Where Were We?

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This essay examines the twentieth-century water infrastructure of Phoenix, Arizona. An extensive network of canals transformed the desert into farmland, then farmland into suburban sprawl. This infrastructure can be studied as a vital force, one whose arrival so contradicted preexisting geology and ecology that it produced unexpected effects and admitted uninvited visitors. Historical documentation of the canals' transition from agricultural to suburban infrastructure reveals complex human-nature interactions mediated by engineered waters. This brief account argues for the potential of infrastructural history as a form of vibrant postnatural history, one which challenges the notion of genius loci on sites where terrestrial definitions of region have been ruptured.

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> So instead of going home to the heartland he liberated a surfboard from someone's backyard and made his home in the curl. He had a mind to surf through all crises and shortages and conflicts past and present. He was surfing the day they pronounced the Colorado dead and he was surfing the day it was dammed, a hundred years before. When some omnipotent current ferried him northward toward L.A., he allowed it. He surfed as that city's aqueducts went dry. He surfed as she built new aqueducts, wider aqueducts, deeper aqueducts, aqueducts stretching to the watersheds of Idaho, Washington, Montana, aqueducts veining the West, half a million miles of palatial half-pipe left of the hundredth meridian.
>
> —Claire Vaye Watkins, *Gold Fame Citrus*[1]

As a direct result of design and engineering of the modern era, the geological underpinnings of regions have come undone. Urbanization "disciplines" waters: infrastructure projects, drain by design, erecting levees and aqueducts, filling wetlands, and channelizing rivers.[2] All this terraforming has accumulated to make humans geologic agents. As landscape architect Jane Hutton relayed, in the history of the planet, we are now the "prime agents of erosion" over all nonhuman geological forces.[3] Agents of the Anthropocene—the Capitalocene, to more precisely describe the motivations behind American hydrological infrastructure—have caused the current and emerging environmental crises of climate change, requiring close attention to the material and physical definitions of region as a dialectical counterpart to the global.[4] As humans escalate their influence on the hydrologic cycle, notions of regionalism and the promise of ecological restoration carry renewed attractiveness as sources of stability.

This essay examines the water infrastructure of Phoenix, Arizona, during the first half of the twentieth century, a system that is but one of many great enabling projects of American territorial expansion (e.g., Chicago's Sanitary and Ship Canal, the Okeechobee Canal in Florida, the Grand Ditch across the Rocky Mountain divide) that rupture the terrestrial definition of region. The people and cultivated landscapes of the Phoenix metropolitan area are sustained by an elaborate system of reservoirs, pumps, and canals. For the foreseeable future, any reconciliation of human history and natural history demands that Phoenix is considered not solely as a Sonoran Desert city but as a

Figure 1. Five hundred square miles around the Hoover Dam. (*Landscape*, 1951.) ("Southwestern Landscapes as Seen from the Air." *Landscape*, Vol 1. No. 2 (Autumn 1951): 11.)

provisional outpost of the Colorado River, whose water is delivered from over two hundred miles away. This infrastructure can be examined as a vital force, in the manner of Jane Bennett, one whose arrival so vehemently contradicted the preexisting geology and ecology that it triggered unexpected resistance and behaviors—effects that might be too small or fleeting to register as environmental history. Specifically, a close inspection of the archival documents of canal infrastructure can reconstitute, in Bennett's words, "the divide between speaking subjects and mute objects into a set of differential tendencies and variable capacities."[5] The photographs, texts, and landscapes heralding the arrival of disciplined water chronicle a heroic Anthropocene history. However, Bennett's mute objects are also present within these artifacts—uninvited visitors, unexpected social behaviors, and glimpses of postnatural ecologies—offering new methodological approaches to landscape history as material evidence of change.

The Departed

Photography was an essential tool for engineering the American West, mobilized for aerial surveys of vast areas and the demonstration of national progress—often in conjunction with each other. In the years following the Mexican-American War, photographers such as Timothy H. O'Sullivan traversed the mountains and deserts of the West on behalf of the U.S. Department of War and Army Corps of Engineers, producing striking documentary images of the landscape. By photographing potential resources and transportation routes, O'Sullivan was, in the words of artist Trevor Paglen, a nineteenth century "spy satellite," giving definition to a vast landscape unknown to Anglo-Americans and documenting baseline conditions for registering change. In spring of 1951, when J. B. Jackson founded the journal *Landscape*—for its first year named *Landscape: Human Geography of the Southwest*—the masthead of the inaugural issue called for "original articles dealing with aspects of the human geography of the Southwest, particularly in those suited to illustration by aerial photographs." In this issue, a dramatic Air Force photograph of the Hoover Dam, encompassing five hundred square miles, shows the inky expanse of Lake Mead, impassive and seemingly assured in its geological setting. To someone unfamiliar with the place, only the meandering access road, the most recent layer of human history inscribed on the Earth's surface, draws one's attention to the dam itself (Figure 1).

