**LAMAG | The Future as Index_Indexing the Future_Storage, Value and Water Management in Los Angeles Talk**

OK, welcome, everyone. My name is Jamie Costa. My pronouns are she, her, hers, and on behalf of the Los Angeles Municipal Art Gallery, we are thrilled to present today's program titled The Future As an Index, Indexing the Future-- Storage, Value, and Water Management in Los Angeles, with Nadia Christidi.

This program is inspired by the newly-commissioned public artwork by Alexandre Dorriz, and is currently available online at lamag.org through April 22. Before I introduce Nadia, I have a few housekeeping bits.

First, please make sure your microphone is muted during the speaker's presentation. We'll also have a few minutes toward the end of the program for Q&A, so if you have any questions, please answer them directly in the chat box. Or if you feel more comfortable and would like to take yourself off mute, you may do so at that time.

And with that, I'm pleased to introduce Nadia Christidi. Nadia Christidi is a researcher, writer, and arts practitioner based between Cambridge and Beirut. Nadia is currently a PhD candidate in history, anthropology, and science, technology, and society at MIT, where she researches how cities that faced water supply challenges-- which are expected to intensify with climate change-- are imagining, planning, and preparing for the future of water.

The cities she focuses on our Los Angeles, Dubai, and Cape Town. Nadia's work has been exhibited at Beirut Art Center, SALT Galata, Istanbul, SALT Ulus, Ankara, and the Kunsthaus Hamburg. And published by ArtEast and ArtAsiaPacific. She was recently awarded a research and writing residency with the Jameel Art Centre in Dubai, for which she developed public programming and a publication-- which is forthcoming-- on Dubai's water resources and water management cultures.

Nadia holds an MA in historical studies from the New School for Social Research New York and a BA in History of art from Bryn Mawr College, Pennsylvania. And with that, I'm going to put myself on mute and turn it over to you, Nadia.

I always forget about that. Thanks so much for the introduction, Jamie, and thanks as well to you and the Los Angeles Municipal Art Gallery for organizing this event. Many thanks to Alex for giving me the chance to present my work in progress and my research in progress. I'm excited to have an opportunity to be in conversation with Alex's exhibition, which is something I've tried to do here by looking at my own research interests through conceptual threads that I see running in his show.

So I'll jump right in. In this talk, I consider different forms of water storage and value in the city of Los Angeles, and how these are being transformed by climate change and its effects on long-established water systems. And I do this through the form of the index. The term index has various meanings and manifestations in the world.

First, there's index as a literary form or writing genre, an alphabetically ordered list of subjects and objects that appears at the end of a book and provides through associated page numbers a skeletal map of the text that it refers to. Second, there's index as an indicator or measure of something else. We might say or hear of something that indexes something else.

And third and finally, there's index as a financial form or tool that indicates the value of an asset or group of assets at a particular time, and that's taken to indicate the climate of a market, or sometimes the economy as a whole. For context, and especially for those in attendance not familiar with Los Angeles and its water supply, since 1913, the city of Los Angeles has come to increasingly rely on imported water from three long-distance conveyance systems.

These are the Los Angeles Aqueduct, which transports water from the Owens Valley and Mono Basin in the foothills of the Eastern Sierra Nevada Mountains; the Colorado River Aqueduct, which transports water from Lake Havasu, where the Colorado River is impacted at the Arizona-California border; and the California Aqueduct, which transports water from the Sacramento-San Joaquin river delta in northern California.

While the Los Angeles Aqueduct is owned and operated by the city of LA's utility, the Los Angeles Department of Water and Power-- or LADWP-- water from the Colorado River Aqueduct and the California Aqueduct is supplied to LADWP by the Metropolitan Water District of Southern California. Metropolitan Water District is a regional wholesaler of water that provides water to 26 member agencies. LADWP is one of Metropolitan's member agencies, and has significant representation on its board of directors.

So the amount that each of these three water systems that I mentioned contributes to LA water supply mix varies from year to year, depending on environmental conditions. In wet years, LA's dependence on the LA Aqueduct is quite significant, while in dry years, LA relies more on imports from Metropolitan's aquifer systems and other sources, like groundwater.

But generally, and over the last five years, imported water supplies have contributed an average of 89% of LA's total water supply. The remaining 11% was met largely by local groundwater, with a small contribution from recycled water. But water from these three long-distance conveyance systems is becoming less reliable. Stricter environmental regulation is requiring the extraction of less water from source environments, like the Owens Valley and Mono Basin.

There are growing competing demands over shared resources, like the Colorado River, and climate change is transforming the nature of water supply. This unreliability, sorry-- is not new. Some environmental regulation dates back 30 years, but it is a situation that has become increasingly acute with the growing recognition of the impacts of climate change.

