Ecosystem services urban design framework:
An adaptive vision for the Dallas air naval station

by

Joshua Sundine

A REPORT

submitted in partial fulfillment of the requirements for the degree

MASTER OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture and Regional & Community Planning
College of Architecture, Planning and Design

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2018

Approved by:

Major Professor
Jessica Canfield

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Abstract

Located eight miles from the heart of Dallas, The Dallas Air Naval Station is a 1045-acre decommissioned airfield site. Since its closure in 1998, it has predominantly sat idle, bringing little value to adjacent neighborhoods and greater community. Due to prolonged site remediation and no formal redevelopment plan, the site's full potential has yet to come to fruition.

Current urban design models tend to primarily focus on achieving a singular, end-result. However, as cities and the environment become more complex and unpredictable, these types of models often lack the ability to respond to change. Adaptive design, on the other hand, allows for more exploration of innovative practices, tools, techniques and methods that are informed by ecological knowledge and research design. As means of illustrating how adaptive design can catalyze and benefit brownfield sites, this project proposes an urban design framework informed by ecosystem services. Ecosystem services are an essential component to human well-being and environmental health, and when used as a guiding principle in site design, can add resiliency and beneficial outcomes to a site.

To inform the development of the Ecosystem Services Urban Design Framework, this project uses literature, a site analysis, an applicable ecosystem services analysis, and precedent analyses. The framework is then applied to an urban brownfield site, the Dallas Air Naval Station, to show its applicability for short-term and long-term adaptive design scenarios. Dallas' current issues and needs are addressed by the short-term plan, whereas informed projections of future issues inform the long-term design scenarios. Collectively, this project illustrates the imperative for incorporating adaptability into urban design, and for the value of using ecosystems services as underlying foundation.

Ecosystem Services Urban Design Framework

An Adaptive Vision for the Dallas Air Naval Station

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Figure 1.1: 181st Fighter-Interceptor Squadron at Dallas Air Naval Station (USAF, 1958)

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Acknowledgments

First, I would like that thank my mother and father for their continued love, encouragement, and support through all my education. Without their support, I would not have had the opportunities and experiences in school that will continue to benefit me beyond. You two don't know how much your help has meant to me over the past five years. An extended thank you to my brother and grandparents for always believing in me.

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1.0

Introduction & Background

Main Dilemmas

Need for Flexible Urban Design

It is estimated that in 2007 the global population shifted from predominantly living in rural locations to living in urban locations, and by 2050 70% of the world's population is expected to live in urban locations (U.N. 2014). With the increasing rate of urbanization, impacts on land use, human welfare, social equity, and sustainability will be a challenge won and lost within cities (Ahern 2011, 341). Thus to better plan and design cities we need new, innovated approaches that are more adaptive and better-utilize knowledge before, during and after the design process (Ahern, Cilliers, and Niemelä 2014, 255).

Current planning and urban redevelopment processes tend to focus mostly on achieving an end result or a singular idea, yet with much uncertainty this model is not appropriate when planning for resiliency (Schilders 2010, 33-34). Cities have many dynamic issues happening all at once, and it can be impossible to understand how cities will look in several years (Schilders 2010, 33-34). Without a clear idea of what future cities may look like, it is difficult to plan and manage the future need of resources. A city's consumption of resources can have a large effect on the other side of the world, revealing the complexity of urban ecosystems (Elmqvist et al. 2013, 176). Ecosystem services can offer a conceptual environmental, social, and economic way to clarify the importance of managing resources (Windhager et al. 2010, 107).

Attention of Ecosystem Services in Design

Even though more than half of the world's populating lives in cities, little attention has been given to the protection or cultivation of ecosystem services in urban areas (Elmqvist et al. 2013, 204). The Economics of Ecosystems and Biodiversity (TEEB) initiative defines ecosystem services as the direct and indirect contributions of ecosystems to human well-being (TEEB n.d.). Humans are entirely dependent on Earth's ecosystems and the benefits they provide. Over the past half-century, humans have rapidly changed ecosystems to meet growing demands for food, water, fuel, etc., while neglecting to manage them appropriately (Millennium Ecosystem Assessment 2003, 1). In order to ensure long-term productivity and benefits of ecosystems, attention must be given to their existence in urban areas. These future urban design models should consider how to incorporate and support ecosystem services.

Potential of Brownfields

Due to 'end result' design models, urban sprawl has become a standard development process throughout the U.S. Because of sprawl and the deindustrialization of older cities, by the end of the 20th century there was an abundance of waste landscapes or brownfield sites in urban cores. Landscapes that have become "waste" (brownfields) and not reused for the benefit of others is one of the twenty-first century's great infrastructure design challenges (Waldheim 2006, 199). The urban brownfield is very prominent in U.S. cities, and the EPA estimates more than 450,000 brownfields are located across the country (US EPA 2015). Due to issues that arise from waste landscapes, sites often site idle for decades, providing little to no value for communities. The redevelopment of brownfields can be costly, lengthy, and complicated

requiring interdisciplinary teams to engage in the process.
One such type of waste landscape is the decommissioned airfield. “Like many early public urban parks and like parks on former industrial sites, the decommissioned airfield is often located on the periphery of urban areas, or in areas that were once peripheral but during the twentieth century became surrounded by new industrial, commercial, and housing developments” (Dümpelmann 2014, 249). These closed airfields in urban settings contain a vast amount of land and relatively flat topography which allows a tremendous challenge and opportunity to create new, more productive sites.

Future Urban Design Models

Given the need for: cities to be more adaptable and resilient to uncertainty, for ecosystem to be better planned to be protected and cultivated, and an abundance of idle brownfield sites, there is an opportunity to develop a new urban design framework model that utilizes ecosystem services as a basis for design programming and spatial planning.

Figure 1.2: Unused Building at the Dallas Air Naval Station (Sundine, 2017)

The Dallas Air Naval Station

History

The Dallas Air Naval Station (DANS) in Southwestern Dallas, TX is a prime example of an underutilized brownfield site. Initially named Hensley Field, the city of Dallas bought the land in 1928 and in 1929 leased the site to the United States Army in a 20-year contract. At the beginning of World War II the city extended the lease to 40-years. Some of the primary uses of the base were for pilot training and operations of new aircraft including, the F-8 and F-14 Tomcat (Freeman 2017).

Impacted by the 1993 Department of Defense Base Realignment and Closure Commission, the DANS officially closed in 1998. After the closure of the DANS, land ownership was returned to the City of Dallas for reuse at their discretion. However, due to significant contamination issues, stemming from previous on-site military activities, the city of Dallas has been unable to productively use the land.

Current Conditions

The condition of the site has remained mostly unchanged for the past two decades, primarily due to setbacks in remediation efforts. The Navy has not met the deadlines for remediation, leaving groundwater plumes untouched. Due to the incomplete remediation efforts, $88.5 million has been spent for evaluations and cleaning to date. Another $17.5 million is expected to be spent by 2023 (Wilonsky 2017). As typical of many brownfield sites (especially decommissioned airfields), the most significant challenge is the time of remediation, causing delays in the ability to reuse the site (Association of Defense Communities 2017).

Though contaminated, the site DANS has supported limited uses since the 1998 closure. The city leased portions to General Motors for storing cars and other companies for stormwater operations (Wilonsky 2017). The southwestern portion of the site remains in use by the Texas Air National Guard to train the Royal Singaporean Air Force's Chinook helicopter pilots (Freeman 2017). The northwestern portion of the site is used for light industry by Dallas Global Industry and Echo Transportation. The majority of former structures and old hangers sit in disrepair, unused, and falling apart. Most recently in 2016, private donors and city officials discussed using the site for the homeless population of Dallas through the construction of tiny homes, community gardens, and other living facilities for "tent exiles" needs (Tsiaperas 2016). Though site's prime location is eight miles from Dallas' Bishop Arts District, and directly next to Mountain Creek Lake, Dallas National Golf Club, and Dallas Baptist University, no redevelopment plans or comprehensive vision has been established for the site.

Today, due to a lack of complete remediation and redevelopment planning, the DANS remains underutilized, lacking value with no sense of urgency of redevelopment. Yet, through application of an ecosystem services urban design framework, the DANS could be transformed into an adaptive urban infill development that could better serve the surrounding community in the short-term and be flexible for long-term uncertainties.

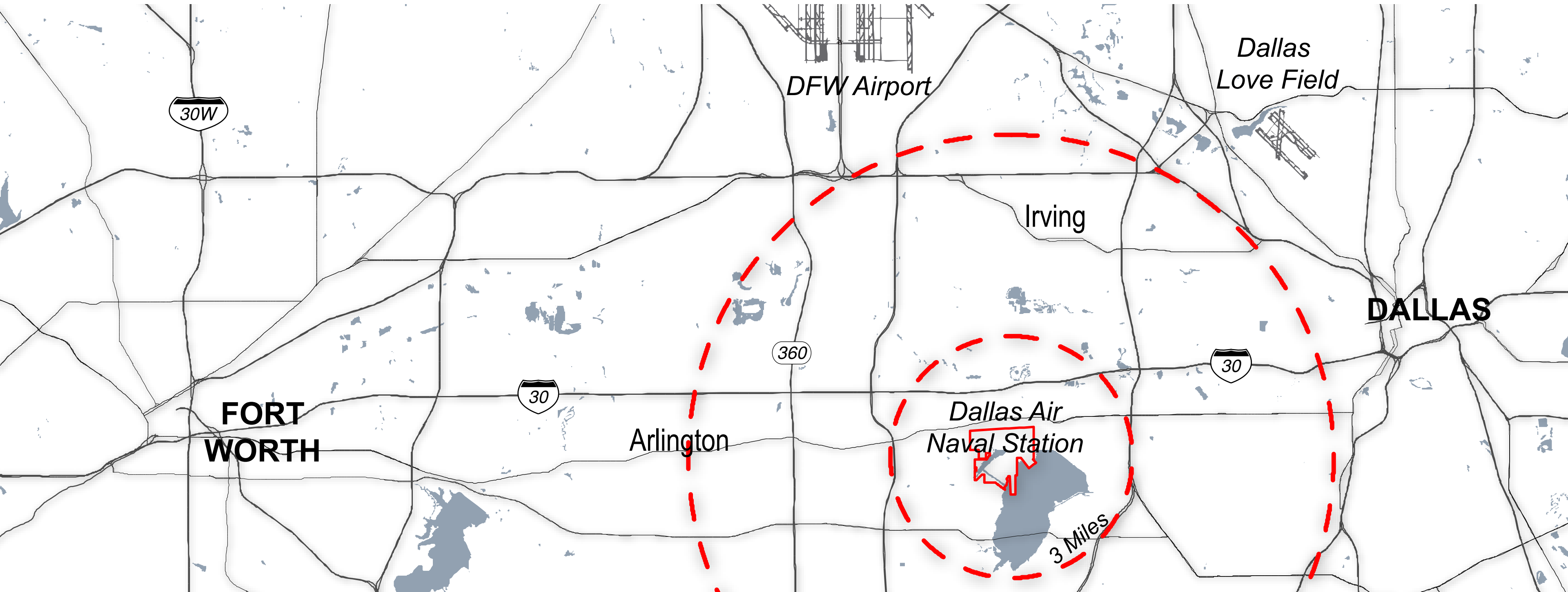
Dallas's Current and Future Issues

Perhaps now more than ever, the future of cities is uncertain. Our globalized world is systematically connected socially, environmentally, and economically. Shifts within these systems can directly impact urban development and ecosystems. In Dallas, the city is facing many predicted and unknown issues. Climate change, for example, will likely have severe, adverse effects on the natural and built environment (Macon 2017). Based on the Nature Conservancy's future climate models, Dallas could see a temperature rise of 4 degrees (F) by mid-century (2050s) and a rise of 6 degrees (F) by the end of the century (2080s). These future conditions will have a significant impact on essential ecosystem services such as agriculture, water supply, health, and recreation. Issues stemming from climate change are predicted to impact the economy, income inequality, and public health too (Macon 2017).

Currently, in the Dallas Fort-Worth area, the major social issues that are of concern are homelessness, affordable housing, poverty, and obesity (Vision North Texas 2010).

Environmental issues include: air and water pollution, renewable energy, sustainable agriculture, heat island effect and loss wildlife habitat (Environment Texas n.d.).

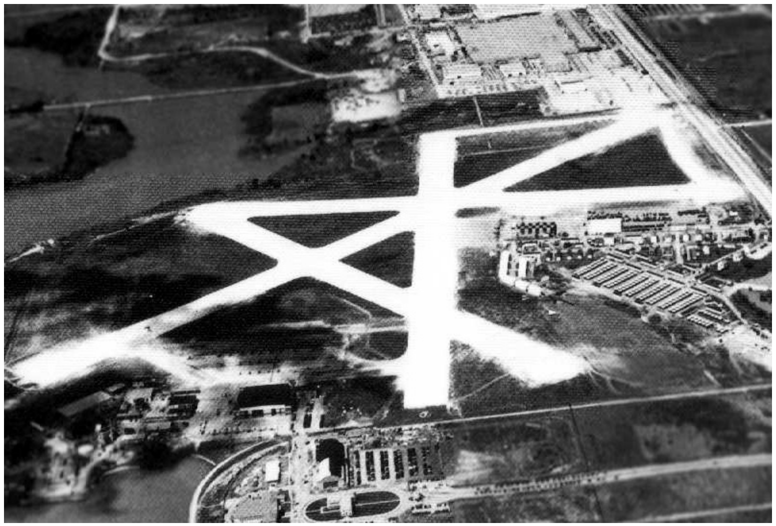
Figure 1.3: Dallas Air Naval Station Context (Sundine, 2018)



Previous Conditions of DANS

Figure 1.4: Final Fixed-wing Aircraft at DANS (Freeman, 1993)

Figure 1.5: Two North American F-86L Sabres (Crosby cited by Freeman, 1960)



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Current Conditions of DANS

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Figure 1.11: Aerial View of Abandoned Hanger (Freeman, 2002)

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Figure 1.14: Largest Abandoned Hanger (2Xploration, 2005)

Research Questions

How can ecosystem services inform an urban design framework that lends itself to more flexible and adaptive design?

How can an ecosystem service urban design framework be applied to a brownfield site, to catalyze short-term redevelopment, while allowing for flexibility and adaptability in future development phases?

How can the Dallas Air Naval Station be redeveloped to add value to the surrounding community, while addressing Dallas's most pressing current and future social and environmental issues?

Project Goals

1. Demonstrate how ecosystem services can be utilized to inform a framework for adaptive urban design

2. Address known and predicted social and environmental dilemmas in Dallas through the application of an ecosystem services urban design framework

3. Apply the ecosystem services urban design framework to the Dallas Air Naval Station through an open-ended plan that provides short-term value and long-term flexibility

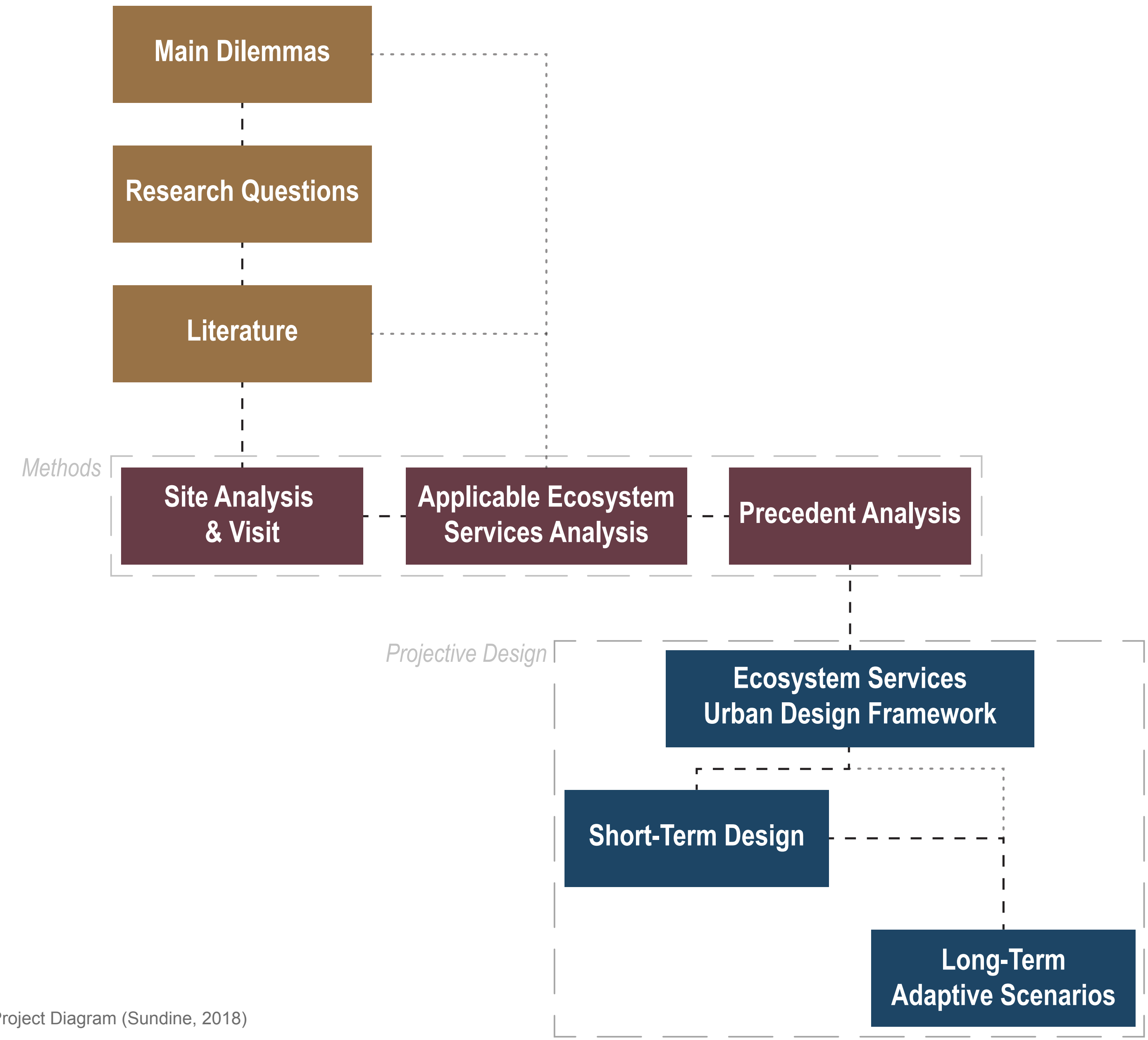


Figure 1.15: Project Diagram (Sundine, 2018)

2.0
Literature Review

Literature Map

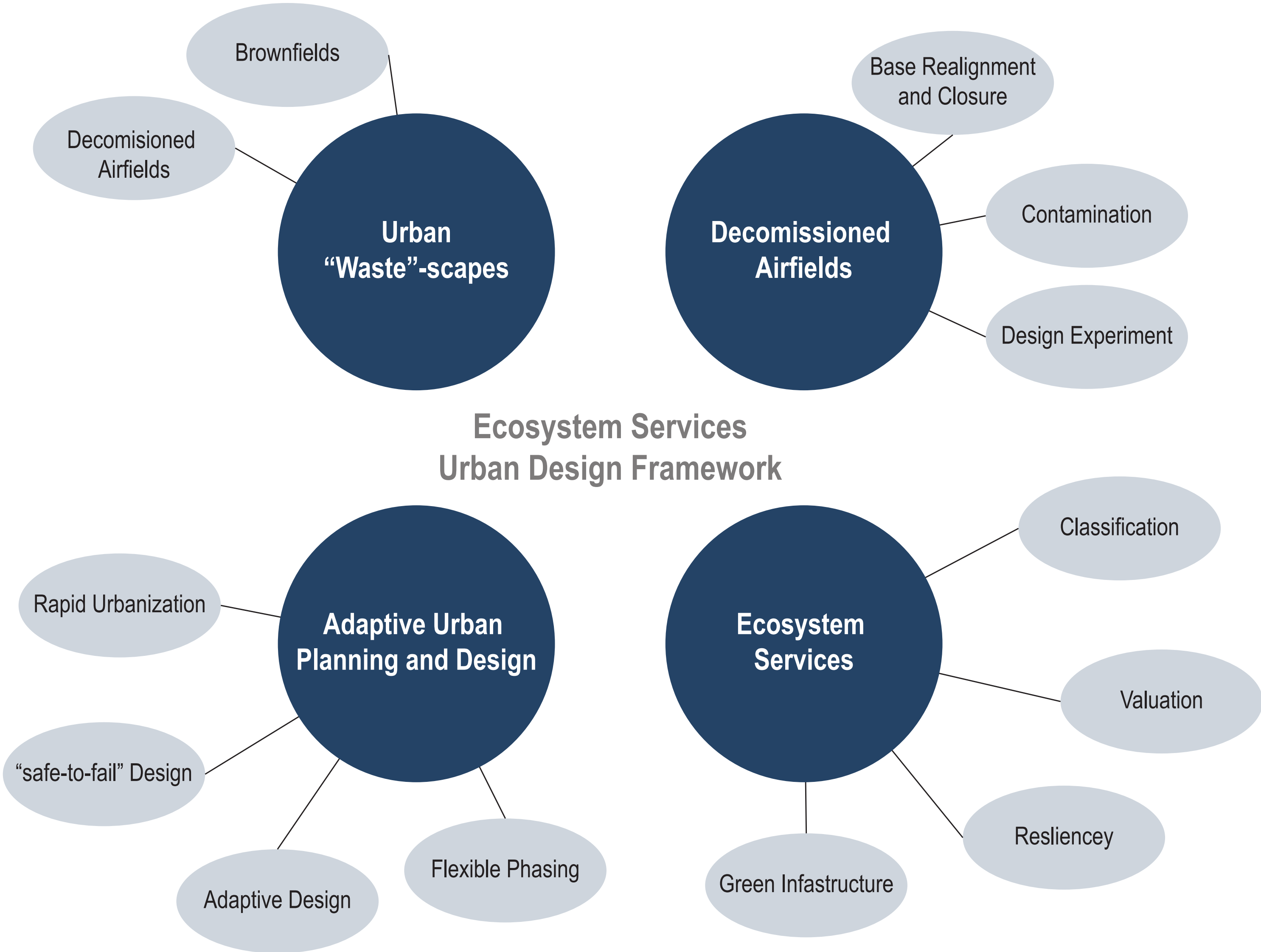


Figure 2.1: Literature Map (Sundine, 2018)

2.1 - Urban "Waste"-scapes

Due to continuous urban sprawl over the past half-century, there has been an increase in abandoned urban sites. Adaptively reusing 'waste landscapes' (brownfield sites) will be one of the twenty-first century's great infrastructure design challenges (Waldheim 2006, 199). "A brownfield is a property, the expansion, redevelopment, or reuse of a site which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (US EPA 2014). Brownfields are often considered a sustainable land-development practice because the sites have been previously developed, rather than 'Greenfield' sites, like farmland and forests, which have never seen development (Hollander, Kirkwood, and Gold 2010, 2–3). The EPA estimates more than 450,000 brownfields are located within the U.S., and with continued urbanization, that number will likely to grow.

Brownfields present a strong case for redevelopment because of the environmental, social, and economic impacts they create. Brownfields are often located is neighborhoods that are characterized by low-income, poor infrastructure, high crime, and blight (Essoka 2010). Brownfields can pose serious public health and environmental hazards for surrounding communities. Though these sites leave a significant impact, they provide opportunities for new development that surrounding communities need. The opportunity to reuse these sites can have a positive impact on the quality of life in the surrounding neighborhoods such as reduced crime, enhanced environmental quality, and improved property values (Hollander, Kirkwood, and Gold 2010, 3). Brownfields can come in many shapes and sizes, but the decommissioned airfield is one of the most distinct types.

2.2 - Decommissioned Airfields

Decommissioned airfields have some of the most unique redevelopment opportunities within urban contexts because of their size and location. Urban sprawl in the twentieth century led to many new industrial, commercial, and housing developments to grow outside of cities; thus, airfields located outside of cities eventually became surrounded by new, sprawling developments (Dümpelmann 2014, 249). Decommissioned airfields present a rare opportunity for reutilization because they are essentially a blank slate, with large centralized open spaces, relatively flat topography, a lack of vertical structures, and absence of vegetation. And when located in urban areas, decommissioned airfields are especially valuable for developers and surrounding communities, with potential for urban infill developments.

