Collaborative Leaders Network

Alexander Dam on Kauai

HAWAII'S STORED WATER: WHERE WE HAVE BEEN AND WHERE DO WE GO NEXT?

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Working together to create effective, durable outcomes for Hawai`i

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INTRODUCTION

As Hawaii looks at the issue of increasing the supply of freshwater, one of the questions that arises is what is the role of stored water in addressing that issue. Hawaii's water systems have been called "flashy," the rains come and drop lots of water in a short period; the water then rushes down streambeds and into the ocean; very little is retained on the land.

The Freshwater Initiative of the Hawaii Community Foundation contracted with the Collaborative Leaders Network to reach out to knowledgeable individuals who represent the various points-of-view from regulators to dam owners to farmers to environmentalists, to Native Hawaiian elders, and to the attorneys who have represented the Native Hawaiian Interest.

As will be detailed in the following pages, from the interviews and subsequent discussions, emerged the key issues of why we store water, the particular opportunity offered by energy, the Department of Land and Natural Resources (DLNR) regulation, the Public Utilities Commission and agricultural water, other regulatory issues, key systems to support, the Native Hawaiian view of stored water, and how can we support stored water. Specific recommendations follow in each section.

At the end, there is a set of recommended steps that could be taken to improve the situation for the dams and reservoirs.

As part of this report, we also needed to update the review of other states laws in order to see if there is anything that Hawaii needs to look at. The conclusion is no, that there are few changes and none that are important for us.

WHERE ARE WE AND WHY?

Hawaii has seen the building of two great water systems. One was the phenomenal ancient Hawaiian system which you can hear painted in words by Sam Gon III, or read about in books like The Shark Going Inland is My Chief by Patrick Kirch. These systems, the remains of which can be seen on every island, once supported a self-sufficient population of upwards of a million people before the arrival of Captain James Cook in the late 1700s. These systems kept water within the valleys from which they sprang and supported crops that matched the amount of water available in that area.

The great Hawaiian systems also preserved top soil and encouraged the recharge of water back into their storage site, the aquifer. Visible to this day are structures which "slowed" water down on its' journey to the ocean allowing some to sink back into the ground and providing some for use in the system.

One hundred years later, as detailed in Sugar Water by Carol Wilcox, the sugar plantations built huge private water systems throughout the islands to move water to their plantations. (The sugar planters had initially asked King Kalakaua to build the water systems but the Kingdom lacked the money so they were built privately.) These systems moved water between valleys and from the rainy mountains to the plantations built in the valleys and plains, regardless of how wet or dry those areas were naturally.

The dams and reservoirs that are the subject of this work are part of that second system. As the plantations closed, these systems met a variety of fates related very heavily to who their owner became.

These storage systems are not evenly spread across the State and are largely concentrated on Kauai and Maui. Of the 135 State regulated dams and reservoirs, 56 are on Maui and 54 are on Kauai; the total comprising over 80% of these facilities in Hawaii. 14 are on Oahu, 10 on the Island of Hawaii, 1 on Molokai, and none on Lanai, Niihau or Kaho'olawe.

The ownership of these 135 dams is very diverse though Alexander and Baldwin own a significant portion of the total (34 of the 56 on Maui and 17 of the 54 on Kauai). Other major owners include the various State Departments, the various County Departments especially the Departments (or Board) of Water Supply; Maui Land and Pine, Gay and Robinson, and the Robinson and Knudsen Trusts. There are quite a few individuals and entities with an ownership interest in a single dam or reservoir.

Most of these are relatively small with there being only five reservoirs of very substantial size: Waita and Alexander on Kauai; and, Wilson, Nuuanu, and Kaneohe on Oahu. The two Kauai ones were clearly built as part of agricultural

systems. The Nuuanu and Kaneohe systems have substantial flood control purposes while Wilson is a significant agricultural resource.

The primary function of most dams and reservoirs was not long term storage but rather short term holding areas as part of the larger systems to get water to the fields. At most, these structures held a few days worth of water at any one time and some emptied each day as the water made its way to the field. Stated another way, they captured water for timed release into the plantations. As a result, they are found throughout these systems as part of a gravity driven system running from the mountains to the sea.

These systems were at once an engineering marvel and a major disaster for the existing streams; in many cases water was totally diverted out of there on a regular basis. The East Maui System, which is largely in tunnels, astoundingly loses only 200 feet in elevation over a 24-mile course run entirely by gravity. These systems, both ditches and reservoirs, were leaky and lost a lot of water en route to the fields. The water was then sent into the fields, into furrow agriculture, which required very large quantities of water. It was a very effective (if not efficient) system though likely not a sustainable one by current standards.

One aspect of many of them, especially the Maui ones, is that they were not designed to deal with storm water. In many cases, when heavy rains occurred, the ditch systems shut down and water was sent down to the sea in its natural streambeds. As these areas became more urbanized, there are sometimes flood control systems created to handle the large volumes of storm water such as is found at the base of the Iao Stream on Maui.

(It is worth noting how very different Hawaii's island system is from most places on the mainland. Their water systems are heavily tied to winter snow packs and spring snow melt, very wide and deep rivers, and especially in the 20th century, the creation of massive dams and artificial lakes. Hawaii's water system by contrast produces water all year long and has been called "flashy" -- rain comes in the mountains and goes quickly down the streams. Some goes into the aquifer in the mountains, the rest largely into the sea.)

One final note on these dams. Many of the Kauai dams and the Maui dams are different in one major respect and that is where they reside on the natural water systems. Almost all the Maui systems are ditch fed, they are not part of the streams. Water is diverted from the streams on Maui, put in ditches to move it to the fields, and the dams and reservoirs are part of that ditch system. On Kauai, however, many of the dams and reservoirs are built into the streams and are a part of those water systems. This difference may have a significant impact on their respective futures.

The Plantations Close Down

By the end of the 20th century, we saw the closure of the sugar plantations in Hawaii with the exception of Alexander and Baldwin's Maui plantation. At first, we seemed to be expecting some plantation level replacement to occur and there were State and County task forces set up to try to facilitate that transition.

Eventually it became clear that that would not be the answer and that each area of the plantation system would have its own separate future depending largely on who owned the land, and ownership became much more diffuse.

The water systems; dams, reservoirs and ditches, were subject to the same fragmentation as they are part of the land ownership changes. Where significant economic activity remained (Alexander and Baldwin, Grove Farm, Gay and Robinson) their systems were maintained in their own best interests.

It was that economic activity which financially supported maintenance and repair of the facilities, had a workforce that could carry on maintenance activities like keeping the face of dams clear of vegetation, and had an ongoing use of the system that helped to preserve it. On this last point, earthen systems (which Hawaii's are) which go "dry" do not hold up well. Regular "wetting" of the system is important.

Many of the dams and reservoirs went to owners who did not have significant activity to support them. In some cases, the State of Hawaii at the urging of farmers in the area became the supporter of the systems that had reverted to State ownership. The Kapa'a and Kekaha/Mana systems on Kauai are examples of that outcome.

And some came to owners who bought the land on which the dam or reservoir sat. In some cases, they were a feature of the property that was important to the landowners involved whether it was Ka Loko where Jimmy Pfleuger had water-based activities and "waterfront" lots; Kalihiwai when the water is an amenity of the surrounding subdivision; or Kauai Ranch where the reservoirs and water systems are maintained as part of both a living area and a spot for economic uses such as film production.

And in some cases, it was simply part of the purchase of land and the new owner who likely had no idea what they were intending with the property. The owners of the Twin Reservoir on Kauai are a good example of that situation.

We will return to this subject later but one key issue remains is what the uses of the dam and reservoir are, and whether those uses produce income that can be used to support the maintenance and repair of the dams and reservoirs.

Agricultural has been the primary source of support for these systems and continues to be. In some cases, this is a direct carryover from the plantation days as is the case with Alexander and Baldwin, Dole, Gay and Robinson, and others.

Another key use is flood control and those facilities (Nuuanu and Kaneohe for example) are government-owned.

Other uses, which tend to be subsidiary and may or may not be income generating are recreation, drinking water, storage and recharge. Especially the latter two are part of a larger discussion that in times of abundance of water, we should find ways to save water for days when it is not so available.

And finally, there is a discussion about the possibility of energy production being a significant supporter of these facilities.

There will also be discussion about the need for government to possibly play a much stronger role in preserving these facilities.

Water Disputes and System Thinking

During many of the interviews, the issue of the disputes and especially the litigation that often occurs with regard to water systems in Hawaii came up often: both with the natural systems (which is strongly connected to Native Hawaiian practices) and the artificial systems (the water systems created to support plantation-style agriculture); and especially in the conflict between those systems.

Overall, there were three major themes that emerged from these voices:

1. The legal system, even if it is the one that parties feel compelled to use, is not the best place to make long-term systemic decisions.

   Among other attributes, the legal system encourages people to take strong and exclusive claims -- to seek 100% of anything in order to preserve their “rights” to the claimed item.

   Then the system considers the claims and allocates rights to the disputed item(s) among the parties. If you get X% of an item, that is “yours” entirely.

   But does that actually make the most sense? If we step back from the legal desire to give (or not) each claimant the piece they are “entitled to,” there are different ways we could allow for use.

For example, what if instead of asking for full rights to an item, you asked for and received 100% of the resource, 50% of the time. Might that not satisfy your "rights," while still allowing for other uses or needs to be satisfied as well. The goal would be to look at the capabilities of the system, the many needs it could serve, place some clear priorities on those needs, and then satisfy as many reasonable needs as possible.

Ironically, or perhaps most fittingly, this is closely akin to the Konohiki system that controlled access to water in the Hawaiian system. You got what you needed, when you needed it, and the rest was given to others.

2. What is Plan C?

   As discussed above, the right answer may well not be the 100% answer for one person. One of the interviewees suggested that Plan C should always be put on the table.

   So for example, the plantation water systems often involved totally diverting the daily flow of a stream into a ditch.

   The current operators of those systems seek to maintain them as is in order to maintain their use for agriculture. Those who are seeking to restore the stream will sometimes seek to eliminate the diversion and restore the full flow to the stream. The insistence would be that both parties spend time looking at a third option, a Plan C that looks to a mid or at least shared ground. Pushing us into an either/or dispute risks leaving out interests which, if possible, should be served.

   This view also requires that we look at the natural processes that are at work in an area -- its biology in particular. There was, for example, a suggestion that we reverse the traditional plantation diversions strategy of diverting the regular flow of the stream and having all storm flow go down the stream, and instead have the normal flow or a portion of it go down the stream and a portion <u>plus</u> all excess go into the diversions.

3. Our efforts should look to the specific system and work with it towards an answer, an answer which must also work with the needs of people.

   Our relationship in this view must first be with the resource -- the water, the place where it begins, and the surrounding environment. (This will be a tough one for those who believe that all disputes are between the people in disputes and will find it hard to lay that aside to begin with the resource rather than each other.) In this view, the stream is given enough water to permit it to live, to have its key species both downstream (o'opu and o'pae) and upstream the opportunity to thrive, and to allow for residents of the area to farm their land. And then what? What if there is agriculture

nearby that will feed or clothe or otherwise support our people? What about the need for drinking water?

This view also requires that we look at the natural processes that are at work in an area -- its biology in particular. There was for example a suggestion that we reverse the traditional plantation diversion strategy of diverting the regular flow of the stream and having all storm flow go down the stream, and instead have the normal flow or a portion of it go down the stream and a portion plus all excess go into the diversions.

The challenge with that, beyond the physical fact that the diversions were not designed for storm flow, is that it ignores the biology of streams and species. The storm flow of stream water, the inflow of larger amounts of freshwater into the ocean acts as a signal to species that it is time to move into the stream.

Incorporating biology into the system design can lead to very discrete actions. For example, in designing it's system at Punalu'u, Kamehameha Schools learned that the upstream movement of species was concentrated at a particular time of day. In order to encourage that movement, other uses of water are curtailed at that specific point in the day providing maximum stream flow at a critical time. That is thinking with the stream and with the biology of the stream.

Another example cited noted that in the normal housing development, the system is designed with impervious surfaces and the run-off from those surfaces is concentrated into concrete channels which flow to the sea. Is there a better way? Using surfaces which allow the water to sink back into the ground and then moving any captured runoff to where farmers might access it. That is what system thinkers are asking that we consider.

Stay on Ground, Go Down

There was a significant level of discussion to the effect that we should preserve what we can but that the future of reservoirs was small and more closely tied to the areas they serve. If you have land, you dig a hole, line it, and then put water in it. Pumping water is expensive so gravity will still play a significant role and these reservoirs should be connected to each other and to the fields using gravity flow.

As one interviewee said, "the old plantations thought vertically, the farmers today need to think horizontally."

Another system thought was that nature collected and cleared water of sediment in wetlands and bogs that were along our shoreline. Kawainui Swamp

is a good example. As we look at the movement of water, and especially water needing some level of treating or cleaning, the creation of wetland areas is worth considering.

One final system thought comes from a story I was told that I cannot personally verify but if even only partly true, is quite instructive:

> People have commented of late about the changes in the Koke'e plum crop -- that there are less plums and they are smaller. There has been much speculation on why this is occurring with climate change and global warming being seen as a potential cause.
>
> Something else however was also going on that might be looked to as well. There was a Job Corps site nearby the plums and the people in that program would, on their own, prune and care for the plum trees.
>
> It is not always about the large systemic answer, sometimes it is simply the absence of attentive, nurturing behavior ….

Conclusion

The subjects raised in this chapter will be explored in the material that follows. Specific suggestions and recommendations will be in each specific discussion.

The one item coming out of this introduction that are recommended for further action is:

1. That in all disputes on water, and the systems that go with it, the parties should focus on system thinking to create the opportunity for better solutions for all concerned.

WHY DO WE STORE WATER?

It turns out that there are at least a dozen reasons why we store water. Agriculture is the one most discussed in part because of the plantation origin of many of these dams and reservoirs but that is not the only reason. The list of reasons raised is as follows:

1. Agriculture
2. Drinking water
3. Recreation
4. Flood control
5. Storm water capture
6. Recharge
7. Hydro power
8. Fire protection
9. Support wildlife
10. Storage of raw water for treatment
11. "Wetting" the water systems
12. Education

Agriculture remains the primary use of stored water. And with a couple of notable exceptions (Waita, Alexander and Wilson for example), the dams and reservoirs in Hawaii are small and can hold only a few days worth of water for agriculture. For the most part, they are part of systems, whether stream or ditch based, where there is a series of dams and reservoirs going down to the agricultural fields to which they provide water. The Kapa'a, Waimea/Koke'e, Alexander, Waita, Waiahole/Kunia, and East Maui systems are examples of which dams and reservoirs are a part of a delivery system that runs mauka to makai for daily agricultural use.

A few large ones (Wilson, Waiale, Waita, and Alexander) are seen as significant resources for their attached agricultural systems and do hold quantities that allow them to play longer service needs in terms of water reserves.

There are also systems that could provide a lot more value to agriculture in the long term but because of short-term challenges, may never get the opportunity to do so. The West Maui reservoir of Maui Land and Pine Company are said to be in decent shape but that there is not sufficient economic activity to cover the costs of maintaining the structures and that Maui Land and Pine is not in a great economic position itself to invest in them.

Drinking water is another use, primarily on Kauai and to a lesser extent on Oahu. (Maui does not use reservoir water for drinking water at all.) This use would need to be replaced by other sources if were not available.

The Maui view is very straightforward; what is the cost to pump potable water from the aquifer as opposed to the cost of taking water from the reservoir and treating it for use as drinking water? On Kauai and Oahu, it comes down more to the availability of large amounts of water near to the area where it is used.

Recreation is part of some of the largest dams and some of the smaller ones. At Wilson and Waita, there is boating/kayaking/canoeing and fishing. At some of the smaller ones like Kalihiwai, there appears to be some water use in the form of kayaking and standup paddling probably for the residents of the homes in the area which support the maintenance of the reservoir. On the Ka Loko reservoir, before it collapsed, there was jet skiing and water skiing.

Flood control. This is a primary reason for reservoirs like Nuuanu or Ho'omaluhia in Kaneohe. In very wet areas, where the possibility of lots of rain creating significant volumes of water, the existence of these reservoirs is critical to the safety of those who live below. One interesting comment was that it was surprising that Manoa Valley did not have a reservoir since heavy rain has led to flooding even with the channels that have been created to move water through the values safely.

Storm water capture is discussed often but does not appear to have been the rationale for any of the current structures. In contrast to flood control, which looks to emergency level amounts of water, storm water capture would be much more deliberate and routine capture of any large amount of rain rather than letting it all go down the system to the ocean. Certainly the large ones like Nuuanu, Waita, Wilson, Alexander and Waiale might be able to play a role in these efforts.

Recharge is being looked at but its discussion is somewhat clouded by the belief that recharge is not seen as an acceptable use of ground water. That view is based on an order that was supposedly handed down in the Waiahole water case. According to the State Attorney who was involved in that case, such an order was contemplated by never actually handed down. What has been ruled is that users of water cannot justify taking excess water on the basis that end of the system it will go into the ground and recharge the aquifer. It has also been argued that leaky water systems recharge the aquifers but that has not been accepted either.

Recharging of our aquifers is seen by most interviewees as one of the most important and beneficial actions we can take with surface water. Native Hawaiians were historically very ingenious in creating opportunities for recharge as they viewed to aquifer as the place to store water.

Nuuanu Reservoir, in particular, is being studied as a recharge site. Given the proximity of the reservoir to the aquifer, and given the amount of water

available in Nuuanu Valley, this would appear to make a lot of sense. There is apparently some concern at the Department of Health with the proposal to inject storm water into the ground, though it is far above the aquifer, that will need to be resolved.

Nationally and internationally what is called “aquifer storage and recovery” is widely used to take water that is excess and put it back into the aquifer. States like Florida, California, and New Jersey are in the forefront of this work. The issues of groundwater contamination do need to be examined but the opportunities are very significant and solutions need to be found.

Serious consideration needs to be given to making recharge a “reasonable and beneficial use” under appropriate circumstances and especially where it does not impede stream life.

Hydro power using the reservoirs and dams, and the water systems which connect them, is seen as a great addition to the possible economic uses for these facilities. And that in turn can provide them money; either through reduced electricity expenses or by selling the power back to the utility, to provide for upkeep and maintenance, and even improvement, of the facilities involved.

Energy was such an important issue that a further discussion on that possibility follows in the next section.

Fire protection is a more modern use of reservoirs that was not contemplated when they were first built. For example, the use of reservoirs to fill up the bladders of water used by helicopters to battle fires was specifically cited. Presumably any body of standing water could be a resource but in some upland areas where precious forestry and watershed areas are involved, these facilities are nearby and may be critical to the quickest possible action.

The support of wildlife came up a couple of times. Ulupalakua Ranch has worked with Ducks Unlimited on creating water areas for birds to settle in. And the Kalihiwai Reservoir’s website focuses a good deal of attention on their work to preserve wildlife.

It is probable that many of the reservoirs covered by this report in fact play a role as wildlife habitats. This again was probably not even contemplated by those who built these systems but as we urbanize and other habitats disappear, this value may well grow in importance.

Storage of raw water for treatment was also discussed a couple times; and appears to be a possible use for an old reservoir with no current use or a reason to create a small new reservoir as part of a system to make use of all water resources in a productive manner. The water can either be treated or perhaps dropped underground to go back to the water table.

One use for the systems, that does not only involve the reservoirs, and is worth noting, is the need to keep these systems "wetted." These systems do not do well when completely dry over long periods; they need regular water running through them. And while plantation systems are often too small to be used for major storage, they have more than enough to keep the system wetted.

Most likely as a combination of the wildlife habitat function and of the historic nature of these systems, this is a role to plan in educating ourselves about the past, about our history. Learning aside the results of the diversions, the actual diversion structure are phenomenal especially when you consider when they were built. As mentioned earlier, the East Maui Irrigation system has a portion of its ditch system, which over the course of 24 miles, drops only 200 feet, and most of that system is in tunnels. Given the sophistication level of construction equipment at the time and its remote location, the engineering is amazing.

We store water for a variety of reasons. Some of these are very situational such as fire protection or using the reservoir to store raw water for other treatment. Most, however, serve much more critical functions and the various regulatory structures which surround water need to recognize these uses of storage, and storage generally. Priorities must be set and emerge from sources like the State Constitution, statutes, rules, policies, and decisions of our government. All may not have them currently.

Looking at the State Water Code, Chapter 174C for example, in terms of whether these uses are mentioned as beneficial uses from a policy standpoint, instream uses or elements to be covered in the elements of the water plan, yields the following coverage:

	Beneficial Uses	Instream Uses	Water Plan Elements
Agriculture	√	√	√
Drinking water	√	√	√
Recreation	√	√	
Flood control			√
Stormwater capture			√
Recharge			√
Hydro power	√	√	√
Fire protection (1)			
Support wildlife	√	√	
Raw water storage		√(2)	
Watering the system			√(3)
Education		√	

Notes:

(1) It could be argued that there is support for wildlife through this use and therefore it is covered by that purpose, at least in part.
(2) As part of the domestic uses of water.
(3) As part of maintaining the State's irrigation system.

Conclusion

The purposes for which water is stored are generally acknowledged in some form in the Water Code, the principal statement or water policy in Hawaii.

It should, however, be noted that there is noting in Hawaii law which makes the "storage of water" on imperative. What there is in law is the following: The Dams and Reservoir Law (Chapter 179D), as will be discussed, is a regulatory law approaching these facilities as public safety issues.

The legislation allowing for the amending of the State Constitution to permit special purpose revenue bonds to support dams and reservoirs refers to "improv[ing] their facilities to provide public safety and provide significant benefits to the general public as important water sources." (emphasis added)

Is that enough? Should something be added to the statutes? As part of the larger issues discussed, it would be an important statement of public policy.

ENERGY AS A MAJOR USE

"If there is not economic activity attached to the water system, it is very difficult to maintain it."

In one form or another, this theme of the need to attach economic activity to these water systems is a consistent one. Where economic activity exists, and agriculture is the primary activity cited, there is income that can support maintenance activities on the system.