Climate change projections for the US Southwest, including LA, spell extreme hydrological variability, and what's known as climate whiplash-- so alternations between more frequent and longer periods of intense droughts and more rain falling in very concentrated storms. This poses a serious challenge for existing infrastructures and built environment, and will likely force rethinking of established approaches.

As architects and co-founders of the Arid Lands Institute, Hadley Arnold and Peter Arnold, describe this, 20th century water infrastructures were designed based on assumptions of hydrological stationarity, which saw precipitation as fluctuating, but within parameters that remained unchanging. Large-scale structures like LA's water conveyance systems were designed with these parameters in mind.

The challenge we now find ourselves faced with is that projected climate variability or volatility outlies these historical parameters. So in my work, I'm interested in, as a UCLA Institute of the Environment and Sustainability report puts it, how infrastructures will be redesigned in the 21st century based on climate models, rather than historical climate data.

Since the late 2000s, LA's response to unreliability has entailed a commitment to transitioning to using more local water. If you're in LA, I'm sure you've heard about this, because it's been in the news everywhere. And the plans are basically to develop local supplies through things like storm water capture, water recycling, groundwater cleanup projects, as well as ramping up conservation.

The city is also looking to, quote, "maintain the integrity of the La Aqueduct," end quote, and quote, "ensure continued reliability of supplies from MWD," end quote. Given expected intensifying variability, storage, or the ability to capture and store water during wet times for when it's needed during dry years, will be crucial. Metropolitan, for example, has increased its storage capacity by 13 times since late 1990s, and aims to soon have one year's worth of water supplies in storage across its systems.

In what follows, I'm going to chart through a small index of storage forms; how climate change variability, with its extremes of water availability and water unavailability, is manifesting in different approaches to water storage and value. And we'll move throughout the index from forms of storage, like snow pack, that index the future of water, to water futures and their index values in financial markets.

So to begin with, reservoirs-- although there are many kinds of reservoirs, the reservoir we're most interested in here is the storage reservoir. Strictly speaking, a storage reservoir is an artificial lake or pool that holds water which has been trapped by a dam. Significantly, reservoirs have been designed with the idea of taming natural variability and ensuring that there's always supply to meet demand. They store water that's collected during what periods so it can be used during dry periods.

Reservoirs have therefore been thought of as an insurance policy against drought. Reservoirs have also been seen as tools for protecting against flood, as they collect and can slowly release water that might have otherwise inundated surroundings. Although thousands of years old, storage reservoirs became especially popular in the 20th century. Built into them was an idea of variability, of short term, or the assumption that dry conditions would soon end, and reservoirs which had been emptied would soon be refilled. Built into them as well were ideas about the intensity and frequency of storms.

Along the Los Angeles Aqueduct, LA's oldest and main long-distance conveyance system, are six storage reservoirs. These are the Grant Lake, Long Valley-- I'm sorry-- I may not pronounce this right-- Tinemaha, North Haiwee, South Haiwee, and Bouquet Reservoirs. Combined, the LA Aqueduct system storage is 311,000 acre feet, which, for those who aren't familiar with these values, is actually pretty small.

The little storage capacity behind LA Aqueduct dams, and environmental, economic, and logistical challenges that are associated with developing further storage capacity is one reason why the LA Aqueduct is particularly sensitive to both drought and flood risks. Water savings can't necessarily be maximized during wet times, and aren't necessarily enough during dry times.

So in the event that there's a lot of water, infrastructures along the system are at a risk of flooding and being damaged if some storm-- stored water-- sorry-- isn't released. And in the event of too little water, LADWP ends up having enough water to send to the city-- and ends up not having-- sorry-- enough water to send to the city after having to meet all its environmental regulations in the Mono Basin and Owens Valley.

The situation was summed up to me by a climate scientist as-- it's like, if they have it, they send it to the city. If they don't have it, they don't, and the city relies on other sources. Extremes outside of historical parameters are majorly exacerbating management difficulties long faced by water managers along the aqueduct. Drought periods, for example, are not uncommon in Southern California, and these have, in the past, impacted water supplies from the LA Aqueduct.

But as droughts last longer, they stretch even thinner systems that are already stressed to pose a very real, and I'd say very different type of risk in the coming decades. So 2017 was actually a very wet year, and it presents us with a picture of one end of this climate extreme that I'm describing. Significantly above precipitation that year spelled the possibility of overwhelming the aqueduct. And in response, LADWP had to figure out all kinds of ways in which to manage the system to be able to handle that deluge of water.

So they maximized the flow by lowering their storage levels in their reservoirs and sending that lowered water, or that water that had been released to LA. They spread runoff at various locations along the aqueduct to recharge their aquifers. But as I've heard, releasing to the environment is not necessarily-- while it has positive effects, can also create additional challenges, because ecosystems end up being produced that then have to be protected that then lead to further water restrictions.