The value of vast amounts of land at closed airfields can be seen by a comparison of popular public parks in the United States. Central Park in New York City is 543-acres, and the Boston Commons and Public Gardens are 50-acres. Some of the most recent decommissioned military bases like the Marine Corps Air Station El Toro in Southern California is 4,682-acres and Crissy Field in San Francisco is 130-acres. These significant tracts of land give opportunities to designers, engineers, architects, and others to experiment with new urban design strategies. In the near future the possibility of redeveloping decommissioned military airfields will continue to grow.

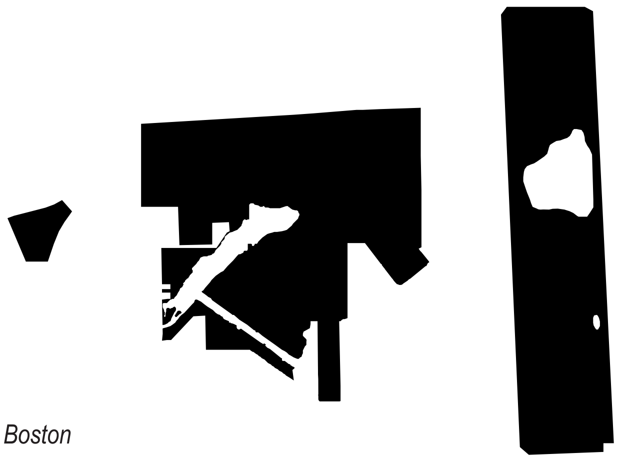


Figure 2.2: DANS Size Comparison (Sundine, 2018)

Military Airfield Closures

In 1988, the Department of Defense (DoD) created the Base Realignment and Closure (BRAC) to reorganize military force structure to create a more efficient system. “The BRAC Commission was formed to provide an objective, thorough, accurate, and non-partisan review and analysis, through a process determined by law, of the list of bases and military installations which the DoD has recommended be closed and realigned” (BRAC 2005). The main criteria used for base closures include: current and future mission capabilities; availability and condition of land; facilities and airspace; the ability to accommodate for total force requirements; and, cost of operations and the workforce implications. Other considerations are the potential cost savings, the economic impact on existing communities, infrastructure conditions, and environmental impact (BRAC 2005).

Since 1988, there have been five BRAC rounds consisting of over 200 major base closures and realignments; recently the Pentagon has asked Congress to create another round of BRAC, possibly within the next five years to decrease nonessential military infrastructure (Maucione 2017). In the process of redevelopments, environmental cleanup can be a significant hurdle for most airfield closures and will continue to play a significant role in redevelopments of airfields.

Today hundreds of active military bases are still contaminating the environment and causing stress on local communities (Roels, Smith, and St. Clair 2017). Whether an active or decommissioned military base, there is much environmental clean-up needing to be done that will continue to cost billions of dollars. Current military base redevelopments have seen challenges to remediation due to delays from military officials, causing local communities to wait until their land has been completely remediated before having an option to re-use for redevelopment.

These sites contain a significant number of impervious surfaces and soils that contain chemicals such as oil, gasoline, and deicing fluids that require remediation before reuse. Unfortunately, many chemicals the military used in the past are not biodegradable and necessitate more time and money for remediation to occur. Often the future uses of the land are based upon the various military operations that previously occurred such as firing ranges to be used as open space for wildlife refuges, endangered and threatened species habitat, and limited recreation areas, but will still be able to be utilized in a way that is beneficial for all. With the challenges that most decommissioned airfields will have, they can still provide the opportunity to explore future design challenges that can create adaptive urban design models that will understand how to use the site efficiently.

2.3 - Adaptive Urban Design

Background

Continuous changes in today's cities make it challenging for urban designers and planners to address changing issues and plan for them accordingly (Rauws and De Roo 2016, 1052). Because of these changes, new developments based on an 'end-result' are no longer appropriate since city's dynamic systems makes predicting the future difficult (Schilders 2010, 53). "The traditional professional timeframe mandates an 'imperative to act' that relies on readily available, existing knowledge and established best practices – typically without the opportunity to conduct new research. This imperative tends to favor decisions based on existing knowledge and to inhibit innovation" (Ahern et al. 2014, 255). On the other hand, adaptive design processes and approaches allow a project to explore innovative practices, tools, techniques, and methods that are informed by ecological knowledge and research design.

Adaptive projects can take place on a small spatial extent to allow "safe-to-fail" design experiments (Ahern et al. 2014). Relative sized sites such as decommissioned airfields can allow for failure that do not have endangering effects on an entire community, ecosystem, watershed, or habitat (Beardsley 2007, 46). Through the process of allowing for failure, ecosystems can become a learning opportunity for adaptive design rather than a liability. The main idea of an adaptive approach is not to aim for a particular future configuration, but to have an understanding of current conditions and aim to support a range of future configuration based on predicted conditions
(Rauws and De Roo 2016, 1053).

Realizing that landscapes reflect the coupling of human and natural systems, requires a change of thinking from landscapes as having a steady state, to landscapes that are dynamic and can better foster resiliency (Mooney 2014, 146). The resilience theory provides a base for adaptive urban design to give a new perspective and possible solutions. To make adaptive urban design more effective and strategic, resilience needs to be informed by the environmental, ecological and social drivers and dynamics of a place (Ahern 2011, 342). Adaptive design processes that can promote resiliency and flexibility can greatly benefit the needs of a community, as the design can be manipulated to meet the current needs.

Flexibility of Landscape Design

The complexities that follow the closure of an airfield can inhibit the speed of the possible redevelopment; thus, the utilization of the site conditions is a vital piece of the complex systems. For brownfield sites, there is often negative connotations, whether environmentally or socially. Through adaptive urban design, redevelopment can prioritize the most important needs of the community immediately after an airfield closure. By having the availability of the land gives opportunities to change the soils conditions, plant trees, give a site positive attributes and controlling the development can have a significant impact in a strategic redevelopment (Intermediate Natures: The Landscapes of Michel Desvigne 2009, 37).

Because of the size of an airfield, the flexibility of redevelopment must be considered to utilize the land efficiently and begin to allow for adaptation over time. “Landscape is a medium uniquely capable of responding to temporal change, transformation, and adaptation” (Waldheim 2016, 15). The changing of a site’s landscape can help in the redevelopment of closed airfields through environmental processes, interim land uses, evolving needs of the public, and gaining the public’s acceptance. This unprecedented urbanization gives emphasize for the need of innovative approaches to generating knowledge before, during and after the design process in an adaptive mode (Ahern, Cilliers, and Niemelä 2014, 255). Utilizing the elements of the site’s landscape that can provide a benefit to the human well-being can provide structure to an adaptive design process

2.4 - Ecosystem Services in Urban Design

Background

"Everyone in the world depends completely on Earth's ecosystems and the services they provide, such as food, water, disease management, climate regulation, spiritual fulfillment, and aesthetic enjoyment. Over the past 50 years, humans have changed these ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel" (Millennium Ecosystem Assessment (Program) 2005, 1). Drastic changes in ecosystem services have a direct effect on human well-being. Ecosystem services are defined as, "The direct and indirect contributions of ecosystems to human well-being" (TEEB n.d.). The Millennium Ecosystem Assessment (MEA) has defined human well-being to include: basic material for good life; choice of freedom; health; security; and, good relations. Each of the five categories of the human well-being are interrelated and can affect one another. Because ecosystems are so vital to human well-being, effective management of these resources is essential. Yet, we already see consequences from lack of management. Figure 2.4 depicts the strength of relations between ecosystem services and human well-being from the study conducted by the Millennium Ecosystem Assessment.

As we grow into a more urbanized society, our use of the Earth's services will continue to rise, and our demands for ecosystems services will continue to multiply. Yet urbanization continues to alter the ability of ecosystems to be healthy, functional, and capable of providing services (Ahern 2011; Costanza et al. 1997). In 2005, 1,300 scientists examined the current state of ecosystem services during the Millennium Ecosystem Assessment; their findings were that approximately 60% (15 out of 24) of the defined ecosystem services are being degraded or used unsustainably. "Management of this relationship is required to enhance the contribution of ecosystems to human well-being without affecting their long-term capacity to provide services" (Millennium Ecosystem Assessment (Program) 2005, 27). Many governments have begun to recognize the need for the effective management of these services to fulfill necessary life-support systems (Millennium Ecosystem Assessment 2003, 28). The use of ecosystem services can help provide the ability to manage future issues that may arise socially, environmentally, and economically.

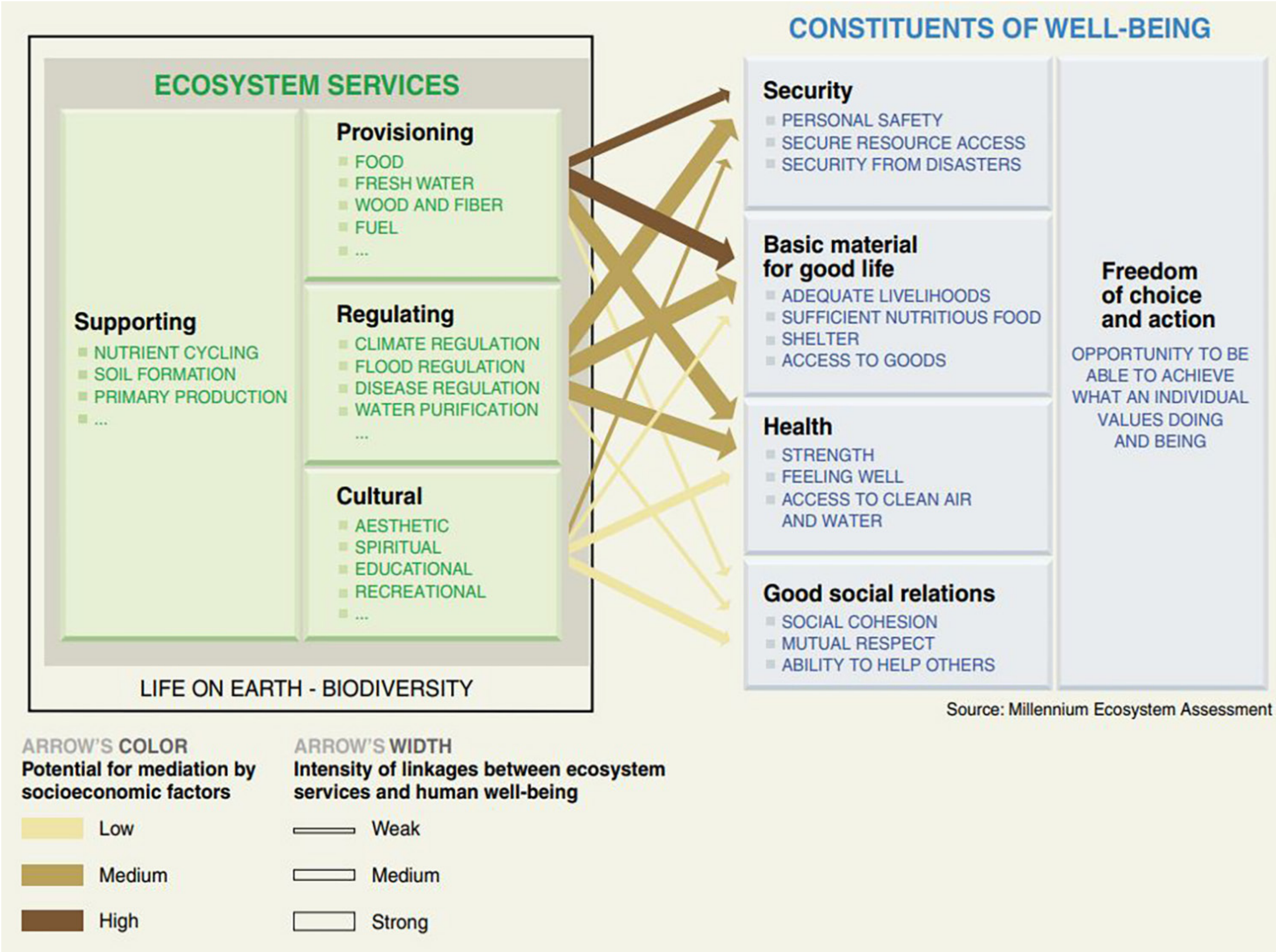


Figure 2.3: Strength of Ecosystem Services to Human Well-Being (MEA, 2005)

Classification of Ecosystem Services

In the early 2000's, an understanding of how humans impact ecosystem functions led to the development of several classification systems and performance indicators to categorize and evaluate ecosystem services, in both the natural and in built environments. The 2005 Millennium Ecosystem Assessment classified ecosystem services, into four categories: provisioning, regulating, supporting, and cultural services.

Provisioning Services are ecosystem goods and services that provide direct utilitarian value to people and include fuel, timber medicinal resources, and potable water.

Regulating Services include climate regulation, regulation of air quality, erosion control, and water purification.

Supporting Services maintain the production of other services and include habitat, soil formation, and oxygen production.

Cultural Services provide non-material benefits such as cognitive functioning, recreation, and aesthetic experience
(Millennium Ecosystem Assessment 2005, TEEB n.d., Mooney, 2014).

Together these ecosystems services provide the basic elements critically important to human well-being. As depicted in figure 2.5, ecosystem services are inner connected systems of direct and indirect drivers of change that correlate strongly with human well-being. Direct drivers that change well-being include: species change, harvest consumption, resource consumption, and climate change having direct drivers of change on well-being. While, indirect drivers of change such as population, technology, and cultural lifestyle can lead to some changes in the direct drivers and human well-being. The strength of these links can occur over many spatial and time scales. Because of the inner connected systems, ecosystem services can become insurances, allowing cities to become more resilient by the implementation of design strategies to promote long-term investments. In the process of understanding the importance of classifying ecosystem services, the classification of each service can be transformed into measurable performance values.

Valuation of Ecosystem Services

Valuation is about assessing the trade-offs toward achieving a goal (Costanza, 2014, 153). The fact that people derive benefits of ecosystem services has to be the primary goal to valuing individual ecosystem services and the goals of valuing individual ecosystem services is a relative contribution to the primary goal. The valuation of ecosystem services can be beneficial in informing urban design by raising awareness of economic accounting, priority-setting, incentive design and litigation (TEEB n.d., Barton et al., 2012).

When working with the valuation of ecosystem services, the valuation often deals with multiple scales and dimensions that can be conflicting (Elmqvist et al. 2013, 189). For example, large street trees may be seen positively in providing shade, aesthetic benefits, reducing heat island and carbon sequestration; while others may see them as a nuisance because of the leaf litter, reduced sunlight, and blocking of views. Trade-offs of ecosystem services will always be occurring; some services will

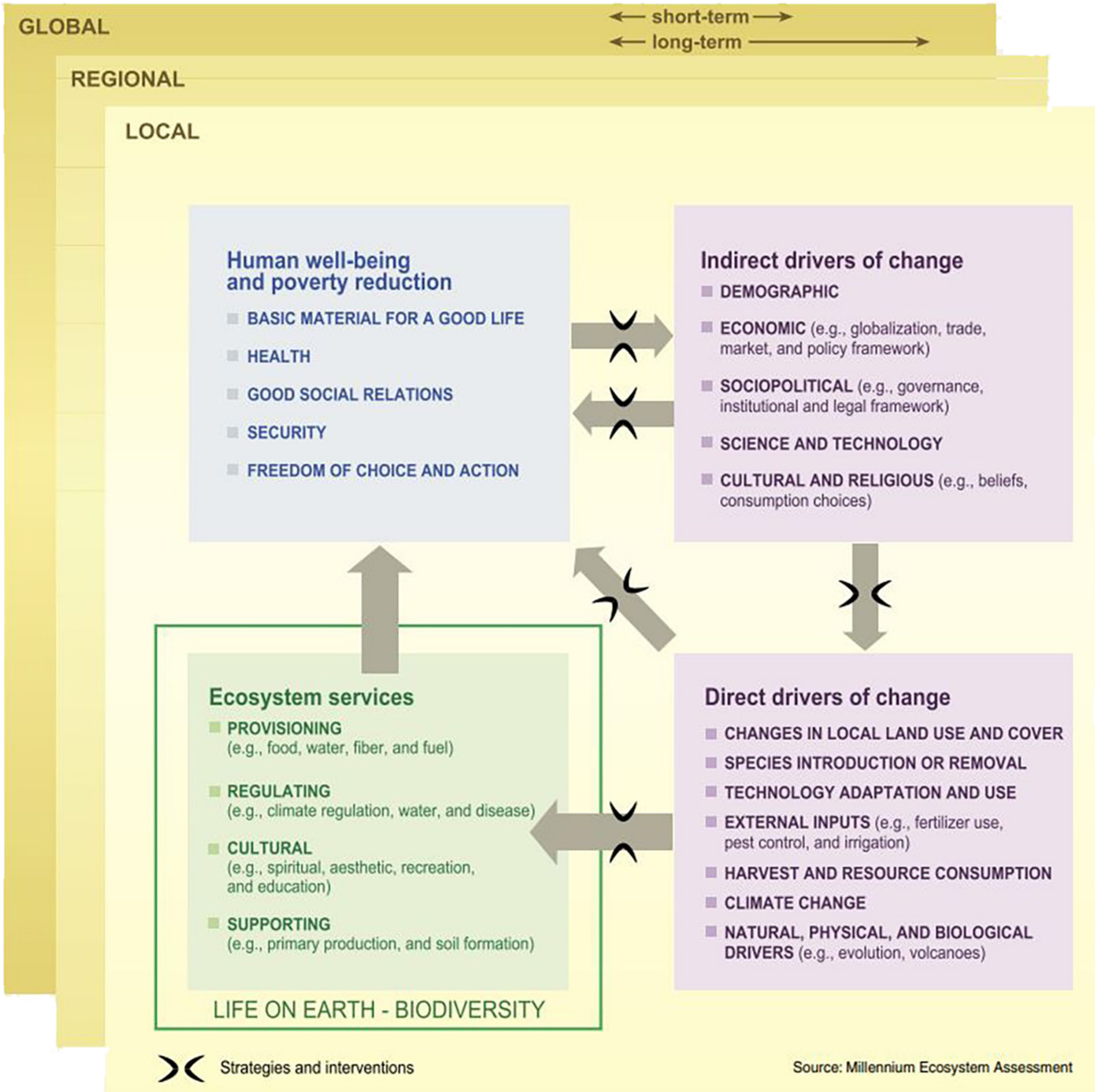


Figure 2.4: Drivers of Change in Ecosystem Services (MEA, 2005)

perceived well and some may be seen as a disservice (Elmqvist et al. 2013, 237). With individual ecosystem service valuation, each service will derive its own benefits, but in different scenarios a priority must be placed on each ecosystem so that it may contribute to the central goal of the human well-being. At any site or regional scale, ecosystem services need their own priority based upon the community need and should reflect in the design features and components that are essential to the appropriate level of priority (Windhager et al. 2010, 111).

Since the 2005 definition of ecosystem services from the MEA, several organizations have begun to develop other models that explore how to use ecosystem services as a metric for assessing sustainable site design. Most metrics of ecosystem services are defined by qualitative, monetary, and qualitative definitions. Planners and designers seek standardized indicators and metrics that are understandable, transferable, robust and defensible with the goal of developing a common baseline of set measures (Ahern, Cilliers, and Niemelä 2014, 256). Organizations such as The Sustainable Site Initiative (SITES) and Landscape Performance Series (LPS) have begun to develop metrics that will help in the goal of creating common metrics that will be understandable to the public, designers, planners, and stakeholders.

The SITES (Sustainable Sites Initiative 2009a, 2009b, 2013) and the LPS (Landscape Architecture Foundation 2012) have become widely used in performance-based design and evaluation. Both SITES and LPS give good measures to assess benefits and performance of a design, but neither SITES or LPS have a basis for identifying and selecting ecosystem service that responds to the specificity of the design program and biophysical characteristics of the site and existing features (Mooney 2014, 147). From the use of SITES and LPS, there is a lack of connection between design practice and delivery of their connected ecosystem services. More connections of design and ecosystem service can be developed through future research of specific metrics from multidisciplinary efforts, but the utilization of ecosystem services is inherently spatial. The foundation of decision making with ecosystem services is still being built but understanding more of the spatial planning and design can continue to help inform how we can implement ecosystem services as design features (Tammi, Mustajärvi, and Rasinmäki 2017, 329).

Resiliency in Ecosystem Services

Because of the resiliency of ecosystems, they can become a source of insurance to protect the human well-being in cities, by enhancing the capacity to deal with environmental and socio-economic shocks (Gómez-Baggethun and Barton 2013, 204). Resilience is defined as the capacity of the system to respond to change or disturbance without changing its underlying state (Walker and Salt 2012). The evaluation of resiliency in a design can be base upon the selection and extent of identified ecosystem services that were delivered (Mooney 2014, 149). In future urban design, information needs to be gathered about past trends and predictions of the future to have an informed designed to promotes resilience. Utilizing the identified needs through classified ecosystem services, resiliency can be promoted through redundancy, multi-scale networks and multifunctionality in designs that allows for each service to have its contribution to promoting the human well-being. Ecosystem services that are not fully considered can cause further degradation of ecosystems. An ecosystem services design approach can conserve and enhance ecosystems to reverse the degradation (Mooney 2014, 141).

The complexity and characteristics of urban mosaics have many different spatial boundaries and land uses associated, because of the dynamics of a location is to be especially important (Gómez-Baggethun et al. 2013, 204). Due to the fact that we are continuing to degrade ecosystem services in the urban and natural environment, the development of more urban ecosystem services and ecological infrastructure can be a major key in reconnecting cities to the biosphere, restoring local commons, reducing ecological footprints, orchestrating disciplinary fields and stakeholder perspectives, and guiding policies to improve quality of life in cities (Gómez-Baggethun et al. 2013, 238). Having the ability to reconnect cities, we must make ecosystem services simplified and understandable to the public through the built environment.

Use of Green Infrastructure for Ecosystem Services

Ecosystem services can become complicated and unrealistic for the public to understand, but to gain their understanding and awareness, built infrastructure will have to become the ultimate link to allow ecosystem services to be perceived as a benefit (Costanza et al. 2014, 153). Making ecosystem services more understandable through built infrastructure, specifically, green infrastructure can be easily relatable for ecosystem service. Green infrastructure or Low Impact Development (LID) can offer 17 ecosystem services such as: local climate, air quality; water regulation, soil fertility, pollination, habit, recreation, etc. (University of Arkansas 2010, 13). “Green infrastructure delivers measurable ecosystem services and benefits that are fundamental to the concept of the sustainable city” (Ahern, Cilliers, and Niemelä 2014, 255). The spatial characteristics of ecosystem services and interrelations are in need to move from an assessment tool to a practical instrument for planning and design (Troy and Wilson 2006, 203–4). Through the utilization of green infrastructure, we can use ecosystem services for design as a practical instrument, allowing for a wide range of adaptive design experiments to solve the most pressing issues.

3.0

Methodology

Methodology

The purpose of this design methodology is to demonstrate how ecosystem services can inform an urban design framework and how that framework can be applied to the DANS site for short-term value and for long-term adaptability. Thus, this research uses projective design. A projective design is a design project that serves as a vehicle for experimentation and research to contribute to the discipline of landscape architecture (Deming and Swaffield 2011a, 208–9). The specific research methods used include:

- Site Inventory, Analysis and Visit
- Applicable Ecosystem Services Analysis
- Precedent Analysis

Findings from these analyses will inform the Ecosystem Services Urban Design Framework. The framework will first be applied to the DANS site to show a short-term urban redevelopment vision that considers Dallas' current issues and needs. The framework will be applied again to show how long-term adaptive urban design scenarios can be developed to address uncertain potential future conditions. Figure 3.1 shows the process of using methods to inform the projective design for the Dallas Air Naval Station.