If there is no economic activity, the landowner must pay for all these costs out of their pockets.

Some do and some don't. And even some that do, are for understandable reasons doing only what they must and not always what would be best to maintain a system in good working order.

There was a specific concern with the water systems in areas where there is great potential for agriculture, but where there is little or no agricultural use today, or at least much less use than might be one day.

In the meantime, however, the water systems are in jeopardy.

Hydro power, the production of electricity from flowing water, was cited by many as having great potential to change the situation. It was even called "critical" to the future of our water systems. Beyond all the virtues of hydro power from a renewable energy standpoint, it could cut the electric bill of the enterprise and/or be sold to the electric utility providing income. Either way, the result would be financial support for maintaining the systems. This could even be the case where there is no other economic activity on the system, a particularly challenging situation that exists today in places.

Hydro power has a long and significant history in Hawaii. King Kalakaua first powered downtown Honolulu with a system built in Nuuanu Valley. (The remnants of the building that housed the major hydro plant can still be found behind the Hawaiian Electric substation on Pali Highway opposite Homelani Street.) The plantations built over 15 major hydro plants with another 100 or more smaller plants spread across their lands. The initial electrical systems on an island like Kauai have a substantial hydro power component.

From a renewable energy standpoint, hydro power is one of the best forms of power in the world. It is very fast starting and adjusting, and especially effective in helping systems handle large amounts of variable power such as photovoltaic. One of the reasons Germany has been able to handle as much photovoltaic power on its grid is said to be the amount of hydroelectric that flows into it from Norway.

Either combining hydro power with solar power in the immediate area in a microgrid for example), or selling it to the utility to balance other resources in the island grids, makes a great deal of sense for Hawaii.

As noted earlier, our water systems are either part of existing rivers and streams, or they are ditch and tunnel systems built to move water to where it was to be used. Hydro power can be built into either type of system as the two requirements for hydro power are the flowing of water and elevation (or "head."

In those settings, hydro power can take two forms. First is run-of-the-river or (given our systems) run-of-the-ditch, which takes water that flows "naturally" through the water way into a power facility, uses the force of the flow to drive a turbine, and then returns the water undiminished into the waterway. Run of the waterway projects are said to be "intermittent power" (rather than "firm power") because the flow of the river may not always be constant. They are, however, largely reliable and can be very valuable because of the characteristics of the power they produce. And in some systems in Hawaii, the source of the water is so strong that the consistency of water flow is very strong.

The other form at hydro power is pumped storage hydro. In this form, water is pumped to a storage area higher up on the system, and then released into the waterway and to an electricity producing facility in that waterway whenever the power is wanted. The key is to use low cost energy to drive the water uphill and then release it to produce energy whenever you want. The low cost energy could either be solar or wind power that the utility system cannot or will not take on or off-peak power from a period like the middle of the night when the utility has much less need for it, assuming we have time of use or power.

In looking at hydro power in Hawaii, most systems today are fun-of-the-river. They exist on Kauai, Maui and the Big Island. Attempts to expand that number, especially on Kauai, have however run into substantial levels of opposition. Some of that opposition is likely based on the same concerns that drive opposition to water diversion generally; that it harms the natural process for stream life and that the "diversion" to the power producing facility and its re-entry into the system may occur in different enough points along the system to disrupt the ecology of the river.

Run-of-the-ditch systems may avoid at least some of the challenge of interfering with the movement of aquatic species. And some of the opposition to hydro power has been very clear in saying that it is not opposed to run-of-the-ditch systems at all. In fact, one of those considered to be most "anti-hydro power" is in fact pro hydro power in the ditch power and believes it is the way to preserve these water systems to support agricultural activities short and long term.

And pumped storage in a ditch system may be the best of all as it allows for the water to be "gathered" during periods of varying flow and then released in a constant flow when it is desired.

The biggest challenge to pumped storage systems in the creation of the water storage area, particularly at the upper end of the system. As one environmentalist put it, "finding new areas to 'flood' in order to create that reservoir or dam will be very difficult. It is not a storage that is the issue, it is the covering of land with water that is the issue." Where there are already reservoirs on the system that system could be looked at to see if a pumped hydro system makes sense. (The focus of the challenge to new systems at the upper end comes from the fact that those upland areas are likely to be in a more natural state with native flora and found while lower land areas are more likely already substantially disturbed.)

There is already discussion of hydro in some form in the Kekaha area on Kauai and at Lake Wilson on Oahu. And systems on each island should generally be looked at for the possibility of hydro power.

A couple of constraints need to be recognized. First, if there is no use for the power in the area where these systems are, there is less likely to be a case for them. Second, if there are no power lines near the area, adding to existing project costs the additional costs of a power line to connect up to the grid may make the overall project untenable. Those constraints will need to be examined on a case-by-case basis.

A third constraint and one that can be addressed, is the reception that hydro facilities receive in the regulatory environment.

In the conservation district, they will undoubtedly require Conservation District Use Applications. If attached to existing systems, especially ditch systems, these facilities should increase the likelihood of approval but there are a variety of permits that may be involved from the Army Corp of Engineers, the U.S. Fish and Wildlife Services, the Department of Health (DOH), the Water Commission, as well as a number of divisions in the DLNR.

In the agriculture districts, hydro power is unfortunately not among the types of renewable energy that is a "permitted use" which would allow projects to proceed without significant permitting. Attempts to change that and add hydro power to that list have not, to date, been approved but that effort should be pursued. Some of the concerns were expressed by the Department of Agriculture but they have made comments to previously proposed legislation and there is a form in which it can pass with their approval.

Fourth, there is an overall lack of strong leadership in the community promoting hydro power. Hydro power needs strong support to overcome the misconceptions that exist about it, the two most significant being:

1. That hydro power is always associated with large scale dams that have blocked the migration of species up formerly flowing rivers and streams. (The mainland U.S. model.)

2. That it "wastes" water by not returning to the river what it takes in order to create power or that the water returned in polluted by the power generation process.

Given Hawaii's size and topography, there will be no Grand Coulee or Hoover type dams. And in run-of-the-river or run-of-the-ditch systems virtually all the water is returned to the waterway undiminished and undamaged.

Fifth, and finally, there is on Kauai a history from hydro power activities in the 1980s that has left a bad taste for many on the island that persists. One recommendation was that hydro developers make clear that certain key streams are off limits and won't be touched, and that they look to where existing storage facilities are the best prospects.

Conclusion

Hydropower can be a major asset both as renewable energy and as the economic activity, which allows for the maintenance and upkeep of dams and reservoirs.

Key supportive activities:

1. Key policy support for hydro power as a permitted use on agricultural lands.
2. A clearly understood permitting path for run-of-the-ditch hydro or pumped storage hydro systems.
3. A champion for hydro power in Hawaii as a renewable energy provider and as source of support to maintain our water storage and delivery systems.

DLNR REGULATION

While a number of agencies have regulatory authority that impacts dams and reservoirs, there is no question that the primary agency involved is the Department of Land and Natural Resources and in particular its' Dam Safety Office.

The Dam Safety Office is the primary regulator of dams and reservoirs. In addition, there is a significant role that the Commission on Water Resource Management (CWRM) plays on all water related matters. And the permitting authority to work in the Conservation Districts (where many of the dam and reservoirs lie) is also in the department.

One feature of the Department to note is that the Engineering Division (of which the Dam Safety Office a part) and the Office of Conservation and Coastal Lands (which handles conservation district use permits) both report to the Chair of the Department and have no direct link to the CWRM. The department leadership likes this structure and it did not generate significant comments. On the other hand, both the Dam Safety Office and the support for the CWRM come from the same deputy director so some level of coordination can be maintained.

(There was some discussion but not much traction around the idea of moving the dam safety regulation to the Department of Agriculture on the basis that most dams and reservoirs support agriculture as their primary function. There was no sense of advantage to the move and a strong sense of working with what we have now first before thinking about changes.)

The Role of the State

When the Ka Loko Dam collapsed in 2006, the primary cause was felt by most to be the filing in of the dam's spillway by its' owner, presumably to create a far larger surface area for recreational use.

There were also however other failures and lapses that contributed to the collapse or that might have prevented it. In his report, the Special Deputy Attorney made the following findings:

> The State of Hawaii failed to conduct required safety inspections of the Ka Loko Dam.
>
> Ka Loko Dam was not a low hazard dam [though it had been classified as such by the Army Corps of

> Engineers in 1972 and that status had not been updated.]
>
> The State of Hawaii inadequately funded its dam inspection program.
>
> Other State inspectors noticed nothing amiss at Ka Loko Dam.
>
> The 1997 Notice of Violation at Ka Loko Reservoir was not enforced [by the County of Kauai.]
>
> Other County inspectors noticed nothing amiss at Ka Loko Dam.
>
> The Ka Loko Dam spillway should not have been altered [by Mr. Pflueger.]
>
> Pfleuger failed to maintain the dam.
>
> Kilauea Irrigation Company, Inc., failed to maintain the dam.
>
> Kilauea Irrigation Company, Inc., failed to control the waters from the Ka Loko Ditch.

It is very important to keep that list in mind as the first six items of the report essentially dealt with regulatory failures and lapses. In spite of the fact that item number seven is most likely the actual cause of the breach on that tragic day, no regulator could read that list and not feel tremendous pressure.

And it was against the backdrop of this report that the 2007 Legislature passed the Hawaii Dam and Reservoir Safety Act of 2007. In its Declaration of Purpose, Sec. 179D-2, the legislature said:

> The purpose of this Chapter is to provide for the inspection and regulation of construction, enlargement, repair, alteration, maintenance, operation and removal of all dams and reservoirs to protect the health, safety, and welfare of the citizens of the State by reducing the risk of failure of these dams and reservoirs…..(emphasis added)

The law is about protecting the public from the harm that a failed dam or reservoir can cause. As many have said, it is a "nuisance" law with dams and reservoirs being the nuisance. And that is understandable given the magnitude of the Ka Loko tragedy and the reality that the State is not entirely immune from liability for its actions or lack thereof with regard to these systems.

The Dam Safety Office has moved forcefully to execute this law as they are required to, and there has been more than a little unhappiness about the State's moving to force compliance with this much stronger law. The State is however in no position to do otherwise, especially given this history.

The Work of the Dam Safety Office

The employees of the Office were given high marks by nearly everyone. The general view is that if you are making good progress on compliance with the law, the Office will work with you. The term "benevolent forbearance" was used to describe a regulatory philosophy of working on the biggest issues first (spillways, the faces of the dams in terms of vegetation removal, emergency actions plans and especially notification phone trees in the event of an emergency) and other issues second.

There were also lots of compliments about the seminars that are sponsored by the Office. They are felt to be very useful and everyone would like them to continue.

Questions Raised on Next Steps

As noted, there is a very broad understanding that the Ka Loko tragedy led to a very strong legislative response followed by a very strong regulatory response. Put otherwise "we knew the pendulum would swing hard against the dams and it did."

There was also a strong sense that the all the dams have now been inspected, that the major problems have been addressed, that filling in a spillway was a very egregious and "rogue" action that no other dam owner would ever

contemplate, and that therefore perhaps the time had come for “the pendulum to swing back, at least a little.”

There is, however, still significant work that needs to be done on many of the dams and reservoirs according to the Dam Safety Office. The biggest issues are the size of the spillways and the issue of embankment stability. The Office will continue to work with owners on these issues and until they are resolved, the overall system cannot be viewed as “safe.” (It was noted that at least one other dam had a sillway filled in post-Ka Loko.)

And even when these issues are attended to, it cannot be said that there will never again be another Ka Loko. What the regulation does is to make any failure far less likely but it cannot guarantee no failure.

It is also the view of the Dam Safety Office that some dams and reservoirs are of more concern than others, with 20-30 being the most of concern. Those will get most focus in the coming period.

Overall the following were the comments, questions and concerns that were expressed about the current regulation and where it is going.

1. The Dam Safety Office used to be supported by general funds. Now it is being paid for by fees charged to the dam owners. Can we go back to general fund support so that the fees can instead be used to support the dams themselves?

   The reality is that user funds supporting regulatory activities has become a fixed part of the State Budget and is the case in a number of State departments. This practice is highly unlikely to change and the State has many other priorities that would come ahead of general funding for this regulatory system.

   The other part of the concern was that there is not a sense of what the fees collected are being used for, whether some of it is going into the State’s general fund, and whether the money is actually improving the situation for the dams and reservoirs.

   The Dam Safety Office may in fact be sharing this information but for whatever reasons it is not being felt by many of those who are paying the fees. The DLNR does submit an annual report to the Legislature and sharing that information in some form would be a good step forward.

2. Is the Dam Safety Office going to lower the threshold for regulation and try to capture even more dams and reservoirs in its regulations?

   There was nothing in any discussions with the State regulatory officials that indicated a desire to lower the current threshold for regulation or to

reach more dams and reservoirs than are currently covered.

3. Is it really necessary to have mainland consultants reviewing other mainland consultants reviewing Hawaii facilities?

   As part of the regulation, the dam owners submit reports prepared by engineers. And since there are not that many local engineers familiar with dams, the engineers are sometimes from the mainland. Apparently, the Dam Safety Office also uses consultants from the mainland to review the work submitted by the dam owners. And both reviews are paid for by the dam owners. The obvious question is whether there is any way to just use one consultant, either from the mainland or from Hawaii, rather than paying for two. From the Office's point of view, the cross-checking that occurs with two reviews is worth the cost.

4. Is the Dam Safety Office willing to relook at certain aspects of their regulation including the physical area covered by a catastrophic release of water, the weather event(s) which the dam must be able to withstand, and the creation of waivers for those dams which present little or no risk of collapse (such a holes in the ground)?

   These and other question are worth the Dam Safety Office and the dam owners discussing with each other. The challenge is that most dam owners do not want to get into disputes with their regulators. It would be worth the Dam Safety Office trying to find a way to let dam owners provide them with comments and suggestions in a way that ensures that there will be no consequences for raising these issues.

5. "We just lost Steve Bolles; we need to capture the wisdom of those who have decades of water knowledge."

   This past summer, Steve Bolles passed away with decades of water knowledge in his head. Perhaps the last comment and this comment could be looked at as an opportunity.

   While they might not appreciate the reference, there are a group of "distinguished watermen" who could be asked to sit down with the DLNR staff in the dams area, the CWRM area, the Conservation and Coastal Lands area, and any other staff interested and discuss the old water systems and what it would take to preserve those we choose to preserve. Names like John Cross, Bert Hatton, Harold Edwards, and Tom Nance are among those who could be invited to share their wisdom.

6. There should be a real "variance" process for dams and reservoirs that pose little or no risk.

There are, many believe, dams and reservoirs that merit some variance from standard regulation. They should be regulated, and they should be reviewed on a regular basis, but under current circumstances they could receive variance from some aspects of the current regulations. This includ that those structures that have no wall and are essentially holes in the ground and those which will not cause any significant harm below them even if they were to breach. The Peahi Reservoir on Maui arguably falls into the latter category.

One commentator noted that the federal government is more of a risk - based analysis of dams while Hawaii (and others) rely on more absolute standards.

The Need to Express Public Policy Favoring Stored Water

As was discussed above, the current regulation of dams and reservoirs is based on a "public nuisance" view of these facilities following the Ka Loko Dam collapse. The public does need to be protected from poorly constructed or managed facilities and the Dam Safety Office's work is important.

At the same time, many of these water storage facilities are felt to be very important to Hawaii. In discussions with DLNR and with the Dam Safety Office the importance of these facilities is also understood.

Without removing the safety-related statutory language, it was suggested that express language be added to the enabling statute for DLNR to call for both the regulation of dams and reservoirs, and the maintenance and preservation of water storage and delivery systems where appropriate.

The Role of the Conservation District Use Application (CDUA) in the Repair and Maintenance of Dams and Reservoirs

There was concern expressed by some that the complexities of applying for and receiving a CDUA permit were a barrier to doing routine repair and maintenance work on the dams and reservoirs, many of which are located in the Conservation Districts.

As a threshold matter, almost every dam and reservoir was built before 1964 when the CDUA provisions came into force. As such they are classic "non-conforming uses" if they have been in continuous use since then. As noted by the DLNR, the rules on non-conforming use are in the Department's view, "pretty generous," and such facilities are allowed to continue to exist, to be operated and to be maintained. And if you keep to the existing waterway, you are highly unlikely to have major permitting challenges.

The regulation is actually tiered based on the value of the work compared to the value of the facility. If below 10%, repairs and maintenance does not require any permit. Between 10% and 50%, it will likely require a minor permit. Above 50%, a full permit will be required.

It is strongly encouraged however that anyone wanting to work in the Conservation District consult with Sam Lemmo and the Office of Conservation and Coastal Lands. Using the general guidelines above the Office will try to allow these water systems to be maintained without too much regulation.

In some cases, the Office will consult with other DLNR staff, especially if there could be cultural or species issues involved.

Comparison to Other States Laws and Regulations

In 2007, as part of the Special Deputy Attorney General's Report, there was a review of the laws and regulations of other states in the area of dams and reservoirs. As part of this report, that review has been made current and is attached as an appendix.

Based on that review, and on consultation with the National Association of Dam Safety Officials, Hawaii's laws are now very much in the norm of such laws around the country. Prior to 2007, Hawaii was considered a weak regulatory state but it is now seen as being in good shape.

As noted in the reports attached, there has been little change in laws and regulations around the country since 2007 and there is nothing in those changes that Hawaii particularly needs to copy.

CONCLUSIONS

The DLNR, based on the 2007 Dam and Reservoir Safety law has moved to strongly regulate Hawaii's dams and reservoirs to ensure that there is no repeat of the Ka Loko Dam collapse. The staff of the Dam Safety Office is well-regarded and has worked with the dam owners to ensure that all currently operating dams and reservoirs are safe to the public.

Specific suggestions for changes to the current structure and implementation include:

1. The Dam Safety Office and the DLNR leadership in conjunction with current dam and reservoir owners, should review the current regulations and implementation in the use of multiple engineering reviews, the size of the area possible impacted by the release, the weather events which structures must withstand, and variances for low/no risk dams.

2. The Dam Safety Office should consider sharing with the dam owners' information on how the fees collected from them are spent, if possible on a yearly basis. Using the yearly report to the Legislature would be a good start.

   The annual report contains any regulatory approvals granted, the list of inspections, how the funds collected were used, any changes to the rules, any enforcement actions, any dam failure and the evaluation of that failure, and any other date on effectiveness.

3. The DLNR should consider hosting a session or sessions with the folks who ran the water systems over the last decades to allow them to share their thoughts and experiences with the department staff.

4. There should be an amendment to the DLNR's enabling law encouraging the preservation and protection of appropriate water storage systems so long as they can be maintained in a safe manner.

THE PUBLIC UTILITIES COMMISSION AND AGRICULTURAL WATER

With a primary use for the dams and reservoirs (and related water systems being agriculture, the layers of government regulation generated a great deal of comment. Agriculture is an activity with significant challenges in the best of cases and if there is any opportunity to reduce the amount or level regulation, it would be very welcome.

One area that received a number of comments was the regulation of agricultural water by the Public Utilities Commission (PUC). Because of the potential complexity and costliness of proceedings before the PUC, there is great concern and "fear" of doing anything that would trigger PUC jurisdiction. The result are actions by those who are in charge of agricultural water systems that largely protects them from regulation and also can lead to very wasteful and inefficient uses of water.

What makes this situation frustrating to virtually everyone involved is that is very little need for this regulation and in fact, most of this activity is probably not even covered by the regulation at all. Few are willing to take the chance, however, that they might be covered so in the absence of clear exclusion from regulation, they will continue to protect themselves from its application.

So what is the issue?

The basic statutory provision states that a business or enterprise is a "public utility" subject to regulation if it provides "… for the … conveyance, transmission, delivery, or furnishing of … water …." §269-1.

As the PUC has considered this question, it has cited the words of the Supreme Court in a case entitled In re Wind Power Pacific Investors-III which state:

> Whether the operation of a given business or enterprise is a public utility depends on whether or not the service rendered by it is of public character and of public consequence and concern …. The test is, therefore, whether or not such person holds himself out, expressly or implied as engaged in the business of supplying his product to the public, as a class, or to any limited portion of it, as contradistinguished from holding himself out as serving or ready to serve only particular individuals.

In the case of these agricultural systems, they would likely fall within the latter serving only the particular individuals within their individual systems. The PUC has, in fact, been reading it that way.

The PUC does not appear to want to deal with cases that do not involve "public" sales or to deal with agriculture in general. The challenge for those with agricultural water is that there is no definitive exemption for them and there is the risk a future PUC could change its mind.

Why is this so important?

In the absence of assurance, and with the risk of regulation hanging over them, those with agricultural water don't charge for it. They essentially include it is the lease rent or general service charges to tenants and users of the systems. One of the consequences of this structure is that they cannot incent or encourage efficiency, the use of water on a staggered basis over the day, watering at night, etc. Given the need to preserve our water resources, this result makes no sense.

The answer is to exempt to supplying of agricultural water to farmers from regulation by the PUC. "This section shall not apply agricultural water provided to farmers by those who own or operate the systems that deliver that water." Or something like that.

The key will be to define "farmer" or "agricultural enterprise" or whatever other term is used to define those who receive such water. This definition needs to exclude those who are not engaged in agriculture as their primary occupation, such as the so-called "gentlemen farmers." Suggestions for coming up with that definition include those who file a Schedule F (for farmers) on their Federal Tax Return, a percentage of income test, and a percentage of property used for agricultural purposes test.

It is believed that a carefully crafted exemption for agricultural water would be supported, or at least not objected to, by the PUC and other State agencies.

Conclusions

Agricultural water should be subject to incentives and structures that would encourage efficiencies and minimize wasting of water.

A major barrier to that activity is the risk that it would subject the provider of agricultural water to regulation by the PUC.

Key supportive activity:

1. Draft legislation to exempt the provision of agricultural water from the jurisdiction of the Public Utilities Commission.

