diversion and flood agricultural land) were socially-economically inefficient because the drainage district’s agricultural use were more highly valued. Protecting this entitlement with a liability rule would have given Everett City the economic incentive to continue flooding agricultural land only if the benefits of doing so exceeded the cost of damages to the drainage district. If not, Everett City would be economically inclined to maintain the diversion, and the drainage district would not suffer harm.

**Natural Soda Products v. Los Angeles**

*Natural Soda Products* did not specifically involve the release of sediment from a reservoir, but the case did involve the interruption of downstream economic activity by dam operations. Similar harm could occur when downstream economic activities became dependant on the operation of a dam in the way downstream parties had become accustomed.

From 1919 to 1937, the City of Los Angeles diverted the entire contents of the Owens River via aqueduct toward Los Angeles and away from its natural terminus in Owens Lake. Consequently, the lake dried up and chemicals in the lake’s subsurface brines became available for extraction. *Natural Soda Products Co.* acquired mineral rights in the lake from the State of California in 1932 and pumped the brines from the lakebed to two plants on the lake’s shores in order to produce soda products. This process depended upon the continued dehydrated state of the lakebed, which was a result
of how Los Angeles operated its aqueduct system. Soon after acquiring its mineral rights, the company invested in a new plant and a new process farther into the lake’s bed. The company’s new plant was still not active when Los Angeles opened the gates to its diversion dam on Owens River in February of 1937, allowing a large amount of water from the Owens River to empty into the lake. Los Angeles continued to release water from Owens River into the lake every so often for another half year, flooding the lakebed with 3 to 4 feet of water, and causing substantial damage to the company’s new plant.

Natural Soda Products Co. sued Los Angeles, asking the court to enjoin Los Angeles’s harmful diversions of water into the dry lakebed and award damages for the harm caused by these diversions. In explaining its decision, the Natural Soda Products court pointed to myriad cases in which courts provided a right to those who have made a substantial investment dependant on a long-continued diversion of water to have that diversion of water continue. The court wrote:

“A change in the flow of a stream that appears to be permanent usually leads to costly adjustments by those interested, as they come to regard the artificial condition as permanent. It is therefore reasonable that they should receive as much protection as if the [artificial] condition were natural” (p. 197).

The court distinguished the facts in Natural Soda Products from those of the first case in this section, Snohomish v. City of Everett, in which the court did not require a dam-owner to continue to operate a dam. The court pointed out the Snohomish court decided it would be too burdensome to force a dam-owner to maintain a useless dam, just
for the benefit of downstream-property owners. The *Natural Soda Products* court did not accept that Los Angeles’s diversion of Owens River into the dry lakebed resulted from the city’s dam and diversion becoming useless. The court implied the city altered the flow of water into Owens Lake arbitrarily or to increase its profits, but in such case, “it is reasonable to require that the alterations shall not injure those who have relied on the customary operation of the dam in the past” (p. 198).

The court awarded damages to Natural Soda Products Co. for harm it incurred, but denied the company’s request for an injunction on Los Angeles’s water releases into Owens Lake. The court essentially entitled Natural Soda Products Co. to be free from harm caused by Los Angeles’s dam operations, but limited the protection of this entitlement to a liability rule. The decision allowed Los Angeles to force a transfer of Natural Soda Products Co.’s entitlement by releasing water and paying damages.

The court’s use of a liability rule maximized net social benefits to the highest extent possible, according to our framework, if the following conditions were present. First, transaction costs were high enough in both directions so the market could not facilitate a transfer of an entitlement that was not assigned to the most valued user. As in *Snohomish*, the court opinion reveals little information about how high the transaction costs would have been for either Natural Soda Products Co. or for Los Angeles to buy an entitlement from each other.

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Second, the party that could more cheaply avoid the harm was unknown. The court opinion indicates that Los Angeles could have avoided the harm caused to Natural Soda Products Co. at a lower cost. The *Natural Soda Products* court based its decision, in part, on evidence showing the city “could easily have found an outlet for the surplus water [from Owens River]… where it could do no harm,” and that it diverted water into the lakebed arbitrarily or to increase profits (p. 198). In fact, the costly adjustments Natural Soda Product Co. was forced to make, in conjunction with the existence of alternative outlets for the Owens River water, was enough for the court to hold the City of Los Angeles liable for damages to Natural Soda Products Co. Because the city had alternative outlets for the water it diverted into Owens Lake, Los Angeles’s cost of avoidance would have been less than the “costly adjustments” the company would have had to make.