By the mid-twentieth century, the demographic and cultural center of the American population was still east of the Mississippi. In Jackson's telling, the promise of the Southwest, in its layers of cultural history, was a distinct counterpoint to the rational modernism offered by contemporary design. The arid climate ossified the past in situ, rendering it both persistent and mysterious. The passage of time in temperate climates is "softened by weathering and concealed by vegetation," but the environment of the southwestern landscape lays bare geological time and the rough traces of human inhabitation: "The Navaho herd their sheep among the masonry ruins of a departed people; the ruins of what was once a prosperous village serve the Spanish-American rancher as a corral for his livestock. . . The past is always with us here in the Southwest, but it is never our own past. It teaches no copy-book lessons because it is largely

Figure 2. Salt Canal, ca. 1920. (McCulloch Brothers Photographs, Herb and Dorothy McLaughlin Collection, Greater Arizona Collection, Arizona State University Library.)

incomprehensible; less a source of pride than of wonder."[6]

The European settlement of the Salt River Valley (within which lies present-day Phoenix) was founded on such inscriptions. Most North American deserts are within the Basin and Range physiogeographical region, characterized by the proximity of mountains to flat, arid valleys. While less than seven inches of rain might fall annually in Phoenix, the nearby peaks may receive over thirty inches of snowfall, providing an abundant source of spring meltwater.[7] The valley's first known long-term human settlers were the Hohokam who for hundreds of years engineered the landscape, creating a sophisticated irrigation system that drew upon the Salt and Gila Rivers. This network supported approximately 250,000 acres of cultivated and settled land, and an estimated population of fifty thousand to two hundred thousand.[8] The last archaeological traces of the Hohokam date to approximately 1450, less than one hundred years before Spanish exploration of the territory.[9] When American settlers arrived in the area (newly annexed from Mexico) during the 1870s, they reestablished farming in the valley by resurrecting the Hohokam irrigation canals, building upon the traces of environmental knowledge still present in the ground.[10] From the work of O'Sullivan to the *Landscape* aerials, photography was critical in reconstructing a landscape whose features, effects, and impacts were not yet fully captured by traditional cartography.

Salt River, Sweet Water

The fertile ground of the Salt River Valley is composed of sediment carried by seasonal flooding and a much deeper and broader layer of alluvium, deposited over millennia, up to eleven thousand feet thick.[11] By the early twentieth century, a loose network of irrigation canals released the productive potential of the soil, supporting the cultivation of cotton, alfalfa, dates, citrus fruits, olives, cut flowers, and dairy. In the city center, industry related to agriculture (e.g., meatpacking and sugar processing) flourished, and regional and national connections by railroad helped convert this bounty into money. In February 1891, the typically languid Salt River betrayed its recent history, rising eighteen feet and flooding an area of more than three miles across the basin.[12] The flood destroyed farm fields and much of the nascent settlement. The idea of a storage dam to discipline and harness the Salt River—in times of water abundance or scarcity—became a priority, though it required coalition-building among local farmers and ranchers who had to commit to participation in a collective water users' association to receive federal funding for large-scale public works; this was a shift in the mode of assistance once based solely on the individual and decentralized homesteader.[13] The United States Reclamation Service (later the Bureau of Reclamation) executed these projects, prefiguring a powerful entity that would eventually orchestrate the hydrologic redesign of the West during the twentieth century. The water captured by the Granite Reef Diversion Dam (1908) and Roosevelt Dam (1911)—which were twenty miles and sixty miles northeast of Phoenix, respectively—was distributed through a new canal network grafted onto the existing one. Although farmers continued to rely on private wells to abstract groundwater, these wells required private capital to construct ever more powerful pumps to draw on diminishing aquifers. In contrast, the federally subsidized water from the Salt River, abundant and reliable, would become the primary source of irrigation water in the valley. As a result, there was a dramatic increase in the acreage of land in production, and the number of farmers more than quadrupled between 1890 and 1920.[14]

By the late 1930s, the "Salt River Project" was a comprehensive term for the infrastructure and organization that provided both irrigation water and hydroelectric power; it had also transitioned from an agricultural cooperative to an entity resembling a modern municipal agency. However, despite this organizational consolidation, the landscapes of water infrastructure were highly varied in their human ecologies. As captured in contemporaneous photographs by the McCulloch Brothers, a

Figure 3. Salt Canal, ca. 1920. (McCulloch Brothers Photographs, Herb and Dorothy McLaughlin Collection, Greater Arizona Collection, Arizona State University Library.)

Figure 4. Arizona Canal, ca. 1920. (McCulloch Brothers Photographs, Herb and Dorothy McLaughlin Collection, Greater Arizona Collection, Arizona State University Library.)

commercial photography studio, the early years of the Salt River Project canal system did not so much define agricultural, domestic, and civic landscapes as they produced new and distinctly Phoenician hybrids.

At some sites, the heroic gesture of the engineered system was clear. In a 1920 photograph of the Salt Canal, the unlined channel gestures clearly from the range beyond toward a dry arroyo in the foreground (Figure 2). A gravel road runs atop a berm that is notably higher than the surrounding topography, calling attention to the smaller, ostensibly hand-dug private canal just to its right. Another photograph from the same decade reveals an allée of cottonwood trees, too regular in their spacing to be accidental, too carefully placed for a mere drainage ditch; it is a human landscape distinct from the rough-hewn transit canals of the American Midwest (Figure 3). These cottonwoods could have helped stabilize the banks and offered dappled shade in the street. A dreamy image of the Arizona Canal from around 1920 belies the wholly constructed nature of the channel—whose route in this location traced neither the original Hohokam canals nor a preexisting Holocene stream—with abundant rushes and a single large cottonwood astonishingly not evidence of a river but of the enduring presence of disciplined water (Figure 4). This feature was not designed as a landscape park or nature preserve, yet it is an example of a kind of water infrastructure, in the words of Matthew Gandy, whose unpredictability "appears to evince a form of vitalism that transcends their mere status as material objects."[15] The material entanglements here are complex in their origins: fertile soil and abundant sunlight suggest agriculture; agriculture requires water; the canal that conveys water inadvertently supports plants that are not crops; and humans find ways to inhabit and represent these spaces. However, from these entanglements emerge an utterly unambiguous naturalization of infrastructure, made apparent by the dramatically uneven distribution of moisture in the land.

