

MORE THAN AN EYESORE: REDEFINING URBAN WASTELANDS THROUGH AN  
INTEGRATED NATURAL SYSTEMATIC DESIGN APPROACH

BY

ELIZABETH L. BARR

THESIS

Submitted in partial fulfillment of the requirements  
for the degree of Master of Landscape Architecture in Landscape Architecture  
in the Graduate College of the  
University of Illinois at Urbana-Champaign, 2015

Urbana, Illinois

Master's Committee:

Professor William Sullivan, Co-Chair  
Assistant Clinical Professor Jessica Henson, Co-Chair  
Professor Rebecca Ginsburg

## Abstract

At its best, landscape architecture serves as the reconciliation between human activity and nature. As global populations rise and cities sprawl, seemingly vacant space *within* cities has become potentially valuable land. What once was considered the fringe or the outskirts has been engulfed by urbanization and surrounded by neighborhoods. Furthermore, as technologies and industry advance, former industrial landscapes become obsolete and abandoned, leaving a decaying fixture of the past behind. To what extent can we use the theories, knowledge, and procedures of Landscape Architecture to address these conditions?

This thesis reconsiders a network of sites that have been deeply marred by more than a century of coal mining, industry and urbanization. In-depth investigations of four landfills along the Vermilion River in Danville, Illinois were conducted in order to develop long term community plans, as well as a site design using twenty-first century design strategies.

Landscapes of waste often threaten public health, violate environmental laws and social justice values and are directly linked to depressed economies. Because many of the environmental and community impacts of contaminated sites are unprecedented, insufficient policies and regulatory measures have been established to adequately protect ongoing ecological and human health and wellbeing. This thesis compares the layers of human impact found on each site, beginning with the discovery of coal and moving to their present condition. Comprehensive understanding of each drosscape's history of utility shed an enlightening perspective on the opportunity to design healthy, productive landscapes as the next layer of human intervention.

By using current scientific knowledge, *in situ*, closed loop design solutions are proposed and strategically arranged on site. Specific design components and resolutions are illustrated and explained in the design chapter of this document. It was discovered that current knowledge

supports the implementation of integrated natural systems as a means to treat leachate and remediate postindustrial conditions. Thereby creating safer, healthier landscapes while alleviating the large economic burden that chemical treatment and monitoring of hazardous sites impose on future generations. Precedents of design and scientific research are also presented to further demonstrate an understanding of current remedial applications being used by practitioners in the field.

Places such as vacant lots, industrial yards and landfills are often overlooked and devoid of readily apparent value. This thesis proposes that it is the landscape architect's responsibility to re-imagine the possibilities such urban voids provide by putting knowledge into action. This shift in perspective encourages us to reexamine places considered marginal, useless or dangerous for human use in order to reevaluate our current design practices, standards and principles.

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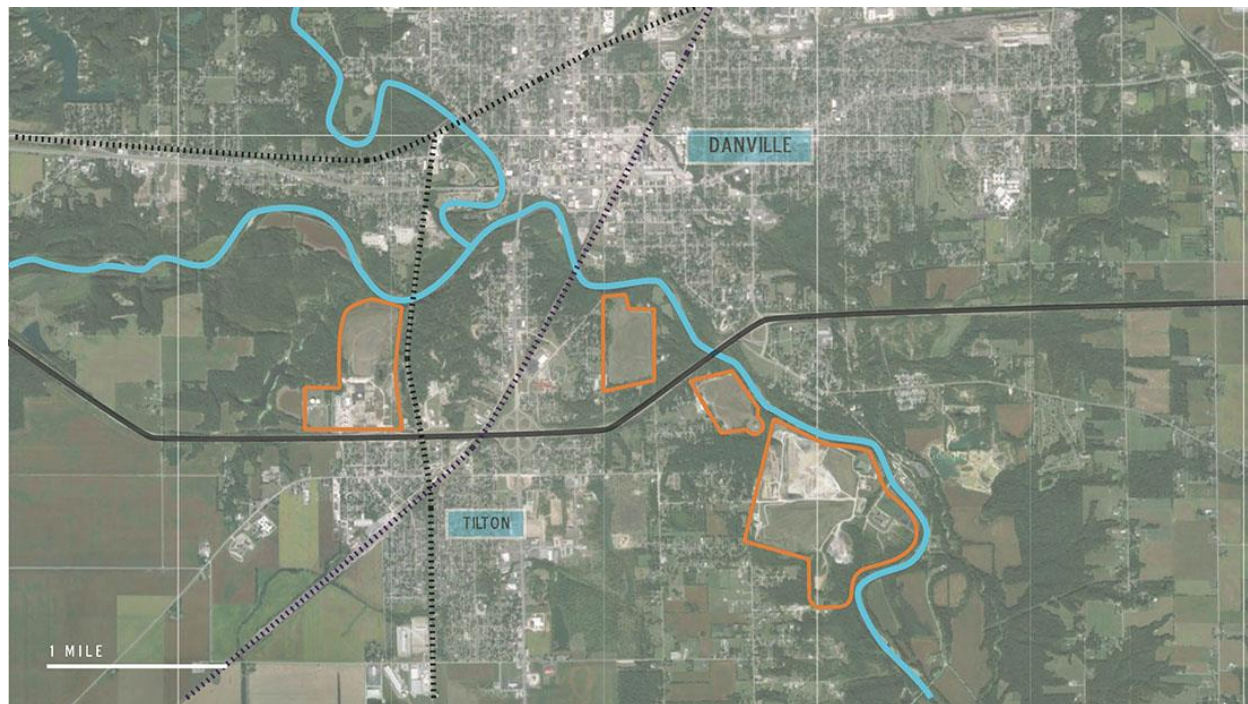
## **1. Introduction**

Landfills are a global environmental and public health liability. Although society openly recognizes contaminated sites as potential threats, little effort has been made in the American Midwest to turn these liabilities into constructive assets. Since its founding in 1827, Danville, Illinois has developed a string of contaminated sites along the banks of the Vermilion River stemming from its once booming strip coal mines. Upon the exhaustion of its natural resources, these sites quickly turned into dumping grounds for the community and have remained as such ever since. Now these landfills sit idle, leach toxic contaminants into nearby groundwater supplies and waterways, and persist as eyesores and economic burdens for the surrounding community members. It is time to take action through design and plan for a more productive future for the city of Danville.

In nature we find an enduring cycle of growth and decay; similarly, cities and societies are in a continual state of transformation. If we are to successfully adapt to the unknown changes the future will undoubtedly bring, new methodologies and flexible design strategies must replace currently accepted solutions to planning and waste management problems. Specifically, in the case of Danville, if the identified landfills are to remain capped and sealed without investigation of potential risks or assessment of alternative design solutions, they will continue to drive the city into further economic disparity and risk the health and safety of those living nearby.

The purpose of this thesis is to explore the postindustrial conditions of Danville, Illinois to better understand historically what brought this once thriving metropolis to its current state of poverty and urban wastelands, and to generate examples of a 21<sup>st</sup> Century approaches to addressing these challenges through design.

This thesis has four sections. First, I discuss the development of landfills in the American Midwest and overview the existing knowledge of the adverse health effects they generate for those living nearby. Second, I describe my investigations of the four landfills along the Vermilion River, as well as identify any threats they may pose to the community's overall wellbeing. Third, I propose both immediate and long term design solutions via a detailed site design for one of the postindustrial sites, in addition to a long range community based plan for subsequent remedial and productive land use in a series of phases. Finally, I evaluate and discuss the outcomes of my design strategies in regards to my initial goals, and their capacity to be applied in other Midwestern cities facing similar postindustrial challenges. The new knowledge generated through my research and iterative design process will be shared with the city of Danville in hopes that it can provide an optimistic view into a healthy, resilient future.



**Figure 1.1:** Site Map identifying in orange (1) the former GM Foundry and landfill, (2) the H&L Landfill, and (3) the inactive and active landfills that comprise the Brickyard Disposal and Recycling Facility (from left to right)



**Figure 1.2:** Aerial View of the Vermilion River separating downtown Danville from the string of landfills along its banks.





*Figure 1.3:* Aerial view of the former GM Foundry and landfill, location of author's design proposal



## *1.1 Drosscapes*

“Drosscape,” a term coined by Alan Berger, describes the condition of wasted landscapes. Over time, interstitial voids form within cities as the relationships between economic, political, cultural and environmental drivers evolve. Circumstances of dross often signify the presence of rapid horizontal urban growth (sprawl) and/or a former economic or industrial system which no longer serves to benefit the community (Berger, 2006). Over the past century, the cost of transportation for both goods and people has dramatically declined. This economic shift has resulted in the deindustrialization of the urban core and mobilized both industry and people to move away from city centers. Such horizontal expansion has brought once outlying urban conditions, such as landfills and industrial yards, into the foreground of communities where they pose numerous health and ecological threats to the local population. Without question, the immediate health and safety of adjacent populations is of utmost concern within the research community studying the long term effects of municipal landfills and other postindustrial settings; however, the question of how these postindustrial urban conditions affect human relationships, overall well-being and long term viability of a city remains largely unanswered. This gap in current knowledge has served as a catalyst for designers, urban planners and ecologists to develop innovative strategies to productively reintegrate these wasted spaces back into the urban landscape.

## *1.2 Landfills & Other Toxic Sites: Past, Present and Future*

In 1981, the Office of Research and Development of the Environmental Protection Agency (EPA) released a report documenting all known hazardous waste sites in the United States; over 7,000 are listed and described within the authors’ findings. The report begins by

warning, “[p]roper management of hazardous waste from a variety of industrial sources poses one of the most formidable challenges to science and technology” (Pishadadazor, 1981). It is more than thirty years later and the question of how to treat the postindustrial landscape and accommodate the waste of an exponentially increasing population remains largely unanswered. Astoundingly, even though landfills across the country are approaching maximum capacity within the next ten years and hundreds have been identified as “toxic hazards,” solid waste treatment strategies have remained nearly constant over the past one hundred years (EPA Municipal Solid Waste in the United States: 2009 Facts and Figures, 2010). Furthermore, treatment of waste byproducts, i.e. landfill leachate (liquid waste produced by landfill contents decomposition), persists as an afterthought and leachate is typically deposited into a subsequent landfill. It is evident that current solid waste treatment methodologies are not only antiquated, but threaten the future well-being and sustainability of the global landscape.

As aforementioned, the relationships between economic, political, cultural and environmental factors of an urban milieu are in continuous flux as technologies and industries advance over time. As one evolves, the others may adjust, respond in unexpected ways or remain inert, generating an unsteady balance for the long term well-being of a community. Although the future holds many unknowns, we can safely assume certain human behaviors will largely remain constant; for instance, the production of waste. As the American landscape continues to develop, the disposal of various types of garbage and refuse in piles and pits has generated countless pockets of decomposing materials dispersed throughout the country (Kadlec, 2010). Due to the rapid lateral urban growth seen over the past fifty years, both rural and now *suburban* American landscapes are riddled with hundreds of closed and operating solid waste disposal sites. As human populations encroach on formerly isolated toxic environments such as landfills, city

zoning and planning offices have attempted to react accordingly. As expected, not all communities have the resources to amend policies that have been in place for decades or simply are unaware of the deficiencies of the current status quo and the violations being made to their basic human rights.

Beginning in the early 1980s, there was a vast consolidation of waste disposal facilities across the country, with over 14,000 landfills closed in the United States by the end of the decade (Mulamoottil et al., 1999). In part, landfill consolidation was in response to the explicit public and environmental health dangers exposed over the previous decades by the EPA and other environmental agencies (McNall, 2011). In addition to this, beginning in the early 1970s, cities across America were faced with the unprecedented challenge of treating unmanageable amounts of waste produced by rapidly increasing populations and their consumption of disposable goods. The overall lifespan of municipal landfills thereby plummeted, generating great opportunity for the emergence of privatized and government run regional waste treatment facilities (McNall, 2011). The motivation to quell public awareness and distress over the vast quantity and evident dangers of operational landfills in America, in conjunction with the reduced cost of transportation of goods and services, resulted in a seemingly effective and economically advantageous plan of action. Rather than servicing hundreds of solid waste disposal facilities, specific landfills were targeted either for expansion or connection to those nearby to form “mega landfills” able to accommodate regional waste, not simply one community’s refuse (Mulamoottil et al., 1999).

The shift to a regional waste collection paradigm was an attempt to isolate toxic sites from human populations once again; however, this simply consolidated *operational* landfills and by no means expunged the contaminated landscapes from affected communities. The closure of

more than 14,000 landfills thirty years ago has left countless communities burdened with landscapes threatening to their safety and well-being (Mulamoottil et al., 1999). In short, the effort to “remove” landfills from the urban context has left cities and towns marred with detritus voids; a new precarious urban condition whose immediate and long term effects have yet to be fully understood.

### *1.3 Concerns for Health: Environmental, Human and Economic*

Largely beginning with the signing of the Superfund<sup>1</sup> law in 1980, the issues surrounding exposure and proximity to contaminated sites or toxic wastelands have been heavily investigated. We now know that these sites often threaten public health, violate numerous environmental and social justice laws and can be directly linked to depressed economies (EPA Municipal Solid Waste in the United States: 2009 Facts and Figures, 2010). For instance, it has been shown that extended exposure to hazardous waste site chemicals increases the risk of adverse cardiovascular development and neurodevelopmental effects (Pohl, et al 2008). In addition, since many of the rising issues regarding contaminated sites and their impacts on the environment and neighboring communities are unprecedented, insufficient policies and regulations have been established to adequately protect their ongoing health and security. One such point of contention is leachate, the liquid waste that is produced by landfills. Even though solid waste management facilities are now mandated to treat and dispose of leachate, it is not uncommon to observe inadvertent seeps spilling leachate out of “indefinitely” capped landfills. These oversights directly impinge on public and environmental justice as it has been proven that leachate leakage and seepage poses a

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<sup>1</sup> The name given to the environmental program established to address abandoned hazardous waste sites. Also the name of the fund established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (EPA.gov/superfund)

great health threat for aquatic biota as well as humans by generating both genotoxic<sup>2</sup> and cytotoxic<sup>3</sup> effects on multiple cellular types (Toufexi, et al 2013). Further, even though it has been found that downtown communities “need to be nurtured through the use of urban design practices and community-oriented planning decisions,” it can be challenging for communities identified as “at risk of contamination” to be heard when it comes to final design or remediation decisions due to larger national agendas (Balsas 2014). Along with this devaluation of community members’ opinions, studies show that contaminated sites, such as landfills, greatly debase nearby property values up to 12% according to a study done at the University of Massachusetts in the year 2000 (Bouvier, et al 2000).

