ARCHITECTURAL INTERVENTIONS FOR POST INDUSTRIAL LANDSCAPE RESTORATION AND COMMUNITY RESILIENCE

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Abstract

This thesis investigates how architecture can operate within contaminated landscapes by reframing soil as an active medium of ecological, cultural, and spatial transformation. Focusing on the Tar Creek Superfund Site in Oklahoma, the project addresses the long-term environmental and social impacts of lead and zinc mining on Quapaw tribal lands, where contamination, displacement, and ecological collapse remain ongoing.

Drawing on regenerative design, Indigenous ecological knowledge, and the ecology of knowledges, the research proposes "earth architecture" as a framework for post-industrial environmental justice. Within this framework, architecture operates as a form of geological prosthetic supporting damaged ground systems rather than imposing upon them. The project develops a phased, process-driven approach that integrates underground stabilization of mining voids, phytoremediation through native plant systems, and ecological zoning across wetlands, prairies, and productive landscapes.

Repository landforms act as both containment infrastructure and cultural markers, referencing Indigenous mound-building traditions while safely storing contaminated material. Through qualitative methods, including case study analysis and site-based research, the thesis identifies strategies for aligning remediation with community resilience.

Ultimately, it argues that healing land is inseparable from restoring cultural relationships, positioning architecture as a long-term participant in ecological recovery and collective healing rather than a static object of design.

Dedication

I dedicate this work to my sister Aimon Snigdha, whose constant encouragement and unwavering support gave me the strength to come this far. I also dedicate this thesis to my brother and sister, Walid Ivan and Samia Tabassum, for their belief in me and their quiet strength throughout this journey. To my mother, Farzana Akter, and my father, Ahmed Reza this work exists because of your continuous love, sacrifices, and support. You made it possible for me to pursue my education and follow my purpose.

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This work carries all of you within it.

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Architectural Interventions for Ecological Restoration and Community Resilience

Abstract

The unchecked expansion of human-made structures has led to severe environmental degradation, displaced communities, and fragmented ecosystems. This thesis explores how architecture can contribute to ecologically restore Tar Creek site and build community resilience through adaptive reuse, regenerative design, and ecological urbanism. It focuses on how design can transform degraded landscapes into climate-resilient, socially inclusive environments. Three case studies form the foundation of the research: the Rebuild by Design Hudson River Project (RbDHR) in the U.S., Emscher Landscape Park (ELP) in Germany, and Evergreen Brick Works in Canada. RbDHR employs the Resist, Delay, Store, Discharge (RDSD) framework to address urban flooding through integrated green infrastructure, highlighting challenges in governance and economic feasibility. ELP demonstrates large-scale adaptive reuse by converting polluted industrial land into a regional green corridor, while Evergreen Brick Works illustrates how derelict sites can be reactivated as community hubs for environmental education and cultural engagement. Drawing on Boaventura de Sousa Santos' "ecology of knowledges," John Tillman Lyle's regenerative design theory, and Moser and Ekstrom's adaptation framework which identifies barriers and enablers to climate adaptation across cognitive, institutional, and resource dimensions, the study critiques top-down planning and promotes participatory, site-sensitive approaches that incorporate local knowledge and natural systems. The research uses qualitative methods archival research, policy analysis, and case comparison to identify the best practices and barriers in implementing ecological architecture. Ultimately, the thesis proposes a scalable design framework that positions architecture as a tool for gradual ecological repair. By aligning built environments with ecological processes and community values, the study argues that architecture can move beyond sustainability toward active environmental and social regeneration.

Key Word

Ecological Urbanism, Environmental Justice, Community Resilience.

Introduction

For centuries, human civilization has reshaped landscapes to suit its needs, often at the cost of ecological integrity. Industrialization, urban expansion, and large scale resource extraction have left behind degraded environments, displaced communities, and fragmented ecosystems. Today, very few places on Earth remain untouched by human influence, and the divide between built and natural environments continues to grow. Whether through agriculture, infrastructure development, or conservation efforts, humans have long imposed their will on nature sometimes for survival, sometimes for economic gain. However, as pollution, climate change, and biodiversity loss accelerate, it becomes increasingly evident that our relationship with nature must evolve from one of domination to one of coexistence. The challenge now is not

merely to preserve what remains, but to restore what has been lost.[i] A striking example of this crisis is Tar Creek, Oklahoma, one of the most toxic Superfund sites in the United States. Once a thriving mining district, decades of lead and zinc extraction left the region with severe soil, water, and air contamination, rendering it uninhabitable and forcing community displacement. Similar to other degraded sites, Tar Creek demonstrates the long-term consequences of unsustainable development and the urgent need for architectural and landscape interventions that prioritize ecological restoration and community resilience. [ii]

Methodology

The research methodology is structured into three integrated phases: Theoretical Frameworks, Precedent Analysis, and Design Research. This research adopts a qualitative, design-research methodology that combines precedent analysis, site investigation, and theoretical synthesis, and is further informed by qualitative field engagement, including site visits, participation in community gatherings, and semi-structured conversations with members of the Quapaw, Cherokee, and Miami Nations, providing place-based insight into environmental conditions, cultural relationships to land, and community perspectives.

This study builds on established design-research frameworks that position architecture not as a final product but as a mode of inquiry capable of testing relationships between spatial, ecological, and social systems[iii] (Frayling 1993; Cross 2006; Groat and Wang 2013). Extending these approaches, this study applies architectural methods to soil remediation processes, treating the ground itself as a site of investigation.

Methods include: Qualitative design-research methodology that integrates multiple approaches to examine the relationship between soil, ecology, and architecture. It includes the analysis of post-industrial remediation precedents to understand long-term ecological recovery strategies, alongside the mapping of geological, hydrological, and contamination systems using EPA and site-specific data. Archival research on land dispossession and mining history provides historical context, while Indigenous ecological knowledge is incorporated through literature and site engagement to inform culturally grounded design decisions. These methods are further supported by iterative design exploration focused on soil processes and time, as well as physical modeling and material experimentation to better understand environmental processes through spatial and material study.

Literature Review

For centuries, human expansion has reshaped landscapes, often with little regard for the ecosystems and communities displaced in the process. The consequences are evident in abandoned industrial sites, flood prone cities, and fragile natural habitats struggling to recover. Yet, these damaged spaces hold immense potential for renewal. Boaventura de Sousa Santos' concept of "ecology of knowledge" challenges the traditional top down approach to development, advocating instead for a more inclusive, participatory model one where we design with nature and communities, rather than for them. Boaventura de Sousa Santos' "ecology of knowledges" framework provides a theoretical lens to address this issue, arguing that design and planning should not impose solutions from above but rather emerge from inclusive, participatory processes. This perspective challenges Western theory that prioritize technical expertise over indigenous and community driven knowledge systems, making a case for designing with nature and communities rather than for them. [iv]

The failure to integrate local perspectives often results in a lack of long term community investment in projects, leading to resource exhaustion, social fragmentation, and policy inefficacy. In addition to environmental and economic sustainability, collective memory plays a critical role in architectural interventions aimed at restoring degraded landscapes. Maurice Halbwachs' theory of collective memory asserts that memory is not solely an individual experience but is shaped and maintained through social interactions.[v] This means that spaces, buildings, and landscapes hold deep cultural and historical significance, acting as anchors of shared identity and remembrance. When designing ecological restorations, architecture must do more than revive the land it must also preserve and engage with the cultural and historical narratives of the community.

Collective healing in post-conflict societies is a multifaceted and long-term process that requires addressing both the emotional trauma and structural inequalities that persist beyond formal peace agreements. Traditional methods such as truth commissions, reparations, and mental health

interventions have been vital yet often fragmented. To overcome this gap, Daniel L. Shapiro introduces **Reconciliation Systems Design (RSD)** a comprehensive framework for conceptualizing, operationalizing, and coordinating healing interventions across multiple societal levels. RSD moves beyond individual interventions by proposing a **meta-process** that weaves together emotional and structural healing mechanisms through twelve interdependent strategies, ranging from stakeholder mapping and ethical guideline formation to synergizing healing mechanisms and mobilizing public will. The foundation of this approach lies in **Relational Identity Theory**, which emphasizes building affiliation and autonomy across divided groups to create an inclusive and participatory healing process. RSD insists that reconciliation is not a single event but a sustained, systemic transformation rooted in shared vision, public engagement, and culturally adaptive mechanisms. By offering templates for action rather than one-size-fits-all prescriptions, Reconciliation Systems Design provides an adaptable structure for societies such as those recovering from environmental, racial, or political injustice to pursue **collective healing** that is psychologically resonant, politically inclusive, and structurally sound.[vi]

Case Study 1: Rebuild by Design – Hudson River Project (Resist, Delay, Store, Discharge)

Location: Hoboken, New Jersey, USA
Initiated by: U.S. Department of Housing and Urban Development (HUD) + Rebuild by Design
Area: ~2 square miles of highly urbanized floodplain
Key Cities Involved: Hoboken, Weehawken, Jersey City

Problem

Hoboken is highly vulnerable to flooding due to its low-lying topography, high-density development, and aging combined sewer system. The city, built on reclaimed marshland, experienced catastrophic damage during Hurricane Sandy in 2012 about 80% of Hoboken flooded, with over 500 million gallons of water submerging streets, homes, and transit infrastructure.

Strategies

The Rebuild by Design Hudson River Project applies the **"Resist, Delay, Store, Discharge" (RDSD)** framework to address coastal and stormwater flooding.

Resist: Builds coastal protection including floodwalls, levees, and deployable barriers to hold back storm surges.
Delay: Introduces green infrastructure rain gardens, permeable pavement, and bioswales to slow runoff.
Store: Adds capacity through detention basins, green roofs, and retention parks to temporarily hold stormwater.
Discharge: Improves drainage infrastructure with upgraded sewer lines and pump stations to remove water more efficiently.
This multi-layered, climate-adaptive design merges public space with resilience infrastructure, setting a global precedent for how water-sensitive cities can combat rising climate threats.

Relevance to Tar Creek

This case demonstrates how a **layered approach to flood and environmental risk** can guide post-industrial remediation. Tar Creek could adopt similar models, combining **hard infrastructure, nature-based solutions, and civic engagement** to manage surface water contamination, reintroduce wetlands, and restore ecological function.[vii]

Case Study 2: Emscher Landscape Park (ELP), Germany

Location: Ruhr Valley, North Rhine-Westphalia, Germany
Initiated by: International Building Exhibition (IBA) Emscher Park (1989–1999)
Area: ~450 km² of green corridors within an 800 km² post-industrial zone
Key Cities Involved: Essen, Dortmund, Duisburg, Gelsenkirchen, Oberhausen, and 15 others

Problem

The Ruhr Valley was once the industrial powerhouse of Germany, filled with coal mines, steel plants, and polluted waterways. By the late 20th century, the region faced massive environmental degradation, economic collapse, contaminated land and rivers, and social fragmentation following industrial decline.

Strategies

The Emscher Landscape Park represents a **paradigm shift in post-industrial redevelopment**:
Ecological Restoration: Re-naturalization of the Emscher River and surrounding wastelands with new forests, meadows, and habitats.

Public Access & Recreation: Creation of diverse open spaces urban parks, walkable art installations, and scenic trails reconnecting people with the landscape.
Cultural Preservation: Adaptive reuse of industrial infrastructure, including railways, factories, and chimneys, transformed into museums, climbing walls, and cultural centers. By integrating **landscape, memory, and ecology**, the park fosters urban biodiversity and cultural identity while supporting tourism and education.
Relevance to Tar Creek
The ELP shows that **severe industrial scars can be turned into ecological and cultural assets**. Tar Creek could similarly reclaim its polluted lands through **phased ecological interventions**, historical storytelling, and recreational opportunities that honor both past injustices and future resilience.[viii]

Case Study 3: Freshkills Park, Staten Island, New York

Location: Staten Island, New York City, USA
Initiated by: NYC Department of City Planning & NYC Parks
Area: 2,200 acres (nearly 3 times the size of Central Park)
Key Cities Involved: New York City (Staten Island)
Problem
Freshkills was the largest landfill in the world, operating from 1948 to 2001. Decades of waste dumping contaminated groundwater, emitted toxic methane gases, and left a massive scar on the urban and ecological landscape of Staten Island.
Strategies
The city undertook a visionary transformation plan that emphasizes **long-term ecological restoration** and community benefit:
Landfill Capping & Remediation: Sealed mounds with engineered barriers and installed systems for methane capture and leachate treatment.
Ecological Regeneration: Introduced native plant species, created tidal wetlands, and restored habitat corridors.
Phased Public Access: Opened sections progressively for recreation (trails, kayaking, birdwatching) and hosted environmental education programs.
Civic Rebranding: Turned a symbol of waste into one of **sustainability, resilience, and urban renewal**, redefining Staten Island's identity.
Relevance to Tar Creek
Freshkills offers a direct blueprint for Tar Creek **a model for transforming contaminated terrain through remediation, habitat recovery, and phased community use**. It reinforces the idea that even the most toxic legacies can be reclaimed to serve public good through careful engineering, community outreach, and design vision. [ix]

Case Study 4: Ford Rouge Center Redevelopment (River Rouge Project)

Location: Dearborn, Michigan, USA
Initiated by: Ford Motor Company, led by architect William McDonough
Area: 500 hectares
Key Cities Involved: Greater Detroit metropolitan area

Problem
The River Rouge Complex, originally developed in 1917 by Henry Ford, became one of the most iconic yet environmentally destructive industrial zones in the United States. By the 1990s, the site was plagued with:
Toxic emissions, runoff pollution, and extensive soil and water contamination.
Decaying steel buildings and outdated manufacturing processes.
A stark disconnect between industrial operations and environmental responsibility.
The site reflected a 20th-century industrial model that prioritized production over ecological health or long-term sustainability, making it one of many environmentally scarred legacy sites in the post-industrial Midwest.

Strategies
Led by architect and ecological designer **William McDonough**, the $2 billion, 20-year rehabilitation of the River Rouge site aimed to transform the facility into a **model of sustainable industrial ecology**. This project was one of the first to demonstrate how heavy industry and environmental responsibility can co-exist. Key strategies included:
1. The Living Roof
a. A 4-hectare (10-acre) green roof was installed atop the truck assembly plant.
b. It serves multiple purposes: filtering rainwater, insulating the factory,

absorbing CO_2, releasing oxygen, and supporting pollinators like butterflies and hummingbirds.

2. Natural Stormwater Management

a. Rainwater is channeled through **man-made wetlands**, porous pavement, and native vegetation rather than treated with costly chemical filtration.
b. This system cost **$13 million**, significantly less than the $48 million that a conventional treatment plant would have required.

3. Cradle to Cradle Industrial Thinking

a. Instead of traditional recycling, McDonough implemented an "industrial ecosystem" where all outputs are either **biologically benign or reused as technical nutrients** in a closed loop.
b. New buildings are designed to function "like trees" producing oxygen, distilling water, and adapting to seasonal conditions.

4. Renewable Materials and Future-Focused Design

Buildings are sunlit, airy, and made of recyclable or compostable materials. The redevelopment was coupled with new research and design for more sustainable products, including a **fully recyclable vehicle prototype**.

Relevance to Tar Creek

The River Rouge Project offers a **powerful model for reimagining industrial scars as regenerative landscapes**. Its success proves that:

Ecological design principles can be economically viable even at the industrial scale.

Nature-based solutions such as green roofs and wetlands can outperform and outprice traditional "grey" infrastructure.

The **"cradle-to-cradle" philosophy**designing with future reuse and ecological integration in mind can redefine contaminated zones like Tar Creek as hubs of environmental repair and community pride.

McDonough's work aligns with the vision of transforming sites of past environmental harm into **symbols of ecological and cultural renewal**, making it deeply relevant to post-industrial remediation projects in the U.S. heartland.[x]

Site Context: Tar Creek Superfund Site, Oklahoma

The Tar Creek Superfund Site, located in northeastern Oklahoma near the former towns of Picher and Cardin, is among the most toxic legacy sites in the United States. Spanning approximately 47 square miles, the site is the remnant of over a century of intensive lead and zinc mining that began in the late 1800s and continued into the 1970s. Today, this landscape is marked by towering chat piles (mine tailings), acid mine drainage, contaminated aquifers, and ecological collapse. The site's continued toxicity is due to the cessation of mine dewatering, which allowed underground tunnels to flood. As water oxidized exposed sulfide ores, it dissolved heavy metals like lead, cadmium, arsenic, and manganese, which now leach into the Tar Creek watershed and its downstream ecosystems.



Fig. 1. Aerial View of The Chat Pile in Tar Creek (Superfund Site), Oklahoma.

This site holds profound significance for my thesis, which explores how architecture can operate within environmentally compromised contexts to foster healing ecologically, socially, and culturally. Tar Creek is not just a site of contamination, it is a site of ongoing environmental injustice, historical displacement, and Indigenous resilience. It allows me to explore how design can support land remediation while offering meaningful spaces for community reconnection and education. The presence of nine tribal nations within the region, including the Quapaw, Peoria, Ottawa, and Cherokee, highlights the opportunity and the ethical responsibility to develop architectural interventions that respect Indigenous sovereignty, traditional ecological knowledge, and cultural narratives. [xi]

Historical and Geopolitical Foundations

The environmental and public health crisis unfolding at the Tar Creek Superfund Site is deeply rooted in settler colonialism, mineral extraction, and federal land management practices. Located in northeastern Oklahoma within what was once Indian Territory, the region became home to over 60 forcibly relocated Tribal Nations, including the Quapaw, Peoria, Miami, Ottawa, Cherokee, and others, throughout the 19th century. Following the passage of the Dawes Act in 1887, the U.S. government divided communal tribal lands into allotments and declared many Indigenous landholders legally "incompetent," thereby enabling mining corporations to lease these lands with federal approval but without tribal consent. [xii] The discovery of lead and zinc ore in the Tri-State Mining District at the turn of the century ushered in a massive industrial boom. From 1891 through the 1970s, the area became one of the largest producers of lead and zinc in the world, contributing to over one-third of the U.S. metal supply for both World Wars. While the U.S. government and mining companies profited from the exploitation of Indigenous land, Tribal Nations were left to bear the environmental and health consequences.

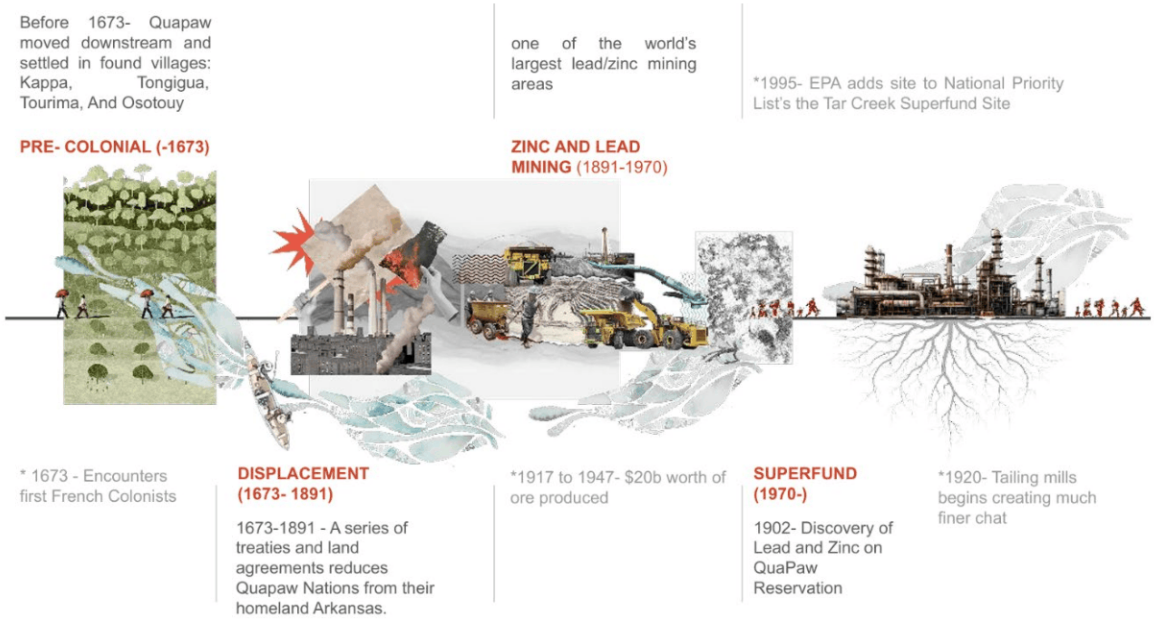


Fig. 2. Historical Timeline Diagram of the Tar Creek Site.

Mining operations produced approximately 500 million tons of waste in the form of "chat" piles huge mounds of crushed limestone, silica, and residual toxic metals such as lead, cadmium, arsenic, and manganese. Over 300 miles of underground mine tunnels were left abandoned beneath the region. When mining ceased in the 1970s, the companies decommissioned the water pumps that had kept these tunnels dry. This allowed groundwater to fill the voids, interact with sulfide ore, and create acid mine drainage a toxic brew that began surfacing in 1979 and turned Tar Creek a visible rust-red.[xiii] The physical scars of industrial extraction are compounded by the cultural trauma of displacement and the persistent neglect of Indigenous sovereignty. Understanding this historical-geopolitical context is essential to any architectural approach to the site. Design here cannot be neutral; it must grapple with layered histories of violence, resilience, and erasure. By acknowledging these intersecting injustices, architects have an opportunity to support spatial practices that restore dignity, ecological balance, and cultural continuity.

Environmental and Health Impacts

The environmental degradation at Tar Creek has had devastating impacts on local ecosystems and human health, particularly among Indigenous communities. The site today is contaminated by

heavy metals, including lead, cadmium, arsenic, manganese, and zinc each of which poses serious risks to the nervous system, cardiovascular health, and reproductive development. As early as the 1990s, public health investigations revealed that over 30% of children living in Picher, Oklahoma (a now-abandoned town within the site), had blood lead levels exceeding 10 µg/dL five times the national average at the time (ATSDR, 1997). Long-term lead exposure is linked to decreased IQ, learning disabilities, behavioral issues, and increased risk of neurological disorders. In addition to lead, elevated levels of manganese in well water have been shown to affect memory, attention, and motor skills in children, particularly when exposure occurs during fetal and early childhood development .[xiv]

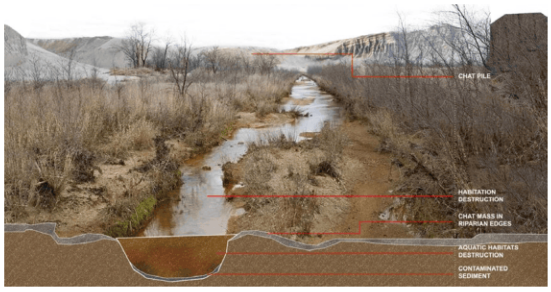


Fig. 3. Impact of Mining on the Site

The region's ecological systems have also been severely disrupted. Fish populations in Tar Creek and its tributaries have largely disappeared, aquatic insects are absent, and plant life downstream shows signs of metal uptake and toxicity. The contamination extends to the Roubidoux aquifer and the Neosho River, both of which feed into Grand Lake a major water supply and recreation area. In a 2000 report, the U.S. Geological Survey found manganese levels in local water wells that were up to 200 times above the EPA's maximum contaminant level.[xv] Moreover, chat piles have been used as gravel for roads, playgrounds, and landscaping, contributing to airborne dust exposure in residential areas. Children who played on or near these piles had increased risks of ingesting or inhaling toxic metals. Although the Environmental Protection Agency designated the site a Superfund priority in 1983, remediation efforts have been slow, fragmented, and underfunded. Federal relocation programs were only implemented decades later, resulting in the eventual disincorporation of Picher in 2009. These cumulative failures reflect a broader pattern of environmental injustice, wherein low-income and Indigenous populations face disproportionate burdens from industrial pollution and systemic inaction.

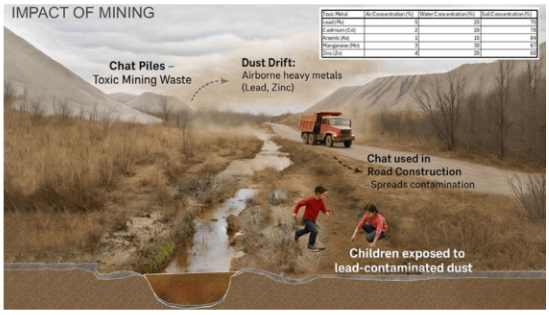


Fig. 4. Diagram showing Re-use of the Chatpile and it's impact on children's health.

Research Potential and Methodological Challenges

Despite the challenges, Tar Creek offers a rich and complex site for architectural inquiry, especially for projects that aim to integrate ecological remediation, historical storytelling, and community based design. The abundance of environmental data collected by the EPA, ATSDR, USGS, and local grassroots organizations provides a solid foundation for mapping contamination zones, understanding hydrological flows, and analyzing site toxicity. In particular, the LEAD Agency (Local Environmental Action Demanded), co-founded by Quapaw activist Rebecca Jim, provides not only community-sourced environmental monitoring but also public educational materials, interviews, and site tours that emphasize the lived experience of environmental harm. These "toxic tours" serve as a model for decolonial, participatory research methodology by prioritizing Indigenous and local voices.[xvi]

However, methodological challenges persist. While scientific data on metal contamination is extensive, there is a gap in design-based and socio-spatial documentation of the site. Much of the landscape has changed dramatically since the height of mining, and documentation of spatial memory especially from tribal perspectives is often anecdotal or fragmented. Ethical concerns also arise: working on contested, sacred, and toxic land necessitates careful collaboration with affected communities. Additionally, the site's dynamic nature constantly shifting due to erosion, water flow, and underground collapse requires adaptable, resilient design approaches rather than fixed architectural forms. Designers must learn

from non-human actors like soil, water, and plants observing how they move, adapt, and recover in a degraded system.

Design Process and Tactics Derieved from Analysis and Research



Fig. 5. Strategies to Combat the Current Issues and Building Community Resilience

Several contextual forces shape how this site should be approached. First is the physical toxicity of the landscape: high levels of lead and other metals in the soil and water mean any intervention must engage with contamination through strategies of bioremediation, soil stabilization, or controlled occupation. Second is the legacy of displacement and neglect. Picher was disincorporated in 2009, and entire communities were uprooted by state and federal buyouts. My design must therefore respond to an emotional and cultural absence as much as a physical one, acknowledging memory, grief, and the resilience of those who once called it home. Third, the site is shaped by tribal jurisdictions, spiritual significance, and land-based knowledge systems. This suggests that any design should not impose form but instead emerge through relationships with community members, oral histories, and the rhythms of the land itself.

The historical context of Tar Creek is foundational to design process. The site was once a homeland forcibly redefined as "Indian Territory" during the 1830s removals. Later, through the Dawes Act and subsequent allotment policies, communal tribal lands were fractured and leased often without consent to mining companies. This double dispossession first of people from their land, then of land from its caretakers underscores the violence embedded in the landscape. The design methods seeks to reverse this effect, to use architecture as a medium of reconnection, ecological recovery, and cultural resurgence. Instead of erasing the scars, the intervention may choose to reveal, remediate, and reframe them as part of a healing process.

There is a substantial body of research and documentation available on the Tar Creek Superfund Site, which supports the development of a design project grounded in real data and community narratives. Government sources such as the U.S. Environmental Protection Agency (EPA) offer detailed records of site contamination, remediation plans, and environmental impact reports. Additionally, the LEAD Agency, a local environmental justice nonprofit co-founded by Rebecca Jim and Earl Hatley, provides a wealth of community-driven knowledge, oral histories, and

educational resources through their long-standing "Toxic Tours" of the region.

However, methodological challenges remain. The abundance of scientific data often overshadows the lived experiences and cultural perspectives of Indigenous and local residents. Navigating the ethical implications of working on land that is both contaminated and sacred requires careful, sustained engagement. Another challenge is the dynamic nature of the site its physical and social conditions are continually shifting due to erosion, weather events, and policy changes. This uncertainty necessitates a flexible, adaptive design strategy rather than a fixed architectural object.

Conclusion

Architecture must transition from an extractive and destructive force to a restorative and regenerative one. This research emphasizes the importance of policy support, interdisciplinary collaboration, and community participation in ensuring the long-term success of ecological restoration efforts. By embracing sustainable design strategies and prioritizing site-responsive, low-impact development, architecture can acilitate the gradual healing of degraded environments, ultimately rebuilding not only landscapes but also the relationship between humans and nature. The future of architecture lies in its ability to create spaces that coexist with ecosystems, strengthen communities, and contribute to the planet's resilience, marking a new era where the built environment is an active agent of ecological recovery.

End Note

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[xvi] Bigby BC, Jim R, Hatley E.

ADDENDUM

SIADA AKHTER
Miami University

Introduction / Personal Origins

My thesis began with a simple but urgent question "Where in the United States is the land so severely harmed by human activity that both nature and people are suffering, and what role can architecture play in healing it"? This question did not come only from academic curiosity. It emerged from my personal history, lived experiences, and a deep sense of responsibility toward communities that have been pushed to the margins.

I grew up in Bangladesh, a country shaped by colonial history, political struggle, and environmental vulnerability. Flooding, pollution, and uneven development are part of everyday life there. Growing up in this context made me sensitive to how land is often treated as something to be extracted, controlled, or sacrificed usually at the expense of people who have the least power to resist. Because of this background, I have always felt drawn toward communities whose suffering is overlooked or normalized. The inner activist in me has never been quiet. My identity has been shaped by displacement, inequity, and resilience, and that continues to guide my work.

Understanding the Site: Tar Creek

When I began searching for a thesis site in the United States, I was not looking for a place that simply needed design improvement. I was searching for a place where harm was deeply embedded in the land itself where environmental damage and social injustice were inseparable. That search led me to Tar Creek.

Tar Creek is one of the earliest Superfund sites in the country. Despite being listed decades ago, it remains dangerously contaminated. The moment I learned about its history the lead and zinc mining, the massive piles of toxic waste, the poisoned water, and the communities still living within this environment I knew this was the site I needed to work with. Even though my studio required selecting multiple sites, I committed fully to Tar Creek.

I felt a strong responsibility toward the tribal nations whose lands were sacrificed for extraction, especially the Quapaw Nation, whose reserved lands have endured environmental injustice for more than a century. Tar Creek is not only an environmental disaster; it is a human one. Entire towns have disappeared. Children have grown up exposed to toxic dust. Rivers once used for fishing, swimming, and ceremony now run orange with acid mine drainage. This damage did not happen in isolation it occurred on tribal land, to communities already displaced and stripped of sovereignty. The injustice is layered, historical, and ongoing.

Discourse Development: Learning from Culture, Landscape, and Tradition

My approach to Tar Creek is shaped by architectural and cultural discourse that centers justice, memory, and place based knowledge. Thinkers such as Frantz Fanon and Sara Ahmed help frame how power, displacement, and lived experience shape landscapes and bodies. Their work supports the idea that space is never neutral and that sites like Tar Creek carry both physical and emotional weight.

Artists working in post-industrial and site-specific practices further inform my approach by revealing hidden damage and making environmental violence visible. These perspectives helped me understand that architectural work at Tar Creek must acknowledge harm rather than cover it, and must work with memory rather than erase it.

This discourse guided how I conducted site and culture specific research. Rather than relying only on technical data, I focused on oral histories, Indigenous worldviews, community narratives, and historical memory. Architecture, in this sense, becomes a mediator between knowledge systems rather than a top-down solution.

Site and Program Selection

My motivation deepened as I learned more about Indigenous communities and their relationships with land. While studying at Miami University, I met Andrew Sawyer from the Myaamia Center. Through conversations with him, I learned about oral traditions, language revitalization, and Indigenous worldviews. These discussions were transformative. I began to understand that Indigenous knowledge is not only cultural it is ecological, spiritual, and based on reciprocal relationships with land, water, plants, and animals.

This understanding changed my approach completely. I was no longer studying Tar Creek as a contaminated site to be "fixed," but as a living place shaped by relationships between people and land. For many Indigenous nations, land is a relative, not property. Water is alive, not a resource. Healing, therefore, is not only repair it is the restoration of broken relationships.

Learning from Precedent and

My academic understanding of remediation

expanded through a visit to the Fernald Superfund Site, organized by my studio professor Mary Ben. Fernald, a former uranium processing facility, has undergone decades of cleanup and partial restoration. There, I met environmental engineer Graham Mitchell, who explained the scale, complexity, and long timelines of remediation.

Seeing Fernald showed me that healing damaged land is possible, but never fast or simple. It requires science, long-term commitment, accountability, and community involvement. This visit helped me imagine what healing at Tar Creek could look like not as an instant transformation, but as a decades-long process.

Site Analysis and Mapping

Before proposing any architectural intervention, I knew the land itself needed to heal. I studied the active cleanup efforts led by the Quapaw Nation, the State of Oklahoma, and the EPA, particularly through presentations from the Tribal Lands and Environment Forum. I learned that over three million tons of mining waste have been removed and hundreds of acres restored, while major challenges still remain.

Using QGIS and guidance from Professor Jeff Kruth, I translated historic mining maps into digital layers. These revealed underground room-and-pillar voids extending 100–350 feet below ground. In many places, the surface landscape is literally hollow. Mapping helped me identify a point of urgency where Tar Creek meets Lytle Creek the source of acid mine drainage and orange water becoming the focus of my intervention.

Concept Development

The core concept of this thesis is grounded in the belief that healing must happen before occupation, and that architecture in damaged landscapes should emerge after ecological and cultural repair has begun. At Tar Creek, the land is not a neutral ground for construction; it is fractured, contaminated, and unstable both physically and socially. Because of this, the project does not begin with buildings as objects, but with systems, processes, and relationships.

Rather than proposing a single large architectural intervention, the concept is structured around a network of modular, site-responsive actions that work together over time. This approach acknowledges the immense scale of Tar Creek and the reality that remediation cannot happen everywhere at once. By identifying points of urgency locations where environmental damage, water contamination, and community impact overlap the project proposes interventions that can begin locally but expand regionally.

A key conceptual move is working from the ground down and the ground up at the same time. Below ground, the project addresses instability through Cemented Rock Fill (CRF), stabilizing voids created by room-and-pillar mining. Above ground, it introduces repositories, wetlands, prairies, and treatment systems that slowly rebuild soil health, water quality, and habitat. Architecture, in this framework, is not separate from remediation it is embedded within it.