So in short, what we're seeing, it seems, is water being valued or managed in these reservoirs or centralized storage systems through time over the long term, where resources in the present are managed with many years in mind, where droughts last years, and where flows in what years can be well beyond the annual system capacities-- all this is requiring us, as I was told, to take a hard look and reconsider whether or not our infrastructures are, quote, "appropriately sized to protect life and property and provide us with water supply," end quote.

Next slide-- snowpack-- snowpack as the snow accumulated in the mountain areas over the course of the winter season that melts in the spring and summer. Snowpack is a significant source of water globally. To give you a sense of just how significant snowpack is for California, 60% of the state's water supply comes from snow.

Water in the LA Aqueduct originates as runoff from the Sierra Nevada Mountains, a large part of which comes snow-- comes from snow. Here, the mountain's snowpack holds water in place frozen during the wet and cool months of November to March. Water is then gradually released as temperatures warm.

Because this release happens when the weather is driest and Southern California and water demand is highest, snowpack is sometimes referred to as a natural reservoir. It is, in essence, seen as a form of natural storage, allowing water managers to sync out-of-sync water demand and weather patterns in LA. The LA Aqueduct system incorporates the natural reservoir of snowpack into its design.

The historical dynamics of snowpack were factored into the specifications of different elements on the system, including the number of storage reservoirs developed, their capacities, et cetera. So it was designed in such a way so that snow would melt right in time to refill the storage reservoirs along the system and allow the supplies to last for the following wet year.

But climate change is spelling a shrinking snowpack and earlier snowmelt. With higher temperatures predicted for the future, more and more precipitation is expected to fall as rain, rather than snow, and the snow that does fall is expected to melt earlier in the year. So it's not necessarily that overall precipitation is going to change in the Sierra Nevada-- more so the timing of its flows. And that has significant implications for water infrastructures.

Water supply is going to come in greater quantities, in bursts, as well as end earlier in the year, requiring much more storage, once again, and once again, different management approaches. But any storage development of any size, including new reservoirs or dam enlargements-- even if they were possible-- would make up a very small portion of the capacity that's lost from snow, and would come at very expensive economic and ecological costs.

Not only do we see in snowpack the nature of natural storage transforming with climate change, but so too ideas about what a changing snowpack index is. As anthropologist Sayd Randale notes, in the previous century, snowpack was perceived as an indicator of the hydrological conditions of the year-- the one year to come-- and a tool for comparing years in the past, whereas more recently in the 21st century, snowpack is understood as an indicator of the hydrological conditions to be expected in the future-- short, medium-term to long-term future.

Randle writes that during the most recent drought, quote, "images of the Sierras were used to index the urgent need to rework urban water supply networks to assure for their water reliability," end quote. Next slide-- stormwater capture-- stormwater capture involves the collection of-- the collection, treatment, and reuse of precipitation. Stormwater capture projects include large centralized capture facilities, like spreading grounds that spread and infiltrate water into municipal groundwater supplies.

They also include smaller distributed projects, like green infrastructures at the neighborhood scale or rain barrels and cisterns at the property scale. Distributed stormwater capture projects augment water supply by meeting demands that would have otherwise been serviced by municipal water, and they meet these demands either by-- through direct use on site or indirectly through infiltration.

So we can think about them as this kind of decentralized form of storage. In Los Angeles County, stormwater capture has been happening-- I was really surprised to learn this, actually-- in large centralized spreading grounds facilities since the 1930s. Distributed capture efforts seem to have a relatively newer recent history. Green infrastructure projects have seen an uptick since the early 2000s, and rain barrels and systems have grown increasingly popular, arguably, since the late 2000s, when there was a municipal-sponsored pilot program.

In LA, a lot of people I spoke to referred to storm water as the city's low-hanging fruit, a relatively cheap resource to capture that had long not been realized. Interestingly, distributed stormwater capture through green infrastructures actually starts out in LA from concerns over clean water, and not water supply. So I've been told lots of different stories about what happened and who was responsible, but the stories all begin with the passage of the Clean Water Act of 1977 and the Water Quality Act of 1987.

And according to city lore or myth, and the many people I talk to, environmental organizations like Heal the Bay, mobilized in the 1990s over the pollution of LA's waterways and beaches, because dirty stormwater and urban runoff was emptying out into them untreated from the city's drains. Mobilizations led to legal action against the EPA, or Environmental Protection Agency, for failing to hold the state of California accountable to these federal regulations on mandated pollutant maximums, the action was won, and then this ended up forcing the state and the city into action.