Given these facts, our framework would propose protecting the court’s entitlement to Natural Soda Products Co. (the party facing the highest costs of avoidance) with the property rule. This maximizes net social benefits by placing the costs of avoiding conflicting use on the known ‘least cost avoider,’ Los Angeles. It also avoids the collective costs of valuing Natural Soda Product Co.’s future damages from Los Angeles’ conflicting use.

*McDaniel v. Greenville*

Courts usually award damages to upstream property owners for flooding that occurs when a dam’s operations decrease the upstream channel’s carrying capacity by channel aggradation (Engberg 2002). The *Natural Soda Products* court argued it is reasonable for property owners to rely on altered conditions downstream of a dam as
though the conditions were “natural” (p. 197). If so, then liability for downstream flooding resulting from dam operations should mirror liability for upstream flooding from the same kind of source. Importantly, the *McDaniel* court did not specifically distinguish between cases of upstream and downstream dam-induced flooding.

In 1907, Greenville-Carolina Power Company built a dam on the Saluda River in order to generate hydroelectricity. Several years later, McDaniel, a property owner on the river upstream from the power company’s dam, sued the company for damages caused by its dam. McDaniel argued the dam stopped the natural flow of sediment and eventually decreased the carrying capacity of the river channel adjacent to her land. Consequently, McDaniel’s land was “overflowed with mud, sand, and water” (p. 269). McDaniel asked for damages resulting from (and not an injunction against) the power company’s dam operations. The power company argued it could not be held liable for damages to McDaniel’s land because its dam was not constructed or operated negligently.

The court held that, even if the dam were constructed and operated with the highest degree of skill, the power company should pay damages for any injury caused by the erection of its dam. The court further explained:

“It may be that when a dam is first built that it will not injuriously affect land some distance from it, and for a long time there will be no cause for them to complain, but when the pond, made by the dam, fills with mud, sand, trash, and other things, causes overflows and injury to lands, then the party injured has a cause of action, if the building and maintenance of the dam is the direct and proximate cause of their injury” (p. 271).
The court entitled McDaniel to be free from flooding, and protected this entitlement with a liability rule. The power company could force a transfer of this entitlement by continuing to operate and paying damages to McDaniel.

The court’s application of a liability rule is more socially efficient than a property rule would have been if transaction costs were high enough in both directions to impede a reallocation of the entitlement via a market transaction, and the least-cost avoider were unknown. As in our previous case analyses, the court opinion lacks the required information for determining if transaction costs were high. The court opinion also provides no information about which party could have more cheaply prevented the harm to McDaniel. The cost of avoidance for McDaniel might have included protecting her land from overflows of sediment and water by erecting a barrier or by divesting herself of the land. The power company’s cost of avoidance might have included adjusting its dam to allow more sediment to pass through, lost revenue from foregone power caused by these adjustments, and potential liability to downstream-property owners for harm caused by sediment released from the reservoir. Even if McDaniel could have more cheaply avoided flood damage caused by Greenville, she still might not have had sufficient information to know she needed to avoid harm. The *McDaniel* court wrote that when the dam was first built, McDaniel “could not foresee that later she would suffer damage” (p. 272). The costs of avoidance for either party may have been quite large. Because there is insufficient information in the court opinion to convincingly argue that the court could have more efficiently protected an entitlement with a property rule, the court’s use of a liability rule appears to maximize net social benefits.
The award of damages to McDaniel is socially efficient if the costs of collectively valuing McDaniel’s flood damages (caused by dam operations) were lower than the costs of collectively valuing the power company’s damages from altering dam operations to prevent harm to McDaniel. The case does not contain information that would indicate cost savings for valuing damages for one side or the other.

Under the above economic circumstances, the court acted efficiently in enforcing its entitlement with a liability rule. We cannot conclude if the court’s entitlement to McDaniel provides a higher level of net benefits than an entitlement to the Greenville-Carolina Power Company would have. The court’s entitlement to did, however, allow the social efficiency of the entitlement to be tested economically. The power company could compare the cost of avoiding harm to McDaniel against the cost of paying the court-awarded damages to McDaniel, and make a cost-minimizing decision. If the value of continuing dam operations in the status quo were sufficiently large, the power company could compensate McDaniel for damages and still operate at a profit.