The repository mounds are central to this concept. Technically, they function as on-site disposal facilities that safely contain toxic chat and contaminated soil. Conceptually, they reconnect the project to Indigenous mound-building traditions, transforming waste into culturally meaningful landforms. These mounds do not erase the site's history; they hold it, mark it, and allow new life to grow above it. They become both infrastructural and ceremonial places of protection, memory, and future gathering.

Another important concept is time as a design material. Healing at Tar Creek does not occur instantly. Phytoremediation, passive water treatment, soil regeneration, and habitat restoration all operate over years and decades. The project embraces this slowness. Instead of presenting a finished image, it proposes a sequence of conditions early stabilization, ecological recovery, limited access, and eventual reoccupation. Architecture here supports transition rather than permanence.

The landscape framework is organized into ecological zones wetlands, riparian buffers, tallgrass prairie, forest edges, and productive agricultural land each responding to contamination levels, water access, and cultural meaning. These zones are not decorative; they perform critical ecological work while also reconnecting people to ancestral practices such as farming, gathering, and stewardship.

At a broader scale, the concept positions Tar Creek as a prototype rather than an exception. The modular strategies developed here CRF stabilization, repository landforms, passive treatment systems, and culturally informed landscapes can be adapted to other mining-scarred sites across the United States and beyond. In this way, the

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At a broader scale, the concept positions Tar Creek as a prototype rather than an exception. The modular strategies developed here CRF stabilization, repository landforms, passive treatment systems, and culturally informed landscapes can be adapted to other mining-scarred sites across the United States and beyond. In this way, the

project moves from a single site toward a transferable model for post-industrial healing.

Ultimately, the concept reframes architecture as a supportive and ethical practice. Instead of imposing form, it listens to land, history, and community. Instead of solving everything at once, it creates conditions for recovery. The project proposes that architecture's role at Tar Creek is not to dominate the landscape, but to help it recover its ability to sustain life, memory, and future possibility.

Schematic Design Process (in Process)

A key part of this phase has been studying oral histories, environmental justice reports, and community narratives to ground the project in lived experience. These sources help ensure that design decisions respond to real people and not only to technical data. I have also relied on regular discussions with faculty mentors to refine the project's scope and identify realistic points of intervention. Community engagement remains central to the process. I am in contact with advocates connected to Tar Creek, including Rebecca Jim of the LEAD Agency, and I am planning a site visit to better understand the land and its conditions firsthand. Walking the site and listening to people who live with its consequences will inform future design decisions.

Spatially, the schematic work focuses on relationships rather than form linking underground stabilization, surface remediation, and future access through deep earth sections and landscape studies. Phasing is also critical. The project is being developed as a sequence of stages, from stabilization and containment to ecological recovery and limited public use.

Overall, this schematic phase emphasizes a slow, adaptive, and collaborative approach, allowing architecture to support healing over time rather than impose immediate solutions.

Thesis Critique Reflection

At the end of the symposium, my design proposal focused on a defined portion of the Tar Creek site measuring approximately 10,600 by 5,320 feet. While this area is still very large, the project primarily illustrated the final condition of the site after remediation and presented the methods used to heal the land. However, it did not clearly communicate the timeline of restoration, the phased process of remediation, or how long the full transformation of the site might realistically take. This gap was thoughtfully identified during the critique by Jennifer Newsom, whose feedback helped me recognize that remediation is not a single moment or a finished image, but a long and layered process that unfolds over decades. While my work addressed both surface and subsurface strategies, it did not yet show how these systems operate over time or how the land gradually changes through different stages of recovery.

I was encouraged to further develop phasing diagrams and timelines that reflect the true complexity of the site. This includes studying deep earth sections, since the damage at Tar Creek exists both underground through collapsed mining voids and contaminated soils and above ground, in waterways, vegetation, and human use. Showing how underground stabilization, water treatment, and surface restoration occur together over time will strengthen the project's clarity and realism.

I found this critique extremely helpful. Moving forward, my goal is to create a clear, phased remediation timeline that explains what happens first, what follows, and how the land slowly becomes safe, productive, and accessible again. This next step will allow the project to better communicate not only what the final vision is, but how it gets there and how long healing truly takes.

Conclusion

Looking back, this project pushed me both intellectually and personally. What began as an interest in damaged landscapes grew into a deeper engagement with environmental justice, Indigenous knowledge, and long-term ecological healing. The scale of Tar Creek often felt overwhelming and made me question the limits of architecture.

Through this process, I learned that architecture cannot work alone. Meaningful intervention requires collaboration across disciplines, with architecture acting as a connector rather than a solution by itself. The challenges of this site became opportunities to grow, learn, and rethink architectural responsibility.

This thesis marks the beginning of my commitment to working with underrepresented communities and damaged landscapes. It is not an end, but a direction



Fig. 6. Toxic Legacies: Visualizing Human-Made Environmental Harm

Design Process



Fig. 6. From the Ground Up: People-Led Remediation

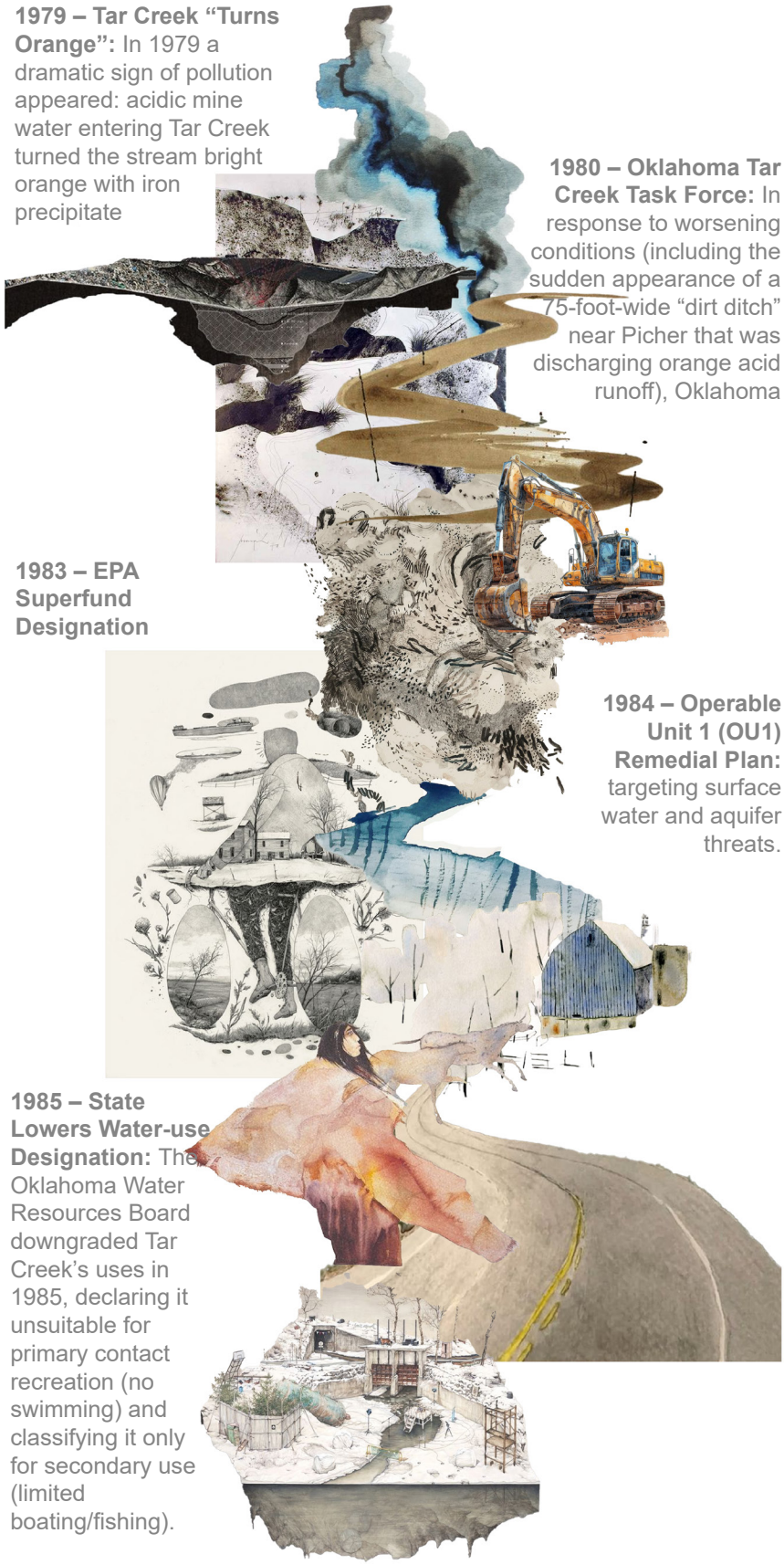


Fig. 7. Timeline of Superfund Activities on the Site

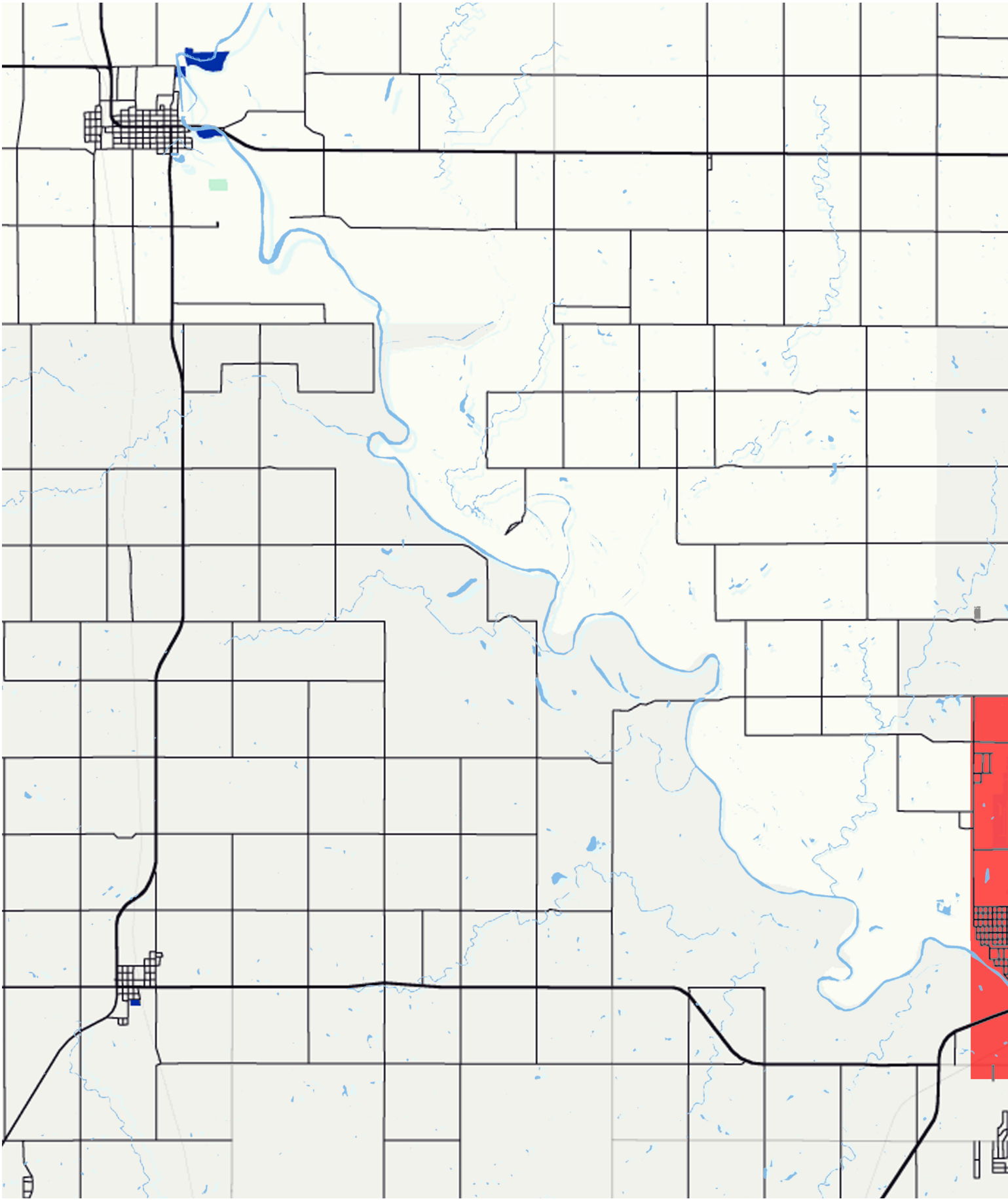
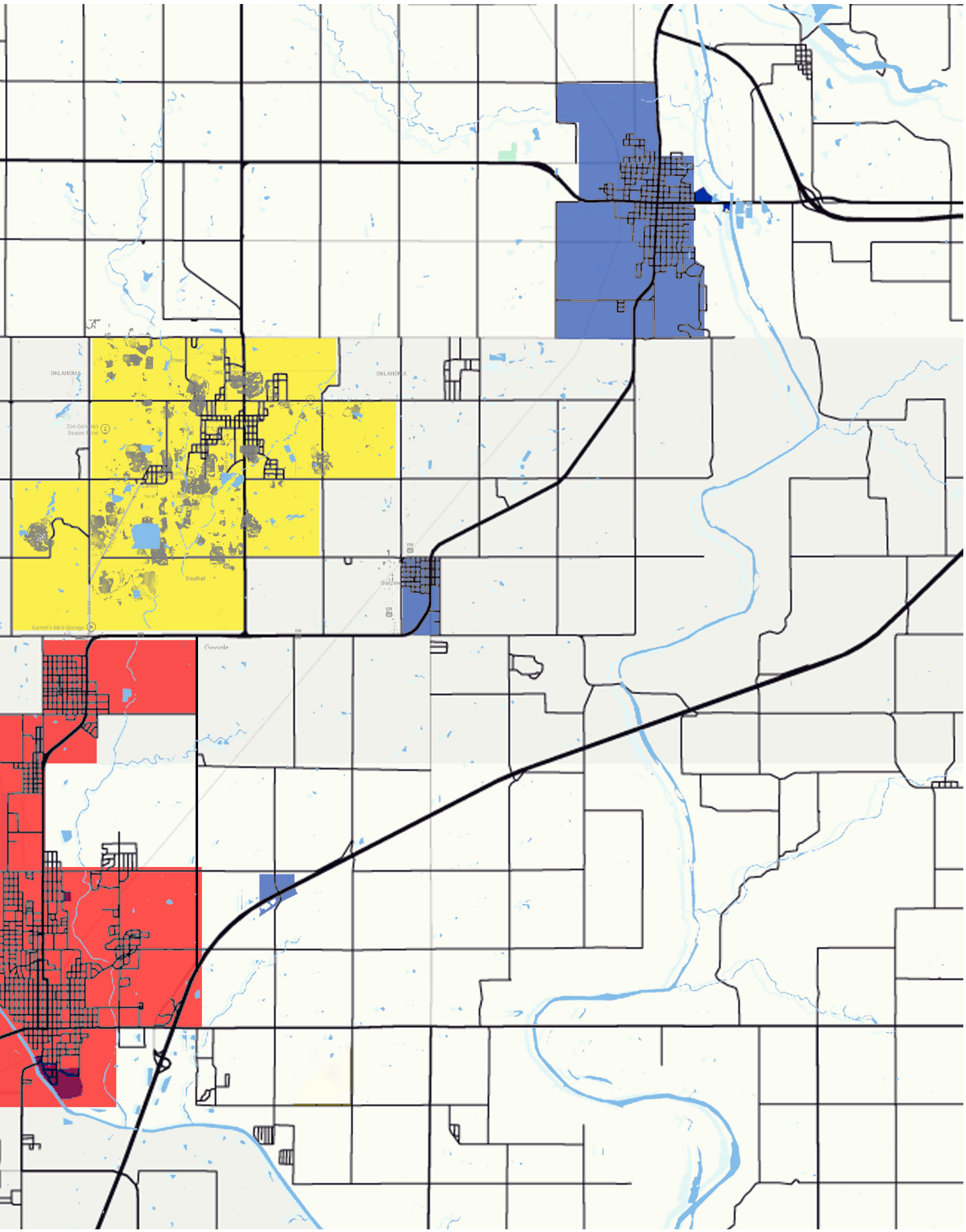


Fig. 8. Artist-Inspired De Stijl Mapping of the Tar Creek Region Showing Affected Urban Areas (Red), Sources of Contamination (Yellow), and Indirectly Impacted Cities (Blue)


OKLAHOMA
OKLAHOMA
Douthat
Google

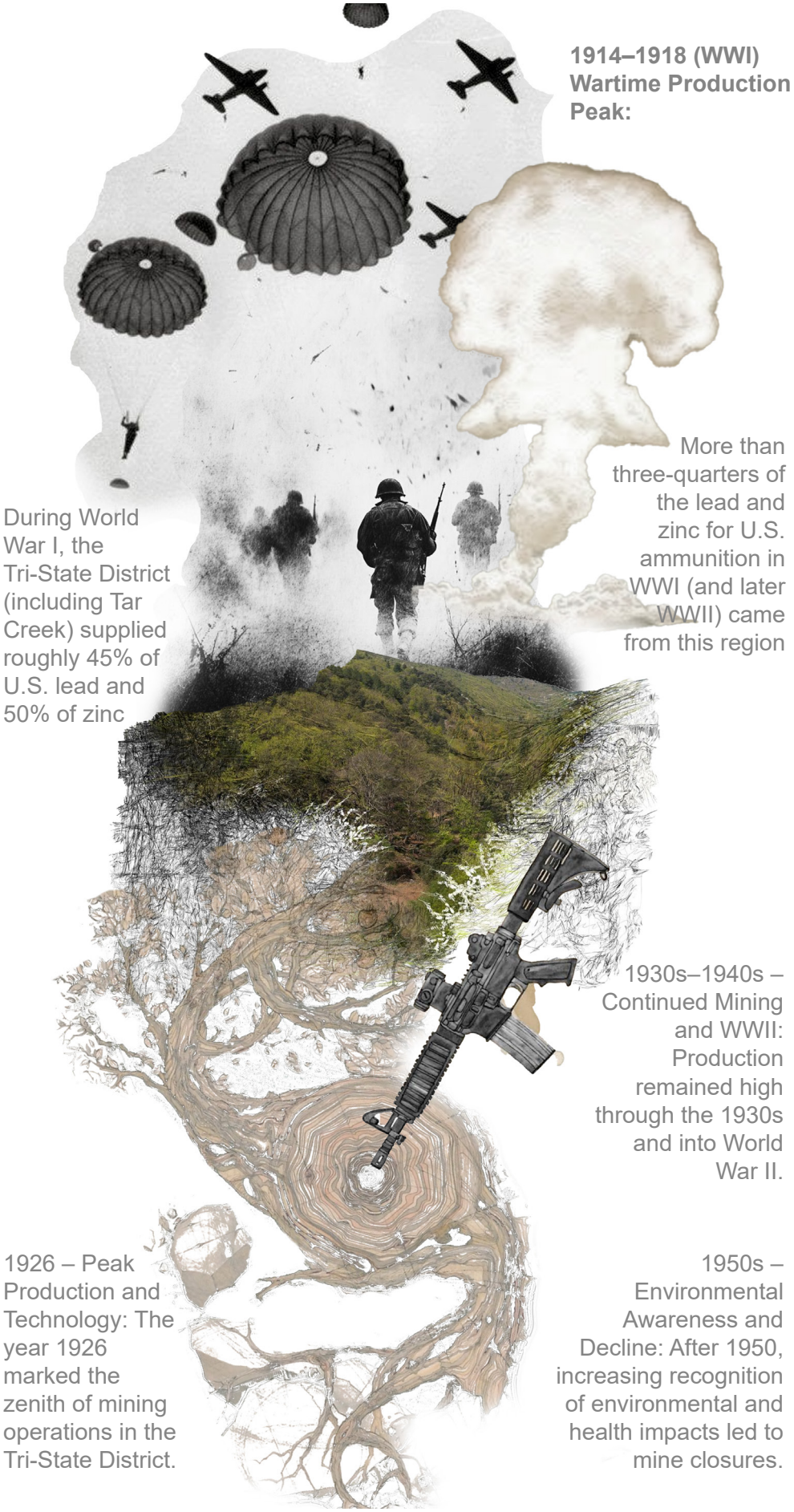
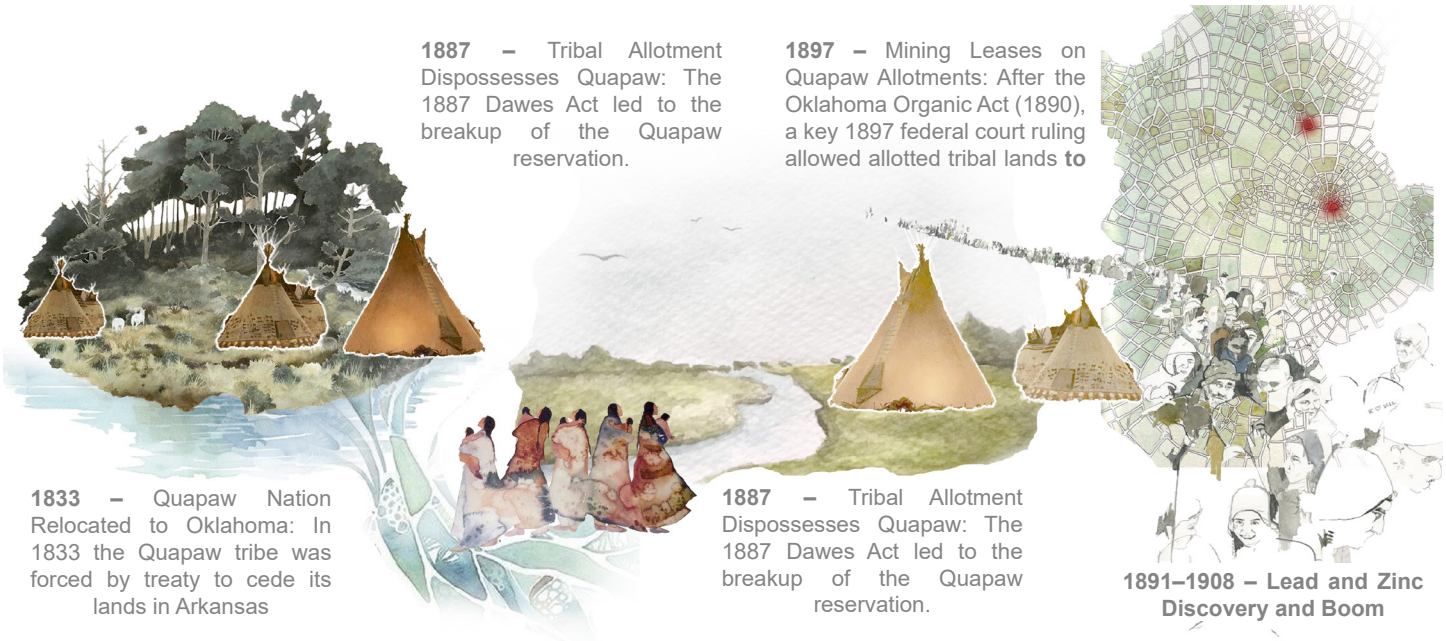


Fig. 9. Timeline of World Wars Highlighting the Origins and Drivers of Heavy Metal Demand



1833 – Quapaw Nation Relocated to Oklahoma: In 1833 the Quapaw tribe was forced by treaty to cede its lands in Arkansas

1887 – Tribal Allotment Dispossesses Quapaw: The 1887 Dawes Act led to the breakup of the Quapaw reservation.

1897 – Mining Leases on Quapaw Allotments: After the Oklahoma Organic Act (1890), a key 1897 federal court ruling allowed allotted tribal lands **to**

1887 – Tribal Allotment Dispossesses Quapaw: The 1887 Dawes Act led to the breakup of the Quapaw reservation.

1891–1908 – Lead and Zinc Discovery and Boom

Fig. 10. Tribal Timeline in Oklahoma Before and During the Onset of Heavy Metal Extraction

Experiments & Artifacts



Fig. 11. Carved Grounds: Materializing Extraction, Remediation, and Indigenous Futures

Carved Grounds

This experiment uses scrap wood as a material metaphor to trace the transformation of land through extraction and remediation. A solid block represents untouched ground. A second block introduces a drilled void with surrounding sawdust, symbolizing extraction and chat piles. The third block reflects ongoing Superfund remediation partial, unresolved, and unfinished. The final block presents only the void, positioning absence as the core thesis question: how can remediation acknowledge the scar of extraction while respecting Indigenous land and empowering the tribe? Together, the blocks form a material timeline that frames land not as something to be erased or concealed, but as a site of memory, accountability, and possibility.



Fig. 12. Decades in Transparency: Visualizing Superfund Remediation and Extraction

Decades in Transparency

This experiment uses engraved Plexiglas tiles to represent thirty decades of Superfund activities, visually mapping the progress of cleanup and highlighting the work still needed. Each tile documents a specific period of remediation, making the temporal scope of intervention tangible. The Plexiglas panels are displayed atop 3D-printed ground modules, which illustrate the site's physical conditions, including chat piles and the underground room-and-pillar method of extraction.

By layering chronological remediation data over a topographical and industrial model, the experiment conveys both the scale of contamination and the complexity of ongoing cleanup efforts. It creates a material and spatial narrative that connects environmental impact, human intervention, and the long-term challenges of restoring the land.

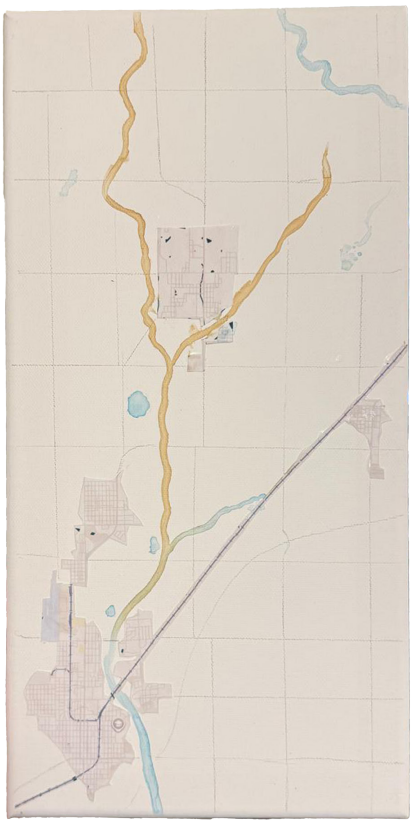


Fig. 13. Flow of Contamination: Visualizing Tar Creek's Water Impact

Flow of Contamination

This canvas-based experiment represents three major towns in the Tar Creek area Miami, Quapaw, and Picher, with Picher being the most affected. The work experiments with clean and contaminated water applied to the canvas, allowing the colors to flow freely downstream. This method makes the spread of pollution visible, demonstrating how a single contaminated water source can create a cascading effect, poisoning all connected waterways.

Through this visual and performative approach, the experiment conveys the interconnectedness of environmental systems, the scale of contamination, and the vulnerability of communities downstream, making the impact of industrial extraction both tangible and immediate.

Layered Protection

This experiment presents a detailed Plexiglas column model of the OSDF (Open Storage Disposal Facility) cap and waste depository system, visualizing all fourteen layers that protect and isolate waste. From the top vegetative layer and filter layer to the multiple barrier systems including biointrusion barriers, synthetic cap materials, compacted clay liners, geosynthetic liners, leak detection systems, and the leachate collection system each layer is represented transparently, allowing a clear understanding of the hierarchy and function of each component.

The column demonstrates how these engineered layers work together to contain hazardous materials, prevent environmental contamination, and manage leachate. By making the infrastructure of remediation visible, the model bridges technical knowledge with spatial comprehension, helping to grasp the complexity of protective systems in Superfund sites.



Fig. 14. Layered Protection: Plexiglass Model of OSDF Cap and Waste Depository Systems

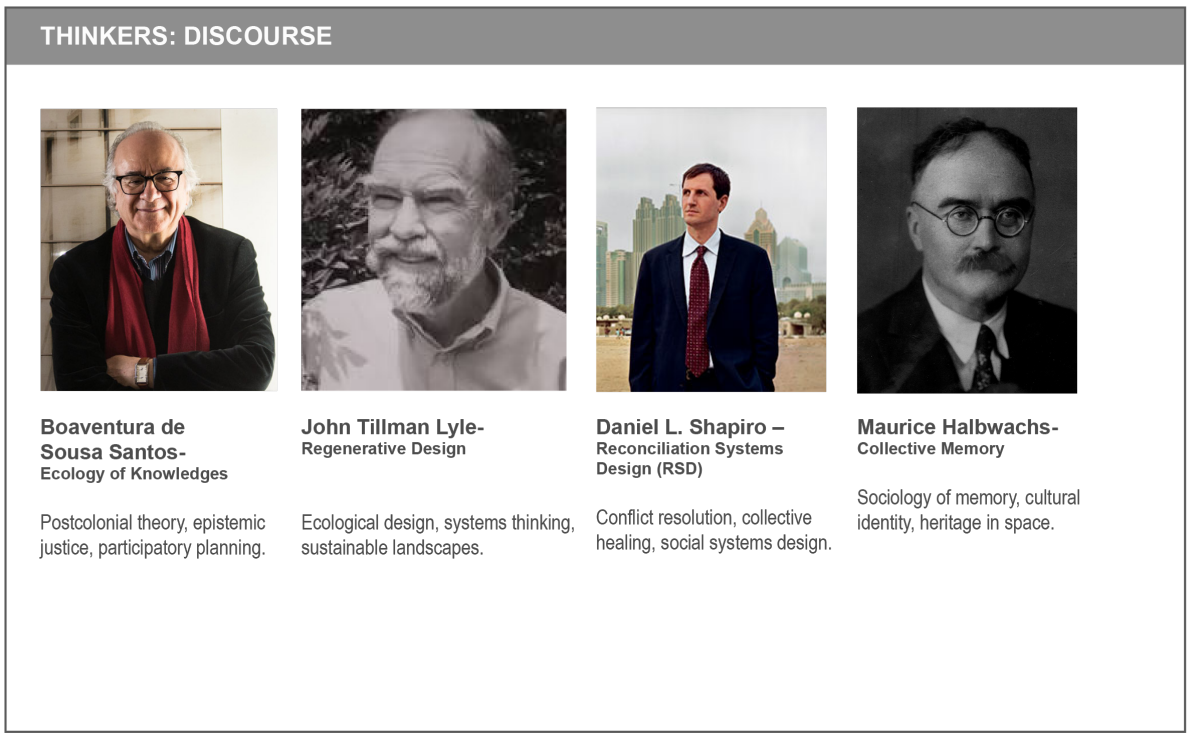


Fig. 15. Discourse Board. Credit- Author.

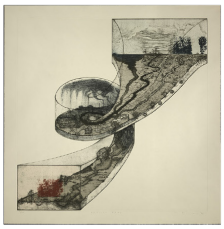
Discourse Board

The discourse board helps explain how this thesis understands Tar Creek not just as a polluted site, but as a place shaped by history, memory, and injustice. The thinkers and artists shown on the board guide an approach to design that is ecological, cultural, and community centered.

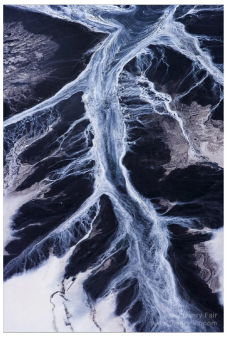
Boaventura de Sousa Santos' idea of an Ecology of Knowledges is central to Tar Creek. For decades, the site has been managed through top-down decisions that ignored tribal knowledge and lived experience. This framework argues that real solutions come from combining scientific knowledge with Indigenous knowledge, oral history, and community voices. This directly supports a bottom-up design approach at Tar Creek.

John Tillman Lyle's work on regenerative design helps frame remediation as a long-term process. Tar Creek is a broken system where mining disrupted natural cycles of

THINKERS: ARTISTS



Mel Chin-
Site specific environmental art



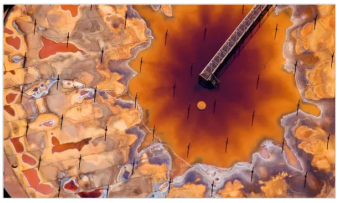
J. Henry Fair-
Post Industrial Landscape

TOPIC

Ecological Restoration in Post-Industrial Sites
Community Resilience and Social Healing
Environmental Justice & Indigenous Sovereignty
Adaptive Reuse & Post-Industrial Heritage
Participatory and Decolonial Design Methods
Climate Adaptation and Resilient Infrastructures
Cultural Memory and Landscape Narratives
Industrial Ecology and Circular Design

CONDITION





Post Industrial Historical Landscape –

Toxic landscape, chat pile, mining site, ecological collapse, contaminated aquifer.





Social & CUltural Displacement –

Displacement of communities; dissolution of towns, Indigenous populations disproportionately harmed, Environmental injustice rooted in settler colonialism

water, soil, and life. Regenerative strategies like phytoremediation and passive water treatment allow the land to slowly heal instead of forcing quick fixes.

Maurice Halbwachs' theory of collective memory explains why Tar Creek cannot be treated as an empty or neutral landscape. The land holds memories of mining, displacement, and everyday life. Design elements such as mound-like repositories and ceremonial paths help acknowledge and protect those memories rather than erase them.

Artists like J. Henry Fair reveal the hidden damage of post-industrial landscapes, much like Tar Creek's orange water and chat piles expose environmental harm. Their work encourages honesty rather than beautification.

Together, these ideas frame Tar Creek as a place where ecological restoration, cultural memory, and social justice must be addressed together, with architecture acting as a supportive and healing practice rather than a controlling force.

Time Line

Pre-1600s (traditions/prehistory)
Ancestors of the Quapaw lived in the Ohio Valley as part of the Dhegiha Siouan group (which also included the Osage, Omaha, Kansa/Kaw, and Ponca). They practiced agriculture, lived in riverine villages, and shared cultural traits with other Siouan peoples.

occasional conflicts with Osage hunting parties to the north.