In one version-- a version that I love, actually-- I'm told that environmental organizations found allies in the real estate development and business community. At the time, there was a major building boom in LA, and sewage plants and sewage system hookups by the Los Angeles Department of sanitation just couldn't keep up.

So the city introduced a permitting system for development with a limited number of permits that were issued each month. After that I hear, quote, "so you have the development community going crazy, which got the financial community going crazy, which got the unions who built these things crazy. And all of these groups began going to the mayor of Los Angeles saying, we don't give a fuck about the coast, but you know, what are you going to do about the sewage problem? And so it was the combination of business community coming from one direction, environmental community, building visibility in another direction. The two combined is what tipped it over"-- end quote.

In the early 2000s, these developments led to the passage of the Proposition O Clean Water Bond Program, which is a $500 million city of LA bond that was spent largely on green infrastructure and nature-based solutions. These were seen as a cost-effective way to capture and treat runoff by drawing on the natural cleaning capabilities of soils and plants.

Green infrastructure projects were also understood to have what's called multiple benefits, and that's how water supply comes into the picture, actually. Proposition O projects are just a subset of the many green infrastructure projects in LA today. So this is a schematic of what lies beneath Albion Riverside Park, a 6-acre site bordering the Los Angeles River in the neighborhood of Lincoln Heights.

Previously, the location was a warehousing and distribution facility. It hosted warehousing and distribution facilities for the Ross Swiss Dairy Company. And the city acquired the site in 2009 as part of this Proposition O program. The site was rehabilitated and remediated to host a park-- that you can now visit-- with stormwater capture and treatment facilities.

Here water is diverted through the storm drain into the park, where it's cleaned by separators and then infiltrated through underground infiltration galleries. And stormwater is also captured on site through features like bioswales and pervious pavement, infiltrated too. Given the expenses that are associated with developing large-scale infrastructures, and the incompatibility of reservoirs with environmental regulation, some see stormwater capture and storage projects, including small-scale distributed ones, as an increasingly significant part of water in the future.

Others question how significant really stormwater capture volumes can ever actually be. Stormwater capture is not going to, by any stretch of the imagination, as far as I see, replace centralized systems. But it will complement them, and if done at significant scales, can make important contributions. But besides distributing storage and maximizing capture-- which, as we've seen, is very important-- I imagine that distributed stormwater capture will also inculcate an ethic and valuation of water that's significant, and that's summed up by a phrase that became really popular in the last drought in the city and in the state, which was water wisdom as a way of life.

In the near term, we will likely see much more distributed stormwater capture projects in Los Angeles. The passage of a measure called Measure W-- which is a tax on properties that are paved-- in LA County in 2018 is expected to produce-- to generate for the county hundreds of millions of dollars annually-- and there's no [INAUDIBLE], so there's no end to this-- for stormwater capture projects. And this has been described to me by one water manager as a game-changer.

Next slide, please-- so use conjunctive-- conjunctive use describes a holistic approach to surface and groundwater management, where surface water is more heavily relied on during wet periods, and groundwater during dry ones. This allows for an increase in groundwater resources, as it maximizes groundwater recharge during wet years.

It offsets some of the uncertainty surrounding fluctuations in surface water from year to year, and in relying completely on that. And it turns groundwater into this critical resource that's used during dry years especially, when surface water isn't available. It's one of the things that's part of this new integrated management approach.

So one form of conjunctive use that LADWP practices is groundwater banking. And I think it's so fascinating actually to note how conversations around groundwater are full of language drawn from banking and finance, from talk of groundwater banking to talk of stored water credits in groundwater aquifers.

Within the area of LA, the city has groundwater extraction rights in the San Fernando Basin-- which underlies the San Fernando Valley, and is its largest groundwater resource-- Sylmar Basin, Eagle Rock Basin, Central Rock Basin, and West Coast Basin-- so in five basins in the area. But currently, the city of LA only withdraws water from three of them, and chiefly from the San Fernando Basin.

It also can't take full advantage of its annual permitted withdrawal amounts from any of these basins, and this is largely because of groundwater contamination issues. So LADWP practices groundwater banking in its groundwater basins, including mainly the San Fernando Basin-- by far its largest, just to emphasize again.

So once again, we're going to go back to the wet year of 2017. And LADWP at this point has had tons of water from the LA Aqueduct, and it's sent it to LA. So the city doesn't have to pump as much, and it doesn't use its annual permitted amount from the groundwater aquifers. So the difference between the amount that it actually does pump that year and the amount that it's permitted to pump annually is what's called the stored water credit.

And theoretically, this could cut it can be drawn on or cashed in in the future during dry times. Imported water, stormwater, and recycled water that's recharged into the groundwater basins also adds to or translates into additional stored water credits. At the end of 2018, and over many, many years of groundwater accounting and banking, the city has over 590,000 acre feet-- so just to remind, you that's 2 times the amount of storage on the LA Aqueduct-- it has over 590,000 acre feet of stored water credits in the San Fernando Basin alone.