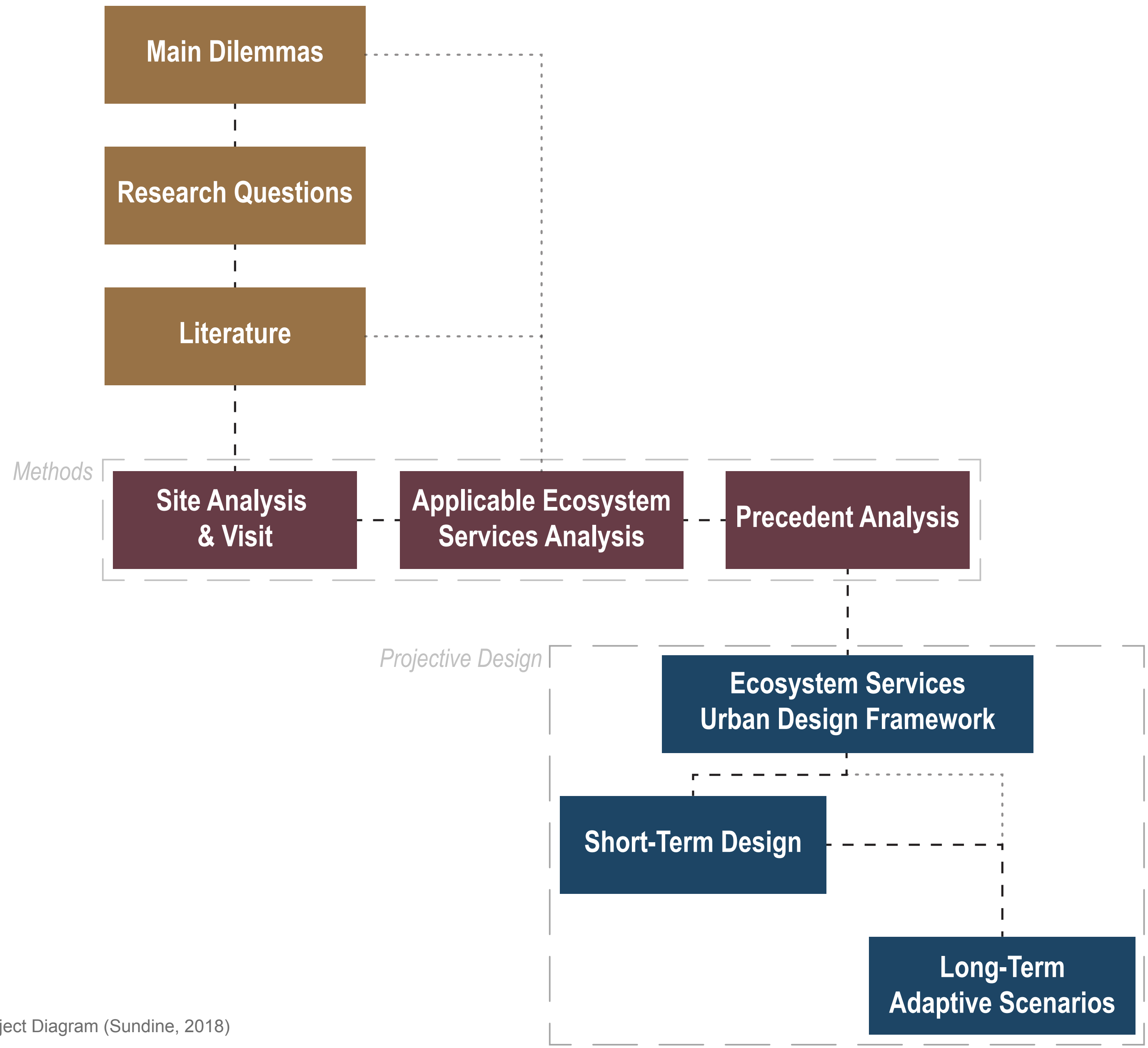


Figure 3.1: Project Diagram (Sundine, 2018)

Methods

Site Inventory, Analysis, and Visit

In the book Site Analysis, author James LaGro Jr. states, “site inventory is an essential step in understanding the character of the site and the physical, biological, and cultural linkages between the site and the surrounding landscapes” (LaGro Jr. 2011, 169). A site inventory and analysis conducted for the DANS will be used to understand the dynamic relationships on site. Understanding the condition of on-site elements, can present design opportunities and constraints of the site, and help identify applicable ecosystem services to be addressed in the Ecosystem Services Urban Design Framework.

The site inventory and analysis is conducted at three different scales: regional, district, and site. The regional scale boundary is an 8-mile radius and the district scale boundary is a 3-mile radius from the center of the DANS site. The boundaries include parts of Arlington, Dallas, Duncanville, Grand Prairie, and Irving. The site scale boundary is defined by: E. Jefferson St.; S.E. 14th St; the Grand Prairie Armed Forces Reserve Complex; and, Mountain Creek Lake.

At the three scales, physical, natural, and social/cultural attributes are examined. Regional attributes to be mapped include: climate, threated and endangered species, and transportation. District attributes to be mapped include: amenities and character of the surrounding neighborhood. Much of the analysis will occur at the site level which will include: historical site uses; current conditions; contaminations; topography and hydrology; and, circulation and views.

Data will be primarily collected from federal agencies that have released information on the Freedom of Information Act (FOIA), and from county websites that contain content in geographic information system (GIS) format. The data collected will be used to create site maps that will display the analysis of the site.

The purpose of a site visit is to see the first-hand current state of the site, including on-site structures and current uses. Primary means of data collection on-site will come from site photos and (qualitative) visual observations. It is anticipated that the site visit to the DANS will occur late November and last 2 hours. Access to the site will be provided by Bret Stone, Army Reserve Retiree. After the on-site visit, an aerial flyover of the site will be conducted with the assistance of Reed Sundine. Photos and notes from the visit will better inform the understanding of the site and how the information can inform the projective design.

Applicable Ecosystem Services Analysis

The purpose of identifying applicable ecosystem services is to create a list of those that are most viable and suitable for presence on the DANS site. This list of applicable ecosystem services will be informed by site conditions, identified dilemmas of the Dallas region, and literature including: The Millennium Ecosystem Assessment (MEA), The Economics of Ecosystems and Biodiversity (TEEB), Landscape Performance Series (LPS), Sustainable Sites Handbooks (SITES), and other relevant sources. The narrowed list of applicable ecosystem services will then be used to inform a structure for the design precedent analysis.

Precedent Analysis

The purpose of conducting this precedent analysis is to collect information that can inspire and inform ecosystem services design-based strategies. From 2016 the book *Airport Landscape* by Dumpelmann and Waldheim, 18 airfields will be analyzed to understand design programming and elements, and presence of ecosystem services.

These 18 projects were selected because of the available information, similarities to the scope of work proposed for the DANS, and because the majority are completed or in progress to become completed. All 18 projects will be listed in a table and analyzed through the lens of applicable ecosystem services. This table will show the priorities of airfield redevelopments and priorities of ecosystem services.

From the initial 18 airfield redevelopments, four will be selected for further analysis. The goal is to show in greater detail different redevelopment scenarios. These four will be selected based on available information, unique design programming, relative site size to the DANS, and their locations with similarities to the DANS location. Through this detailed analysis, we can understand innovated design strategies, phasing, programming, and the priorities of ecosystem services which can help shape the scope of work needed at DANS. To standardize the collection and preparation of information an analytical framework was developed and includes the following components:

1. Location | Size | Year | Progress
2. Why Selected?
3. History & Context
4. Design Concept
5. Ecosystem Services Used
    - Design Strategies
6. Adaptive Planning
7. Criticism
8. Take Away

This framework will be applied to the four sites. Data will primarily come from *Airport Landscape*, but other sources may be used as a supplement.

Summary

Collective findings from the site inventory, analysis, and visit; applicable ecosystem services analysis; and precedent analysis will help inform the development of the Ecosystem Service Urban Design Framework tailored for use of the DANS site.

Chapter Summary

This chapter presents the outcomes from the site inventory, analysis, and visit; the applicable ecosystem services analysis; and, the precedent analysis.

4.0

Findings

4.1

Findings

Site Analysis & Site Visit

Regional

Physical: Climate

Located in North Central Texas, in the hardiness zone of 8a, the city of Dallas experiences a wide range of weather events. The climate is humid subtropical with hot summers. Because of the continental location, there is a wide annual temperature and precipitation range with summer frequently exceeding 100F. Dallas is at the highest risk of natural disasters due to tornadoes, hurricanes, hail, wind, drought, and floods (Ericson, Burgess, and March 2011). Drought, extreme heat, and floods are the most connected to urban design possibilities. The City of Dallas Office of Emergency Management created a list of information of each possible disaster with tips to prepare.

- **Drought**: Find ways to recycle water, reduce irrigation needs and possible native plants, rainwater harvesting
- **Extreme Heat**: Limit outdoor activity during or have access to shade and water
- **Floods**: Understanding location about current floodplains, have constructed water barriers

The climate alone, shows the necessity to design for a wide range of climate activity because of the location of the DANS.

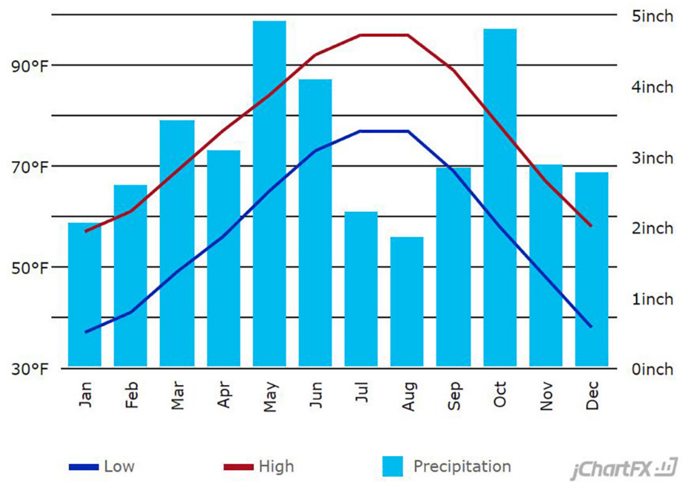


Figure 4.1: Dallas Climate Graph (U.S. Climate Data, 2018)

Figure 4.2: Trinity River Flood (Henderson, 2015)

Natural: Threated and Endangered Species

Designated Wildlife Areas

There are no designated wildlife management areas within the 8-mile region and city areas. Species likely to be found on, or predicted to return to, the site should be identified and accommodated.

Two threatened species are the Western Burrowing Owl and the Henslow's Sparrow. The Western Burrowing Owl prefers open grasslands and vacant lots near human habitation. The Henslow's Sparrow is fond in weedy fields with a key component of bare ground for running or walking.

No designated wildlife areas near DANS

Figure 4.3: Western Burrowing Owl (Dori, 2010)

Figure 4.4: Henslow's Sparrow (Reago; McClarren, 2017)

Regional

Social - Cultural: Transportation

Rail

The current public transportation in Dallas is centered around the Dallas Area Rapid Transit (DART) light rail system. Most of the rail lines for DART move North to South, with the Trinity Railway Express (TRE) connection between Dallas and Fort-Worth. Amtrak and freight rail lines run adjacent along the north side of the DANS but the freight rail lines does have existing connections to the site (see page 53). However, existing infrastructure near and on the DANS could allow for possible future connections to downtown Dallas and Fort-Worth.

Connecting Dart to the DANS site, could also help connect students at Dallas Baptist University, the stadium district for AT&T Stadium, and western residents of Dallas and Grand Prairie.

Figure 4.5: DART Rail System (RadicalBender, 2005)

Trails and Park Relationship

As seen in figure 4.27, there is a lack of regional trail connections from East to West. At the district 3-mile radius around the Dallas Air Naval Station, there is only one trail connection on the southeast side of Mountain Creek Lake, with a lack of trails anywhere else.

In future development in and around the Dallas Air Naval Station, the site can act as a trail hub to better connect Dallas and Fort Worth.

Legend

- DART Rail
- Amtrak Rail
- TRE Rail
- Freight Rail
- Trails
- Parks

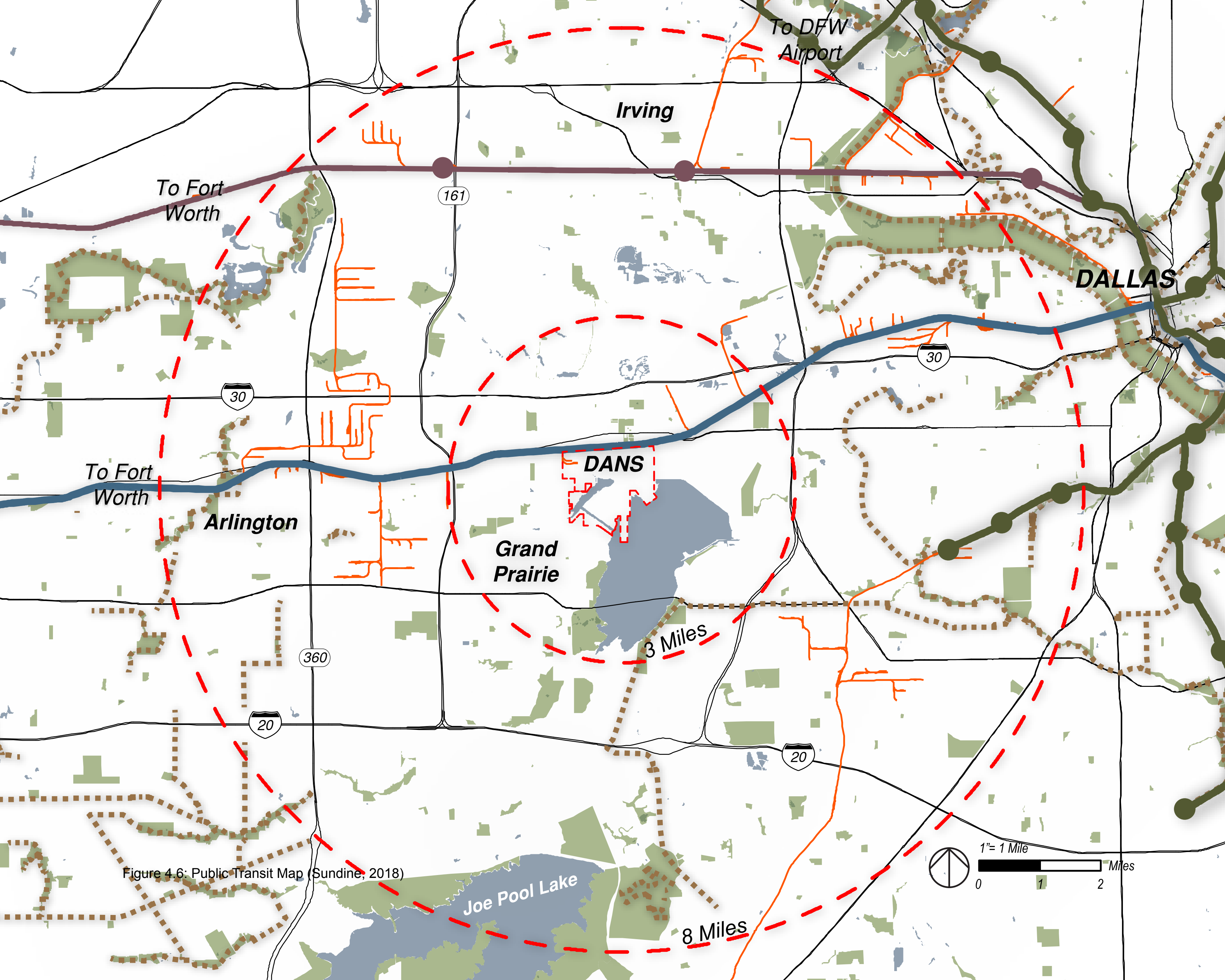


Figure 4.6: Public Transit Map (Sundine, 2018)

District

Social - Cultural: Amenities in the Neighborhood

Retail

Within district 3-mile radius of the Dallas Air Naval Station, there are only two grocery stores and three shopping centers. With an anticipated rise in population for the community around the DANS, on-site retail will be a necessity for the community. On-site options for retail and food will help limit the vehicular dependency and promote more on-site jobs.

Strip Center

Shopping Center

Grocery Store

Schools

There are several public schools in the district ranging from primary to higher education. The Dallas Baptist University is located across Mountain Creek Lake and could provide a significant attraction to the area for future residents. Similar to retail opportunities, a possible on-site school can benefit the local community in the education of the youth.

Higher Education

Secondary Education

Primary Education

Parks and Trails

There are no significant sized community parks within the district. A significant sized green space for the DANS community can provide a variety of amenities and public open space. Moreover, because the site is adjacent to Mountain Creek Lake, it can provide new trail connections to other parks, and allow for waterfront activities unlike many other parks in the district.

Legend

Existing Park

Community Center

Existing Trail

1 Prairie Park

2 Charley Taylor Park

3 McFalls Park

4 MCL Park

5 Prairie Lake Golf Course

6 MCL Boat Ramp

7 Dallas National Golf Club

8 Sunset Golf Club

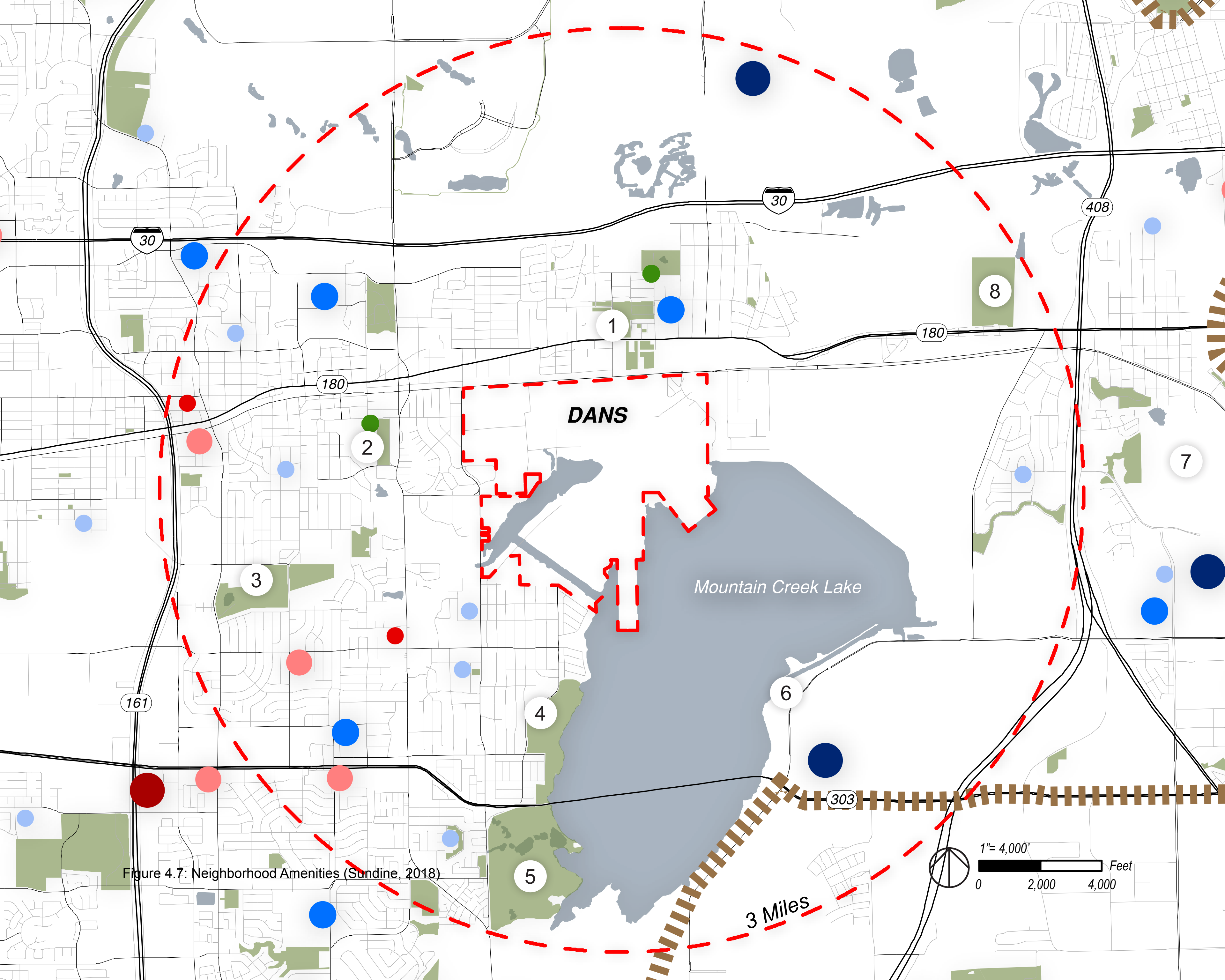


Figure 4.7: Neighborhood Amenities (Sundine, 2018)

District

Social - Cultural: Character of the Neighborhood

Because of the long aviation history at the DANS, there is a variety of existing land uses surrounding the site. Several pose unique opportunities for future redevelopment.

On the west and southwest parts of the site are residential areas that may be important to connect into. The northern and eastern parts of the site are characterized as retail and industrial, with several auto shops to the north. Considerations must be taken for the distances of the residential populations within the vicinity to industrial sites in regard to their health and well-being.

Variety of land uses surrounding the DANS

Figure 4.8: North Street of DANS (Google Street View)

Legend

- Single Family Residential
- Multi-family Residential
- Retail/Commercial
- Light Industrial
- Industrial
- Utilities
- Education
- Park
- Open Space
- Undeveloped Open Space

1 Lone Star Park
2 Grand Prairie Landfill
3 Regional Wastewater System
4 Exelon Power Plant
5 DFW National Cemetery
6 Dallas Baptist University

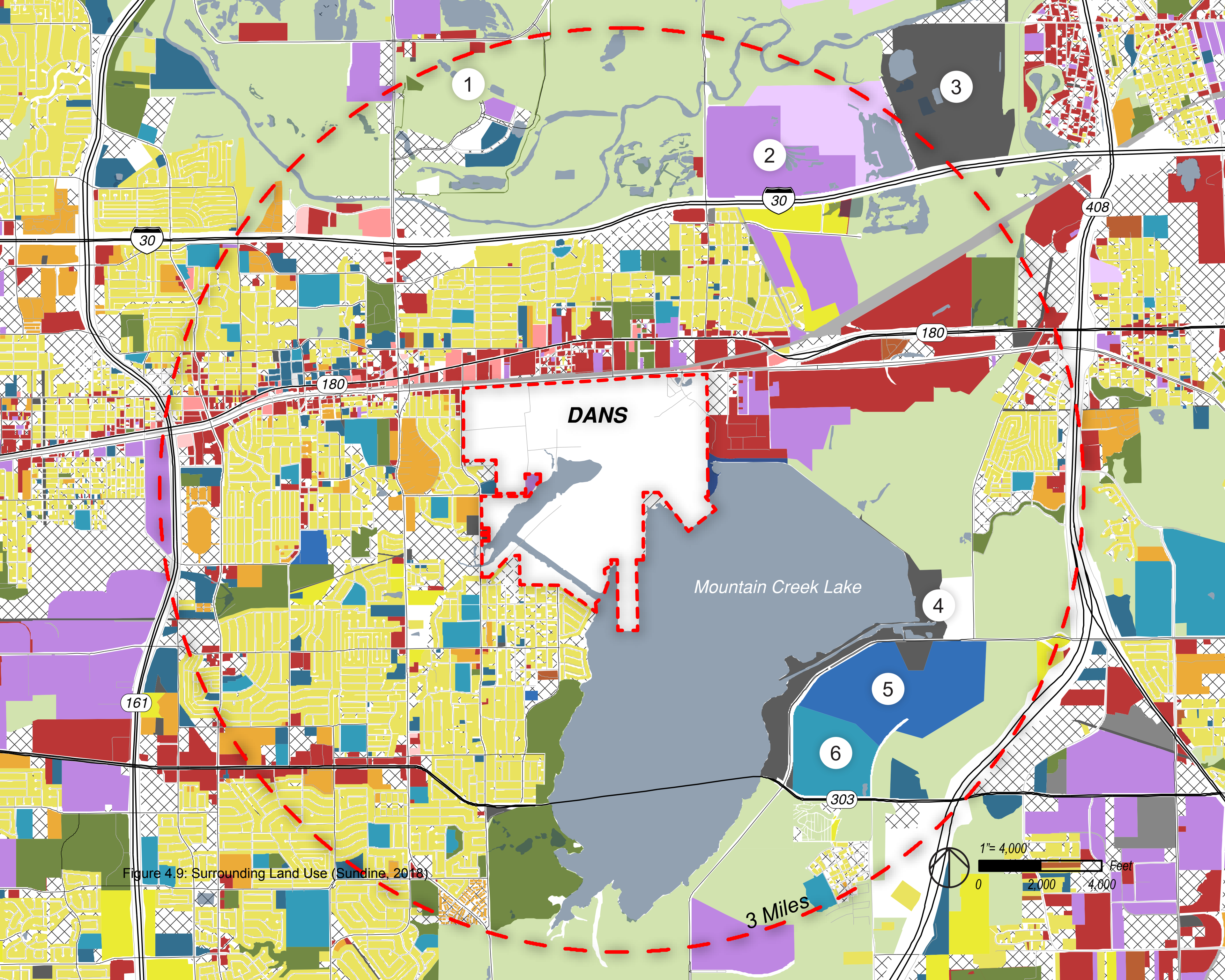


Figure 4.9: Surrounding Land Use (Sundine, 2018)

Site

Social - Cultural: Historical

With over 60 years of activity on the DANS, there are many historical and recognizable aspects to the public. When in use, the base had three active runways and eventually simplified to only use the currently visible north-south runway. The unique history of the concrete runways and taxiways shows, acting as a palimpsest, “something reused or altered but still bearing visible traces of its earlier form.”