In spite of all the knowledge we have regarding urban wastelands, it is apparent that we know significantly less about the human interactions and relationships formed between contaminated sites and the community members who live around them. The overarching issues of public health, policy and depressed economies, pertaining to contaminated wastelands, often bleed into one another, and drawing distinct lines between them has proven difficult for investigators. A study done in 2000 by the London School of Hygiene and Tropical Medicine took into account the complexity of factors associated with investigating the ecological, social and economic impacts of contaminated sites and conducted “single –site studies” and “multisite studies” of communities living adjacent to landfills. This methodology allowed the researcher to produce “cross-sectional” comparisons between sites, which quickly located where present knowledge was lacking: “results of human exposure over time” (Vrijheid, 2000). In other words, there simply has not been enough time or record of landfill exposure to fully understand the long

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<sup>2</sup> Chemical damage to the genetic information within a cell causing mutations, which may lead to cancer (Merriam-webster.com).

<sup>3</sup> Substance or process which results in cell damage or death (Merriam-webster.com).

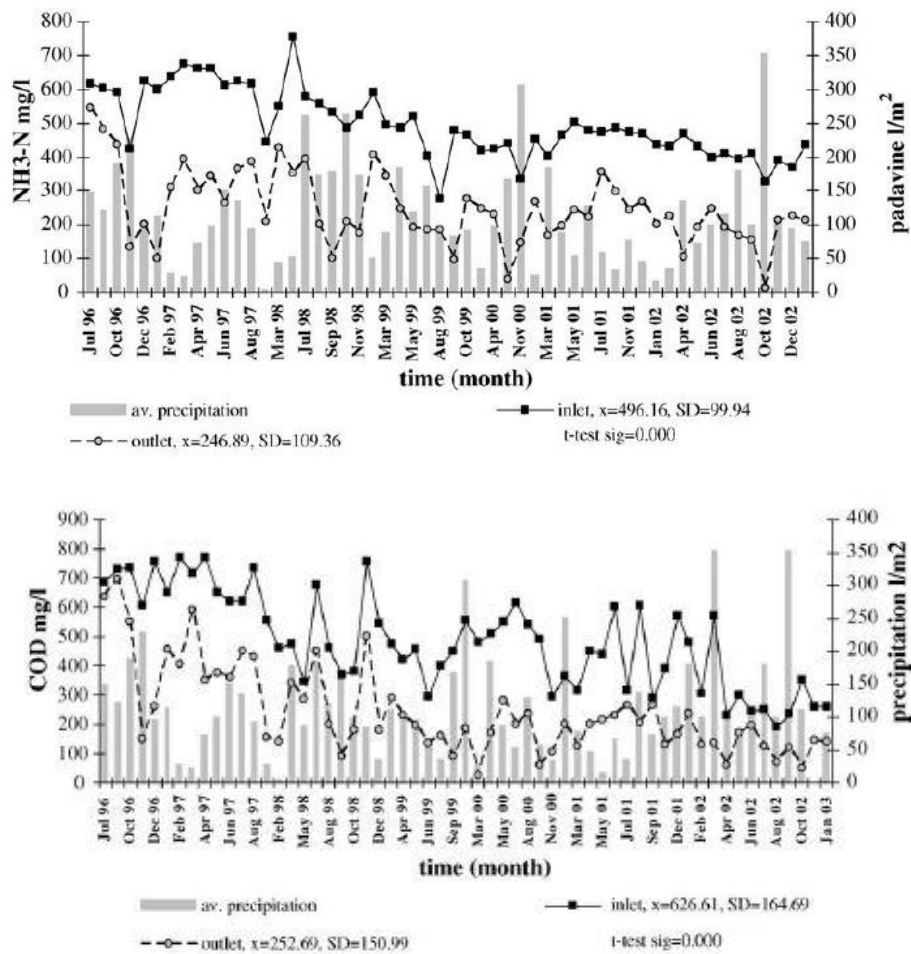
term ramifications of living adjacent to landfills or other toxic wastelands. By continuing to fail to understand the dynamic relationship between the Danville community members and their adjacent contaminated sites, the tendency to ignore them is facilitated, as is the opportunity for these sites to persist as endangerments to surrounding populations.

#### *1.4 Precedents in Scientific Research*

During the rapid closure of landfills in the 1980s, numerous facilities were closed prior to today's standards for landfill capping and leachate control resulting in a range of hazardous conditions. A common malfunction of timeworn landfills is the formation of open seeps, which leak toxic materials into local water bodies, emit noxious gases and expose communities to points of direct contact with hazardous materials (Kaldec, 2003). Fortunately, remedial treatment and design strategies for operating and closed solid waste disposal sites are being explored. Namely, over the past twenty five years the effects of constructed wetlands and varying phytoremediation applications on existing landfill sites have been studied and documented in greater detail (Kaldec and Wallace, 2008). Although ecological treatment strategies have gained a greater audience in recent years, a number of concerns remain regarding their safety, efficiency, and viability over time. Excitingly, the data consistently demonstrates that not only are these integrated natural systems (INS) safe and significantly more cost effective than traditional treatment strategies, but their capacity to cleanse and treat toxic leachate improves over their lifespan, especially when used in conjunction with other natural treatment strategies (Nivala, et al. 2006).

For nearly a decade, a research team in Saginaw, Michigan studied the effects of an INS on the treatment of leachate produced by the township's closed landfill. The findings of the

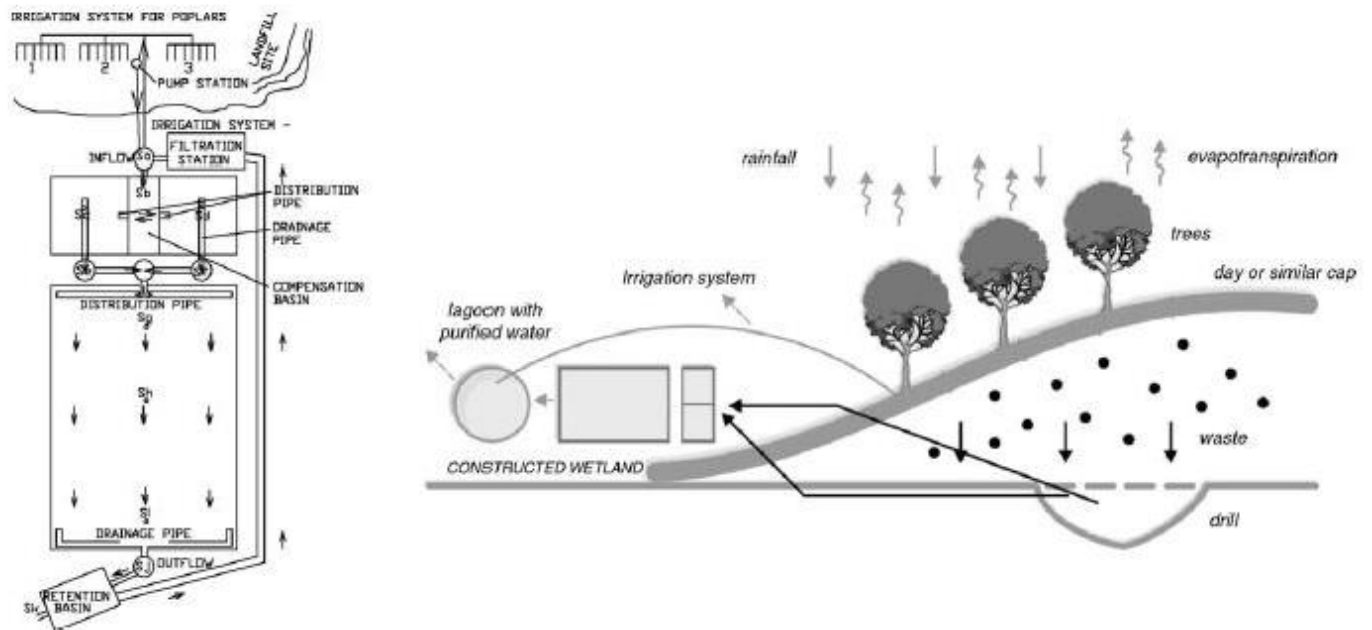
experiment are compelling and reinforce positive results found in the team’s previous short term and full scale studies. Kaldec illustrates how INS, such as wetlands, can play a significant role in the management of both rural and urban landfill leakage and control of leachates pollutants. The constructed wetland (CW) leachate treatment system in Saginaw was concluded to be a “relatively inexpensive, passive technology [that] can provide reductions in the wide spectrum of contaminants...” (Kaldec and Zmarthie, 2010).



**Figure 1.4 and 1.5:** Resulting reductions of Ammonia (NH3) and chemical oxygen demand (COD) within a six year investigation of a constructed wetland leachate treatment system (Kaldec, et al., 2008).



Traditional methods of leachate treatment include on-site chemical and physical treatment systems as well as transport to off-site treatment facilities or landfills. These common strategies are typically undesirable as on-site treatment demands great amounts of energy and monetary capital, and the transport of such toxic materials is not only expensive, but also dangerous (Bulc, 2006). Although there are varying opinions regarding approaches to leachate treatment, it is widely agreed upon within the field that “on-site treatment facilit[ies] [are] needed that require little maintenance or power and [are] financially less demanding” (Surface et al., 1993; Higgins, 2000). In another INS leachate treatment experiment spanning seven years of observation, the authors examine how effective CW systems are at achieving the goals of low-maintenance, cost effective leachate treatment. Again, the evaluation of the system concluded that indeed a CW can be “considered a technology suitable for purification of leachate of closed sanitary landfill sites” (Baldec, 2006). However, it is important to recognize that the by-products of landfills vary, and that each landfill site must be comprehensively evaluated to understand the history of the materials deposited, the length of time it was in operation and elements found in leachate samples before an adequate treatment method can be determined. At the 10<sup>th</sup> International Waste Management and Landfill Symposium in Italy in 2010, Zupančič and his colleagues presented their successful application of CW treated leachate onto a landfill cover densely vegetated with trees (see figure 1.7). This research design married the idea of phytoremediation strategies with wetland filtration in a way that had yet to be investigated.



**Figure 1.6:** Constructed wetland scheme in conjunction with a densely planted landfill phytocap. This proposes a closed loop design approach to leachate treatment rather than existing linear strategies of collection and extraction (Zupančič, 2008).

The empirical data gathered within the body of knowledge of INS systems suggests that the use and application of constructed wetlands, supplemented with other INS treatment strategies, such as, phytoremediation, microbial treatment, vertical and horizontal bed filtration, and aeration lagoons, is a safe, viable and economically advantageous approach for the future of on-site leachate and landfill cover treatment.

### 1.5 Design Precedents

As the concerns for human and environmental health surrounding toxic sites grow, we must consider how various design solutions will take shape in the context of a real setting. Over the last several decades, the effort to create more resilient landscapes has become more common. Design has been utilized as a tool for remediation, restoration as well as revitalization of communities that deal with the 21<sup>st</sup> century issues that sweep the globe. Issues such as rapid

population growth combined with immense horizontal spread of urbanization have transformed the way in which our planet is able to regulate itself. Fortunately, there are numerous successful examples of how design strategies ranging in scope and scale have been employed to create viable, healthy places in order to establish a more sustainable global future.

In 2001, James Corner's Field Operations began designing ideas for Freshkills Park, located on Staten Island in New York. Nearly a decade later, the design broke ground and was underway. The park is a successful example of how even the largest landfill in the world can be transformed into a productive and culturally significant place. The central goal of the design is to demonstrate ways in which our society can restore balance over time to even the most abused landscapes. The site is heavily programmed and organized in a way that intends to make the visitor's experience fluid and effortless. The juxtaposition between the heavily engineered landscape and the "natural" is intriguing and reminds the visitor of the site's past and poses a positive change for its future.

In 2006, Parc du Chemin l'île opened in Nanterre, France. The park is an inspiring combination of ecological restoration met with exceptionally elegant design. Parc du Chemin features a series of filtration basins that capture water of the Seine. Through ecologically based treatment process, plants and microorganisms remove large amounts of pathogenic bacteria. Additionally, the basins attract wildlife and create new habitats in the park. The park has become an educational and cultural destination in a neighborhood dominated by industry and roadways. In regards to his design, Guillaume Geoffroy-Dechaume, simply stated, "I consider nature an ally, not a guest."

Byxbee Park in Paolo Alto was designed by Hargreaves and Associates along with the artists Peter Richards and Michael Oppenheimer in 1991. It is a unique example of a

collaboration between art and landscape architecture and illustrates the beauty of simple, yet meaningful design. Each art installation was designed purposefully with the intent of capturing a piece of the site's long history. Although the park remains largely un-programmed, the expansive vistas and large scale art installations draw people out to this former landfill to explore, recreate and enjoy the view.

Northalla Fields Park located in London was designed by Studio Fink and opened to the public in 2008. The site utilized rubble and waste created by the demolition of structures from a pool of London-wide development projects, and generated an active and productive landscape; this continues to be an innovative design approach for waste management. The design features four large mounds comprised of the demolition material, which allow the park to become an iconic landmark in the city landscape rather than an eyesore. More importantly, the design aims to enhance the ecological values found on site and reconnect people to this new found landscape.