2. Develop a clear definition of “agriculture” or “agricultural purposes” that will separate those who truly are farmers from those using the pretense of farming to build homes in these areas.

REGULATORY ISSUES

The Department of Land and Natural Resources was the regulatory agency subject to the most discussion. It's Dam Safety Office, Commission on Water Resource Management and the Office granting the Conservation District Use Application have significant impact on dam and reservoir issues.

There are, however, other agencies whose activities are important as well; the two most important being the U.S. Army Corps of Engineers and the State Department of Health.

The U.S. Army Corps of Engineers is in charge of Sec. 404 permits which are required to do work in all "navigable waters."

Overall the Corps expresses strong support for storage, believes much more should be done to keep water on the surface in ways that would encourage its recharge, and is working with others to rehabilitate some existing facilities.

One aspect of this issue comes down a question of whether a particular agency sees excess water as a problem or a resource. The Corps clearly sees an asset and is concerned that at least some local government agencies see it as a problem.

The Corps is willing to help fund projects in this area. The federal matching share in project construction is 65%, which is a 2 to 1 match. Funding is declining so those interested should apply sooner rather than later.

The Corps believes that the major agencies need to get together and coordinate their activities, a view shared strongly by DLNR.

The major concern with the Corps was that funding cutbacks ha left it very short of staff to process permits and the response is a problem. The Corps acknowledged the challenge.

The other major agency discussed was the State Department of Health, which issues Section 401 permits to those who propose any discharge into State waters.

The general view is that the DOH process is very slow, that it takes years to get a permit, and that it is not supportive of the water storage systems in Hawaii.

One bright spot that was the possibility of looking at the recently created Fishpond Process as an example for work on the dams and reservoirs. It is a multi-agency initiative, a programmatic Environmental Assessment was done for

the State, and the Land Board approved a Statewide Conservation District Use Application allowed for the repair, restoration, and operation of the fishponds.

The final regulatory issue raised here as well as elsewhere is the desire to find a definition of “agriculture” which separates the growing of crops from the so-called “gentlemen farmers.” Suggestions included the volume of crops grown, the dollar value of the farming, and the intensity of the land use.

Conclusions

1. The new Governor should bring together the heads of DLNR and DOH, as well as the Army Corps, and any other agency to which this is applicable. Like the Fishpond process, this one should focus on processes which will assist dams and reservoirs to continue to operate subject to meeting overall water policy needs.

KEY STORAGE SYSTEMS

There are, as noted at the outset, over three hundred known dams and reservoirs in Hawaii; of which about one hundred thirty are regulated by the State. They range substantially in terms of size, location, condition and purposes among other factors.

One consistent theme in the interviews was that they are also not of equal value to Hawaii. The strong recommendation was to focus on certain dams and reservoirs with special attention. That does not mean to the exclusion of others, or to suggest other dams should not be supported, but rather that there are dams that offer very significant benefits that others do not. Or they are at serious and special risk if not assisted soon.

There are seven that received the most comment:

1. Lake Wilson/Wahiawa Reservoir
2. Nuuanu #4
3. Kekaha/Mana System
4. The Maui Land and Pine/West Maui System
5. The Kaneohe Dam at Ho'omaluhia Park
6. Waita Reservoir
7. The DHHL Kauai Dams

1. Lake Wilson/Wahiawa Reservoir

This structure was mentioned more often than any other as in need of a comprehensive plan to preserve and promote it. It is considered a major resource to agriculture in Central Oahu. And the development of that area for agriculture is considered critical to plans for increasing the amount of produce and fruit grown locally.

The biggest single issue with the Lake is what happens when the City and County's sewage treatment plant, on occasion, spills sewage into the Lake. As a result, its waters cannot be used on much of the agricultural crops in the area. There is said to be 10 million gallons a day not being used on ag lands either because of the water quality issues and lack of farmers.

There have been solutions proposed to the sewage issues and the most likely solution involves having any spills go into storage ponds or storage tanks rather than into Lake Wilson. Key players in this discussion, including Senator Donovan Dela Cruz and DLNR believe that the City and County will move to resolve this issue in the very near future.

A second issue is to get agreement on the primary use or uses for Lake Wilson and the deal with the consequences from a structural standpoint. The question really comes down to whether the Lake is used for recreational purposes. If it is, then the desire is to have the water level higher which may necessitate significant additional expense.

A third issue involves the condition of the reservoir itself. There were a range of views on what condition it was in and how much repairs and upgrades to it would cost. Those numbers range from $5 to $50 million dollars. There needs to be some process for determining what the right number is and then to determine how those repairs will be supported. There is not sufficient income from the current uses of the dam to make major repairs. It may need direct State support given both the State's desire for recreational use at the Lake and the desire to see much more water available to support agriculture in the areas north of Lake Wilson. This is especially important as it takes years to fully develop the agricultural enterprises and the work on the dam needs to begin now.

One significant potential income source for Wilson is hydro power. This could be developed at the dam site itself, or in the ditch system coming out of there on which there are the remains of an old hydro plant. There is certainly both the volume of water and the incline necessary to make such a system work. The power from it could help support agricultural operations by reducing the electricity costs paid to the utility or the power could be sold to the utility providing income to support maintenance of the dam and lake.

At this point, it would appear to be best for some agency or entity to gather the critical parties together to develop a coordinated game plan for lake Wilson. Participants need to be the Department of Land and Natural Resources; the Department of Agriculture; the Agricultural Development Corporation; the Office of Hawaiian Affairs; the City and County of Honolulu; the U.S. Army; Dole; Howard Green, Esq.; and Senator Donovan Dela Cruz. Other possible participants are Kamehameha Schools and the Trust for Public Lands.

That meeting should probably be called by the new Governor as soon as possible so that steps that need to be taken at the 2015 Legislative Session could be discussed.

2. Nuuanu #4

This is the large reservoir that can be found at the top of Nuuanu Pali Drive. Most recently, the public knows it as the site of fishing activities

though its primary function currently flood control.

The Board of Water Supply has responsibility for the facility and is making improvements to the dam and related structures. Given its size and location, it could be a major source for storm water capture. And the BWS has been looking at the potential to use the water to recharge the aquifer.

The recharge proposal apparently faces some opposition from the Department of Health and that dispute, if there is one, should be resolved. The issue apparently concerns the quality of the water that would be put back into the ground and the use of injection wells. Whatever the challenge is, the recharge activity is important and a solution needs to be found so it can proceed.

There is also a strong possibility of pumped storage hydro in the Nuuanu system of reservoirs and piping. This resource could reduce the BWS bills, provide support for the reservoir, and provide the utility with firm power added to its system on a distributed basis.

3. Kekaha/Mana System

This system, which includes both the Waimea River and the Koke'e Ditch along with a number of reservoirs supports agriculture in the Kekaha and Mana areas.

The Mana Plain and the Kekaha area have as much as 15,000 of agricultural land available as well as plenty of water. If fully developed, the agricultural resources are quite significant.

The water system is essentially a complete ahupua'a system as modified by the plantation system. Substantial amounts have already been invested in the repair and maintenance of the system. There is ongoing work with much more planned. Continued support for the development of this area, which is largely out of the urban and tourism areas and therefore can remain in agriculture, is critical.

This system also provides water to the Department of Hawaiian Home Lands area which it hopes to develop, presumably for agriculture.

There is, however, litigation in this region that must be resolved. Earthjustice has filed suit against this system for its diversions and to restore water into this natural streambeds. The sooner the parties are able to sit down and try to find a resolution that could accommodate both interests, the better.

4. The Maui Land and Pine/West Maui System

The West Maui systems on the far eastern end of the island were mentioned by a number of people as deserving of special attention. Some of the dams and reservoirs are being maintained and are in active use today. Others are not.

The concern is that this is an area which could support significantly more agriculture than currently in use and in order to make that possible, the existing systems need to be maintained.

Of greatest concern are the Maui Land and Pine reservoirs.

The challenge is the current fiscal condition of Maui Land and Pine which does not allow for these facilities to be maintained as well as is optimal. There is general consensus that these facilities remain in good condition but that attention must be paid to them soon or that condition will deteriorate

If Maui Land and Pine cannot take financially support its system, can someone else step in and do so? And who might be in a position to do so? The Maui County Department of Water Supply is one possibility, the Agricultural Development Corporation is another.

And what might be possible outcomes? Acquisition or a long-term lease are possibilities. Perhaps there is some other way to work with Maui Land and Pine. The other systems in the area would also be likely participants in the process with the possibility of cooperative action that could address other issues in the area.

In this case, given the issues involved, it might be best for the Mayor of Maui to use his offices to bring the parties together to look at the West Maui systems with a particular emphasis on the Maui Land and Pine system to see if there is a good resolution that can be pursued. If not, the Governor may need to step in as well.

5. The Kaneohe Dam at Ho'omaluhia Park

The Kaneohe Dam is one of the more recent in the State as it was completed in 1980 as a flood control measure. It's maximum storage capacity at 1.5B gallons is actually larger that Nuuanu's at 1.1 although much smaller than Lake Wilson's 3.0B gallons.

The Dam and the accompanying park was built as a flood control measure after a series of devastating floods hit neighborhoods in the Kaneohe area.

Other than recreational use, the water in the reservoir is not used for other purposes. That should be reexamined by the City and County, the Board of Water Supply and the applicable State Departments as a possible source to water the nearby golf courses and cemeteries rather than those facilitators drawing potable water to water their facilities as appears to be the case currently.

6. Waita Reservoir

The Waita Reservoir on Kauai is the State's largest with a storage capacity of 3.2B gallons of water. It is used for agricultural purposes, primarily in the Koloa, Poipu and Mahaulepu areas with four irrigation systems coming out of it.

It has been maintained and upgraded and will continue to be monitored and improved by its owner Grove Farm.

It is also used for recreation purposes including fishing and paddling.

There is, however, some level of controversy with Waita and the diversions which feed it. There is no litigation as yet and it is to be hoped that those who have issue with the Waita and related systems, and Grove Farm, would attempt to work out their differences without litigation.

7. The DHHL Kauai Dams

The DHHL systems at Anahola have not been maintained over the years. They are not currently in use and have not been for many years. In the wake of the Ka Loko dam collapse, the DHHL looked to breaching all four as a matter of liability.

More recently, however, the DHHL is looking to rehabilitate two of the four to support agricultural activities on its Anahola lands. (The other two would be decommissioned because there is no longer any water source that feeds them.)

The system for the lower two is entwined with the neighboring Kealia system. While there has not been a good working relationship to date, it makes more sense for DHHL and the owners of the Kealia system (which is well-maintained) to work together to allow both systems to prosper.

In the case of the Mana system, the Puu Opae reservoir is maintained in conjunction with the Waimea/Kokee system discussed previously. It's future is very much intertwined with the decisions made around that

system.

There are substantial lands that DHHL has in this area which they would like to see in agricultural use. Having water is critical to that goal and so this reservoir and the systems that feed it, are important.

Conclusions

There are key dams and reservoirs, with their attached water systems, that deserve special attention and consideration. This is not to the exclusion of all other dams and reservoirs but simply a matter of some needing special and immediate help.

In most cases what is initially required is the exercise of leadership in convening the key parties together to determine what are the best, most effective ways to support these systems in conjunction with other needs and requirements.

1. In the case of Lake Wilson, the convening is best done by the Governor as quickly as possible include the structural soundness of the dam and improvements needed to make it fully usable and useful. Other key players include the State Departments of Agriculture, Land and Natural Resources, and Health; the City ad County of Honolulu; the Office of Hawaiian Affairs; the Agricultural Development Corporation; Kamehameha Schools; the Dole Company; Howard Green, Esq.; and Senator Donovan Dela Cruz.

   The agenda should include an assessment of the condition of the dam, any update on where the situation is with the sewage treatment plant, the key use(s) for the water, and what changes in operations of the dam would make it a greater asset to the landowners north of the lake/dam.

   The initial meeting should take place as soon as possible, especially if there are things that the 2015 Legislature can do to be supportive.

2. In the case of the Nuuanu Reservoir, the recharge issue with the Department of Health needs to be resolved, perhaps with the assistance of the Department of Land and Natural Resources. The Governor and Mayor of the City and County of Honolulu need to ensure that the necessary meeting and work that results are accomplished.

3. On the Kekaha/Mana system, it is imperative that the parties in the current litigation get together as soon as possible and look to a resolution of the issues involved that allows both sides to have their interests honored.

4. On the Maui Land and Pine/West Maui Systems, the logical convening party is the Mayor of Maui County. The various landowners, and dam and reservoir owners, in the West Maui area should be invited to discuss the future of that system. The watersheds that would appear to be involved include the Kahana, Honokawai, Wahikuli, and Kahoma Watersheds.

   Of particular concern would be the future of the Maui Land and Pine reservoirs but aiding the entire set of reservoirs and related water systems should be examined. The goal would be to keep the systems available to support agricultural development in the region.

5. In the case of the Kaneohe Dam, the Mayor of the City and County should coordinate a review of the possibility of Kaneohe Dam waters being used on area golf courses, especially the nearby City course.

   The possibility of using this water or the nearby cemeteries should be explored as well.

6. In the case of Waita, it is perhaps not yet at the point of resolution, but the parties involved should look to resolving their issues in as constructive a manner as possible.

7. In the case of the Anahola systems, it is hoped that DHHL and the neighboring landowner in Kealia can work together to restore the lower two reservoirs in Anahola to support agricultural activities on DHHL land.

THE NATIVE HAWAIIAN VIEW OF STORED WATER

The Kumulipo, the Native Hawaiian chant that traces the creation of the world and the life within it, speaks to the systems of water in Hawaii. There are two systems that interact with each other in support of the land and her people. Tracing from the Hawaiian gods; the Kanaloa system is the aquifer -- the principal method of water storage; and the Kane system which encompasses all the surface waters -- those that flow or are "pushed"; rainfall; springs; and the irrigation systems.

Hawaiians were very aware that "water never disappears; it is always in its ascending and descending aspects." It comes down from the forests, through many streams, down to the fishponds and on to the sea, and then back up into the sky to fall again as rain. It was a dynamic system to be worked with and respected on its own terms.

As the Hawaiian population grew in size, water also became an issue of power and control.

The Hawaiian storage system was the aquifer. They understood what it was and the importance of supporting it. As a result, activities to recharge it were part of their water systems. From berms on the land, to low walls and pools lined with pebbles in streams, to the lo'i themselves; there were deliberate actions to "slow down" the movement of water in order to allow it to seep back into the earth and recharge the aquifer.

Hawaiians did have limited amounts of what can be viewed as above ground storage. At the top of some of the auwai systems were small pools of water which were perhaps sediment traps so that any debris brought down by stream water could be caught there and not go down into the auwai system. There was standing water in the thousands of lo'i, some of which went down into the earth as recharge. (The lo'i also trapped top soil and nutrients and the water that went back into the stream was cleaner.) There was water captured in the fish ponds at the point where the land met the sea. But beyond these, there was no storage of water.

Why no significant levels of storage? The consensus view is not that storage was bad or in any way unimportant; it simply wasn't necessary. The Hawaiians grew wetland crops where there was water and dryland crops where there was some water and no crops where there was no access to water. They had phenomenal systems to move what water there was around the area involved but they did not create large above ground storage systems as part of those system.

This is not an insignificant point. In the litigation over water uses, the water storage and distribution systems have almost always been part of the

dispute. And in at least one case, the operations of a plantation era water storage system was a key issue. The key, however, is not the storage itself, it is the diversion and its resulting impact on stream life. One of the lead Hawaiian plaintiffs had himself proposed storage, so long as the stream system is restored to health first.

Two other major thoughts that need to be added to this discussion. The first is the native of these systems. Some have viewed the Hawaiian use of water as a fairly non-intensive system of diverting some stream water into a channel which goes into the lo'i systems, and afterwards returns to the stream on its way down to the ocean.

There was nothing casual or accidental about the way water was handled by Hawaiians. Quite the contrary, driven by periods of extreme drought and even more by an increasing population and the need for food, Hawaiians diverted more water, more skillfully, than the plantations ever did. And, almost all of it was done within a specific ahupua'a. Ultimately water was controlled at the highest levels of the political system, and found its pinnacle with the Konohiki system in which an official would allocate specific quantities of water, at specific times of day, for specific lengths of time.

The need was clearly great. Population estimates range as high as one million with most agreeing that there were at least half a million people living in the islands when Captain Cook first landed here. The size of that population can be significantly inferred from the levels of cultivation in a society with no imports or exports. Water was increasingly moved beyond the obvious low land areas as more arable land was needed. As one expert put it, "why else would you find a lo'i the size of a postage stamp eight miles up in a valley?" People needed to be fed.

The biggest systems were on the wettest islands, Oahu and especially Kauai, though all islands ultimately had extensive systems. And the level of water knowledge is quite extraordinary. One story comes from Molokai and begins with a group in current times rebuilding a set of lo'i that had existed in ancient times but had not been cultivated for a long time. As they were doing the work, they observed a series of stones and stone formations on the mauka side of the lo'i area. The arrangement seemed quite haphazard but not knowing why the stones were there, the group decided not to touch them.

As they were completing their work, the island was hit by a sudden and severe storm. It was too late for them to make it back down from the area they were working, and they were also very concerned that the heavy rains would wipe out all of their work on the lo'i so they took what cover they could and watched the fields. As the volume of water coming down the mountain got heavier and heavier, they were stunned by what they saw. That seemingly

haphazard series of stores diverted literally all of the water off to the sides and around the lo'i entirely.

A story like that leaves one in awe of the understanding that Hawaiians had of water and the complexity of the systems they used to manage water.

One other interesting note about these systems. Warfare, and the conquering of areas by one chief or another, and ultimately by Kings, was a feature of Hawaiian life. There is very little evidence, however, of conquerors doing any damage to the water systems. They might destroy a heiau or other structures associated with their enemies but they did not harm the water systems. Certainly a very common feature of warfare in most other places in the world is the destruction of the infrastructure of those conquered. But not water systems in Hawaii, a further measure of the way they were viewed.

The other major issue that arose consistently in these conversations was the importance of looking at all water infrastructure from a "systems" point of view.

"Systems thinking" is critical to understanding how Hawaiians viewed water and its uses.

First and foremost were the needs of the people and the systems that took care of them. There had to be enough water in the streams to sustain life in those streams, especially the opae and the o'opu. Then water could be diverted into the irrigation systems that fed the lo'i and other agricultural systems. There was not a "conservation" ethic so much as "use for the benefit of all" ethic. Especially as the uses were not "wasting" uses and the water in the end went back into the stream, the fishponds, and the ocean, or the aquifer.

Again, the key issue that was articulated by all the Hawaiians interviewed was "what is the purpose for which the water is being used?" If the purpose was feeding people, there was much more allowance for the use of the water.

Second, as to understand that there were multiple systems that made up the overall environment. The challenge for many Hawaiians with the plantation systems was that they began with the 100% diversion of the regular flow of streams. That disruption impacted life in the stream, it impacted the agricultural systems that rely on regular stream flow, and it disrupted the shore and near shore environment. System thinking would approach it by looking to see what can be done to allow each part of the system, to exist. It would begin with life in the stream and move on to examine what makes sense for all concerned.

Finally, the emphasis on feeding our people comes through over and over as a very critical purpose for any system. Even outcomes that bear significant levels of discomfort are considered if the end result provides food. For example,

in a case involving substantial water diversions, the attorney for the Hawaiians offered to allow for substantial continuing diversions so long as the land to which the water was provided was dedicated to agricultural use. (A condition which was not accepted in that case.)

One of the challenges, and opportunities, of system thinking is to how to engineer systems to accommodate many outcomes. As noted, the plantation systems often involved total diversions of the regular stream flow with storm flow being allowed in many cases to go down the stream. It was suggested that that system be reengineered to have some of the regular flow go down the stream, divert some of the regular flow, allow some of the storm flow to go into the stream and then divert much of what is above that to go to storage or even to other places for agriculture. Such an outcome is not, however, possible unless we back away from the win/lose outcomes of litigation and contested process and move towards more long-lasting results through conversations with the parties involved.

As the questions of water storage, and water systems generally, will be often be debated and decided in the context of litigation by Hawaiians to preserve their cultural and personal rights, it is worthwhile reflecting on the way in which Hawaiians carefully stewarded water while at the same time making incredible use of that water particularly to feed the people.

It is also worthwhile remembering that the Hawaiians were, and are, very practical people. As one Kupuna said,

"Nothing is ever <u>all</u> wrong."

The key is to know basic values behind and the underlying purpose of the actions taken. And in this context the underlying purpose of agriculture ("feeding ourselves") stands out as key for Hawaiians as well.

Conclusions

Hawaiians understood very deeply the importance of water and created intricate and extraordinary systems that both preserved life in the rivers and streams of Hawaii and also allowed for very large scale cultivation of food to feed a large population.

1. The aquifer was viewed as the primary storage system.

2. Significant efforts were made to “slow down” the movement of water to allow it to recharge the aquifer.

3. There was little other storage other than standing water in the lo’i and fishponds at the shoreline.

4. There is no philosophical or cultural objection to storage itself; where there has been objection, it is to diversions associated with some storage.

5. Systems thinking from a Hawaiian point of view requires that we begin with that which is essential and then layer on other uses as well. The life of the stream and the life of the lo’i came ahead of all other uses. Agricultural uses can be accommodated next, even in some cases outside of the immediate area.

6. Significant diversion is at least possible for Hawaiians to consider when the water is being used to feed our people. The greatest accommodations will be made when the land to which there was is sent is placed in a legal status that will ensure ongoing agricultural use. (Perpetual Easements, Important Ag Lands Status, etc.)

HOW DO WE BEST SUPPORT DAMS AND RESERVOIRS?

Along with all the other suggestions that came out of the interviews and are detailed above, the following are the major responses to the question, "How best can we support Hawaii's dams and reservoirs?"

1. SPERBS

   There was a lot of hope that the constitutional measure would pass in the November election and it did. The hope now is that dam and reservoir owners can utilize this lower cost financing to assist with the repair of their facilities.