Another McCulloch Brothers photograph from the 1930s, labeled *A Maricopa Woman Washing Clothes in the Canal*, could be interpreted as a tableau of the pastoralized poor from an Anglo-American perspective (Figure 5). But it also calls into question upstream and downstream relationships, where those who rely on irrigation water for domestic cleaning would be intimately aware of its turbidity, smells, and color. Going further, from the material evidence present in the image, we might cautiously consider a duration of settlement and rhythm of female labor inscribed in the worn path to the water's edge and a larger narrative of indigenous disenfranchisement. The Maricopa tribe, who resided along the nearby Gila River in the nineteenth century, were

Figure 5. *Maricopa Woman Washing Clothes in the Canal*, ca. 1930. (McCulloch Brothers Photographs, Greater Arizona Collection, Arizona State University Library.)

subject to forced migration when the water they depended on was diverted by white settlers for irrigation.[16] Today, the Christian cross atop a distant structure, centered in the image, looms as much a symbol of assimilation as salvation. These archival photographs are, to evoke historian Caroline Elkins, "a means by which the state—both at the time of empire and thereafter—exercised its power and affirmed its fictions."[17] Though the client for the McCulloch Brothers series is unknown, the images support a dominant narrative of progressive western settlement through engineering that is compatible with the goals of the Bureau of Reclamation and Phoenician civic boosters. However, as Elkins elaborates, such archival images can simultaneously be derivative *and* reflective of colonial power. In the case of the Salt River waterworks, the presumptive pictorial objective—to document the cultivation of the frontier—can be compared against the undeclared traces of ecological and social change. A present-day conservationist view might acknowledge the disruption to the desert ecology through habitat fragmentation locally and habitat destruction farther afield at dam sites. A vitalist perspective might offer that the presence of the canals made visible the thirst of a diverse community of desert dwellers. As Bennett pointed out, "culture is *not* of our own making, infused as it is by biological, geological, and climatic forces."[18] The landscapes of the newly built Salt River canals did not merely elicit emergent behaviors but ratified these forces, for a time, into new desert cultures.

Monocultures Meet

In the postwar era, Phoenix's politicians and business leaders ushered in a period of urban growth, promoting the unrelenting desert sun and bone-dry climate as a healthful and affordable alternative to coastal cities. Their efforts to modernize the economy through "clean" aerospace and defense-related manufacturing sought to attract a white, affluent, educated class who were not in search of a heroic, western, "awe-inspiring confrontation with nature's immense scale and elemental power," but instead a morning hike in the foothills or a poolside barbecue: "rather than revelation, the goal was rehabilitation."[19] When Frank Lloyd Wright initiated the construction of the snowbird campus of Taliesin West in 1937, Phoenix was an agricultural and agro-industrial town of approximately 65,000 people. Wright's complex, perched in the foothills of the McDowell Mountains, drew on a private well and was, at the time of its inception, far from the city. However, by 1960, the population of Phoenix grew sixfold into a city of 440,000 people. Farmland was subdivided into suburban residential neighborhoods but not eliminated from the valley; rather, the agricultural periphery was extended farther and farther afield, an advancing greenbelt that lapped at the shores of the Sonoran Desert (Figure 6). Agriculture was a logical precursor to urbanization from a financial perspective, clearing land so developers did not have to, and the architecture of this transition—homes, schools, roads—was orchestrated at the scale of the 160-acre quarter section, if not larger parcels owned by a single corporation. The wet infrastructure of this transition relied on coordinating and stratifying the needs and desires of a much more unruly, diverse, and multiscalar set of inhabitants.

Until the mid-twentieth century, nonfarming Phoenicians off of the farm depended on many different sources for drinking water. Irrigation canals initially provided water from the Salt River, which was, unsurprisingly, disagreeably salty and bitter. Private and municipal wells served residents who were not connected to the canal system and could draw upon groundwater from the Late Pleistocene era. The Verde River and its aquifer were eventually tapped to satisfy local desires for taste and municipal delivery; this system nearly collapsed during a drought in the late 1940s but continues to serve parts of Phoenix today. By the rules of prior appropriation doctrine—"first in time, first by right"— and the original cooperative agreements of the Salt River Project—"water rights for irrigation, delivered by canal"—accompanied the land as it was urbanized.[20] Irrigation water from the surface canals, once intended for agricultural use, was an available source of water for yard care that was cheaper than potable "city water" delivered by pipe.[21] Although domestic users far outnumbered farmers, they consumed much less water. In 1967, 1,350 farmers

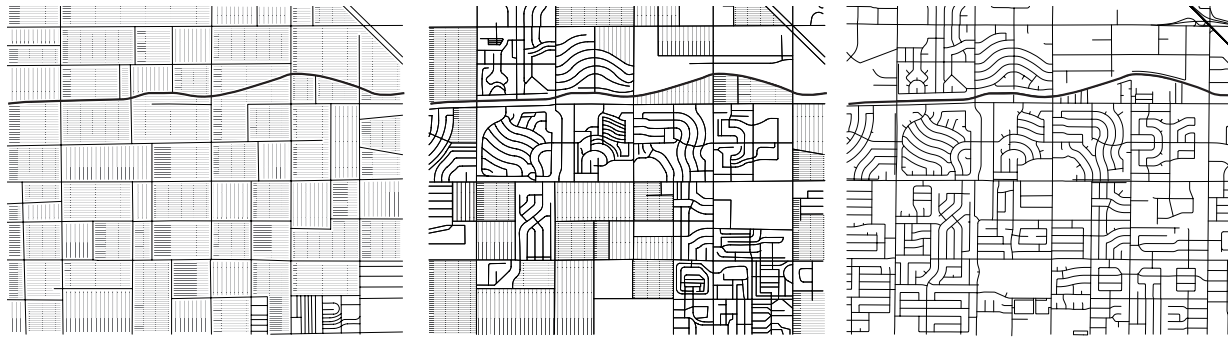

Figure 6. Transition from agricultural land to residential subdivisions, 1954, 1964, and 2018. The Grand Canal runs east-west across the landscape. (Drawing by author.)