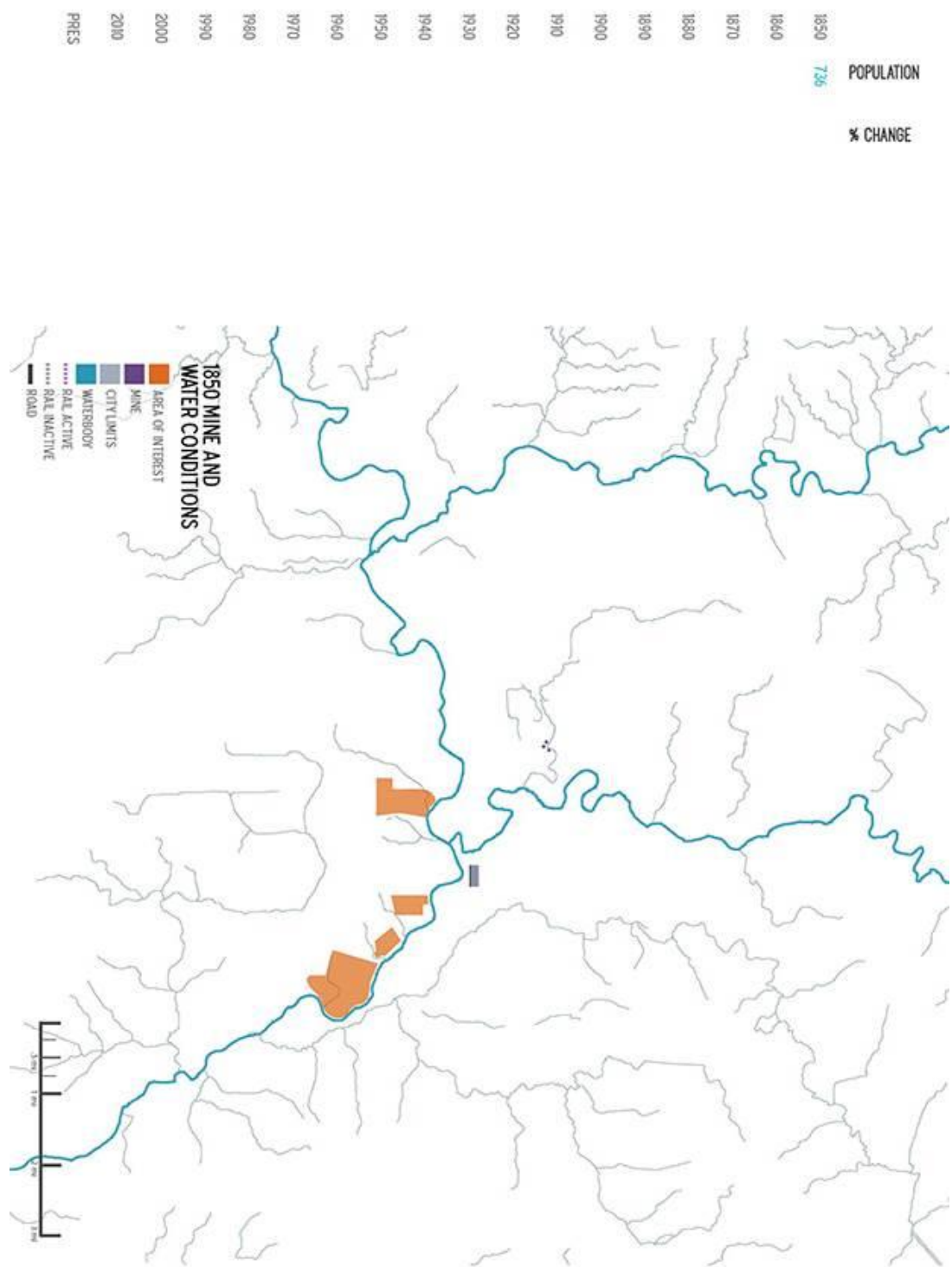
Qunli National Urban Wetland designed by Turenscape in 2009 is a lovely example of how nature can be inserted within the urban context. This wetland remains largely undisturbed despite being surrounded on all sides by roadways and new urban development. The way in which this design enhances natural ecosystem functioning while encouraging people to reconnect with this unexpected environment is inspiring. The strength of this design also lies in its seeming simplicity and intriguing path network that draws the visitor through the park to moments of expansive vistas over the wetland and others of restricted views within the birch trees groves.

There are many additional examples of ecological and remedial designs found around the world, further illustrating one common concern: the health and longevity of our planet and the people that inhabit it. Design is a powerful tool that can help redirect the landscapes of the future; it should be utilized to its full capacity.

## *1.6 Danville's Evolution*

Danville, Illinois was settled because of its bountiful natural resources. Its rich geologic history bestowed the area with a deep, fertile river valley and salines, which quickly made salt the first source of major industry in the area. In the early 1800s, it was discovered that the bluffs along the Vermilion River were brimming with coal just below the surface. Over the next century, this information would bring about an extensive land transformation that would be difficult to imagine today. The forested river corridor and the vast amounts of surrounding prairie and oak savanna were mined, and the land became a barren, black industrial mecca for the developing Midwest. During the mid-1800's the booming mining industry brought thousands of immigrants to the area for work. Man-power combined with the seemingly endless coal reserves allowed Vermilion County to lead the nation in coal production for several years (Vermilion County Museum). By the late 19<sup>th</sup> century, the arrival of the railroad, the direct connection to the country's river highway and the plentiful natural resources had set Danville apart from other cities in the region. Moving into the 20<sup>th</sup> century, industries flocked to this prosperous place and further affirmed the triumph of the Midwestern town.

The following series of diagrams locates the landfills of investigation in orange while illustrating the development of coal mines, manmade water bodies and growth of Danville's city limits and population over time (see figures 1.8-1.12).



**Figure 1.7:** 1850 Mine and Water Conditions in Danville, Illinois

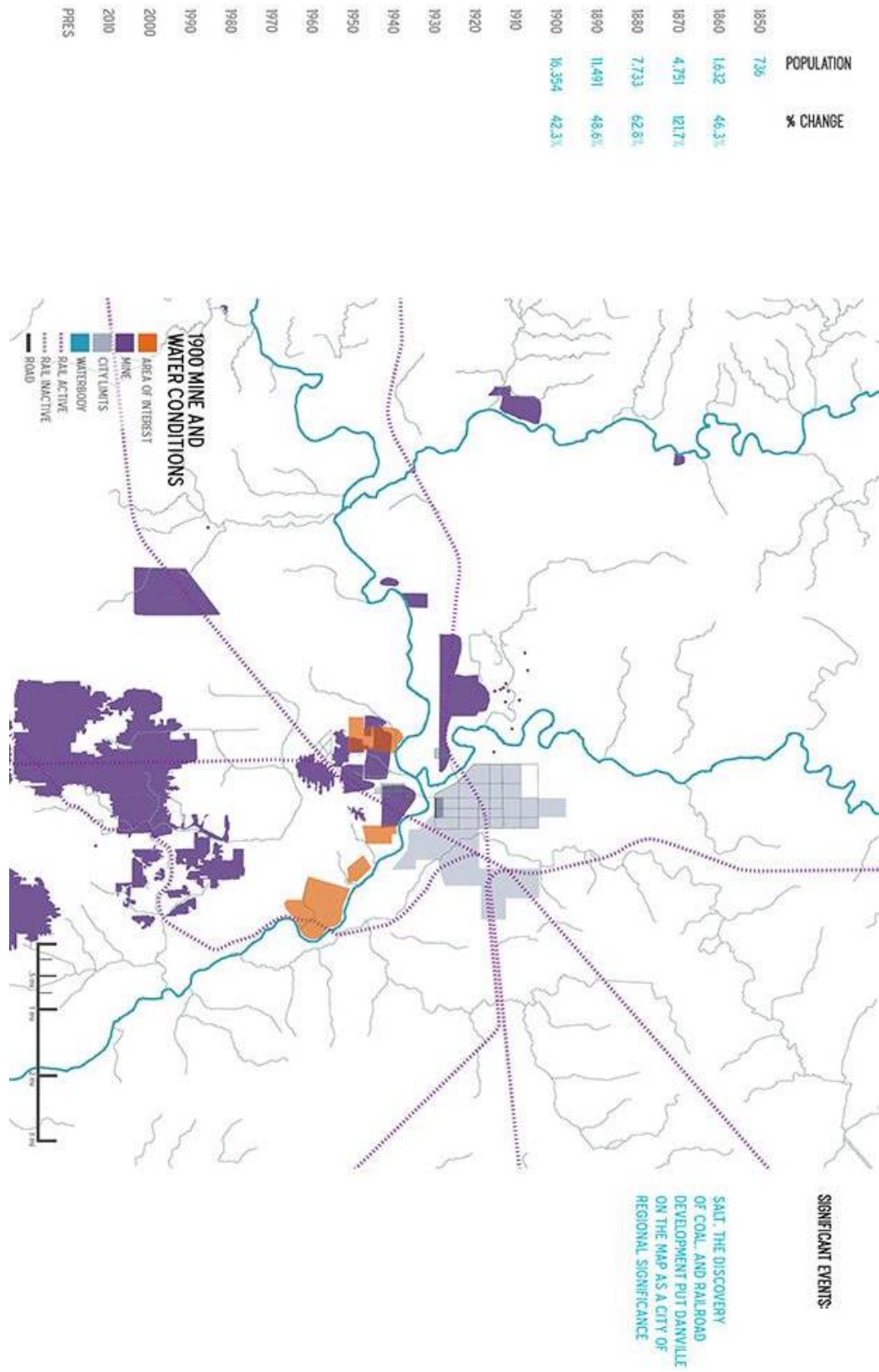


Figure 1.8: 1900 Mine and Water Conditions in Danville, IL



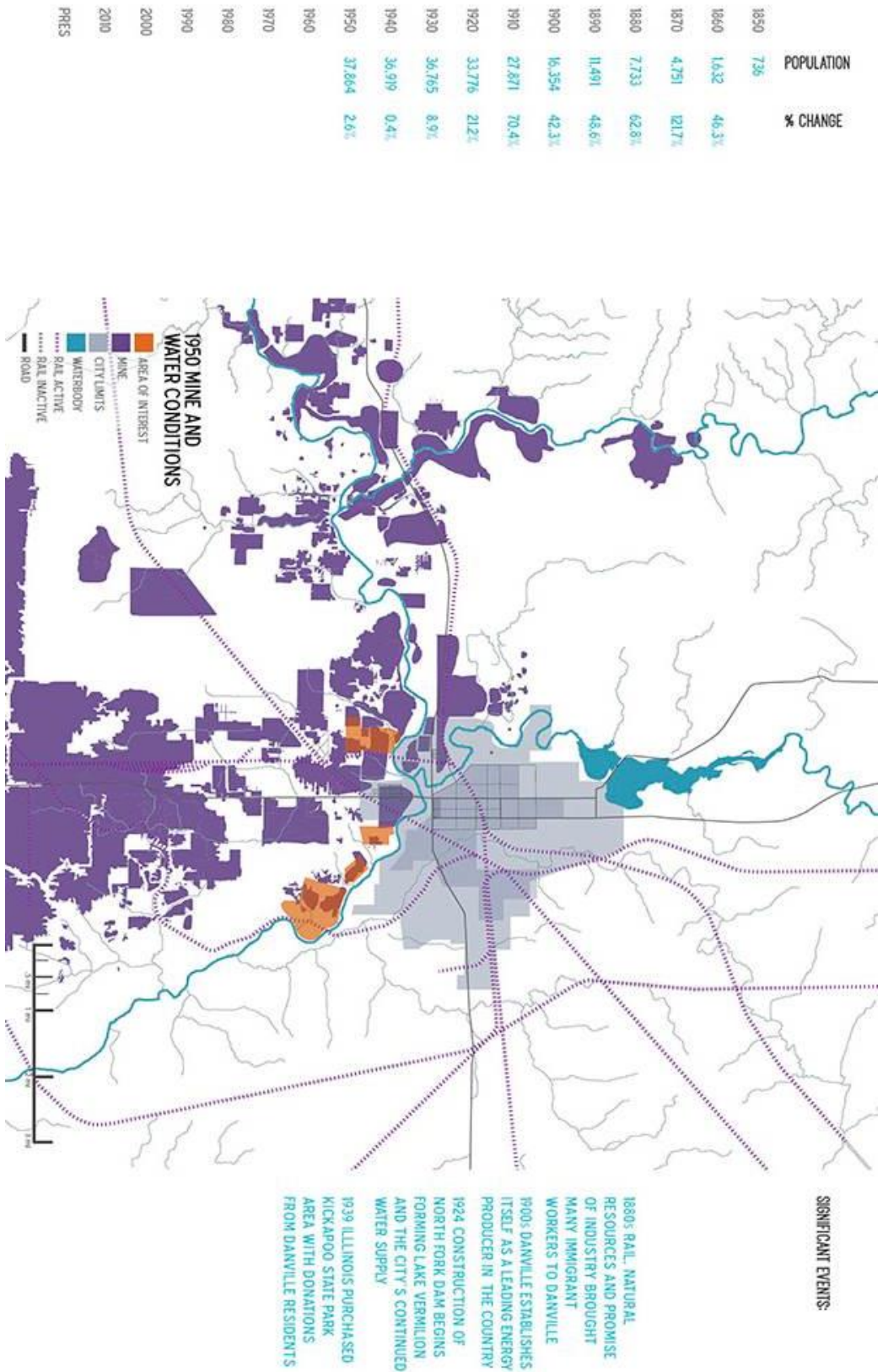


Figure 1.9: 1950 Mine and Water Conditions in Danville, IL

	POPULATION	% CHANGE
1850	736	
1860	1,632	46.3%
1870	4,791	121.7%
1880	7,733	62.8%
1890	11,491	48.6%
1900	16,354	42.3%
1910	27,871	70.4%
1920	33,776	21.2%
1930	36,765	8.9%
1940	36,919	0.4%
1950	37,864	2.6%
1960	41,856	10.5%
1970	42,570	1.7%
1980	38,985	-8.7%
1990	33,828	-13.2%
2000	33,904	0.2%
2010	33,027	-2.6%
PRECS	32,649	-1.1%