*Gossner v. Utah Power and Light*

In *Gossner*, the court considered how to resolve a controversy, in which operation of an upstream and a downstream dam were believed to have decreased the carrying capacity of the channel between the dams, and consequently flooded a property adjacent to the river. If a dam-owner released more sediment than could be transported by the volume of water flowing below the reservoir, sediment deposition, flooding would result. Over time, sediment deposition may lead to flooding, especially when a downstream dam traps the released sediment.
The Gossner farm was located between two dams owned and operated by Utah Power and Light, and the power company had a great degree of control over the amount of water flowing past the farm. During the 1920s, two judicial decrees gave Utah Power and Light the right to store 5,500 cubic feet per second (c.f.s.) of Bear River water, and release this water from the dam upstream of Gossner. Gossner sued Utah Power and Light in 1976, claiming the operation of both the upstream and downstream dams decreased the carrying capacity of the natural channel to a maximum of 3,400 c.f.s., and when Utah Power and Light continued to release water at a rate of 5,500 c.f.s. into the altered downstream channel, Gossner suffered crop damage from flooding. Utah Power and Light argued the decrees gave it the right to release 5,500 c.f.s. any time it desired, without being held liable for resulting downstream flood damage.

A district court gave a summary judgment in favor of Utah Power and Light on the grounds that Gossner had conveyed an easement to the power company for flooding that resulted from the company’s water releases. In addition, the court issued an order that Utah Power and Light would only be held strictly liable for flood damage if such damage were caused by sedimentation behind the dam downstream of the Gossner farm. Therefore, the power company could not be held liable for flood damage that resulted if the upstream dam had decreased the carrying capacity of the channel adjacent to Gossner’s farm.

Both Gossner and Utah Power and Light appealed parts of the court’s summary judgment to the Utah Supreme Court. The high court overturned the summary judgment, finding that Gossner had not conveyed a flood easement to Utah Power and Light, and the power company could be held liable for flood damage caused by the dam upstream of
Gossner’s land. The high court sent the case back to district court to be tried on its merits, giving the following direction:

“If the evidence establishes that the carrying capacity of the natural channel is being gradually reduced by deposits of sediment in the bed of the river caused by the existence of defendant’s dams and reservoirs along the river, and the absence of the scouring effect of high spring runoff and flash floods from time to time, this is a situation which the defendant should remedy without flooding lands adjacent to the river. To the extent that any such flooding is caused by the defendant the rule of strict liability for damages is appropriate…” (p. 341).

The Utah Supreme Court asserted the judicial decrees only gave Utah Power and Light the right to release up to 5,500 c.f.s. from its upstream reservoir, but limited the actual amount released to the maximum carrying capacity of the river channel. The Utah Supreme Court stopped short of recommending that the lower court enjoin harmful water releases from Utah Power and Light’s dam upstream from Gossner. Rather, the Utah Supreme Court specified evidentiary conditions supporting an entitlement to the downstream-property owner (Gossner) to be free from flooding caused by the power company’s dam operations protected by a liability rule. The power company could force a transfer of Gossner’s entitlement by continuing to operate and paying damages to Gossner for ensuing floods.

The high court’s recommendation to use the liability rule would be socially efficient if transaction costs prevented the parties from correcting a socially inefficient
initial entitlement on the market. Consistent with the previous cases analyzed, the
Gossner opinion offered little information regarding transaction costs.

The use of a liability rule also would be socially efficient if the court did not know
the identity of the least cost avoider. However, the facts suggest that Utah Power and
Light might have been able to avoid harming Gossner at a lower cost than the cost to
Gossner of protecting himself under normal operating circumstances. For example, Utah
Power and Light could restrict releases to 3,400 c.f.s.—the amount Gossner claimed was
the river channel’s post-dam maximum carrying capacity. The court reasoned that the
power company only needed to release up to 3,000 c.f.s. to generate electricity at any one
time, and thus that the release of additional water wasted valuable resources. The court
wrote, “it is safe to assume that [Utah Power and Light] will not knowingly release water,
except in an emergency or to supply other appropriators’ rights, without obtaining as
much power as possible from its use” (p. 341). These facts, if validated by the lower
court trial, would support protecting an entitlement to Gossner with a property rule. To
continue operating, Utah Power and Light would forego the release of ‘wasted’ water
damaging Gossner’s land, or purchase Gossner’s entitlement to be free from flooding.