1673 (July) – First European contact
Jesuit missionary Jacques Marquette and trader Louis Jolliet descended the Mississippi, reaching Kappa village. The Quapaw welcomed them through calumet (peace pipe) ceremony, a sacred ritual that sealed

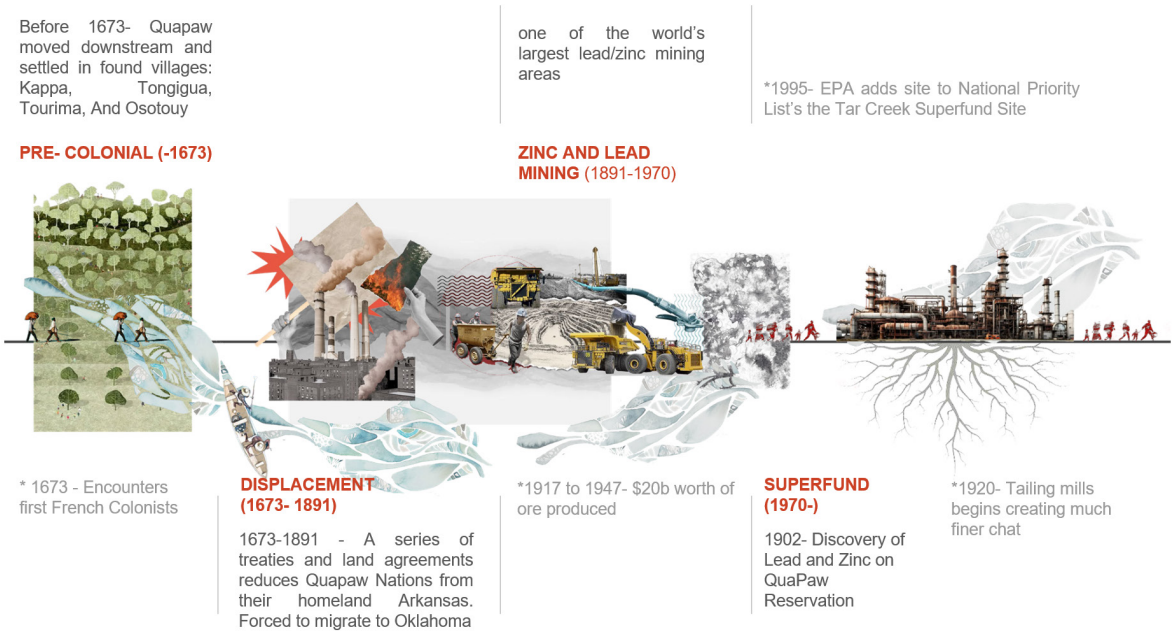


Fig. 16. Quapaw History at a Glance.
Credit- Author.

Mid-1600s – Displacement by Iroquois warfare
The Iroquois Confederacy ("wolf packs") expanded westward from New York, fueled by guns obtained from European traders, launching the Beaver Wars to dominate the fur trade. Their attacks forced many tribes, including the Dhegiha Sioux, to flee west from the Ohio Valley.

Mid–Late 1600s – Migration & separation of Dhegiha tribes
At the Mississippi River, Dhegiha traditions tell of fog or a broken grapevine rope that split the groups. Osage crossed west into Missouri. Omaha and Iowa moved north toward Iowa and Nebraska. Quapaw moved downstream along the Mississippi, giving them their name: Ugakhpa - Quapaw ("Downstream People").

Late 1600s – Settlement at the Arkansas–Mississippi confluence
Quapaw established four villages: Kappa, Tongigua, Tourima, and Osotouy. They displaced Tunica and Illinois peoples, clashed with Chickasaw neighbors, and fought

alliances and imposed supernatural sanctions on agreements.

1682 – La Salle's expedition
René-Robert Cavelier, Sieur de La Salle, visited Kappa on his way to the Gulf of Mexico. He claimed the Mississippi Valley for France, naming it Louisiana. Quapaw hoped for French weapons to defend themselves; La Salle's lieutenant Henri de Tonti estimated 1,500 warriors (~5–10k population).

1686–1689 – Arkansas Post established
After La Salle's death, Henri de Tonti left Frenchmen at Quapaw villages, creating Arkansas Post, the first permanent European settlement in the lower Mississippi Valley, which became a hub of French-Quapaw relations.

1698–1700 – Catastrophic smallpox epidemic
Epidemics spread by Europeans devastated the Quapaw, reducing their numbers by two-thirds. By 1699 only ~300 warriors remained; villages consolidated for survival.

1700s (early–mid) – Missions and trade
Catholic missionaries attempted work among the Quapaw, but several were killed by other tribes (e.g., Father Foucault in 1702, Father du Poisson in 1729 during the Natchez revolt).

A French military post (1721) and nearby German settlement tied Quapaw life more tightly to colonial trade networks.



Fig. 17. Quapaw people photographed in 1890.

1730s–1740s – Colonial rivalry
Britain and France vied for alliances. Quapaw, courted by both, were sometimes drawn into slave-raiding expeditions to supply British traders.

1747 & 1751 – Further epidemics
Successive disease outbreaks further weakened Quapaw demography, leaving fewer than 1,200 by the mid-1700s.

1754–1763 – French & Indian War
Global conflict between Britain and France reached the Mississippi Valley. The war ended with France's defeat.

1762 (Treaty of San Ildefonso): France secretly ceded Louisiana west of the Mississippi to Spain.

1763 (Treaty of Paris): France gave Canada and all east of Mississippi to Britain, ending French power in North America.

1763–1783 – Spanish period
Quapaw became Spanish subjects. Both Britain and Spain courted them with trade goods, gifts, and alcohol. Chiefs traveled to New Orleans to petition for support.

1776–1783 – American Revolution
Spain supported the American rebels to weaken Britain. Quapaw avoided major involvement but remained a strategically courted ally because of their Mississippi River location.

1784 – Peace with Chickasaw
Spain arranged a treaty between Quapaw and their old enemies the Chickasaw, ending generations of warfare.

1787 – Alcohol crisis
Quapaw chiefs begged Spanish officials to halt alcohol imports after deaths and violence plagued the villages. The Spanish governor banned liquor traffic at Fort Carlos.

1793–1800 – French return (brief)
France regained Louisiana from Spain (Treaty of San Ildefonso, 1800), worrying U.S. leaders about French control of New Orleans and Mississippi navigation.

1803 – Louisiana Purchase
Napoleon, needing funds, sold Louisiana to the United States for $15 million. This doubled U.S. territory and brought Quapaw lands under American sovereignty, paving the way for U.S. treaties and eventual removals.

1818 – First U.S.–Quapaw Treaty
The Quapaw signed their first treaty with the U.S., beginning a century of land loss and displacement.

1907 – Oklahoma statehood
The Quapaw, like other tribes, saw their Indian Territory incorporated into the new state of Oklahoma, forever altering their sovereignty and land base.

The Beginning of It All

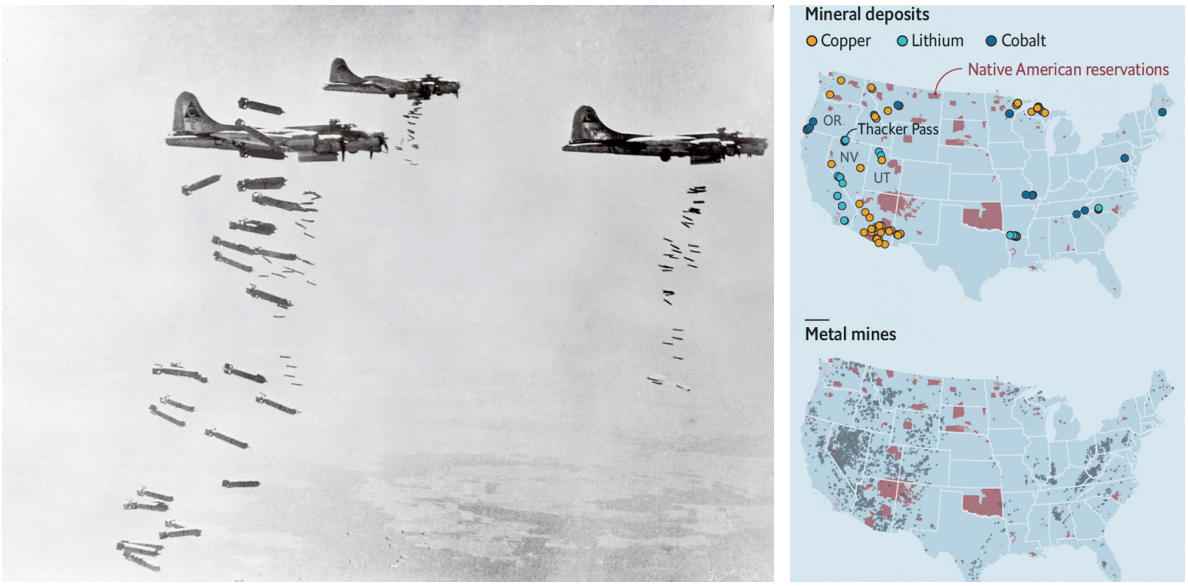


Fig. 18. Lead and Zinc in War: Overlapping Tribal Lands and Mining Sites

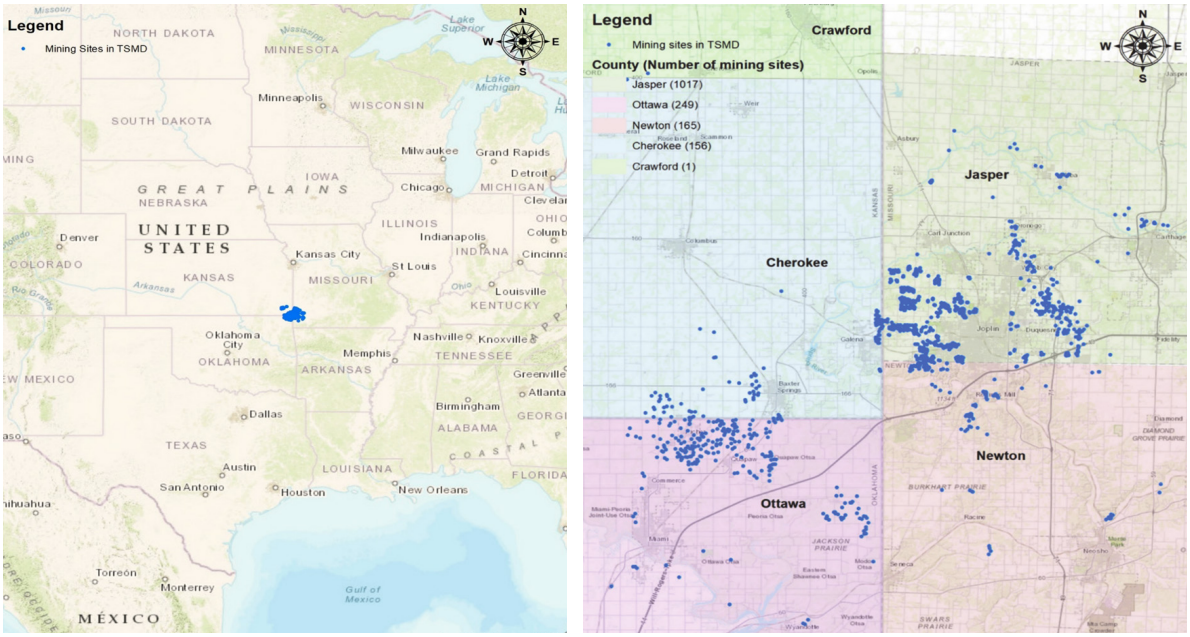


Fig. 19. Tri state Mining Area & Superfund Sites

Mining in the Tri-State Mining District expanded rapidly during World War I and World War II to meet the growing demand for lead and zinc used in ammunition and industrial production. The district spans parts of northeastern Oklahoma, southwestern Missouri, and southeastern Kansas, and today it is recognized as one of the most heavily contaminated mining regions in the United States. Records show 1,017 contaminated sites in Jasper County, Missouri; 165 sites in Newton County, Missouri; 249 sites in Ottawa County, Oklahoma; and 156 sites in Cherokee County, Kansas. Altogether, the Tri-State Mining District contains over 600 abandoned and contaminated mining areas, forming a vast network of environmental damage. Mining maps reveal that many of these extraction zones overlapped directly with tribal reserved lands, particularly those of the Quapaw Nation, leaving Indigenous communities to bear the long-term consequences of wartime and industrial extraction. Underground room-and-pillar mining destabilized the land, while millions of tons of toxic chat were left piled across the surface. Long after mining ended, acid mine drainage and heavy metal contamination continue to affect water, soil, and human health, making Tar Creek a lasting symbol of environmental injustice within the Tri-State region.

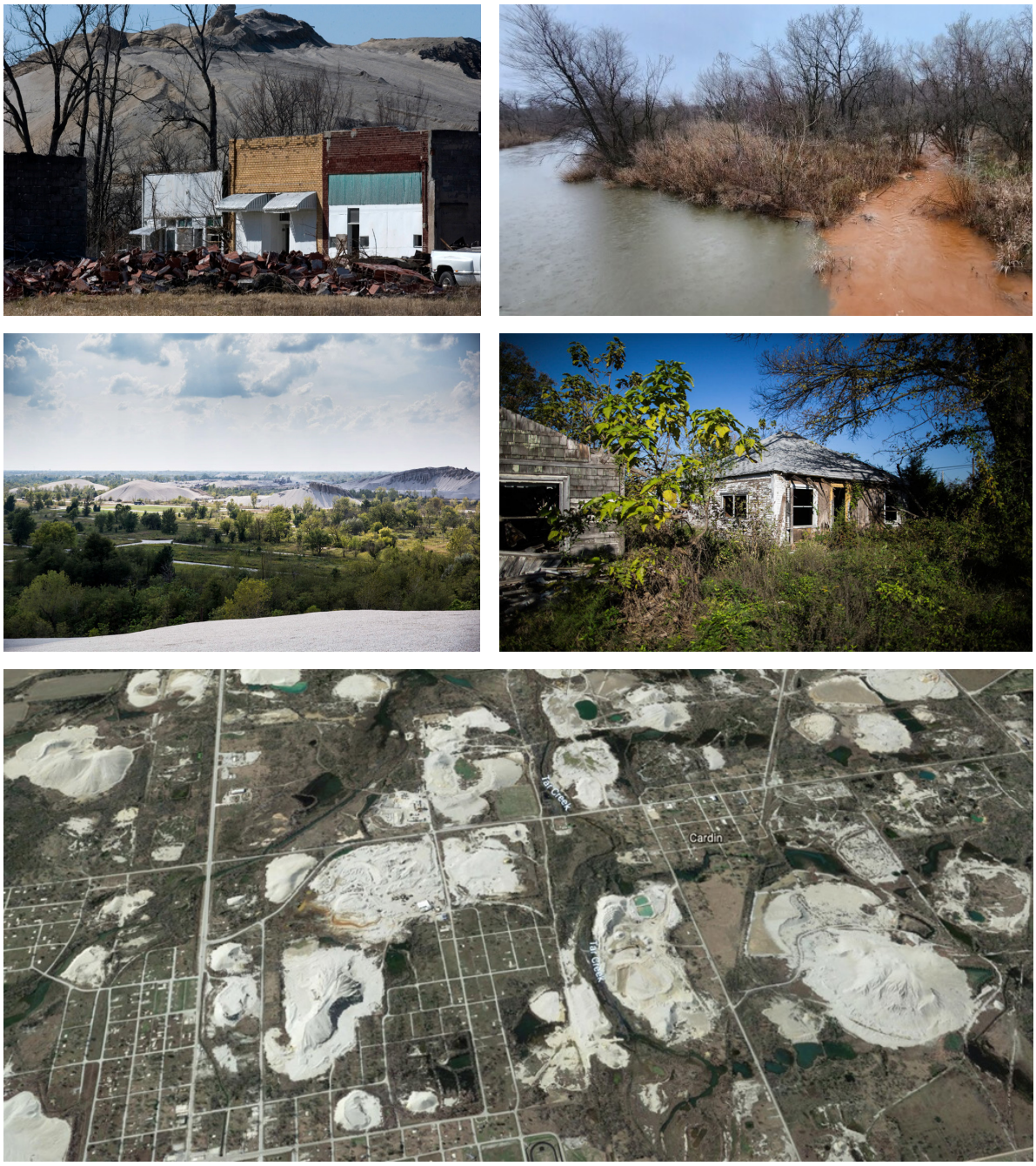


Fig. 20. Current Conditions at Tar Creek

Even after more than three decades as a Superfund site, Tar Creek remains deeply damaged. In Picher, Oklahoma, massive chat piles still tower over the town, slowly poisoning the soil, air, water, and surrounding vegetation. Toxic dust spreads with wind, and heavy metals continue to seep into the landscape.

Abandoned mine shafts discharge acid mine drainage, where contaminated groundwater rises to the surface and turns streams a bright orange. This polluted water flows directly into Tar Creek, spreading contamination downstream. Many homes now stand empty and decaying following government buyout programs, leaving behind a hollowed-out townscape. From above, aerial views reveal a landscape fractured by mining scars, collapsed ground, and waste piles. The damage is so extensive that it blurs the line between a mined landscape and a battlefield scarred by war, showing that Tar Creek remains an active environmental and social crisis today.

Quapaw Migration Pattern Mapping



Fig. 21. Native American Land Pre 16th Centruy



Fig. 22. Native American Land Post 16th Centruy

This map illustrates the ancestral origins and migration of the Quapaw people, who are part of the Dhegiha branch of the Sioux (Siouan) language family. The Quapaw migrated gradually from the northern regions of the Mississippi River Valley toward the south. Following river systems, they eventually settled near the Arkansas River, where water, fertile land, and trade routes supported long-term habitation. Their territory historically overlapped with what is now Arkansas and parts of the Mississippi River region, forming a strong river-based culture centered on farming, fishing, and stewardship of the land. This migration was not forced but followed ecological knowledge, seasonal movement, and cultural relationships with waterways long before colonial borders existed.

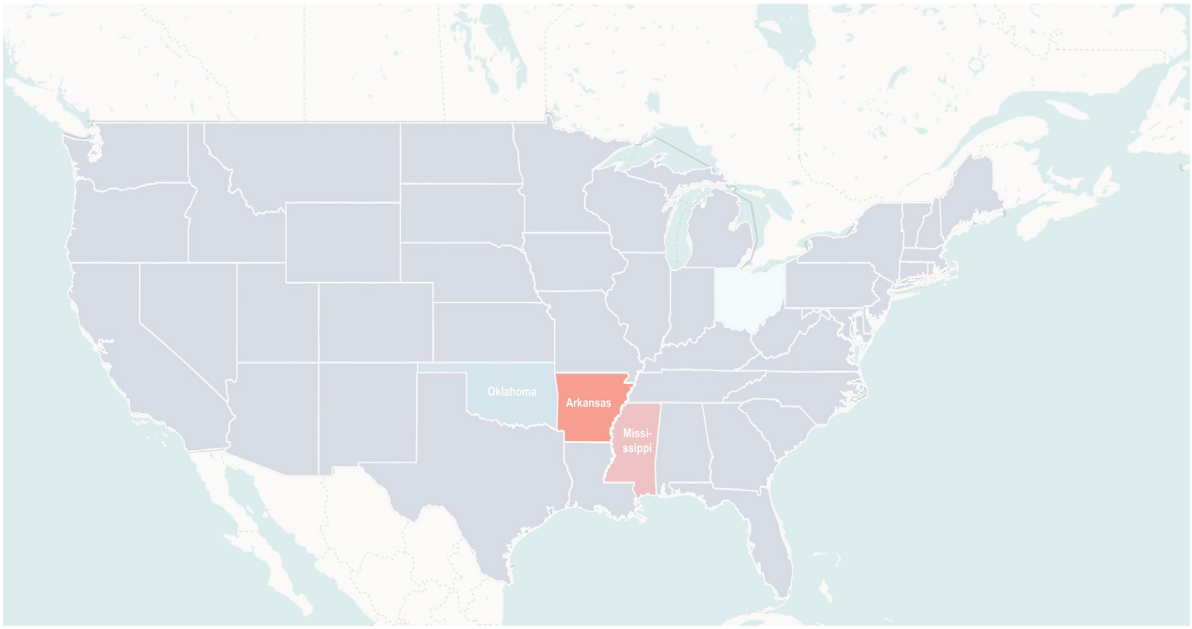


Fig. 23. Present Day America

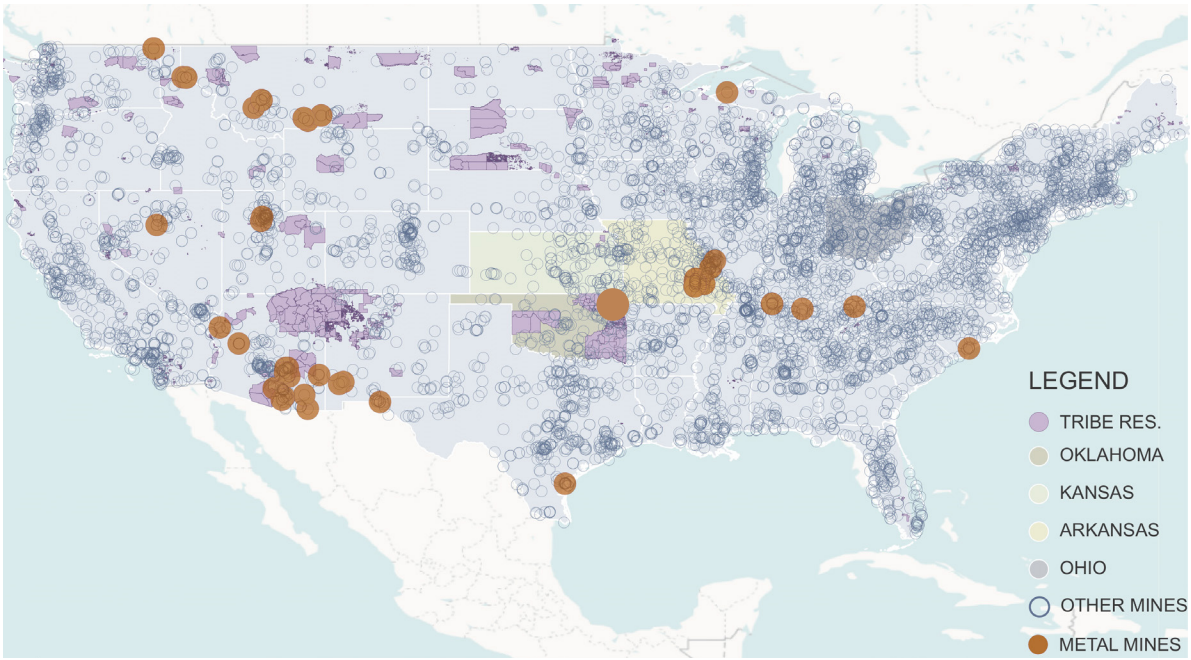


Fig. 24. Mining Site in Relation to Native American Lands

The map shows the forced removal of the Quapaw people to present-day Oklahoma through broken treaties and federal policies in the 19th century. Relocated from their ancestral lands along the Arkansas River, the Quapaw were confined to a small reservation in what is now Ottawa County, Oklahoma an imposed settlement that severed long-standing cultural, spiritual, and ecological ties.

The map reveals the overlap between Quapaw tribal lands and extensive mining within the Tri-State Mining District. Lead and zinc extraction cut directly across reservation boundaries, prioritizing mineral deposits over tribal sovereignty and leaving behind toxic waste, unstable ground, and contaminated waterways concentrated on Indigenous land.

Site Analysis and Mapping

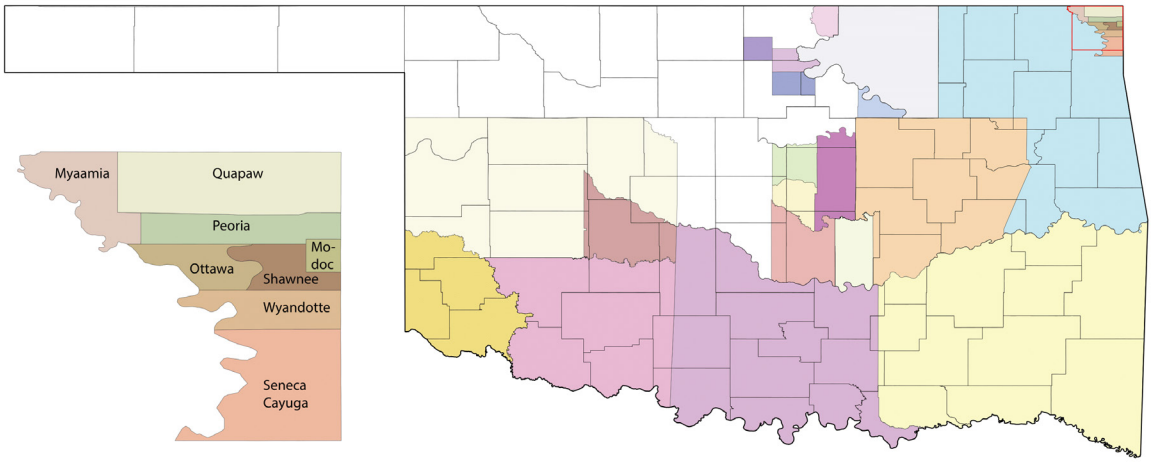


Fig. 25. Tribal Reserved Lands in Oklahoma

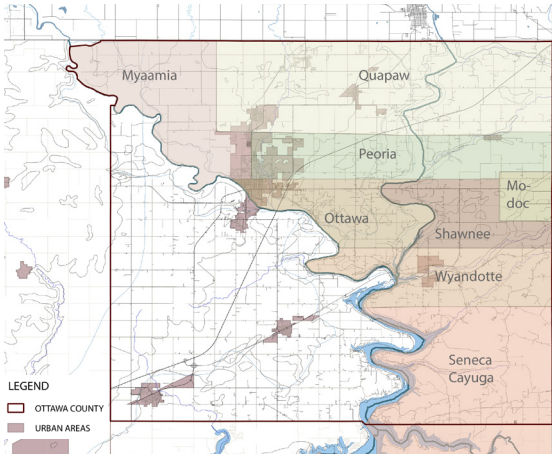


Fig. 26. Quapaw Tribal Reserved Lands in Ottawa County, Oklahoma

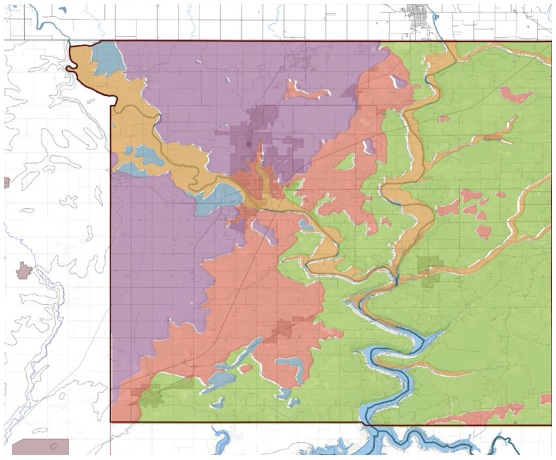


Fig. 27. Geological Rock Types of the Ottawa County

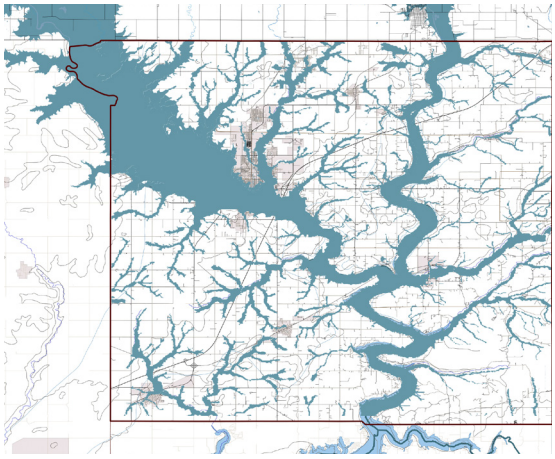


Fig. 28. 100-Year Floodplain within Ottawa County, Oklahoma

Figures 25 through 30 together illustrate how environmental risk, geology, and historical injustice overlap at the Tar Creek site. Figures 25 and 26 locate the Quapaw tribal reserved lands at both the state and county scale, showing how Indigenous territory is embedded within the affected landscape. Figure 27 identifies the geological rock types that enabled extensive lead and zinc mining, while Figures 28 and 29 show the 100-year floodplain conditions that continue to spread contamination through periodic flooding. Figure 30 highlights the lasting impact of mining: approximately 83 chat piles containing nearly 500 million tons of lead- and zinc-contaminated waste, poisoning water across 63 tailings ponds and sitting above nearly 300 miles of underground cavities. As a result, the 47-square-mile landscape remains highly unstable and prone to collapse, underscoring the urgency and complexity of remediation at Tar Creek.



Fig. 28. Floodplain Conditions along the Tar Creek Watershed

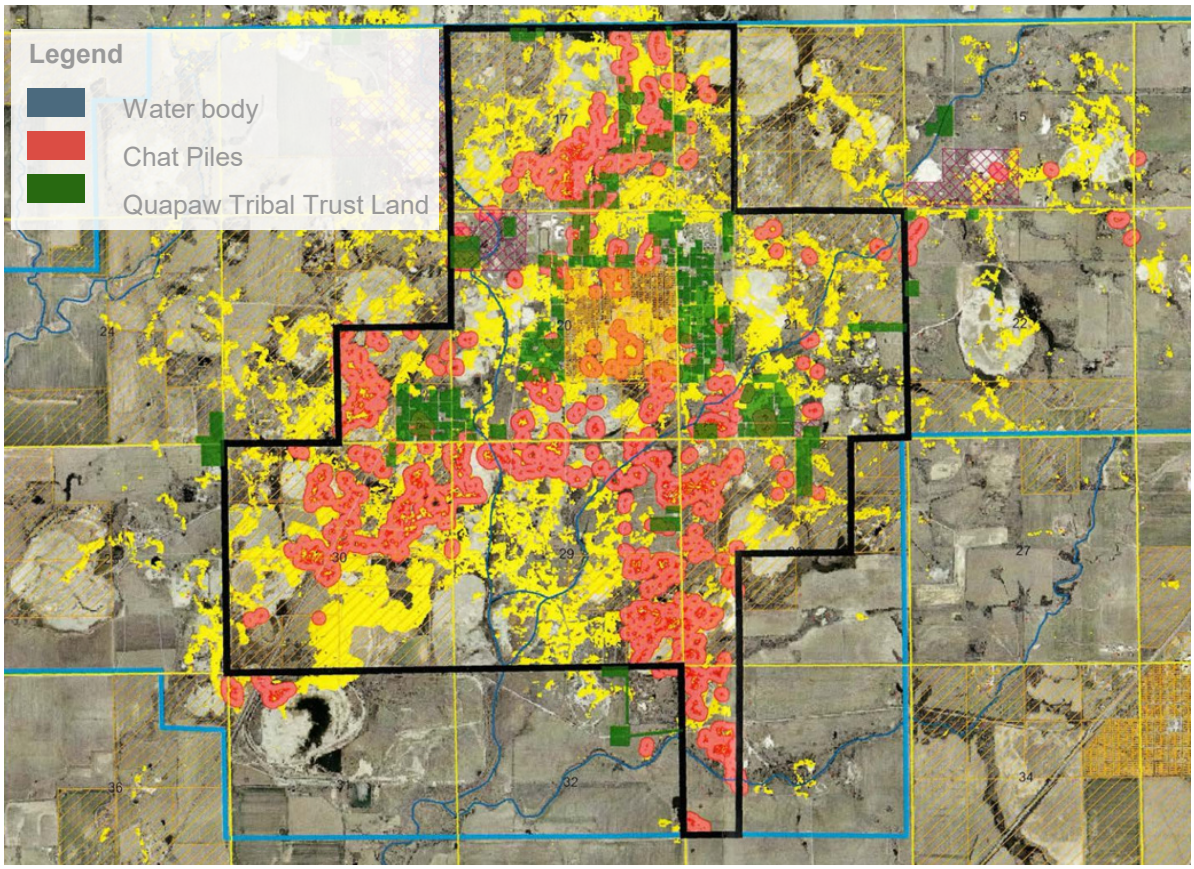


Fig. 29. Chat Piles and Mining Waste Distribution at Tar Creek

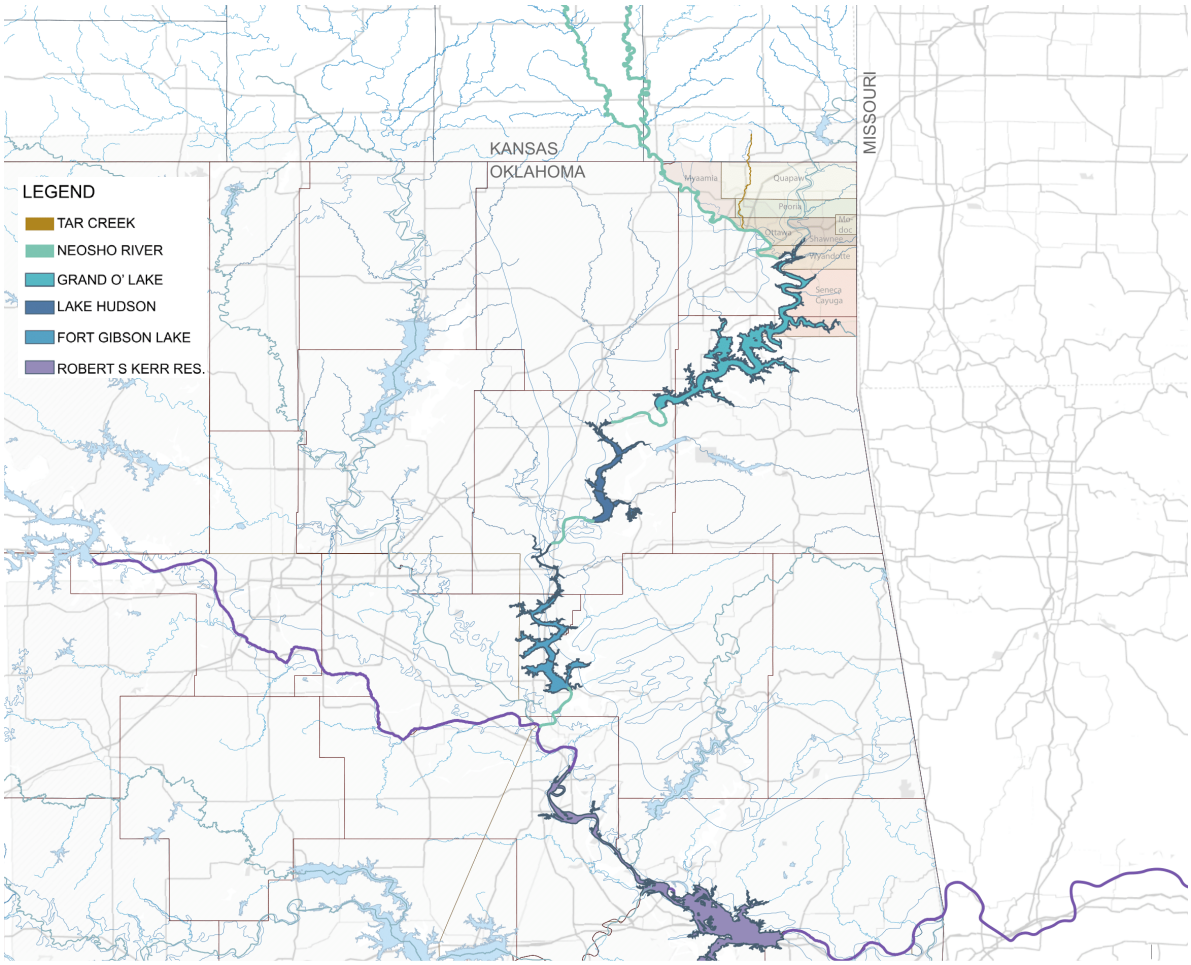


Fig. 30. Hydro Connectivity of Surface Water



Fig. 31. Section of Tar Creek at Lytle Creek's
Original Meeting Point

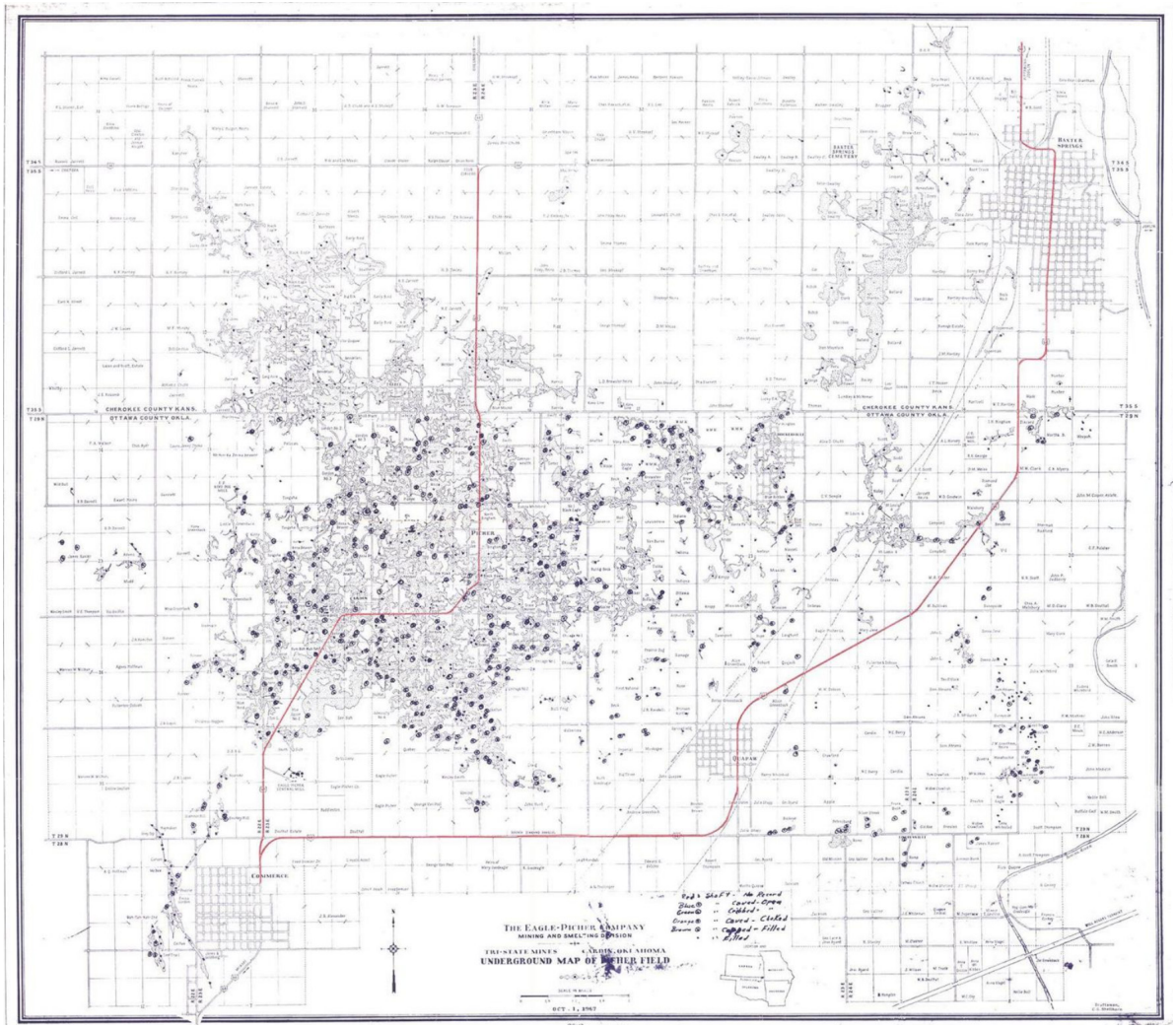


Fig. 32. 1967 mining map showing the labyrinth of tunnels under Tar Creek.