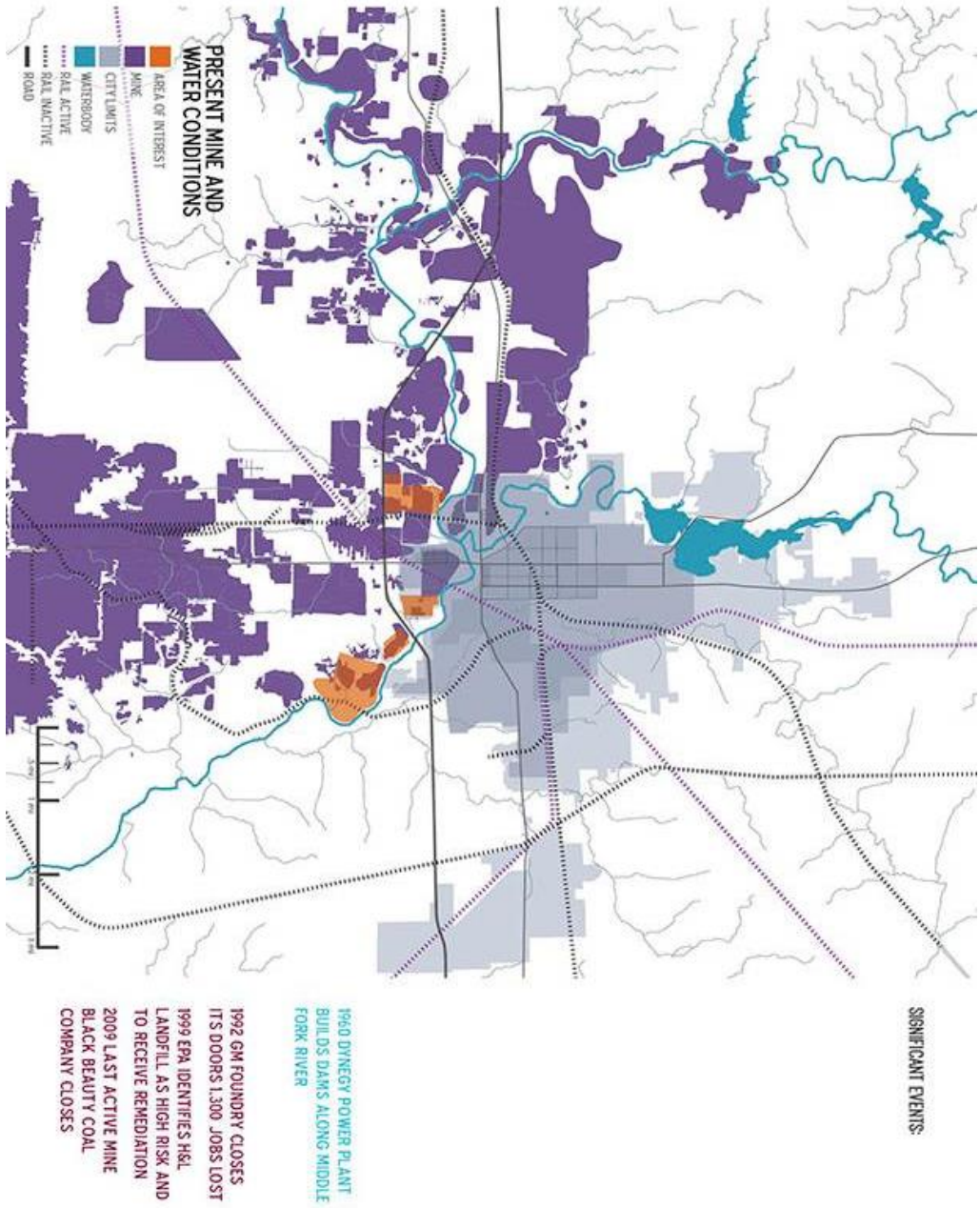
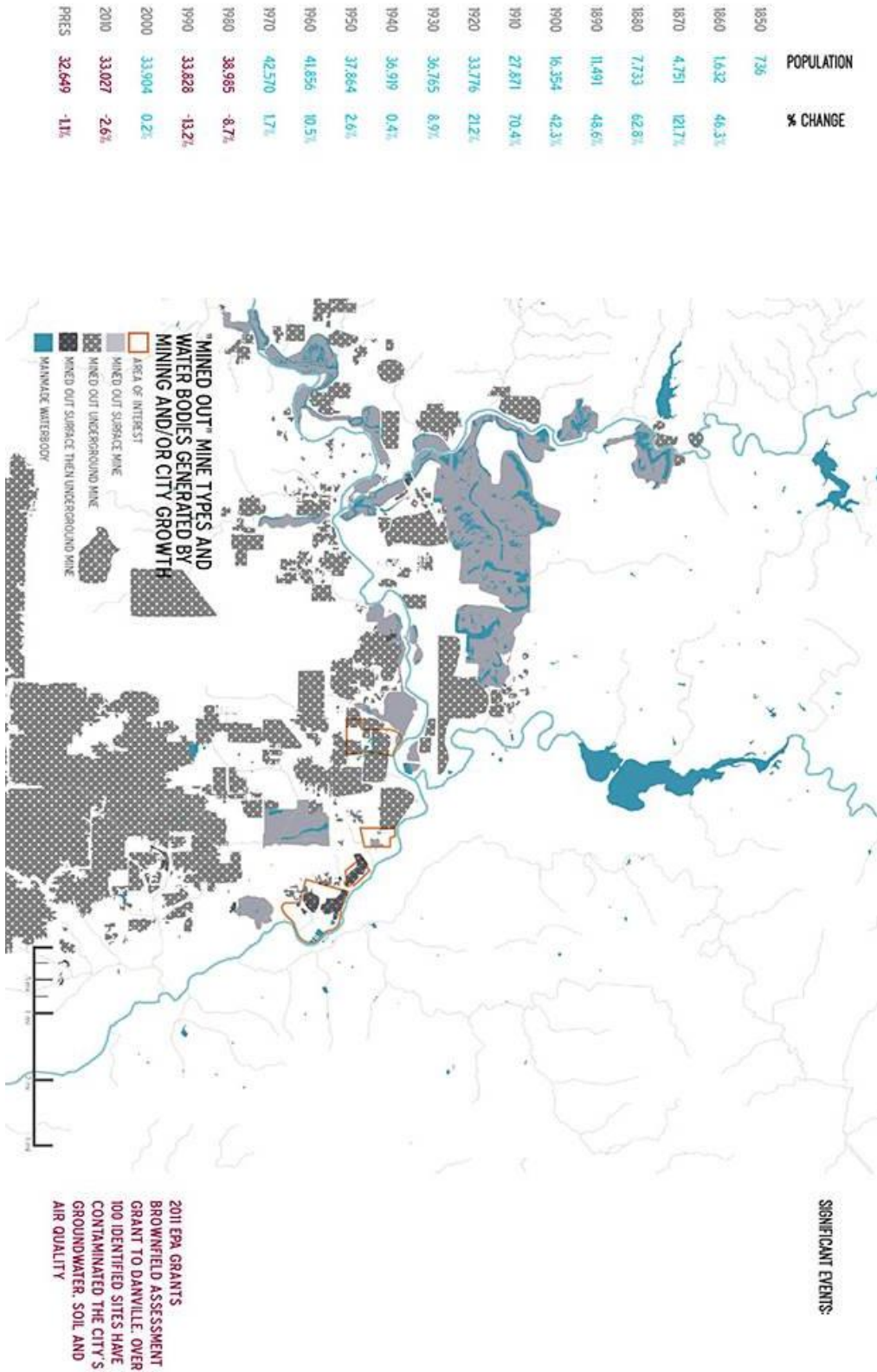


Figure 1.10: Present Mine and Water Conditions in Danville, IL



**Figure 1.11:** Areas in Danville, IL that have been “mined out” and waterbodies that have been created by human activity

As coal mines were exhausted, the landscape was left deeply scarred. Scoured with massive craters and carved into foreign land formations, the area had been transformed. These alterations offered various opportunities for Danville, but ‘reinsertion’ of new purpose in these voids was a necessity. At this point in time, policies were not in place to protect the future environmental integrity of mines once excavation had ceased, unlike present mining practices where strict policy mandates that specific ecological characteristics be restored upon mine closure, such as, water flow and re-vegetation. The fate of the landscape varied drastically. For example, in 1939, the state of Illinois, with the help of donations from Danville citizens, purchased the land of one of the largest former surface mines in the area. The 1,300 acre barren site was reclaimed, replanted with trees and became the Kickapoo State Park we know today. Unfortunately, this fortuitous outcome was not the case for many remaining exploited coal mines.

As Danville’s population and industries continued to grow, the city found itself in need of a waste disposal plan to accommodate the increasing amount of refuse being produced. The vacuous terrain lent itself to serve as dumping grounds and has since become the string of landfills that line the South and West banks of the Vermilion River and inhabit communities of Danville. Like a palimpsest, layers of Danville’s physical and cultural history have been erased, discarded and carved away, and written over with unfamiliar materials layered back into their place to tell a new story. It is through thorough site investigations and the exploration of potential design strategies that the next layer of human intervention placed upon these sites will be one that breaths life back into the community and the future of these sites.

### *1.7 Purpose of Thesis*

It is apparent that there is a gap in our current knowledge concerning 21<sup>st</sup> century strategies for planning and design of waste management systems, especially in regards to the long term health and wellbeing of adjacent human and ecological populations. Both scientific and design precedents illustrate the opportunity to reconsider typical waste management and treatment systems in ways that will promote healthier, more resilient landscapes and communities for the future. Currently, landfills function linearly rather than utilizing cyclical, closed loop treatment strategies. Flexible design methodologies which utilize an integrated natural systems approach must be utilized to put current knowledge into action. The purpose of this thesis is to propose *in situ* design strategies for Danville's abandoned GM Foundry along with a long term phasing plan to reconnect Danville's disjointed communities and activate its network of "drosscapes."



## **2. Analysis**

In this chapter, I review the findings of my community and regional scale analysis, and site specific investigations. Next, I illustrate how this information directly informed the design strategies I employ to address the ecological, human health and safety, and economic concerns that threaten the future wellbeing of the city of Danville.

### *2.1 Regional and Community Analysis*

Danville is surrounded by a number of state parks which attract thousands of visitors annually. These parks host annual music festivals, attract nature enthusiasts and provide a variety of active recreation trails. Unfortunately, these parks are difficult to access without a vehicle as public transportation does not serve them. These parks currently serve the regional community, but often fail to serve those living nearby. If properly planned, the sites of investigation are all opportunities to bring this type of park into the Danville community if approached with a vision for the future health of each landscape.

Since the 1970s, Danville has seen a significant decline in its population. This is mainly due to the loss of major industries such as the GM Foundry, which previously served one of the identified landfills. The investigation of Danville's demographic evolution began with a series of questions: Although Danville as a whole has undergone mass population loss, has the area surrounding the landfills experienced similar declines or have their populations remained due to loss of income and decreased property values? Is there a relationship between the increased poverty and unemployment levels in Danville and the identified landfills?

During the past five decades, Danville Census tracts associated with the landfills of investigation, have lost over a thousand people in total population, yet the number of impoverished people remained nearly constant within the one mile buffer zone of the landfills themselves. This demographic transformation illustrates how such landscapes of distress have the capacity to tether people to an area that blatantly fails to meet current residential zoning recommendations laid out by the EPA because of the economic advantage created by greatly reduced property values. A perpetual disadvantaged cycle of poverty has thereby been established, as residents are unable to financially afford to move away from these openly recognized health hazards.

The economic advantages of a lower cost of living brought on by devalued land surrounding the landfills of Danville, have placed the adjacent communities at risk. Living in such close proximity to toxic sites, such as landfills, may expose residents to toxic chemicals in the air, water and soil. These environmental and social injustices are to be addressed in my proposed design strategies to ensure the health and safety of the surrounding community members are of the utmost concern.

Since its inception in 2011, Danville's Brownfield Initiative Program has been invaluable in protecting the safety of its residents; however, the revelation of over one hundred hazardous sites within the business district due to failing underground tanks left behind by gas stations and laundromats has greatly deterred external investment (Danville Public Works). Additionally, current owners of such toxic sites are faced with the challenge that their land is worth less than the cost of adequately cleaning and remediating it. This has led to over one hundred toxic brownfields to sit untouched as many owners have walked away from their investment rather than attempt to remediate and rebuild.



## *2.2 Site Analyses*

Brickyard Disposal and Recycling is a 293 acre waste management facility. In 2004, the landfill accepted 1,232 tons of waste daily from both in and out of the state of Illinois, and was given a “landfill life expectancy” of fifteen years (Nonhazardous Solid Waste Management and Landfill Capacity in Illinois, 2004). The 2013 Report on Illinois Landfills indicated that after the 2003 opening of new cells at the Brickyard facility in concert with the reduction of daily tons received to 796, the landfill now anticipates closure in 2031 (Illinois Landfill Projections of Disposal Capacity, IEPA, 2014). This dramatic reduction in daily tonnage was offset by the 207 acre horizontal expansion and 75 foot vertical increase of the regional Livingston Landfill. This added 50.5 million cubic yards airspace capacity at this landfill and allowed for greater regional deposit to alleviate surrounding municipal landfills nearing capacity (ILPDC, 2014). The Brickyard landfill is visually expansive and can be seen from the highway while approaching the city of Danville. Upon multiple personal on site investigations in July, August, October and November of 2014, contamination of surface water and a local stream was evident and a pungent odor was present during each visit (see figures 2.2-2.4). These open water bodies, as well as the landfill itself, are directly adjacent to private residences and private wells. Since 1999, landfill gas has been captured and harvested as a minor energy source, and as part of the 2010 EPA Landfill Methane Outreach Program (LMOP), Brickyard has been identified as a candidate for an energy production program overhaul. Currently, the methane serves to produce electricity for a city generator and other small operations on site. According to the LMOP March 2015 report, there is far greater energy potential within this landfill than what is being utilized.



**Figure 2.1:** Looking east towards the entrance of the Brickyard Disposal and Recycling Facility

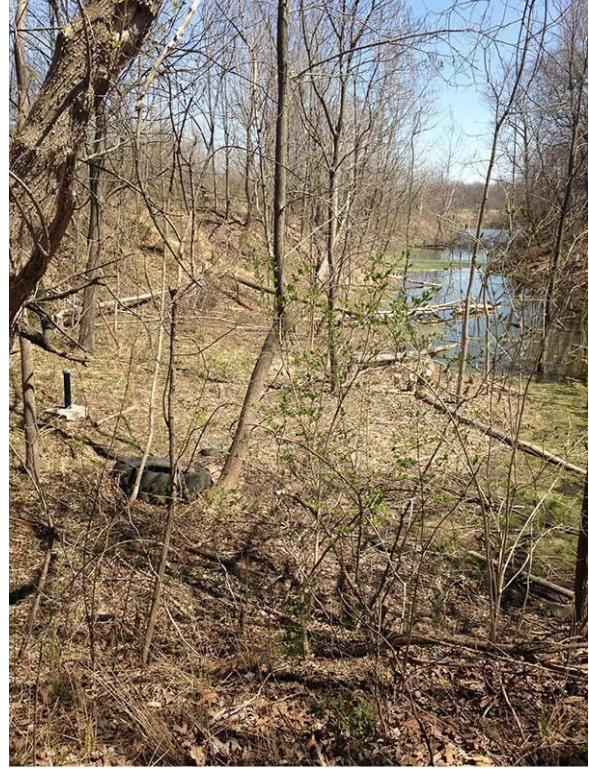


**Figure 2.2:** Looking east across an open tributary leading to the Vermilion River along the southern edge of the Brickyard active landfill. Trash, algal blooms and intense odor present during several observations.





**Figure 2.3:** Closer view of Vermilion tributary. Tire, road sign, and rubbish visible



**Figure 2.4:** Closer view of Vermilion tributary. Groundwater monitoring and observation well seen on left side of image above tire.