used 541,200 acre-feet of water; in comparison, 25,500 residential water users consumed only 37,400 acre-feet of water.[22] This differential in users not only had metric implications but also spatial ones. The midcentury "subdivision" atomized the 160-acre quarter section into individual lots, and each property owner had a financial incentive to make use of cheap water. However, the inherited system of gravity-fed canals was designed for the longer distances of farm deliveries and for use as "flood irrigation," wherein water flows freely, pools on the field (with losses to evaporation), and then slowly infiltrates the soil (Figure 7). A *zanjero*, or "ditch rider," working for the Salt River Project would open flood gates for each subdivision at an assigned time, sometimes late at night or before dawn. To take advantage of this water, subdivision residents had to cooperate with their neighbors to coordinate the opening and closing of localized floodgates on their own properties, moving the water from yard to yard according to a specific sequence and schedule.[23] This choreographed neighborhood activity was not required for the use of more costly potable municipal water, which was conveniently delivered by pipes to each individual home and billed by metered use. The homogeneity within the postwar suburb preceded the choices of individual consumers. Prospective

Figure 7. Flooding of subdivision landscape using agricultural irrigation system. (Courtland Smith, *The Salt River Project: A Case Study in Cultural Adaptation to an Urbanizing Community*, © 1972, the Arizona Board of Regents, reprinted by permission of the University of Arizona Press.)

homebuyers might select one subdivision over another based on class, taste, and personal preference, but there was little spatial distinction between one house and another as their configuration and appearance had been predominantly defined by a higher order of influence. In its common association with such homes, the lush emerald carpet of the suburban yard is often assumed to originate from the same cultural and economic forces of production. However, the Salt River Project system points to an allied, yet different set of protocols that produced the domestic landscape.

In efforts to attract middle- and upper-middle-class residents, the Phoenix Chamber of Commerce promoted the image of the "Valley of the Sun" by the early 1940s to supersede the hardscrabble country connotations of the name Salt River Valley. As such, "Phoenix's parochialism . . . was an attraction, allowing a life perfectly balanced between the modern and its escape."[24] The *Sunset* magazine spirit of a casual western lifestyle may or may not have included a year-round lawn but was almost certainly framed by fruiting trees and a blooming garden. Citrus groves in particular, for their sweet perfumed scent and cheery harvest, were present on the most desirable lots, from the trailer park to the custom, architect-designed home (Figures 8, 9). The aesthetic taste for fruit trees was

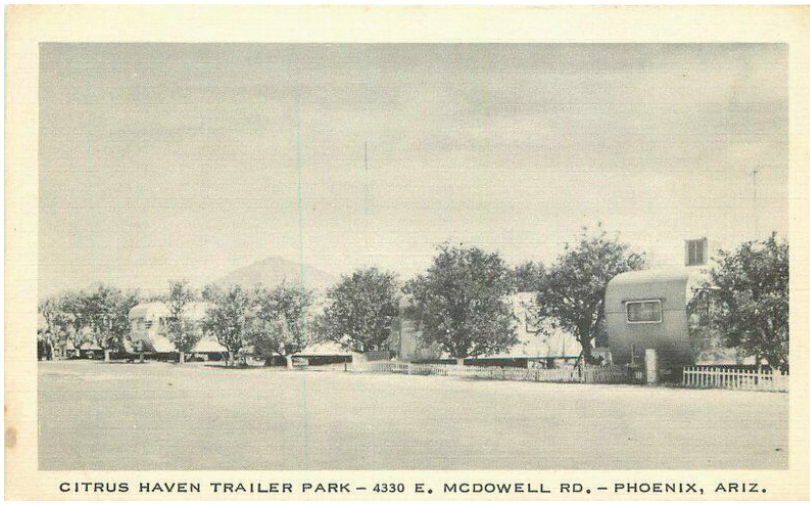

Figure 8. Postcard of orange trees in the Citrus Haven Trailer Park.

Figure 9. Frank Lloyd Wright, David and Gladys Wright House among preexisting citrus groves and adjacent suburban subdivisions, 1952. (© Estate of Pedro E. Guerrero.)

not only a self-conscious import to the arid region (like the English manor lawn or Italian cypress), and its prevalence can only be partially attributed to the charm of a newly constructed modern home accented by reminders of a receding agricultural past (cotton farming and cattle ranching are seemingly less popular motifs in the domestic landscape). The postwar domestic landscape was born out of changing technical and emotional obligations between people and plants, a relationship that is in this place foremost mediated by water.