Much of these credits aren't necessarily currently cashable, as I mentioned, because of contamination and dropping water levels because of decreases in natural recharge with urbanization. But artificial groundwater recharge and recapture possibilities have made groundwater basins not only an increasingly significant form of storage, but also like a crux of water planning for LA's future. In its draft 2020 urban water management plan, which just recently came out, LADWP writes, quote, "while the city's groundwater rights are a critical important-- component"-- sorry-- "of local supply, the true value of the groundwater basins includes water storage"-- end quote.

Local groundwater basins, in fact, have a-- are able to store or have a combined storage capacity of a million acre feet, and represent the cornerstone of the city's future supply reliability strategy. It's for this reason that the city is highly prioritizing groundwater basin cleanup in the present. So through conjunctive use, some agencies, like Metropolitan, are even trading extra surface supplies in their wet years for groundwater credits in the aquifers of other agencies during dry years.

And what I find so fascinating about this is that the same infrastructures are being managed-- if managed differently, end up producing completely different results. And storage can be stretched somehow beyond physical infrastructure limitations and across time. But in general-- and if I give you with one thing throughout this talk-- I think artificial storage and recovery, or recharge of groundwaters and the use of groundwater aquifers as storage is-- well, storage in general is the future of water, and the use of groundwater aquifers for storage is really the future of water.

And it's something that I've seen in all the cities that I've studied, and it's largely because these projects can be very big and cost relatively very little compared to other approaches. Next slide, and final slide-- so what are futures? Futures markets revolve around futures contracts. A futures contract is an agreement between a buyer and seller to exchange an amount of a commodity at a certain price at an agreed upon date in the future.

So a futures contract can be sold to other buyers any number of times before it goes into effect at the agreed upon date. The totality of transactions in futures contracts around a given commodity is what constitutes a futures market. Futures contracts actually are really old financial tools. They date back to ancient Mesopotamia, where they made an appearance under the famed Babylonian King Hammurabi.

So a few things to keep in mind before we go into California's water futures marketplace, which is our topic here-- first, futures markets tend to exist for commodities with great volatility, because they're developed as a way to reduce risk from price fluctuations, or profit from them. The more volatile the commodity is, for whatever reason, the bigger and more unknown the difference is between its present-day price and its future price, as well as between its future price and a futures contract price.

And this difference or uncertainty is what gives both hedgers and speculators incentives to participate in the futures market. While hedgers participate in futures markets to reduce the risks associated with these unknowns, speculators look to make a profit from them. Second, futures markets don't necessarily involve the actual exchange of commodities. They can be completely cash-settled, meaning that buyers and sellers in the contract just pay each other the difference between the contract price and the market price at the time of contract end.

And I'm going to give a more concrete example so that people understand, because I myself spent two days actually writing this up, because finance can be very confusing. So historically, water has been sold and bought in California through the trading of water rights. Cities in Southern California and the San Joaquin Valley are significant buyers of water, while farmers who tend to own water rights are most commonly sellers-- though farmers significantly participate in buying too.

In the physical market, water is exchanged through transactions in water rights at what's known as a spot price, a price determined at the time of sale based on supply and demand. Because the market is fragmented, information on the aggregated or average price of water can be really hard to come by. So in 2019-- '18-- sorry-- the NASDAQ, which is a global economic marketplace, partnered with financial products company Veles Water, an economic consulting firm West Water Research, to develop what's known as the NASDAQ Veles California water index, or NQH2O.

So the index reflects the value of water in California based on this aggregate price of all these transactions at a particular moment in time. So the index in December reflects the average of all of these different transactions, let's say, on December, 20 for that period. So it's priced in US dollars per acre foot, and in essence, the index aggregates all this previously fragmented information on water pricing and allows for tracking an aggregated price over time. So in 2020 a new development happens, which is a California waters market-- a futures market-- sorry-- is launched by the Chicago Mercantile Exchange, a futures market based out of Chicago.

The market involves trading in water through futures contracts. The contract price for water in the future is negotiable between buyer and seller, and at the time of the contract, end date, the price of the contract is compared to the price of water on the NQH2O index to figure out what losses and gains are. So to make this more concrete, let's say that the price of water on the NQH2O index now is $500 an acre foot, and it's believed that this coming year is going to be dry.

If I'm looking to hedge my risks, I might buy water futures contract now for $500 an acre foot for six months from today. If the season is actually dry, and in six months, water's being sold at $560, then I've reduced my risk. If it's a wet season and the price of water has gone down to $460, then I've lost $40 per acre foot, but I've made up from losses in increased access to cheaper water.