Figures 30–32 illustrate how contamination at Tar Creek extends far beyond the immediate site, both horizontally and vertically. Figure 30 traces the hydrological connectivity of Tar Creek, showing how polluted water flows from its source into the Neosho River, then through Grand Lake O' the Cherokees, Lake Hudson, Fort Gibson Lake, and Robert S. Kerr Reservoir, before entering the Arkansas River, joining the Mississippi River, and ultimately reaching the Gulf of Mexico. This map makes clear that one poisoned stream becomes an entire poisoned system, spreading contamination across multiple states and ecosystems.

Figure 31 focuses on the critical meeting point of Tar Creek and Lytle Creek, where acid mine drainage rises to the surface. This section reveals how contaminated groundwater emerges directly into surface water, creating the orange, acidic flow that marks the beginning of downstream pollution.

Figure 32 presents a 1967 mining map that exposes the hidden condition beneath Tar Creek a dense labyrinth of underground tunnels created by room-and-pillar mining. These tunnels extend approximately 100 to 350 feet below ground, leaving the land above structurally unstable and vulnerable to collapse. Together, these figures demonstrate that Tar Creek's crisis is not only visible on the surface, but deeply embedded underground and far-reaching downstream.

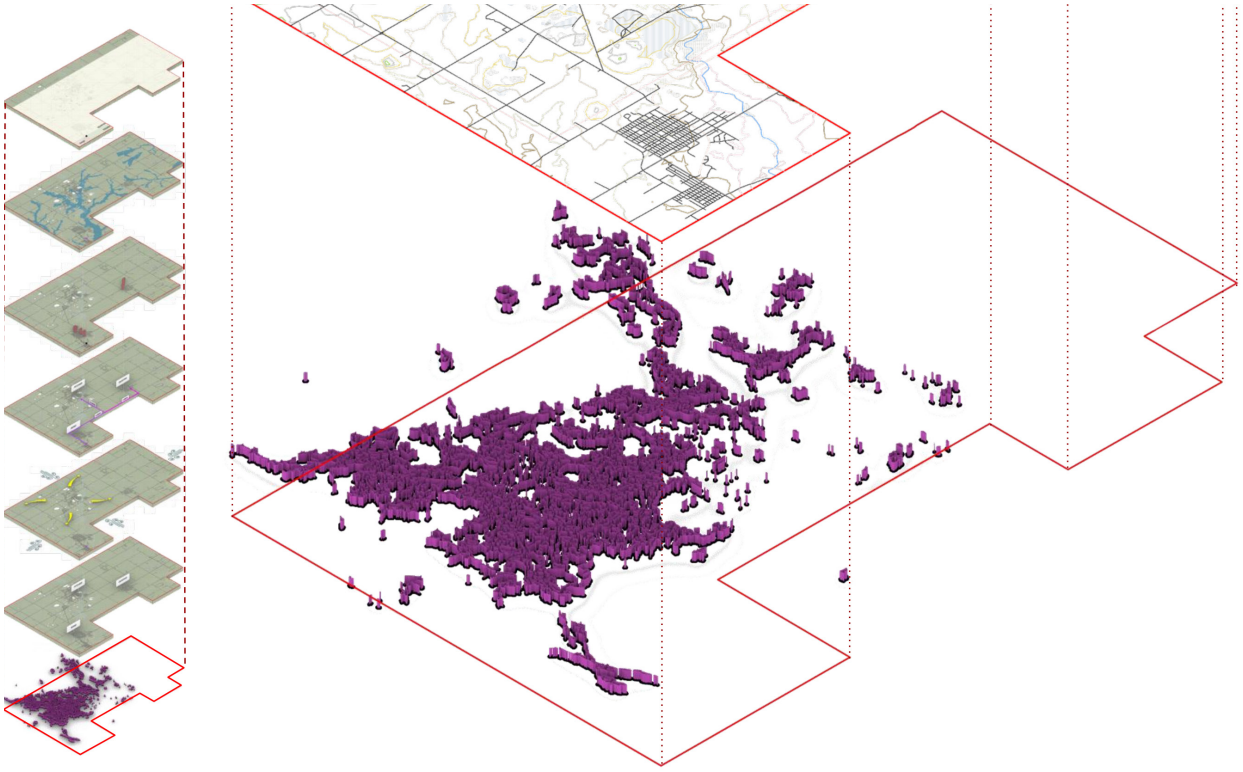
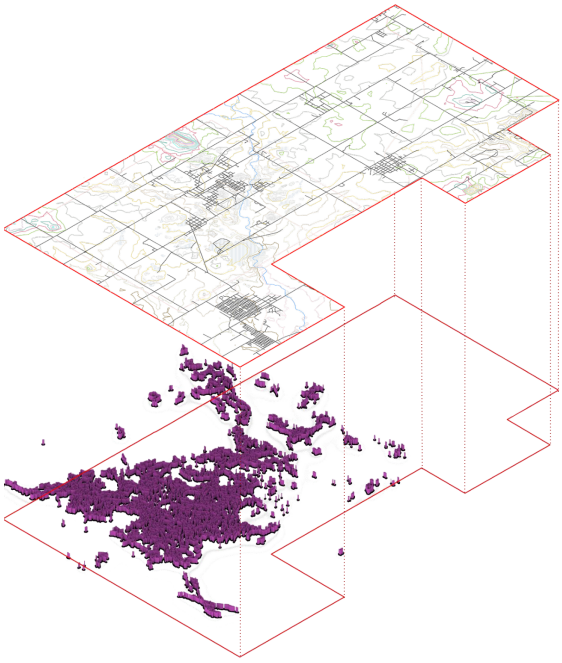
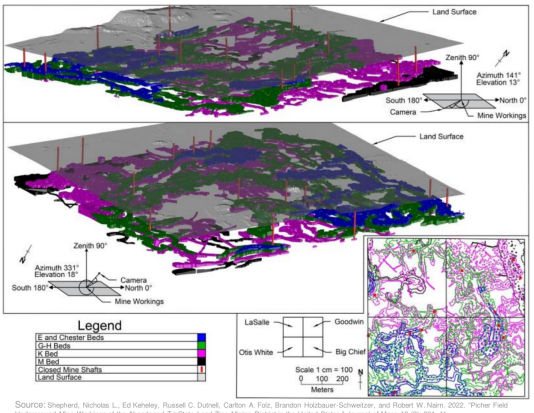


Fig. 33. Three-Dimensional Reconstruction of Underground Mine Tunnels beneath Tar Creek (Based on 1967 Mining Map)



Bed	Approx. Depth (below surface)*	General Composition	Mining Importance	Notes
M Bed	~300–350 ft	Hard, gray cherty limestone	**Uppermost ore horizon**	Used as a structural reference in maps; often above main ore zones
K Bed	~250–300 ft	Dense dolomite, partly brecciated	**Primary ore-bearing layer**	Rich in lead/zinc; major production zone
G Bed	~200–250 ft	Limestone with chert nodules	**Secondary ore zone**	Hosted replacement ores and minor veins
E Bed	~150–200 ft	Massive limestone with thin dolomite seams	**Locally mineralized**	Used for orientation; not always mined



Source: Shepherd, Nicholas L., Ed Keheley, Russell C. Dutnell, Carlton A. Folz, Brandon Holzbauer-Schweitzer, and Robert W. Naim. 2022. "Picher Field Underground Mine Workings of the Abandoned Tri-State Lead-Zinc Mining District in the United States." Journal of Maps 18 (2): 331–41. doi:10.1080/17445647.2022.2057877.

Fig. 34. Picher Field Underground Mine Workings, Tri-State Lead–Zinc Mining District (Source: Shepherd et al., 2022)

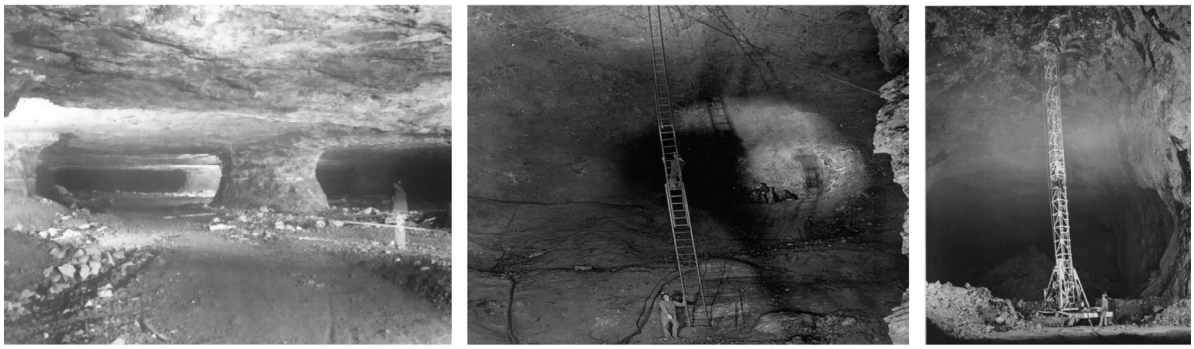


Fig. 35. Room-and-Pillar Mining Method and Photographic Evidence of Underground Conditions at Tar Creek

Figures 33 through 36 together reveal the hidden depth of damage at Tar Creek and its long-term social consequences. Figure 34, based on the research by Shepherd et al. (2022), documents the extensive underground mine workings of the Picher Field using historic data, highlighting the vast and interconnected tunnel networks created during lead and zinc extraction. Building on this research, Figure 33 converts the 1967 underground mining map into a three-dimensional model to better visualize the spatial condition beneath the surface. This 3D reconstruction makes clear how deeply and widely the land has been hollowed out, helping to understand risks of collapse and subsidence. Figure 35 explains the room-and-pillar mining method used throughout the area and pairs it with actual underground images from the Tar Creek region, showing narrow supports, unstable voids, and the fragile condition of the subsurface landscape. Finally, Figure 36 connects these environmental impacts to human consequences by showing population decline in nearby towns: Miami, Oklahoma (12,978 residents); Quapaw (811 residents); and Picher, once a booming mining town, now reduced to only 12 residents. Together, these figures demonstrate how underground extraction reshaped both the land and the lives above it, leaving behind a landscape of structural instability and social loss.

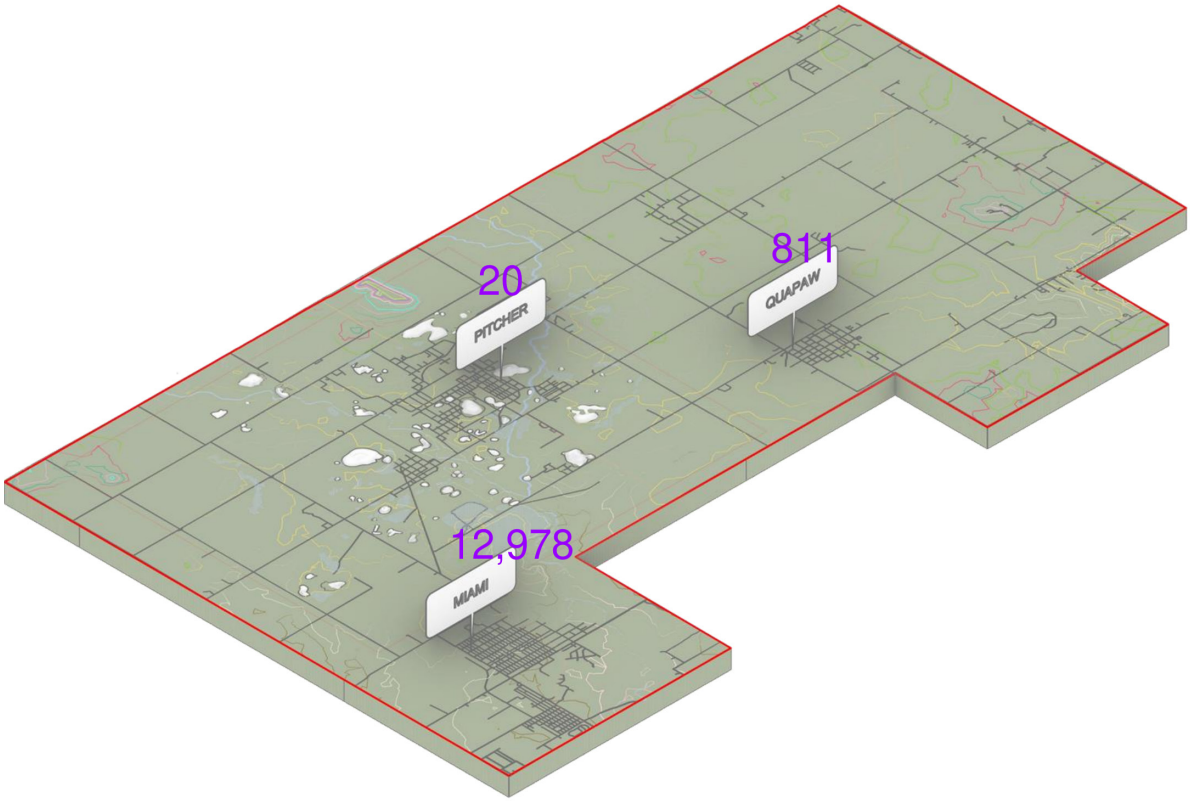


Fig. 36. Population Decline in Key Towns Affected by the Tar Creek Mining Region

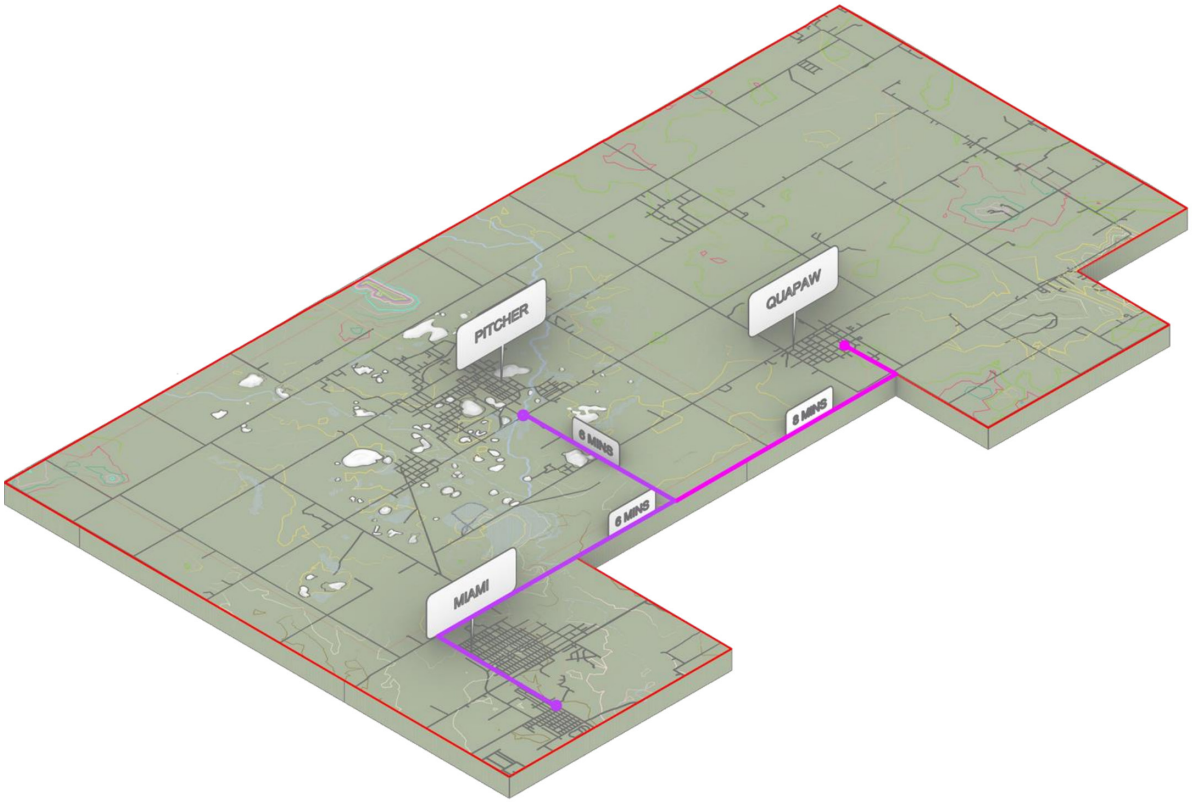


Fig. 37. Proximity of Toxic Chat Piles to Homes and Schools near Picher, Oklahoma

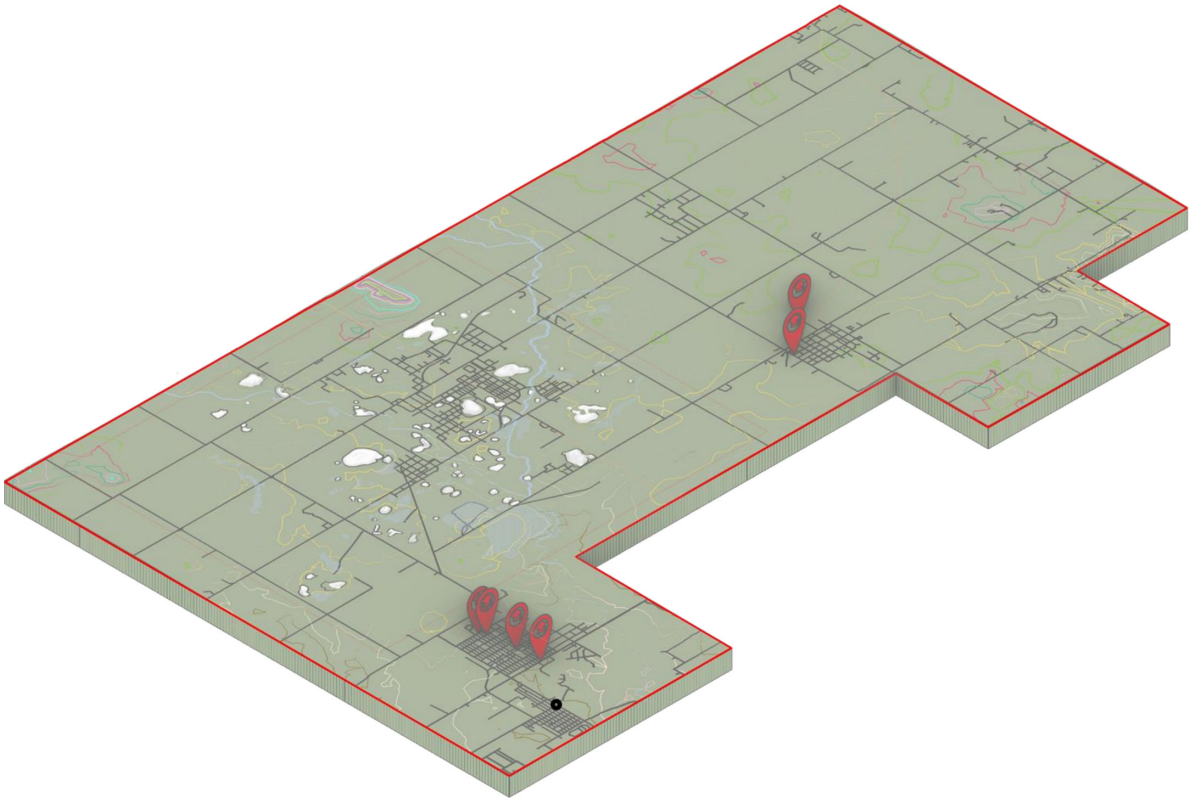


Fig. 38. Childhood Exposure to Contamination: Schools and Residences Adjacent to Chat Piles

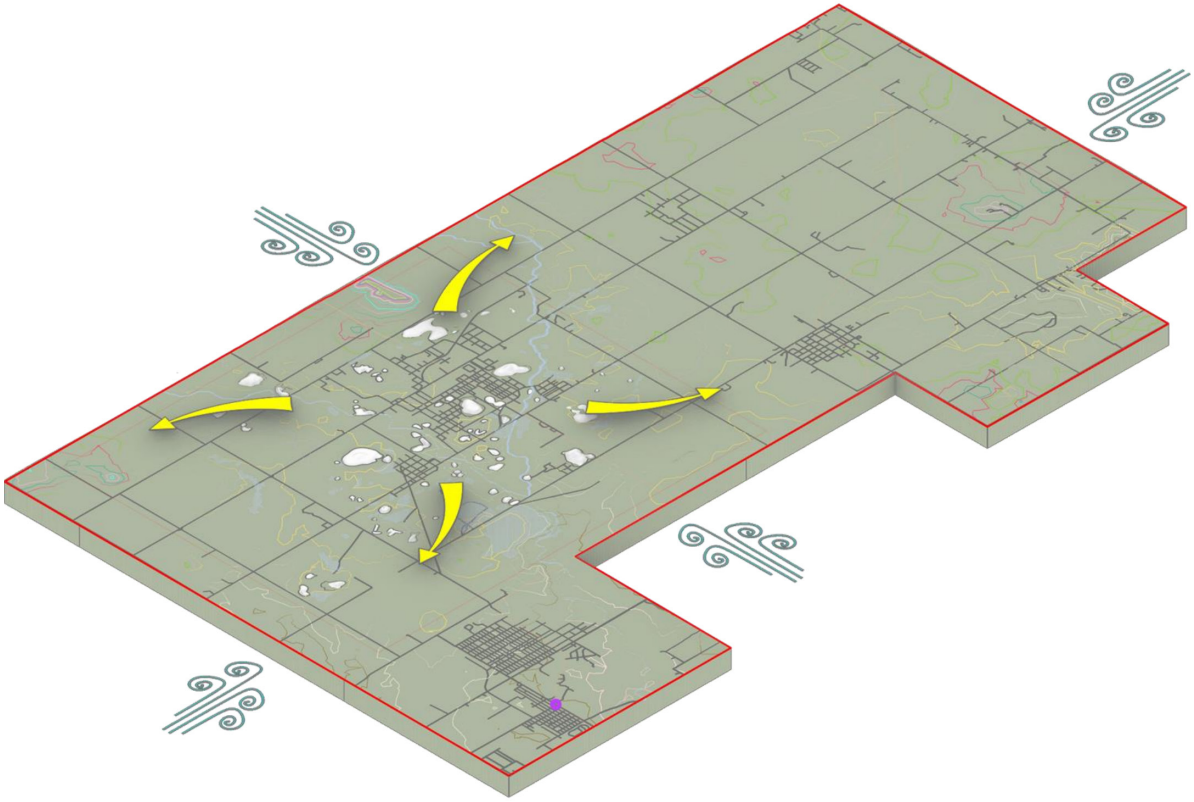


Fig. 39. Windborne Toxic Metal Dust Dispersal
from Chat Piles across Surrounding Communities

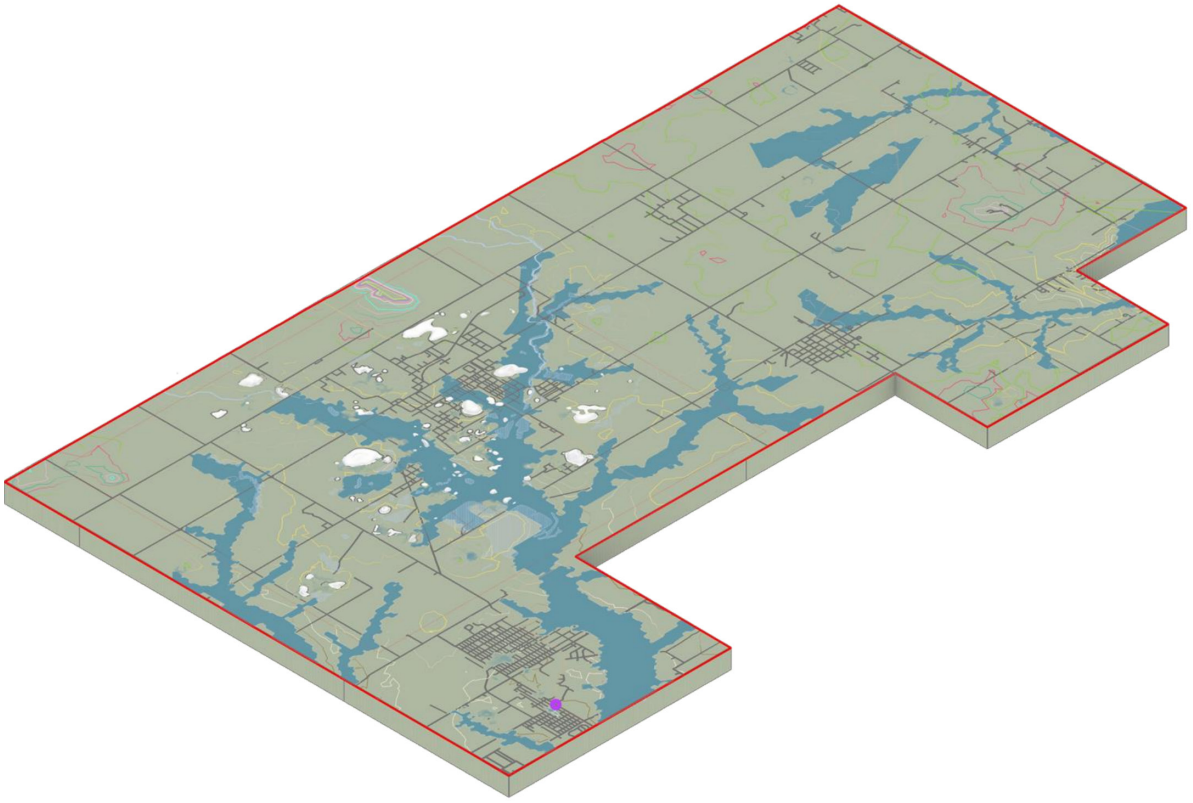


Fig. 40. From 100-Year Floods to Decadal Events:
Climate Change at Tar Creek

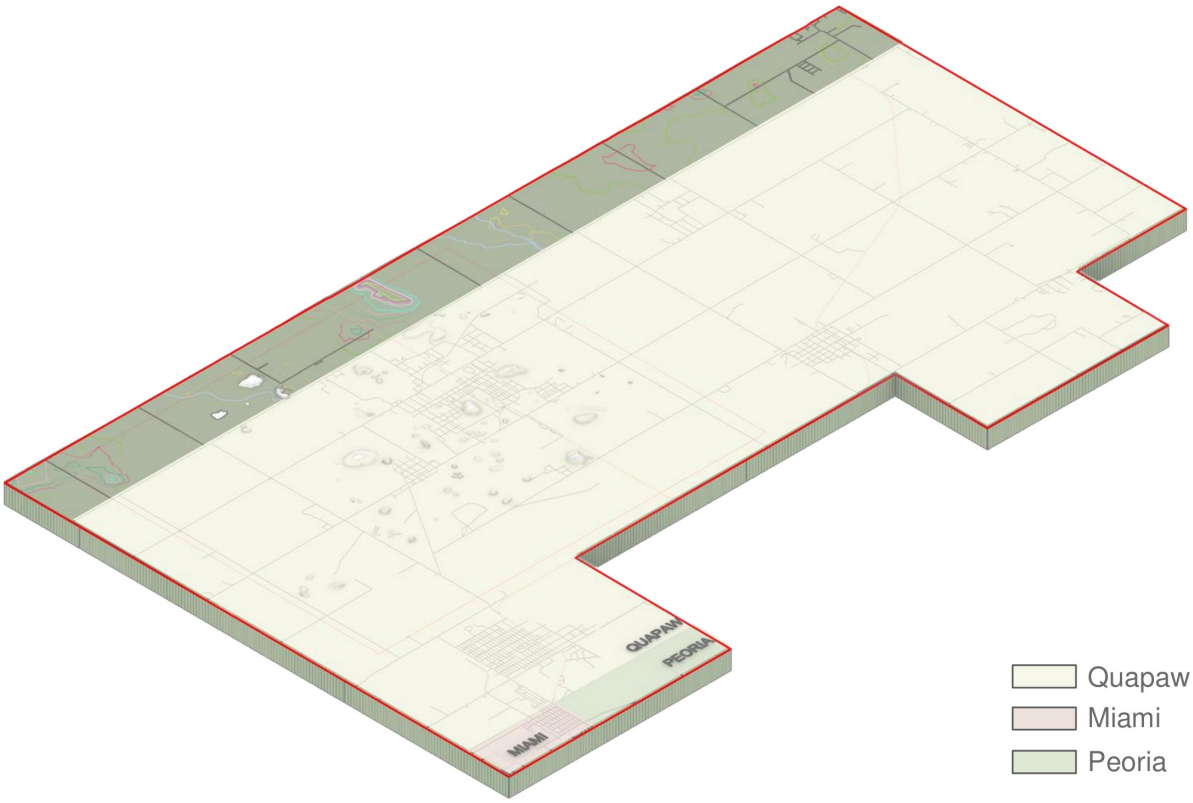


Fig. 41. Overlap of Contaminated Zones with Quapaw, Miami, and Peoria Tribal Lands