There are many relic structures on site, such as control towers; hangers from Hensley field, DANS, and Vought industries; and structures from the Naval Weapons Industrial Reserve Plant. Many of these structures are not likely in useable condition but could still have possible future uses. Other airfield redevelopments have renovated decaying structures to create a new identity for the site.

Figure 4.10: Photos of Site History (Various Authors)

Legend

- Historic Runways
- In use structures
- Historic Structures

1 Naval Station Industrial Reserve Plant
2 Administrative, Recreational, and residential area.
3 Control Towers
4 Vought Industries
5 Hensley Field
6 Athletic Fields

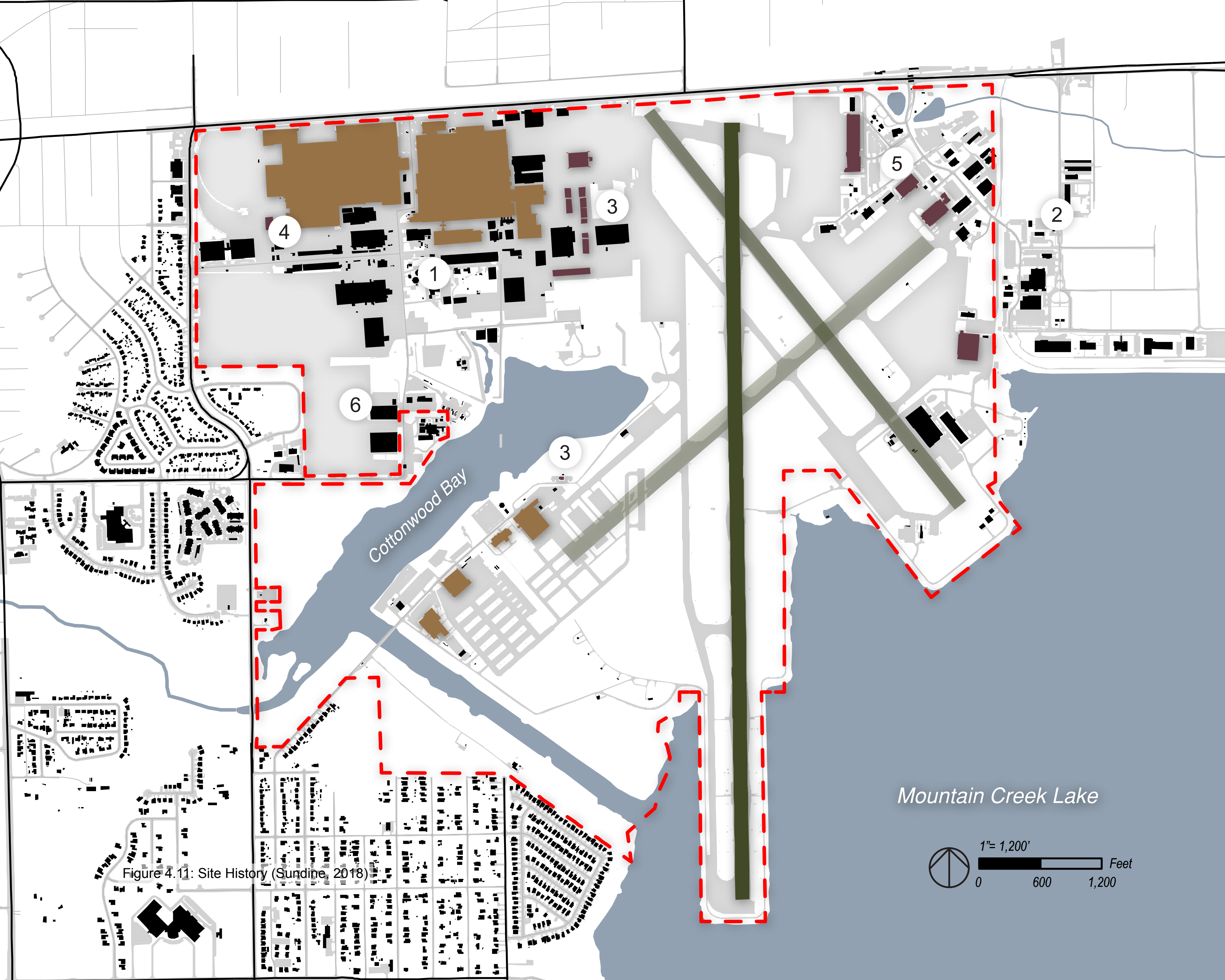


Figure 4.11: Site History (Sundine, 2018)

Site

Social - Physical: Current Site Conditions

For a source of revenue to the site, the city of Dallas has allowed companies to use portions of the site. General Motors is storing cars in the northeast corner, the Texas National Guards is using the southwest part of the site for pilot training, and Dallas Global Industries occupies the largest structures in the northwestern corner. These companies bringing economic gain to the site will have to be considered in the redevelopment process for a continuation of economic value until the site become self-sustaining.

As with most airfields in the world, there is a significant size of impervious surfaces. Of the 1045-acres at the Dallas Air Naval Station, it is made up of 40% of impervious surfaces alone, not including structures. A significant amount of concrete provides an opportunity for reuse of the materials.

Most airfields always have a lack of vegetation due to the uses of large expensive aircraft. At the DANS, the only on-site vegetation is surrounding Cottonwood Bay and the canal with overgrown vegetation. These overgrown areas can become an opportunity for future habitats that can be maintained. The rest of the site is prairie grass between runways and taxiways. These massive open spaces give the opportunity for future economic value such as a tree farm, agriculture, and future recreational fields for the community.

40%

Impervious Surface

Legend

- Impervious Surface
- Woody Vegetation

1 Dallas Global Industries
2 Hensley Field
3 Armed Forces Reserve
4 GM Car Storage
5 Cemetery
6 Texas Air National Guard
7 Undeveloped
8 Lockheed Martin
9 Echo Transportation

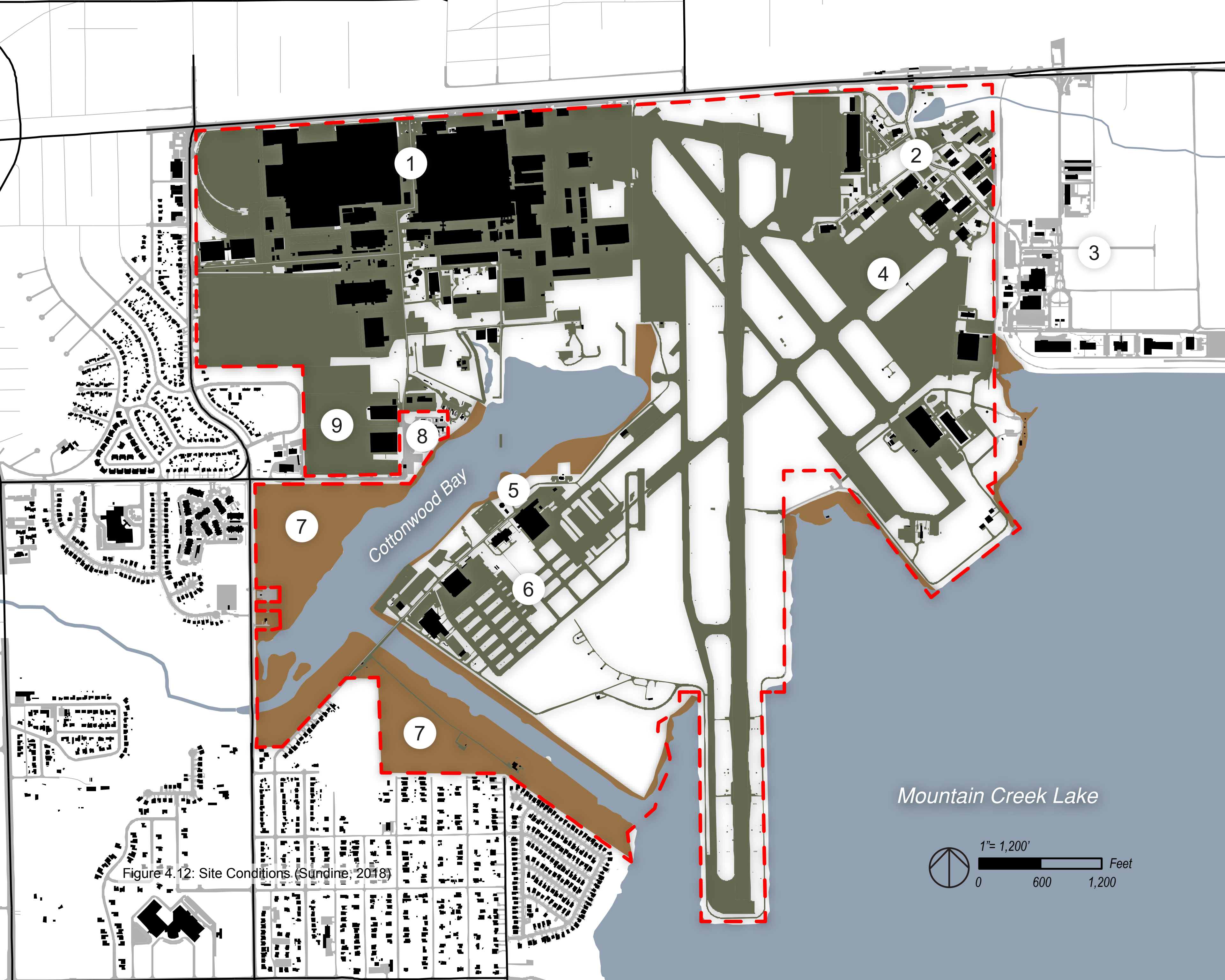


Figure 4.12: Site Conditions (Sundine, 2018)

Site

Physical: Contaminations & Soils

Soil

Currently, there is no soil contamination, reports have concluded that contaminated soils are remediated. From the Web Soils Survey, soils located on site are not in good condition. In the redevelopment process, soils have to be regenerated for specific uses.

Ground Water

The only contaminants that remain on site are toxic groundwater plumes. These plumes are located near hanger facilities that used an extensive amount of chemicals for aircraft maintenance. These plumes contain perfluorinated compound (PFC) and Trichloroethylene (TCE), these chemicals have been recognized by the EPA as emerging chemicals found in the use of fire suppressants. These chemicals are difficult to remediate through biological processes and would require costly extraction methods. In future design options, not allowing surface runoff to reach these plumes through infiltration will help limit the spread of contaminants.

Mountain Creek Lake and Cottonwood Bay

In 1997, the USGS conducted a chemical quality analysis of the water, sediment, and fish in Mountain Creek Lake and Cottonwood Bay. The report concluded that concentrations of selected heavy metals in the sediment bottoms of Cottonwood Bay were 2 to 4 times greater than Mountain Creek Lake, with the most significant concentrations near the National Weapons Industrial Reserve Plant (NWIRP) outfalls. The metals included cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc. From the stormwater outfalls of the site, volatile organic compounds (VOC) were identified, mainly from the NWIRP usage of solvent and fuel-related compounds. Currently, the Texas Parks & Wildlife Department, has a fish consumption advisory in effect, recommending to not eat fish due to chemicals found.
(Van Metre et al. 2003)

Even though the site can be a significant attraction next to Mountain Creek Lake, recreational activities promoted by the redevelopment may not be advised because of the current contaminations of the water. Possible freshwater ponds on-site may be more suitable for recreational activities for the community.

Legend

Main Contaminates
PFC Plumes
Unknown TCE Plume
Limit Water Infiltration
Groundwater Flow
1 Stormwater Drain
2 Landfill
3 Fire Suppression Area

Soils

Altoga silty clay
Urban land
Arents, clayey
Houston Black-Urban
Ferris-Heiden complex
Ustorthents
Frio silty clay

Figure 4.13: Contaminations and Soils (Sundine, 2018)

Site

Social - Physical: Site Topography and Hydrology

Located within the Mountain Creek Watershed, the DANS sits adjacent to the man-made Mountain Creek Lake. Texas Utilities owns the lake for cooling the oil-fired electrical-power generation plant on the northeast shore. The lake is not used for water supply but is a future consideration as a source and used for recreation. After several expansions to the DANS, Cottonwood Bay was eventually separated from Mountain Creek Lake, but still connected through a canal for the Cottonwood Creek outflow.

On-site, the topography is relatively flat across with few stormwater drains located near Cottonwood Bay and Mountain Creek Lake. The majority of topographical change occurs near and around Cottonwood Bay. Two drainage ponds located in the Northeast corner handle the northeast corner drainage and some off-site drainage that connects back to Mountain Creek Lake outfall. Besides the northeast corner, the majority of surface drainage is directed toward Cottonwood Bay and Mountain Creek Lake.

In the storm drainage locations near Cottonwood Bay and Mountain Creek Lake can provide future bioswales and wetlands to promote green infrastructure to clean contaminated runoff and promote new wildlife habitat. One primary consideration the future stormwater design, limiting the spread of current groundwater contaminations.

Legend

Inland site Water
Site Drainage Flow
H.P. High Point
L.P. Low Point

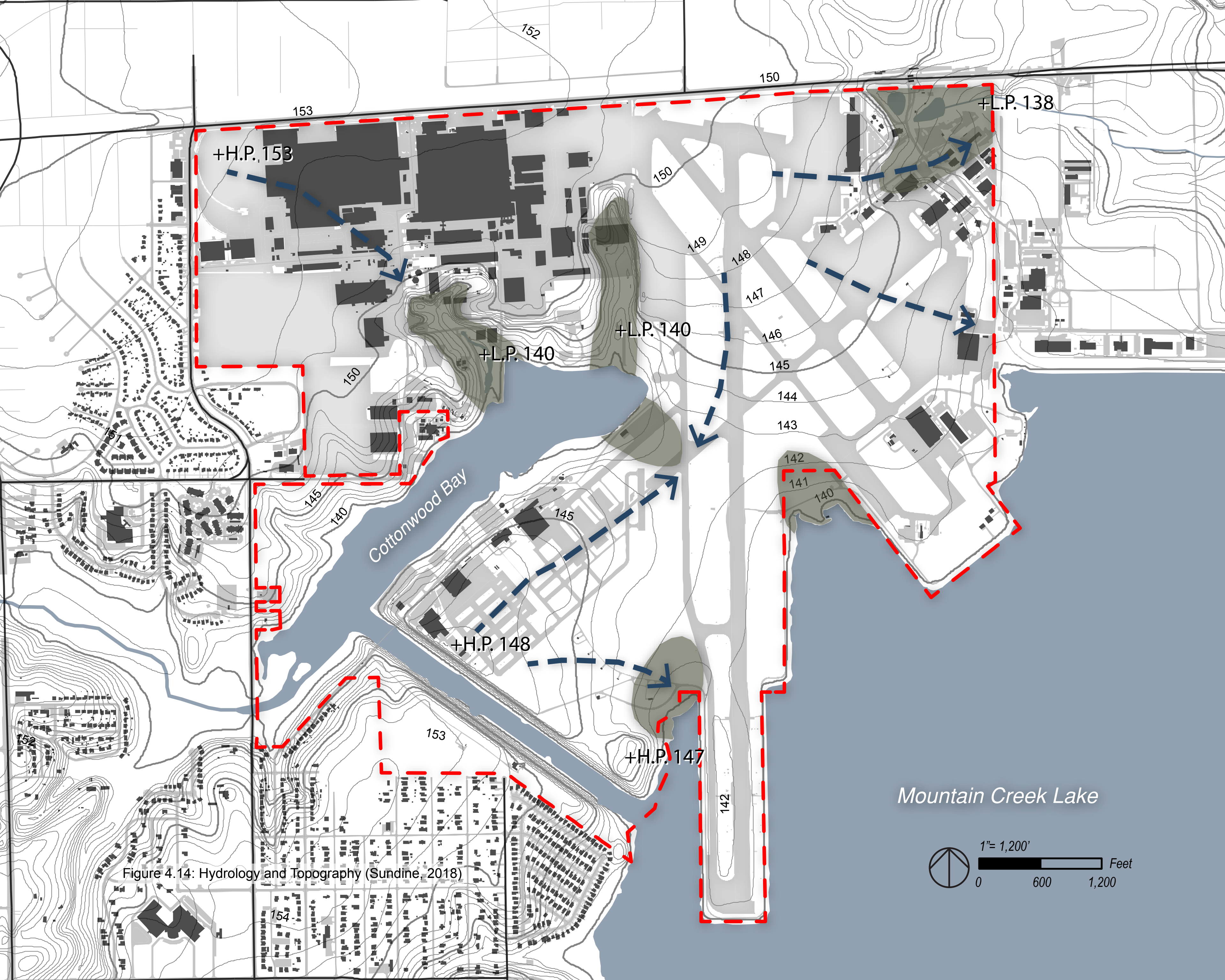


Figure 4.14: Hydrology and Topography (Sundine, 2018)

Site

Social - Cultural: Circulation & Views

The previous use of the site as an airfield provided several access points throughout the 1045-acres. The primary vehicular access to the redevelopment will be to the north and the one access over Cottonwood Canal near the southwest. Because of the existing infrastructure of rail lines on-site, the primary access for a possible DART line would be to the northwest. In the southern locations of the site, water access could be a future possibility for other forms of transportation and a trail connection to the south can be connected to other parks and regional trails.

Because the site is relatively flat, there are limited views outside of the site. To the south overlooking Mountain Creek Lake can provide some views toward Dallas Baptist University; any other on-site views would be directed to the existing character of historic buildings and new site amenities.

Legend

- Views
- Vehicular Access
- Rail Access
- Water Access

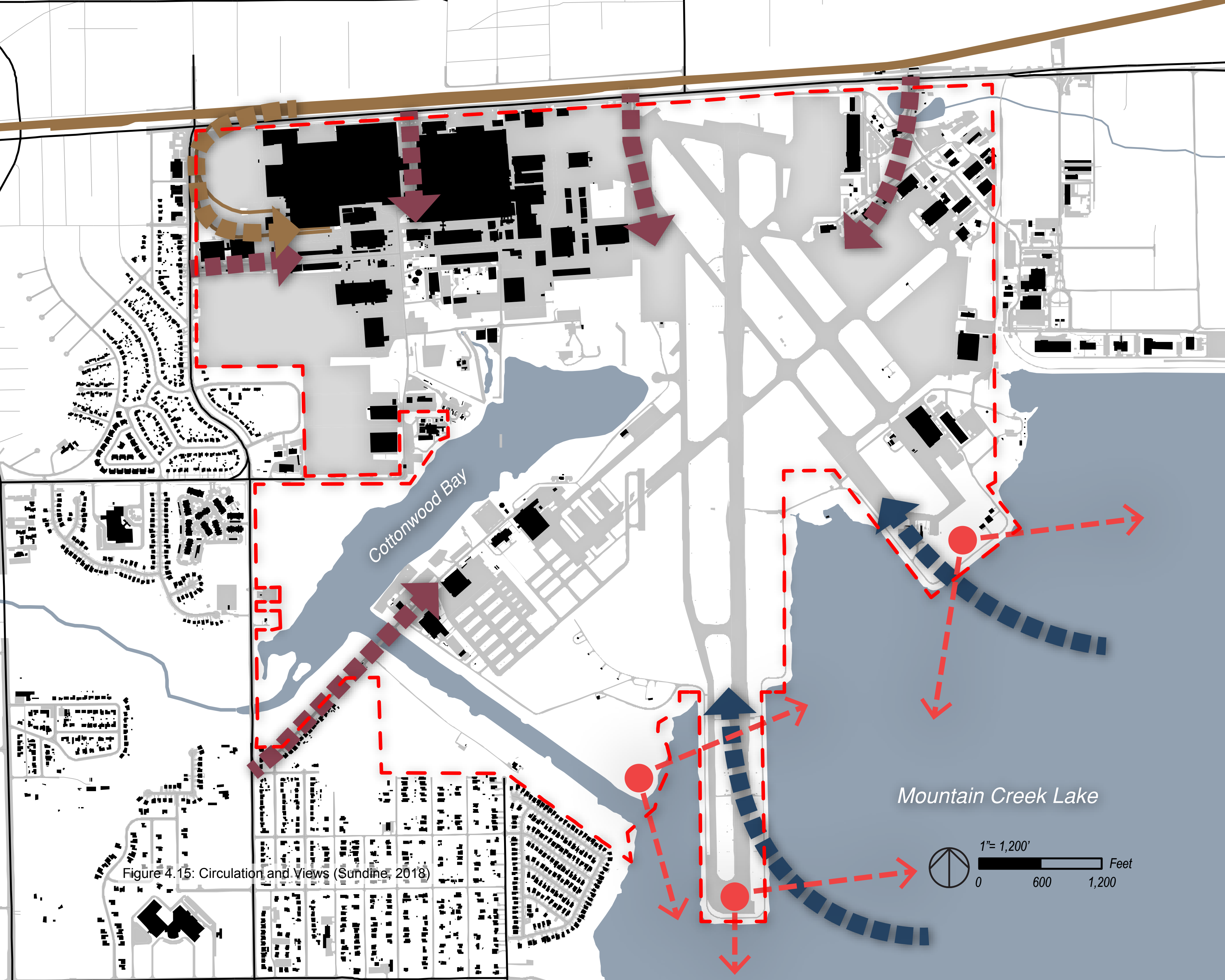


Figure 4.15: Circulation and Views (Sundine, 2018)

Site Visit

The site visit was conducted on November 19th, 2017. Because the site is being used for military and vehicular storage, access was limited to a few locations. The purpose of this visit was to gain any visible knowledge about conditions of the site that may be beneficial in the redevelopment of the site. After an on ground site visit was conducted, an aerial flyover was conducted to photograph and see other current on-site uses and conditions.

Observations

- The character of the neighborhood surrounding to the site is characterized by small single-family residential, used for military housing when the base was active.
- There are few productive uses on site. Texas National Guard, Dallas Global Industries, GM car storage, and Echo Transportation.
- On-site there seemed to be some to be some signs of wildlife such as coyotes who will occasionally inhabit underutilized decommissioned airfields
- Biannual Dallas ½ mile shootout car racing event takes place on the inactive runway

Figure 4.16: Redmond Taylor Army Heliport (Sundine, 2017)

Figure 4.17: Display Helicopter (Sundine, 2017)

Figure 4.18: South-East Aerial View (Sundine, 2017)

Figure 4.19: Cottonwood Bay Canal (Sundine, 2017)

4.2

Findings

Applicable Ecosystem Services Analysis

Applicable Ecosystem Services Analysis

To determine which ecosystem services are applicable to the DANS, a review of Dallas's environmental and social issues (see page 6) and findings of the site analysis and visit informed the applicable services. The classification of ecosystem services comes from the literature of MEA, TEEB, LPS and SITES groups. From each sources, specific services were narrowed to the similarities between lists and to tailored to the DANS site. This list of ecosystem services will inform the precedent analysis and Ecosystem Services Urban Design Framework.

Provisioning Services

- **Food**
  - "Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems, but water systems or forests also provide food for human consumption" (TEEB n.d.). Supported by MEA and LPS.

- **Fresh Water**
  - "Ecosystems play a vital role in the global hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally"(TEEB n.d.). Supported by MEA and LPS.

- **Urban Site Conditions: Recycle/reuse of materials**
  - The current environment of a site is a current ecosystem of itself from the past and current used of the site. Supported by LPS and SITES.

Regulating Services

- **Local Climate and Air Quality**
  - "Trees provide shade while forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere" (TEEB n.d.). Supported by MEA and LPS.

- **Pollution Mitigation (Water, Air, Soil):**
  - Mitigation of current and future spread of pollutants. Supported by MEA and LPS.

- **Carbon Sequestration and Storage**
  - "Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove CO2 from the atmosphere and effectively lock it away in their tissues. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change" (TEEB n.d.). Supported by LPS.

- **Hazard Regulation: Moderation of Extreme Events**
  - "Extreme weather events or natural hazards include floods, storms, tsunamis, avalanches and landslides. Ecosystems and living organisms create buffers against natural disasters, thereby preventing possible damage" (TEEB n.d.).

- **Water Regulation (Stormwater)**
  - "The timing and magnitude of runoff, flooding, and aquifer recharge can be strongly influenced by land cover, including alterations

that change the water storage potential of the system, such as wetlands, forests, cropland, and urban areas” (MEA 2005, 58). Supported by LPS and SITES.

- **Soil Fertility and Erosion Prevention**
  - Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply the soil with nutrients required to support plant growth. “Soil erosion is a key factor in the process of land degradation and desertification. Vegetation cover provides prevention of soil erosion” (TEEB n.d.). Supported by MEA, LPS, and SITES.