   Special Purpose Revenue Bonds or SPERBS allow private parties to use the full faith and credit of the State to borrow money at reduced rates so long as there is a clear repayment mechanism and the purpose for which the funds are used has been authorized as a matter of public policy. The Constitutional amendment is that declaration of public policy.

   There was a clear sense that SPERBS will only help some dam owners because of the need to show a revenue source to repay the bonds that are sold. Nonetheless everyone supported the amendment and the assistance it will bring to at least some of the dams and reservoirs.

2. High Level Policy Support

   As has been discussed earlier, there is a very strong sense that from a policy standpoint, the State's view of dams and reservoirs is that they are a public safety hazard -- a nuisance.

   The SPERB legislation is a statement of strong support for dams and reservoirs but is simply on enabling law for a constitutional amendment.

   The strong desire is for specific language to be added to Hawaii law, most likely in the governing statute for the Department of Land and Natural Resources that declares Hawaii's dam and reservoirs to be an important resource to Hawaii.

   Such a declaration would, it is believed, help to place some balance on what appears to be a one-sided, negative view of dams and reservoirs in the current dam safety law which was passed in the wake of the Ka Loko Dam collapse.

3. State Water Plan Documents

The State Water Plan is essentially a number of plans including the Water Resource Protection Plan, the Water Quality Plan, Water Use and Development Plans (for each county), the Agricultural Water Use and Development Plan, and the State Water Projects Plan.

There is a desire to see water storage systems be discussed in each of the plans so that their place as part of the overall water systems of the State is recognized.

These plans are ultimately combined at the Commission on Water Resource Management in DLNR and any request/requirement that storage be included in the plans can come from the CWRM.

4. State Involvement in Dams

The State of Hawaii, through its various departments already owns a number of dams and reservoirs. There was, however, a strong sense that the State needs to do more to directly be involved in water systems. Among the possible roles suggested:

a. State ownership of dams. Among those suggested are the Maui Land and Pine dams and reservoirs, the Ka Loko and related dams in North Kauai, and even Lake Wilson.

b. State funding for critical dams. As was discussed above, some dams are seen as especially critical and there was a desire to see the State step in and provide direct funding to upgrade these dams. Lake Wilson was one that was mentioned.

c. State assistance on critical support activities. Beyond the discussion of ownership or focus on a major dams, there was discussion of the State taking on activities which would support dams and reservoirs. One clear challenge to many dams is the amount of silt that has accumulated in them. In some cases, it has substantially reduced the actual capacity of the dam. Would the State engage in a program with State funding to de-silt the reservoirs in the State? Another issue that was raised was having the State take on an albezia containment or even eradication program. These trees represent a specific danger to dams and reservoirs and need to be cleared from all dam and reservoir faces, and they should also need to be pushed back as far as possible from dams and reservoirs. And since many of these are also in watershed areas, this would have the additional benefit of removing one of the greatest threats to the watersheds themselves. And

albezias also damage water quality in other ways. The final area that was suggested for State support was assistance with spillway redesign and increases. The spillway is the key safety feature in virtually all dams and reservoirs and many would be safer with larger spillways. Quite often, however, there is no income or not enough income to support spillway changes. Therefore, the idea of the State undertaking spillway changes for at least some set of dams and reservoirs was raised.

d. Increased support for the State-owned systems. The State owns a number of systems which must constantly compete for limited State monies for both capital projects and operations and maintenance. The State should significantly increase the support levels for these systems in order to provide the maximum level of support possible for agriculture in particular.

5. Solve the R-1 Water Issue

Much, if not most, of the dam and reservoir water is classified R-1. R-1 water is routinely used on the mainland to water agricultural crops. Most produce brought to Hawaii by the "big box" outlets was grown with R-1 water in California.

Locally, however, there is major hesitancy to discuss the R-1 issue, much less to support the use of R-1 water to water agricultural crops. Allowing R-1 water of agricultural crops will substantially increase the amount of water available for agriculture, it will also provide support for the existence of the storage systems.

6. Create an Insurance Program for Dams and Reservoirs

Some of the dam and reservoirs are covered by insurance, usually in large corporations where coverage is provided as part of an overall corporate insurance policy. Most, however, do not have insurance and their strong sense is that if an individual dam sought insurance coverage they would not be successful.

There may be a way to create an insurance program. At a threshold level, the insurance program would require assurance of basic dam and reservoir soundness, which would begin with it meeting State approval to impound water.

The next part would be some level of self-insurance or from another vantage point, a significant deductible. The question would be, how much could a dam owner pay if the dam collapsed for some reason? The higher that amount can be, the less expensive the insurance cost

will be. The losses in this instance could be covered by an excess insurance policy, which would be akin to an umbrella policy.

The next level could be a captive insurance company which would hopefully draw most owners to participate. It may be important in that regard to have the large corporations bring their dams into this program in order to help make the group more viable. Like the self-insurance model, the catastrophic losses would be covered externally. At this level, it would be reinsurance that would be purchased by the captive insurance company.

The final level, and one that is community based, would be obtaining coverage from the Hawaii Property Insurance Association (HPIA) which currently provides insurance for the uninsurable risk of homes in the major lava flow prone areas. HPIA's coverage is being brought into play right now because of the losses from the current lava flows into Pahoa. The HPIA Dam and Reservoirs Program would encompass the various aspects of the above.

Insurance policies would be issued with a deductible to ensure active participation of the risk by the dam and reservoir owners. These risks would be aggregated similar to the captive insurance company. The HPIA can then purchase reinsurance for the catastrophic losses. Hence, it would have elements of the self-insurance and captive insurance models within an association designed for residual market or hard to place risks, framed by State regulations regarding the soundness of the dams and reservoirs.

7. Immunity for Dam Owners for Injuries Suffered by Those Who Trespass on Posted Dams and Reservoirs Sites

In other words, trespassers on dams and reservoirs with posted warning signs would not be able to sue dam owners for injuries suffered by those trespassers on the dam facilities.

One regulator told a dam owner that "he had the greatest water park in Hawaii and the admission is free." Particularly as it applies to spillways, this is a major concern. Providing owners with immunity from suits by those who trespass would remove a major concern for dam owners and encourage others to stay away.

8. Buying Reservoir Water

One very non-traditional solution was suggested to resolve the issue of reservoirs having no source of income to support their maintenance. The possibility that was raised was having the State or a county buying the water in a reservoir for use in its systems. The income would then support the upkeep of the system until a more normal revenue source like agriculture was available.

The idea was analogized to net energy metered photovoltaic purchases by the utilities which have the utility paying much more than the power is worth in order to subsidize the spread of renewable energy. In theory, the cost of that subsidy is then broadly spread across all ratepayers and the gains provided by the subsidized facilities are seen as part of the larger goal of supporting such facilities existence and expansion.

While unlikely to receive widespread support, it is a creative idea.

Conclusion

The issue of the SPERB authority was settled by the voters in November. Beyond that, the key areas of support are as follows:

1. Providing a firm statutory declaration of the importance of Hawaii's stored water system.

2. Ask the Commission on Water Resource management to require all water plans to include a storage component.

3. Ask the new administration to relook at all its dams, reservoirs and irrigation systems and the support provided to them to look for ways to dramatically increase that support including owning more facilities, providing grants to support work on key systems, looking at de-silting programs and albezia control programs, and considering a spillway enhancement program.

4. Resolve the R-1 water issue to increase the ability to use that water on agricultural crops.

5. Examine the feasibility of an insurance program using in part a mechanism like HPIA.

6. Provide immunity for dam owners from suits by trespassers for injuries suffered on dam and reservoir based systems.

KEY WATER AND STORAGE OBSERVATIONS TO CONSIDER

The traditional sugar plantation style of agriculture was very water intensive. Current agricultural techniques are much less water intensive. The old style created 100% diversions, current techniques should allow for both ditch and stream.

Ditch water systems which are still using 100% diversions when far less water is needed either because less land is planted or because of more modern irrigation techniques, exacerbate the feelings of those (especially Hawaiians) who want water restored to the streams.

All water issues ultimately impact all other water issues. At some point, removing water from the ditch systems leads to the pumping of ground water. The key is the most efficient shared use of resources.

The fact that dams and reservoirs were begun with a particular purpose as part of those plantation systems, and that those circumstances have significantly changed, should not end the conversation. There may be uses not thought of at that time, which are very valuable today, and need to be acknowledged. Said otherwise, before we abandon a facility we should ask ourselves, are there values that it serves today and if it does, let us look to see if we can keep it.

When dams and reservoirs were first built, there was little downhill of them other than fields of sugar cane. Today, we have built along virtually every shoreline and there is likely to be someone living between most dams and reservoirs and most shorelines. Virtually every dam is as a result, a “high hazard dam.”

Dams and reservoirs in Hawaii are with few exceptions not about long-term storage. The entire system holds around two weeks worth of water if it were the only source that existed. They do, however, play other very important roles, and with the consequences of climate change coming, will likely play an even greater role in the future.

Preserving most of the dams and reservoirs that remain needs to be seen as a significant priority for the State as once gone, they are highly unlikely to be built again and we cannot afford to take that risk.

WHAT NEXT: KEY STEPS FOR THE FUTURE OF HAWAII'S DAMS AND RESERVOIRS

Time is running out on many of Hawaii's dams and reservoirs. And given the more slowly than any of us would like growth of local agriculture, the support from normal commercial activity will not likely come in time.

One issue is money, not surprisingly. There are changes to the law that could be helpful. Most of all, however, it is leadership that is needed, and needed immediately. As a matter of policy and priority, government needs to make the preservation of Hawaii's agricultural water systems a major priority and then see it through.

The leadership need is not reflexive, preserve at any costs, leadership. It is leadership that skillfully balances interests and asks everyone involved to assist in creating answers that honor as many important needs as possible. The plantation systems must accommodate the needs of the streams; the regulators must ensure public safety while creating an open dialog on how best to do it and be willing to find the exceptions to the rules; and we humans must accommodate the natural environment around us that ultimately sustains us (or not).

In terms of legislation, legislation that accomplished the following, whether in one bill on in a number of them, would be very helpful:

1. The provision of water for agricultural activity is exempt from the jurisdiction of the Public Utilities Commission.

2. Hydro power is a permitted use in agriculturally-zoned districts.

3. The law governing the Department of Land and Natural Resources has the storage of water in a safe manner as a distinct and specific purpose of the Department.

4. "Agriculture" is defined for a number of purposes in a way that qualifies actual agricultural enterprise for various programs without allowing those who do not engage in the business of farming (the so-called gentlemen farmers) to participate or qualify.

5. The creation of an insurance program modeled on the Hawaii Property Insurance Association's coverage for those with property in lava inundation zones.

In terms of administrative (at least initially) activities, it is critical for the new administration to exercise immediate and direct leadership in a number of key areas. Specifically, the needs are as follows:

1. The Governor needs to gather the key administration, and county and private parties to gather to determine the best course of action in getting the most productive use of Lake Wilson, the Nuuanu Dam, the Kanaole Dam, and the West Maui dam and ditch system.

2. The Governor needs to convene a working group of key directors including the directors of Land and Natural Resources, Agriculture and Health, and the Office of State Planning, to among other outcomes:

    a. Substantially increasing the support provided to State owned dams, reservoirs and related water systems.

    b. Consider ownership of key structures such as Lake Wilson, the Maui Land and Pine reservoirs, and the Ka Loko and related dams.

    c. In lieu of, or in addition to owning the dams, a program of supportive actions is agreed upon that includes:

        (i) The use of R-1 water for agriculture;
        (ii) An albezia eradication program focused on agricultural systems, watersheds and streams;
        (iii) A State-supported spillway improvement program;
        (iv) A State-supported de-silting program for at least the major reservoirs;
        (v) A working agreement between on the processing of projects involving dams and reservoirs and hydro power installations. (The recently developed fishpond process can serve as a model.)

3. The Chairman of Land and Natural Resources and the DLNR staff, especially its Dam Safety Office, need to continue to fine tune their regulation and support of dams and reservoirs in Hawaii. Specific actions include:

    a. Meeting with dam owners and their consultants to look at areas of mutual concern such as spillway size; operations and maintenance plans; the use of multiple engineering consultants or the same review; the weather events which the facilities must withstand; and others.

    b. The establishment of a meaningful variance process as it is the proper handling of exceptions that ultimately validates the rules.

    c. The sharing of the Dam Safety Office's Annual Report to the Legislature, or its equivalent, with all dam and reservoir owners.

d. Convening a regular set of talk story sessions between the DLNR and the Commission on Water Resource Management (CWRM) staffs, and the “old timers” whose water knowledge will largely be lost if not shared.

e. The CWRM needs to mandate a review and discussion of storage in every plan in the State’s Water Plan.

These steps will not make owning a dam or reservoir easy as that it will never be. What these steps do is make it possible to own a dam or reservoir. And that is really all we can do in the end, make it possible.

Researched and written by Robbie Alm, President,
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APPENDIX 1

Statutory and Regulatory Changes

To Dam Safety Programs Since 2006: An Overview

David Kirk Stapp
October 2014
Honolulu, Hawaii

As part of the Special Deputy Attorney's Report on the Ka Loko Dam Failure, the statutory and regulatory provisions of other states were examined to give Hawaii a sense of what other jurisdictions were doing and what features of those laws we might want to incorporate in any revisions to our current law. (See Appendix E, Survey of Dam Safety Programs in Other States, Report of the Independent Civil Investigation of the March 14, 2006, Breach of Ka Loko Dam.)

In this paper, the changes to those other States laws are set forth both to see what the trends in regulation are, and to see if there are features in those other states laws and regulations that Hawaii might want to consider enacting.

This overview looks at certain core features of dam safety regulation and is followed by a more detailed State by State listing of the changes.

Introduction

State statutory and regulatory policy concerning dam safety is emblematic of many other political questions in this country: what is the proper balance between regulation meant to promote safety, and deregulation meant to promote efficiency? States have engaged in both deregulatory and regulatory actions relating to dam safety legislation since 2006, and several trends have emerged.

Generally, some states have engaged in deregulation by narrowing dam classification requirements. By narrowing such requirements, fewer dams are covered by regulation, which in turn means that state regulatory departments have reduced their supervision obligations, and certain dam owners have been relieved of specific responsibilities. Trends concerning state permit and approval processes are mixed: some states have increased regulatory mechanisms, while others have engaged in deregulation. Surprisingly, a few states have substantially lengthened the period between inspections, while no states have shortened such periods. Regarding hazard potential classifications, some states have incorporated additional hazard potential factors, other states have refined and specified their hazard potential definitions, and other states have provided dam owners a pathway to reduce their hazard classification. Finally, some states have substantially raised their application fees relating to dam construction and alteration.

Dam Classifications: Deregulations and Exemptions

Dam statutory and regulatory changes concerning dam classifications have resulted in overall deregulation and the implementation of jurisdictional dam exemptions since 2006. States have implemented deregulation by either (1) raising the minimum height and impoundment capacity requirements for regulation, or by (2) establishing minimum dam height or impoundment requirements for state regulation (which, by implication, deregulates those dams

below the newly established minimum thresholds). Furthermore, several states have established unique criteria by which dams may be completely exempt from state regulation.

The New Mexico Legislature raised the minimum height and impoundment capacity requirements for dam regulation by amending N.M.S. § 72-5-32 in 2009. Formerly, New Mexico only regulated dams that were "more than 10 feet in height or capable of impounding more than 10 acre-feet of water." However, the amendment raised the state's minimum height and impoundment capacity requirements for regulation by requiring dams to be a minimum of 25 feet in height or to have a minimum impoundment capacity of 50 acre-feet of water. Furthermore, dams "less than six feet in height regardless of storage capacity or dams with storage capacity of 15 acre-feet or less of water, regardless of height" are now exempt from state authority. N.M.S. § 72-5-32.

The North Carolina Legislature followed New Mexico by amending G.S. § 143-15.25A in 2013. Formerly, the state regulated dams that measured at least 15 feet in height or that had an impoundment capacity of at least 10 acre-feet. Currently, the state regulates dams that are at least 25 feet in height or that have an impoundment capacity of at least 50 acre-feet. Furthermore, North Carolina established several criteria that exempt dams from regulations under G.S. § 143-15.25A(7). For example, dams constructed by the U.S. Army Corps of Engineers, or dams constructed for agriculture use under the supervision of individuals whom have federal engineering job approval authority are exempt from state regulation.

Before 2009, Texas maintained no minimum regulatory "floor" pertaining to dams. Presumably, all dams in Texas, regardless of height or impoundment capacity, were subject to regulation. Currently however, Texas regulates any dam that has a "height greater or equal to 25 feet and a maximum storage capacity greater or equal to 15 acre-feet, or has a height greater than 6 feet and a maximum storage capacity greater or equal to 50 acre-feet, or is a high or significant hazard dam regardless of height or maximum storage capacity." T.A.C. § 299.1. Furthermore, the Texas Legislature enacted a statute in 2011 that exempts certain dams from state oversight. Owners of dams located on private property are exempt from state regulations if the dam (1) impounds, at maximum capacity, less than 500 acre-feet, (2) has a hazard classification of low or significant, (3) is located in a county with a population of less than 350,000, and (4) is not located inside the corporate limits of a municipality. T.W.C. § 12.052.

The Kansas Legislature created state jurisdictional dam exemptions in 2013. For a dam to be subject to regulation in Kansas, the dam must impound more than 30 acre-feet of water at the top of the dam. However, dams "(1) not located in incorporated areas, and (2) are more than 300 feet from property boundaries, (3) so long as the watershed area above the water obstruction is

less than five square miles" shall be exempt from state regulations. KS ST 82a-301(c)(d).

In summary, both New Mexico and North Carolina legislatures raised their minimum height requirement to 25 feet, and their impoundment capacity requirement to 50 acre-feet. Texas implemented a regulatory floor, regulating dams at least 25 feet in height or those with a 15 acre-feet storage capacity. Lastly, both Texas and Kansas enacted jurisdictional exemptions for dams located on private property that meet certain specifications.

Fees and Costs: Simplification and Increases

Two states (Arizona and Pennsylvania) have substantially amended their laws relating to dam regulatory fees and costs. Arizona universalized its fee and cost pricing system, resulting in simplified, coherent pricing schedule. Pennsylvania implemented a new dam permit applicant pricing table system, and this change has resulted in a substantial application price increases as compared to the state's former pricing system.

Before 2011, Arizona used a filing fee sliding scale system whereby the state would charge a maximum application filing fee of 2% of the estimated dam project cost. The filing fee percentage would reduce as the estimated cost of the project increased. For example, a project estimated to cost $1,000,000 would be charged a filing fee of 2% for the first $100,000, 1.5% for the next $400,000, and 1% for the last $500,000, resulting in a filing fee application of $13,000. However, the Arizona Department of Water Resources repealed R12-15-151 in 2011 and adopted R12-15-104(A)(7), giving the director the authority to charge a flat fee of 2% of the estimated total project cost. Therefore, a current filing fee application for a project estimated at 1,000,000 would be charged a flat fee of 2% ($20,000). Arizona's new filing fee system is simple and results in increased revenue for the state's dam repair fund.

The Pennsylvania Department of Environmental Resources substantially increased the state's dam application fees in 2013. See R105.13. Formerly, the department utilized a simple pricing fee system, charging application fees of $3,000 for Class A dams, $2,500 for Class B dams, and $1,500 for Class C dams. Under this approach the department was not taking into account the hazard potential category when pricing each dam's application fee. Currently, the department uses application fee tables which incorporate both the size category (A, B, C) and the hazard potential category (1,2,3,4,). Below is the departments pricing table for new dam construction applications:

Application Fees for New Dam Construction	Hazard Potential Category	1	2	3	4
Size Category					
A		$26,500	$26,500	$26,500	$23,500
B		$19,000	$19,000	$18,500	$17,000
C		$10,500	$10,500	$10,000	$8,000

The department increased new dam construction application pricing fees from 500% to 800%. The department also implemented a pricing table for the modification of existing dam applications (these fees have risen from 500% to 600%) and a pricing table for the modification of the operation and maintenance of existing dam applications (these fees have risen 400%).

Permit/Approval Process: Increased and Decreased State Regulations

There have been many changes to statutes and regulations concerning dam permit and approval processes since 2006. Some states, like Delaware and Virginia, have increased the level of regulatory oversight. Other states, like Kansas and Texas, have decreased the level of regulatory oversight.

In 2009, the Delaware Department of Natural Resources and Environmental Control adopted a new set of dam regulations requiring owners of existing or new dams to apply and obtain a permit to impound water prior to allowing dams to become fully operational. See 7 D.A.C. § 5103-4.8. This rule acts similarly to other states' certificate of approval requirements whereby a dam owner must obtain final approval before the dam begins operation. The department also promulgated a regulation allowing any action or determination by the department to be appealed to the Environmental Appeals Board. See 7 D.A.C. § 5103-6.2.4.

The Kansas Legislature and the Kansas Department of Agriculture made multiple changes to the state's statutes and regulations pertaining to the dam permit and approval process after 2006. Most changes were typical of changes made in other states; however, a few are worth noting. Statute K.S.A. § 82a-302 was amended in 2013 in order to lessen the department's permit and approval responsibilities. The amendment removed the department's requirement to "maintain a list of licensed professional engineers who may conduct the review of any application for a consent or permit," and the amendment removed the department's 45-day application determination deadline, and the department's 15-day determination notification deadline. Currently, the statute states that "a

licensed professional engineer, competent in dam design and construction, shall design all plans and specifications for dams." Therefore, the statute indicates that dam owners are to seek out licensed engineers without access to any database of engineers compiled by department, and the department is not tied to application deadlines.

The Kansas Department of Agriculture adopted regulations whereby at least two permanent geodetic vertical datum benchmarks shall be installed for future reference at each dam after construction completion. K.A.R. § 5-40-2a. The regulation goes into great detail concerning the installation and criteria for these benchmarks. Furthermore, the department promulgated regulations specifying the design criteria to be applied during the application process for newly discovered existing, unpermitted dams in the state. See K.A.R. § 5-40-74.