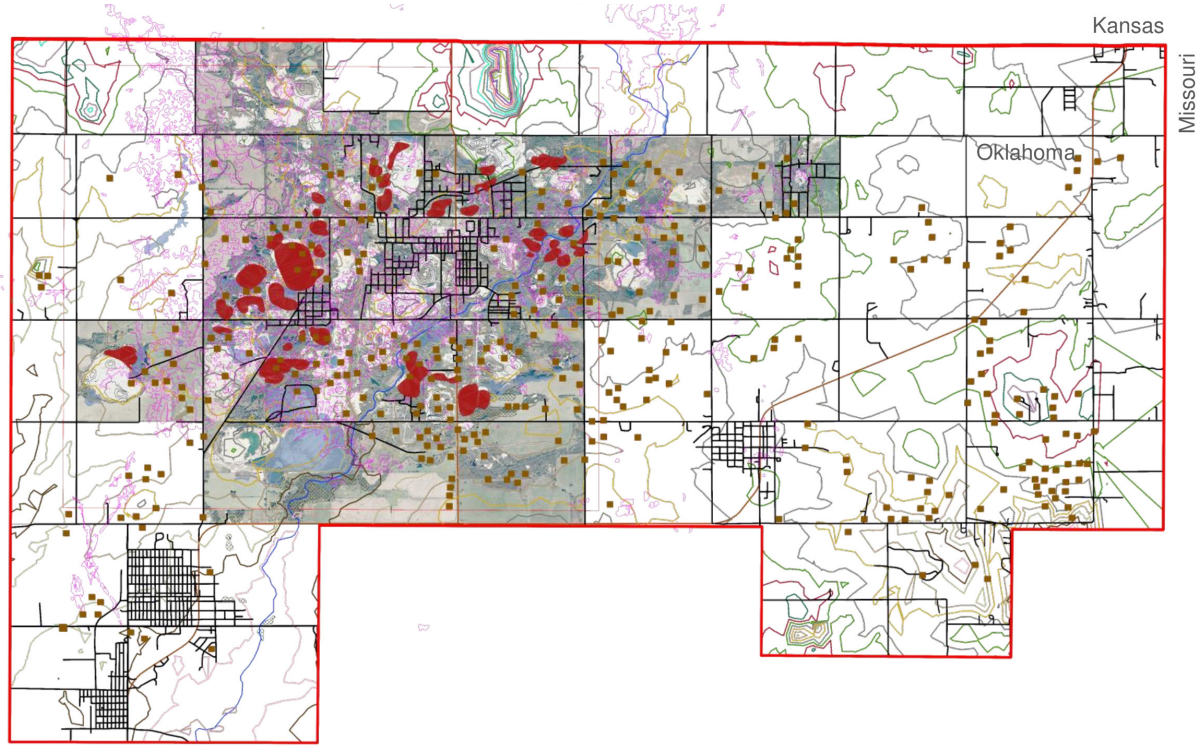


Fig. 42. Restricted and Collapsing Ground Conditions within the Tar Creek Contaminated Zone

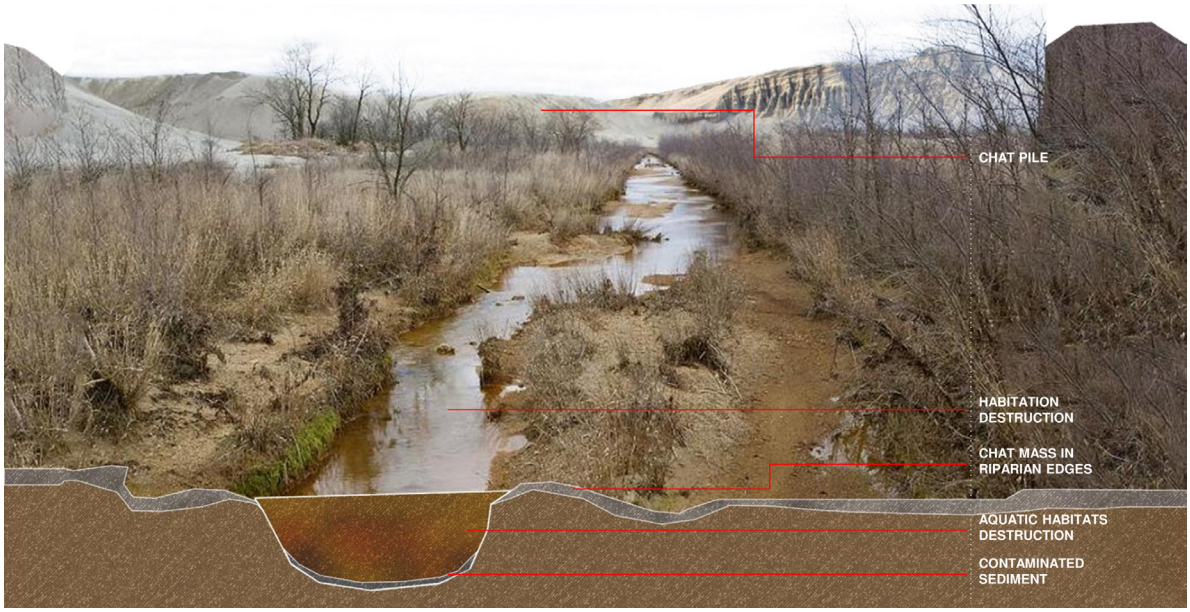


Fig. 43. Loss of Riparian Buffer and Replacement by Contaminated Sediment along Tar Creek



Toxic Mining Waste | Affected Waterbody | Unstable Ground

Fig. 44. Chat Piles, Acidic Surface Water, and Sinkhole Formation at Tar Creek

Figures 42 through 44 illustrate the physical danger and ecological collapse caused by decades of mining at Tar Creek. Figure 42 identifies red-marked areas that are now restricted due to ground instability, where underground mine voids have led to surface collapse, making large portions of the landscape unsafe to access. Figure 43 shows a sectional condition of Tar Creek, revealing how mining destroyed the riparian buffer the vegetated edge that once protected the river. In its place, contaminated sediment now lines the creek, aquatic habitats have been eliminated, and toxic dust settles along the shoreline like ash. Figure 44 brings these conditions together by showing towering chat piles, acidic yellow-orange water, and visible sinkholes, making clear how surface contamination, water pollution, and ground failure are interconnected. Together, these figures demonstrate that Tar Creek is not only polluted, but physically unstable and ecologically broken, reinforcing the urgency of remediation before any form of safe occupation can occur.

Tactics



Fig. 45. Indigenous Mound Traditions across Arkansas, Oklahoma, Indiana, Ohio, and Illinois

Figures 45 through 48 directly inform the tactical framework of the design by linking Indigenous spatial knowledge with contemporary remediation practices. The study of Indigenous mound traditions and typologies (Figures 45 and 46) provides more than historical reference; it offers proven land-based strategies for flood management, communal gathering, burial, and ceremonial use. These precedents guide the shaping of remediation mounds at Tar Creek, allowing on-site disposal facilities to function not only as containment infrastructure but also as culturally meaningful landforms.

The oral histories illustrated in Figure 47 contribute to the design process by grounding tactics in everyday human experience. Memories of swimming, farming, gathering, and learning from elders inform where access, trails, educational spaces, and safe recreational zones are introduced after remediation. These narratives ensure that design decisions respond to lived relationships with land rather than abstract zoning.

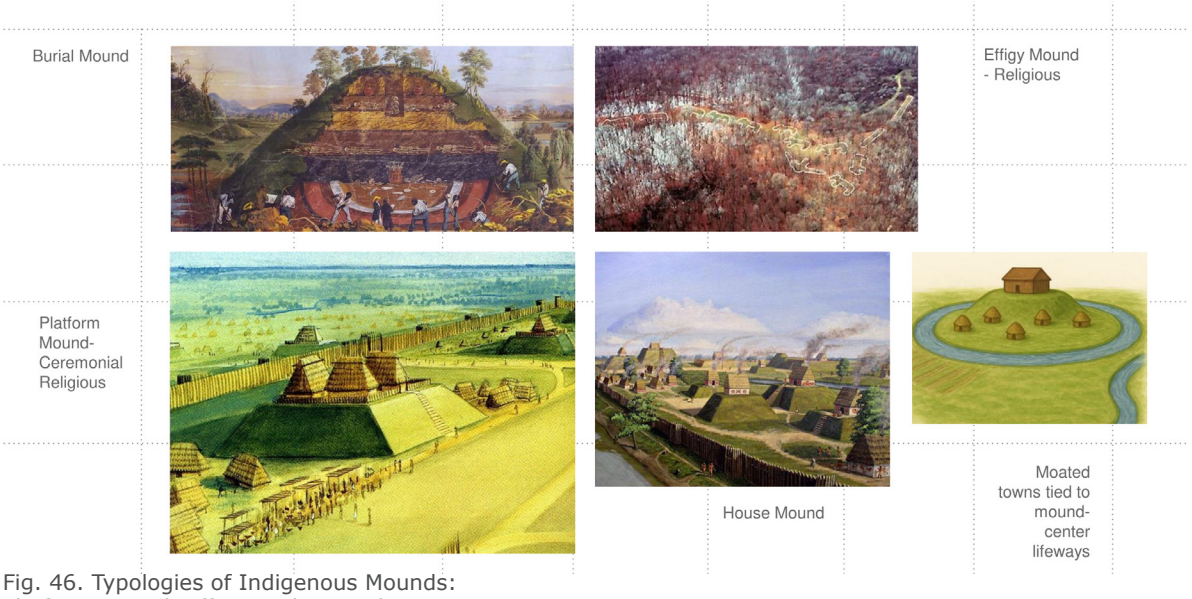


Fig. 46. Typologies of Indigenous Mounds: Platform, Burial, Effigy, and Moated Towns



Fig. 47. Oral Histories and Childhood Memories Shaping Cultural Relationship to Tar Creek. . Source: Author, with assistance from Nano Banana image-generation tool, using stylistic references derived from the Robe of the Three Villages, Quapaw artist, c. 1740–1750 (Arkansas Post National Memorial; National Park Service).

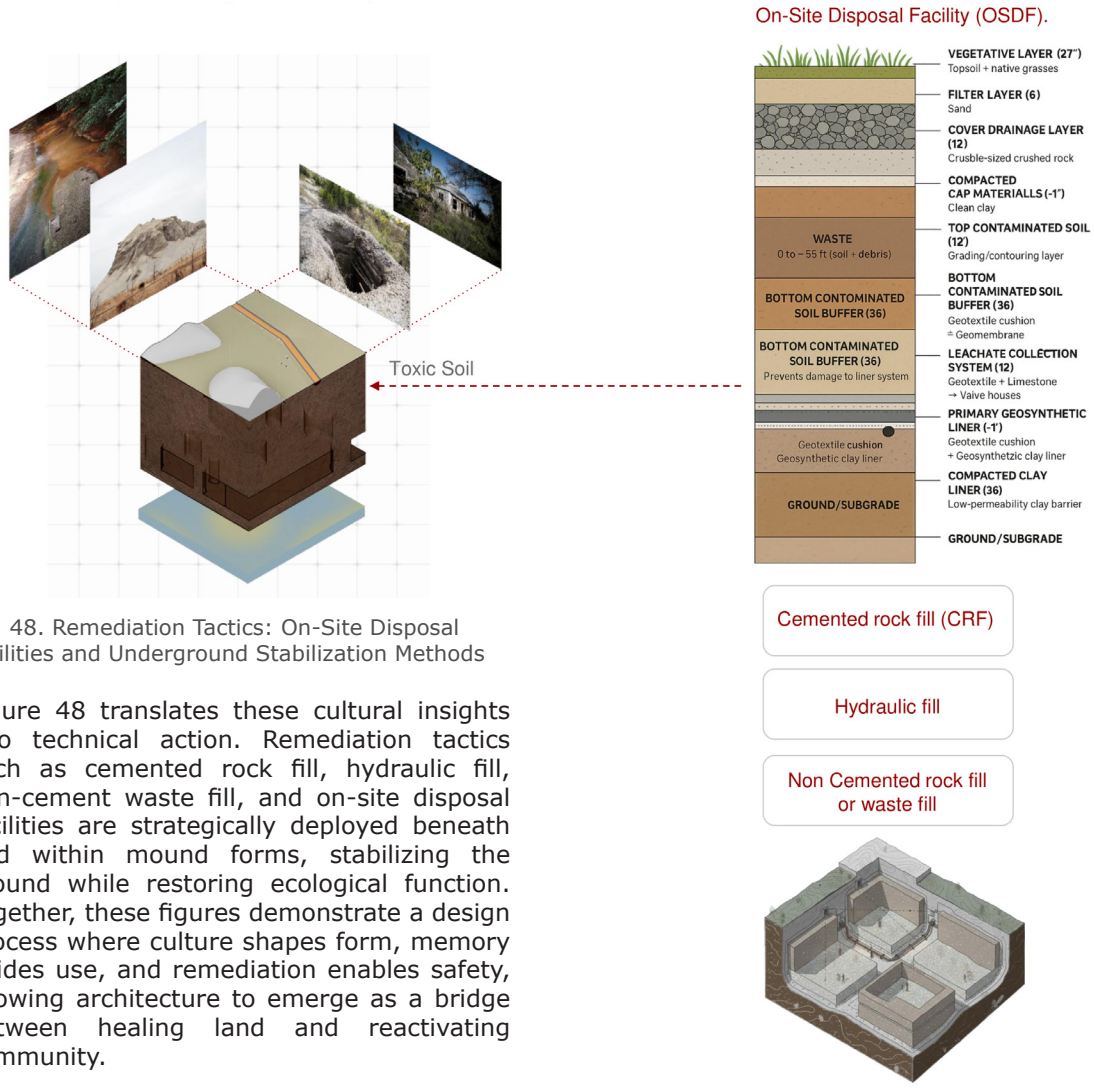


Fig. 48. Remediation Tactics: On-Site Disposal Facilities and Underground Stabilization Methods

Figure 48 translates these cultural insights into technical action. Remediation tactics such as cemented rock fill, hydraulic fill, non-cement waste fill, and on-site disposal facilities are strategically deployed beneath and within mound forms, stabilizing the ground while restoring ecological function. Together, these figures demonstrate a design process where culture shapes form, memory guides use, and remediation enables safety, allowing architecture to emerge as a bridge between healing land and reactivating community.

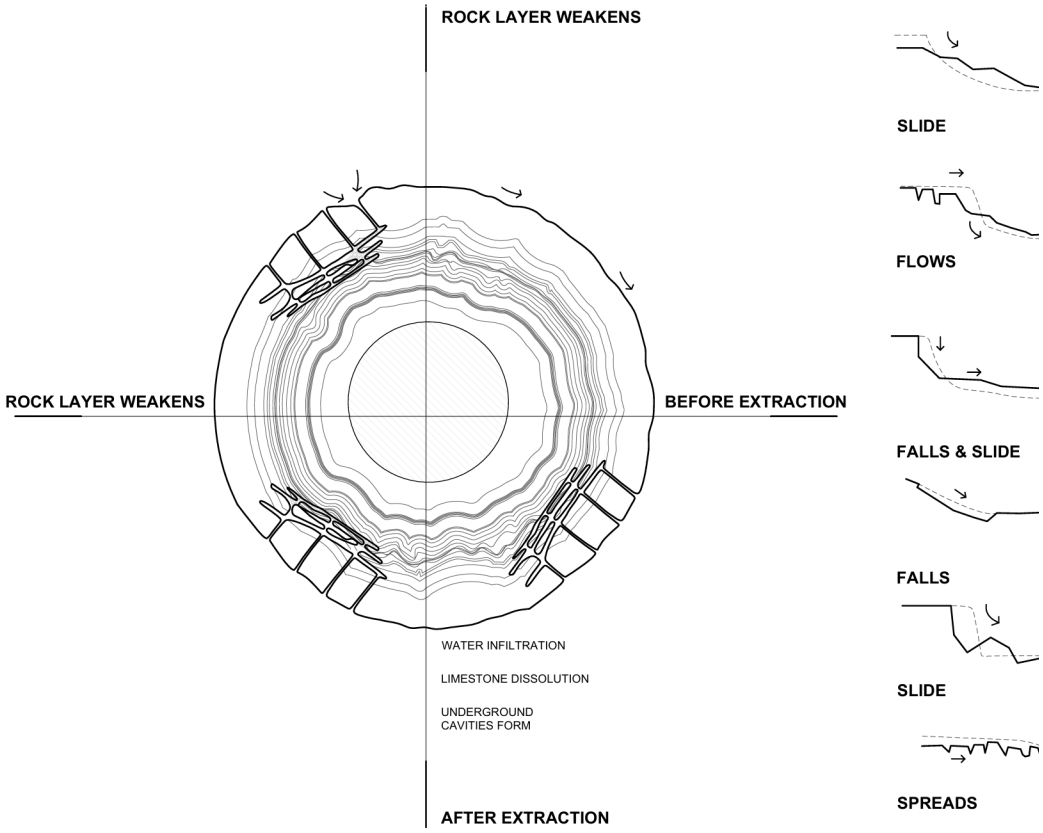


Fig. 49. Understanding the geological sequence for Sinkhole formation

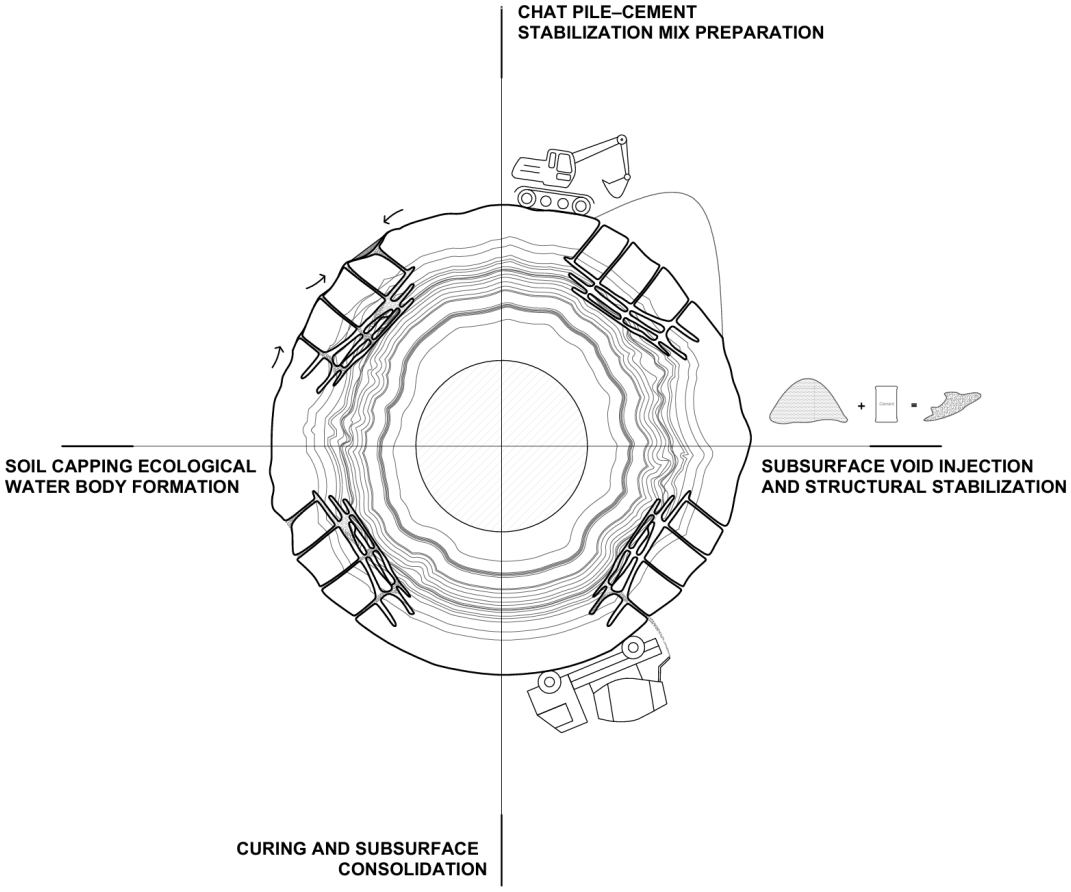


Fig. 50. Subsurface stabilization tactic

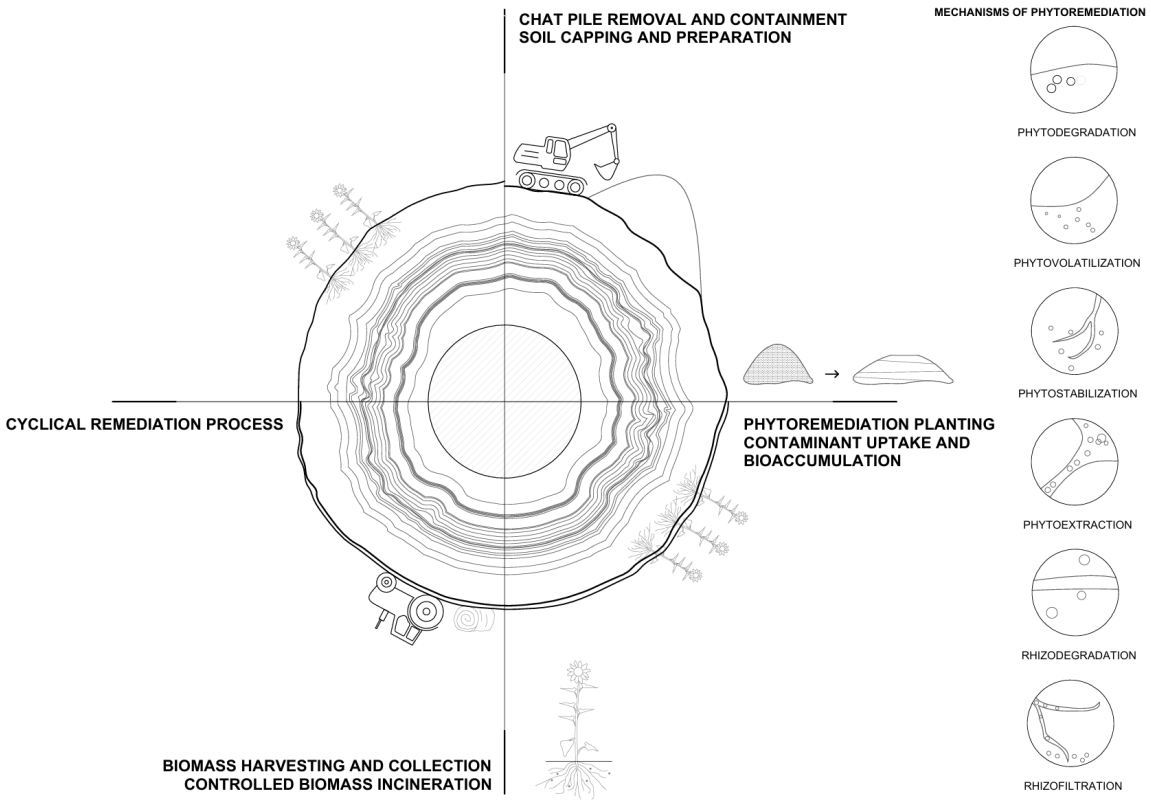


Fig. 51 . Cyclic phytoremediation for heavy Metal soil detoxification

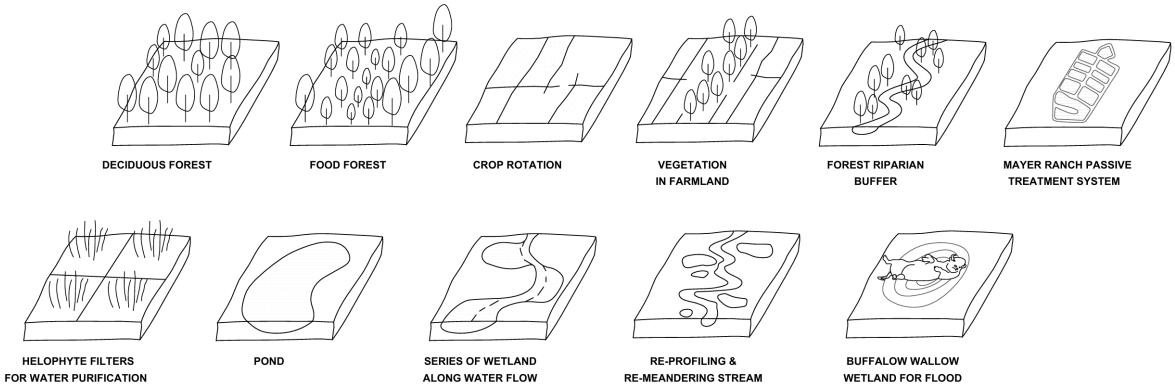


Fig. 52 . Primary selection of landsscaping tactics

These figures together describe a ground-first remediation process, moving from extraction-induced damage to ecological recovery through layered architectural and environmental interventions.

The first diagram (Fig. 49) illustrates the geological sequence of sinkhole formation. Before extraction, the subsurface rock is stable, but mining creates voids within the limestone. As these cavities expand, the overlying rock layers weaken, leading to cracking, sliding, and eventual collapse. Water infiltration accelerates this process, causing material to fall inward and spread outward, resulting in unstable ground conditions that define much of the Tar Creek landscape.

The second diagram (Fig. 50) introduces subsurface stabilization as a geological prosthetic. Here, chat (mining waste) is combined with cement to create a stabilization mix that is injected into underground voids. This process reinforces the structurally, preventing further collapse while reusing site material. Above ground, soil capping and controlled grading begin to re-establish ecological conditions, allowing for water retention and the formation of new surface systems.

The third diagram (Fig. 51) shifts to cyclical phytoremediation. After stabilization and capping, contaminated soils are treated through planting systems that absorb, stabilize, or break down heavy metals. This is an ongoing cycle: plants uptake contaminants, biomass is harvested and safely processed, and the soil gradually detoxifies over time.

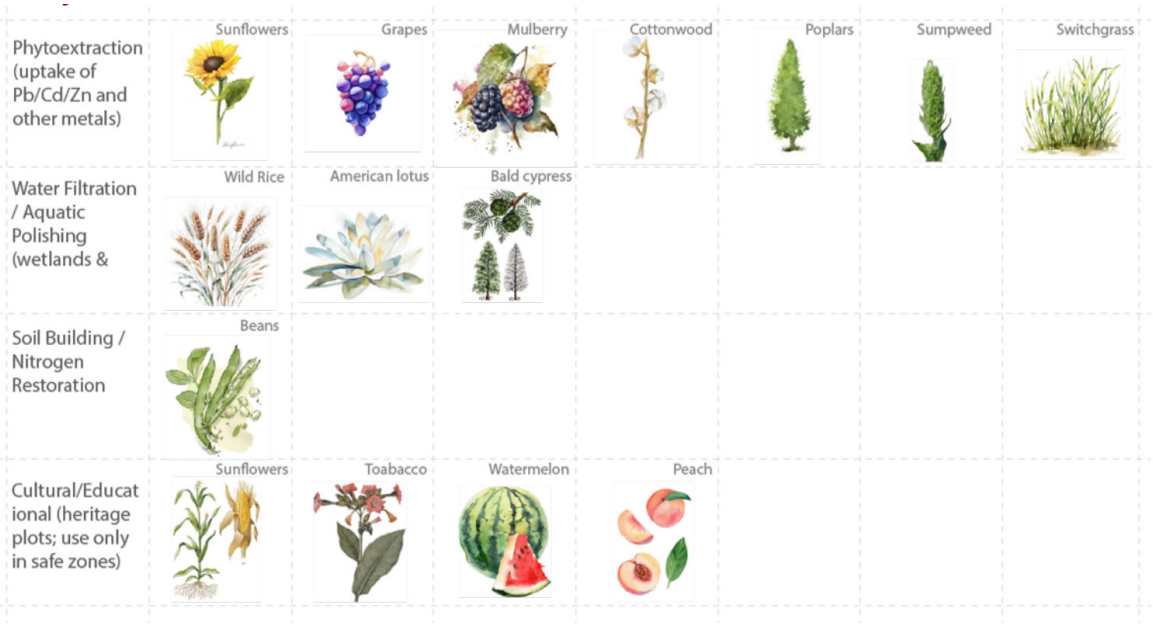


Fig. 53. Indigenous Plant Knowledge and Phytoremediation Strategies of the Quapaw Tribe

Figure 49 highlights the Quapaw Tribe's deep knowledge of farming and native plant systems as a critical path forward for remediation. Plants such as switchgrass and willow are used not only for their cultural significance, but for their ability to stabilize soil, absorb heavy metals, and filter contaminated water. These plant-based strategies align ecological healing with Indigenous stewardship practices, allowing remediation to work with natural processes rather than against them.

Figure 50 identifies the project's Point of Urgency, a southeast portion of the site measuring approximately 10,600 by 5,320 feet, where intervention must begin. This area marks the confluence of Tar Creek and Lytle Creek, the source of the orange, acidic water caused by acid mine drainage. Although the EPA diverted the channel in the late 1980s, contamination persists, with sulfuric acid continuing to bleed through the soil. The figure's layered maps reveal surface and subsurface conditions: tailings ponds (shown in blue) that can be repurposed as repositories, commercially valuable chat piles (shown in brown), and a hollow underground condition created by extensive mining. Together, these maps make visible why this location is both the most damaged and the most critical place to begin healing the site.

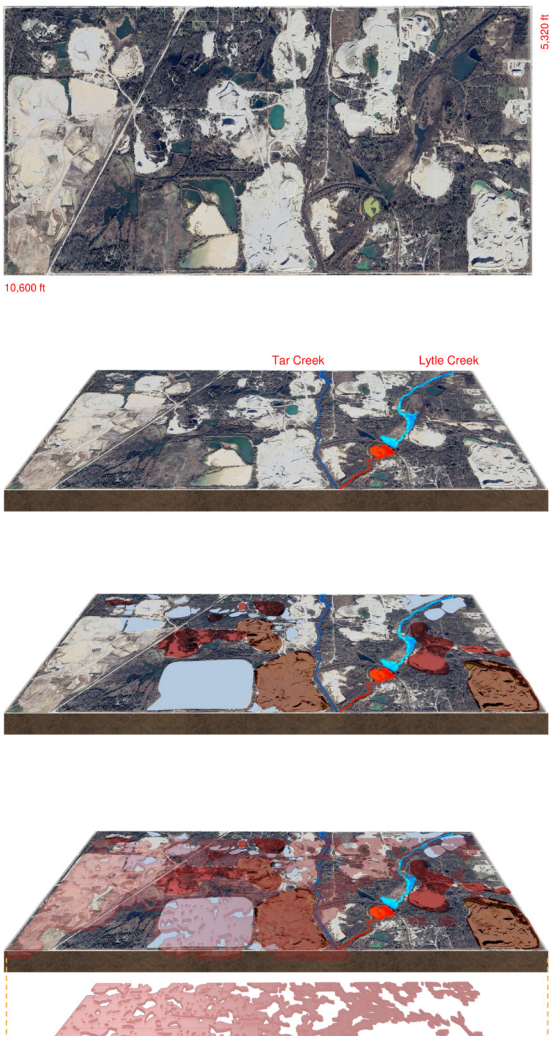


Fig. 54. Point of Urgency at the Confluence of Tar Creek and Lytle Creek

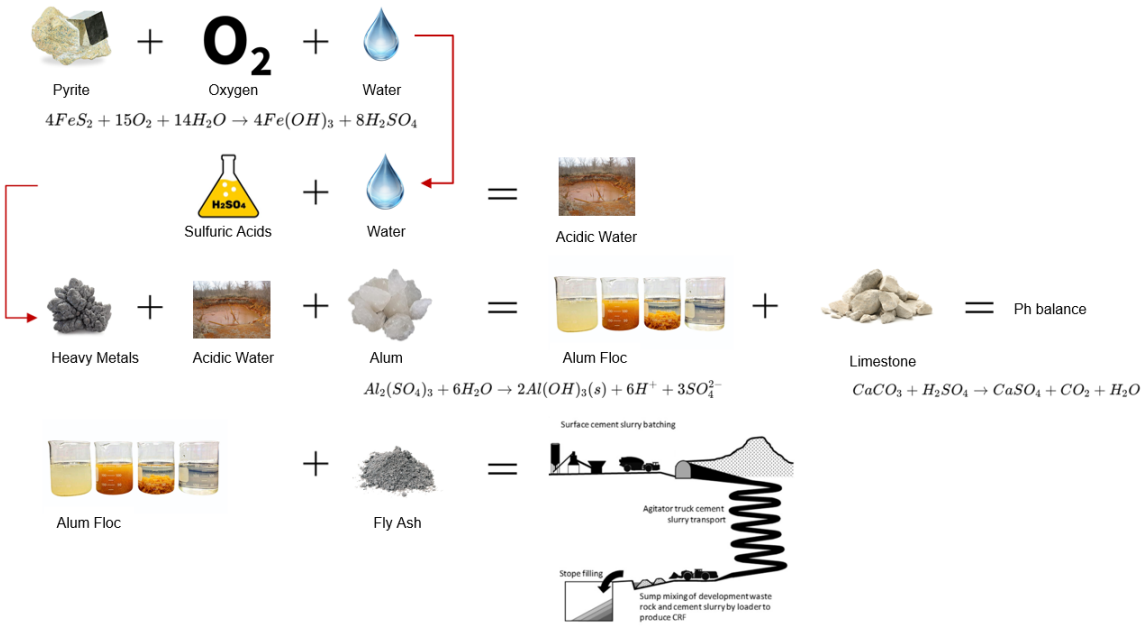


Fig. 55. Indigenous Plant Knowledge and Phytoremediation Strategies of the Quapaw Tribe

Fig.55 Shows how the water turns yellow when pyrite reacts with oxygen and water, forming sulfuric acid and releasing heavy metals from chat piles. As a solution, alum is added to bind and settle these contaminants as alum floc, removing them from the water. However, the water remains acidic, so limestone is introduced to neutralize the pH and restore balance. The collected alum floc is then combined with fly ash and cement to create a stabilized material used to seal sinkholes turning waste into a resource.

Figure 56: Geo Prosthetic Weir The weir acts as a strategic intervention within the hydrological system, positioned along the flow of contaminated water. It slows down the velocity of the stream, creating a controlled condition where sediment and pollutants can be intercepted. As a geo-prosthetic element, the weir does not block the system entirely but regulates flow, allowing the landscape to begin a process of self-repair while preventing further downstream contamination.

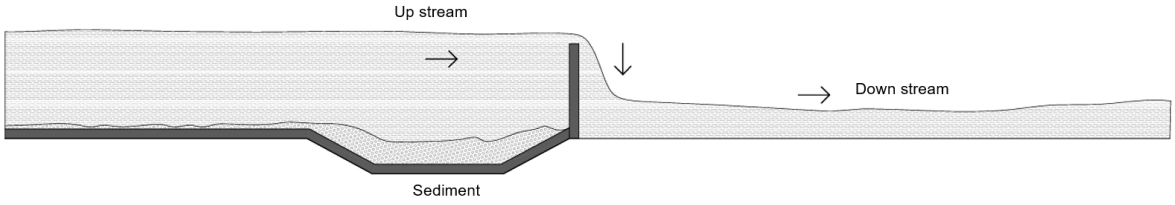


Fig. 56. Indigenous Plant Knowledge and Phytoremediation Strategies of the Quapaw Tribe

The concept of geological prosthetics reframes architecture as an extension of the earth rather than an imposition upon it. Instead of constructing objects on top of damaged land, these interventions operate within geological systems to stabilize, filter, and repair them. At Tar Creek, this approach responds to a landscape fractured by extraction, where underground voids, contaminated water, and unstable soil require support systems that function like prosthetics augmenting the land's ability to heal and sustain itself over time.