To the extent that these facts were uncertain in trial, the lower court could
promote social-economic efficiency by using a liability rule to protect an entitlement to
the party for whom the costs of collective valuation were lower. The court opinion
contains no information on the costs of collective valuation for either party, but entitling
either party would test the value of Utah Power and Light’s harmful dam operations. An
entitlement to the power company, protected by a liability rule would have allowed
Gossner to compare the cost of avoiding harm from the water releases against the cost of
paying damages to Utah Power and Light. If the cost of damages was lower, Gossner would enjoin Utah Power and Light’s harmful water releases. On the other hand, the court’s suggested entitlement to Gossner gave Utah Power and Light the economic incentive to restrict water releases to levels not harming Gossner, unless the benefits of doing so outweighed the court-assigned damages it would have to pay Gossner.
CHAPTER 4

CONCLUSIONS

Dam owners have an interest in managing sediment when its accumulation negatively impacts dam/reservoir operations, or increases their potential liability for flooding of upstream lands. Downstream-property owners have an interest in protecting their interests from damages attributed to sediment releases, such as flooding of lands adjacent to the river channel, and damage to downstream environmental values. When these interests collide, courts are called upon to resolve the conflicting resource uses. Given the economic nature of the interests involved, it is appropriate to consider how judicial decisions can promote the greatest net social benefits possible.

Judicial decisions resolve controversies, in general, by entitling one of the parties to act in a certain way, or to be free from certain actions of the other party. The entitlement is protected by either a property or a liability rule. Under a property rule, a dam owner entitled to release sediment, for example, could continue to do so unless s/he voluntarily agreed to cease releases in return for a payment from downstream property owners. Under a liability rule, downstream-property owners could force a transfer of a dam owner’s entitlement by paying court-determined damages to the dam-owner. Alternatively, downstream-property owners might be entitled to be free from sediment harm. Under a property rule, property owners could continue to be free from harm caused by sediment releases unless they voluntarily transferred that right to the dam
owner. With a liability rule, a dam owner could force a transfer of the property owners’ entitlement by paying them damages determined by the court.

We offer the following principles for how courts might allocate and protect entitlements to maximize the net social benefits of sedimentation management:

First, a court’s decision of which party to entitle has a neutral effect on social-economic efficiency if transaction costs do not prevent a voluntary transfer of the entitlement from the entitled party to the non-entitled party (Coase 1960). In such case, the market can correct an inefficient initial entitlement assignment by the court. A non-entitled party that can make a higher-valued use of the entitlement than the entitled party will have the economic incentive to purchase it. Consequently, the entitlement can be protected with a property rule that requires a market transaction for the entitlement to move from one party to the other. Our case analysis demonstrates that transaction costs are not yet on the radar screens of courts determining sediment-damage cases.

Second, when uncertain or high transaction costs preclude corrective market transactions between parties, a court can promote social-economic efficiency by granting an entitlement to the party facing the highest cost of avoiding (property owners) or preventing (dam owner) harm from sediment releases. Such an entitlement imposes a legal duty on the non-entitled party to prevent harm, and maximizes social economic benefits because this is the party that can do so at least cost. Thus, a corrective market transaction is unnecessary to achieve social-economic efficiency. As a result, the entitlement can be protected with a property rule without worrying that high transaction costs would preclude such a transaction.
Three out of the four cases we analyzed (*Snohomish, Natural Soda Products, and Gossner*) attempted to identify a least-cost avoider. Both the *Natural Soda Products* and the *Gossner* courts ascertained that the dam owner was the least cost avoider, and promoted social efficiency by favoring an entitlement to property owners. Interestingly, each court favored protecting the entitlement to property owners with a liability rule instead of a more efficient property rule, which would not have required the court to value and assess damages. Ironically, the only court that did protect its entitlement assignment with a property rule, *Snohomish*, was split regarding the identity of the least cost avoider.

Third, when the identity of the least-cost avoider is uncertain, courts can achieve social efficiency gains by protecting entitlements with a liability rule. Three of the four cases (*Natural Soda Products, McDaniel, and Gossner*) entitled downstream-property owners to be free from damages, and protected the entitlement with a liability rule. This entitlement and protection rule gave the dam owner in these cases an economic incentive to engage in the various management activities only if the benefits of doing so outweighed the damages owed to property owners. This forces dam owners to include the impacts on downstream-property owners in testing the economic efficiency of their management activities.

Courts can make additional efficiency gains by entitling the party for whom the costs of identifying and valuing damages is lowest. In the cases we analyzed, information on the costs of collective valuation was lacking.
REFERENCES


CASES CITED

Gossner v. Utah Power and Light, 612 P.2d 337 (Utah 1980).


Natural Soda Products v. Los Angeles, 23 Cal. 2d 193, 143 P.2d 12 (Cal. 1943).