The Ohio Legislature amended certain dam statutes in 2006 to provide for construction permit extensions. See O.R.C. § 1521.061. The amended statute specifies that if the revised construction cost estimate provided within the construction permit extension request exceeds the original construction cost estimate by twenty-five percent, then an additional surety bond is required. The department may still require an additional surety bond to be filed so that the total amount of the bond equals at least fifty per cent of the revised construction cost estimate.

The legislative amendments to Texas' dam permit and approval process statutes may be the most provocative deregulatory actions taken by any state since 2006. Essentially, the Texas Legislature gave the executive director of Texas' Natural Resource Conservation Commission carte blanche powers over the state's permit and approval processes. Statute T.W.C. § 12.052 was amended in 2011, and this amendment provided the commission complete discretion over existing dam or spillway compliance mandates and timelines. The statue states that "The commission may enter into an agreement with an owner of a dam whom is required to reevaluate the adequacy of an existing dam or spillway. The agreement may include timelines to achieve compliance with the commission's design criteria and may authorize deferral of compliance with the criteria, as appropriate." Therefore, the compliance or timeline "agreement" is subject to the full discretion of the commission; or the commission may simply prefer to defer certain compliance mandates completely.

In 2009, the Texas Natural Resource Conservation Commission gave the executive director the power to grant exemptions if the director "determines that the physical conditions involved or consequences of potential failure, when evaluated using accepted engineering practices, make the requirements unnecessary." T.A.C. § 299.5. The exception powers refer to: (1) professional engineering requirements (T.A.C. § 299.4), (2) Review and Approval of Construction Plans and Specifications (T.A.C. § 299.2), (3) Maintenance of Construction Records (T.A.C. § 299.23), (4) Construction Progress Reports

(T.A.C. § 299.24), (5) Construction Inspection (T.A.C. § 299.25), (6) Construction Change Orders (299.26), (7) Deliberate Impoundment (T.A.C. § 299.28), (8) Record Drawings (T.A.C. § 299.30), (9) Permanent Reference Mark (2 T.A.C. § 99.31).

The Virginia Legislature mandated dam applicants to notify potential members of the public who are potentially at risk whenever a dam construction application is submitted. See C.V. § 10.1-606.4. When an applicant is applying for a high or significant hazard potential dam construction permit, the applicant must provide copies of the construction permit request and the dam break inundation zone map to the localities that lie within the inundation zone. The applicant shall then publish a notice in the newspaper of general circulation in the affected localities. Virginia's Soil and Water Conservation Board may then hold public hearings pertaining to safety issues associated with the potential construction of the proposed dam. Additionally, the applicant must also send the permit request and location of the map inundation to each address in the zone.

In conclusion, there has been a mix of regulation and deregulation concerning permit and approval processes since 2006. Delaware adopted regulations requiring dam owners to apply and obtain a permit to impound water prior to a dam being operational. Additionally, Delaware established an Environmental Appeals Board for aggrieved dam owners. The Kansas Legislature loosened the Department of Agriculture's responsibilities relating to maintaining a professional engineer database, and application determination and notification deadlines. Furthermore, Kansas' Department of Agriculture promulgated regulations requiring geodetic vertical datum benchmarks to be installed on newly completed dams, and created regulations pertaining to newly discovered, "illegal" dams. The Ohio Legislature created a means for dam owners to apply for and receive construction permit extensions, subject to certain surety bond requirements. The Texas Legislature and Natural Resources Commission gave the commissioner the authority to create specialized agreements or to forgo regulatory requirements completely in relation to new and existing dam owners and the permit and approval process. Finally, the Virginia Legislature mandated dam applicants to notify certain members of the public that a dam may be constructed near their property after the dam application has been submitted.

Inspection Process: Establishment and Lengthening of Inspection Frequency Periods

While inspection process procedural mechanisms have for the most part remained unchanged since 2006, two states (Vermont, Maine) have substantially lengthened their inspection frequency periods. Other states have played catch-up by working to establish formal inspection frequency periods.

The Vermont Department of Environmental Conservation radically lengthened the state's dam inspection frequency periods when the department promulgated its first set of dam regulations in 2014. V.A.C. § 18-1-13:4.520 states that inspection reports must be filed to the department every five years for large or high hazard dams, and every ten years for medium or significant hazard dams. Furthermore, the board may grant inspection exemptions in extraordinary, good cause circumstances. Any inspection exemptions are to be reviewed every five years. Previous Vermont law required high hazard dams to be inspected every year, and significant hazard dams to be inspected every 1 - 3 years.

The Maine Legislature, like Vermont, lengthened the state's dam inspection frequency periods in 2013. Maine law now holds that all high and significant hazard potential dams shall be inspected every 6 years, or within 60 days of a request by the dam owner or municipality in which the dam is located, or whenever the commissioner believes the dam may constitute a potential risk to public safety. See 37-B M.R.S. § 1119. Previous Maine law required high hazard dams to be inspected every 2 years, significant hazard dams every 4 years, or within 30 days of a request by a dam owner.

Before the Delaware Department of Natural Resources and Environmental Control promulgated regulations in 2009, Delaware statutes merely indicated that the department should require regular inspections, but no specific frequency periods were iterated. Delaware regulations now require that high hazard potential dams be inspected annually, and significant hazard potential dams at least once every 2 years. See 7 D.A.C. § 5103-10.0.

Rhode Island's Department of Environmental Management promulgated its first set of regulations after 2006. Previously, there were no inspection frequency periods mandated by Rhode Island law. Currently, high hazard classification dams must receive a visual inspection every 2 years, significant hazard classification dams are to be visually inspected every 5 years, and low hazard classification dams must receive a hazard classification reassessment every 5 years.

The Oklahoma Water Resources Board now mandates that significant or high hazard dams in an unsatisfactory or poor condition shall be inspected by a professional engineer at the expense of the owner at least once every 6 months until the deficiencies have been corrected. See Rule 785:25-9-1-1. Furthermore, the regulations now state that unscheduled inspections shall occur after an earthquake within 50 miles of a dam that measures 5.0 or greater on the Richter magnitude scale.

The Connecticut Legislature gave the supervising commissioner the authority to place an inspector to work on any high or significant hazard dam where a sensitive ecological situation exists. See CT ST § 22a-404.

In conclusion, Vermont and Maine have substantially lengthened the required inspection period frequencies for dams in each state. Delaware and Rhode Island, through the promulgation of regulations, now have mandatory inspection period frequencies. Oklahoma has enacted a special regulation that mandates frequent inspections for dams that are deemed unsatisfactory, or at potential risk, and Connecticut may place an inspector to work on a dam where a sensitive ecological situation exists.

Changing Hazard Classifications

Dam and reservoir statues and regulations have changed in three ways regarding hazard classifications since 2006. In certain states, the legislation has become more (1) specific, (2) traffic and public utilities factors have been included in hazard classification analysis, and (3) the possibility of hazard re-classification now exists.

The Delaware Department of Natural Resources and Environmental Control, through the promulgation of regulations in 2009, specified the analysis factors to be used when determining a hazard classification. Delaware statutes give sparse definitions regarding hazard classifications. For example, the statues simply state that Class I, high hazard potential dams, are those, the failure or mis-operation of which will cause probable loss of human life. However, the promulgated regulations gave needed elaboration to these definitions. For example, the regulations state that Class I hazard classifications include instances when "the existence of normally occupied homes [or recreational facilities such as campgrounds or recreation areas] in the areas that are susceptible to significant damage in the event of a dam failure, will be assumed to mean 'probable loss of life'", and thus under a Class I classification. 7 D.A.C. § 5103-5.2.

The regulations detail the specific tests the department utilizes when establishing a hazard classification. See 7 D.A.C. § 5103-5.3. The department is required to conduct a downstream danger reach estimate by conducting a dam breach analysis. The department may also establish a 100-year frequency flood estimate, a 50 and 100 percent probable maximum flood estimate, and a sunny day failure estimate, when conducting the dam breach analysis.

Delaware, Indiana, and Kansas included traffic and public utility factors to be analyzed when a hazard classification is to be determined. Delaware wrote that the possibility of damage to major and non-major roads, railroads, or interruption of service to public utilities are factors to be considered for Class II and Class III dams. 7 D.A.C. § 5103-5.2. Indiana expanded its hazard classification criteria by including the interruption of service to county, state, U.S. or interstate highways, the interruption of service to operating railroads, or the interruption of service to utility, power, or communication lines as high or significant hazard factors. 312 I.A.C. § 10.5-3-1. Kansas regulations hold that

damage to traffic on high, moderate, or low volume roads are factors when determining hazard classification. See K.A.R. § 5-40-20.

Regarding re-classification, Indiana, Rhode Island, and Virginia's newly enacted statues and regulations do provide for the possibility of hazard re-classification. Indiana allows dam owners to file a hazard re-classification consideration request if the owner can submit certain documentation that the commission was not privy to previously. See 312 I.A.C. § 10.5-3-2. Indiana's reconsideration criteria are identical to the original hazard classification criteria. Rhode Island allows a dam owner to petition the director for the re-classification of a dam. R.A.C. § 25-6-1:9. The petition must include a report prepared by a qualified engineer that supports the claim for re-classification. Additionally, Rhode Island's hazard classifications are not permanent: one of the director's responsibilities is to examine each regulated dam as often as necessary to assess whether the dam warrants re-classification. Virginia allows a dam owner to request a simplified dam break inundation analysis to determine if the dam can be classified as a low hazard potential. See C.V. 10.1-604.1. Such a request would follow from the dam owner's belief that conditions downstream have changed to the point where the risk of a possible dam failure has been reduced.

In conclusion, Delaware has provided needed specification to the state's hazard classification definitions. Several states have included traffic and public utility factors to be considered when determining dam hazard classifications. And finally, other states have provided for the possibility of a hazard re-classification at the request of the owner.

Dam Operation and Maintenance: An Increase of Regulation and Oversight

Since 2006, some state legislatures and regulatory departments have enacted, amended, and promulgated statues and regulations relating to dam operation and maintenance. Such enactments have resulted in a net increase state department oversight powers, and a net increase of requirements that dam owners must follow. Delaware, Rhode Island, and Vermont had not passed dam regulations as of 2006; thus, the passing of such resulted in an increase of regulation in each state. However, Connecticut and Virginia had relatively detailed legislation and rules regarding dam operation and maintenance as of 2006. Nevertheless, the legislative and regulatory departments of both states enacted further requirements for dam owners to abide by.

Before the Delaware Department of Natural Resources and Environmental Control promulgated its first set of regulations in 2009, there were no requirements for routine dam surveillance, formal and informal inspections, or the annual renewal and approval of the O&M plan. The department now mandates dam owners and operators to develop, use, and update as necessary, an operation and maintenance plan [O&M]. See 7 D.A.C. § 5103-10.0. Furthermore,

dam owners and operators must conduct routine surveillance and formal and informal inspections to dams. Additionally, the O&M plan must be renewed and approved by the department once each year, and informal inspections must occur on a quarterly basis.

The Rhode Island Department of Environmental Management promulgated its first set of regulations relating to dam safety and management after 2006. Before this promulgation, Rhode Island had virtually no operation and maintenance instructions for dam owners. The department now has a very comprehensive set of regulations regarding dam operation and maintenance. The regulations require dam owners, upon request, to prepare and/or make available all the existing surveys, plans, drawings and reports related to the dam that may be required by the Director for the purposes of dam safety. R.A.C. § 25-6-1:8. The newly adopted regulations also specify the procedures for maintaining a high or significant hazard dam, the procedures for the repair of high or significant hazard dams, the procedures for the emergency repair of high or significant hazard dams, the procedures for the review of applicants, the Director's requirements for applicants to provide public notice to the municipality that the dam is located in, and the specifications regarding the modification, suspension, or revocation of approval of dams.

The Vermont Department of Environmental Conservation promulgated its first set of regulations relating to dam safety and management in 2014. Like Rhode Island, Vermont had little guidance for dam owners. However, the department now requires an owner to report to the department any condition affecting the safety of the dam "as soon as practicable" after the condition is discovered. V.A.C. § 18-1-13:4.531. The regulations detail what conditions constitute a "condition affecting the safety of a dam." After a dam owner has reported a concern, the department has the authority to order the owner to take specific actions as required to correct the condition, or the department may retain a consultant to inspect the dam.

Connecticut statutes originally held that a dam owner was allowed reasonable time to make any required repairs to the dam, depending on the severity of the deficiency. However, the Connecticut Legislature, after 2006, gave the commissioner the ability to notify and order dam owners to undertake necessary maintenance or repairs of a dam within certain time frames, so long as a safety justification is made. See CT ST § 22a-402.

As of 2006, Virginia statues were relatively comprehensive concerning the operation and maintenance of dams. However, the Legislature amended several statutes in 2008 and 2011, and these amendments introduced further legal parameters for dam owners to follow. Virginia statues now require owners to prepare dam break inundation zone maps that must be filed with the Department of Conservation and Recreation and with the plat and plan approval authority located within the dam's respective locality. See C.V. § 10.1-606.2. Furthermore,

Virginia statutes now hold that prior to the dissolution or termination of any entity that owns a dam, the entity must convey ownership of the impounding structure to a third-party or decommission the impounding structure.

It should be noted however that Virginia did loosen one standard regarding dam operation and maintenance. C.V. § 10.1-605, amended in 2011, states that structures built before July 1, 2010, or structures classified as high hazard before July 1, 2010, are exempt from current Virginia spillway upgrade requirements (current spillway requirements hold that a dam must pass 90 percent of a probable maximum precipitation). These exempt dams are to be in compliance if they are able to pass 2/3 of a probable maximum precipitation event.

In conclusion, in these states the trend is clear concerning dam operation and maintenance: states are enacting statues and adopting regulations that are (1) increasing the operation and maintenance responsibilities of dam owners, and (2) as is seen in the case of Vermont's V.A.C. § 18-1-13:4.531, increasing the departments' oversight powers.

Conclusion

Looking nationwide, the changes since 2006 appear to have gone in two very different directions. In some there has been significant deregulation (Texas being the strongest) or less stringent regulation (the lengthened dam inspection periods in Vermont and Maine for example) or limiting the number of dams covered by increasing to threshold (New Mexico and North Carolina for example).

Other states have either fine-tuned their regulations or increased it in very specific ways such as adding more items to consider the hazard classifications or supplementing statutes with specific rules to detail the regulatory requirements.

Overall, there does not appear to be any major trends or specific features for Hawaii to take into account in its regulatory structure.

Attachment: Appendix 2 - Survey of Dam Safety Programs in Other States - 2014 Update

APPENDIX 2

Survey of Dam Safety Programs in Other States – 2014 Update

The Survey of Dam Safety Programs in Other States was originally compiled in 2006. This report lists the specific revisions that are to be applied directly into The Survey of Dam and Safety Programs in Other States document. The revisions represent a comprehensive review and update of each State's statutory and regulatory changes since 2006. This review and update was conducted over the summer of 2014.

It should be easy for anyone to take the revisions below and incorporate them into the original survey. The revisions are organized by State, and then by the topic within the State.

Specific Instructions:

- The topic subjects are in bold. These topic subjects directly correspond with the topic subjects in the original document.
- The description next to each topic subject describes the revision that is to be made to the original survey.
- Each description refers to the text directly below it.
- Description Instructions:
    - **Find Similar Sentence and Change as Follows:** This description indicates that the text is very similar to a sentence in the topic subject of the original survey. Simply delete the similar text in the original survey and replace it with the revised sentence.
    - **Entire Section Should be as Follows:** This description indicates that the entire topic paragraph(s) in the original document should be deleted and replaced with the revised text.
    - **Add to End of Section:** This description indicates that the revised text needs to be added to the end of the topic section in the original document.
    - **After, Add:** This description indicates that a sentence needs to be added directly after a previous sentence in the original document.
- All footnotes in this document should be included in the original report, and attached to the sentence that the footnote is connected to in this document. The footnotes will indicate to future readers the statutory and regulatory changes since 2006.

Alaska

Summary [Pro] - Find Similar Sentence and Change as Follows

Except in the performance of routine maintenance and operations not affecting structural safety, the department must grant a 'certificate of approval' before any dam construction, alteration, repair, operation, or removal may occur, and are subject to department discretion.

Jurisdiction/Powers of the Department - Find Similar Sentence and Change as Follows

Except in the performance of routine maintenance and operations not affecting structural safety, a person may not construct, enlarge, repair, alter, remove, maintain, operate, or abandon a dam or reservoir without the approval of the department. A.S. § 46.17.040.

Arizona

Fees and Costs - Entire Section should be as Follows

The law gives the director the authority to establish filing fees based on the estimated cost of the dam. Approval of plans for construction, enlargement, repair, alteration or removal of dam are 2% of total project cost." R12-15-104(A)(7).[1]

Safety Inspection Fees

All department safety inspections fees are pursuant to R12-15-1219(A). High or significant hazard potential dams are based on the total crest length of the dam, as follows:

Length (feet)	Fee
0 up to and including 500	$2,000.00
More than 500 up to and including 1,000	$2,200.00
More than 1,000 up to and including 2,000	$2,400.00
More than 2,000 up to and including 4,000	$2,600.00
More than 4,000 up to and including 8,000	$3,000.00
More than 8,000 up to and including 16,000	$3,400.00

[1] Arizona repealed R12-15-151 in favor of making all filing fees 2% of the project cost. R12-15-151 utilized a sliding scale fee structure, whereby the maximum fee was 2%, and the percentage was reduced as the projected cost of the project increased.

Length (feet)	Fee
More than 16,000 up to and including 32,000	$3,800.00
More than 32,000	$4,200.00

The owner of a low or very low hazard potential dam shall pay a fee of $1000. R12-15-105.[2]

Citation and Title - Make these Detailed Changes
Delete "R12-15-121" and **add in its place** "R12-15-104 and R12-15-105."

Connecticut

Summary [Pros] - Entire Section Should be as Follows
The State has a clearly established schedule, which sets forth the frequency with which periodic inspections of dams should be conducted. The regulations indicate that the Department of Environmental Protection shall conduct the periodic inspections. If the department does not receive notice of the owner's intent to have the owner's own engineer conduct the regularly scheduled inspection, the department shall go forward with the inspection and charge the owner the appropriate fee for the inspection. The State has amended or enacted certain statutes after 2006 resulting in an increase of the State's regulatory and oversight powers.[3] Notably, the commissioner can notify any dam owner to make specific repairs when the commissioner believes a risk is posed to the public's safety. Also, chief executive officials of any municipality for which a dam is located within, have the right to enter and inspect dams and hydroelectric power generating facilities when there is a believed public safety concern. Furthermore, owners of high or significant hazard dams must submit EAPs to the Commission every two years. The Guidelines for Dam Emergency Operation Plan set forth guidelines for dam surveillance by an owner when a "flood watch" or "flood warning" takes effect. Specifically, emergency operation monitoring by a dam owner should commence when the National Weather Service for a particular geographic area issues a "flood watch" alert, or when heavy runoff conditions are experienced at the dam site. The Guidelines set forth inspection steps that should be immediately undertaken and at three-hour intervals thereafter, unless the "flood watch" is upgraded to a "flood warning," at which time the dam should be inspected hourly. The observations include (but are not limited to): (1) the rainfall and water level of the impoundment should be measured and recorded; (2) the crest of the dam should be walked to determine if any cracking, settlement, movement or sloughing of the embankments has occurred; (3) the toe of the dam embankment and the abutment contacts should be inspected and all areas of seepage, soft spots, and boils noted (boils are areas of concentrated seepage under pressure which have the ability to remove or "float" away the soil material through which it flows); and (4) all spillway and outlet structures should be checked for accumulation of debris which should be removed

[2] R12-15-105 was amended in 2010. The former inspection fee plan charged $100 per inspection plus an additional two dollars per every foot in the total crest length of the dam.
[3] See CT ST § 22a-402, 22a-404, 22a-409, 22a-411a.

as necessary. A written record of the emergency observations must be maintained. The Guidelines also set forth a schedule for downstream warning notification including early notification and final warning procedures. Early warning takes place when local officials are notified that conditions at the dam site exist, which may require the evacuation of downstream residents. A final warning should be initiated when, in the judgment of the inspector, a dam failure is likely and evacuation of the downstream area is necessary. [Cons] Dam safety program funding is not addressed.