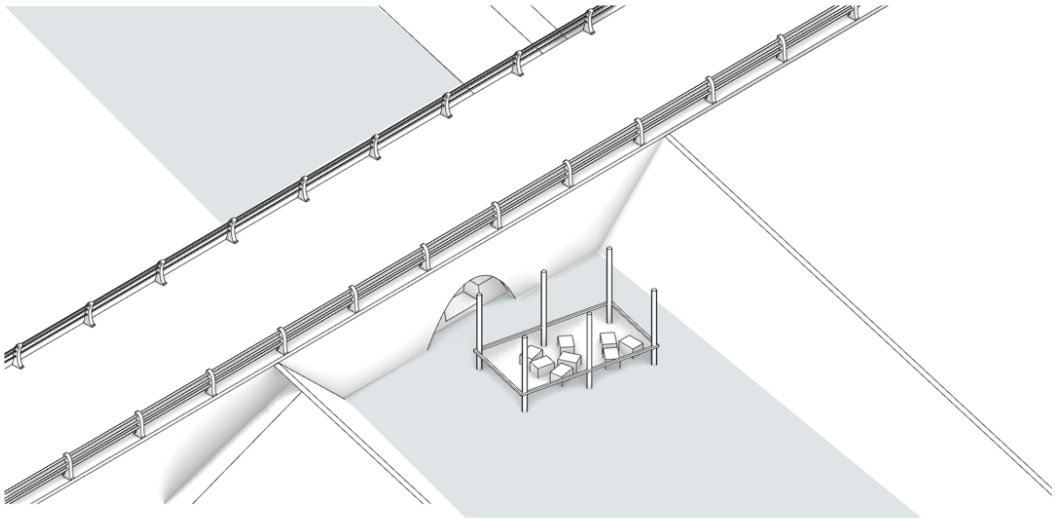


Fig. 57. Geological Prosthetic- Alum induces sediment setteling at **Weir**

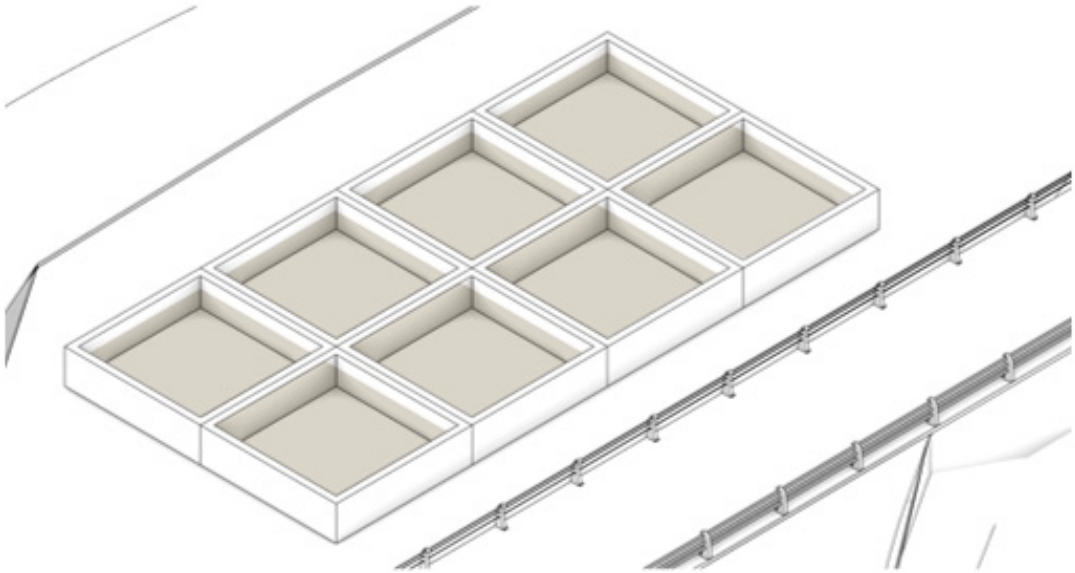


Fig. 58. Sediemnt collection/ storage

Figure 57: Alum-Induced Sediment Settling at Weir
Building on this control, alum is introduced upstream of the weir to accelerate sedimentation. The alum binds with suspended particles and heavy metals, causing them to clump together and settle at the base of the weir. This process transforms dispersed contamination into concentrated material that can be more effectively managed. The slowed water velocity at the weir enhances this settling process, making it a critical point of chemical and physical remediation.

Figure 58: Sediment Collection and Storage
Once sediments accumulate, they are collected and transferred into designated containment units. These storage systems isolate the contaminated material, preventing re-entry into the water system. Over time, this allows for safer handling, potential treatment, or long-term containment. This final step completes the cycle from interception to concentration to containment demonstrating how architectural systems can operate as part of an ongoing environmental remediation process.

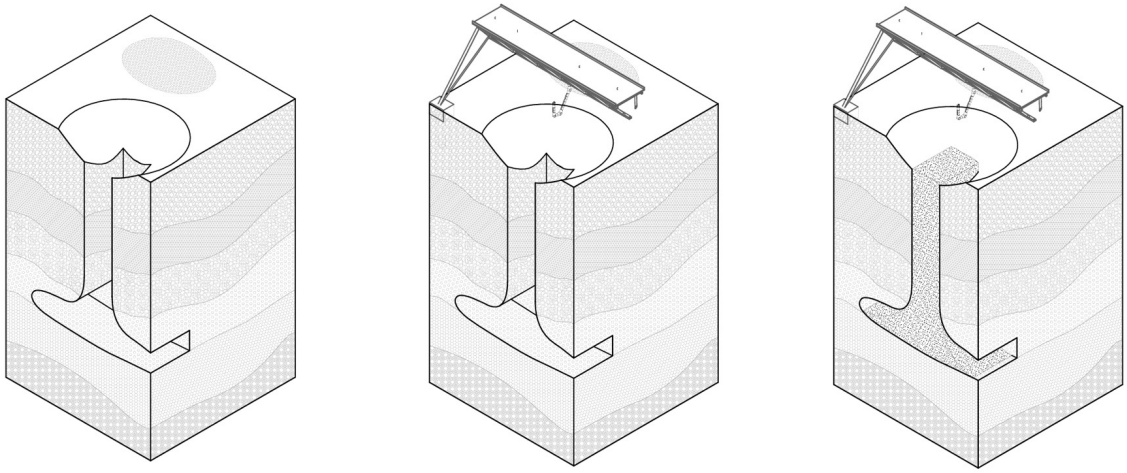


Fig. 59. Geological Prosthetic- water spray and slurry injection **infrastructure** for aeolian toxicity control and subsurface stabilization.

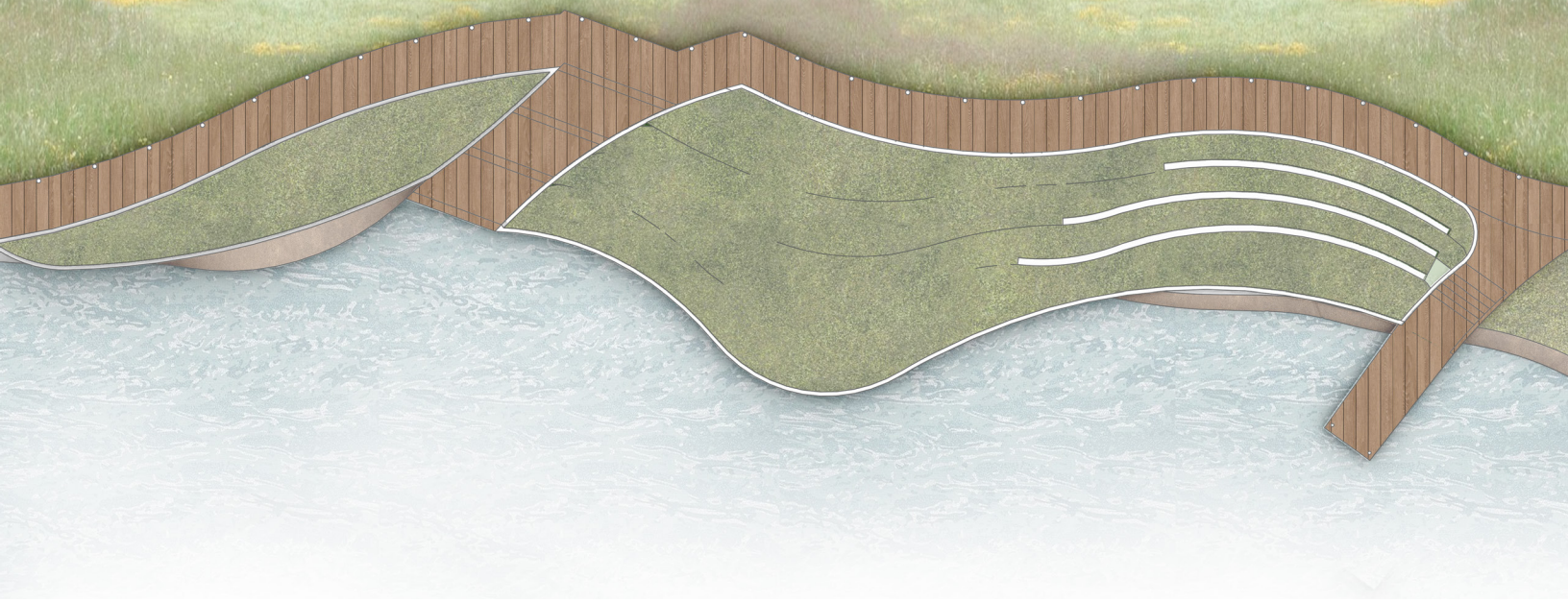
figure 59 illustrates a dual-function system that operates as a geological prosthetic, supporting both ground stabilization and environmental remediation. Contaminated sediment, captured through earlier treatment processes, is mixed with chat to form a cement-based slurry. This slurry is then transported through a pipeline network and injected into underground voids created by mining. As it hardens, it fills these cavities, stabilizes the ground, and reduces the risk of further collapse, effectively turning toxic material into a structural support.

At the same time, the infrastructure carries water through a separate system. This water is sprayed over chat piles to suppress dust and reduce the spread of airborne toxic particles, protecting workers and nearby communities from exposure. Over time, this same water system can support irrigation, helping establish vegetation and aiding in long-term ecological recovery.

As a geo-prosthetic intervention, this system works with the land rather than against it. It connects subsurface repair with surface processes, transforming waste into a resource while gradually restoring stability and ecological function to the site.

Together, these interventions position geo-prosthetics as a comprehensive system that intercepts, concentrates, repurposes, and stabilizes contamination across both surface and subsurface conditions. From alum-induced sedimentation at the weir to sediment collection, slurry injection, and dust suppression, the framework transforms dispersed toxicity into manageable material while reinforcing the structurally and ecologically. Architecture, in this sense, becomes an active participant in remediation operating through processes rather than objects, and working in continuity with geological and hydrological systems.

However, despite the effectiveness of these strategies in addressing heavy metal contamination and physical instability, a critical challenge remains unresolved: the pH imbalance of the water system. Acid mine drainage continues to produce highly acidic conditions, which limit ecological recovery and reduce the effectiveness of long-term restoration efforts. This raises an important question for the next phase of intervention how can geo-prosthetic systems expand to address not only material toxicity but also the chemical conditions of water?



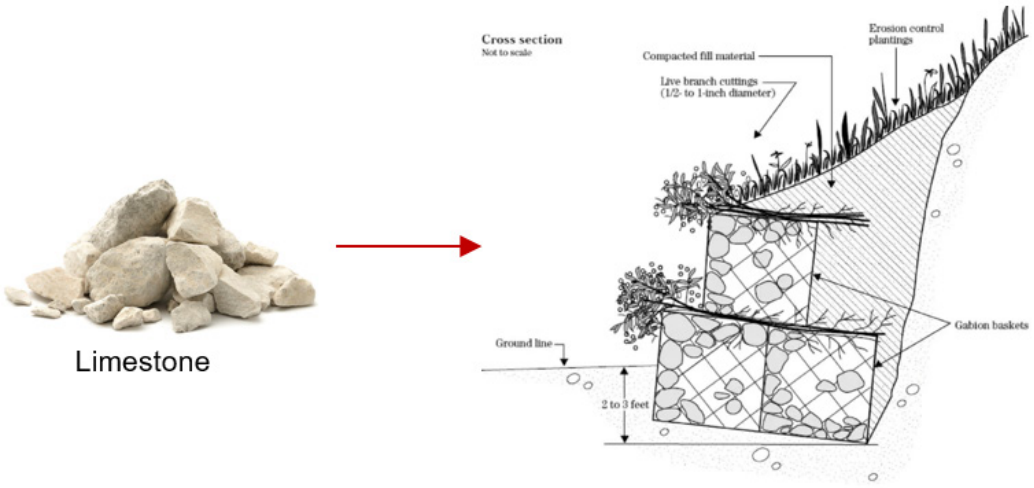


Fig. 60. Ecological Typologies Rooted in Quapaw Knowledge and Post-Industrial Landscape Healing

This figure introduces a geo-prosthetic strategy that addresses both chemical imbalance and physical instability along the water's edge. The gabion wall, filled with limestone gravel (calcium carbonate), is positioned at the creek boundary where acidic water is most active. As water flows through and around the porous gabion structure, the limestone gradually dissolves, releasing alkaline compounds that help neutralize acidity and raise the pH level over time.

Simultaneously, the gabion system functions as a structural embankment, stabilizing the shoreline and reducing erosion caused by fluctuating water levels and contaminated flow. Its permeable nature allows water to pass through while slowing velocity, supporting sediment retention and minimizing further degradation of the bank.



Fig. 61. Key map showing the location of the limestone gabionwall for pH regulation

As a geo-prosthetic intervention, this system works through slow, continuous processes combining passive chemical treatment with physical reinforcement. It demonstrates how material choice and landscape infrastructure can operate together to restore both the ecological balance of the water system and the structural integrity of the land.

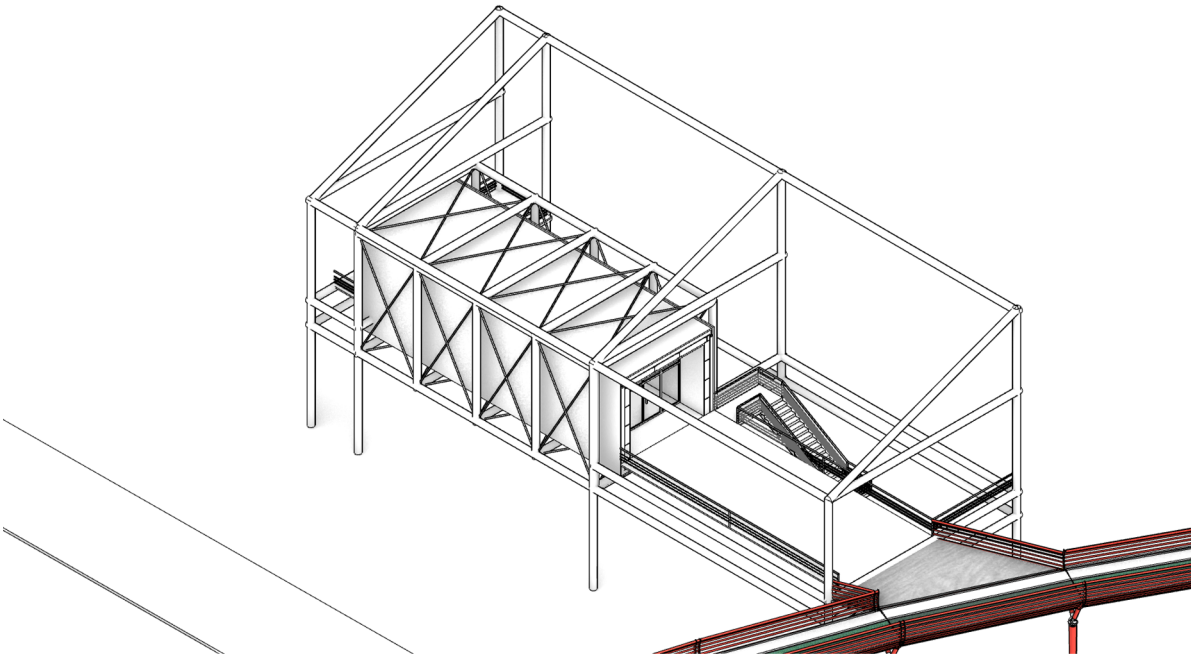


Fig. 61. Wet lab/ the sky people's monitoring station

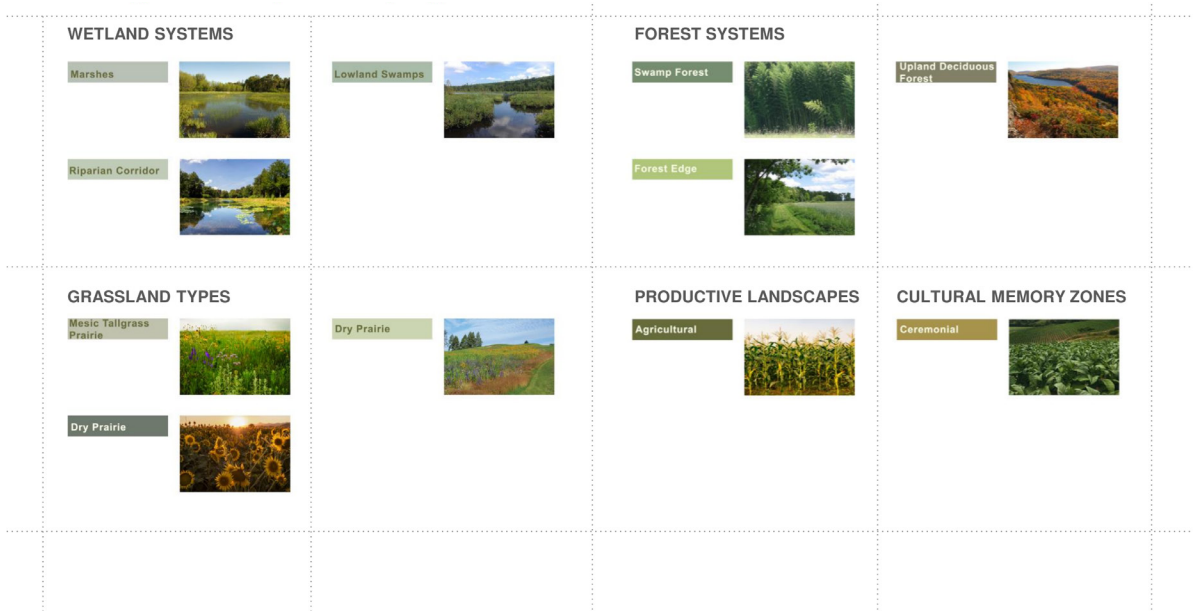
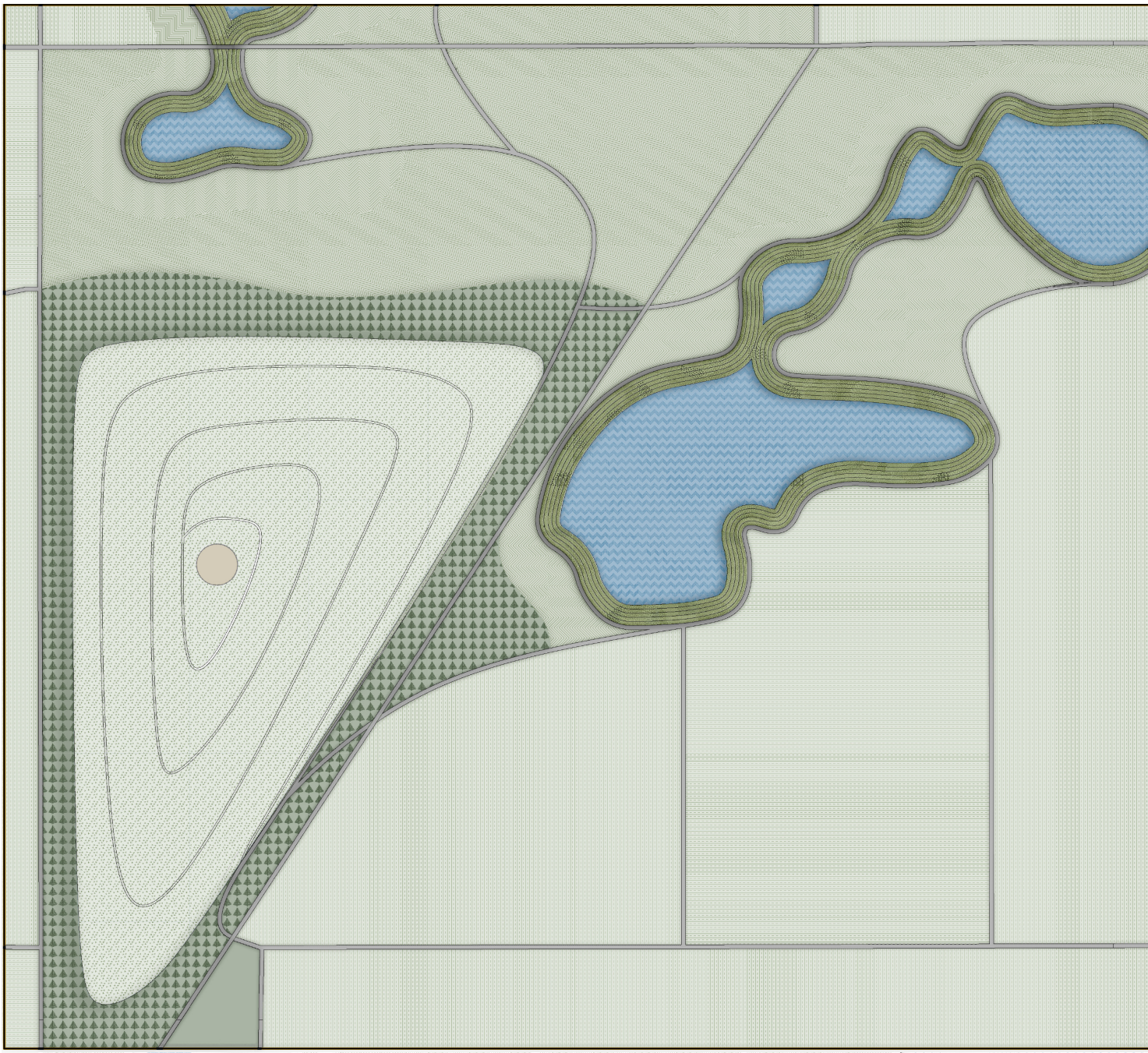


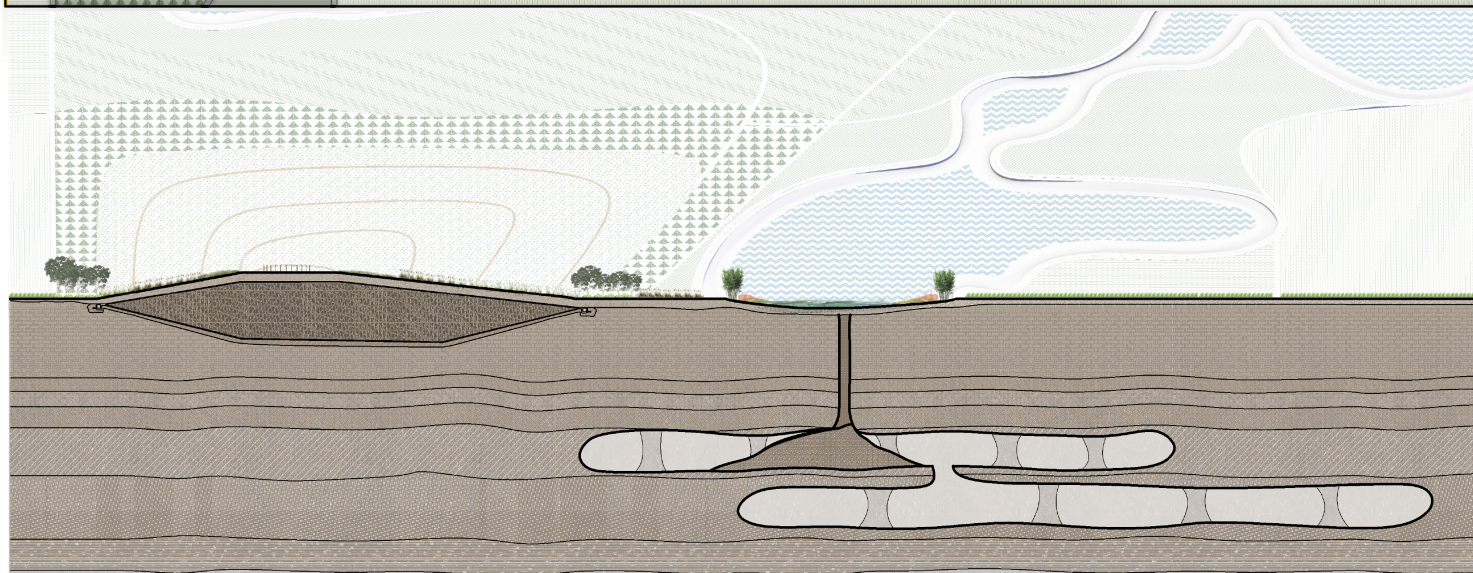
Fig. 62. Ecological Typologies Rooted in Quapaw Knowledge and Post-Industrial Landscape Healing

Like the concept of the sky people, figure 61. shows the tribe reclaims the power to care for and restore their land. Here, the "sky people" take form as modern-day researchers and workers, positioned above ground in the wet lab, continuously monitoring and guiding the system.

Figure 62 illustrates the conceptual shift that guided the design framework for Tar Creek. Inspired by Freshkills Park and its transformation of a toxic landscape into a regenerative ecological system, this figure reimagines Tar Creek not through extraction or control, but through Quapaw ecological wisdom. The landscape is organized into five interconnected typologies wetland, forest, grassland, productive landscape, and cultural memory. These categories are not imported environmental design strategies; they emerge directly from Quapaw relationships to land, farming practices, water stewardship, and cultural continuity. By grounding remediation in these typologies, the project allows healing to grow from Indigenous ecological identity, ensuring that restoration is both environmentally effective and culturally meaningful. farming practices, water stewardship, and cultural continuity. By grounding remediation in these typologies, the project allows healing to grow from Indigenous ecological identity, ensuring that restoration is both environmentally effective and culturally meaningful.

Illustrative Site Plan







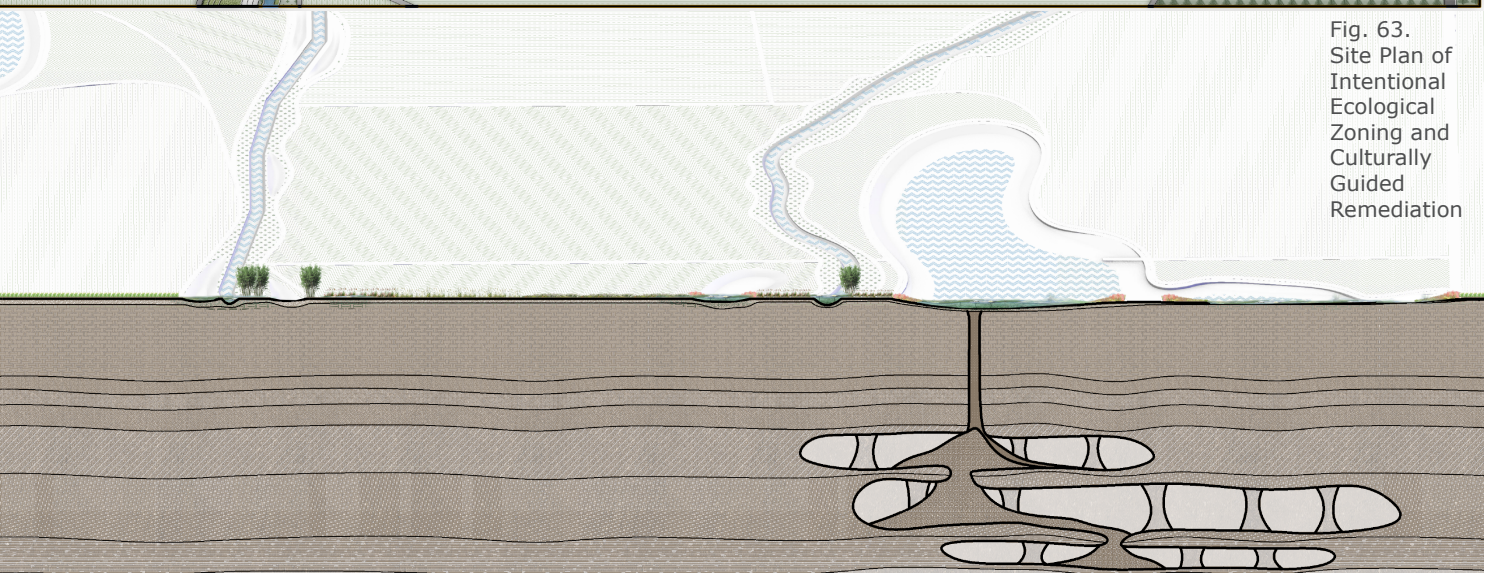
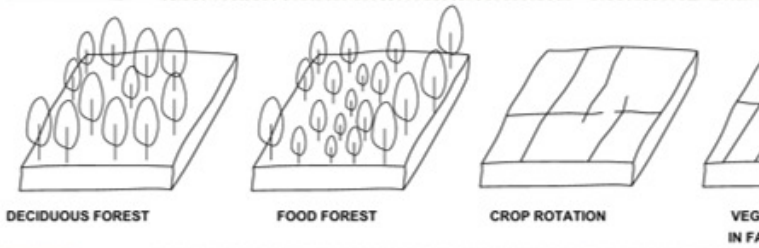


Fig. 63.
Site Plan of
Intentional
Ecological
Zoning and
Culturally
Guided
Remediation

Atop the repository mound, a mesic tallgrass prairie is established on restored topsoil, with deep-rooted species that stabilize the surface and prevent erosion by binding the soil together. These planted systems transform the mound from a containment structure into a living landscape. Multiple repository mounds can be distributed across the site, each one safely containing toxic material while reinterpreting the mound-building traditions central to Quapaw cultural identity.