First, the irrigation canals were created for a highly specific purpose: bringing distant meltwater to an arid region with abundant sunshine and potentially fertile soil. However, the agricultural impetus of the Salt River Project did not reside predominantly or unevenly with any single interest (e.g., private citizens, investors, worker collectives, or the state), and as such, the technical apparatus of the canal produced a highly legible "geography of responsibilities," in the words of anthropologist Madeline Akrich, for distributing water.[25] As demonstrated in the historical photographs discussed above, the spaces of the canal, in their nascence, simultaneously reflected visions of civic, pastoral, and domestic life. The transition of agricultural land into urbanized subdivisions refracted these relationships. Although the midcentury suburban builder/developer and the medium-scale farmer arguably worked at a similar scale and sought economic predictability through monocultures of buildings and crops, they required water distribution systems with fundamentally different temporal logics. Furthermore, the abstract commodity of fresh water for irrigating plants, when delivered to individual homeowners on the municipal pipe network, offered greater freedoms for the expression of class and taste. Finally, the botanical survivors of subdivision lot clearing—primarily citrus and nut trees and date palms—were not spared by cultural landscape traditions alone, especially for a population of new transplants from the Midwest and the East Coast. Following Paul Robbins and Julie Sharp's work on the political ecology of the suburban lawn, the botanical object plays an important role in producing its human subject. Robbins and Sharp wrote, "The lawn is a capitalized system that produces a certain kind of person, one who answers to the needs of landscape . . . as a socio-technical system . . . [The lawn] produces turf grass subjects—that urban/suburban subject whose identity and life is disciplined by the material demands of the landscapes they inherit."[26] Reinforced by the social pressure of keeping up appearances, the lawn is a "community ideology" wherein neighbors agree to be bound by the biophysical requirements of growing grass in a particular way, in a shared climate, with specific desired outcomes. The lawn produces the consumer rather than vice versa.

The Phoenix homeowner who resided in a neighborhood serviced by canal irrigation water had choices. She could choose to use only irrigation water (saving money and sacrificing personal comfort and convenience), only municipal water (either forsaking or spending extravagantly on yard care), or a combination of irrigation water and municipal water (a moderate inconvenience at a moderate cost, enabling the deep soak required by large fruit-bearing trees in an arid environment). The citrus groves of suburban Phoenix produced their own botanical subjects. The circumstances of prior land use, confronted by human desire and the search for delight, generated certain interactions around water, new

forms of "hydro-social" behaviors.[27] As the script of the original canal unraveled, we might wonder what other kinds of landscapes might have emerged had the citrus groves been cleared, but what remained was the capacity to collaborate with neighbors in periodic local flooding.

Dryland Democracy

In 1879, John Wesley Powell, director of the U.S. Geological Survey, plainly stated that of the arid regions he had recently surveyed, "the arable lands are much greater than the irrigable."[28] His testimony before a hostile congressional committee in 1890 recommended that new state boundaries west of the hundredth meridian be strictly aligned with watersheds—a "blueprint for a dryland democracy" of poor, white settlers—that did not rely on the interbasin transfer of water in a land that received insufficient annual rainfall for agriculture.[29] Powell's now well-known proposal, based in physiogeographical divisions of the region and driven by a pragmatic conservation ethos, was ultimately rejected by congress as it contradicted the pervasive, quasi-religious belief that "as the population increases the moisture will increase"—the rain follows the plow westward, beyond the Mississippi River, in the meteorological fulfillment of manifest destiny.[30] Only several years after the completion of the Salt River infrastructure, the State of Arizona reluctantly joined the 1922 Colorado River Compact, divvying up the river's water between an Upper Basin (i.e., Wyoming, Colorado, Utah, and New Mexico) and a Lower Basin (i.e., California, Arizona, and Nevada). In retrospect, this plan was far more radical than Powell's. Each basin was allocated 7.5 million acre-feet, with 1.5 million acre-feet allocated for Mexico; this distribution maximized an estimated annual flow of 17.5 million acre-feet.[31] Later scientific analysis of tree-ring patterns confirmed Powell's reading of the land: the early twentieth century was "the greatest and longest high-flow period [of the Colorado River] during the last 450 years" (Figure 10).[32] The Colorado River, in its very long history, carried far less water than was being planned for. The system's organization and political battles were far too complex to describe here in full, but the Colorado River Compact, based on an optimistic view of hydrological data, set in motion a cascading series of massive infrastructure projects that sought to irrigate and eventually urbanize the Mojave Desert, Sonoran Desert, and California west of the Sierra Nevada Mountains (also generating enough revenue from hydroelectricity to be financially self-sustaining).[33] These public works, constructed in the latter half of the twentieth century by the Bureau of Reclamation, are dramatically different in size, scale, and ambition from the earlier Salt River Valley aqueducts.

Figure 10. A. E. Douglass, founder of the discipline of dendrochronology at the University of Arizona, with a sequoia slab marked with dates of historical and ecological events dating back to the third century CE. (Charles Herbert Photographs, Arizona State Museum.)

The once mighty Lake Mead featured in the 1951 issue of *Landscape* was just one part of the bureau's postwar building bonanza. The largest aqueduct by far, the Central Arizona Project (CAP), conceived in the 1940s and constructed between 1973 and 1994, was an effort by the state to claim its share of an overcommitted Colorado River and forestall an imminent groundwater crisis. The CAP runs in a predominantly open channel for 336 miles across the desert, bringing water to the Phoenix metropolitan area and to Tucson (Figures 11, 12). Colorado River water is lifted 1249 vertical feet along the CAP's course—the height of the Empire State Building; with no hydropower dams, pumps are powered by a massive coal-fired plant on the Navajo Reservation northeast of the Grand Canyon, soon to be replaced by cheaper natural gas plants. The design capacity of the CAP *could* deliver more water than Cleveland, Detroit, and Chicago consume in combination—though that water will likely never materialize amid current predictions for drought and higher temperatures—lending a modern Promethean quality to the project, the dream of an endless summer surfing a palatial half-pipe across the West.[34] The CAP was conceived when the region was still predominantly agricultural; according to the Central Arizona Conservation Water District, the rights to 46 percent of CAP water is