Operation and Maintenance - Entire Section should be as Follows
Dams found to be unsafe under the inspection program must be repaired by the owner. Depending on the severity of the identified deficiency, an owner is allowed reasonable time to make the required repairs or to remove the dam. If the commissioner determines as a result of an inspection that maintenance or repairs to a dam are needed to maintain the dam in a safe condition, the commissioner shall notify the owner and request the owner to undertake such repairs within the time period specified in the notice. If the owner does not undertake the necessary maintenance or repairs within the time period indicated in the notice, the commissioner may proceed to order the owner to undertake the necessary maintenance or repairs. CT ST § 22a-402.[4]

Right of Entry - Entire Section Should be as Follows
The commissioner or his representative may enter upon private property at any time to investigate or inspect any dam. Additionally, if the chief executive official of a municipality of which a dam is located within, reasonably believes that a public safety concern exists with a dam, hydroelectric power generating facility, or a dam that is owned or controlled by a water company, then that official may inspect the dam so long as that official has notified the commissioner and has made a reasonable attempt to notify the owner of the dam. A report of any inspection performed shall be filed with the commissioner within seven days of such inspection, except when an immediate threat to public safety is discovered in which case such report shall be filed with the commissioner immediately. A chief elected official of a municipality has the right to enter and inspect water company dams that are under the ownership or control of the municipality. CT ST § 22a-402.[5]

Inspection Process [State]
After "The inspection shall be performed by qualified personnel of the DEP Dam Safety Program with technical training in the inspection of dams and under the supervision of a civil engineer." **Add, "**For a high or significant hazard dam, or if the commissioner determines a sensitive ecological condition exists, the commissioner may place a

[4] CT ST § 22a-402 was amended in 2007. The former statute simply held that the owner was allowed reasonable time to make the required repairs depending on the severity of the deficiency.
[5] CT ST § 22a-402 was amended in 2007 to greatly expand the right of entry provision. The former statue simply held that the commissioner could enter upon private property at any time to investigate or inspect a dam.

competent inspector on the work, and the compensation for such inspector shall be shared equally by the state and by the owner. CT ST § 22a-404.[6]"

Record Keeping - Add to End of Section
The commissioner shall make surveys or maps of each town showing the location of any dams or similar structures within such town, and the commissioner shall file a copy of such map with the town clerk. After the effective date of this section (October of 2007), real property owners, where a high hazard or significant hazard dam is located, shall record on land records in their respective municipality a document that identifies the existence of the dam and whether the dam is categorized as a high hazard dam or a significant hazard dam. The commissioner shall publish a standardized form to be used for such purposes. The owner of any dam or similar structure that, by failing, may endanger life or property and that is not already registered shall register the dam on or before October 1, 2015, with the Commissioner of Energy and Environmental Protection on a form prescribed by the commissioner. The commissioner shall notify the owner of any dam registered after October 1, 2015, in writing, no later than January fifteenth of any year in which inspection of such dam is due. Such notice shall identify the classification, the regulations adopted, and a statement of frequency for such an inspection. CT ST § 22a-409.[7]

Emergencies/Emergency Action Plans - Entire Section should be as Follows
The owner of any high or significant hazard dam shall develop and implement an emergency action plan (EAP). The EAP shall be updated every two years and copies shall be filed with the Commissioner of Energy and Environmental Protection and with the chief executive officer of any municipality that would be affected in the event of an emergency. CT ST § 22a-409.[8]

Permit and Approval Process - Entire Section should be as Follows
Before any person, firm, corporation, or municipality or political subdivision thereof constructs, alters, rebuilds, substantially repairs, adds to, replaces, removes any such structure, or modifies the dam in anyway to produce ecological benefits, such person, firm, corporation or municipality, or political subdivision thereof shall apply to the commissioner for a permit to undertake such work. The permit application shall be submitted in triplicate (by administrative practice) with the original including the necessary drawings, plans, specifications, and any other data and shall be submitted to the commissioner in the form and to the extent required by him. C.G.S. § 22a-403. A Certificate of Approval for the construction permitted is issued following inspection and approval. The commissioner also has the authority to suspend, modify or revoke a permit.

[6] CT ST § 22a-404 was amended in 2013 to include the provision detailing that the commissioner might place an inspector to work on any high or significant hazard dam where a sensitive ecological situation exists.
[7] CT ST § 22a-409 amended in 2013 to reflect these changes. Formerly, the EAP was to be reviewed annually, but copies of the EAP did not have to be filed with the chief executive officer of the municipality that incorporated the dam.
[8] Statute enacted in 3013

Delaware

Summary - Entire Section should be as Follows

[Pros] Delaware has a comprehensive set of statutes and regulations which guild the management of the State's dams and reservoirs. The Secretary of the Department of Natural Resources and Environmental Control adopted the regulations and standards in 2009. These regulations established a set of overarching definitions that are to be applied. Furthermore, the regulations detail the dam permit and approval process, requirements for construction, engineering, design, the hazard potential classification system, operation and maintenance plans, emergency action plans, and the inspection process.

[Cons] Dam safety program funding was not addressed.

Citation and Title – Entire Section should be as Follows

[Statute] Delaware Code Annotated (Del. C.) Title 7. Conservation, Part IV. Agriculture and Soil Conservation; Drainage and Reclamation of Lowlands, Chapter 42. Dam Safety [effective upon specific appropriations; see 74 Del. LAWS, c. 392 § 2.

[Rules/Regulations] Regulations are found in the Delaware Administrative Code (D.A.C.), Title 7. Natural Resources and Environmental Control, Division 5000. Division of Soil and Water Conservation, Chapter 5103. Delaware Dam Safety Regulations, 7 D.A.C. § 5103 through 5103.12.0.

[Administrative Agency] The Department of Natural Resources and Environmental Control (department).

Definitions/Dam Classification - Add

"**Abandonmen**t" means to render a dam non-impounding by dewatering and filling the reservoir created by that dam with solid materials and by diverting the natural drainage way around the site.

"**Hazard potential**" means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the dam or appurtenances. The hazard potential classification of a dam does not reflect in any way on the current condition of the dam and its appurtenant structures (e.g., safety, structural integrity, flood-routing capacity).

"**Spillway**" means a structure other than low flow outlets, over or through which flood flows are discharged.

Permit/Approval Process – Entire Section should be as Follows

Owners intending to construct any dam to which this chapter applies shall file with the department a preliminary application. The application should include a dam break analysis, the dam height, the maximum impounding capacity, purpose, location and determination of hazard class, and other information required by the department. Every owner applying for approval of a dam subject to the provisions of this chapter shall also file with the department a Certificate from a qualified professional engineer, licensed in the State. 7 D.A.C. § 4202. Before commencing repair, alteration or removal of any dam to which this chapter applies, application shall be made by the owner for approval by the department. The application shall state the name and address of the owner, shall adequately detail the changes it proposes to affect, impacts or modifications to plans of

operation and maintenance and emergency action plans. Maps, plans and specifications shall accompany the application. 7 D.A.C. § 4205. Owners of all existing dams regulated under Delaware Regulations must apply for and obtain from the Department a Permit to Impound in accordance with the requirements of these Regulations. Within 60 days of the satisfactory receipt of the Supervising Engineer's Certificate, as-built plans, the O&M Plan, and the EAP, from the owners of new dams or existing dams that have been modified, the Department will issue a Permit to Impound prior to the impoundment of water behind the dam. 7 D.A.C. § 5103-4.8.[9] Any action or determination by the Department shall be subject to appeal to the Environmental Appeals Board in accordance with the provisions of 7 D.A.C. § 6008, and such appeals shall be conducted pursuant to 7 D.A.C. § 6009. 7 D.A.C. § 5103-6.2.4.[10]

Detailed engineering and design requirements must be met before new or existing dams can be built or altered, including but not limited to geotechnical investigation, spillway, material, and surveillance requirements. 7 D.A.C. § 5103-8.0.[11]

Hazard Potential Classification - Entire Section Should be as Follows
Class I - High Hazard Potential: This classification includes any dam whose failure or misoperation will cause probable loss of human life. The existence of normally occupied homes in the area that are susceptible to significant damage in the event of a dam failure will be assumed to mean "probable loss of life." Recreational facilities below a dam, such as a campground or recreation area, may be sufficient reason to classify a dam as having a high-hazard potential. If, in the opinion of the Department, future development is probable in the area flooded throughout the danger reach, the dam shall be categorized as a Class I.
Class II - Significant Hazard Potential: This classification includes any dam whose failure or misoperation will cause possible loss of human life, economic loss, environmental damage, and disruption of lifeline facilities, or can impact other concerns. This classification applies to predominantly rural agricultural areas, where dam failure may damage isolated homes, major highways, or railroads or cause interruption of service of relatively important public utilities.
Class III - Low Hazard Potential: This classification includes any dam whose failure or misoperation is unlikely to cause loss of human life but may cause minor economic and/or environmental losses. This classification applies to rural or agricultural areas where failure may damage farm buildings other than residences, agricultural lands, or non-major roads. Class III dams are exempted from the requirements of these Regulations. 7 D.A.C. § 5103-5.2**.**[12]

[9] 7 D.A.C. 5103-4.8 was adopted in 2009, requiring dam owners to follow the stipulations in order to receive a permit to impound water.
[10] 7 D.A.C. § 5103-6.2.4, 7 D.A.C. § 6008, and 7 D.A.C. § 6009 were adopted in 2009.
[11] 7 D.A.C. § 5103-8 was adopted in 2009.
[12] 7 D.A.C. § 5103-5.2 was adopted in 2009. The newly adopted regulation did not change the hazard potential classification system as stated in Delaware Statues. Instead, the regulations detail the factors that determine the hazard potential classification for dams in the State. Those details have been included in this report.

The hazard classification shall be determined by establishing a danger reach downstream of the dam by conducting a dam breach analysis and routing the dam breach flood wave through the downstream valley. At the discretion of the Department, this analysis may require routing several spillway design floods through the danger reach, with and without the effects of failure of the dam, including at a minimum the following events: (1) 100-year frequency flood, (2) 50 percent probably maximum flood (PMF), (3) probably maximum flood (PMF), and (4) a sunny day failure for dams with permanent pools. The determination of the hazard classification shall be according to the criteria above based an evaluation of hydrologic calculations assuming ultimate development of the watershed using existing comprehensive plans and zoning, and a review of potential damage within the danger reach. The Department shall assign the classification of the proposed dam after the applicant has provided information on the potential damage within the danger reach, as defined herein. After the classification has been assigned, the inflow design flood and spillway design may be established. 7 D.A.C. § 5103-5.3.[13]

Fees - Entire Section should be as Follows

Owners filing an application for existing dams shall submit a $500 application fee upon issuance of a Provisional Certificate to Impound by the Department. Owners filing for the construction of new dams or for the repair, alteration, or removal of existing dams shall submit a fee of $500 at the time the application is submitted. 7 D.A.C. § 5103-7.0**.**[14]

Inspection - Entire Section should be as Follows

Owners or operators of all Class I dams shall have a regular inspection performed annually by a Delaware-licensed professional engineer assigned from the department. Owners or operators of Class II dams shall have a regular inspection performed at least once every two years under the supervision of a Delaware licensed professional engineer. The department may also require the owner to have additional formal inspections conducted if deemed necessary to confirm the safety of the dam. Delaware regulations specify specific timeframes of required correspondence between dam owners and the department, after inspections have been performed. 7 D.A.C. § 5103-10.0.[15]

Operation and Maintenance - Entire Section should be as Follows

The department shall require that dam owners and operators develop, use and update as necessary an operation and maintenance plan [O&M] which provides guidance and instruction to personnel for the proper operation and maintenance of any reservoir or dam to which this chapter applies to safeguard life and property. The O&M plan shall be subject to approval by the department. Dam owners and operators must conduct routine surveillance, formal and informal inspections in accordance with the requirements of Delaware regulations and each dam's O&M plan. The O&M plan must be renewed and

[13] Regulation adopted 2009.
[14] Regulation adopted 2009.
[15] 7 D.A.C. § 5103-10.0 was adopted in 2009. Formerly, Delaware Statutes merely indicated that the department should require regular inspections, but no specific timeframes were stated.

approved by the department once each year. Informal inspections must occur on a quarterly basis. 7 D.A.C. § 5103-10.0.[16]

Emergency/Emergency Action Plans - Entire Section should be as Follows
Dam owners of Class I and II dams must prepare an emergency action plan [EAP] that complements the O&M Plan and provides detailed guidance on surveillance, including what constitutes an emergency situation and the actions to be followed in the event of an emergency. The EAP is subject to department approval and must be approved annually. 7 D.A.C. § 5103-10.0.

Indiana

Summary – Entire Section should be as follows
[Pros] The hazard classifications are comprehensive and detailed. Under the statute, the owner of a high hazard structure must have a professional engineer make an engineering inspection of the high hazard structure at least once every two years. Upon completion of the inspection, the owner must submit to the department a report of the inspection in a form approved by the department. The owner is required to maintain and keep the structure in the state of repair and operating condition required by the exercise of prudence, due regard for life or property, and the application of sound and accepted engineering principles. The rules grant the department the authority to take control of a structure during an emergency, if the conditions of a structure become so dangerous to the safety of life and property and there is not sufficient time for the issuance and enforcement of an order for the maintenance, alteration, repair, reconstruction, change in construction or location, or removal of the structure. The department may recover the cost of the emergency measures from the owner through appropriate legal action.
[Cons] The Indiana Natural Resources Commission has promulgated very few dam regulations. Inspection of existing dams is primarily the responsibility of the department. Under the provisions of I.C. § 14-27-7-4, the department is required to make engineering inspections of all dams at least once every three years. In addition, although the statute requires that a permit be obtained prior to the construction, repair, or alteration of a dam, the actual permit process is not discussed. The statute does not state where funding for the dam safety program originates or whether State funds are even appropriated to the program. Emergency action plans are not required.

Citation and Title - Entire Section should be as Follows
[Statute] Indiana Code Chapters 14-27-7 and 14-28-1, originally enacted in 1945, and last amended in 1995.
[Rules/Regulations] Indiana Administrative Code (I.A.C.), Title 312. Natural Resources Commission, Article 10.5. Regulation of Dams. 312 I.A.C. 10.5-1-1 through 10.5-3-2.[17]
[Administrative Agency] Indiana Natural Resources Commission

Definitions/Dam Classification - Add

[16] 7 D.A.C. § 5103-10.0 was adopted in 2009. Until this regulation was adopted, there were no requirements for routine surveillance, formal and informal inspections, or the annual renewal and approval of the O&M plan by the department.
[17] Indiana Regulations regarding dams were first promulgated in 2007.

Spillway: "Spillway system" means a structure or structures that conveys flow through, around, or over the dam. A spillway system typically consists of the following: (1) A principal spillway, (2) An emergency spillway, and (3) A drawdown mechanism.

Hazard Classifications - Entire Section should be as Follows
Under I.C. § 14-27-7.5-2, hazard classification means a rating assigned to a structure by the department based on the potential consequences resulting from the uncontrolled release of its contents due to a failure or mis-operation of the structure. When determining a dam's hazard classification, the division shall apply existing U.S. Army Corps of Engineers Phase 1 reports and other appropriate documentation, and may also consider observations of the dam and the vicinity of the dam, including the risk posed to human life and property of the dam fails. 312 § I.A.C. 10.5-3-1.[18]
High Hazard: A structure the failure of which may result in any of the following: (1) the loss of life, (2) serious damage to homes, industrial and commercial buildings, public utilities, major highways, or railroads, (3) interruption of service for more than one day to a county road, a state two-lane highway, a U.S. highway serving as the only access to a community, or a multilane divided state or U.S. highway, including an interstate highway, (4) interruption of service for more than one day on an operating railroad, (5) interruption of service to an interstate or intrastate utility, or power or communication line which would adversely affect the economy, safety, and general well-being of the area for more than one day.

Significant Hazard: A structure the failure of which may result in any of the following: (1) damage isolated homes, (2) interruption of service for not more than one day to a county road, a state two-lane highway, a U.S. highway serving as the only access to a community, or a multilane divided state or U.S. highway, including an interstate highway, (3) interruption of service for not more than one day on an operating railroad, (4) damage to important utilities where service would be interrupted for not more than one day.

Low Hazard: A structure the failure of which does not result in any of the items given above and damage is limited to farm buildings, agricultural land, or local roads.

Dam owner may request reconsideration of a determination of hazard classification made by submitting a maximum breach inundation area, current damage evaluation, and any other technical information or reports that were not previously available to the division. The reconsideration criteria are identical to the original hazard classification criteria. 312 I.A.C. § 10.5-3-2.**[19]**

Kansas
Definitions/Dam Classifications

[18] 312 I.A.C. § 10.5-3-1, adopted in 2007, expanded the hazard classifications criteria as previously written in the Indiana statutes. The regulation included the consideration of the U.S. Army Corps of Engineers reports when making a hazard classification. Further, the regulation included the possibility of service interruptions to roads or highways as considerations when determining hazard classifications.
[19] 312 I.A.C. § 10.5-3-2 was adopted in 2007, specifying Indiana's policy for hazard reconsideration.

After, "According to K.A.R. 5-40-5, a jurisdictional dam has to impound more than 30 acre-feet of water at the top of the dam" **Add,** "Jurisdictional dam exemption criteria are found under KS ST § 82a-301(c) and (d).[20] One exemption applies for water obstructions that (1) are not located in incorporated areas, and (2) are more than 300 feet from the property boundary, (3) so long as the watershed area above the water obstruction is less than five square miles."

Hazard: means the property or people that could be damaged or endangered by the failure of a dam, including people or property that might be inundated. This term shall include a public or industrial water supply stored in the reservoir created by the dam that would be released if the dam failed.
Owner: means the owner or owners of the land upon which a dam and appurtenant works are constructed unless an easement authorizes another person or entity to construct and maintain a dam on that easement. With such an easement, the holder of the easement shall be considered to be the owner of the dam.
Repairs: means any action, other than maintenance, taken to restore a dam and its appurtenant works to their original permitted condition.
Spillway: "Primary spillway" means the uncontrolled outlet device through a dam that provides the initial outlet for storm flows, usually consisting of either of the following:
(1) A riser structure in combination with an outlet conduit; or
(2) A canopy or hooded inlet structure in combination with an outlet conduit.
This term is also known as a "principal spillway."
"Service spillway" means an open-channel spillway constructed over or around a dam embankment to convey safely past the dam all flows entering the reservoir that cannot be stored in the reservoir behind a dam that does not have a primary spillway.

Add these lines to the end of the existing definition. Do not delete the existing definition, just add to the end.
Class (a): Low Hazard – "or traffic on low-volume roads that meet the requirements under K.A.R. § 5-40-20."
Class (b): Significant Hazard – "damage traffic on moderate-volume roads that meet the requirements under K.A.R. § 5-40-20."
Class (c): High Hazard – "damage to traffic on high volume roads that meet the requirements for under K.A.R. § 5-40-20."[21]

Permit/Approval Process – Replace First Paragraph in Section with Paragraph below
The law gives the Chief Engineer the authority to approve or deny permit applications for construction, repair, modification, or removal of a dam. The law states that it is unlawful to perform the above on a structure without prior permitting by the State. An application for permitting must include maps, plans and specifications, and profiles as required by the Chief Engineer. A licensed professional engineer, competent in dam design and construction, shall design all plans and specifications for dams. The chief engineer shall

[20] KS ST 82a-301 was amended in 2013 to include jurisdictional dam exemptions.
[21] K.A.R. § 5-40-20 was adopted in 2007 to include regulations concerning hazard classifications in relation to traffic conditions.

adopt rules and regulations for the issuance of general permit that may be issued for projects that require limited supervision and review.[22]

Add Near to End of Paragraph
The regulations detail the requirements concerning the design and construction of dams, as specified in K.A.R. § 5-40-22 through 5-40-57.[23]

Replace Similar Sentence With
Dam owners must submit drawings of the structure "as built" after completion of the dam for 'high hazard' dams, or any other dam if required by the chief engineer as a prior condition. K.A.R. § 5-40-12.

Add to End
At least two permanent geodetic vertical datum benchmarks shall be installed for future reference at each dam after the dam is completed. K.A.R. § 5-40-2a goes into great detail concerning the installation and criteria for the benchmarks.[24]

Add Near End
An authorized engineer must routinely inspect high and low impact dams during construction at varying times as specified by K.A.R. § 5-40-71 and submit an inspection report to the chief engineer within 30 days of construction completion, as specified by K.A.R. § 5-40-72.[25]

Add Where Appropriate
The regulations specify the design criteria to be applied during the application process for newly discovered existing illegal, unpermitted dams. K.A.R. 5-40-74.[26]

Fees and Costs – Entire Section should be as Follows
All application fees for permits to construct, modify or add to a dam shall be $200.[27] Fees for construction commenced prior to approval – in addition to other penalties – shall range from $200 to $500.
Annual inspections ordered by the Chief Engineer are at owner's expense, ranging from $2,500 to $4,000, depending on hazard class, drainage area, and construction progress. The owner shall pay costs for any work required by the Chief Engineer prior to, or as a result of an inspection. If dam owners fail to conduct scheduled inspections, the Chief

[22] K.S.A. § 82a-302 was amended in 2013. The amendment simplified the department's permit and approval responsibilities. The amendment removed the department's requirement to "maintain a list of licensed professional engineers who may conduct the review of any application for [a] consent or permit." Furthermore, the amendment removed the department's 45-day application approval/denial requirement, and the department's 15-day approval/ denial notification requirement.
[23] K.A.R. § 5-40-22 through K.A.R. 5-40-57 were enacted in 2007.
[24] K.A.R. § 5-40-2a was enacted in 2013.
[25] K.A.R. § 5-40-71 and K.A.R. 5-40-72 were enacted in 2007.
[26] K.A.R. § 5-40-74 was enacted in 2007.
[27] K.S.A. § 82a-302, amended in 2013, universalized the application fee to $200 when applying to construct, modify, or add a dam. Before the amendment, the fees ranged from $100 to $1000, depending on the type of application submitted.

Engineer may order or conduct one at dam owner's cost, in addition to other penalties. All fees collected pursuant to this statute shall be remitted to the State Treasurer. K.S.A. § 82a-303b.