- **Pollination**
  - “Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds. Some 87 out of the 115 leading global food crops depend upon animal pollination” (TEEB n.d.). Supported by MEA and LPS.

Habitat Services

- **Habitats for Species and Genetic Diversity**
  - “Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species’ lifecycle. Genetic diversity is the variety of genes between and within species populations. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others” (TEEB n.d.). Supported by MEA and LPS.

Cultural Services

- **Social Cohesion**
  - Supporting groups of people in promoting social equity through culture, housing, and public gathering spaces. Supported by MEA, LPS, and SITES.

- **Mental and Physical Well-being**
  - “The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement” (TEEB n.d.). Supported by MEA and LPS.

- **Recreation**
  - “Walking and playing sports in green space is not only a good form of physical exercise but also lets people relax” (TEEB n.d.). Supported by LPS and SITES.

- **Tourism**
  - “Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and source of income” (TEEB n.d.). Supported by LPS.

- **Aesthetic Appreciation**
  - Promoting “sense of place” through recognized features of their environments and finding beauty and value in aesthetics in parks, scenic drives, and housing. Supported by MEA LPS, and SITES.

4.3

Findings

Precedent Analysis

Precedent Analysis Comparisons

Of the applicable ecosystem services analysis, the identified services are applied to the 18 decommissioned airfields from the book *Airport Landscape*. As seen in figure 4.20 this allows to see the range of ecosystem services utilized and which services have been of the most important. To determine if a service was present, data was collected through inferring information from *Airport Landscape*, past available project case studies, and other relevant journal articles. From the 18 decommissioned airfields, four were selected to be studied at a more in-depth level.

Analyses from the 18 decommissioned airfields revealed that regulating and cultural services were most present. Provisioning and habitats services were of the lowest utilized, even though provisioning services is of the most needed like food and fresh water. When presented in the table below it is easy to see similarities and difference in the presence of ecosystem services across sites and scales.

Figure 4.20: Precedent Analysis Comparison (Sundine, 2018)

Provisioning
Regulating
Habitat
Cultural
In-Depth Study

Airfield Name Location | Year Closed | Size	Food	Fresh Water	Urban Site Conditions	Pollution Mitigation	Local Climate and Air Quality	Carbon Sequestration and Storage	Moderation of Extreme Events	Water Regulation	Soil Fertility and Erosion Prevention	Pollination	Habitat for Species and Diversity	Social Cohesion	Mental and Physical Well-Being	Recreation	Tourism	Aesthetic Appreciation
Squantum Point Peak Quincy, MA | 1999 | 43-ac						Regulating	Regulating		Regulating		Habitat		Cultural	Cultural		Cultural
Oldenbur Airbase Solar Farm Oldenbur, Germany | 2011 | 71-ac				Regulating	Regulating											
Crissy Field San Francisco, CA | 2001 | 100-ac				Regulating		Regulating	Regulating		Regulating		Habitat		Cultural	Cultural	Cultural	Cultural
Phase Shift Park Taichung, Taiwan | 2011 | 172-ac				Regulating	Regulating	Regulating	Regulating						Cultural	Cultural	Cultural	Cultural
Johannisthal Airport Berlin, Germany | 1996 | 190-ac						Regulating				Regulating	Habitat			Cultural	Cultural	Cultural
Generalisimo Franciso Caracas, Venezuela | 2012 | 254-ac				Regulating		Regulating		Regulating		Regulating		Cultural	Cultural	Cultural	Cultural	

Airfield Name Location | Year Closed | Size	Food	Fresh Water	Urban Site Conditions	Pollution Mitigation	Local Climate and Air Quality	Carbon Sequestration and Storage	Moderation of Extreme Events	Water Regulation	Soil Fertility and Erosion Prevention	Pollination	Habitat for Species and Diversity	Social Cohesion	Mental and Physical Well-Being	Recreation	Tourism	Aesthetic Appreciation
Downsview Park Toronto, Canada | 1999 | 291-ac	■		■		■	■	■	■		■	■	■	■	■	■	
Bicentennial Park Quito, Ecuador | 2013 | 300-ac	■		■		■	■			■		■			■		■
Vatnsmyri Airport Reykjavik, Iceland | 2007 | 370-ac												■		■	■	■
Landscape Park Munich-reim, Germany | 1997 | 518-ac				■		■					■		■	■	■	
Gatow Gatow, Germany | 2010 | 520-ac	■									■				■		
Hamilton Army Airfield Navato, CA | 1999 | 743-ac				■			■		■							
Fornebu International Airport Oslo, Norway | 2004 | 840-ac			■	■				■			■			■	■	■
Tempelhof Field Berlin, Germany | 2010 | 939 -ac	■		■		■		■	■		■	■	■	■	■	■	
Floyd Bennett Field Brooklyn, NY | 1971 | 1,300-ac	■		■			■	■		■		■	■		■	■	■
Orange County Great Park Orange County, CA | 2005 | 1,300-ac	■		■	■		■		■		■	■	■		■	■	
Hellinkion Metropolitan Park Athens, Greece | 2005 | 1,300-ac			■	■				■	■		■			■		■
Stapleton Denver, CO | 1995 | 4,695-ac	■	■	■	■		■	■		■		■	■	■	■	■	■

In-Depth Precedent Analysis Selection

From the 18 decommissioned airfield studies, the four identified for further analysis include: Downsview Park, Fornebu International Airport; Tempelhof Field; and Stapleton.

Downsview Park

The Downsview Park is a pioneering example for the adaptive reuse of a decommissioned airfield site, where design blends natural systems with culture and people. Many subsequent urban design projects have used the winning team's James Corner's Field Operations adaptive design concepts as a inspiration for new design strategies.

Figure 4.21: Spring Vegetation (Irina No, 2012)

Fornebu International Airport

As one of Norway's most significant urban infill developments, the project consists of a new housing, businesses, recreation and conservation projects. With a lot of competing interests in the development, the program consisted of transportation, energy supply and consumption, building materials, natural and cultural conservation, and pollution mitigation. Fornebu is known for its natural beauty and attractive undeveloped land which was fought for in the redevelopment processes (Beate Habhab Folkestad, n.d.).

Figure 4.22: Aerial View of Fornebu (Anderson, Wihelm, 2010)

Tempelhof Field

Tempelhof Field has had a rich history and value to the people of Berlin. Bottom-up planning has allowed the park to become 'the peoples' park. Through incremental development, the design is better able to respond to changes in the future.

Figure 4.23: Runway at Tempelhof Field (Sundine, 2017)

Stapleton

The Stapleton development is one of the most significant urban infill redevelopment in the U.S. With foundational principles of sustainable living, Stapleton has been used as an example of successful urban infill throughout the U.S. for economic, environmental, and social performance.

Figure 4.24: Central Park Recreation Center (Sundine, 2016)

Precedent 01 - Downsview Park

Toronto, Canada | 291-acres | Closed 1994 - In Progress, Competition 1999

History & Context

Established in 1940 as a military air base in Toronto, the site is located at the periphery of the city, now enclosed by the city's major suburban areas. In 1994, the federal government decommissioned the military base and decided not to redevelop the site but to create a new public park for the people (Czerniak 2001, 27).

Figure 4.25: The Pond at Downsview (Balcerzak, 2013)

Design Concept

Development of a new landscape that combined public use with the establishment and conservation of wildlife, and the protection of natural systems. Two main features are: "Circuits," which accommodate all active programs, event spaces and circulation, and "Through-flows," which support all hydrological and ecological dynamics on site (Czerniak 2001, 58).

Figure 4.26: Aviation Wind Socks (Irina No, 2012)

Adaptive Planning

The "self-organization," design framework is intended to respond flexibly to the unforeseeable future developments of the site's natural systems and cultural programs. The park is presented as an engineered matrix, a "living groundwork" for new forms and life to emerge.

Ecosystem Services Used

Provisioning Services

- **Food**
  - Agriculture: 3-acres of urban farms

- **Urban Site Conditions: Recycle/reuse of materials**
  - Old hangers converted into sports field and event spaces

Regulating Services

- **Local Climate and Air Quality**
  - Large swaths of vegetation throughout the park
  - Limited vehicular access on site

- **Carbon Sequestration and Storage**
  - 45-acres of urban forests and 5-acres of tallgrass prairies throughout the park

- **Hazard Regulation: Moderation of Extreme Events**
  - Stormwater: capable of handling 100-year rainfall event

- **Water Regulation (Stormwater)**
  - Stormwater management: designed to handle a drainage area of 427-acres, more extensive than the site itself. Bioswales, filtration bed/ponds, and a 9-acre lake. System capable handling 100-year rainfall event.

- **Pollination**
  - 5-acres of tallgrass prairie and 3-acres of urban agriculture

Habitat Services

- **Habitats for Species and Genetic Diversity**
  - Habitat creation for diverse amounts of wildlife
  - Open-ended adaptive planning

Cultural Services

- **Social Cohesion**
  - Transportation: Rail stations provide access to all Toronto, with no commuter parking available at Downsview Park

- **Mental and Physical Well-being**
  - Access to all green spaces throughout the park

- **Recreation**
  - Recreation: 1.6-mile Circuit Path and multi-sport courts

- **Tourism**
  - Urban agriculture, education, events provide economic income

Precedent 01 - Downsview Park

Criticism

Over 20 years of attempted growth, Downsview Park has been criticized by the public for the lack of the site's identity. Some criticism of has been focused on the lack of accommodation the site provided the surrounding community and to incoming residents (Hume 2017).

Take Away

Downsview Park provides a new way of adaptive urban design strategy of a "self-organizing" system. This strategy allows for constant feedback and adequate adjustments that may need to be made for humans or nature. For people, urban agriculture and recreation are incorporated into the design of nature with over 45-acres of forested land and over 5-acres of tallgrass prairie to allow a diverse amount of species to thrive. With recent news of the lack of identity to the site, there is key importance to provide residents with their needs.

Figure 4.27: Playground at Downsview (downsviewpark.ca, n.d.)

Figure 4.28: Urban Forest (downsviewpark.ca, n.d)

Figure 4.29: Native Vegetation (Irina No, 2012)

Precedent 02 - Fornebu International Airport

Oslo, Norway | 840-acres | Closed 1998 - In Progress

History & Context

Built in the 1930's the airport served Oslo as an international airport for decades. Located on the periphery of Oslo, Norway the land is surrounded by shoreline and urban development to the north and south.

Design Concept

With considerable emphasis on sustainability, the developers began with several sustainability studies. The design is centered around a large green park with green corridors branching in seven directions that connect to transit locations and the shoreline with resident locations concentrated in innermost areas. By refurbishing old buildings, industrial developments have already begun to occur to create new jobs to support future residents (Beate Habhab Folkestad, n.d.).

Figure 4.30: Aerial View Before Redevelopment (Widerøe, n.d.)

Figure 4.31: Fornebu Indoor Golf Center (Ree, 2009)

Ecosystem Services Used

Provisioning Services

- **Urban Site Conditions: Recycle/reuse of materials**
  - Optimal reuse of existing buildings
  - Established local plant for recycling soil and asphalt aggregates

Regulating Services

- **Local Climate and Air Quality**
  - Reduction of transportation needs

- **Pollution Mitigation (Water, Air, Soil):**
  - Cleaning of all pollutants and prevention of future pollution
  - Reduction of transport needs, prioritize internal pedestrian and cycle
  - Reuse of remediated soil for topography

- **Water Regulation (Stormwater)**
  - Stormwater directed to green space and central pond

- **Soil Fertility and Erosion Prevention**
  - Cleaning of all soil contaminations

Habitat Services

- **Habitats for Species and Genetic Diversity**
  - 264 species of migrant bird currently living on site
  - At least 150ft wide buffer to shield nature reserves from human activity
  - Continued monitoring to protect and develop future diversity

Cultural Services

- **Social Cohesion**
  - Green space connection throughout site

- **Recreation**
  - 1.5 miles of public access to shoreline

- **Aesthetic Appreciation**
  - Green space connection throughout site

Precedent 02 - Fornebu International Airport

Adaptive Planning

Authorities for Fornebu's redevelopment made clear goals on a long-term perspective and high environmental ideals. The development first began with the implementation of infrastructure and monitoring of green spaces to understand performance goals for remediation of polluted soils and recycling of materials (Beate Habhab Folkestad, n.d.).

Criticism

Criticism of the Fornebu development is primarily focused on whether the development should be a precedent model for future development in Oslo, Norway and beyond. Some disconnections between the site's corporate campuses and residential densities do not match the needs of the development. There are also tensions about transportation, nature recreation, and sustainable design standards that have not been met throughout the redevelopment process (Forsberg 2016).

Take Away

Fornebu's redevelopment is focused on long-term sustainability. Through the main five planning categories of energy, transportation, materials, conservation, and pollution, the design shows good spatial planning in the housing, parks and industrial sites to create onsite jobs (Beate Habhab Folkestad, n.d.). The spatial planning of Fornebu is a good example of development centered around green spaces, providing opportunities for stormwater design and interconnectedness throughout the site for all users (Åstebøl, Hvitved-Jacobsen, and Simonsen 2004).

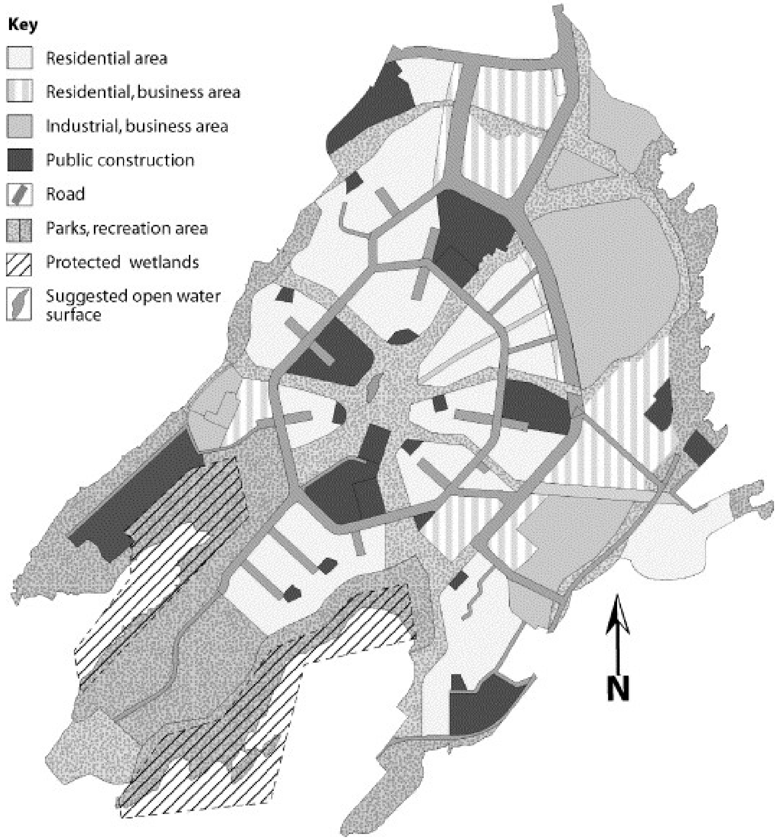


Figure 4.32: Spatial Planning of Fornebu (Kommune, 2004)

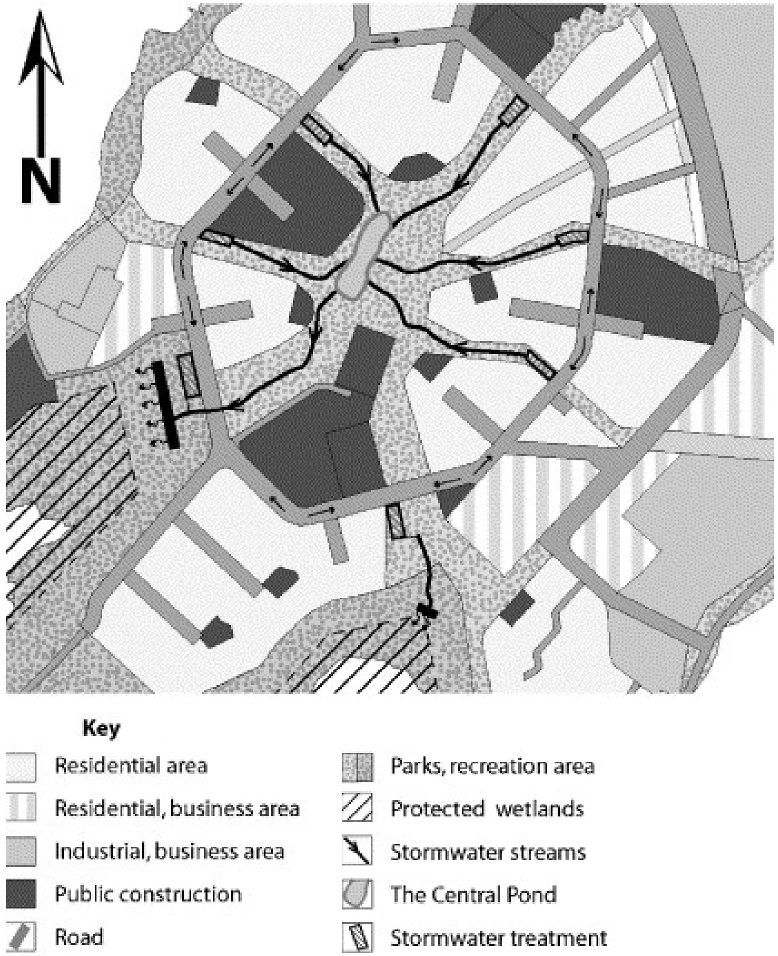


Figure 4.33: Stormwater Strategy at Fornebu (Åstebøl, Hvitved-Jacobsen, and Simonsen, 2004)

Precedent 03 - Tempelhof Field

Berlin, Germany | 877-acres | Closed 2008 - In Progress

History & Context

First established in 1923 as "Airport Tempelhof," the airport would play a unique role in history during WWII and the Berlin Airlift. The monumental 4,000ft arc terminal was a gateway symbol for the Nazi empire and late became a symbol of freedom for the airlift. From 1989 till its closure in 2008, the airfield was used for handling most of Berlin's air travel and various U.S. Air Force operations (HF 2017).

Design Concept

The design concept for the Tempelhof Field "aims to retain the character of the site while offering a space for a wide range of new activities. The design promotes the notion of 'nature activation' this is seeking not only to conserve biodiversity but also to enhance it" (WLA 2011). Many other guidelines for the competition were, "integration of multicultural, socially intermixed and aging urban society," "new public-private areas" and "self-sustaining" of the park to allow for new start-up businesses and to respond to changing future conditions as the Berlin economy can improve (Dümpelmann 2014, 253). In recent years, parts of the site have been transformed to become Germany's largest refugee shelter through the use of empty hanger space and open areas for cubicle structures (Shead 2017).

Figure 4.34: 1984 Open House of Tempelhof (Lopez, 1984)

Figure 4.35: Designated Pollination Area (Sundine, 2017)

Ecosystem Services Used

Provisioning Services

- **Food**
  - Community garden along the edge and entrance areas

- **Urban Site Conditions: Recycle/reuse of materials**
  - Runways and taxiways left for recreation and main terminal building for future renovations

Regulating Services

- **Local Climate and Air Quality**
  - No vehicular access on site

- **Carbon Sequestration and Storage**
  - Open spaces between runways and taxiways used for native plantings

- **Water Regulation (Stormwater)**
  - Recycling runoff from terminal and existing 70-acres of hard surface

- **Pollination**
  - Designated areas with selected vegetation for pollinators

Habitat Services

- **Habitats for Species and Genetic Diversity**
  - Bees, butterflies, skylarks. Habitat formed from remains of former airport taxiway
  - Selected diversity of plants in open spaces for habitat

Cultural Services

- **Social Cohesion**
  - Connectivity of the park with open space system of surrounding urban districts

- **Mental and Physical Well-being**
  - Open spaces for education to connect and understand nature

- **Recreation**
  - Allotments, dog-walks, skateboarding, wind skateboarding, distance markers
  - 40-meter rock monument with interior climbing school

- **Tourism**
  - Beginning entrepreneurs to provide new businesses for the site

Precedent 03 - Tempelhof Field

Personal Visit

During a study abroad semester in Orvieto, Italy, I took a trip to Berlin, Germany to visit Tempelhof Field. As a landscape architecture student, I was intrigued by the adaptability of people to make a place for themselves. The community used the park in several different ways through community gardens, wind skateboarding, exercising, artist-designed mini golf, and the utilization of start-up businesses.

Figure 4.36: On-site Community Garden (Sundine, 2017)

Figure 4.37: Community Using Open Runway (Sundine, 2017)

Figure 4.38: Sign about Local Insects (Sundine, 2017)

Figure 4.39: Start-up Berlin Business (Sundine, 2017)

Figure 4.40: Remaining Taxi-way Sign (Sundine, 2017)

Precedent 03 - Tempelhof Field

Adaptive Planning

The redevelopment process has allowed for flexible and adaptive master planning. The public has had significant input during the design process, which allows for constant feedback to designers and city officials. Due to the external force of Berlin's debt crisis, the park had to be designed with the adaptability that welcomes change as economies improve (Dümpelmann 2014, 253).

Criticism

Because the Berlin government has included the community in the future of Tempelhof Field, the park has had been welcomed by the public. Since the terminal building was vacant, parts were transformed into a "container village" that supports foreign refugees. Even though this addition has been controversial, it demonstrates the versatility of the site in providing all people with the benefits of human well-being.

Take Away

The people of Berlin were the primary designers for Tempelhof Field. The ability for the public to have large amounts of input gives the project more ability to be used. The non-structured adaptive planning still allows for planning in increments with significant goals to accomplish.

Figure 4.41: Wind Stake-boarding (Sundine, 2017)

Figure 4.42: Emergency Practice Aircraft Remaining On-site (Sundine, 2017)

Figure 4.43: Overlook View Toward Hanger (Sundine, 2017)

Precedent 04 - Stapleton

Denver, Colorado | 4,695-acres | Closed 1995, Construction began 2001 - Present

History & Context

Starting in 1929, Stapleton became well known for aviation activity, and continued to grow to over 4,700 acres from World War II and the emergence of the jet age. Because of the continued growth of the Denver Metro area, Stapleton became enclosed by suburban development. Stapleton is now surrounded by racially diverse, middle- and lower-middle-class neighborhoods (Leccese 2005). In 1995 when Denver International Airport opened, Stapleton International Airport closed and began its journey to become the largest redevelopment in Denver and one of the largest in the U.S.

Design Concept

The redevelopment was based on the three principles: economic opportunity, environmental responsibility, and social equity (Leccese 2005). The design focused on integrating the site seamlessly into the city fabric conditions through elements such as streets, single-family housing, mature trees, and pocket parks. Today Stapleton consists of over 1,100-acres of park space, designed to handle stormwater convergence with trails, recreation facilities, and natural areas. Housing at Stapleton is very diverse in the opportunities for all levels of class from high-, middle-, and low- through low to high-density housing, affordable housing, veterans, and disabled populations (Leccese 2005; Meltzer 2017).

Figure 4.44: Community Sign about Wildlife (Sundine, 2016)

Ecosystem Services Used

Provisioning Services

- **Food**
  - Community gardens and farmers markets

- **Fresh Water**
  - Established plants will not require irrigation reducing 70% water needs

- **Urban Site Conditions: Recycle/reuse of materials**
  - 6 million tons of runways recycled into roadways and another hardscape throughout Stapleton and Denver metro area
  - 200,000 tons asphalt recycled and used at the Rocky Mountain National Wildlife Refuge
  - City recycling programs of household goods and trash

Regulating Services

- **Pollution Mitigation (Water, Air, Soil):**
  - Water filtration through parks stormwater management
  - Walkable, bikeable, transit-oriented mixed use to reduce the dependence on automobile transportation
  - Clean up of all previous toxic soils

- **Carbon Sequestration and Storage**
  - Streets lined with trees & large green spaces

- **Hazard Regulation: Moderation of Extreme Events**
  - Parks design to accommodate large flooding events

- **Water Regulation (Stormwater)**
  - Stormwater management system design to handle all on-site runoff

- **Soil Fertility and Erosion Prevention**
  - Diverse plantings and for specific topography to prevent erosion
  - Continued maintenance of park stormwater system

Habitat Services

- **Habitats for Species and Genetic Diversity**
  - Habitat corridors for birds and other species connecting to off-site habitats
  - Plants with seed mixes and plant species for specific micro-climates and micro-topography of the Front Range ecosystems

Cultural Services

- **Social Cohesion**
  - Affordable housing, mixed-use development
  - Front porches, ally loaded garages, parks, farmers markets

- **Mental and Physical Well-being**
  - Promoting healthy physical and community lifestyles

- **Recreation**
  - Open sports fields, biking, and running trails

- **Tourism**
  - Commercial development, event space

Precedent 04 - Stapleton

Adaptive Planning

Because of the importance of environmental responsibility and social equity, Stapleton was designed to accommodate several different purposes. The 1,100-acres of parks are designed for resiliency to significant flood and/or periods of drought. The various housing opportunities allows Stapleton to fit into the diverse social contexts and build upon social equity. There is no true adaptiveness designed into the master plan, besides phasing strategies. The site will be fully completed with the initial 'end result' in mind.