Figure 11. Central Arizona Project canal, northwest of Phoenix. (Photograph by author.)

allocated to Native American tribes in Arizona, though only a portion of this water is actually distributed on reservation lands.[35] Meanwhile, more and more water is transferred to and consumed by municipal and industrial users each year as more and more people move to the region.[36]

In its cross-section, the CAP is concrete-lined and barren for most of its run through the open desert. High fences, often topped with barbed wire, trace its course, a precaution for human safety and deterrent against tampering with the water supply. Under the smooth water surface there is a perceptible current, and occasionally fish or birds present themselves. In Phoenix, the various branches of the canal are a constant, monotonous presence—some accessible by trails but kept clear of vegetation—the most visible of the many water infrastructures that support life. Although both the historic Salt River Project system and the CAP are part of the highly engineered metabolism of human settlement in the American Southwest, these projects are dramatically different not only in size and scale but also in the ways they coalesce distinct cultural relationships between the hinterland and metropolis. The early Salt River system, built on the Hohokam ghost channels, were used for both domestic and agricultural use. They were constructed at a time when the crazed optimism of American settlers, seeking to make the desert bloom, occupied a land with latent potential, whose fertile soils could and would be made productive with disciplined water. The new cultural environments of the canal—canoeing, fishing, swimming, laundering, baptism—flourished for a brief period as rich, polyphonic, ex tempore additions to the technical "script."[37] The transition of canal waters from agricultural to domestic use produced new social environments, requiring communication and cooperation across varied systems of plant and human life. In stark contrast, the CAP accepts no uninvited characters. Its stark, armored profile discourages interaction by its management and physical form. It is as estranged from its surroundings as the water it carries. In short, as a design, the CAP does not suggest any new futures for co-inhabiting a dry land, only more of the same—it represents the most pernicious form of contemporary urban "sustainability."

The Sunbelt City

The water that serves Phoenix originates hundreds of miles beyond the boundaries of the twenty-first-century city. The infrastructure that conveys this water transformed the desert into an irrigated agricultural outpost and then transformed farms and orchards into a twenty-first-century emblem of urban sprawl. As Jackson observed in "The Sunbelt City," rapid urbanization in many parts of the Southwest did not progress superficially from hamlet to village to metropolis but, for reasons unique to each city, produced hybrids of vernacular landscapes that would not be found in wetter, weedier, temperate climates.[38] And although the suburban lawn and golf course fairways still have a stronghold in many parts of Phoenix, the city's urban ecology is built on a framework of agricultural origin.

The development of Phoenician water infrastructure can be framed through two distinct ideological alignments. On the one hand, the consolidation, modernization, and expansion of aqueducts and water treatment plants have led to a prosperous postwar economy that can continue to grow sustainably into the twenty-first century, supported by improvements in water conservation techniques and injections of capital. On the other hand, obstinate historical ignorance about climatic patterns and projections, combined with hubristic engineering of the twentieth century, has produced a metropolis that is now home to a human population as vulnerable to climate change as any coastal city. Each of these ideological stories are supported, in different ways, by binaries of nature/culture, wild/domesticated, and development/conservation. Beyond Phoenix, design and social theory have endeavored to make practical and political sense out of the tension between these narratives of progress and demise, from the cyborg landscape to "unintentional

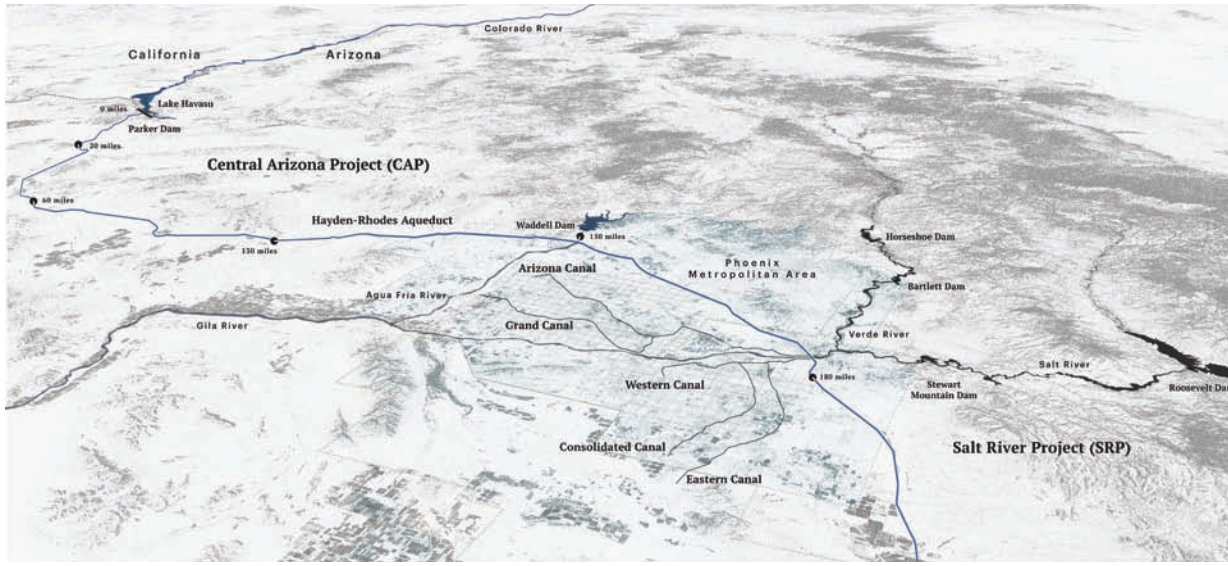

Figure 12. Overview of the Central Arizona Project and Salt River systems. (Drawing by author.)