Emergency/Emergency Action Plans – Delete Last Sentence in Section and Replace With

The owner of a hazard class B dam shall create an emergency action plan (EAP) and submit the plan to the chief engineer within 180 days of the chief engineer's request. The owner of a hazard class C dam shall create and maintain an emergency action plan that meets the recommendations of the "federal guidelines for dam safety: emergency action planning for dam owners," and submit this plan to the chief engineer within 180 days of the chief engineer's request. Owners of dams that require EAPs shall annually review the EAP to determine if it is still accurate and applicable to the dam and downstream conditions. K.A.R. § 5-40-73.[28]

Owner Non-Compliance/Violations/Penalties – Add to End

If the chief engineer becomes aware of an existing illegal, unpermitted dam, he shall determine the hazard classification, notify the owner that the dam is illegal and unpermitted, and require the owner to submit a complete application within 120 days of the date of the notification. If the owner fails to submit an application, or the application is rejected, the chief engineer must require the owner to have the dam decommissioned and removed. K.A.R. § 5-40-73a.[29]

Inspection Process – Add in Section Where Appropriate

The regulations throughly detail the specfic requirements to be included in the inspection report by the engineer. K.A.R. § 5-40-90.[30]

The regulations specify the minimum requirements and application process engineers must abide by in order to be included on the list of licensed professional engineers approved to review the applications of dam permits. K.A.R. § 5-40-100/101/102.[31] The regulations further specify the procedure that engineers are to follow when conductiong an independent review of an application to construct a dam. K.A.R. 5-40-105.[32]

Maine

Summary [Cons]

After "Inspection of existing dams is primarily the responsibility of the department." **Add,** "Dam inspection frequences are longer than the regulatory norm (significant and high hazard potential dams to be inspected every 6 years)." **Add to end**, "Dam regulations fall under multipule departments, and the regulations seem to indicate that multiple departments have the power to conduct inspections and make recommendations;

[28] K.A.R. § 5-40-73 was adopted in 2007 to include submittal time frames, and emergency action plans for significant hazard dams. Formerly, Kansas' regulations only required emergency action plans for permit applications for high hazard dams. The former regulations did not have time frame requirements, nor did they have required annual review of EAPs.
[29] K.A.R. § 5-40-73a was adopted in 2007.
[30] K.A.R. § 5-40-90 was adopted in 2007.
[31] K.A.R. 5-40-100/101/102 were adopted in 2007.
[32] K.A.R. 4-40-105 was adopted in 2007.

therefore, confusion is created as to the inspection and oversight process due to the duplicative efforts of oversight."[33]

Citation and Title – Entire Section should be as Follows
[Statute] Law regarding dam safety and inspection is found in Maine Revised Statutes Title 37-B "Defense, Veterans and Emergency Management" sections 1111-1131, Chapter 24 "Dam Safety."
[Rules/Regulations] Additional regulations pertaining to dams and reserviors are found under Regulations, Department of Agriculture, Conservation and Forestry, Agriculture General, Chapter 375. "Determination of the Safety and Sufficiency of a Dam or Reservoir," C.M.R. 01-001 Ch. 375, § 1 through 5.
[Administrative Agency] The Department of Defense and Veterans Services and Emergency Management ("department"); Maine Emergency Management Agency (MEMA); Department of Agriculture, Conservation and Forestry (DACF)

Inspection Process – Change Similar Sentence to Below
The inspector shall conduct an investigation of: all significant hazard potential dams, at least once every 6 years; (b) all of high hazard potential dams, at least once every 6 years; (c) any dam, within 60 days of a request for an inspection from the dam owner or the municipality in which the dam is located; and (d) at any time any dam that may, in the judgment of the commissioner, constitute a potential risk to public safety. 37-B M.R.S. § 1119.[34]

> **Add to End**
> The Department of Agriculture, Conservation, and Forestry can conduct inspections, safety assessments, and make repair recommendations to dam owners when a dam is deemed to be unsafe. C.M.R. 01-001 Ch. 375, § 1. The regulations specifically define when a dam is "unsafe

Jurisdiction/Powers of the Department – Add to End
The Department of Agriculture, Conservation, and Forestry has the power to make recommendations for specific repairs to a dam when it is found to be "unsafe or dangerous to the lives or property of persons residing, carrying on business, or employed near or below the same." C.M.R. 01-001 Ch. 375, § 1. Such a finding of unsafe conditions is found through inspections.

Maryland

Owner Non-Compliance/Violations/Penalties – Change Similar Sentence to Below
The law states that any person who violates the provisions of any administrative order is guilty of a misdemeanor. Upon conviction, the violator is subject to a civil penalty not

[33] The Department of Defense and Veterans Services and Emergency Management and the Maine Emergency Management Agency had regulatory powers over Dams in the State. However, C.M.R. 01-001 Ch. 375, § 1 gives power to the Department of Agriculture, Conservation and Forestry (DACF) to conduct inspections and make recommendations to dam owners.
[34] 37-B M.R.S. §1119 was amended in 2013. Formerly, significant hazard potential dams were to be inspected every 4 years, high hazard potential dams every 2 years, and inspection requests from dam owners were to be performed within 30 days.

exceeding $5000 per day for each offense, or imprisonment not exceeding one year, or both, with costs imposed in the discretion of the court.[35] Futher details regarding criminal sanctions are found under M.E.C. § 9-343.

Add to Section
The Department has the power to hold investigatory hearings and issue subpoenas to. M.E.C. § 5-516.[36]

Massachusetts

Owner Non-Compliance/Violations/Penalties
Delete "No fines are cited in teh laws or rules" and **Add** "Any person performing substantial repairs without complying with sections 44 to 48A of the Massachusetts Statues, or who fails to comply with the provisions of this chapter or of any order, regulation or requirement of the department relative to dam safety, shall be fined an amount not to exceed $5000 for each offense, to be fixed by the court. M.G.L. 253 § 47.[37]

Nevada

Owner Non-Compliance/Violations/Penalties – Add to End
In addition, the State Engineer may, after notice and opportunity for a hearing, require a person who violates any provision, permit, order, or decision, to pay an administrative fine not to exceed $10,000 per day for each violation as determined by the State Engineer. N.R.S. § 535.200.[38] Furthermore, the State Engineer may seek injunctive relief to prevent the continuance or occurrence of any act that violates the statutes and regulations pertaining to dams. N.R.S. § 535.210.[39]

New Jersey

Summary – Add to End
New Jersey statutes have strict penalties for dam owners whom are non-complaint or commit statutory violations. Some penalties include (1) the issuance of direct orders from the department that are to be followed, (2) the filing of both monetary and injunctive civil actions, or (3) the levying of criminal or civil administrative penalties. N.J. Stat. § 58:4-6.

Jurisdiction/Powers of Department – Delete Entire Sentence
"The Commissioner, upon finding that a person has violated the Safe Dam Act … in accordance with subsection f. of this statute."

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[35] M.E.C. § 5-514 was amended in 2007 changing the fine penalties. Previously, fines could not exceed $500 per day. However, M.E.C. § 9-343 states that the maximum accrued penalty for first time violators is $25,000, and $50,000 for second time violators.
[36] M.E.C. § 5-516 was in 2007, giving the department the power to hold investigatory hearings and issue subpoenas evidence and witnesses.
[37] M.G.L. 253 § 47 was amended in 2013 to include the $5000 penalty provision. The former penalty was $500.
[38] N.R.S. § 535.200 was enacted in 2007. Formerly, there was no administrative fine cap specified in the statues.
[39] N.R.S. § 535.210 was enacted in 2007. Formerly, there was no stated power in the statues giving the State Engineer injunctive relief remedies.

Owner Non-Compliance/Violations/Penalties – Entire Section Should be as Follows
Whenever the Commissioner of Environmental Protection finds that a person has violated any provision of the "Safe Dam Act" or any other rule or regulation adopted pursuant thereto, the commissioner may (1) issue an order requiring any such person to comply with the commissioner's directive(s), (2) bring a civil action which can include an injunction, recovery of costs incurred from an investigation, compensatory damages for destruction of natural resources, and/or an order to restore the site in question to the maximum extent practicable, (3) levy a civil administrative penalty of not more than $25,000 for each violation per day, (4) bring an action for a civil penalty not to exceed $25,000 for each violation per day, or (5) petition the Attorney General to bring a criminal action. All penalties collected pursuant to N.J. Stat. § 58:4-6 shall be deposited in the "Environmental Services Fund.[40]"

New Mexico

Definitions/Dam Classifications – Make these Specific Changes to First Sentence of Paragraph
Delete "more than 10 feet in height" and **replace with** "twenty-five feet in height or more." **Delete** "more than 10 acre-feet of water" and **replace with** "fifty acre-feet of water or more."

At end of first sentence, add: "Dams less than six feet in height regardless of storage capacity or Dams with storage capacity of fifteen acre-feet or less of water, regardless of height, are exempt from state authority."[41]

New York

Inspection Process
Just before the sentence starting with "If a dam is classified as unsafe or unsound…"
Add "The Department must send an inspection report for any intermediate or high hazard dam within 30 days to all chief executive municipal officers of municipalities located within the county in which the dam is located." E.C.L 15-0515[42]

North Carolina

Definitions/Dam Classifications – Make Changes as Described Below
Delete first sentence and write: "*Dam*" means a structure and appurtenant works erected to impound or divert water. A dam must measure at least 25 feet in height or have an impoundment capacity of at least 50 acre-feet to be regulated under North Carolina statues.[43] Several criteria exist that exempt dams from North Carolina statutory regulations including dams constructed by the United States Army Corps of Engineers, or

[40] Formerly, New Jersey regulations allowed a maximum penalty of $5,000 per violation per day.
[41] N.M.S. § 72-5-32 was amended in 2009. Formerly, the statute held that New Mexico water law applied to dams which were "more than 10 feet in height or capable of impounding more than 10 acre-feet of water."
[42] E.C.L § 15-0515 was enacted in 2006.
[43] G.S. § 143-15.25A previously regulated dams that measured at least 15 feet in height or that had an impound capacity of at least 10 acre-feet.

dams constructed for agriculture use under the supervision of individuals whom have federal engineering job approval authority, as specified under G.S. § 143-215.25A(7).[44]

Ohio

Permit and Approval

After "The construction permit is valid for two years, but may be extended if the project warrants extension or if the Chief is satisfied that substantial effort has been made to complete the construction as approved." **Write**: "If a construction permit is to be extended, it must be made with a written request, provided that the request includes a revised construction cost estimate. An additional filing fee may be charged for construction permit extensions."[45] Additionally, the chief shall determine whether the revised construction cost estimate provided with the request exceeds the original construction cost estimate by more than twenty-five per cent. If it does exceed twenty-five per cent, the chief may require an additional surety bond to be filed so that the total amount of the surety bonds equal at least fifty per cent of the revised construction cost estimate."[46]

Recordkeeping – Add in Sentence at End of Section

An owner must notify the department in writing when the ownership of the dam is changing. O.R.C. § 1521.062.[47]

Oklahoma

Miscellaneous

After "The Oklahoma legislature created a Water Supply and Flood Impact Task Force to study and review the hydrological characteristics of certain waterways. This was an option to consider for those waterways under considerable strain and warranting additional protection." **Add**, "However, this Task Force is no longer in existence since OS § 110.20, the statute that created the Task Force, was repealed in 2007."

Inspections

After: "Periodic inspections of dams should be scheduled according to hazard classification as follows:" **Add:**

Significant or high hazard dams in an Unsatisfactory or Poor Condition: If a dam is in an unsatisfactory or poor condition (per Section 6 of the National Dam Safety Review Board's Guidelines for Updating 2008 National Inventory of Dams, as determined by the board) the Dam shall be inspected by a registered Professional Engineer at the expense of the owner at least every six months until such time the deficiencies have been corrected. (Rule 785:25-9-1(b)(4)).[48]

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[44] G.S. § 143-15.25A(7) was amended in 2013 to include the federal engineering job approval exemptions.
[45] O.R.C. § 1521.06 was amended in 2006 to include the construction permit extension requirements.
[46] O.R.C. § 1521.061 was amended in 2006 to include the provision requiring an additional surety bond included with a construction permit extension, if the request exceeds the original construction cost estimate by twenty-five per cent.
[47] O.R.C. § 1521.062 was amended in 2006 to include the requirement of owners to notify the department in the event of a change of ownership.
[48] Rule 785:25-9-1(b)(4) was added in 2013.

Add bold into sentence: "Unscheduled (non-periodic inspections, such as those conducted in response to a complaint or in emergency situations, **or after earthquakes within 50 miles of a dam that measure 5.0 or greater on the Richter magnitude scale**, shall be conducted by board staff."[49]

Pennsylvania

Summary [Pro] – Add to End

Pennsylvania has a well-categorized, well-defined fee and cost structure for permit application fees for new dam construction, the modification of existing dams, and the modification of the operation and maintenance of dams.

Fees and Costs – Entire Section should be as Follows

All fees, inspection costs, and any remedial work expenses are to be paid for by the owner. (DSE Act Section 5). The board is authorized to establish reasonable fees for application processing and periodic inspections, for the purpose of reimbursing state costs to administer these rules. Application for permits shall be submitted to the Department, in writing, on department-approved forms. (Rule 105.13) Dam permit application fees for new dam construction shall be based on the size and the hazard potential category as defined in 105.91 (relating to classification of dams and reservoirs). Please see the charts below:[50]

Application Fees for New Dam Construction	Hazard Potential Category	1	2	3	4
Size Category					
A		$26,500	$26,500	$26,500	$23,500
B		$19,000	$19,000	$18,500	$17,000
C		$10,500	$10,500	$10,000	$8,000

Staged construction requires an additional 90% of the appropriate fee for each additional stage beyond the initial stage of work proposed under this permit application, including any closure stage.

[49] Rule 785:25-9-1(d) was amended to include the provisions relating to earthquakes in 2013.

[50] Rule 105.13 was amended in 2013. Formerly, the statute held that each application for a permit would follow the following schedule: Class A - $3,000, Class B - $2,500, Class C - $1,500. Clearly, the revised statute includes substantially higher prices, and has different price schedules for new dam construction, existing dam modifications, and fees for the operation and maintenance of dams.

Application fees for modification of existing dams.	Hazard Potential Category	1	2	3	4
Size Category					
A		$18,500	$18,500	$18,500	$18,000
B		$12,000	$12,000	$12,000	$11,500
C		$7,500	$7,500	$7,500	$7,500

Staged construction requires an additional 85% of the appropriate fee for each additional stage beyond the initial stage of work proposed under this permit application, including any closure stage.

Application fees for modification of Operation and Maintenance of Existing Dams.	Hazard Potential Category	1	2	3	4
Size Category					
A		$12,500	$12,500	$12,000	$10,000
B		$10,000	$10,000	$9,500	$8,500
C		$7,000	$7,000	$6,500	$6,000

Rule 105.13 also specifies major dam design revision review fees, environmental assessment review fees, transfer of dam permit fees, annual dam registration fees, water obstruction and encroachment permit application fees.

Rhode Island

Summary – Entire Section should be as Follows

[Pros] The statutes state that the general assembly shall appropriate funds necessary to carry out the responsibilities under these sections. The State has statutory authorization to enter upon private or public property in order to carry out their duties under these provisions. The recordkeeping provisions are standard; requiring dam owners to be able to furnish to the department, upon request, pertinent information regarding dam safety. The Department of Environmental Management implemented a comprehensive set of

regulations in 2008. The regulations provide a comprehensive set of definitions. The regulations specify the process by which the director shall notify dam owners of the classification of a dam, and the regulations detail the process by which dam owners can make appeals to any department decision. The regulations go into detail concerning department and dam owners' responsibilities concerning the operation and maintenance of dams, and the repair and emergency repair of dams. The regulations specify a specific schedule regarding the inspection of dams. Any orders or notices issued by the director must be recorded in the city or town wherein the subject property is located.
[Cons] Dam inspection responsibilities lie primarily with the State. There are no fees assessed for dam safety program operation. The regulations discuss visual inspections and detailed inspections, but the regulations never mention when detailed inspections are to be performed. There is no clear Emergency Action Plan regarding the notification or warning of civilian populations in areas of risk from unsafe dams.

Citation and Title – Replace [Rules/Regulations] With
[Rules/Regulations] The Rules and Regulations for Dam Safety (25-6-1:1 through 25-6-1:17) are found under the Rhode Island Administrative Code, Title 25. Department of Environmental Management, Division 6. Compliance and Inspection.[51]

Operation and Maintenance – Add in Sentence at End
Any order or notice issued by the director shall be eligible for recordation. The director shall forward the order or notice to the city or town wherein the subject property is located and the order or notice shall be recorded in the land evidence records in the city or town wherein the subject property is located. Upon satisfactory completion of the requirements of the order or notice, the director shall provide written notice of the same, which notice shall be similarly eligible for recordation. The written notice of satisfactory completion shall be forwarded to the city or town wherein the subject property is located and the notice of satisfactory completion shall be recorded in the land evidence records in the city or town wherein the subject property is located.[52]

Definitions/Dam Classifications – Add
Hazard Potential: means a rating for a dam that relates to the probable consequences of failure or misoperation of the dam, which is a determination made by the Director based on an assessment of loss of human life, damages to properties or structures located downstream of the reservoir, or loss of use as a drinking water supply. This rating has no relationship to the current condition of the dam. A higher hazard dam does not imply that it is more likely to fail or be misoperated than a lower hazard dam.
Owner: means the person or persons, including any individual, firm, partnership, association, syndicate, company, trust, corporation, municipality, agency, political or administrative subdivision of the state or any legal entity of any kind holding legal title to a dam.
Person: A person maintaining or having control of a dam means the person or persons, including any individual, firm, partnership, association, syndicate, company, trust,

[51] Rhode Island Regulations regarding dams were first promulgated after 2006.
[52] G.L.R.I. § 46-19-4(c) was added into the statute in 2012.

corporation, municipality, agency, political or administrative subdivision of the state or any legal entity of any kind having authority to operate or maintain a dam.
Repair: means any work performed at a dam that may affect the integrity of the dam, including certain cutting or removal of trees where the resulting decomposition of the tree root system could jeopardize the integrity of the dam, work requiring excavation into the embankment fill or foundation of a dam, work requiring reinforcement of the embankment or work requiring removal or replacement of major structural components of a dam; or any related, new, temporary or permanent access way(s) that may be required within freshwater wetlands.
Spillway: means a structure, a low area in natural grade or any part of the dam which has been designed or relied upon to allow normal flow or major flood flow to pass over or through while being discharged from a reservoir.

After Definitions, but Before High Hazard Definition, Add:
The department shall classify each regulated dam as a high hazard, significant hazard dam, or low hazard dam. The Director shall send notice of the proposed classification to the registered owner of the dam. The dam owner may contest the proposed classification pursuant to Rule 15 of these Rules and Regulations. The Director shall maintain a list of all classified dams and shall make a list available to the public. The Director shall examine each regulated dam as often as he or she shall deem necessary to assess whether the dam warrants reclassification. Any person may petition the Director for reclassification of a dam. The petition must be in writing and must include a written report prepared by a qualified engineer that details the findings and analyses that support the engineer's opinion that the dam should be reclassified. R.A.C. § 25-6-1:9.[53]

Recordkeeping – Add to End
Under R.A.C § 25-6-1:8, owners of regulated dams must notify the Director and the local municipality's emergency management authority, of the transfer of legal title of a dam, or any change in contact information no later than 30 days after such a change. The director shall then issue a certificate of registration with the proper owner's contact information.

Operation and Maintenance – Entire Section should be as Follows
The owner of a regulated dam, upon written request from the Department, shall make available to the Director, all the existing surveys, plans, drawings and reports related to the dam, in possession of or available to the owner, that may be required by the Director for the purposes of dam safety, and the owner of a regulated dam, upon written request from the Department, shall prepare all the necessary surveys, plans, drawings and reports related to the dam that may be required by the Director for the purposes of dam safety. R.A.C. § 25-6-1:8. R.A.C. § 25-6-1:10 specifies the procedures for maintaining a high or significant hazard dam, the procedures for the repair of high or significant hazard dams, the procedures for the emergency repair of high or significant hazard dams, the procedures for the review of applicants, the Director's requirements for applicants to provide public notice to the municipality that the dam is located in, and the specifications regarding the modification, suspension, or revocation of approval. Regarding the

[53] R.A.C. § 25-6-1:9, enacted after 2006, mandated the requirement for the director to notify dam owners of their hazard classification, and allowed for owners to contest their hazard classifications.

procedures for maintaining a high or significant hazard dam, maintenance (except for certain cutting or removal of trees) does not require an approval from the Department. The regulations do state certain stipulations and exemptions regarding the removal of trees and shrubs near dams, and the best maintenance practices in relation to erosion, sediment controls, and the protection of water and wetland quality. Regarding the procedures for the repair of high or significant hazard dams, dam owners must submit a written application for repair of a high hazard dam or significant hazard dam directly to the Department's Dam Safety Program. The application must include variety of specifications including a written justification of the work, three sets of plans and specifications for the proposed work that have been verified by an engineer, and other specifications as detailed in R.A.C. § 25-6-1:10. Regarding emergency repair approval, The Director may grant verbal approval of an emergency repair if the owner maintaining the dam explains the problem necessitating an emergency repair and specifies the reason why the problem represents an imminent threat to public safety. If the verbal request is approved, the dam owner must submit a report, and other documentation, not later than thirty days following the emergency repair. R.A.C. § 25-6-1:10. Regarding the procedures for the review of applicants, the Department may use a variety of criteria and manuals, including, but not limited to, resources from the United States Army Corps of Engineers, the United States Department of Agriculture, and the United States Department of Energy. The Director may request documentation from the dam owner, may issue an approval with certain stipulations, or deny the application for failure to satisfy the director's requirements or for a failure to provide adequate documentation. Rhode Island's Freshwater Wetlands Act and Water Pollution Act require the director to protect freshwater wetland values and water quality. Thus, dam owners should recognize the Director's responsibilities and plan repair projects to minimize negative impacts to fresh wetlands and water quality values. Dam owners must adhere several requirements as specified in R.A.C. § 25-6-1, Appendix I.

Inspection Process
Delete: "The laws make no mention of the owner's inspection or the frequency thereof."
And replace with: "Regulated dams shall be inspected in accordance with the following schedule.

Hazard Classification	Minimum Inspection Frequency	Type of Inspection
High	2 years	Visual
Significant	5 years	Visual
Low	5 years	Hazard Classification Assessment

These time periods are the maximum time between inspections and more frequent inspections may be performed at the discretion of the director.

The Director shall periodically perform or require the owner to perform a visual inspection of all high hazard dams and significant hazard dams. The Director will notify the owner by certified letter in the event that the Department will require the owner to

perform a visual inspection of the dam. The owner must then retain a qualified engineer to perform a visual inspection of the dam. Visual inspection by a qualified engineer must be completed within sixty (60) days following receipt of notification from the Director. Whenever the findings of the visual inspection reveal, in the opinion of the Director, that the dam may be unsafe, the owner shall be required to retain a qualified engineer to perform a detailed investigation of the dam and to provide a schedule by which any work needed shall be accomplished. The owner shall be responsible for completing all work required by the Director and in a reasonable time frame required by the Director. Any person who has cause to believe that an unsafe dam exists may make a request to the Director to inspect the dam. If the director believes a probable risk exists concerning human life or major economic loss, then the Director shall perform a visual inspection of the dam to determine its safety. Visual inspections, conducted by qualified engineers or department dam engineers shall include an assessment of the condition of the major components of the dam (embankments, spillways, low level control structures) and rate these components as *good, fair, or poor.* The regulations specify the requirements for "detailed inspections," but the regulations are unclear as to when detailed inspections are to occur. R.A.C. § 25-6-1:10."