It's significant to note that it's not water itself that's being traded here. In the case where I was hedging against risk, I would have gained $60 an acre foot-- I would have gained that $60 an acre for the difference, which would help me in buying water at its increased price. If I'm a speculator, the $60 plus or $40 minus per acre foot would have been my profit or loss. So hedgers increasingly expected to participate in the California futures market-- waters futures market are farmers and utilities looking to reduce the risks associated with water supply and price volatility. Speculators are most likely financial companies seeking to profit from water's increasing price volatility.

And it's important to note that these don't necessarily have to be farmers and utilities in California. They can be anywhere in the world. At the moment, the California water futures market remains very, very small and very, very new, but the specter of water's further commoditization, of profits being made from speculation on water pricing, and of the potential feedback loop effect of this on real-world prices has already caused a lot of alarm.

This builds on already existing outcry over developments in water rights trading, where hedge funds and companies are profiting from water scarcity by buying up land to access water rights in California and control increasingly valuable fresh water sources. So proponents of the water futures suggest that the water futures market is a good index or indicator of future water supply or scarcity.

A water futures market allows farmers and utilities, among others, to see what the cost of water is expected to be based on an aggregated projection, and make management decisions in the present accordingly. The market would, in this way, help hedge-- hedgers-- sorry-- manage risks associated with fluctuating supply by softening the financial burden of rising water prices and scarce times.

Detractors, on the other hand, argue that water futures markets could, in time, and with significant growth, have an impact on real-world water prices. Speculators with large investments might be motivated to influence real water-- real-world water trades to move the index price and hedge against losses in the water futures market, which we've actually seen for other things, like silver.

And those trading in water in the real world might look to the water futures market price and conduct their transactions accordingly. Finally, while the water futures market hedges against risks associated with water scarcity, it doesn't do anything to improve water supply conditions, and arguably de-incentivizes such actions by removing financial risks, which can be motivating factors.

By indexing the speculated value of future water, water futures provide an abstract financial means for, oddly enough, concretely engaging with the value of water in the future today. And I'll stop here, and we can talk about things further or other things in the Q&A. Thanks so much for listening.

Thank you so much, Nadia, for that very insightful presentation and research. I'm very fortunate that we were able to hear from you directly about that, so thank you again. And yeah, let me just get rid of the PowerPoint really quickly on my end. So now we are heading into the Q&A portion of this program. And to kick off the Q&A portion, I do have some questions for Nadia and Alex.

And again, if folks have questions and you feel comfortable entering them in the chat box, please do so. I will keep an eye on the chat box and read them out as I see them. Or if you feel comfortable taking yourself off you to ask your question directly, please do so.

But I think one of my biggest takeaways from both your presentation, Nadia-- then also, Alex, your exhibition-- is just the-- how municipal agencies at all levels play a really important role in water storage, supply, and distribution. So first, Alex, can you describe why this aspect was important to your newly-commissioned public artwork?

Thank you, Jamie, and thank you, Nadia. I just wanted to hold space for just thanking everyone-- thanking Nadia for-- I think it's 11:30 right now where you're at in Beirut, so I just want to let the audience know that, that you're doing this remotely in the evening. And thank you, LA municipal team. Thank you, Jamie, for just hosting this talk. This is very special.

But I guess, to address the question, I'm processing. I guess, from the conception of the project, I was thinking of the Kern Water Bank as a sort of-- the conception of the Kern Water Bank and its relationship with the Department of Water resources, and its transference-- its transfer from a public entity from the DWR to-- for water districts basically, and a private company with majority ownership.

So I spent some time thinking of that-- this hypothetical sculpture that I'll be installing in the gallery, and this phantom reversal of water, or paper water back to where it would come from. And I guess, while I was working on this show, I was also thinking on the financialization of municipalities.

And what, Nadia you've been so gracefully able to address is these markets that I'm just navigating through this show, that I'm just trying to address and circumvent by addressing. And I guess, for me, it was more-- I think I was thinking of the photographic memory of the water, or the paper memory of the water, the physical memory of the water, the physical properties of the water, and this-- through this game of mirrors, taking it back somewhere else to where this space that was designated for-- the Kern Water Bank was initially, from its conception, designated-- thought through as a sort of partial use for reservoir for Los Angeles water. So I think that was one thing I was thinking through too.

I don't know if that answers the question. I don't know if I got anywhere there, but--

Yeah, and-- No, yeah, thank you, Alex. The next question will talk a little bit or focus more on the financialization aspect. But I think, just moving along with this question, Nadia, I'm really curious to hear how Alex's exhibition expanded or changed your ideas on the role municipal agencies can and should play with respect to water storage and distribution.