The H&L Landfill is identified as an abandoned landfill by the EPA. It is a fifty-six acre facility that once accepted general refuse and industrial waste from the 1940s to 1974.

Historically, this site has had significant issues with “leachate flow, seeps and persistent odors” (Agency for Toxic Substances & Disease Registry (ATSDR), 2009). Prior to remedial action, leachate periodically flowed openly through the landfill’s shallow cover material and into nearby communities and local waterbodies (IEPA H&L Fact Sheet, 2002, 2003, 2004). One specific example of the grave dangers associated with landfill materials coming in direct contact with residential neighborhoods and water resources comes from the Illinois Environmental Protection Agency’s (IEPA) discovery that in 1972 approximately 3.5 tons of insecticides and pesticides were illegally dumped into this landfill. This is extremely disconcerting considering the site’s

immediate proximity to homes, agricultural fields and local drinking water sources, as well as the unknown long term human and environmental health effects of exposure to such hazardous materials. For decades local residents have complained on record about the visible seeps and offensive odors coming from the landfill. After an on-site investigation was conducted by the EPA in 1987, it was determined that a leachate collection and monitoring system was desperately needed. The system was built in 1992 and continues to serve the landfill (EPA H&L Landfill Report, 2002). The majority of liquid leachate produced by the H&L landfill is collected via this system and then transferred to a receiving truck and sent to a subsequent toxic landfill for final deposit.



**Figure 2.5:** The H&L leachate collection system

According to the EPA's 2009 report on the H&L's environmental and health concerns, local community members, as well as those who investigated the site first hand, share common



concerns for the safety and security of the surrounding populations. Ultimately, in 1999, the H&L was identified as one of thirty three abandoned landfills in the state of Illinois to receive funding from the Illinois FIRST funding program to be adequately capped and sealed (Illinois EPA H&L Landfill Fact Sheet, 2004). This cap was not completed until 2004 at a cost of approximately \$5 million (paid for by the state of Illinois and contributions from the city of Danville), and still reports issues with leachate seeps as well as difficulty and high cost of transferring collected leachate safely off site. A highly trafficked road used by the surrounding community circumvents the landfill and serves a school bus route. The landfill remains fenced off from public access and the grass cover is to be maintained and mowed regularly.



**Figure 2.6:** Looking south across the H&L landfill. Sign reads: “No trespassing hazardous substances contamination present.”



**Figure 2.7:** The H&L landfill and surrounding roadway

The former GM Foundry and its adjacent landfill pose great immediate and long term ecological and human health threats to the surrounding area. One hundred and twenty-five acres and seventy two acres respectively, it is difficult to ignore the overgrown remnants of Danville's industrial past from the highway. Uncharacteristically from the surrounding terrain, the landfill rises nearly one hundred feet vertically behind the infrastructural relics of the once thriving GM auto and military equipment plant. The landfill operated from 1947 to 1995 under official capacity and was reported to receive undocumented waste until the late 1990s (Realm Project Summary Form, 2008). Currently, one structure centrally located on site serves a small resale tire supplier and a stone contractor (Tilton Gazette, 2013); otherwise, aside from the evidence of other curious trespassers, the site remains vacant (see figure 2.8).



**Figure 2.8:** Stone contractor and tire sales operation and abandoned foundry facility with paintball evidence

The foundry operated for decades prior to present day environmental protection and human health regulations regarding the use and ultimate disposal of hazardous materials such as lead paint and postindustrial sludge. According to Doug Toole, Environmental Health Protection specialist with the Vermilion County Health Department, the landfill accepted scrap metal and sand blasting waste from the foundry until its closing. He went on to say that “landfill materials were out in the open and not buried” during the mid-1990s. Toole also noted that not until “final cover closure” was granted by the IEPA in 2001 was the landfill closed in a way that protected the surrounding ecologies and human populations from direct run off and toxic airborne emissions. The landfill was repeatedly expanded upon as the foundry’s production increased during the war, again during the ongoing automobile boom and finally when it began accepting waste from the surrounding municipal area.





CENTRAL FOUNDRY, GENERAL MOTORS PLANT, TILTON, ILLINOIS  
Earlier photo - notice Interstate 74 and ball diamonds-top left.

*Figure 2.9:* GM Foundry c. 1965 (Image courtesy of Vermilion County Historical Society)

The immediate concern for the adjacent ecologies and community members is that without intervention, hazardous materials present on site will persist and continue to threaten local animal populations and the health of nearby waterbodies; mainly by means of soil percolation and rain water run off carrying harmful materials off site (National Pollutant Discharge Elimination System (NPDES) Permit No. IL0004138, 2013). Historic operations on site were investigated in order to identify the areas of greatest concern regarding present day soil quality. Through the analysis of historic imagery, on site investigations as well as soil and groundwater reports released by the IEPA, it was determined that the area occupied by the

central foundry suffered the most significant, long term damage and requires the most remedial attention.

More recently, the GM landfill has undergone heavy investigation by The RACER Trust, a land development program that aims to “empower America’s auto communities,” in conjunction with the IEPA. These groups have worked together to develop an ongoing groundwater monitoring and cleanup plan and continued effort to monitor fluoride and inorganic constituent levels in the groundwater with a mutual understanding that “further remedial activities will be closely coordinated with development plans” (RACER Trust, 2012). RACER Trust invested \$5.26 million for site cleanup prior to listing the landfill property for lease or sale in 2012 with a specific interest in solar energy production. The land is valued at \$13,365 and continues to remain on the market.

### 3. Design Solutions

The purpose of this thesis is to employ design in order to address the challenges facing the ecological health and community wellbeing of a specific Midwestern postindustrial landscape. I selected the former GM Foundry and its adjacent landfill as the site to explore these challenges through design. In this chapter, I address two significant concerns through the application of twenty-first century design solutions: (1) ecological remediation and (2) human health, safety and justice. Finally, I identify and explain specific examples of proposed *in situ* design strategies that I employed on site to respond to immediate ecologic and human health risks. I also discuss my long term plan for rethinking future land use and development opportunities within the community in order to solidify a resilient future for Danville.

## Site Design

### Site Features:

- 1) Prairie Landfill Cover
- 2) Recreation Lawns
- 3) Wet Prairie
- 4) Marsh Boardwalks
- 5) Lotus Pool
- 6) Play Mounds
- 7) Savanna
- 8) Hybrid Poplar Grove
- 9) Leachate Treatment Wetlands
- 10) Energy Park
- 11) Sunken Skate Park
- 12) Cafe
- 13) Visitor Center
- 14) High Intensity Trails in Forest
- 15) Pedestrian Bridge over RR



### Goals:

- 1) Remediate and stabilize local ecologies
- 2) Promote community and regional connectivity
- 3) Generate closed loop, in situ design solutions

1/2 MILE

**Figure 3.1:** The final site design features specific ecological and community oriented design features listed above.

### *3.1 Ecological Remediation*

The former GM Foundry and its adjacent landfill pose great immediate and long term ecological threats to the surrounding area. The site has been exposed to decades of heavy metal handling and production, extensive automotive traffic, and use and disposal of industrial chemicals. I explored a range of phytoremediation strategies and investigated both strengths and weakness of specific plant varieties that could potentially serve as hyperaccumulators<sup>4</sup> on site. I then determined which methodologies and plant species were best suited to eradicate toxic materials from the soil as well as operate as part of a larger closed loop leachate treatment system that will be discussed later on. My design proposes that a grove of hybrid poplar trees be densely planted at the core of the former industrial yard. Poplar trees not only tolerate poor quality soils inundated with heavy metals, but they also move large amounts of water through themselves regularly thereby removing greater quantities of contaminants from toxic soils much faster compared to smaller, less tolerant plant species (Jones and Owen, 2005). The trees are strategically organized at an angle off set from the surrounding orthogonal grid in order to create forced perspectives into the site for those driving by on the elevated I-74, allowing the space to be uniquely experienced even at 70 miles per hour. In addition to their remedial capabilities, poplars have an incredible seasonal display of bright yellow foliage in the fall, bringing color into this space even during colder months. The relatively rapid growth of this particular tree species also provides flexibility for the future needs of the community as the trees may remain a permanent fixture or periodically harvested and replanted for lumber or biofuel production.

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<sup>4</sup> A plant capable of growing in soils with very high concentrations of metals, absorbing these metals through their roots, and concentrating extremely high levels of metals in their tissues.



**Figure 3.2:** Hybrid poplar hyperaccumulator grove becomes most densely planted at the core of the former GM industrial yard.

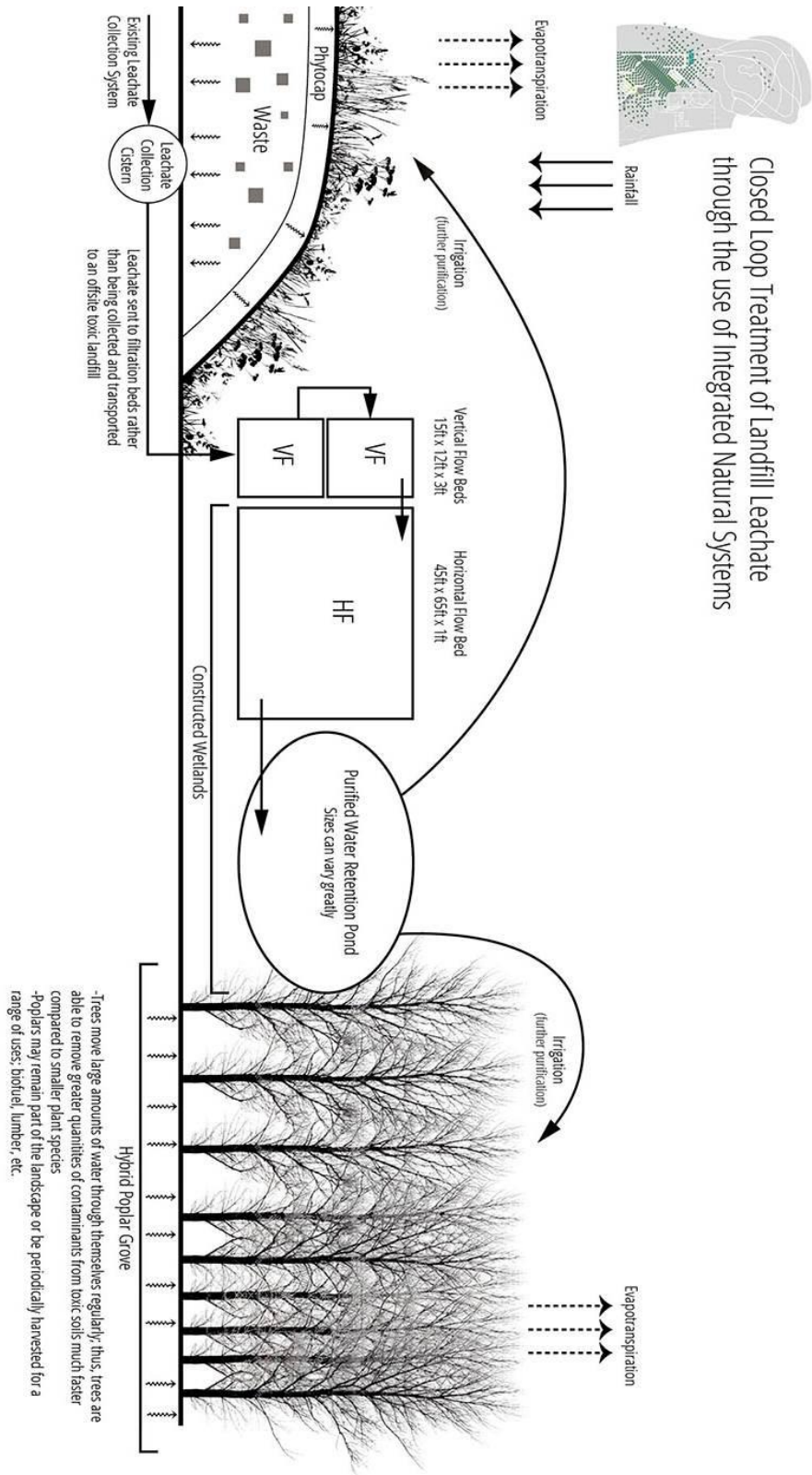
As discussed earlier, the existing toxic landfill was established between 1940-1945 when the foundry began its operations and continued to receive foundry waste until its closure in 1995. In 1997, the landfill terminated its receipt of outside materials from both documented and undocumented sources. Ultimately, the open air landfill was identified as an environmental and human health hazard by the EPA and capped with a vegetative cover in 2001 (EPA Cleanup Enforcement, 2010). During its operation, materials such as “scrubber sludge,” scrap metal, core sand and coke ash were accepted creating a highly diverse and precarious material quality within the body of the landfill. Although the site has since been highly engineered and capped to meet all environmental protection standards, it can be appreciated that the long term security of landfill caps is by no means assured (Laner, et al., 2011). Additionally, the required well monitoring, and treatment and disposal of landfill leachate are processes that will persist indefinitely if left unchallenged. Bulc points out that aside from the varied opinions on treatment methodologies, “[leachate treatment] experts agree that on-site treatment facilit[ies are] needed that require little management or power and [are] financially less demanding” (Bulc, T. 2006). The objective of this design proposal is to provide long term security for the health and wellbeing of the adjacent ecologies and human populations by providing resilient, ecologically based strategies for onsite leachate treatment and management of possible future cap failure seeps. These strategies also aim to reduce long term economic costs dedicated to maintaining current unsustainable practices on site. The traditional treatment strategies found onsite demand large capital investments as well as great chemical and energy inputs to treat landfill effluent, thereby generating an array of foreign byproducts. These byproducts are either released via several outfalls located across the site for ultimate receipt by the Vermilion River, or transported off-site to treatment facilities or toxic landfills. These traditional approaches are considered not



only expensive, but dangerous (Surface, et al., 1993). My design proposal illustrates ways in which we can confidently break the cycle of relocating waste's waste, and move towards a closed loop, ecologically based solution.