landscapes," "technical lands," and "anxious landscapes."[39] The cyborg landscape harnesses and structures natural phenomena and is thus animated by acts of design. Unintentional landscapes and technical lands are animated by representation, wherein a pervasive sense of the uncanny demands new kinds of sensory and textual description.[40] Anxious landscapes are apprehended rather than animated; they are frightening because they signal "the death of humanity amid the signs of its triumph over nature."[41] As a case study sympathetic to these efforts, this essay is advocacy for postnatural regionalism animated by infrastructural history. Twentieth-century humans of the Salt River Valley created new regions for themselves (and the plants they preferred) through the construction of hydrological infrastructure. This manifestation of the postnatural concerns engineered habitats defined by "cultural circumstances" rather than primarily by climate and ecology.[42] The Phoenician case additionally suggests that if hydrological infrastructure is a cultural project that can produce new, vital forms of life, it can also generate compelling counterfeits. Who knows what vintage of water sustains that lovely lemon tree: the Colorado River, the Salt River, or an aquifer?

The engineering that transformed the Salt River Valley into the Valley of the Sun brought about unintended cultural effects and social interactions. A careful and curious examination of archival documentation reveals a period when ecology and human settlement were not engaged in a zero-sum game but in real-time negotiations over water. There was never any confusion between the canals and seasonal desert streams, but both waters summon the cottonwood and the canoe alike. So, where were we? The human settlement of the Salt River Valley was founded on the estrangement of geology and the hydrologic cycle. The search for historical ecology in the archive can reveal what was lost (and thus needs to be restored); it can also show what life was like when there were simply fewer people and more room for the creative forces of nature. Whatever this irrigated valley becomes in the future, seeking out the quiet desires of other thirsty life-forms might guide its human inhabitants to reconsider what is possible during times of transition.

> Bathe in it, fling it into the air, carpet the desert in Bermuda and Buffalo and Kentucky Blue. Blast it into the night sky, burble it at every porte cochere and waiting room atrium, adorn it with koi, trout, dolphins, killer whales. Freeze it with freezing machines and glide down atop it in the sunshine. Hold it icy against your injuries. Cut it with sugar, with liquor, with pesticide, blast for gold or gas with it, grow creatures with it. Ride it, spray it into the street, swim in it, soak in it, drink it in, piss it away. . . The flood came upon them like an animal, like a vengeful live thing, earth-colored and savagely fast. "It's water, Ray. Is it water?"
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> —Claire Vaye Watkins, *Gold Fame Citrus*[43]

Author Biography
Danielle Narae Choi is an assistant professor of landscape architecture at the Harvard Graduate School of Design, where she teaches core studio and design research seminars. Her research concerns infrastructure, technology, and the synthetic role of landscape architecture in the

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Notes

1 Claire Vaye Watkins, *Gold Fame Citrus* (New York: Riverhead Books, 2015), 20.

2 See Stuart Oliver, "The Desire to Metabolize Nature: Edward Loveden Loveden, William Vanderstegen, and the Disciplining of the River Thames," in *In the Nature of Cities: Urban Political Ecology and the Politics of Urban Metabolism, ed. Nik Heynen, Maria Kaika, and E. Swyngedouw* (London: Routledge, 2006), 93–109.

3 Geologist Bruce H. Wilkinson claims, "Humans are now an order of magnitude more important at moving sediment than all other natural processes operating on the surface of the planet. Relationships between temporal trends in land use and global population indicate that humans became the prime agents of erosion sometime during the latter part of the first millennium, A.D." See Bruce H. Wilkinson, "Humans as Geologic Agents: A Deep-Time Perspective," *Geology* 33, no. 3 (March 2005): 161. See also Jane Hutton, "Substance and Structure I: The Material Culture of Landscape Architecture," *Harvard Design Magazine* 36 (2013): 116–23.

4 Donna Haraway offered a succinct and optimistic argument for the use of the term *Capitalocene* over *Anthropocene*: "The Capitalocene is terran; it does not have to be the last biodiverse geological epoch that includes our species too." Donna Jeanne Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016): 49. Though the accounting around western water megaprojects was socialistic in nature, it ultimately served an agenda of "growth liberalism," which maximized federal absorption of risk and minimized social welfare programs. See also Andrew Needham, *Power Lines: Phoenix and the Making of the Modern Southwest* (Princeton, NJ: Princeton University Press, 2014): 111.

5 Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke University Press, 2010), 108.

6 J. B. Jackson, "Still the Southwest," *Landscape* 3, no. 2 (Winter 1953–54): 3.

7 See Michael F. Logan, *Desert Cities: The Environmental History of Phoenix and Tucson*, 1st ed. (Pittsburgh: University of Pittsburgh Press, 2006), 16.

8 See Logan, 22.

9 See Logan, 21–24.

10 See Philip R. VanderMeer, *Desert Visions and the Making of Phoenix, 1860–2009* (Albuquerque: University of New Mexico Press, 2010), 15.

11 See S. M. Richard et al., *Estimated Depth to Bedrock in Arizona: Arizona Geological Survey Digital Map 52 (DGM-52)*, 1:1,000,000 (Arizona Geological Survey, April 2007).

12 See Andrew M. Honker, "'A Terrible Calamity Has Fallen upon Phoenix': The 1891 Flood and Salt River Valley Reclamation," *Journal of Arizona History* 43, no. 2 (2002): 109, 114.