Emergency/Emergency Action Plans – Entire Section should be as Follows
The Director may, pursuant to R.I. Gen. Laws Section 42-17.1-2(u), issue an immediate compliance order stating the existence of the unsafe condition and the action deemed necessary to correct the unsafe condition. The Director may order the water in the reservoir to be drawn off, in whole or in part. The immediate compliance order shall become effective immediately upon service or within such time as is specified by the Director in such order. Any emergency action taken by the owner or person maintaining or having control of a dam shall immediately be reported by the dam owner to the Director and the municipality(s) in which the dam and reservoir lies. The owner or person maintaining or having control of a dam shall also report, by telephone within twenty-four (24) hours and in writing within three (3) days, the emergency action taken. If water has been drawn off or the dam has been altered pursuant to an order by the Director, the reservoir shall not be refilled without approval of the Director. R.A.C. § 25-6-1:12. The dam safety regulations do not specifically address emergency procedures or emergency action plans for populations or communities whom may be at risk to unsafe dams.

Oversight – Entire Section should be as Follows
Within thirty (30) days of the receipt of a decision from the Department regarding an application for repair of a dam or hazard classification of a dam, the owner may request an adjudicatory hearing to appeal the decision, or portions thereof. The request for an adjudicatory hearing must be in writing, must comply in form and content for such requests as required by the "Administrative Rules of Practice and Procedure for the Administrative Adjudication Division for Environmental Matters", and must be filed directly with the Administrative Adjudication Division (AAD) of the Department. A copy of such request must also be forwarded to the Dam Safety Program. A request for an adjudicatory hearing automatically stays any contested approval issued for repair of a dam. It shall be the dam owner's burden to demonstrate by a preponderance of the evidence that the application as proposed or hazard classification is consistent with the purposes of the law, complies with these Rules and Regulations and protects the public,

real property and natural resources. R.A.C. § 25-6-1:15. [54]

Texas

Jurisdiction and Powers of the Department – Add to End

The Commission has specific regulations concerning hydrologic and hydraulic dams. (T.A.C. § 299.15)

Definitions/Dam Classifications

Add immediately before size classification: "Texas regulations apply to any dam that (1) has a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet, or (2) has a height greater than six feet and a maximum storage capacity greater than or equal to 50 acre-feet, or (3) is a high or significant hazard dam regardless of height or maximum storage capacity, or is used as a pumped storage or terminal storage facility. T.A.C. § 299.1.[55] The commission shall exempt an owner of a dam located on private property from meeting requirements relating to dam safety if the dam (1) impounds, at maximum capacity, less than 500 acre-feet, (2) has a hazard classification of low or significant, (3) is located in a county with a population of less than 350,000, and (4) is not located inside the corporate limits of a municipality.[56]

Abandon--The owner no longer maintaining a dam for a period of ten years, or refusing to maintain the dam.

Professional Engineer--An individual licensed by the Texas Board of Professional Engineers to engage in the practice of engineering in the state of Texas, with experience in the investigation, design, construction, repair, and maintenance of dams.

Hazard Potential - Hazard classification--A measure of the potential for loss of life, property damage, or economic impact in the area downstream of the dam in the event of a failure or malfunction of the dam or appurtenant structures. The hazard classification does not represent the physical condition of the dam.

Owner--Any person who can be one or more of the following:

(A) Holds legal possession or ownership of an interest in a dam;

(B) Is the fee simple owner of the surface estate of the tract of land on which the dam is located if actual ownership of the dam is uncertain, unknown, or in dispute unless the person can demonstrate by appropriate documentation, including a deed reservation, invoice, bill of sale, or by other legally acceptable means that the dam is owned by another person or persons;

(C) Is a sponsoring local organization that has an agreement with the Natural Resources Conservation Service for a dam constructed under the authorization of the Flood Control Act of 1944 (as amended), Public Law 78-534, the Watershed Protection and Flood Prevention Act, 1954 (as amended), Public Law 83-566, the pilot watershed program under the Flood Prevention of the Department of Agriculture Appropriation Act of 1954, Public Law 156-67, or Subtitle H of Title XV of the Agriculture and Flood Act of 1981,

[54] Rhode Island statutes formerly held that individuals contesting orders of the department would have their cases heard in the supreme or superior court.

[55] T.A.C. § 299.1 was adopted in 2009. Before 2009, there was no "minimum floor" set for the regulation of dams.

[56] TWC § 12.052 was amended in 2011 to include these exemption provisions.

the Resource Conservation and Development Program; or
(D) Has a lease, easement, or right-of-way to construct, operate, or maintain a dam.
Repairs--Any work done on a dam that may affect the integrity, safety, and operation of the dam, including, but not limited to:
(A) Excavation into the embankment fill or foundation of a dam; or
(B) Removal or replacement of major structural components of a dam or appurtenant structures.
Spillway--An appurtenant structure that conducts outflow from a reservoir.

Permit/Approval Process
Before second to last sentence of paragraph that begins with "Dam removal shall be at the owner's expense, and except for emergencies…", **Add:** "The commission may enter into an agreement with an owner of a dam whom is required to reevaluate the adequacy of an existing dam or spillway. The agreement may include timelines to achieve compliance with the commission's design criteria and may authorize deferral of compliance with the criteria, as appropriate. TWC § 12.052. [57]

Add after first sentence, "The executive director may require the owner to obtain the services of an independent team of professional engineers or other dam experts, at the owners expense, to determine the adequacy of the design, construction, or operation of the dam if safety considerations warrant an independent review. The executive director shall submit the requirements in writing to the owner and shall provide a list of engineers and other dam experts. The owner shall submit the qualifications and size of the team to the executive director for any comments prior to beginning the independent review. T.A.C. § 299.3. When an owner submits an application for a water rights permit to either construct a dam, reconstruct, modify, enlarge, rehabilitate, alter, or repair an existing dam, or authorize an existing dam without making any changes to the dam, the owner shall submit the following: (1) a conceptual design of the construction for a proposed dam and appurtenant structures, or proposed reconstruction, modification, enlargement, rehabilitation, alteration, or repair of an existing dam; (2) the geotechnical, hydrologic, and hydraulic reports for the proposed site, if the reports have been completed; and (3) other pertinent information on an existing dam using a form provided by the executive director. (4) The executive director shall provide a technical review of these documents as described in § 281.19 of this title (relating to Technical Review). T.A.C. § 299.3.[58]

Add at very end of Section: "The executive director may grant an exception if the executive director determines that the physical conditions involved or consequences of potential failure, when evaluated using accepted engineering practices, make the requirements unnecessary. The exceptions refer to: (1) professional engineering requirements (T.A.C. § 299.4), (2) Review and Approval of Construction Plans and Specifications (T.A.C. § 299.2), (3) Maintenance of Construction Records (T.A.C. § 299.23), (4) Construction Progress Reports (T.A.C. § 299.24), (5) Construction Inspection (T.A.C. § 299.25), (6) Construction Change Orders (299.26), (7) Deliberate

[57] TWC § 12.052 was amended in 2011 to include the provision of commission discretion over compliance timelines or the deferral of compliance.
[58] T.A.C. § 299.3 was adopted in 2009.

Impoundment (T.A.C. § 299.28), (8) Record Drawings (T.A.C. § 299.30), (9) Permanent Reference Mark (2 T.A.C. § 99.31).[59]

After the sentence starting with "Hydrologic evaluations shall be conducted from 'time to time'…" **Write**, "The executive director shall evaluate the hydrologic and hydraulic adequacy of the dam and spillways using the criteria, in the most current version, of the agency's Hydrologic and Hydraulic Guidelines for Dams in Texas. T.A.C. § 299.11. All hydrologic and hydraulic dams must conform to the Commission's minimum design flood hydrograph criteria. T.A.C. § 299.15."

Recordkeeping – Add to End
When there is a change in dam ownership, the current owner shall include notification to the new owner in the transaction that the new owner shall notify the executive director in writing within 90 days following the transaction and provide certain information detailed in T.A.C. § 299.6.
The executive director shall maintain an inventory of dams that includes information on ownership, physical dimensions of the dam, hazard classification, normal and maximum storage capacity, use of reservoir, including the water rights permit, inspection date, location, and conditions of the dam. TAC § 299.7.

Vermont

Summary [Cons]
Add, "Vermont regulations only require large or high hazard dams to be inspected every five years, and medium or significant hazard dams to be inspected every 10 years."
Delete, "Vermont has not promulgated any regulations on dam safety, governing dam safety via the Vermont Statues Annotated."

[Rules/Regulations] Vermont Administrative Code, Title 16. Agency of Natural Resources, Subtitle 3. Department of Environmental Conservation, Environmental Protection Rule, Chapter 28. Unsafe Dam Revolving Loan Fund Rules. Rule 16-3-701:28-101 through 303, and Title 18. Public Service Board, Subtitle 1. General, Safety of Hydroelectric Dams, Rule 18-1-13:4.500 through 540.[60]

Program Funding – Add at Very End of Section
10 V.S.A. § 1106. Concerning the Unsafe Dam Revolving Loan Fund, Vermont regulations dictate the application process, the eligibility for financing, the selection process, financing, the disbursement of funds, and the repayment details. V.A.C. § 16-3-701:28-101 through 303).[61]

Inspection Process – Entire Section Should be as Follows
Safety inspections are required for all Dams in Vermont that are (1) more than twenty-five feet in height above the streambed, or (2) that have a gross storage capacity of more

[59] The exemption provisions are new Texas regulations of dams as of 2009.
[60] Vermont regulations regarding dams were adopted in 2014.
[61] Vermont regulations concerning the Unsafe Dam Revolving Loan Fund were adopted in 2014.

than 750 acre-feet, or (3) any dam with a significant or high hazard potential rating, or (4) any other dam specified under V.A.C. § 18-1-13:4.520 of the Vermont regulations. Inspection reports must be filed to the DEC every five years for large or high hazard dams, and every ten years for medium or significant hazard dams. The regulations specify the inspection requirements to be fulfilled when an inspection is conducted. All inspections are to be completed by independent consultants. The criteria for proper independent consultants are specified in the regulations. The Board may grant an exemption from the requirement for inspections in extraordinary circumstances that clearly establish good causes for exemptions. However, the Board shall conduct a review of the exemptions every five years to determine if such extraordinary circumstances still exist. Dams inspected by the Federal Energy Regulatory Commission are exempt from state inspections so long as the owner of the dam files a copy of the inspection report to the DEC. V.A.C. § 18-1-13:4.520.[62]

Operation and Maintenance – Add to End

An owner or operator shall report to the Board by telephone any condition affecting the safety of a dam as soon as practicable after that condition is discovered, without interfering with any necessary or appropriate emergency repair, alarm, or other emergency action. The regulations stipulate what constitutes a "condition affecting the safety of a dam." A written report should be delivered to the board after an oral report has been made. The written report should be submitted within thirty days of the oral report. The Board may order the owner or operator to take action reasonably required to correct the condition or conditions reported, or the Board may retain a consultant to inspect the dam. V.A.C. § 18-1-13:4.540.[63]

Emergencies/Emergency Action Plans – Add to End of Section

If, in the course of an inspection, an independent consultant discovers any condition for which emergency corrective measures are advisable, the independent consultant shall immediately notify the owner or operator, and the owner or operator shall report that condition to the Board and take corrective action as required. V.A.C. § 18-1-13:4.531. Not later than sixty days after the report of the independent consultant is filed with the Board, or fifteen days in the case of emergency corrective measures reported pursuant to 4.531, the owner or operator shall submit to the Board two copies of a plan and schedule for designing and carrying out any corrective measures that the owner or operator proposes. The owner or operator shall complete all corrective measures in accordance with the plan and schedule submitted to the Board, as approved or modified by the Board. V.A.C. § 18-1-13:4.532.[64] Concerning Emergency Action Plans, the owner or operator of any dam which is required to maintain an emergency action plan by the Federal Energy Regulatory Commission shall file a copy of the Commission's approval letter to the Board for its most recent plan. The owner of a dam which is classified as high or intermediate hazard, but which is not required by the Federal Energy Regulatory

[62] V.A.C. § 18-1-13:4.520 was adopted in 2014. Previous Vermont law concerning inspections required high hazard dams to be inspected every year, significant hazard dams to be inspected every 1-3 years, and low hazard dams to be inspected every 5-10 years.
[63] V.A.C. § 18-1-13:4.540 was adopted in 2014.
[64] V.A.C. § 18-1-13:4.531 and 4.532 were adopted in 2014.

Commission to maintain an emergency action plan, may be required by the Board to develop a plan to protect lives and property downstream. Any plan so developed shall be filed with the Vermont Emergency Management Division. V.A.C. § 18-1-13:4.540.

Virginia

Definitions/Dam Classification – Add to End

If a dam owner believes conditions downstream have changed which reduce the risk of a possible dam failure, the owner may request a simplified dam break inundation analysis to determine if the dam can be classified as a low hazard potential. C.V. § 10.1-604.1[65]

Operations and Maintenance

Add to End: The owner of an impounding structure shall prepare a map of the dam break inundation zone for the impounding structure in accordance to Virginia regulations, and the map must be filed with the Department of Conservation and Recreation and with the offices of plat and plan approval authority located within locality in which the dam break inundation zone resides. C.V. § 10.1-606.2.[66] Virginia regulations stipulate that structures built before July 1, 2010, or structures classified as high hazard before July 1, 2010, are exempt from current spillway upgrade requirements (current spillway requirements hold that a dam must pass 90 percent of a probable maximum precipitation). Instead, these exempt dams are to be in compliance they pass 2/3 of a probable maximum precipitation event. C.V. § 10.1-605[67] Developers must notify a dam owner and the Department of Conservation and Recreation of a proposed development within the dam's dam break inundation zone. If the development alters the dam's hazard status, the developer cannot build unless the development plan is altered so that the classification is not affected. C.V. § 10.1-606.3.[68] Prior to the dissolution or termination of an entity that owns an impounding structure, the entity must convey ownership of the impounding structure to a third-party or decommission the impounding structure.

Recordkeeping – Add to End

Prior to conveyance, the owner must notify the Director of such a transfer, and the owner must verify that the transferee is capable of discharging the obligations of the impounding structure. C.V. § 10.1-63.4.[69]

Oversight – Add to End

At each meeting of the Board, the Director shall identify those impounding structures that are currently classified as high hazard and determined noncompliant with the spillway requirements of the Board's Impounding Structure Regulations (4 V.A.C. § 50-20) or with statutory stipulations concerning exempt dams under C.V. § 10.1-605.[70]

Permit and Approval Process

[65] C.V. § 10.1-604.1 was enacted in 2011.
[66] C.V. § 10.1-606.2 was enacted in 2008.
[67] C.V. § 10.1-605 was amended in 2011 to include the dam exemption.
[68] C.V. § 10.1-606.3 was enacted in 2008.
[69] C.V. § 10.1-613.4 was amended in 2014 to include the stipulations regarding dam conveyance.
[70] C.V. § 10.1-605.1 was amended in 2011 to include the provisions stated above.

After "… plans and specifications which must be developed in accordance with Reg. 4VAC50-20-310." **Add,** "An applicant, who is applying for a permit to construct a new high or significant hazard potential, impounding structure, must provide copies of the construction permit request and the dam break inundation zone map to the localities that lie within the inundation zone. The applicant shall publish a notice in a newspaper of general circulation in the affected localities. The Department may hold public hearings pertaining to safety issues associated with potential construction and existence of the proposed dam. The applicant also must send the permit request and location of the map inundation to each address in the inundation zone. C.V. § 10.1-606.4."[71]

> **Add to End:** The Board shall develop general permits for the regulation of low hazard potential impounding structures. In order for a general permit to be issued, the impounding structure must be engineer certified, have a 100-year spillway design flood requirement (or when meeting certain stipulations, a 50-year spillway design flood requirement), and have an approved emergency preparation plan. C.V. § 10.1-605.3.[72]

Program Funding – Add to End
Owners of impounding structures may be eligible for matching grants of up to 50 percent from the Dam Safety, Flood Prevention and Protection Assistance Fund and other sources of funding available to the Director to assist in the development of dam break inundation zone maps and for conducting incremental damage assessments in accordance with the Virginia Impounding Structure Regulations. C.V. § 10.1-606.2.[73]

Liability and Immunity – Add to End
The owner of the land upon which an impounding structure owned, maintained, or operated by a soil and water conservation district is situated shall not be responsible for liability for damages to the property of others or injury to persons, including the loss of life, resulting from the operation or failure of the impounding structure unless the damages are the result of an act or omission of the landowner that is unrelated to ownership, maintenance, or operation of the impounding structure. C.V. § 10.1-613.4.[74]

West Virginia

Summary [Pro]
After "… remedial emergency action and enforcement of the provisions of this article." **Add**, "The Dam Safety Rehabilitation Revolving Fund was established for the purpose of making federal loans to persons who own an interest in a deficient dam to help finance design, repair, and removal projects."

Program Funding – Add to End
There is also a Dam Safety Rehabilitation Revolving Fund which is comprised of money

[71] C.V. § 10.1-606.4, which specifies the public notification requirements of dam construction applicants, was enacted in 2008.
[72] C.V. § 10.1-05.3 was enacted in 2011.
[73] C.V. § 10.1-606.2 was enacted in 2008.
[74] C.V. § 10.1-613.4 was amended in 2014 to include the provisions regarding landowner immunity.

allocated to the state by the federal government for the purposes of making loans to persons who own an interest in a deficient dam to help finance the engineering, design, alteration, improvement, repair, breaching or removal of the deficient dam. However, such actions taken must be authorized by a federal grant, legislative appropriation, or by the secretary. C.W.V. § 22-14-19.[75]

Emergencies/Emergency Action Plans
After " d. Taking any other steps necessary to safeguard life and property.", **Add,** "Additionally, the secretary may assume full charge and responsibility over any deficient dam, and may expend money from the Dam Safety Rehabilitation Revolving Fund for the purpose of repair or removal of the dam or other remedial action if (1) the dam is deficient; (2) the dam is privately owned; and (3) the owner is noncompliant. C.W.V. § 22-14-22."[76]

Wisconsin

Right of Entry – Entire Section Should be as Follows
Any member, agent or employee of the department can at all times be accorded access to any dam and may enter upon any property to investigate a dam, waterway, or use of water from any lake or stream. W.S. § 31.02.[77]

[75] C.W.V. § 22-14-19 was enacted in 2007.
[76] C.W.V. § 22-14-22 was enacted in 2008.
[77] W.S. § 31.02 amended after 2006 to include the right of entry provision for department officials. There was previously no statute giving department officials right of entry before this amendment occurred.

APPENDIX 3

List of Interviewees

William Aila, Chair, BLNR
Adam Asquith, Sea Grant, UH
Cat Awakuni, former PUC General Counsel
Giorgio Calderone, Kamehameha Schools
Meredith Ching, A&B
Derek Chow, U.S. Army Corps of Engineers
Nelson Chun, A&B
Dave Craddick, former Maui and Kauai Departments of Water Supply
John Cross, Ed Olson Trust
Donovan Dela Cruz, Hawaii State Senate
John Dolley, Dam Safety Program, DLNR
Ka'eo Duarte, Kamehameha Schools
Harold Edwards, ITC Management
Scott Enright, Chairman, BOA
Sumner Erdman, Ulupalakua Ranch
Mark Fox, Nature Conservancy
Robert Godbey, Special Attorney General Ka Loko Dam Investigation
Alan Gottleib, Hawaii Cattleman's Association
Howard Green, Attorney and Dam Owner
Lisa Hadway, Division of Forestry and Wildlife, DLNR
Neil Hannahs, Kamehameha Schools
Warren Haruki, Grove Farm and Maui Land and Pine
Bert Hatton, Waiahole Water Company
Garret Heu, East Maui Irrigation
Jason Hines, Joule Group
Lea Hong, Trust for Public Lands
Dawn Huff, Joule Group
Landis Ignacio, Kekaha Agricultural Association
Yvonne Izu, Attorney
Larry Jefts, Farmer
Sam Lemmo, Office of Conservation and Coastal Lands, DLNR
Jimmy Leung, Dam Safety Office, DLNR
Chris Kanazawa, USDA, Rural Development
Ken Kakesako, DOA
Pualani Kanahele, Edith Kanakaole Foundation
Brian Kau, Agricultural Resource Management Division, DOA
Nolan Kawano, Island Holdings
Imi'ola Lindsay, Kamehameha Schools
Chris Manfredi, Hawaii Farm Bureau
Denise Manuel, Dam Safety Program, DLNR
Edwin Matsuda, Dam Safety Program, DLNR
Mina Morita, Public Utilities Commission Chair

Issac Moriwake, Earthjustice
George Morvis, A&B
Alan Murakami, Native Hawaiian Legal Corp
Mae Nakahata, A&B/HC&S
Dean Nakano, Brown and Caldwell
Jimmy Nakatani, Agribusiness Development Corp
Tom Nance, Engineer
Dan Nellis, Dole Hawaii
Tom Ochwat, Maui DWS
Mark Ogden, Association of State Dam Safety Officials
Dean Okimoto, Nalo Farms
Jon Okudara, Consultant
Jerry Ornellas, East Kauai Irrigation
Alan Oshima, Attorney
Paul Oshiro, A&B
Jeff Pearson, Maui DWS
Pauline Sato, Malama Learning Center
Harry Saunders, Castle and Cooke
Dan Sargent, McBryde Properties, A&B
Kapua Sproat, UH Law School
Paul Subrata, Maui Land and Pine
William Tam, Deputy Director, DLNR
Dave Taylor, Maui Department of Water Supply
Mike Tresler, Grove Farm
Barry Usagawa, Board of Water Supply
John Wherheim, Kauai hydro power developer
Mark Vaught, A&B/HC&S
Carol Wilcox, Sugar Water Author, Community Activist
Daryl Yagodich, DHHL
Gerry Yoshida, Attorney
Nalani Kanakaole Zane, Kumu Hula