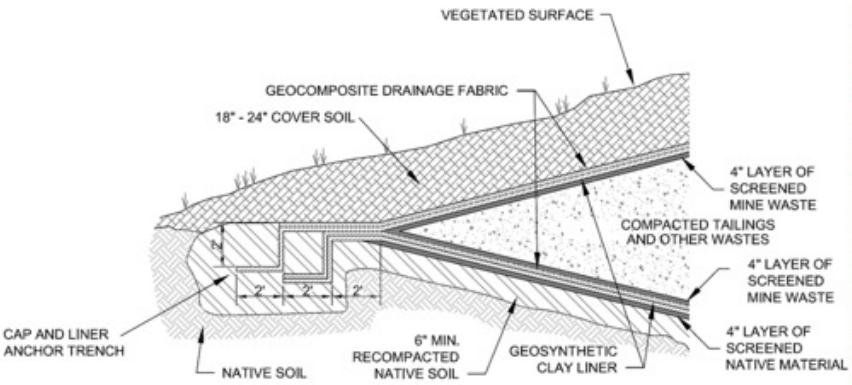
Mesic Tallgrass Prairie (moderate moisture, deep-rooted)

Switchgrass (Panicum virgatum) – metals uptake

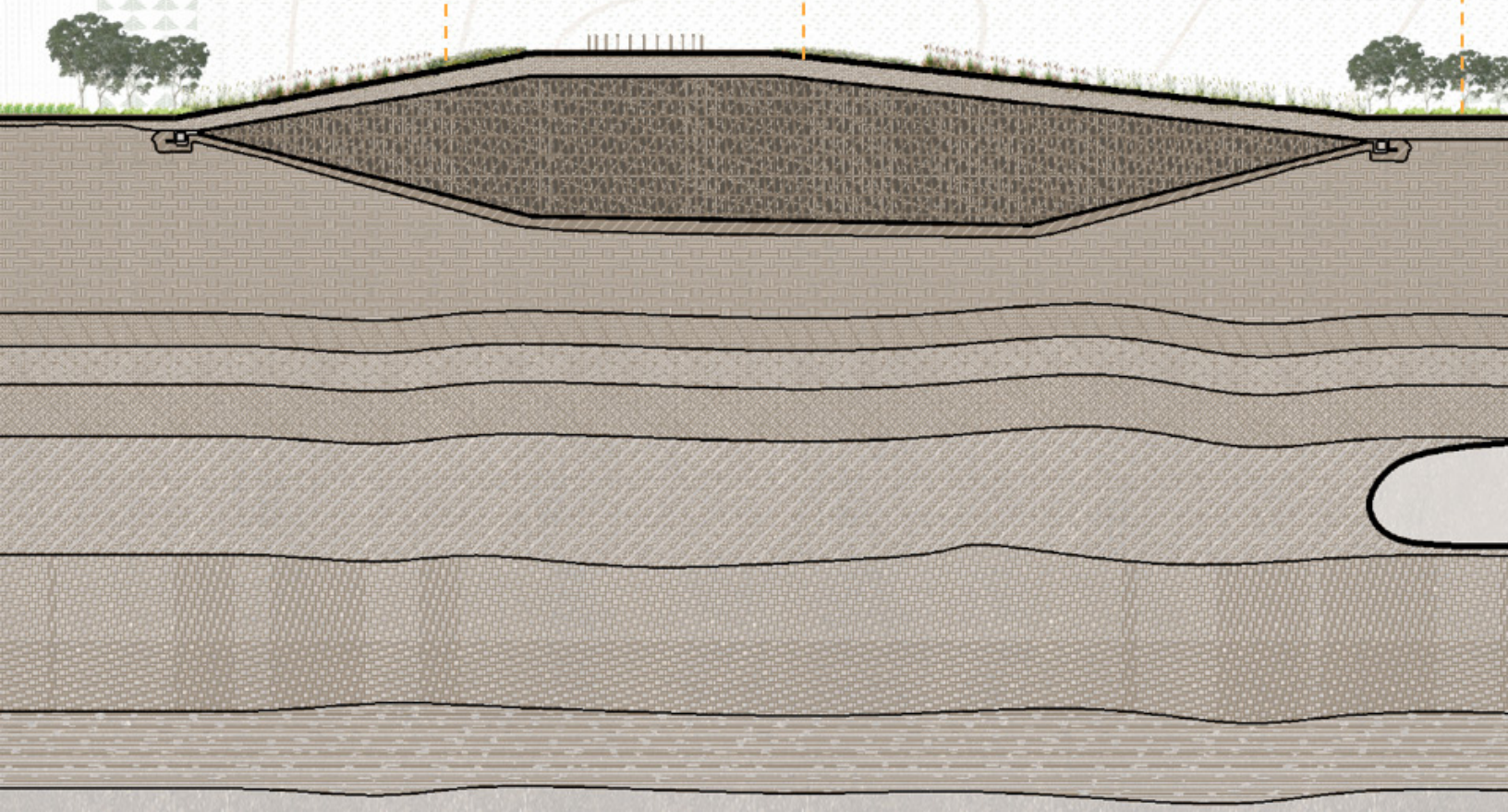
Big bluestem (Andropogon gerardii) – erosion control

Indian grass (Sorg-hastrum nutans) – prairie restoration

Sump weed (Iva annua) – tolerant of toxic soils



Repository Section



At the edges of the mound, bottomland hardwood forests form a protective buffer, shielding the landscape from wind, storms, and seasonal fluctuations while supporting habitat regeneration. Along the riparian edge, river cane an ecologically and culturally significant species is reintroduced. Traditionally managed through controlled burning, river cane produces ash rich in nutrients, naturally restoring soil fertility within a short cycle. This regenerative process extends beyond the land, as nutrient-rich

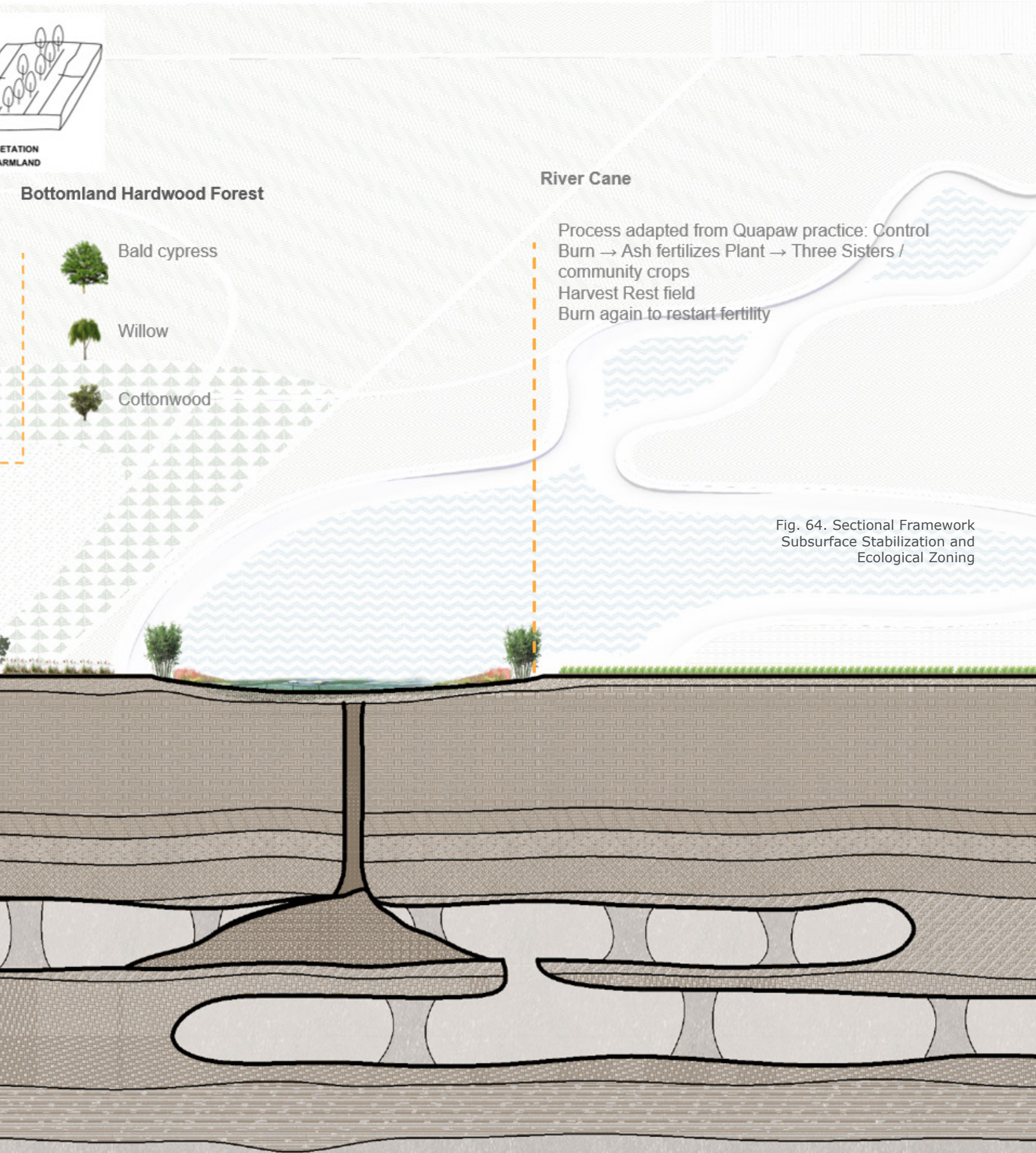


Fig. 64. Sectional Framework Subsurface Stabilization and Ecological Zoning

Closer to Tar Creek, productive agricultural landscapes are reintroduced on remediated, safe soil, reconnecting the land to practices of cultivation and sustenance. Positioned near water for irrigation, these fields restore both ecological function and cultural continuity. Crops such as beans, corn, squash, pumpkin, watermelon, and peaches begin to grow again, reflecting traditional planting systems and reinforcing a regenerative relationship between land and community. The reintroduction of buffalo plays a critical role in activating the landscape. Their movement and grazing patterns support soil health, seed

Productive Landscapes (Safe-Soil Only)



Beans (Phaseolus spp.) – nitrogen fixing



Corn (Zea mays) – heritage crop



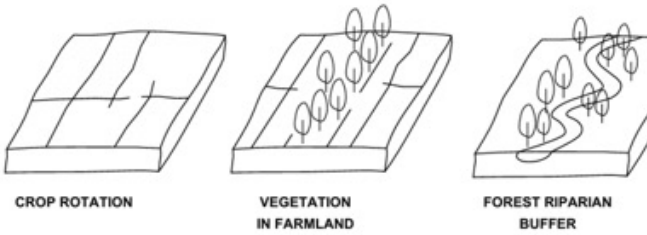
Squash/Pumpkins (Cucurbita spp.) – groundcover

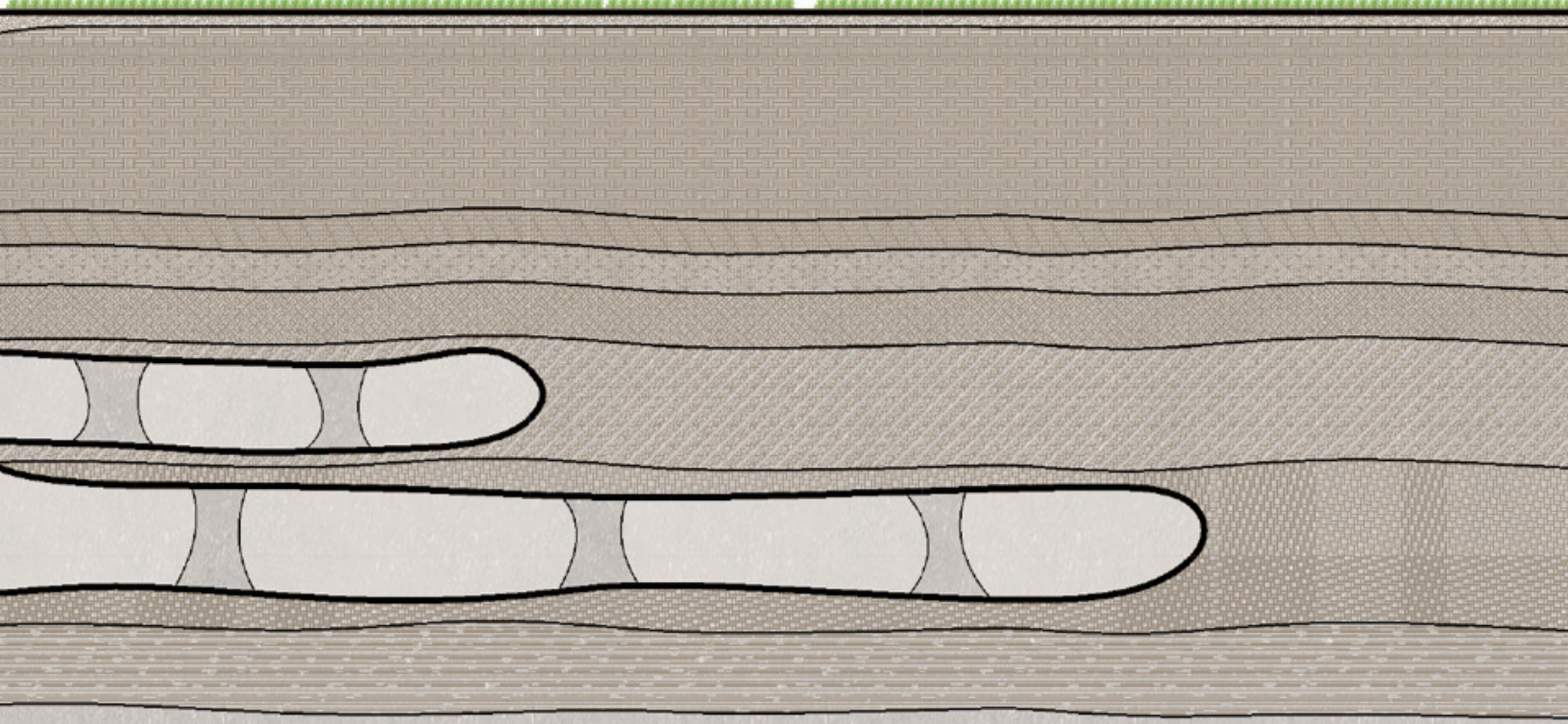


Water melon (Citrouilles Lantus) – démonstration Garden



Peach (Prunus persica) – orchard





dispersal, and ecological diversity, while also restoring a vital cultural and spiritual presence. Between Tar Creek and Lytle Creek, restored wetlands create spaces for buffalo to wallow, forming micro-habitats that support amphibians, birds, and aquatic life. These wetlands also function as natural flood infrastructure, slowing water flow, absorbing excess runoff, and reducing downstream impact. As these systems take hold, woodland species begin to return, signaling the gradual recovery of ecological balance.

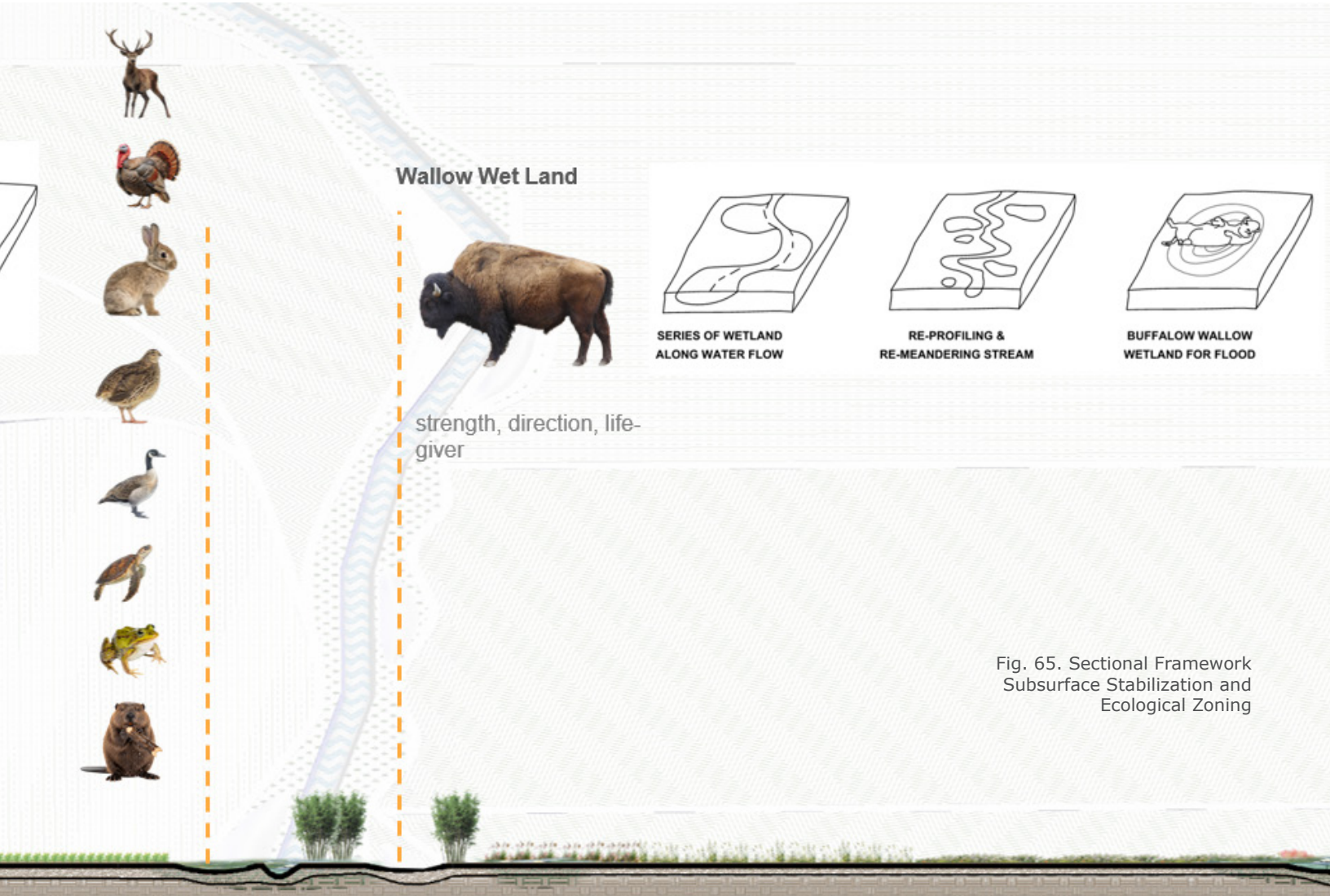
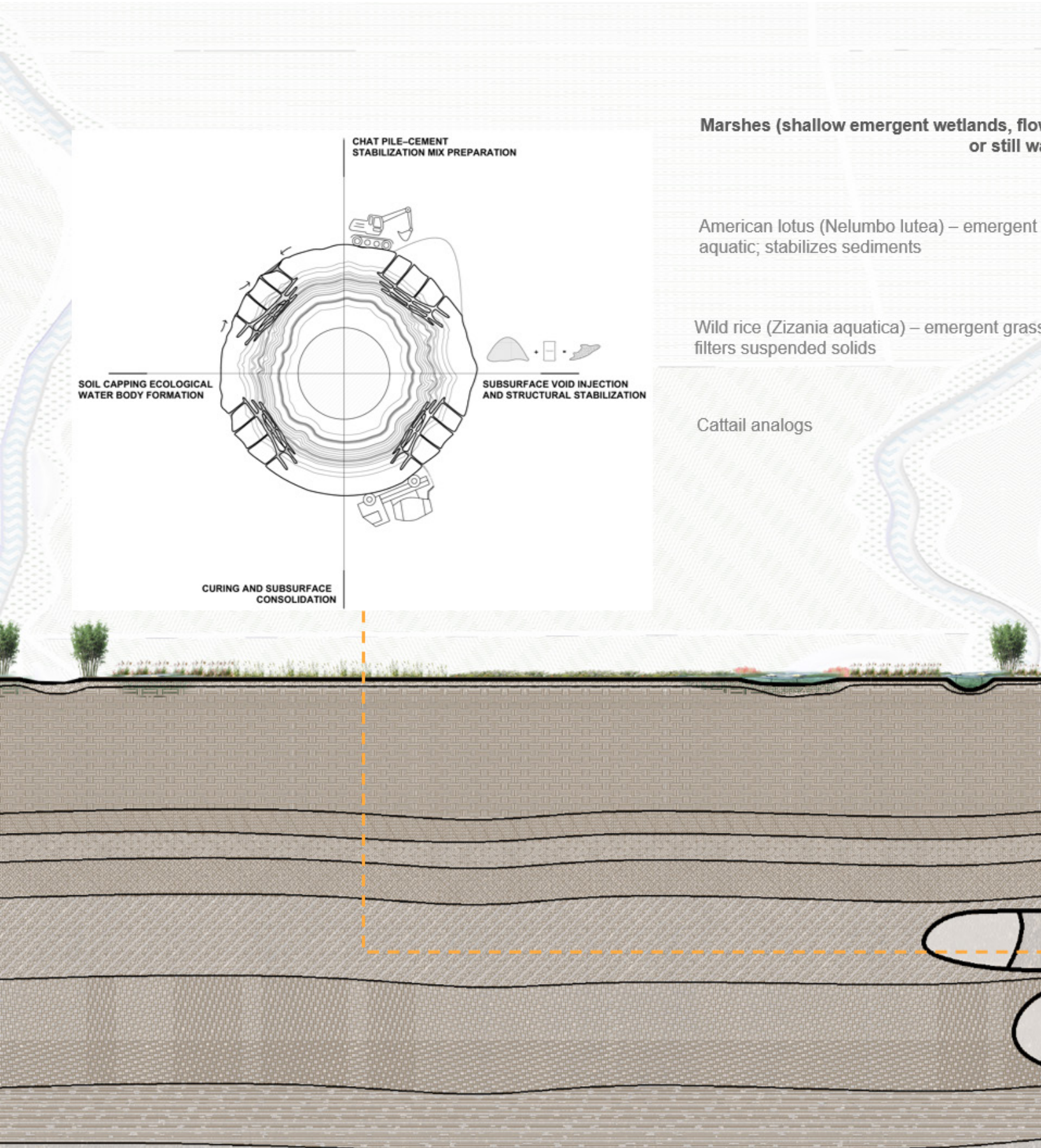


Fig. 65. Sectional Framework Subsurface Stabilization and Ecological Zoning

This section shows the integration of subsurface stabilization, passive treatment, and long-term containment. Contaminated chat is mixed into a slurry and injected into underground voids, stabilizing the ground and reducing collapse. At the surface, marsh-based wetlands with species like lotus and wild rice filter contaminants, stabilize sediments, and improve water quality. These systems connect to passive treatment zones that slow and clean water before it re-enters the watershed. The On-Site Disposal Facility (OSDF) provides secure containment through layered



liners and drainage systems, isolating toxic material while supporting surface restoration. Together, these strategies operate across ground, water, and ecology forming a continuous system for stabilization, filtration, and long-term recovery.

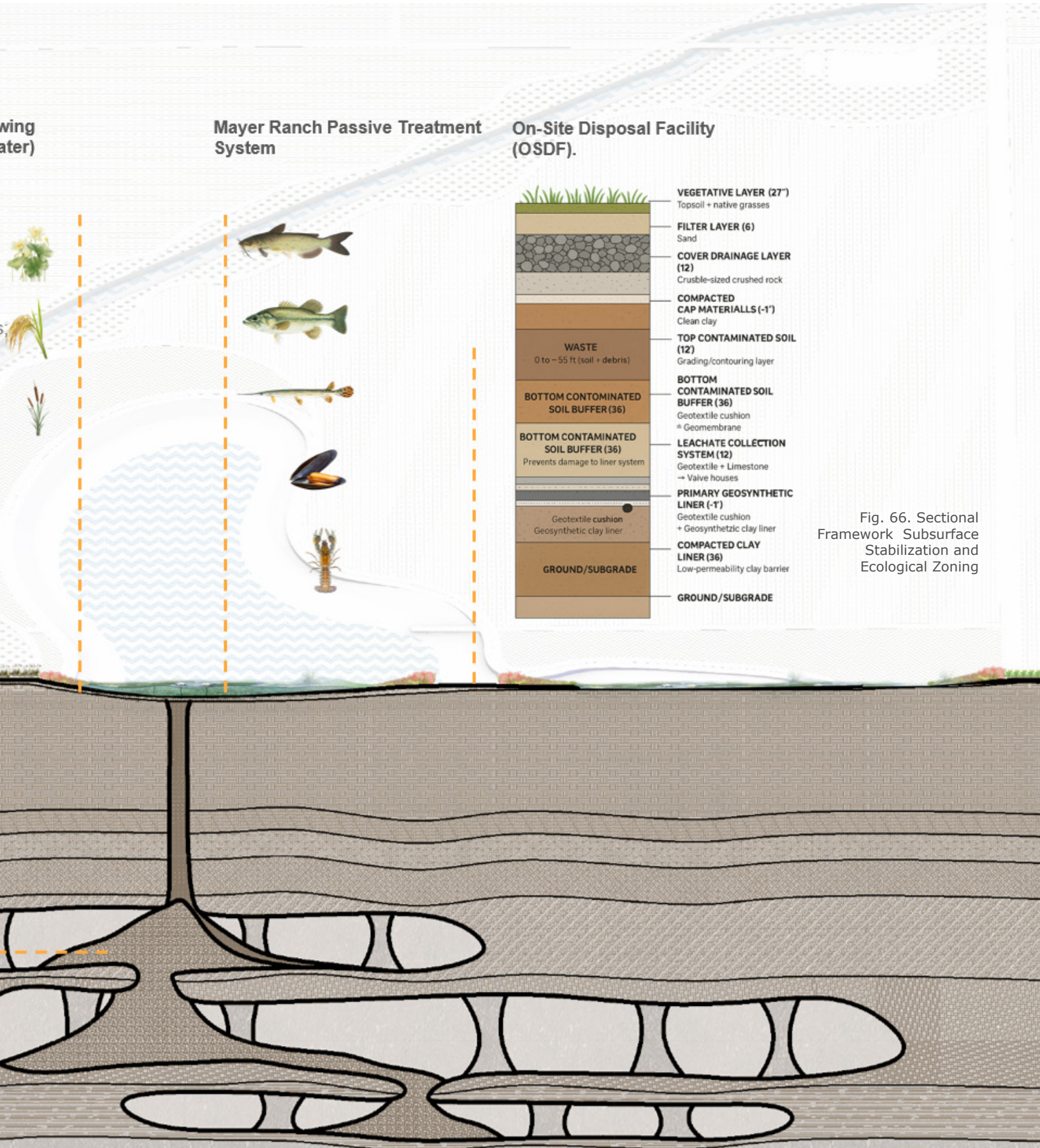


Fig. 66. Sectional Framework Subsurface Stabilization and Ecological Zoning



Fig. 67. Speculative view of the elevated wetlab

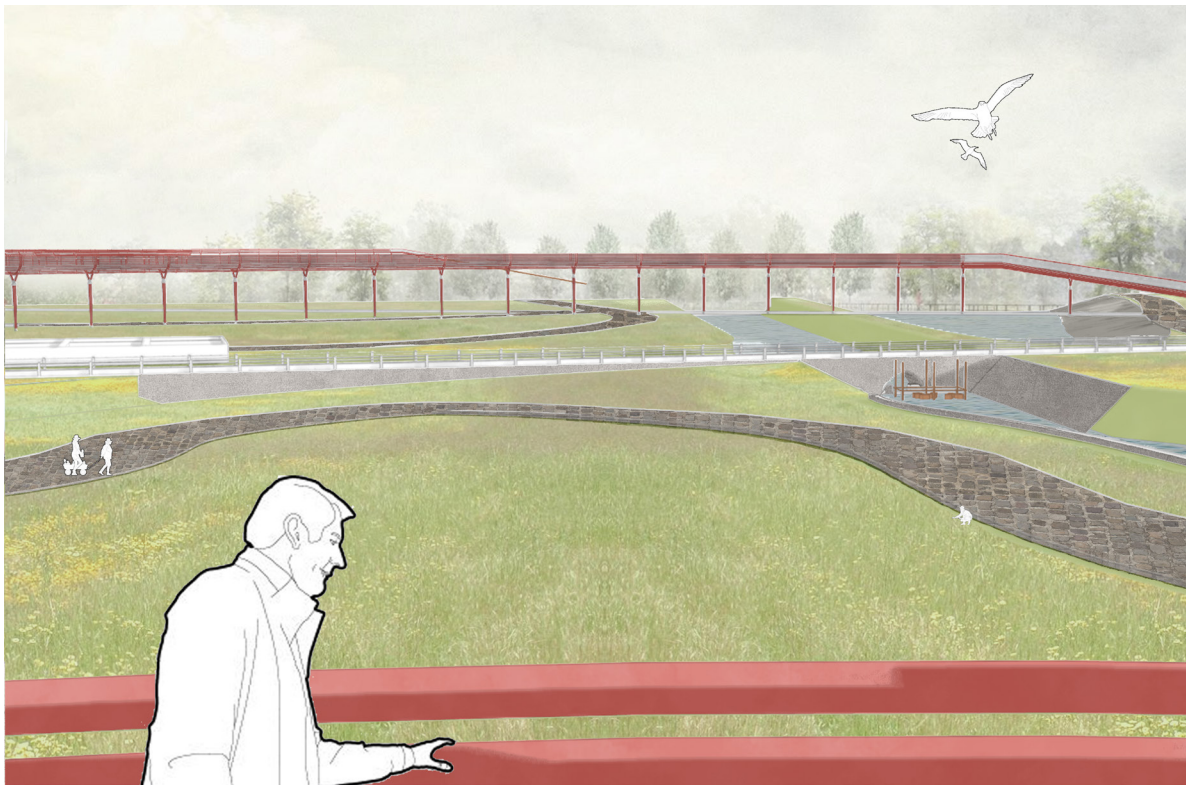


Fig. 68. Speculative view of the elevated wetlab connections



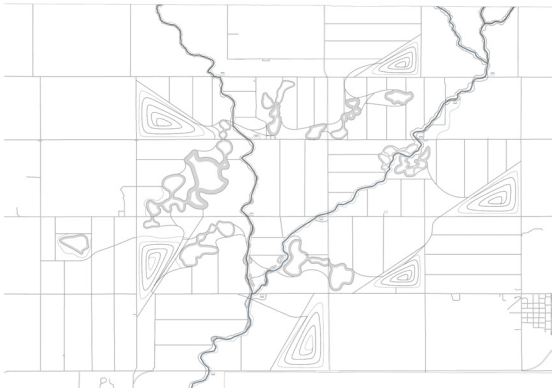
Fig. 69. Phased Remediation Process and Long-Term Site Recovery Timeline.

Figure 69 outlines the phased remediation process required to heal the Tar Creek site, beginning with the removal of marketable materials and progressing through water management, vegetation clearing, soil screening and sampling, stabilization of mine shafts and subsidences, capping of borings, site regrading, and final revegetation. Each step is complex and time-intensive, with remediation occurring over multiple years often nearly three years per phase. This extended timeline highlights that healing is not immediate, but incremental and deliberate. Recognizing this reality led the thesis to explore future programmatic trajectories, including a Center for Indigenous Environmental Science and an Environmental Education Center two programs that can function independently while remaining deeply connected to the site's long-term recovery and knowledge-sharing mission.

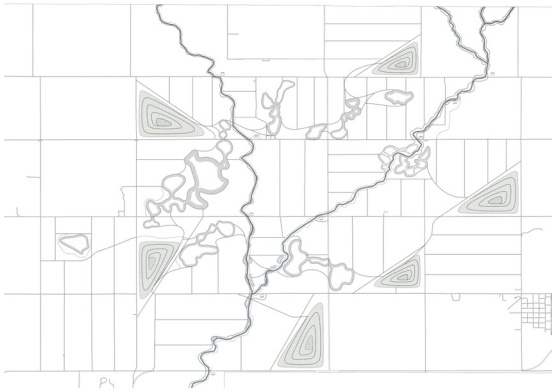
Figure 70 serves as a closing reflection on the project's narrative. Tar Creek is not presented as a story of loss, but as one of endurance. Although the land was fractured and collapsed by extraction, the people did not disappear. This figure reframes the site as a place of resilience, where ecological repair and cultural continuity move forward together. It affirms the central idea of the thesis: that healing landscapes is inseparable from honoring the communities who continue to live, remember, and care for them.



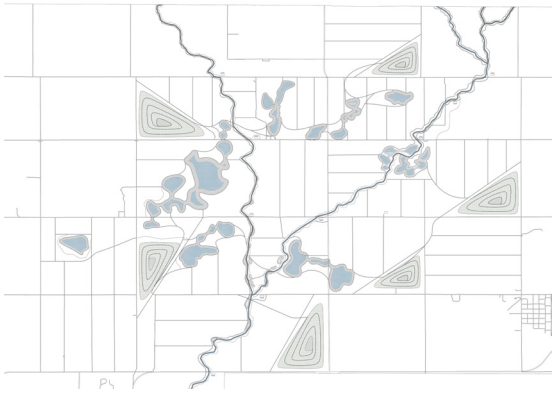
Fig. 70. Endurance beyond Collapse: Tar Creek as a Landscape of Survival



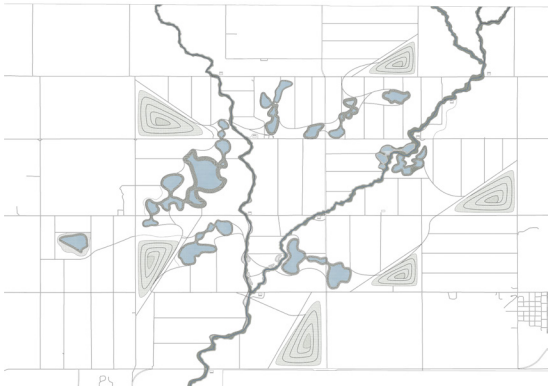
(a)



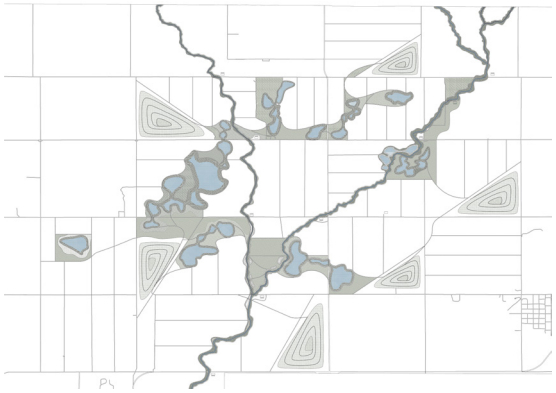
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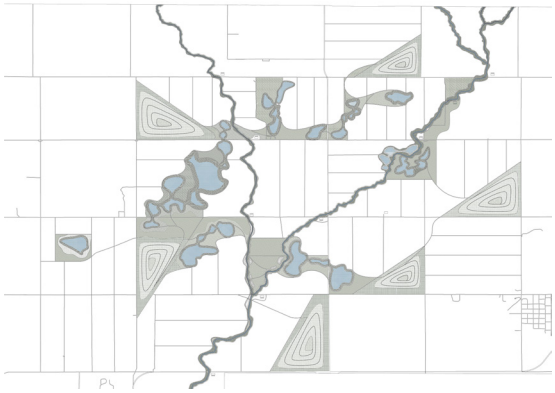
(c)



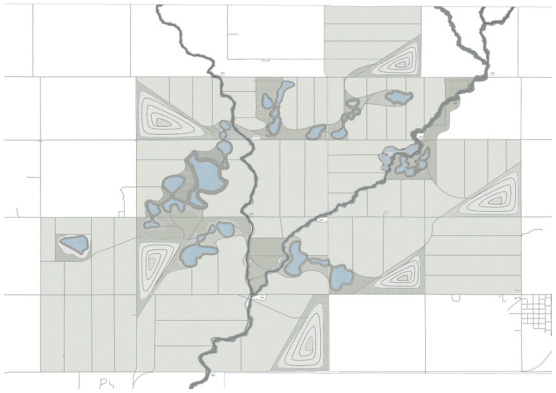
(d)



(e)



(f)



(g)

Fig. 71. Timeline of remediation process unfolding step by step, as the site gradually moves from contamination toward recovery.

This sequence illustrates the site's gradual transformation through a step-by-step remediation process. It begins with a new access and road network that allows contaminated chat to be collected, relocated, and capped within repository mounds. A portion of the same chat is reused as aggregate for subsurface stabilization, filling underground voids and reducing collapse risk.

Around stabilized ponds, wetland habitats are introduced to filter water, slow runoff, and support biodiversity. As remediation expands, surrounding tallgrass prairie is established to stabilize soil and begin long-term phytoremediation. This planting process continues as a cyclical system, gradually absorbing and managing contaminants until the ground can safely support ecological recovery and future community use.