Thanks for the question. I've had the pleasure of having many, many wonderful conversations with Alex, and I have to say that-- I very much tried to think through some questions that I see him thinking through in this work, like commoditization, financialization-- which isn't necessarily what I usually look at in my work-- and like things like exchangeability, abstraction-- all these things that are happening that I think Alex's exhibition really helped me think through in some of the things I look at.

But then again, also, the other thing that I think has been increasingly coming out in my work as I go through some of the research I collected, and I start to write it up now-- since it's part of my dissertation-- and in thinking through this-- for this talk, and with Alex's work, I think the role of the private sector in the relationship between the city and the private sector-- so that quote that I gave about how it wasn't just nonprofit organizations and it wasn't just the city that was doing this-- there's a huge business community that also has investments in this, and they have investments for various reasons.

And I think that was something that maybe I hadn't been thinking through so much, and this exhibition, and me having a chance to talk to Alex, in general, has-- and preparing for this talk in that framework has really helped me think through some of these things and become really interested in them-- so more the relationship between the private sector and the public sector.

Great-- yeah, I think that also ties in with this other element I wanted to touch on a little bit more, which is the financialization of water. Nadia, you did just-- at least for me, the water futures market was totally new, so thank you thank you for just succinctly just really talking about that. And then also, I think it was very interesting to hear to how just even the financial language that is used within municipal entities in talking about water is just on one level.

It's a life-sustaining resource. We all need water to survive, and now just seeing it as a commodity that gets traded, or kind of treated as gold, or silver-- just Wall Street aspect-- is really interesting. I'm curious, though, just if you could talk a little bit about how important or not this tool is in terms of transparency and I think-- and also just transparency with all the stakeholders involved in this.

So I would say, one-- maybe I want to first address something in your lead up to the question, and then I want to address maybe the question. So the first part is to say that there's all kinds of conversations about water and commoditization, and that includes things like-- things that have been debated for many, many decades about, how should want to be priced-- with one side being like, we should price water and it's very important-- and we should price it like closer to cost, rather than subsidize, because that's going to end up producing-- or that's going to make people conserve or treat water more carefully.

And then, on the other hand, you have people that say, no, it's a right to allow it to become commoditized-- opens it up to all kinds of market forces that are terrifying, when it comes to something like water. I just wanted to maybe mention that. So this whole conversation around commoditization has so many aspects, when it comes to water.

And the conversation is very long, even though some of these developments are only since like 2020. But they come out of a much longer history. And then I think, in terms of the transparency, so from my reading-- so one, I want to emphasize again, the water futures market is very, very small right now still, so I'm not really sure-- I think there's a lot of reactions online, and that's because of this conversation that I've explained, or debate about commoditization of water.

But I'd say the real emphasis on transparency is actually about the index, because there's all these transactions that have been happening and there's been no way for someone to necessarily figure out, how should I price my water without having to do all kinds of research and go to different places, because it's very-- the management of water in general is very fragmented. And then the management of water sales is very fragmented.

And that also always, I guess, ends up favoring people or entities with resources to produce this kind of information, or to be able to access this kind of information, or have the resources to invest in getting it. So that's what's been talked about in terms of the importance of the index.

But I'm always skeptical also just to think about some of these things where it's like, OK, well, I think Alex sent me a few-- or shared a few weeks back an article on Instagram about how Harvard was buying up land in-- I think it was the Central Valley of California. And I wonder, OK, so they bought land. They didn't buy water, but does that get-- is that somehow part of this water-- how is this stuff calculated?

And some of these things-- they're so non-transparent that it's-- I don't know-- it's more complicated, I think, than some of the claims that are being made about transparency. Yeah, so mixed bag, I guess--

Thank you. And then just to, again, piggyback off of it and bring it back to your exhibition, Alex, I'm curious to hear more about why the financialization of water, or perhaps water futures, speculation, et cetera was most interesting to you in exploring with this particular exhibition.

I was thinking a lot about the trades, the trades of these commodities. And I guess something that, Nadia, you just addressed was the slippery slope between, if you're buying land, are you also buying that water? And if you're in the show, releasing land-- that's access to water, so what does that mean?

And I guess I just-- I was very interested in conflating these commodities, conflating them almost as one-- like water, gold, and land as one, and just their nature of trading. But it's interesting. I appreciate so much the navigating of future markets in this talk, because I guess it's helped me kind of vacillate from my show, where I was kind of-- when I was grounding myself in historical legislative rhetoric by like settlers and colonizers towards westward expansion and that kind of-- like the mining rights and that and that language that like legislative language-- how it informs future markets-- so legislative language around like *Irwin v. Phillips,* and that being a large impetus to westward expansion, agents of displacement and genocide for the native and indigenous populations.