13 See Courtland L. Smith, *The Salt River Project: A Case Study in Cultural Adaptation to an Urbanizing Community* (Tucson: University of Arizona Press, 1972), 12.

14 See Logan, *Desert Cities*, 77.

15 Matthew Gandy, *The Fabric of Space: Water, Modernity, and the Urban Imagination* (Cambridge, MA: MIT Press, 2014), 6.

16 See Malcolm L. Comeaux, "Creating Indian Lands: The Boundary of the Salt River Indian Community," *Journal of Historical Geography* 17, no. 3 (July 1991): 241–56.

17 Caroline Elkins, "Looking Beyond Mau Mau: Archiving Violence in the Era of Decolonization," *American Historical Review* 120, no. 3 (June 2015): 855.

18 Bennett, *Vibrant Matter*, 115, Emphasis in original .

19 Needham, *Power Lines*, 64.

20 In the mid-twentieth century, the United States split roughly at the hundredth meridian with regard to surface water laws. Arid states west of that meridian generally followed appropriation doctrine. This right is based on "beneficial use," such as irrigation, and the historical use of water supercedes upstream to downstream relationships. In states following riparian doctrine, a landowner must allow a natural water body to flow freely across their property but can allow for consumptive use. Uses like a water mill, for example, are not "consumptive" in that they primarily consume the energy of the water.

21 Smith, *Salt River Project*, 39–40.

22 An "acre-foot" is the quantity of water required to cover one acre at a depth of one foot, or 325,851 gallons. See Smith, 39.

23 Smith, 40–41.

24 Needham, *Power Lines*, 65.

25 Madeleine Akrich, "The De-Scription of Technical Objects," in *Shaping Technology/ Building Society: Studies in Sociotechnical Change*, ed. Wiebe E. Bijker and John Law (Cambridge, MA: MIT Press, 1992), 207.

26 Paul Robbins and Julie Sharp, "Turfgrass Subjects," in Heynen, Kaika, and Swyngedouw, *Nature of Cities*, 112–13.

27 E. Swyngedouw, *Liquid Power: Water and Contested Modernities in Spain, 1898–2010, Urban and Industrial Environments* (Cambridge, MA: MIT Press, 2015).

28 John Wesley Powell, *Report on the Lands of the Arid Region of the United States: With a More Detailed Account of the Lands of Utah: With Maps*, 2nd ed. (Washington, DC: GPO, William Shein, 1879), 81.

29 Wallace Stegner, *Beyond the Hundredth Meridian: John Wesley Powell and the Second Opening of the West* (New York: Penguin Books, 1954), 202.

30 It should be noted that Powell did not oppose the settlement of the West by homesteaders. In several ways, Powell's conservation ethic called for "removing the Indians" to preserve and redistribute resources to white settlers. See Powell, *Report on the Lands*, 24, 70–71.

31 See Marc Reisner, *Cadillac Desert: The American West and Its Disappearing Water*, rev. ed. (New York: Penguin Books, 1993), 124–25.

32 Subsequent studies, which date the tree-ring record back to AD 762, show periods where the mean flow was less than 85 percent of the twentieth-century mean. See James Lawrence Powell, *Dead Pool: Lake Powell, Global Warming, and the Future of Water in the West* (Berkeley: University of California Press, 2010): 166.

33 See Reisner, *Cadillac Desert*.

34 See Bradley Udall and Jonathan Overpeck, "The Twenty-First Century Colorado River Hot Drought and Implications for the Future," *Water Resources Research* 53, no. 3 (2017): 2404–18.

35 "Tribal Water," CAP: Your Water. Your Future., http://www.cap-az.com/tribal-water.

36 See Jennifer E. Zuniga, *Central Arizona Project History* (Washington, DC: United States Department of the Interior, Bureau of Reclamation, 2000), https://www.usbr.gov/projects/index.php?id=504.

37 In the 1950s, the canals began to be lined with concrete to reduce water loss to seepage and evaporation. By 1973, 70 percent of the canals were fully lined. For an extended description of the social life of the agricultural canals during the early twentieth century, see VanderMeer, *Desert Visions*, 54–55.

38 See John Brinckerhoff Jackson, "The Sunbelt City: The Modern City, the Strip, and the Civic Center," in *The Southern Landscape Tradition in Texas*, ed. J. B. Jackson (Fort Worth: Amon Carter Museum, 1980), 25–36.

39 See Elizabeth Meyer, "The Expanded Field of Landscape Architecture," in *Ecological Design and Planning*, ed. George F. Thompson and Frederick R. Steiner (New York: John Wiley & Sons, 1997), 45–79; Kees Lokman, "Cyborg Landscapes: Choreographing Resilient Interactions Between Infrastructure, Ecology, and Society," *Journal of Landscape Architecture* 12, no. 1 (2017): 60–73.

40 Matthew Gandy, "Unintentional Landscapes," *Landscape Research* 41, no. 4 (May 2016): 433–40; Peter Galison, "Technical Lands," keynote lecture, Harvard University Mahindra Center for the Humanities, Cambridge, MA, April 6, 2017.

41 Antoine Picon, "Anxious Landscapes: From the Ruin to Rust," trans. Karen Bates, *Grey Room* 1 (September 2000): 79.

42 Richard W. Pell and Lauren B. Allen, "Preface to a Genealogy of the Postnatural," in *Land & Animal & Nonanimal*, ed. Anna-Sophie Springer and Etienne Turpin (Berlin: K. Verlag, Haud der Kulturen der Welt, 2015), 91.

43 Claire Vaye Watkins, *Gold Fame Citrus* (New York: Riverhead Books, 2015): 338.