Criticism

A few criticisms focuses on homes that are farther than the ideal pedestrian one-quarter mile from shops, schools, and transit (Leccese 2005). The main goal was to get residents to become less reliant on vehicles, but that only happens when shopping centers are in close proximity. It has also been found that the site does not physically and socially integrate well into the existing neighborhood fabric, causing some to consider it a 'non-gated' gated community' (Gibson and Canfield 2016).

Take Away

The residential diversity of multiple housing types and affordability levels are built around ideas for social cohesion and afforded by public spaces, open space, pocket parks and reduced dependency of vehicles. Open spaces are also used for habitat regeneration and stormwater efficiency. The focus of the new urban design was a major goal for the infill development. An adaptive planning could make the project more successful in the long range and would allow the community to become for investing in the process.

Figure 4.45: Park Layout Map (Forest City, 2014)

Figure 4.46: “Staplestone” - Recycled Runway Concrete (Sundine, 2016)

Figure 4.47: Stormwater Management (Sundine, 2016)

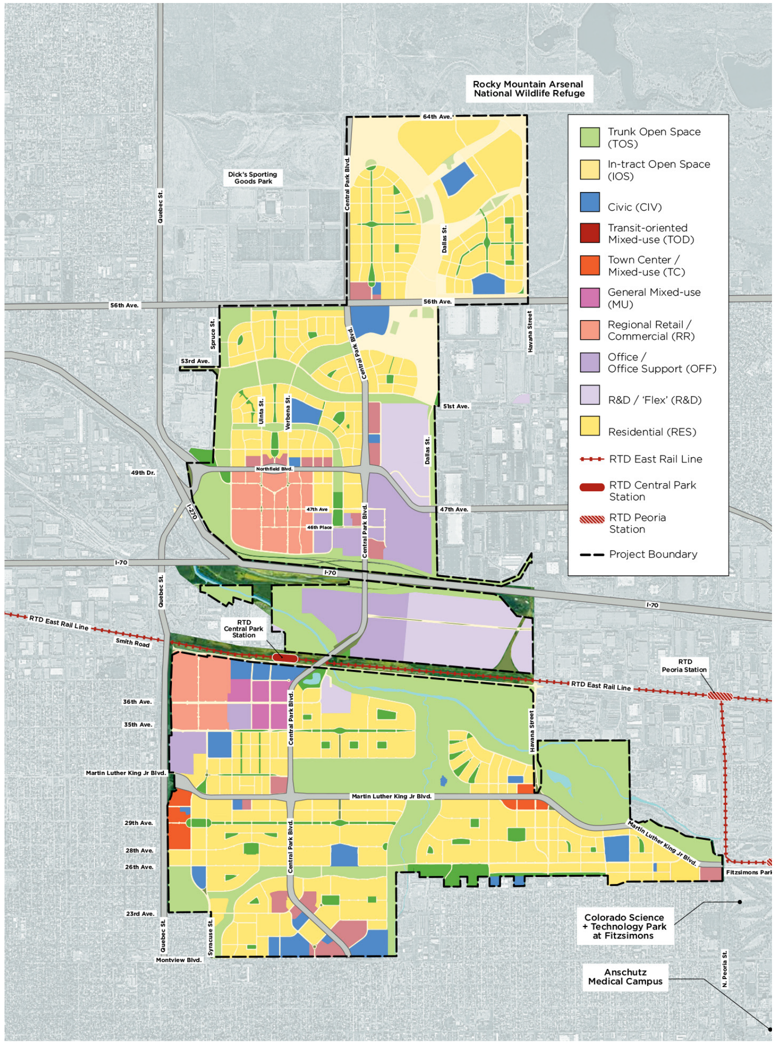


Figure 4.48: Land Use Map (Forest City, 2017)

Chapter Summary

This chapter presents the components of the Ecosystem Services Urban Design Framework and illustrates its application to the DANS site. A short-term urban design plan is presented, along with four different long-term scenarios that illustrates how the plan can adapt to potential future needs.

5.0

Dallas Air Naval Station Design

5.1

Dallas Air Naval Station Design

Ecosystem Services
Urban Design Framework

Ecosystem Services Urban Design Framework

Purpose

The purpose of the Ecosystem Services Urban Design framework is twofold. First, it can be applied to a brownfield site to guide redevelopment in a short-term design solution that addresses current social, environmental, and economic issues, while also maximizing ecosystem services benefits. Secondly, the framework can be used to create adaptability and design flexibility that can change for unknown future issues and needs.

The framework presented here has been tailored to possibilities and constraints of the DANS site; however, it could be adjusted and applied to other brownfield sites.

Framework Structure

The framework is structured in four sections, based on the broader ecosystem service categories: provisioning, regulating, habitat, and cultural. Each section describes:

- **Design Strategies**: Programmatic elements and guides
- **Consideration for Implementation**: General brownfield site condition considerations
- **Benefits of the Service**: Gain from each service
- **Valuation Criteria**: Literature based performance evaluation metrics
- **Complementary Ecosystem Services**: Correlation of services between others
- **Design Vignette**: Visual cues of service

Identified Applicable Ecosystem Services

Provisioning Services

- Food
- Fresh Water
- Urban Site Conditions: Recycle/reuse of materials

Regulating Services

- Local Climate and Air Quality
- Pollution Mitigation
- Carbon Sequestration and Storage
- Hazard Regulation: Moderation of Extreme Events
- Water Regulation
- Soil Fertility and Erosion Prevention
- Pollination

Habitat Services

- Habitats for Species and Genetic Diversity

Cultural Services

- Social Cohesion
- Mental and Physical Well-being
- Recreation
- Tourism
- Aesthetic Appreciation

Figure 5.1: Example Design Vignettes Informed by Ecosystem Services

Provisioning Service: Food

Design Strategies
- Urban Agriculture – food production in high density urban area
- Community Gardens – local gardens for community members
- Edible Planting – on-site vegetation consumable for community

Considerations for Implementation
- Soil fertility
- Limiting agriculture over toxic groundwater plumes
- Protection from existing wildlife

Benefits
- Provide local, affordable food for community
- Promote community involvement
- Reduced use of pesticides
- Create on-site jobs

Valuation Criteria
- % urban green area dedicated to agricultural activities
- Amount of food for production
- Economic gain or saving from local food production

Complementary Ecosystem Services
- Soil fertility, pollination, social cohesion, tourism, aesthetic appreciation

Design Vignette

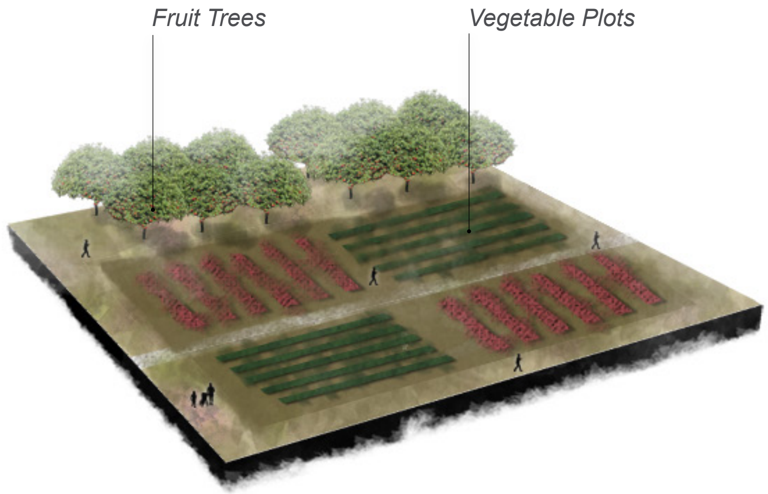
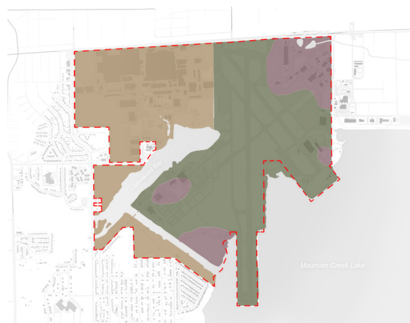


Figure 5.2: Design Vignette of Food (Sundine, 2018)

Potential Application to DANS



Legend
- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.3: Site Suitability for Food (Sundine, 2018)

Provisioning Service: Fresh Water

Design Strategies

- Purification Facilities - cleaning water from nearby polluted water
- Fresh Water Pond - use of on-site potable water source
- Stormwater Detention Pond - management of stormwater runoff
- Bioswales – directing stormwater to detention ponds and allow filtration

Considerations for Implementation

- Fresh water ponds will not be located near toxic groundwater plumes
- Location of purification facilities
- Public access to fresh water ponds

Benefits

- Gain local water source
- Rely less on current water systems
- Reduction and reuse of water
- Promote water recreation opportunities
- Reduction of potable water

Valuation Criteria

- On-site water storage capacity
- Water Quality

Complementary Ecosystem Services

- Local climate and air quality, pollution mitigation, moderation of extreme events, mental and physical well-being, aesthetic appreciation

Design Vignette

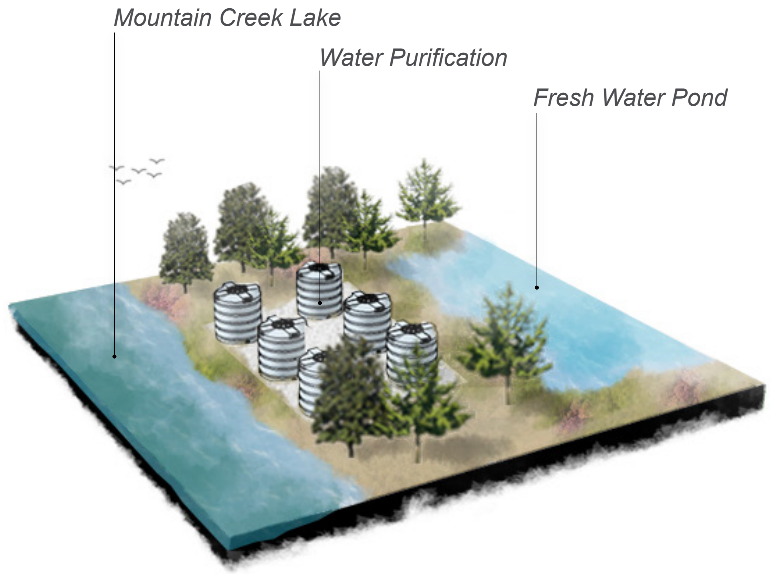
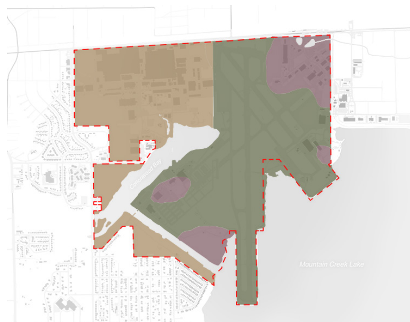


Figure 5.4: Design Vignette of Fresh Water (Sundine, 2018)

Potential Application to DANS



Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.5: Site Suitability for Fresh Water (Sundine, 2018)

Provisioning Service: Urban Site Condition

Design Strategies

- Recycle Concrete Surfaces – reuse on-site material to lessen production of new materials
- Reuse and Adapt Existing Structures – utilizing existing structures for community purposes

Considerations for Implementation

- Evaluate condition of structure and surfaces
- Cost savings of reuse

Benefits

- Gain economic costs and feasibility of reuse
- Maintain site aesthetic and cultural identity
- Reduce further disturbance to site

Valuation Criteria

- Number of structures to be reused
- Amount of concrete possible to be recycled
- Economic gain or saving from resource reuse

Complementary Ecosystem Services

- Local climate and air quality, pollution mitigation, recreation, tourism, aesthetic appreciation

Design Vignette

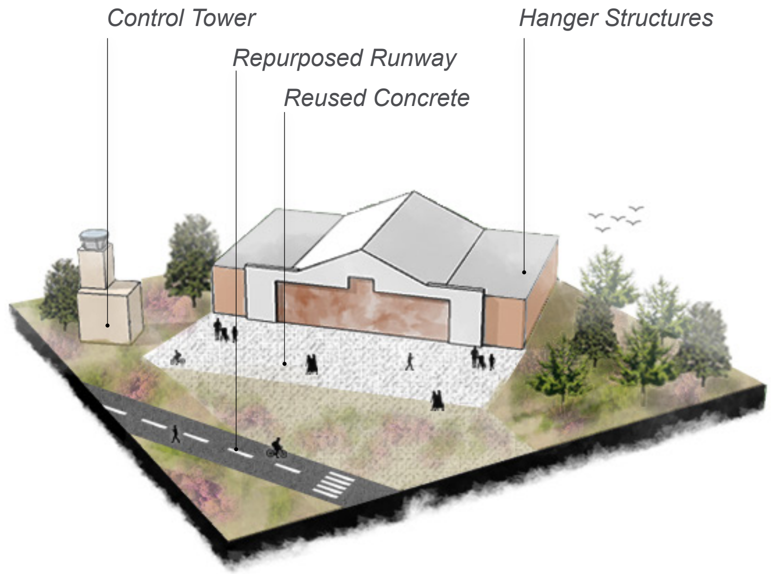
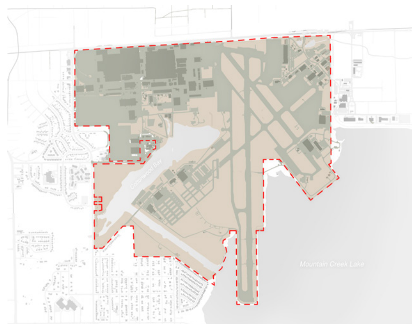


Figure 5.6: Design Vignette of Urban Site Condition (Sundine, 2018)

Potential Application to DANS



Legend
- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.7: Site Suitability for Urban Site Condition (Sundine, 2018)

Regulating Service: Local Climate and Air Quality

Design Strategies

- Tree Groves - reduction of surface temperature and improved air quality
- Green Infrastructure - low impact development (bioswale, filtration ponds)
- Renewable Energy Infrastructure (Solar, Wind) – reduction of fossil fuel dependency (coal, oil)

Considerations for Implementation

- Best on-site micro-climate location for green energy infrastructure
- Tree species best paired to supporting soil types

Benefits

- Reduce reliance on fossil fuels
- Mitigate temperature and air purification from trees

Valuation Criteria

- Carbon storage of trees
- Economic gain or saving from renewable energy
- Air quality

Complementary Ecosystem Services

- Pollution mitigation, carbon sequestration and storage, moderation of extreme events, water regulation, pollination, habitat for species, mental and physical well-being

Design Vignette

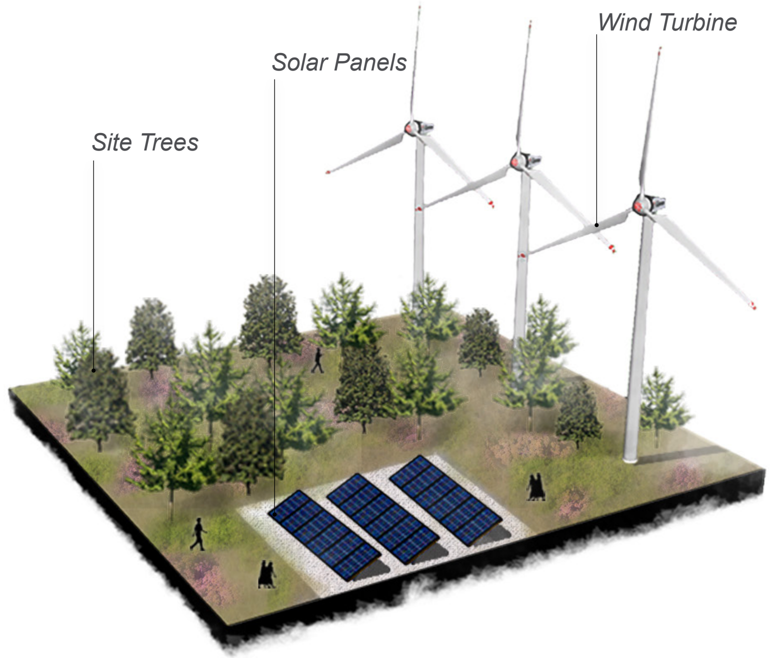


Figure 5.8: Design Vignette of Local Climate and Air Quality (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.9: Site Suitability for Local Climate and Air Quality (Sundine, 2018)

Regulating Service: Pollution Mitigation

Design Strategies

- Building impervious surfaces above groundwater plumes – limit further spread of toxic groundwater
- Bioswales - direct stormwater runoff and allow infiltration
- Trees – Sequester carbon and intercept stormwater
- Green Infrastructure – renewable energy sources

Considerations for Implementation

- Site hydrology
- Location of toxic soils and groundwater
- Amount of vehicle access to site

Benefits

- Limit spread of current pollutions
- Limit creation of future pollutants

Valuation Criteria

- Tree Capacity
- Amount of carbon stored by urban trees
- On-site surface hydrology
- Number of vehicles on site per day
- Site micro-climate

Complementary Ecosystem Services

- Food, fresh water, local climate and air quality, carbon sequestration and storage, moderation of extreme events, water regulation, soil fertility, pollination, habitats for species, mental and physical well-being

Design Vignette

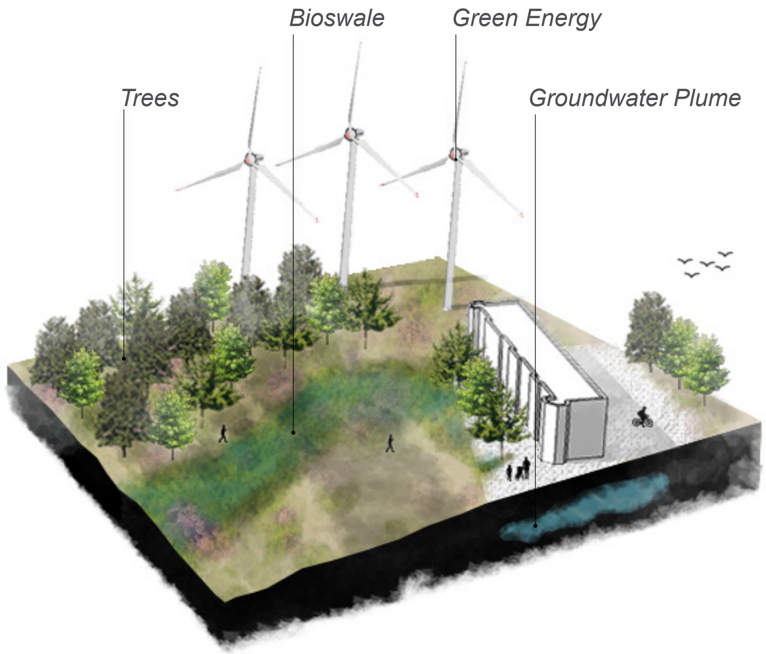
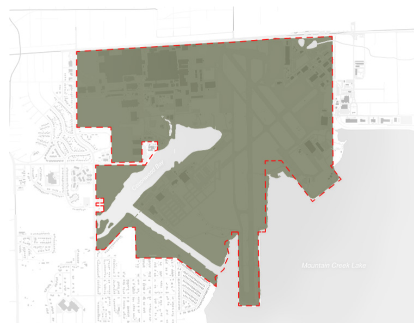


Figure 5.10: Design Vignette of Pollution Mitigation (Sundine, 2018)

Potential Application to DANS



Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.11: Site Suitability for Pollution Mitigation (Sundine, 2018)

Regulating Service: Carbon Sequestration

Design Strategies

- Planting diverse and native vegetation – providing greatest amount of sequestration and increasing biodiversity (tree groves, street trees, wetlands, shrubs)

Considerations for Implementation

- Necessity of current structures and surfaces
- Appropriate soil, water, space, and maintenance for trees

Benefits

- Cleaning of air pollutants
- Promoting public health

Valuation Criteria

- On-site tree capacity
- Amount of carbon stored by trees

Complementary Ecosystem Services

- Local climate and air quality, pollution mitigation, soil fertility, habitat for species, mental and physical well-being, tourism

Design Vignette

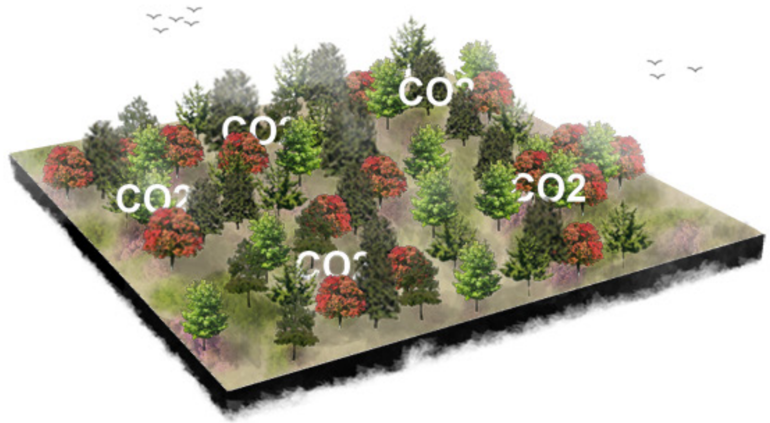


Figure 5.12: Design Vignette of Carbon Sequestration (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.13: Site Suitability for Carbon Sequestration (Sundine, 2018)

Regulating Service: Moderation of Extreme Events

Design Strategies

- Water Storage – on-site fresh water storage in drought event
- Wetland Buffer – prevent future flooding of Mountain Creek Lake
- Shade Elements (trees, structures)– decrease amount of heat island effect in extreme heat

Considerations for Implementation

- Location of on-site structures
- Site micro-climate
- Site hydrology and topography

Benefits

- Building resiliency from extreme events into the site
- Promoting community safety

Valuation Criteria

- Site water carrying capacity and buffer from bodies of water
- Shade % coverage

Complementary Ecosystem Services

- Food, fresh water, local climate and air quality, pollution mitigation, carbon sequestration and storage, water regulation, habitat for species, mental and physical well-being, aesthetic appreciation

Design Vignette

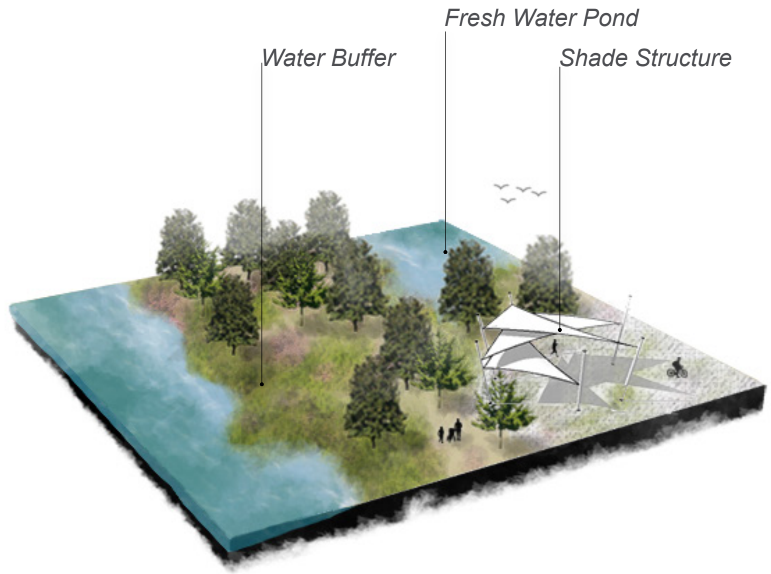


Figure 5.14: Design Vignette of Moderation of Extreme Events (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.15: Site Suitability for Moderation of Extreme Events (Sundine, 2018)

Regulating Service: Water Regulation

Design Strategies

- Porous Surfaces – water infiltration through surfaces
- Green Infrastructure (bioswales, detention ponds) – promoting sustainable use of stormwater runoff

Considerations for Implementation

- Site soils, topography, and slope
- Ground water pollutants
- Location for detention/retention ponds