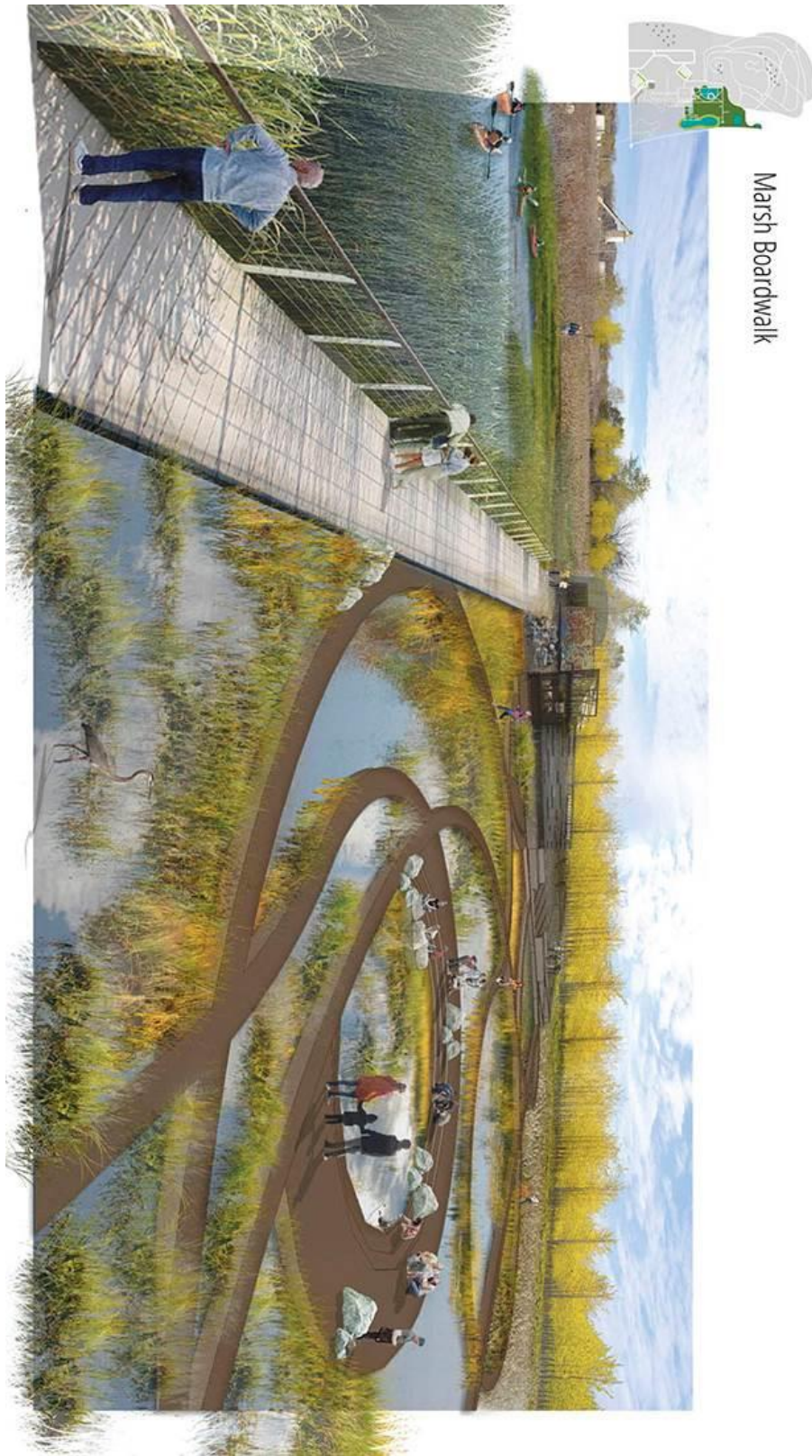
By applying the findings of Zupančič and his colleagues and layering the knowledge gathered from numerous other teams investigating INS for onsite leachate treatment, a closed loop, *in situ* leachate treatment system is proposed for the GM Foundry site. As seen in figure 3.3, leachate will be collected from the landfill using the existing gravity driven system and then directed to a collection cistern. This design proposes to direct untreated leachate into a series of filtration beds varying in size, depth and material, i.e. coarse and fine gravel, sand. This treated liquid will then enter various purified water lagoons found in the marsh boardwalk and the lotus pool. From there, the water is utilized either for irrigation of the poplar grove, the prairie landfill cover or to continue through the wetland network for further filtration before reentering the Vermilion River. This proposed system breaks away from traditional waste management strategies, but aims to create a safe, resilient environmental framework for the future of Danville.





**Figure 3.3:** An integrated natural systems approach to leachate treatment providing an ecological solution to the current hazardous and chemical treatment standard.

Deciduous forests, wetlands, marshes, and wet and dry prairies all play distinct roles in forming unique habitats that support a rich biodiversity and provide an array of ecosystem functions. By introducing these conditions to the site, the area is provided with the opportunity to utilize the restorative capacities nature is able to provide. Wetlands and marshes foster particular significance in that they retain and slow the movement of water and play the important role of denitrification in the nitrogen cycle. These habitats are critically important ecologically as they are some of few environments which return nitrogen back into the atmosphere in a form that is readily accessible to plants and bacteria. They are strong decomposers, which makes them ideal for aiding the remediation process of a contaminated area. By arranging a progression of wetlands and marshes on site, water is directed from one pool to the next before its eventual return to the Vermilion River. The cleansing performance of wetlands improves with age, as does their capacity to serve as a dynamic habitat for a specific set of animal and bird species, thereby establishing a long term resilient solution that is capable of adapting to future conditions we have yet to experience.



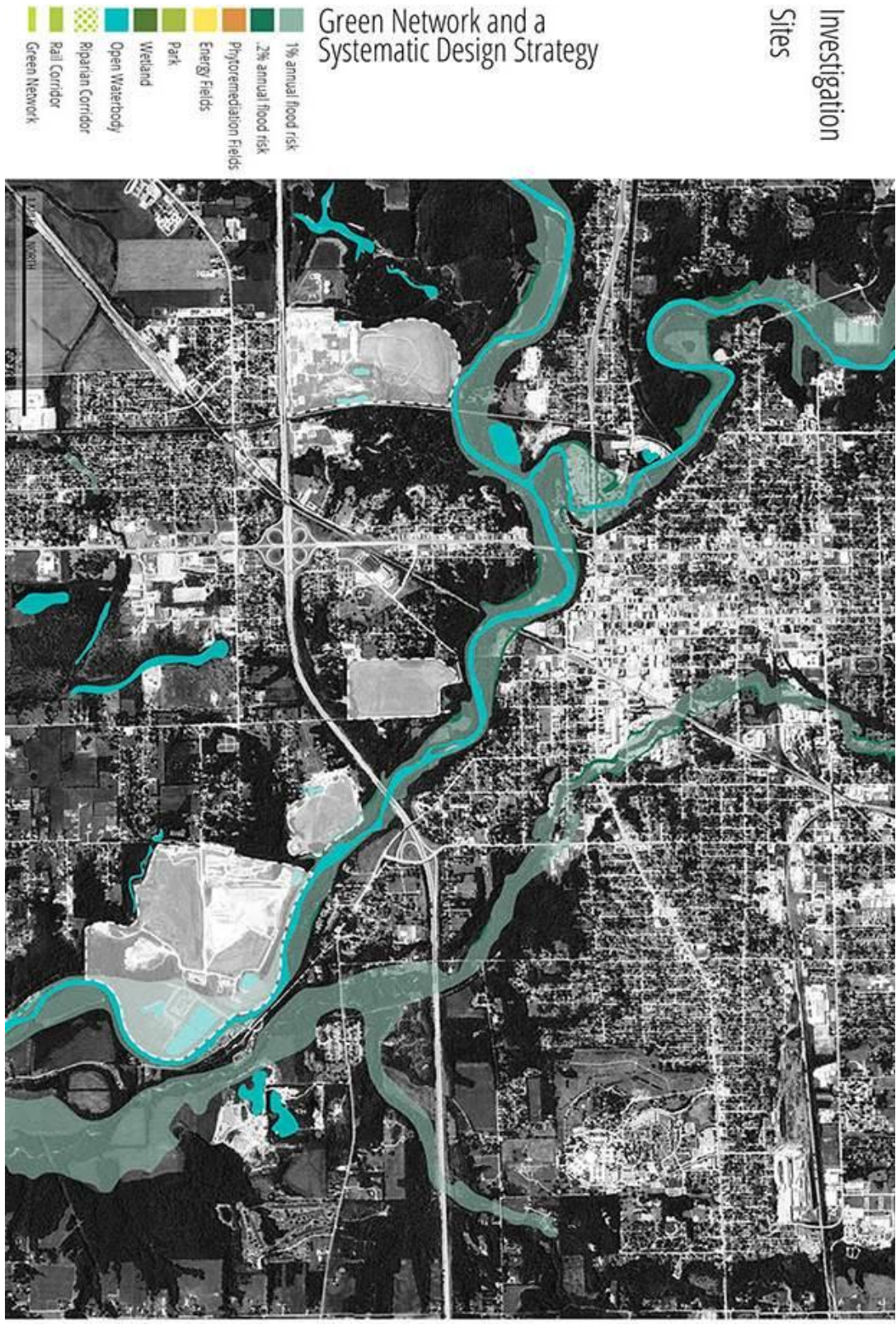
Marsh Boardwalk

**Figure 3.4:** The Marsh Boardwalk serves as an area for engaged recreation (kayaking, birding, walking or jogging) and education where the path meets the water's edge at the outdoor classroom.

### *3.2 Human Health, Safety and Justice*

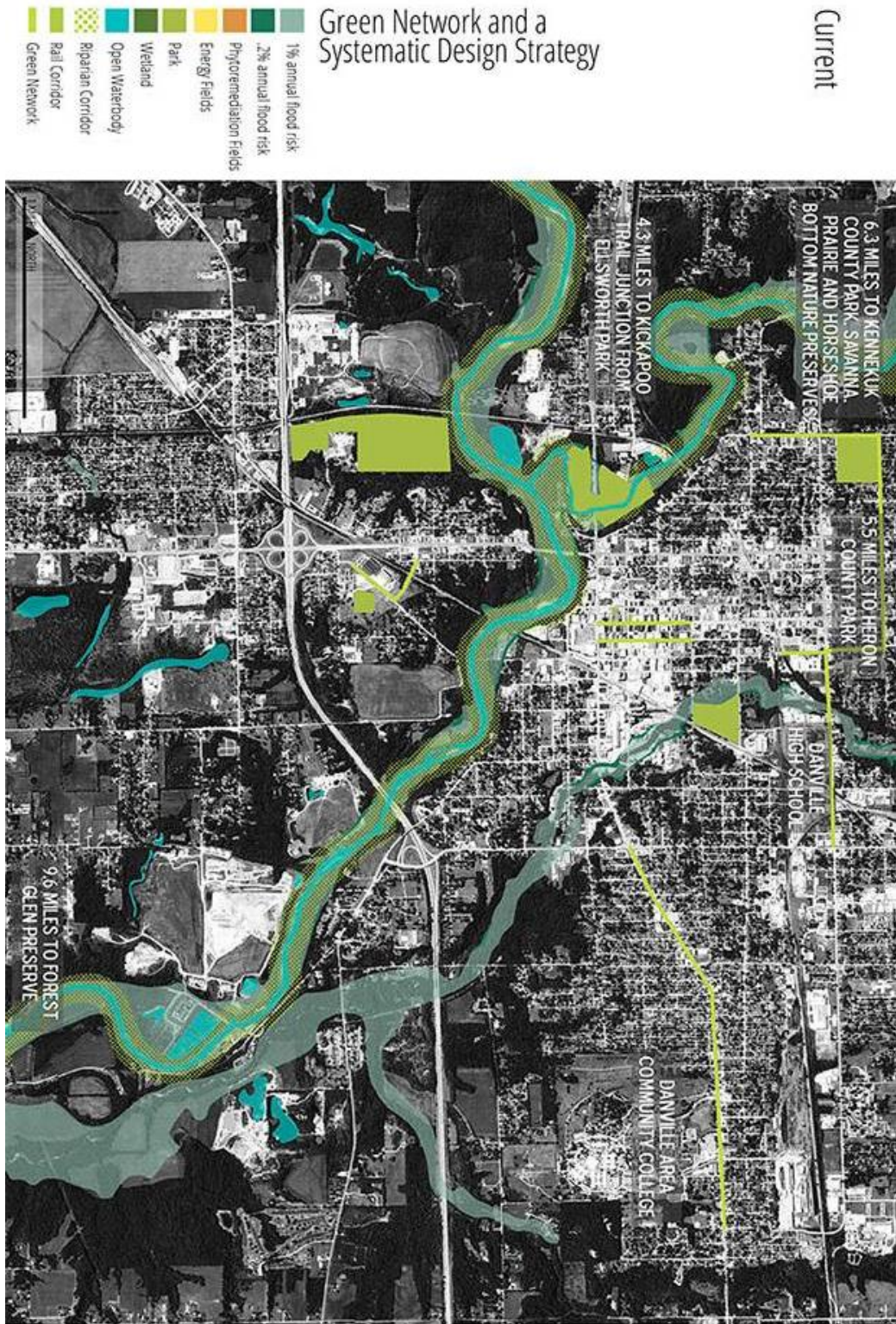
There is an immense concern for the health, safety and justice of the individuals living adjacently to the toxic sites of investigation. By addressing the immediate ecological threats found at the GM Foundry, the design simultaneously works to diminish current and future human health concerns caused by direct contact with toxic materials as they enter water bodies, become airborne and persist on site. Beyond site specific concerns, the surrounding community is glaringly disjointed and isolated from the northern, wealthier part of town. A “green network” is proposed (see figures 3.5-3.10) to build future connections throughout the community, which will be allowed to grow and extend over time. This green network brings nature out of the singular park environment and weaves it through the community forming a lattice framework that reconnects communities separated by infrastructure and neighborhoods lacking walkability.