That kind of language is analogous today in these future markets, where displaced from the gentrification are existing for mining rights and for commodities, whether that's bottled water, oil, or gold. A water bank is just one like one like facet, I almost feel, to a lot of these commodities and the ways they're mined, which is yielding a very speculative future-- a very-- yeah, I don't know.

If I can just actually maybe say something, one of my favorite things also-- I actually met Alex at the Welcome Center when he had his exhibition there, and one of my favorite things as well about it was that he also looked at the art-- did this like really self-reflexive also-- move, I think-- self-reflexive in the sense of coming from the art world, and then thinking about the art world's place within this, within some of these processes in his work at the Welcome Center. And I thought that that was quite amazing.

Thank you.

Yes, thank you. Thank you both. I don't want to completely monopolize this Q&A section, so again, if anybody has any questions that they would like to chime in and ask, please do so. We want to make sure that we're holding space for everyone. But I do have a few more questions for you both.

Nadia, you touched on it a little bit, but with respect to water supply and climate change, how do you think tools such as water futures can stimulate investment and innovation and more accurate weather and climate modeling as a possible long-term solution?

So I think, just in general, going off of what I've been talking about in terms of what Alex's work-- increasingly, in general in my work, and partly also from this conversation with Alex's work, I've been thinking a lot about the role of the private sector now in some of these questions.

I remember I talked to two startups actually that are being incubated at the-- or two owners of a startup that's being incubated at LACI, and they said one of the things that they told them at LACI-- which is the Los Angeles Cleantech Incubator-- is essentially that you have to figure out who's hurting or what's hurting, and that that's the way that you're going to be able to make change.

And in their case, who's hurting or what's hurting was-- sorry-- one second-- the word has slipped my mind-- insurance. In their case, it was insurance, which is actually one field that's very invested, I think, in climate change going forward. I think that there are all kinds of business incentives that are going to lead, I think, into greater investments in future climate modeling.

And that's not just financial tools, like water features, which I think might, but also things like the investments of insurance, et cetera. But again, like I would say, kind of similar to what we talked about in terms of transparency and access to information, who's developing these models, who's invested in developing them, who will have access to them-- these are all super important questions, I think. So yes, I think maybe we will have better climate information, but I hope that that information is accessible.

Yes. That's, I think, very critical first step with such important issues. I have one last question for both you, Nadia and Alex. What questions, ideas, or calls to action do you hope folks will have from experiencing this talk and exhibition? And I don't know who would like to go first. I don't want to pick on one of you.

I can go first, if you want. So that way, Alex will be the last to speak. So curiosity is a major driver for me, in general, in life, and I feel like-- I hope that people have learned a few things-- namely, that storage is super important going forward. And I hope that I've made people curious about something like storage, which I know can seem super technical and boring, but is actually really fascinating in my mind. I hope that I've been maybe I sparked some curiosity, and some learning, and I think-- and I hope that that will continue outside of this framework.

Yeah. I appreciate that. There's an ordinance that actually passed while I was working on this show. And it's been during the pandemic. It's this oil and gas ordinance in Kern County that would add thousands of wells right beside-- with no restrictions to being right beside residential family homes. And it's a huge threat to the health and safety-- we're talking about farmers, working class farmers in the Central Valley a lot of the time, when we're navigating-- I'm navigating Kern County.

And I feel like I have this bad habit of conflating all these commodities, like oil, gas, gold, water-- all of them into one thing. But there are certain petitions right now circulating and certain legislations that are circulating that would prevent-- at least protecting these very vulnerable families from these initiatives by these behemoth companies to at least implement-- I think it's like a 2,500-foot human buffer-- a human health and safety buffer between the wells themselves and the family homes.

But things like that, I think, I've just been spending more time on, just figuring out legislative loopholes and things like that that can protect families, protect people, protect our futures. That's just something I've been navigating, circumventing, and stumbling over, and without fully figuring-- wading my way through. But I guess I'll put that out there.

Great-- thank you, Nadia. Thank you, Alex, for just your really thoughtful insights, and just being really, really open with the incredibly important work that you're both doing. So just thank you. And unless there's any other questions from folks, I think we'll end we'll wrap it up here.

Thank you again, Nadia, for just being really just a-- for the incredible presentation and sharing your research. Thank you, Alex, for your really-- I would call it a very provocative exhibition that we have on view at LAMAG, So if folks have not seen it, experienced it, please check it out. It's at lamag.org, It will be available through April 22.

And we hope to see you again soon virtually. Take care. Thank you all so much. And again, I apologize if I didn't mention it before, but this talk has been recorded, and will be made available online at a later date. So we will make sure that it's available for everyone who wasn't able to join us. Or if you want to rewatch it again, I'm planning on rewatching it, because there's just so much really great information-- so great.

Really nice to see some familiar people also--