Benefits

- Controlling direction and amount of surface runoff
- Reuse of gray water

Valuation Criteria

- Water capacity able to handle of stormwater system
- % impervious cover, soil permeability, slope of surface

Complementary Ecosystem Services

- Fresh water, local climate and air quality, pollution mitigation, moderation of extreme events, soil fertility and erosion prevention, mental and physical well-being

Design Vignette

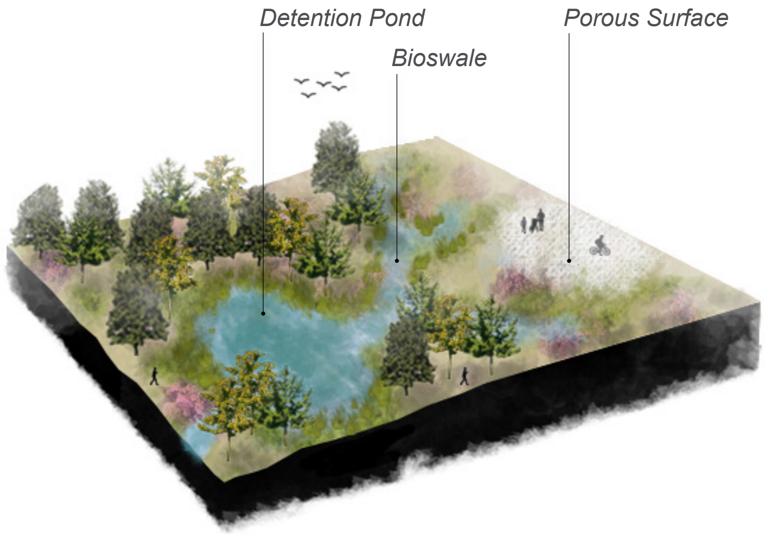


Figure 5.16: Design Vignette of Water Regulation (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.17: Site Suitability for Water Regulation (Sundine, 2018)

Regulating Service: Soil Fertility & Erosion Prevention

Design Strategies

- Revive Soil Fertility – allow for new productive uses
- Variety types of vegetation – vegetation that is capable of thriving current site conditions

Considerations for Implementation

- Soil types and location
- Toxic soils
- Ground water plumes

Benefits

- Revive poor soils for productive usage
- Improve water infiltration

Valuation Criteria

- Soil pH, infiltration, earthworm tests

Complementary Ecosystem Services

- Food, pollution mitigation, moderation of extreme events, water regulation, mental and physical well-being

Design Vignette

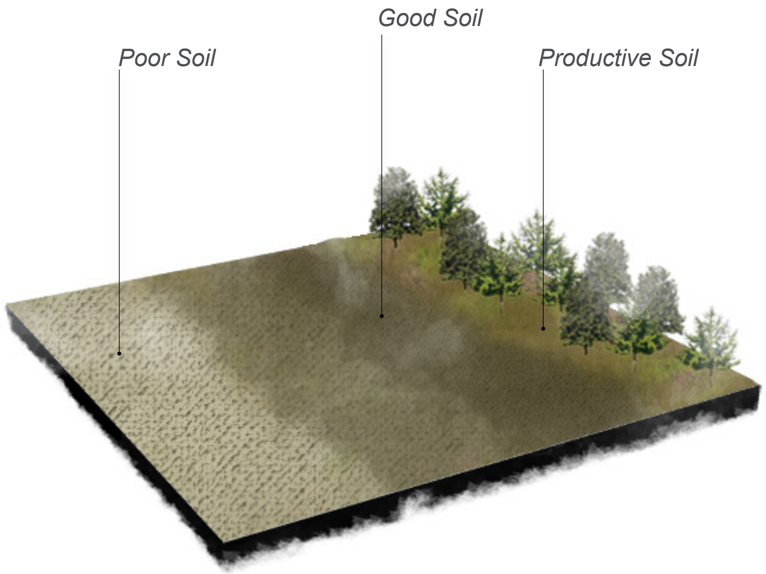


Figure 5.18: Design Vignette of Soil Fertility (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.19: Site Suitability for Soil Fertility (Sundine, 2018)

Regulating Service: Pollination

Design Strategies
- Reduce use of pesticides – limiting further decrease of bee populations
- Pollination Plants – maintaining healthy ecosystems
- Bee Farm – production of honey and promote pollination

Considerations for Implementation
- Soils to support pollinator plants
- Site micro-climate
- Regional connections for pollinator populations

Benefits
- Encourage sustainable production of food
- Promotion pollination education to community
- Maintaining healthy ecosystems

Valuation Criteria
- Capacity for bee farm and pollinator plants
- Production of honey per year

Complementary Ecosystem Services
- Food, habitat for species, mental and physical well-being, tourism, aesthetic appreciation

Design Vignette

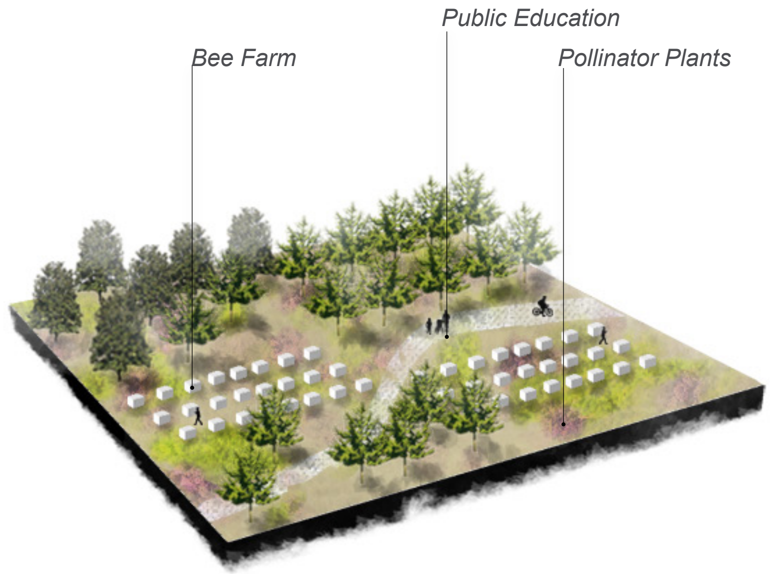


Figure 5.20: Design Vignette of Pollination (Sundine, 2018)

Potential Application to DANS

Legend
- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.21: Site Suitability for Pollination (Sundine, 2018)

Habitat Service: Habitat for Species & Genetic Diversity

Design Strategies

- Providing food, clean water, and places for shelter for species
- Biodiversity Plantings – supporting range of species habitat needs
- Human Interaction Buffers – species protection from humans

Considerations for Implementation

- Maintenance of spaces
- Distance of separation from human interaction
- Toxic soils and groundwater

Benefits

- Promote community wildlife education
- Protect spaces for endangered or threatened species

Valuation Criteria

- % of site use
- Index of Biotic Integrity
- Species diversity and abundance
- Number of people participating in education events

Complementary Ecosystem Services

- Food, fresh water, pollination, recreation, tourism

Design Vignette

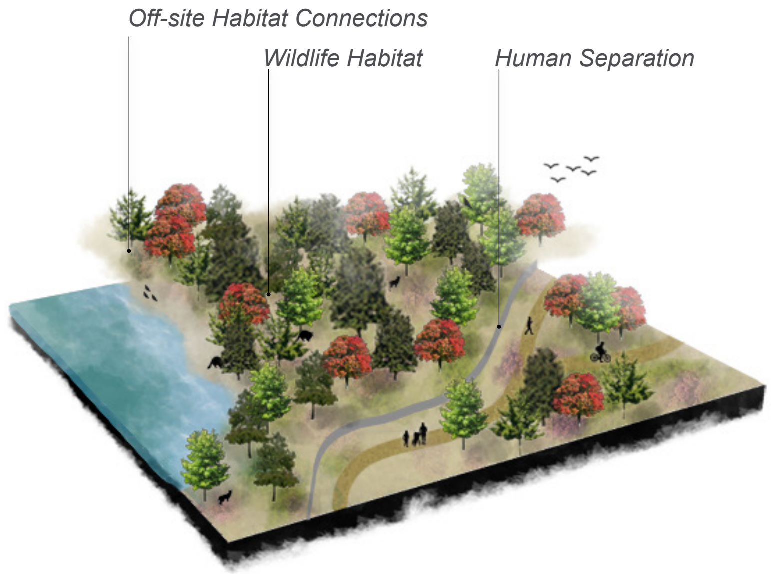
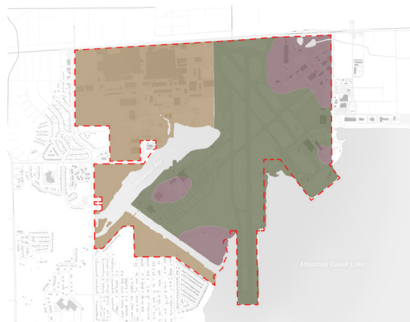


Figure 5.22: Design Vignette of Habitat for Species (Sundine, 2018)

Potential Application to DANS



Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.23: Site Suitability for Habitat for Species (Sundine, 2018)

Cultural Service: Social Cohesion

Design Strategies

- Diverse Housing – equality of housing options
- Mixed Use – promoting variety of land uses
- Public spaces and safety – encouraging sense of community

Considerations for Implementation

- Site amenity locations (retail, green space, recreation)
- Ease of access
- User demographics

Benefits

- Builds send of community, identity and culture
- Reduce crime
- Improve pedestrian safety

Valuation Criteria

- Amount of housing options
- Quality of living
- Occupancy status
- Perception of site safety (reduction in traffic, reduction in crime)

Complementary Ecosystem Services

- Food, reuse of materials, mental and physical well-being, tourism, aesthetic appreciation

Design Vignette

Figure 5.24: Design Vignette of Social Cohesion (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.25: Site Suitability for Social Cohesion (Sundine, 2018)

Cultural Service: Mental & Physical Well-Being

Design Strategies

- Public Outdoor Spaces – promoting community spaces
- Encouragement of physical activity – promote physical well-being
- Green infrastructure education – use of green space and infrastructure to benefit human well-being

Considerations for Implementation

- Access to site
- On-site program elements relative distances to each other

Benefits

- Promote focus of the human mental and physical well-being
- Creating sense of community

Valuation Criteria

- Distances between housing, natural vegetation, public spaces, and educational institutions
- Increase amount of physical exercise
- Change in mood and satisfaction

Complementary Ecosystem Services

- Fresh water, food, local climate and air quality, pollution mitigation, water regulation, carbon sequestration and storage, moderation of extreme events, pollination, social cohesion, recreation, tourism, aesthetic appreciation

Design Vignette

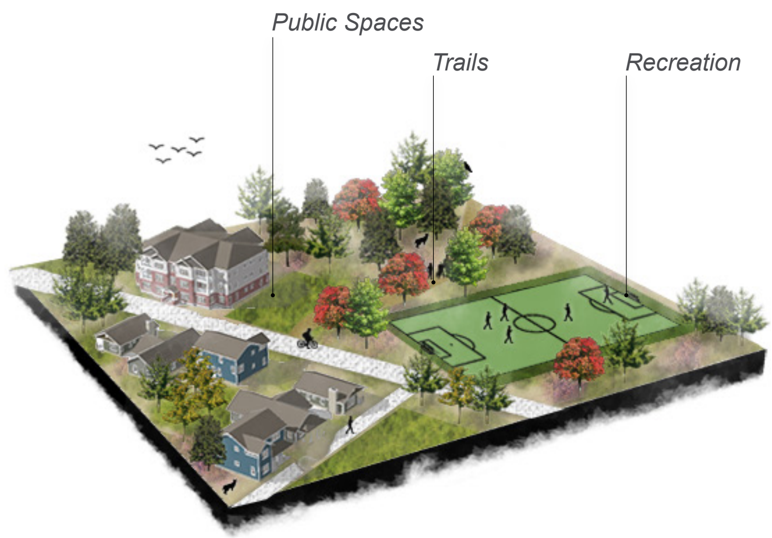


Figure 5.26: Design Vignette of Mental & Physical Well-being (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.27: Site Suitability for Mental & Physical Well-being (Sundine, 2018)

Cultural Service: Recreation

Design Strategies

- Multi-purpose Courts (soccer, football, basketball) - providing for all types of community uses
- Biking and Walking Trails - site connectivity
- Wind Skateboarding and Skate Park - reuse of runway and concrete materials

Considerations for Implementation

- Easy of access and visibility to site
- On-site and off-site views
- Site micro-climate

Benefits

- Encouraging passive and active recreation
- Promoting social interactions

Valuation Criteria

- Number of users per day
- Amount and sizes of facilities (sports fields, trail distances)
- Quality of visitor experience

Complementary Ecosystem Services

- Food, fresh water, reuse of materials, local climate and air quality, pollution mitigation, social cohesion, tourism

Design Vignette

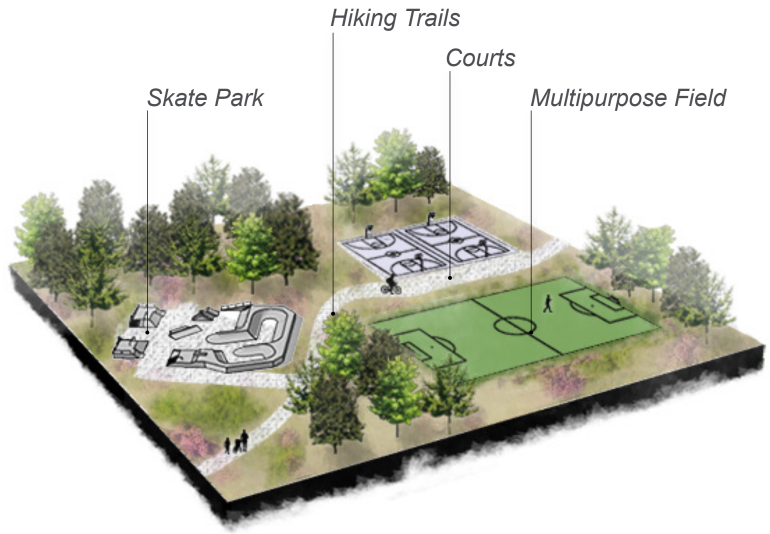


Figure 5.28: Design Vignette of Recreation (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.29: Site Suitability for Recreation (Sundine, 2018)

Cultural Service: Tourism

Design Strategies

- Dallas ½-mile Shootout – use of re-purposed runway for biannual event
- Start up entrepreneurs – new businesses to begin for site utilization
- Aviation Museum – education about the site and aviation history
- Tree, Agriculture, and Bee Farm – education and production of goods

Considerations for Implementation

- Easy of access and visibility to site
- Site micro-climate and soils
- Space requirements for events

Benefits

- Production of site economic value
- Creating new site identity

Valuation Criteria

- Number of users per day
- Economic generation

Complementary Ecosystem Services

- Food, fresh water, reuse of materials, water regulation, pollination, social cohesion, mental and physical well-being

Design Vignette

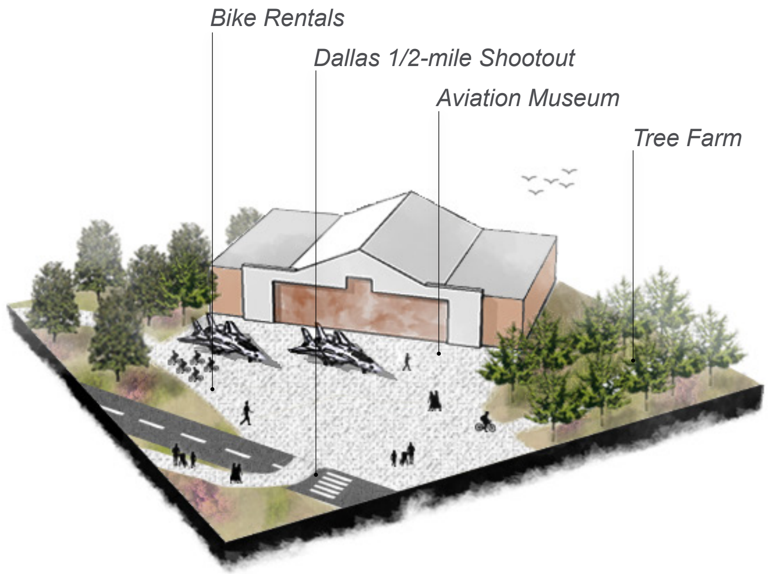


Figure 5.30: Design Vignette of Tourism (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.31: Site Suitability for Tourism (Sundine, 2018)

Cultural Service: Aesthetic Appreciation

Design Strategies

- Site identity - creating identity from history and new uses
- Comfort of people - promoting safe and pleasing spaces
- Noise reduction - public spaces distant or protected from noises
- Hiking trails - site connectivity to scenic views

Considerations for Implementation

- Elements on site that remain to create identity
- Good and poor views on and off site

Benefits

- Additive to human mental and physical well-being
- Create new site identity
- Promote safety and comfort of community

Valuation Criteria

- Kaplan, Kaplan
- Kevin Lynch (Path, edge, district, node, landmark)
- Perception of improved aesthetics

Complementary Ecosystem Services

- Food, fresh water, reuse of materials, local climate and air quality, pollution mitigation, social cohesion, mental and physical well-being, recreation, tourism

Design Vignette

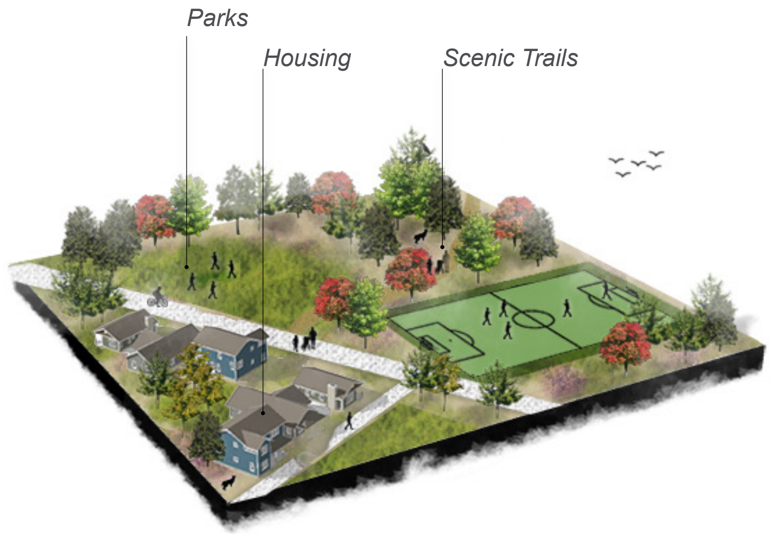


Figure 5.32: Design Vignette of Aesthetic Appreciation (Sundine, 2018)

Potential Application to DANS

Legend

- Most Suitable
- Moderately Suitable
- Least Suitable

Figure 5.33: Site Suitability for Aesthetic Appreciation (Sundine, 2018)

5.2

Dallas Air Naval Station Design

Short-Term Design

Short-Term Design

Purpose of Short-Term Design

By applying the Ecosystem Services Urban Design Framework to the DANS site, a short-term (5-10 year) master plan is developed; thus, activating the site and setting foundation for future flexible phasing. In the short-term the 465-acres on the eastern portion of the site begins to address immediate issues within the Dallas area, while preserving current economic uses on the western site, including the Texas National Guard and Dallas Global Industries. The proposed design program, layout, and spatial extent were informed by current issues in Dallas, including: water quality, loss of habitat, air pollution, neighborhood inequality, public health and findings from the site analysis. Utilizing only a portion of the site in the short term, reserves an opportunity for expansion that can be tailored to address future issues.
(See Figure 5.34)

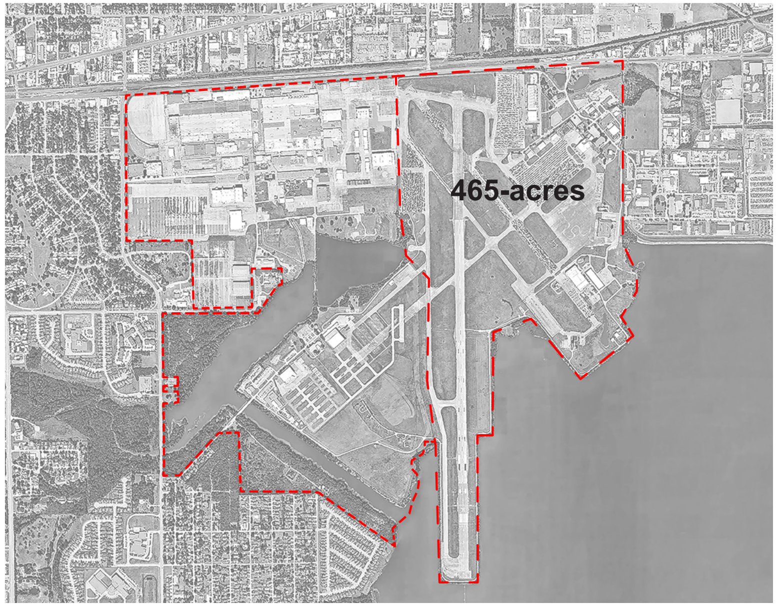
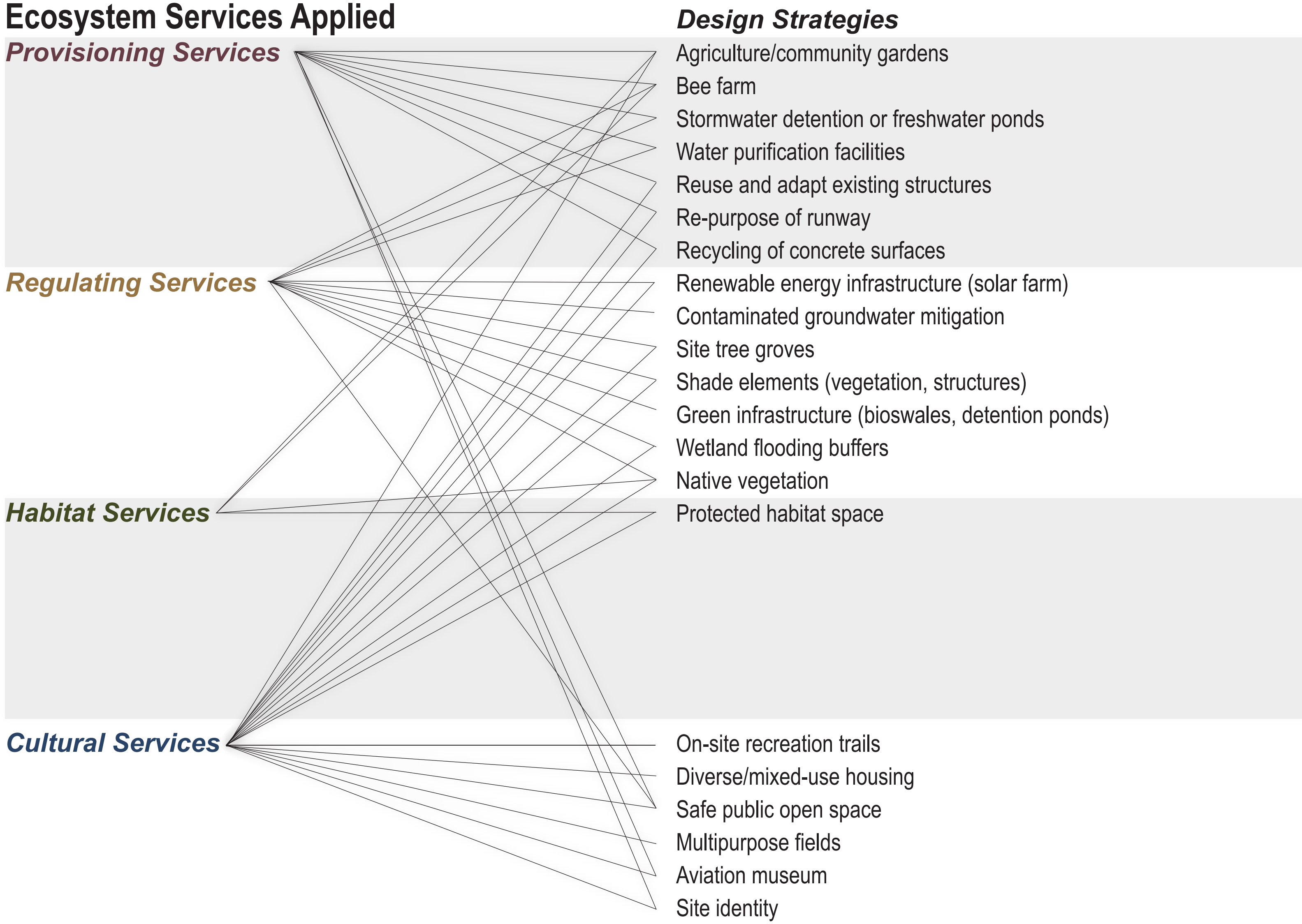


Figure 5.34: Short-Term Design Potion of Site (Sundine, 2018)

Design Vision

Create a mixed-use urban infill community that is centralized on the improvement of the community's well-being through prioritizing provision, regulating, habitat, and cultural services.