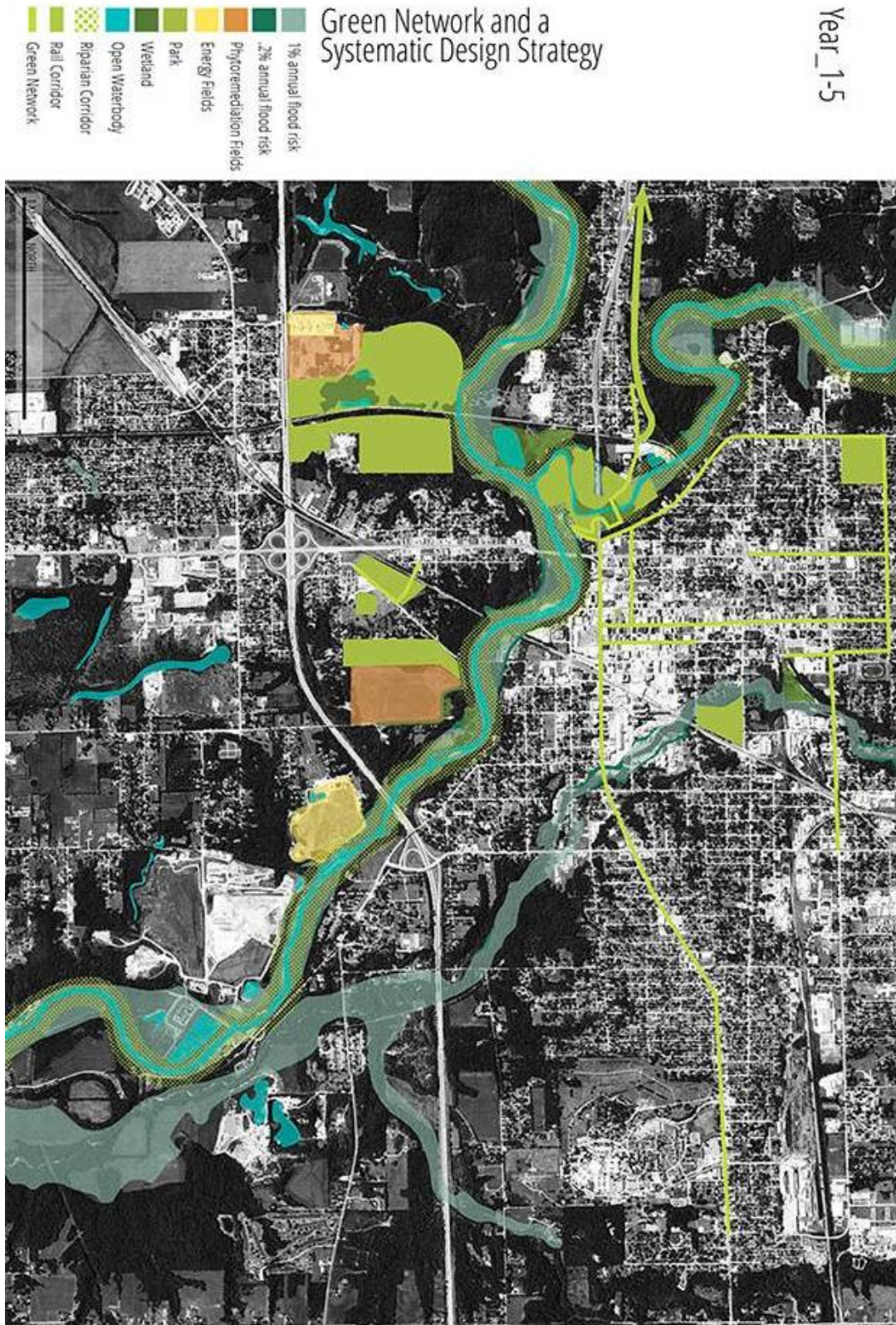
**Figure 3.5:** Locator map identifying the four sites and the related flood zones along the Vermilion River





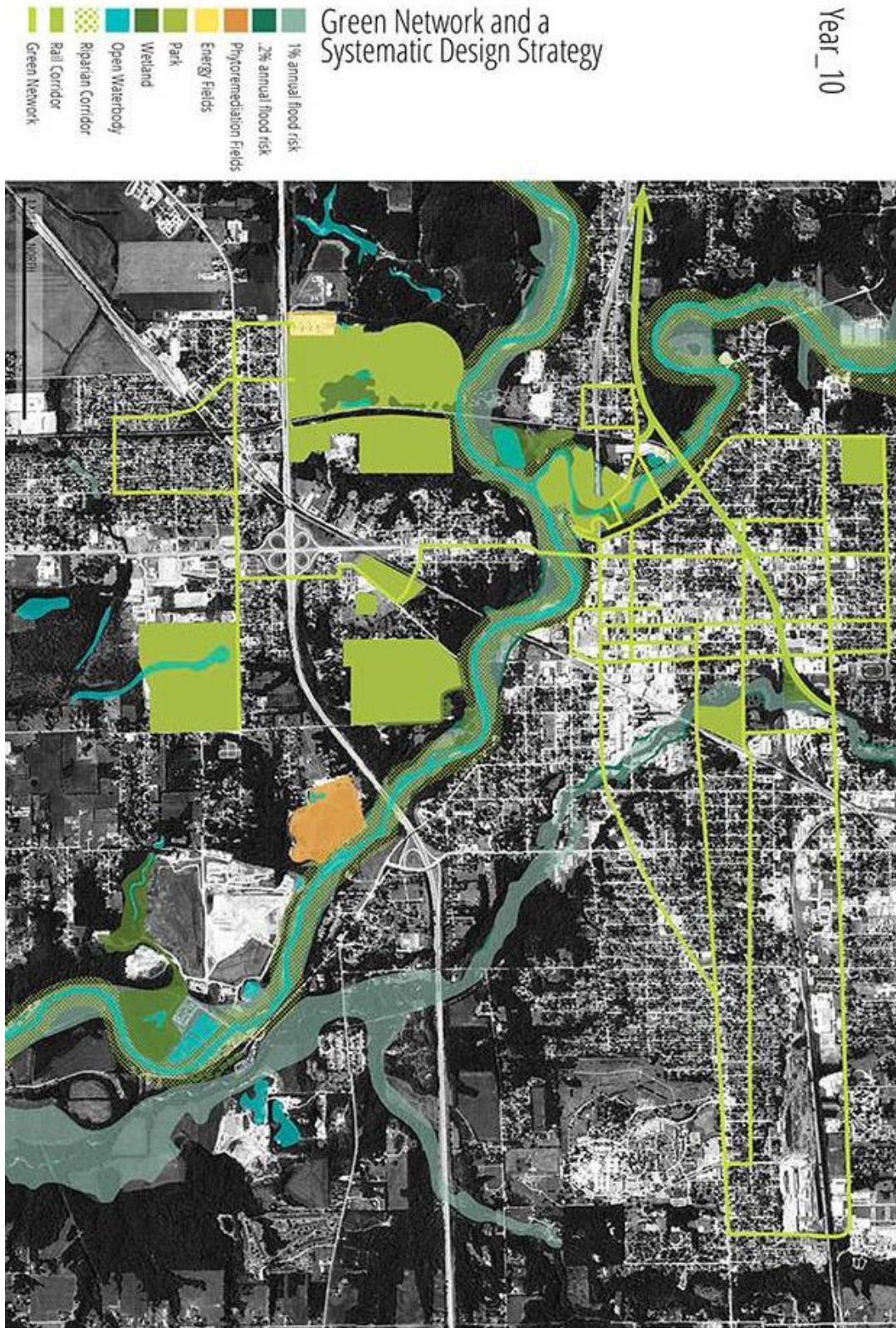
**Figure 3.6:** Current conditions of parks, pedestrian friendly corridors and recreation trails that are under construction





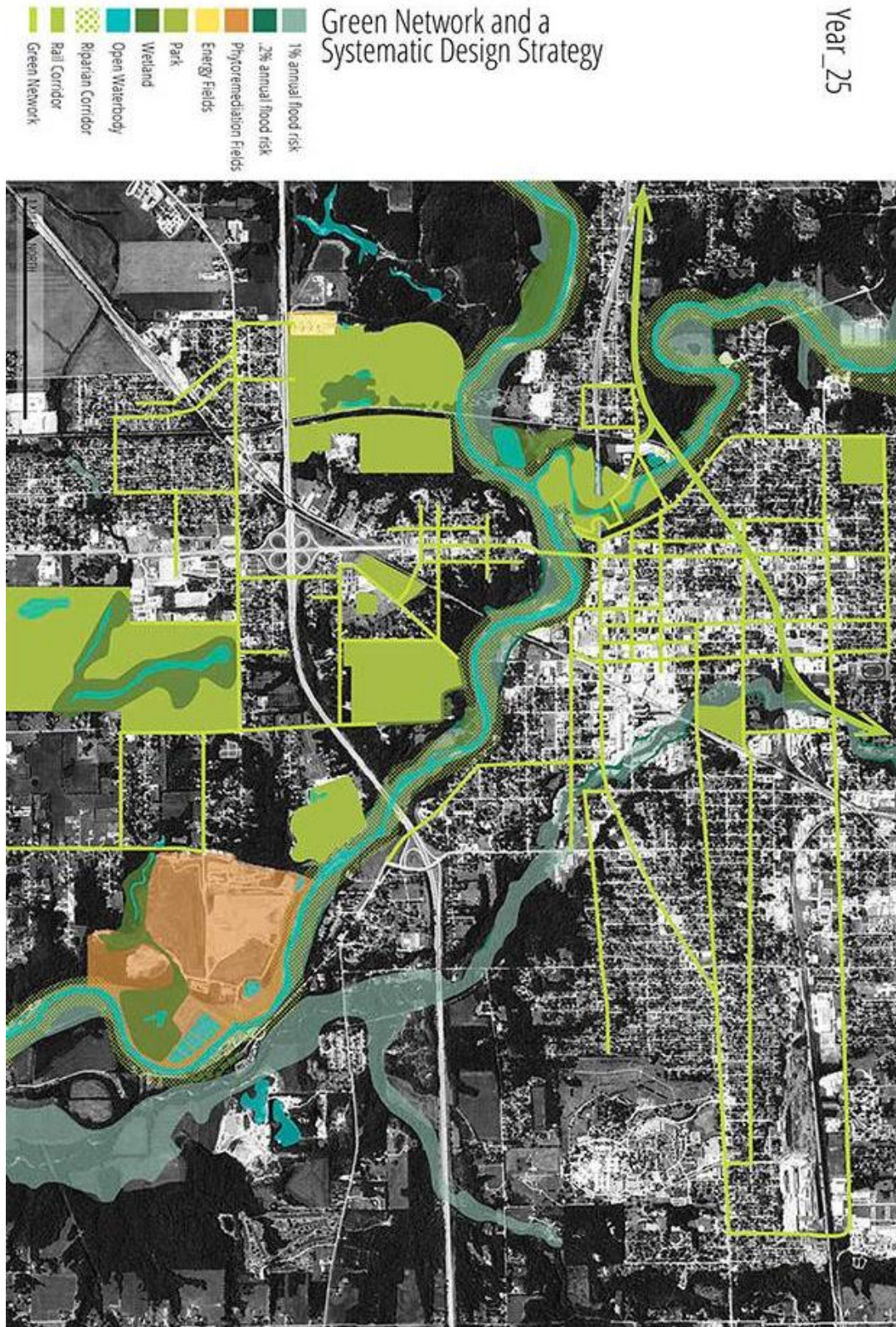
**Figure 3.7:** Proposed land use plan (year 1-5). Encouraging productive land use during rehabilitation of landscapes and considering both the ecological and economic values within each site.





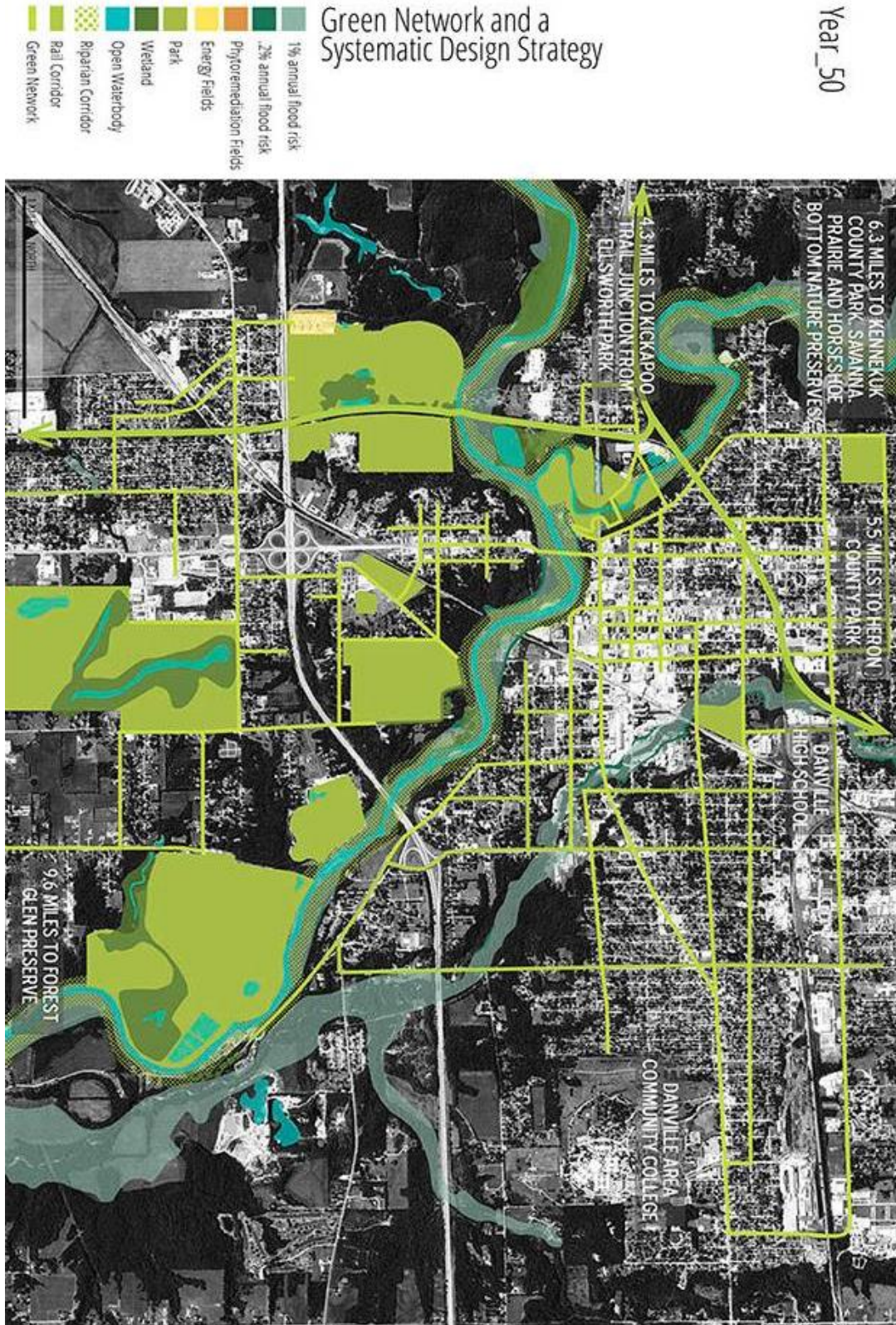
**Figure 3.8:** Proposed land use plan (year 10). Formerly hazardous environments become productive and safely reintroduced to the surrounding communities.