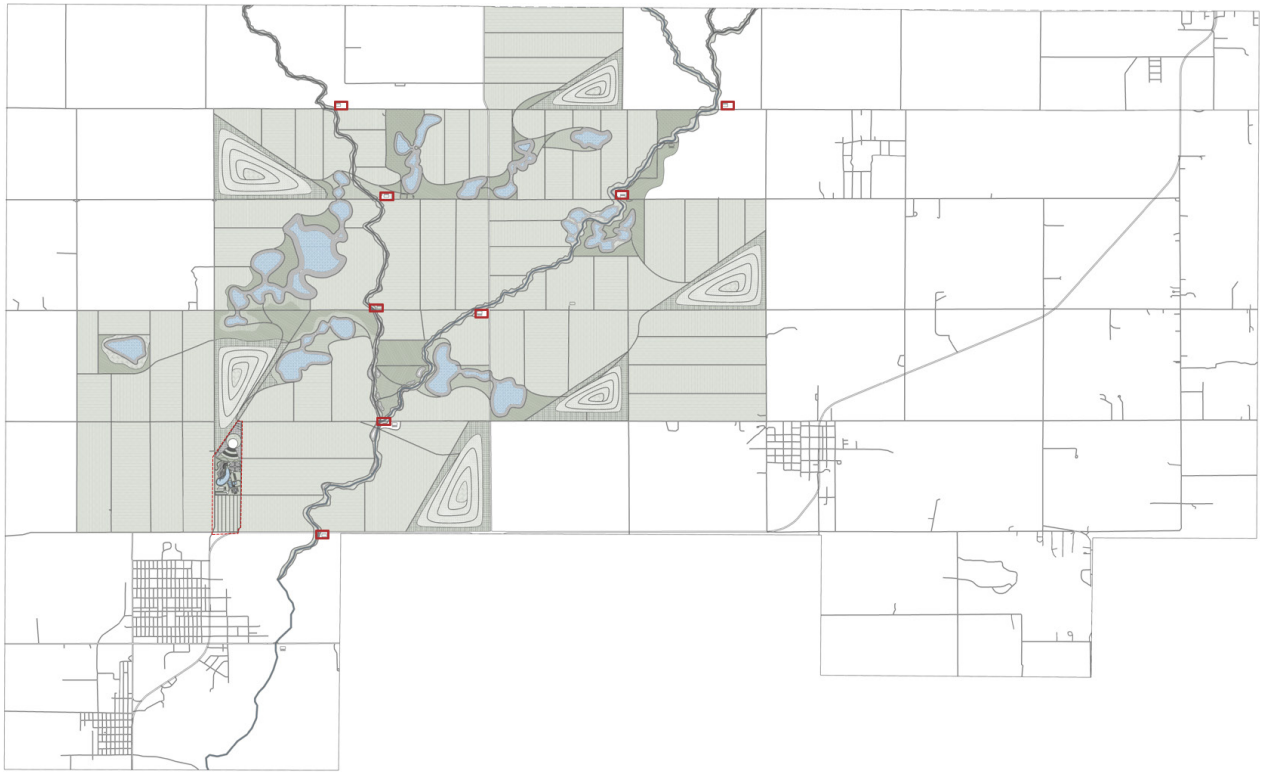


Fig. 72. Tribal Apprenticeship Center and series of wet lab

The master plan is organized as a distributed network of remediation and learning landscapes, anchored by a centrally located Tribal Apprenticeship Center. Positioned at a strategic high point within the site, the center overlooks the restored wetlands, repository mounds, and ecological zones, acting as both a physical and symbolic hub. From this vantage, it maintains visual and operational connections to the network of wet labs dispersed across the landscape, where ongoing monitoring of water quality, soil health, and ecological recovery takes place.

This centrality allows the apprenticeship center to function as a space of coordination bringing together data collection, environmental stewardship, and Indigenous knowledge systems into a unified framework of learning and practice. Extending from this hub, a series of satellite interventions including wet labs, biomass processing zones, and powerplant workshops are distributed along the creek and wetland systems.

These nodes operate as active sites of remediation, where biomass harvested from phytoremediation processes is processed and potentially converted into energy, closing the loop between ecological repair and resource generation. The apprenticeship center supports these operations by providing training, research space, and community engagement, ensuring that knowledge flows continuously between sites. Together, this network establishes a decentralized yet interconnected system, where monitoring, production, and education work in parallel to support long-term environmental recovery and tribal resilience.

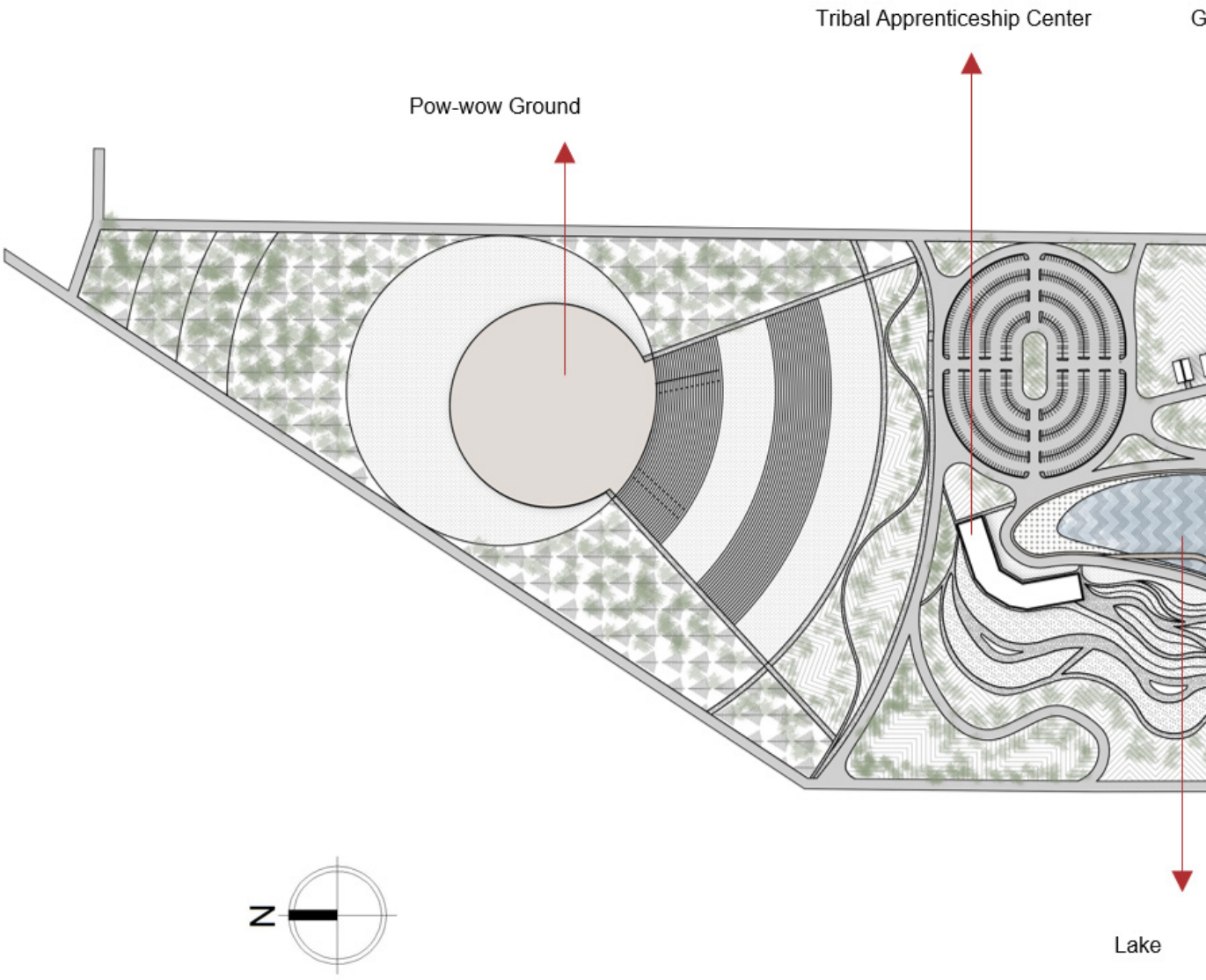
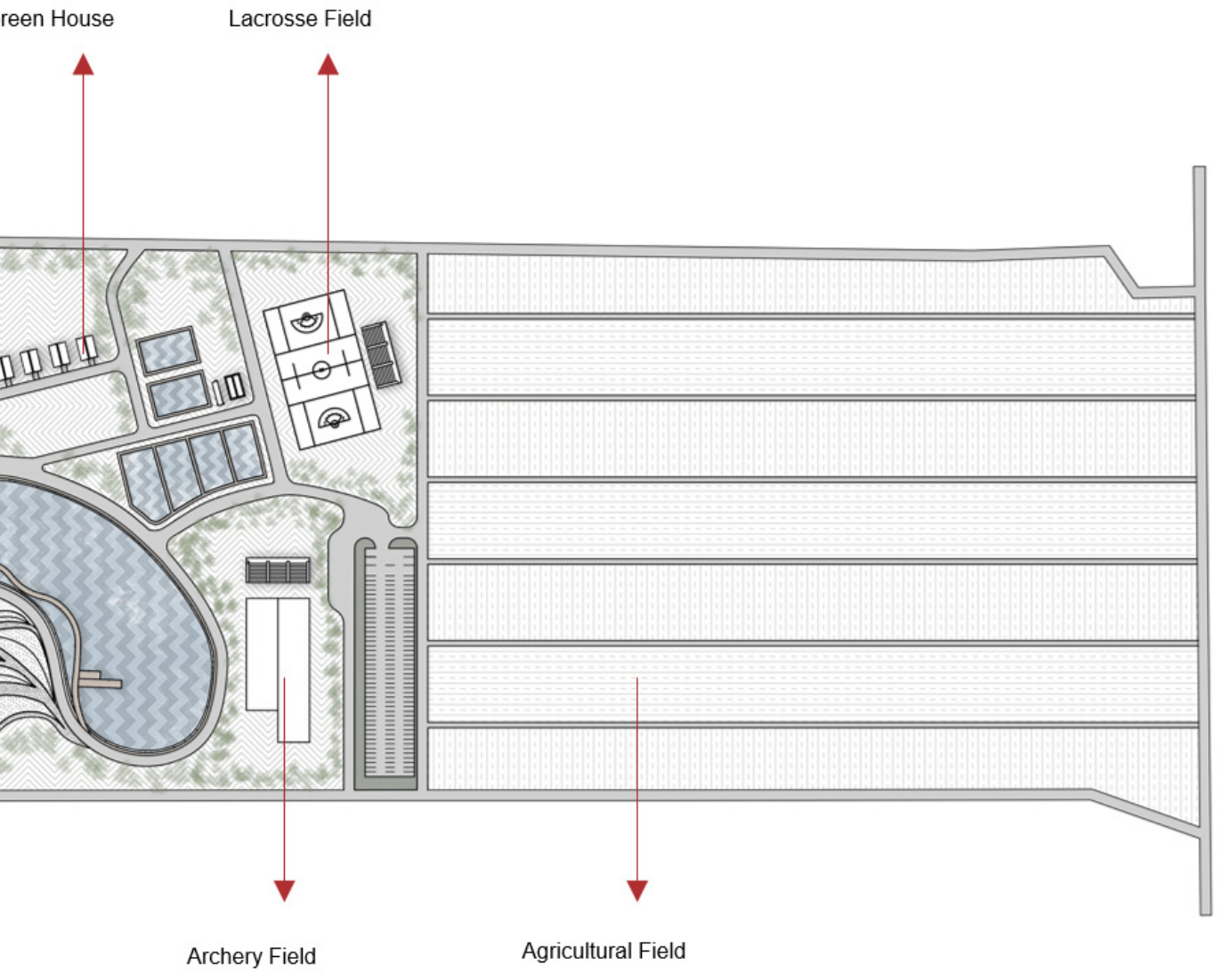


Fig. 73. Tribal Apprenticeship Center Master Plan

This master plan brings together cultural, ecological, and educational programs within a restored landscape, organized around a central water body. At its core, the Tribal Apprenticeship Center anchors the site as a place of learning and gathering, connected to a greenhouse and surrounding ecological systems that support ongoing remediation and cultivation. The lake acts as both a visual and environmental focal point, integrating water management with habitat creation.

Radiating outward, the plan balances cultural and productive landscapes. A pow-wow ground provides space for ceremony and community gathering, while archery and lacrosse fields reconnect youth with traditional practices and physical activity. To the east, agricultural fields reintroduce cultivation and food systems, reinforcing long-term sustainability. Together, these elements create a cohesive environment where culture, ecology, and everyday life are interwoven within a landscape of healing.



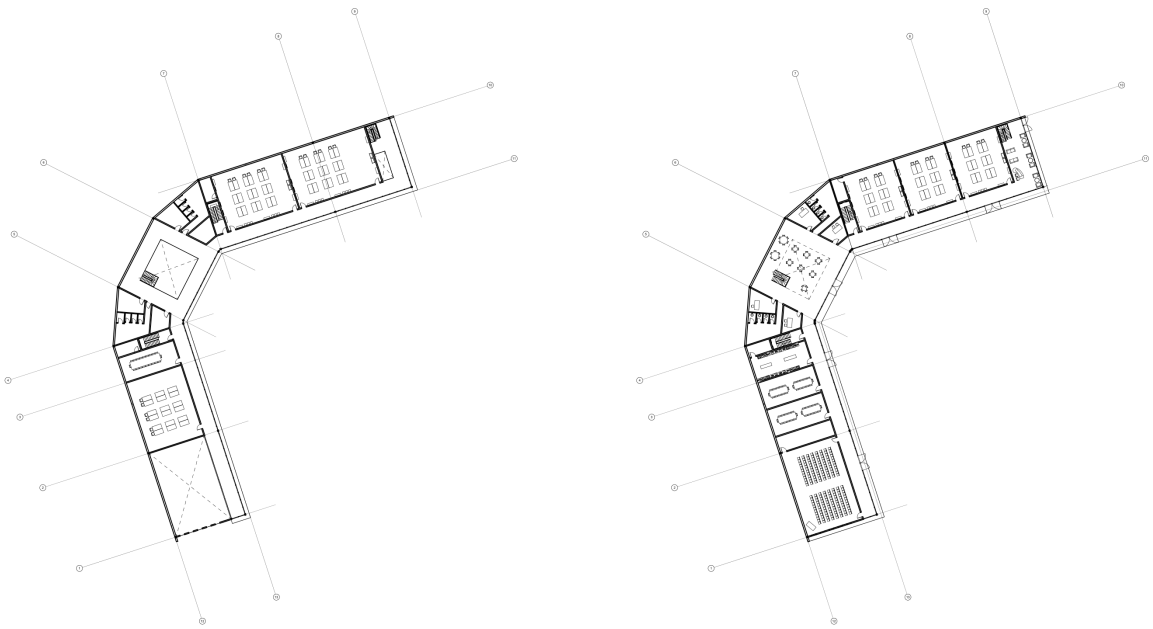


Fig. 74. Tribal Apprenticeship Research Center

Speculative Views



Fig. 75. Youth learn archery and hunting reconnecting with ancestral skills.

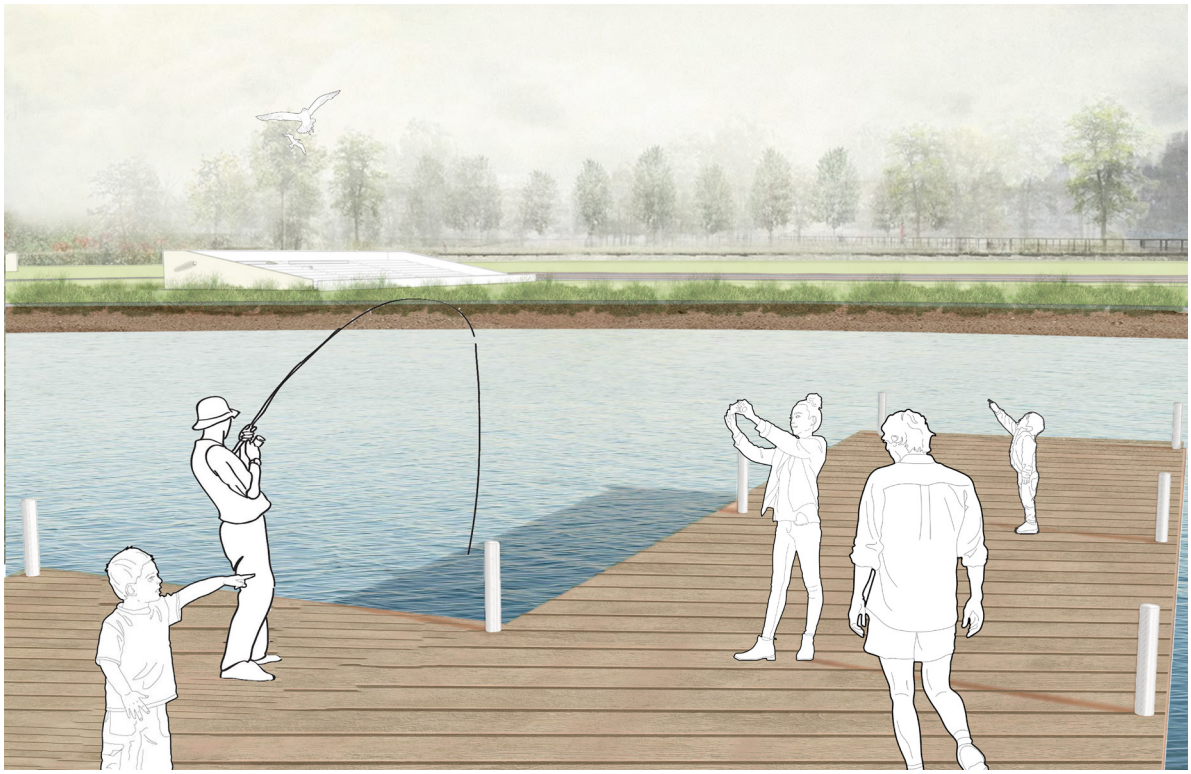


Fig. 76. They learn to Þsh building relationships with water once again.

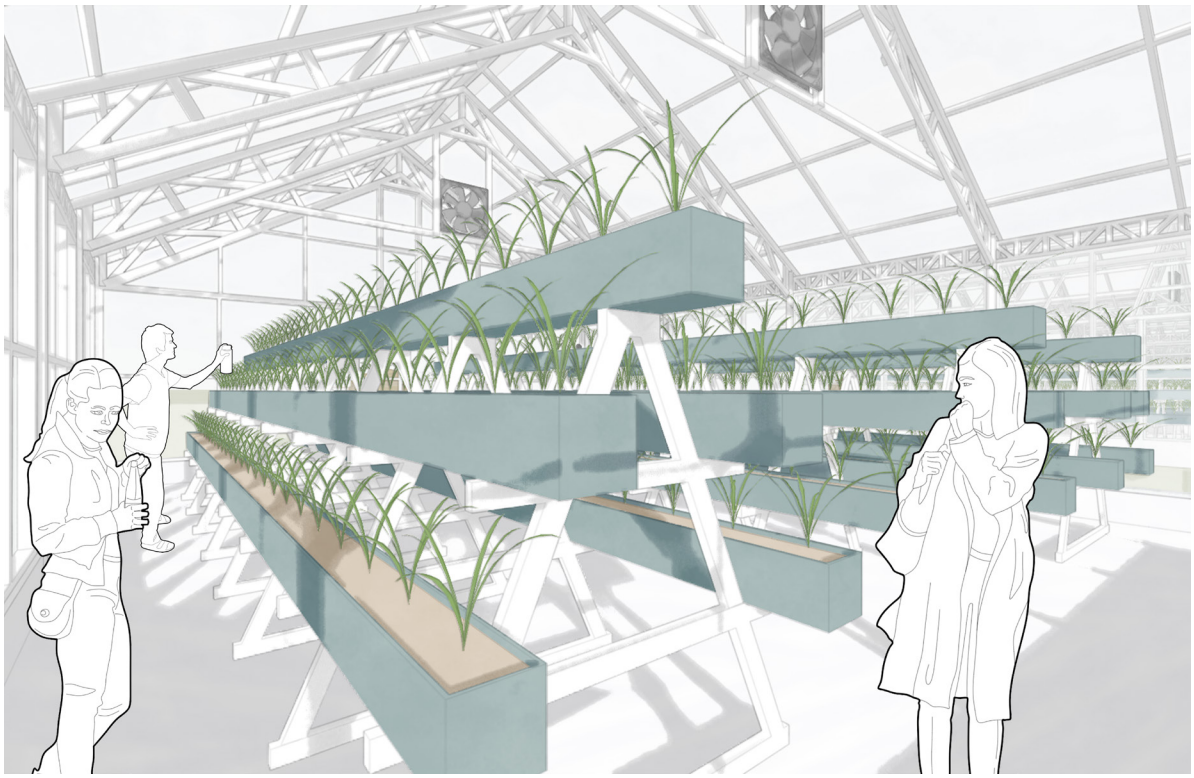


Fig. 77. The greenhouse becomes a place of cultivation of food, of knowledge, of future generations.



Fig. 78. The pow wow ground becomes a circle of gathering where community, culture, and identity come together.

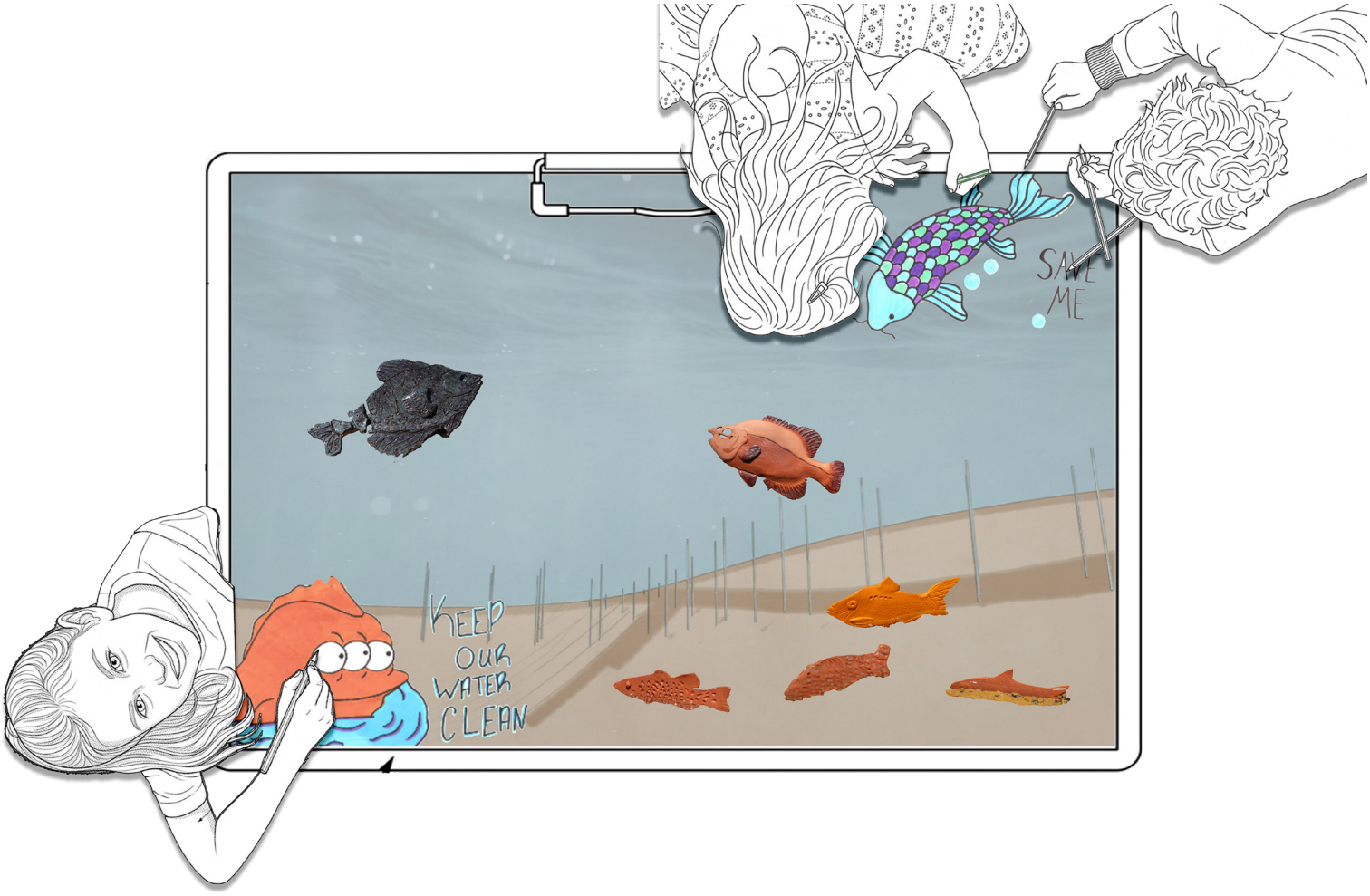


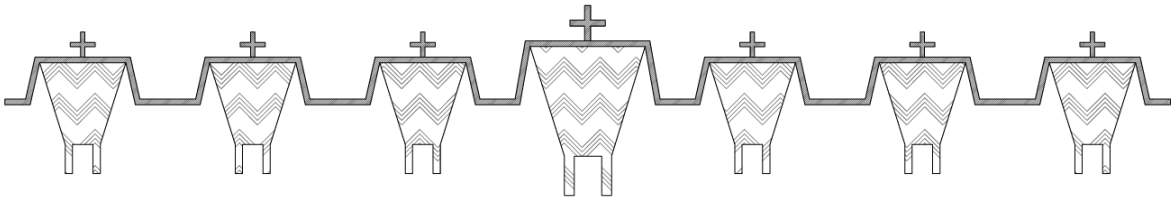
Fig. 79. Learning Through Art and Memory
Art Source: Terracotta Fish by local Tar Creek artist.
Children's drawings from Tar Creek youth workshops.



Fig. 81. Rebecca Jim's Toxic Tour: Witnessing a Contaminated Landscape, Imagining Its Healing



Fig. 82. Across the land, wildlife returns a sign that the ecosystem is healing



PAST ← PRESENT → FUTURE



Past

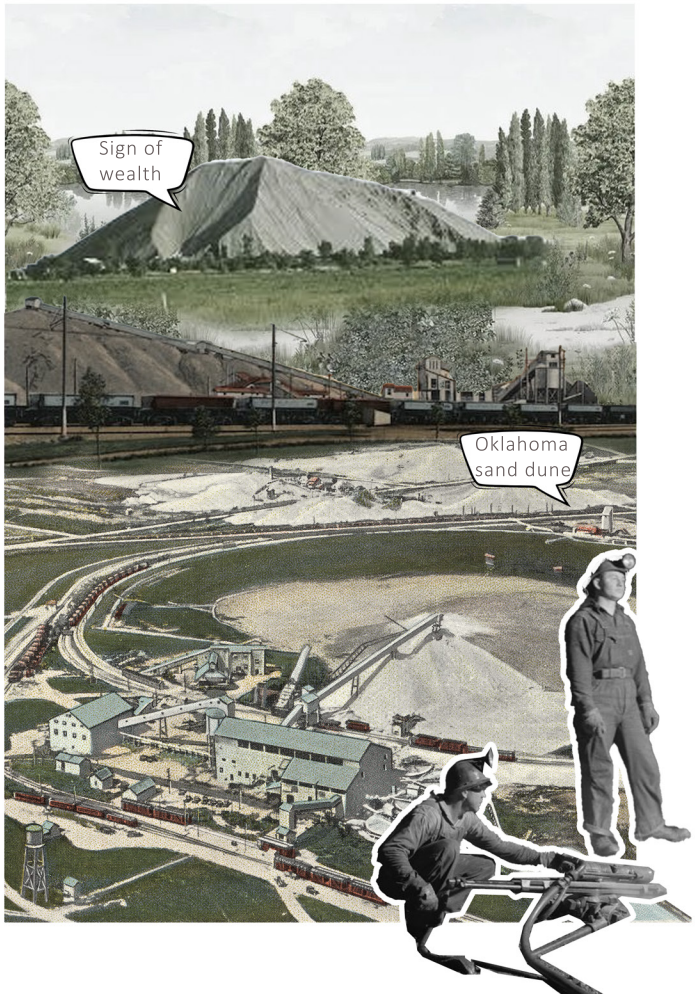
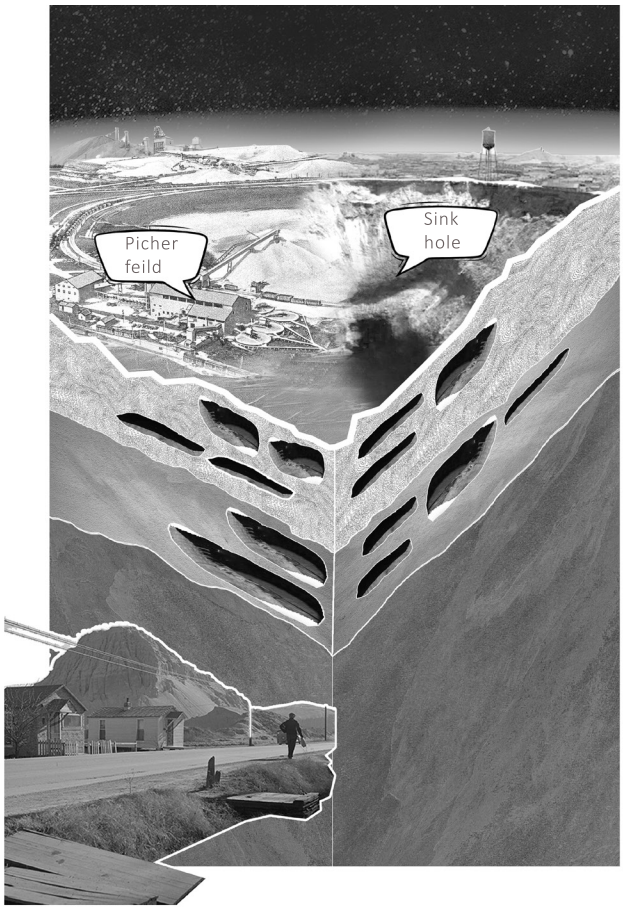
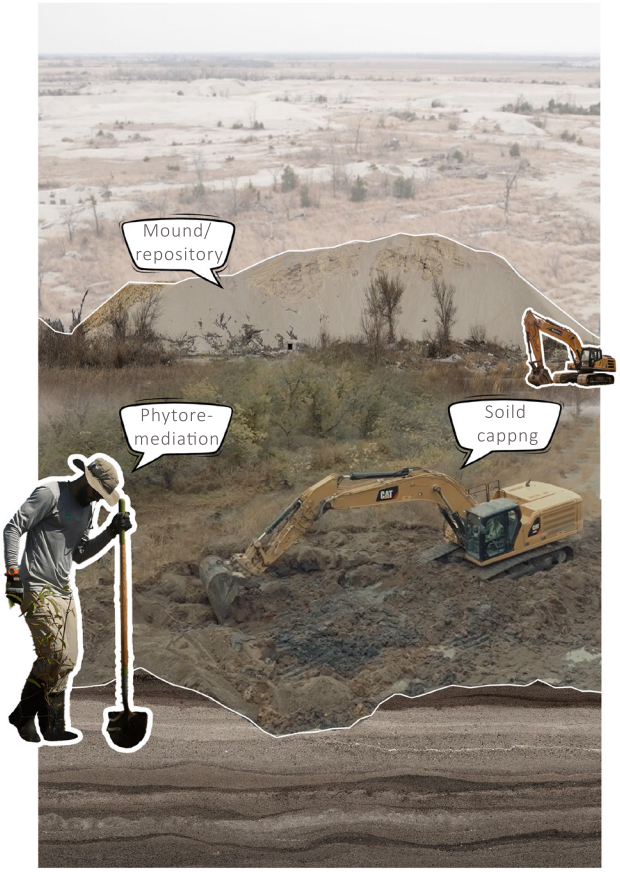


Fig. 83. Seven Generations Forward: A Story of Land, Repair, and Return





Present





Future



Fig. 84. Beneath the Surface: Histories of Extraction, Futures of Healing

Spatial Prototypes



Fig. 85. Modeling the Ground: Remediation Landscapes

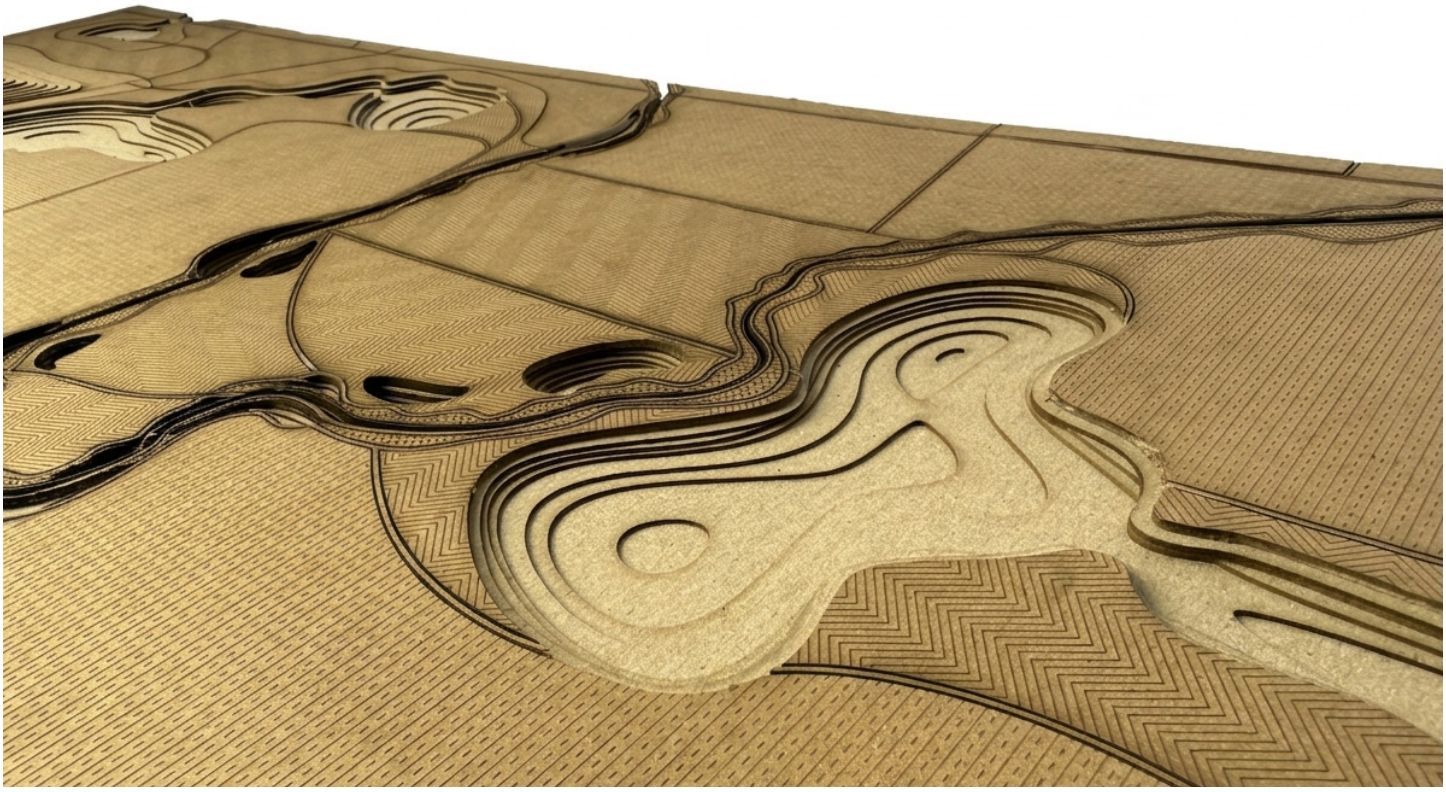


Fig. 86. Earthwork Strategies: Physical Models



Fig. 87. Deep earth section - Picher mining feild geology study

Geology in the Picher Mining Field Portion