Lake Drummond Canal & Water Co. v. Burnham, 147 N.C. 41, 60 S.E. 650 (N.C. 1908).
APPENDIX A

ENGBERG’S ‘LIABILITY THEORY’ APPROACH
Engberg explains the retirement of obsolete dams can occur in three ways: the dam-owner can (1) remove the dam and allow sediment behind the dam to flow downstream, (2) do nothing, in which case sediments will eventually fill the reservoir and spill over the top of the abandoned dam, or (3) prolong the life of the dam by dredging the reservoir and disposing of the sediments offsite. Engberg does not address the last option because it does not lead to sediment flows to downstream land. She also does not mention a fourth option, which this paper specifically addresses: prolonging the life of a dam by releasing reservoir sediments into the downstream channel.

Engberg writes courts use the distinction of intent to choose between several liability theories in deciding torts. These tort liability theories include strict liability, trespass, negligence, and nuisance. Plaintiffs will usually litigate under several tort theories at once, and defendants will likewise assert many defenses to shield themselves from liability under any of the liability theories. The courts’ choice of liability theory restricts how the court will decide the liable party and the extent of his liability. In entitlement terms, the liability theory indicates the kind of evidence considered in choosing the entitled party and in deciding how to protect that party’s entitlement. Engberg’s framework is portrayed in Figure A1.

Assuming a dam-owner has chosen to retire his dam, the first question Engberg proposes a court will ask is, how will the dam be retired? According to Engberg, the
dam-owner can remove the dam or “do nothing.” If the dam-owner chooses “dam removal,” intent is established, because dam removal “resembles an intentional, rather than accidental, act since the owner makes a deliberate decision to allow the contents of the reservoir to flow downstream” (p. 190) If the dam-owner chooses to “do nothing,” the court would liken his actions to an unintentional act “if it appeared to be a careless or accidental failure to act” (p. 190). Unlike with dam removal, intent is not automatically established, but the court might still find intent exists, Engberg argues, if the dam-owner either knew or should have known the downstream impacts his reservoir sediment flows would cause. Even if the dam-owner did not, or was not required to know, about downstream impacts, the court might still find intent exists if the dam-owner later finds out about the impacts and does nothing, in other words, if his “careless omission became a knowing commission” (p. 191).

Engberg argues, once a court finds that intent exists, it would most likely decide liability under either trespass or intentional nuisance. Plaintiffs could most easily show liability for downstream damage from reservoir sediment flows under trespass because they must only prove that reservoir sediment constitutes a “physical entry” onto their land (p. 208). A defendant dam-owner found liable under trespass would be held liable for the full extent of damage caused by his reservoir sediment, regardless of how the plaintiff’s actions contributed to his own damage. The intentional nuisance liability theory is not a distinct tort, but provides another way for a plaintiff to collect damages for harm if that harm constitutes an interference with the enjoyment of the plaintiff’s property. A plaintiff asserting an action under nuisance must typically show he suffered substantial harm in order to receive damages, and that the nuisance was unreasonable in order to
enjoin the defendant’s nuisance-causing action. Because it does not require substantial harm or unreasonable conduct, trespass allows a plaintiff to more easily claim damages resulting from a dam-owner’s sediment flow.

If the court determines a dam-owner’s intent is lacking, it can assess liability under two tort theories: strict liability (also called absolute liability) and negligence. Under strict liability, a dam-owner would be completely liable for all downstream damage caused by his reservoir sediment flow. Engberg asserts a court would rarely find liability for damage from reservoir sediment flows under strict liability because courts have typically reserved this liability theory for ultra hazardous activities having little redeeming social value.

Engberg argues courts would most likely assess liability for nonintentional sediment flows under negligence. In order to claim damages under negligence, a plaintiff would have to show damage caused by sediment flows resulted from the defendant dam-owner’s failure to use the amount of care that was reasonable under the circumstances. When plaintiffs bring court action under negligence, dam-owners could lower their liability by using the comparative negligence defense. Comparative negligence allows the court to reduce the plaintiff’s damage award when the plaintiff’s own negligence has contributed to the sediment flow damage. Engberg argues this could greatly lower dam-owner liability when downstream parties have developed in historic floodplains and rely on dam-owners to perpetually provide artificial conditions created by dams and reservoirs. When courts assess liability under negligence, they would probably not enjoin the dam-owner’s release of reservoir sediment.
Figure A.1. Engberg’s description of how courts will choose to decide reservoir sediment flow torts: assuming dam is retired