**Figure 3.9:** Proposed land use plan (year 25). The Brickyard facility is predicted to reach capacity by this time, and plans for the site’s future include energy harvesting and phytoremediation.





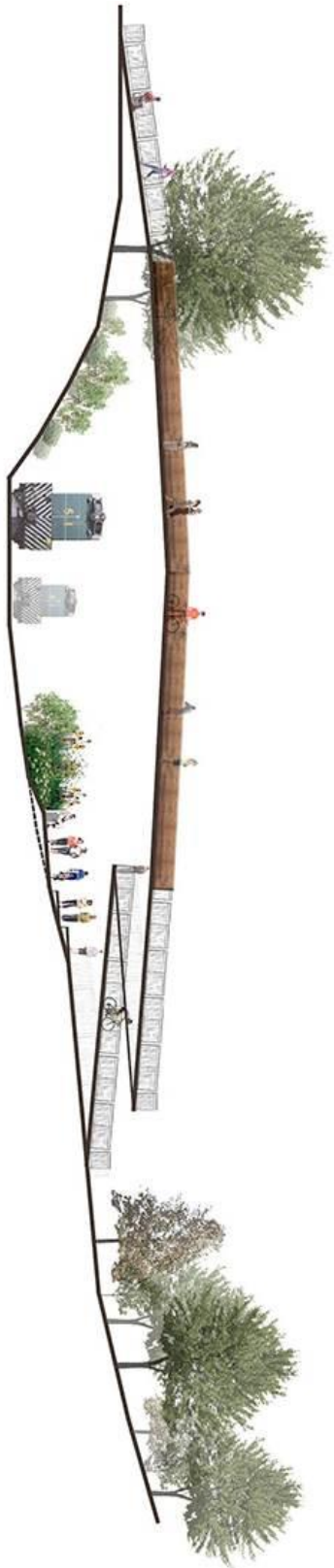
**Figure 3.10:** Proposed land use plan (year 50). Long term land use planning illustrates how landscapes of waste can be reincorporated into the community fabric and continue to remediate as time advances.

The proposed framework mimics the recent streetscape redevelopment located near the Presence United Samaritans Medical Center in North Danville in order to create a cohesive urban fabric that unifies the communities of Danville. The redevelopment embodies 21<sup>st</sup> century best practices of storm water management and pedestrian friendly design.

My design proposal for the GM Foundry site seeks to insert an active, healthy green space for both local and regional visitors to enjoy while the green network serves as a link between neighborhoods and the newly established GM Park. My long term vision for the green network aims to encourage community members' daily interaction and exposure to nature. I believe it is our responsibility as landscape architects and planners to bring nature to every doorstep and encourage an active lifestyle from within a community. For this reason, many of the features included within the GM Park design include trails which extend beyond the park boundaries and connect to larger networks. For instance, the recreational trail along the railroad links to the Rails-to-Trails project that will connect Danville's Kickapoo State Park to Urbana-Champaign upon its completion. The pedestrian bridge flies over the railroad recreation trail and connects the GM Park to the Tilton Baseball Complex and the Tilton ATV Park, both of which have a large regional draw. I feel strongly that the GM Park has the capacity to serve as a regional anchor as well as bridge the gap between Danville's currently isolated communities.



### Pedestrian Bridge and Bike Path along Railroad Tracks



The bike trail runs alongside the currently operational railroad tracks and connects to the Rails to Trails Project in Kickapoo State Park. Eventually, these lines will become inactive and this corridor will become a linear park bridging the communities north and south of I-74 as well as the Vermillion River. The pedestrian bridge links the Tilton Baseball Complex, ATV Park (both serve regional enthusiasts and athletes) and disconnected communities to the park.

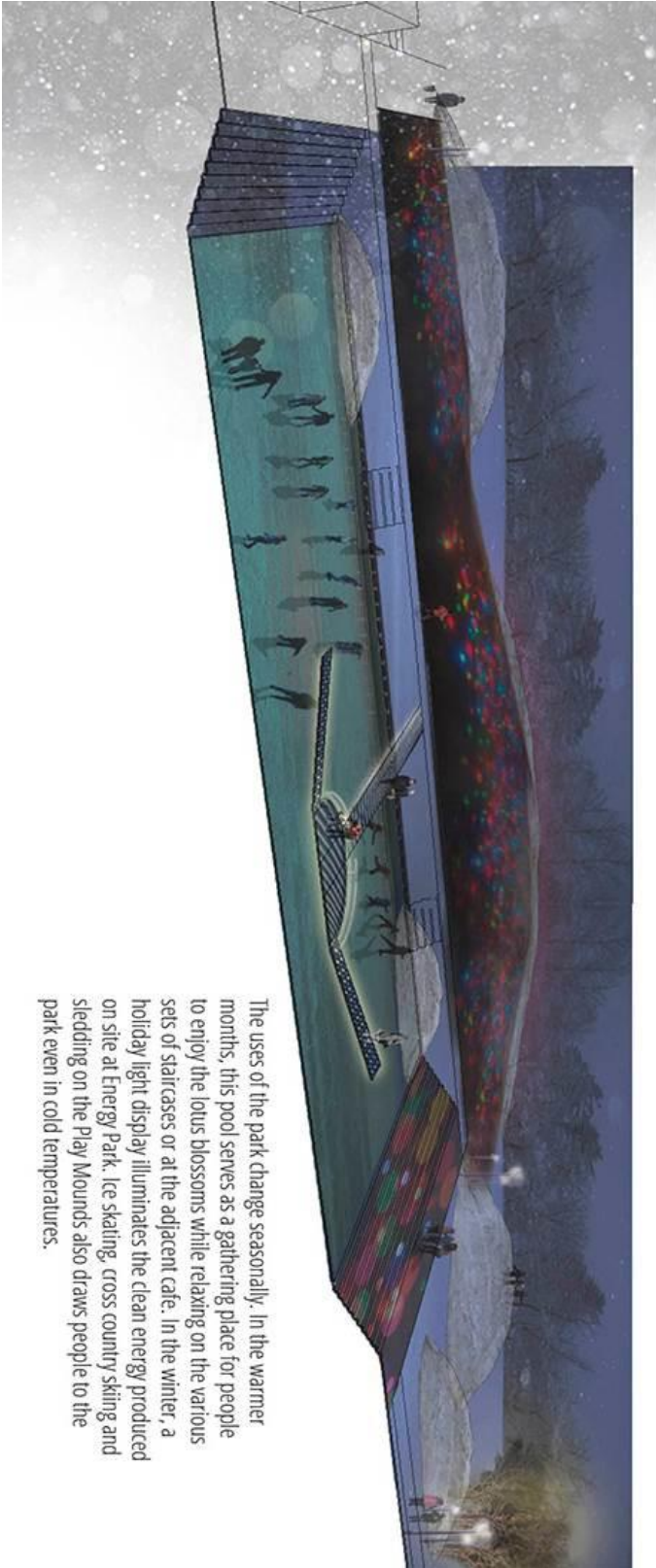
**Figure 3.11:** A pedestrian bridge reconnects two isolated communities and works to extend the reach of the Green Network of the larger area.

Within the park, I developed a network of trails that lead visitors through several distinct habitats and across a varied terrain rarely found in central Illinois. This is largely due to the landfill, but also because of the park's immediate proximity to the Vermilion River Valley. Atop the prairie, several large lawns welcome community gathering and events, such as music and art festivals, film screenings, and school field trips. The marsh boardwalks provide space for birdwatching groups, as well as educational events within the outdoor classroom that floats within the wetland. By encouraging interaction between diverse groups with varied interests, the community is strengthened and provided with spaces to grow and develop. Linking a community together through accessible and active green space is a healthy, long term approach to building a resilient community.





Lotus Pool



The uses of the park change seasonally. In the warmer months, this pool serves as a gathering place for people to enjoy the lotus blossoms while relaxing on the various sets of staircases or at the adjacent cafe. In the winter, a holiday light display illuminates the clean energy produced on site at Energy Park. Ice skating, cross country skiing and sledding on the Play Mounds also draws people to the park even in cold temperatures.

**Figure 3.12:** The Lotus Pool features seasonal qualities while serving as a rainwater collector and passive cleanser year round.



## The Lawns and Prairie

The Lawns serve many purposes for visitors. They are places to relax, play or enjoy a festival or event. The adjacent trails traverse the Prairie and lead to other areas of the park. The lawns provide expansive views of the prairie as well as the Danville skyline. The newly established prairie habitat attracts numerous songbirds creating a melodious environment year round.



**Figure 3.13:** The Lawns and the Prairie serve as both passive and active recreation space. These areas encourage community interaction while specifically chosen plant material is used to control run off and hyperaccumulate heavy metals in the soil.





Danville is a community largely deprived of direct access to greenspace, and by constructing a landscape framework that not only weaves nature into its neighborhoods, but additionally connects these communities to an educational, interactive outdoor space, the city's intrinsic value will increase in a number of ways. First, by remediating this toxic area, land values surrounding the park will increase economically as well as ecologically. This will in turn, increase the desirability for other remediation investments within the community and its Brownfield Initiative Program. The GM Park also aims to generate a source of local jobs through its new energy production fields, mixing solar and wind energy in an area that has been designated as "prime" for such types of renewable energy production (RACER Trust, 2012). The energy fields will not only generate new jobs, but act as a major source of revenue for the city and the county by providing consistent clean energy. Additionally, the newly established on-site leachate treatment system will reduce long term costs of treatment and off site transport of toxic materials. This will reduce the community's monetary investment in its ongoing waste treatment and monitoring efforts in addition to moving towards a safer place for people to live. This 21<sup>st</sup> century approach to energy production and waste treatment will be accessible to the community and serve as an educational and recreational space for Danville while drawing regional attention.



**Figure 3.15:** Energy Park with views to the hybrid poplar grove in the distance. Clean energy production replaces the former coal burning power plant and provides a new resource of current trade jobs.

## 4. Discussion

The network of “drosscapes” located in Danville, Illinois poses immediate and long term threats to the health and wellbeing of the nearby environment and of nearby residents and workers. My observations reveal that hazardous conditions have been repeatedly documented over the past several decades, and yet surprisingly, little effort has been made to protect the ongoing safety and security of the adjacent community members and the Vermilion River Valley. While a standard capping protocol has been implemented, it requires ongoing maintenance, monitoring and continual repair to prevent cap failure, all of which are dependent on the availability of funds and man power.

Rather than cap, we know better how to design and build ecologically sound strategies for on-site remediation, which simultaneously alleviate high economic inputs into these failing systems, as well as provide a framework for a more resilient, healthy landscape. In this chapter, I will review the larger contributions of my research and design, pose questions for future investigations, and reiterate why this contemporary issue is inherently significant to the field of landscape architecture.

### *4.1 Contributions*

My design for the GM Foundry fills a void in the Danville landscape, reduces the environmental hazard posed by the site, and positions it for further economic investment and ongoing public use. My proposal for a phased-in Green Network re-imagines the way in which contaminated sites are treated and planned for programmatically in the future. Rather than fencing off these wastescapes indefinitely, my strategy proposes a series of phases that will not only remediate, but also activate this network of drosscapes into productive places, even during

the time it takes to make them safe for human use once again. For example, it is anticipated that the Brickyard Disposal Facility will reach its capacity within the next fifteen to twenty years.

Within my proposal, I demonstrate ways in which proper land use planning can be used to prepare such landscapes for future utility rather than counting down the days until they are no longer of use for waste disposal and permanently closed off from the public domain. Considering the extensive amount of time natural remediation strategies require, the long term plan projects a series of phases fifty years into the future. During the interim, energy harvesting and production are proposed. This plan acknowledges that technology will surely advance over the next fifty years, and anticipates that the current land use plan will need to be adapted as new innovations are developed. This portion of my proposal seeks to motivate designers and planners to reconsider alternative long term programmatic uses of seemingly useless drosscapes.

Landscapes of waste are a burden to the communities where they are located, and due to their complex and largely undocumented compositions, they pose unpredictable conditions to future generations. Therefore, it is imperative that remedial design solutions for the postindustrial landscape remain flexible and responsive in order to adapt to an ever changing and growing knowledge base.

The design solutions I generated for the GM Foundry site and the larger Danville community illustrate ways in which flexible, projective design are able to be applied to a range of postindustrial communities facing similar challenges. For instance, by establishing prairie plantings on the landfill, rainwater runoff is slowed and passively cleansed as it moves across the landfill and towards the wetlands. Here, runoff is captured and retained for further cleansing prior to its ultimate destination of the Vermilion River. Designing the site as a self-sustaining organism rather than a park comprised of isolated components was a central concept in my

understanding and incorporation of the best practices associated with remedial landscape design. Integrated natural systems offer strong cleansing and hyper-accumulating potential, especially when used in a connective system of green infrastructure. We can feel confident in the design solutions presented here because they grow from a deep understanding of the site and from scientifically tested concepts that increase the probability of short-term and long-term success.

#### *4.2 Future Research*

The proposed design for GM Park raises a number of questions for future research. Most significantly, the investigation of the long term effects and results of the proposed *in situ* remedial design choices. Additionally, exploring how these proposed solutions work together as a system rather than individual treatment strategies would be invaluable for future design implementations. As current scientific research largely focuses on the ecological effects of individual strategies, building off of this knowledge to better understand systematic design would be highly advantageous for this dimension of design. Lastly, the human relationship with the postindustrial landscape is an area of research that has not been largely explored. Investigating how living alongside landfills, former industries or other landscapes of dross affects peoples' daily lives is a critically important next step in advancing our design strategies of the postindustrial landscape.

#### *4.3 Conclusion*

As a society, we have an urgent obligation to rethink current hazardous landscape treatment standards and look beyond the societal biases held against postindustrial landscapes. Rapidly increasing global populations and horizontally sprawling cities leave no time to question

whether these vast landscapes of dross will one day be looked upon for potential alternate uses or more assuredly, engulfed by human development. Without direct and immediate action, drosscapes like the former GM Foundry, H&L Landfill and Brickyard Disposal Facility threaten the health and wellbeing of the adjacent human and ecological populations, and violate the environmental justices due to them. As landscape architects, we have a responsibility to put current knowledge into action and work to create healthy, safe environments. The opportunity to make a dramatic, positive change for the future health and wellbeing of the postindustrial landscapes of the American Midwest is within reach. It is time we plan for a brighter, more resilient future.



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