Ecosystem Services Applied



Short-Term Design

Program Development

The programmatic elements have been developed with findings from the precedent analysis, site analysis, and informed by the Ecosystem Services Urban Design Framework. The program is separated into three categories: residential, commercial, and open space.

Residential

- **Design Goal**: Address neighborhood inequality and homeless populations
- Housing (DU/ac)
    - Homeless population
    - Affordable housing (4 Story max, 30 – 60 DU/ac)
    - Mixed Use (5 Story max, > 55 DU/ac)
    - Single Family (3 Story max, 5-30 DU/ac)

Commercial

- **Design Goal**: Address pollution and management of resources
- Retail (Mixed use)
    - Grocery Store
- Primary civic area for the community
- Aviation Museum
- Tree Farm
- Commercial/industrial

Open Space

- **Design Goal**: Address lack of habitat and promotion of public health
- Centralize/connecting green space
- Recreation (Open fields, trails)
- Community gardens
- Wildlife Preserve
- Stormwater detention and fresh water ponds

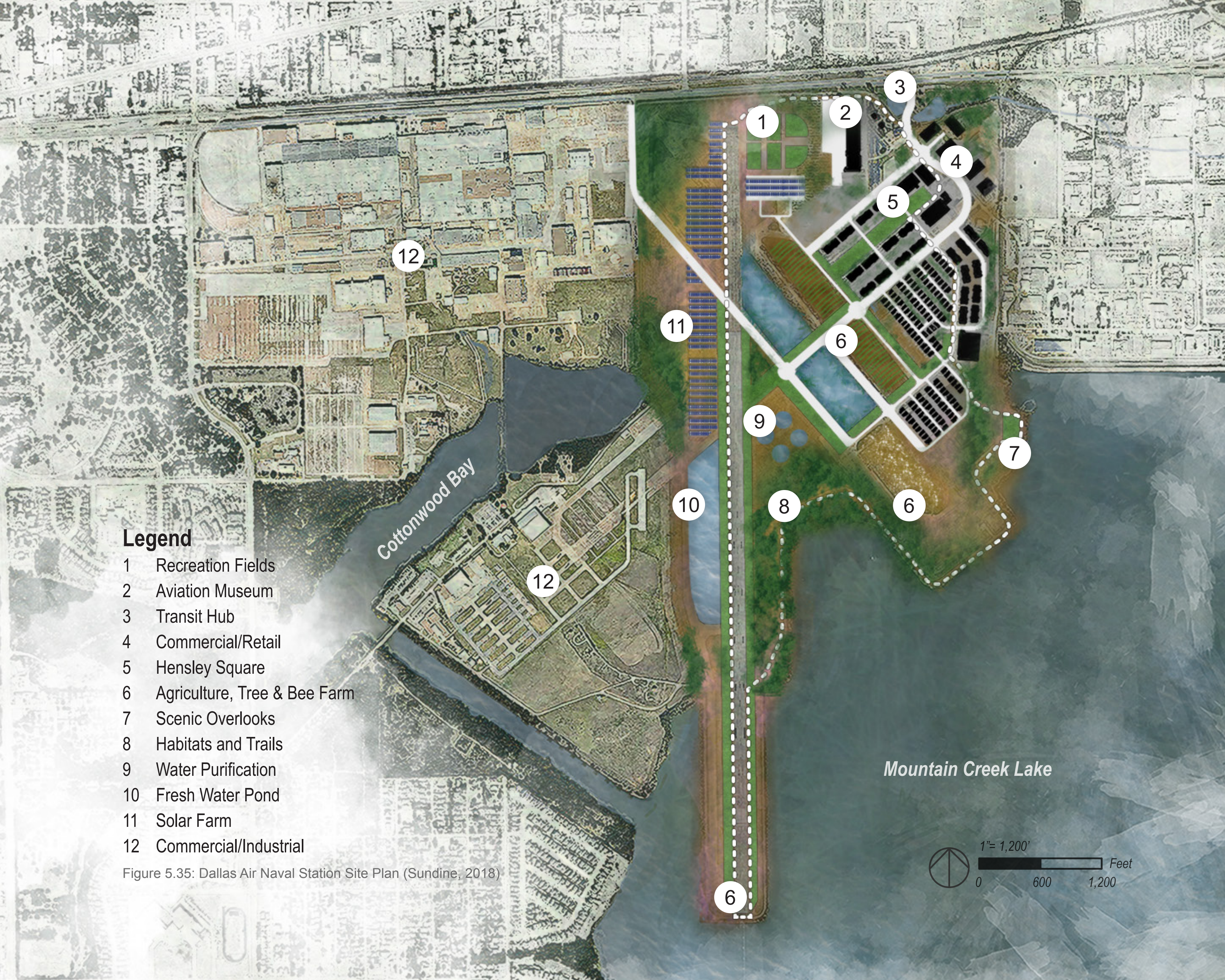


Figure 5.35: Dallas Air Naval Station Site Plan (Sundine, 2018)

Figure 5.36: Hanging out on the runway (Sundine, 2018)

Recreation on the Runway

Many activities can be held on the re-purposed 8,000ft. runway. Recreation can include bicycle riding, jogging, wind skateboarding and other activities. Because the land around the runway is relatively flat and cleared, it offers valuable space for a solar farm and rows of trees for shade and carbon sequestration.

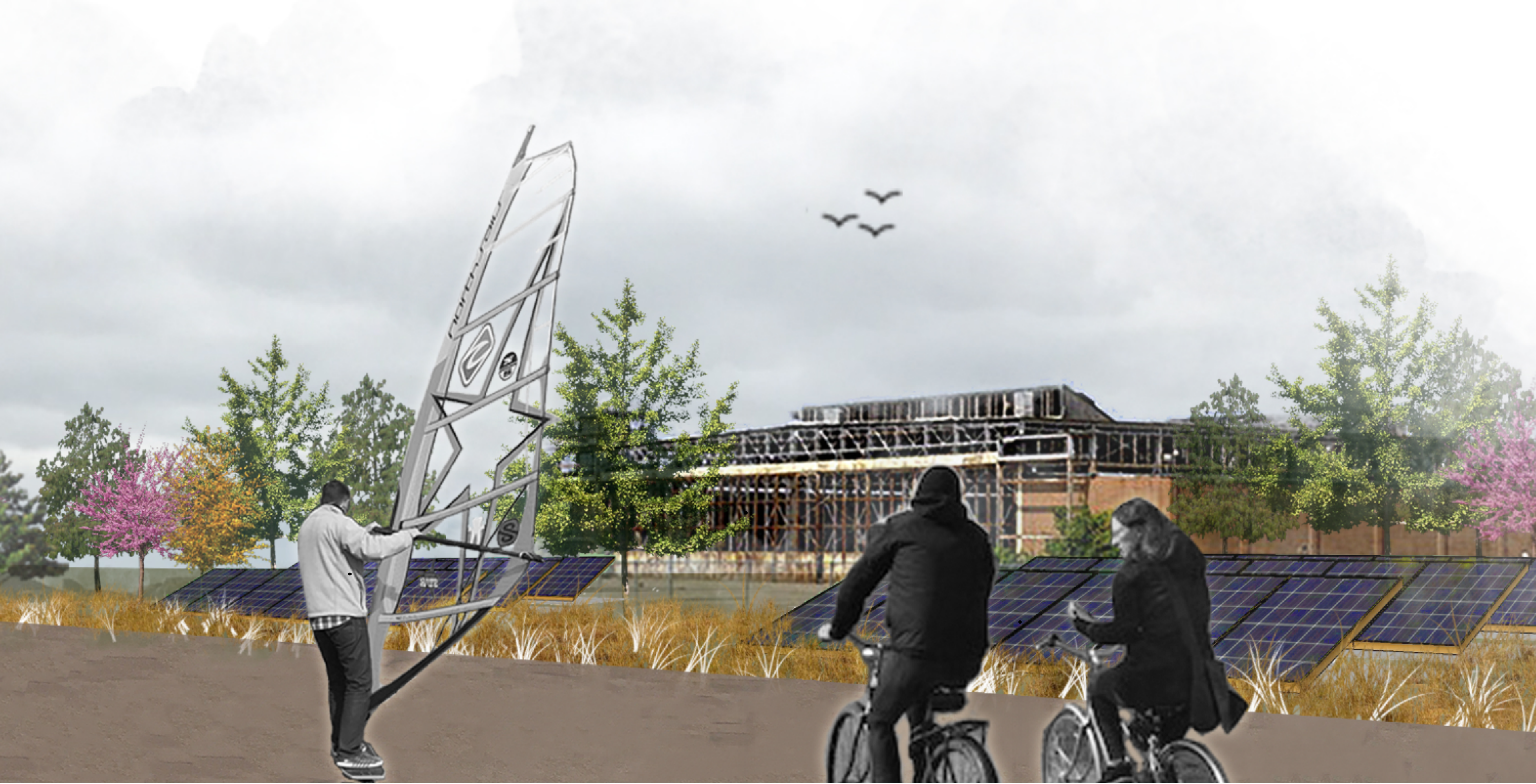

Recreation
Reuse of Materials
Local Climate and Air Quality

Figure 5.37: Community Events in Hensley Square (Sundine, 2018)

Community Events in Hensley Square

Located between two re-purposed airplane hangers, Hensley Square will be a central gathering space for the on-site and adjacent community. Potential events may include a food markets, outdoor movies, concerts, and other community events. Housing developed near the square will provide people ease of access.

Water Regulation

Reuse of Materials

Social Cohesion

Aesthetic Appreciation

Figure 5.38: Sustainability of Dallas Air Naval Station (Sundine, 2018)

Sustainability of Dallas Air Naval Station

Open spaces of the site provide many opportunities for agriculture, bee farming, fresh water ponds, trails, and habitat spaces. These ecosystem service elements can help build resiliency into the site, allowing for multifunctional usage, and physical expansion or contraction based on future needs.


Pollination
Habitat

Short-Term Design Ecosystem Services Provided

Provisioning Services

Food

- Established community garden for residents at DANS
- 21 acres available for urban agriculture

Fresh Water

- Reduction of potable water use
- 24 acres available for stormwater detention or fresh water ponds
- Fresh water purification systems

Urban Site Conditions: Reuse of Materials

- 4 large hangers reused for aviation museum and civic spaces
- 4 building used for historical and administration
- Reuse of runway for community events and recreation

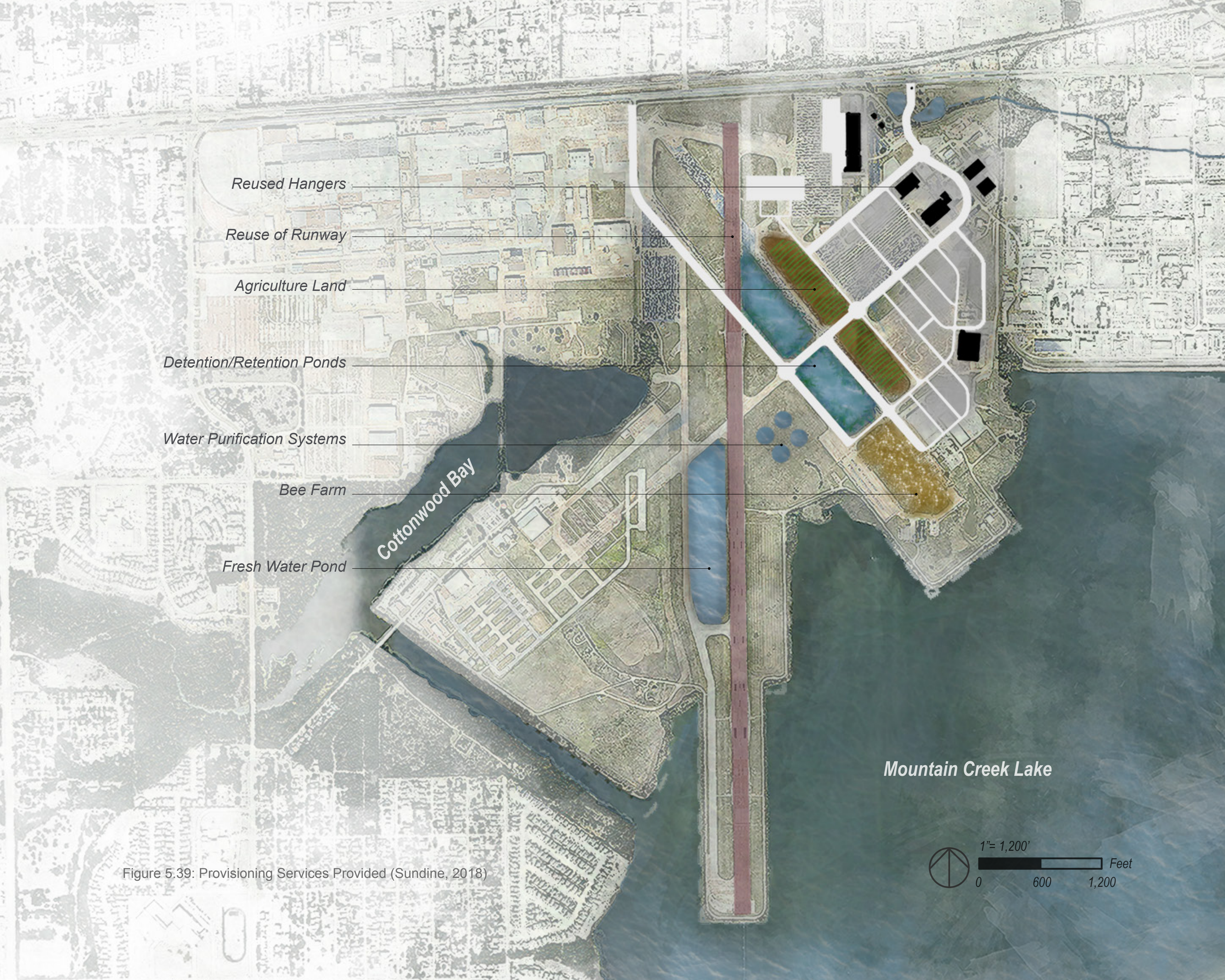


Figure 5.39: Provisioning Services Provided (Sundine, 2018)

Short-Term Design Ecosystem Services Provided

Regulating Services

Local Climate and Air Quality

- 20-acre solar panel farm and panels located on top of structures
- Limited need of vehicles from compact, walkable, bike-able development
- Street trees

Pollution Mitigation

- Mitigate spread of contaminated ground water plumes by locating structures above
- Direct runoff water to green spaces and ponds for infiltration

Carbon Sequestration and Storage

- Over 30 acres of planted urban forest
- Street trees
- Residual spaces seeded with native grasses

Hazard Regulation

- Flooding buffer of Mountain Creek Lake
- 24 acres of fresh water ponds
- Shade elements throughout the site (vegetation/structures)

Water Regulation

- Utilize green space to accommodate stormwater management system
- Mitigation runoff on-site

Pollination

- Use of native plants to the Dallas region
- Development of bee farm

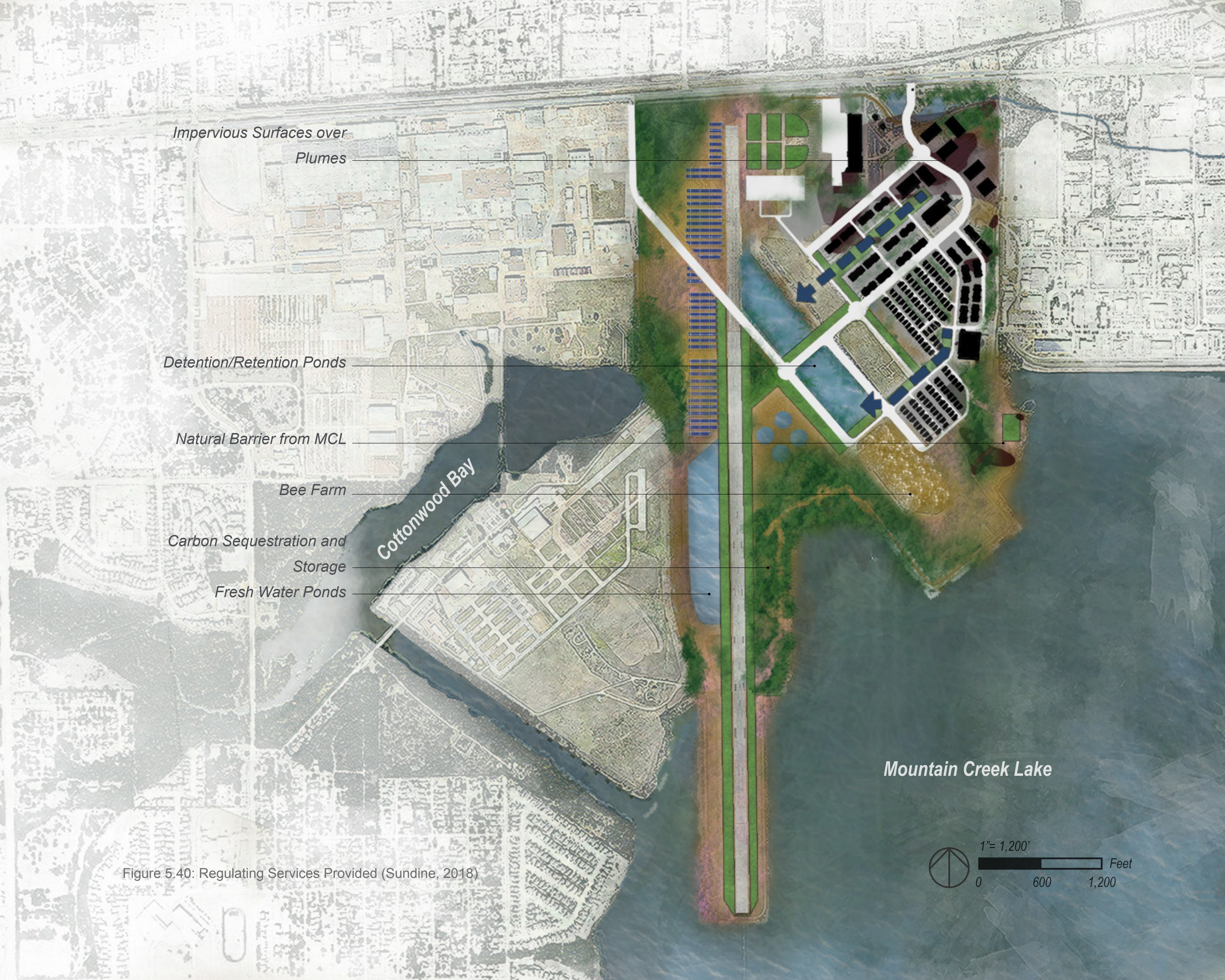


Figure 5.40: Regulating Services Provided (Sundine, 2018)

Short-Term Design Ecosystem Services Provided

Habitat Services

Habitats for Species

- 40 acres of protected and non-protected wildlife habitat
- 150ft habitat buffer from human interaction
- Bee farm and native vegetation

Figure 5.41: Habitat Services Provided (Sundine, 2018)

Short-Term Design Ecosystem Services Provided

Cultural Services

Social Cohesion

- Public trails that connect within the site to the surrounding context
- 131 of single-family units
- 264 of multi-family units
- 10 acres of on-site public spaces

Mental and Physical Well-Being

- Ease of access to on-site green spaces
- Promoting recreational activities

Recreation

- 6 multipurpose fields and parks
- 4.5-mile trail around site
- Passive recreation areas near closed species habitats

Tourism

- Tree and bee farm
- Aviation Museum
- Accommodation for Dallas ½ mile shootout car racing event on the runway
- Open to new entrepreneur to create site's new identity in public realm

Aesthetic Appreciation

- New site identity
- Usage of street trees
- Regional materials for structures and site elements

Figure 5.42: Cultural Services Provided (Sundine, 2018)

Short-Term Design

Short-Term Design Valuation of Ecosystem Services

Based on Dallas' short-term needs and the opportunities and constraints inherent to the DANS site; a qualitative valuation was created to visualize the presence and relationships of the ecosystem services applied in the short-term design.

The value of each ecosystem service is moderately equal. Reuse of materials, local climate, pollution mitigation, and social cohesion are the main services of most importance because of the present issues to address air quality, neighborhood inequality, and public health.

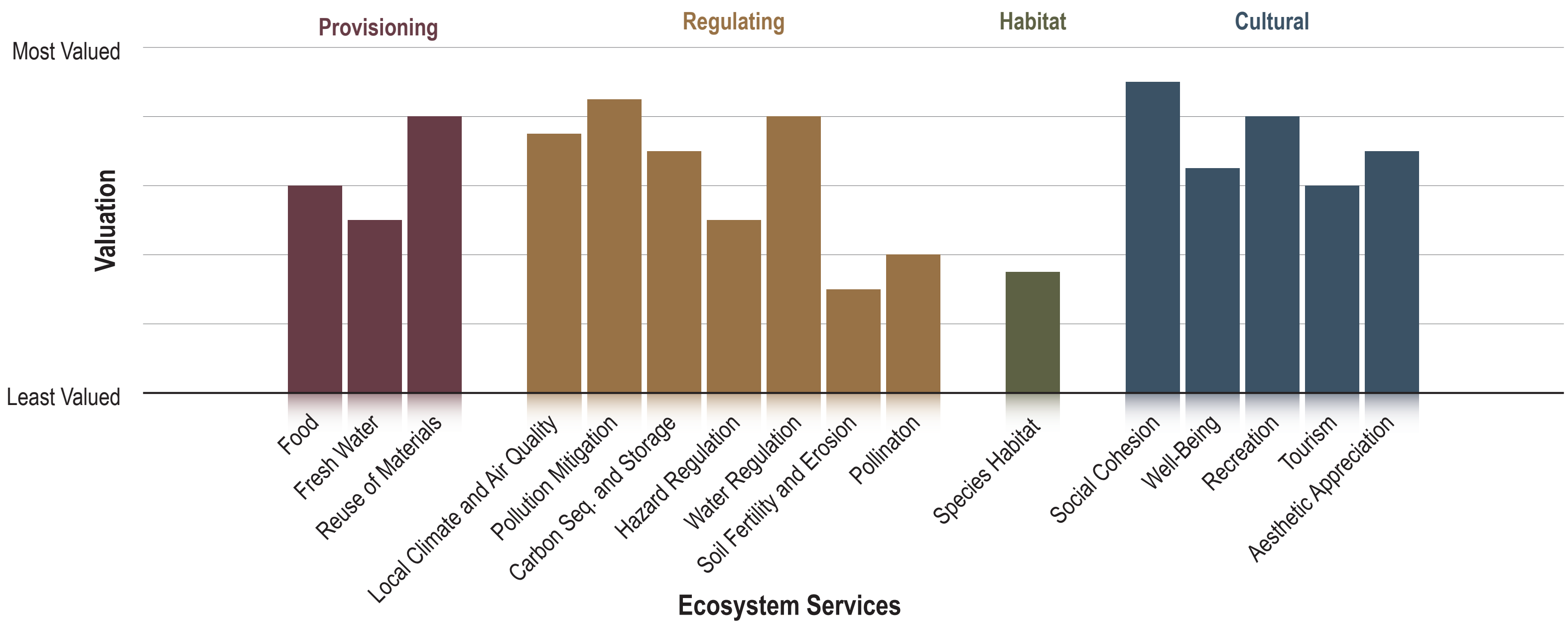


Figure 5.43: Short-Term Plan Valuation (Sundine, 2018)

5.3

Dallas Air Naval Station Design

Long-Term Adaptive Scenarios

Long-Term Adaptive Scenarios

Purpose of Long-Term Adaptive Scenarios

The purpose of the long-term design is not to focus on a single end result, but rather a series of conceptual design scenarios. Each scenario is informed by the Ecosystem Services Urban Design Framework and takes into consideration potential future issues of the Dallas region.

The short-term design utilized the western portion of the site, while the long-term adaptive design scenarios focus mainly on the remaining eastern 580-acres. Because of the uncertainty of the future, the adaptive design strategy uses scenario-based situations, derived from projected future issues of Dallas. These issues were determined by predictions found in literature and cover topics such as: climate change, water quality, air pollution, neighborhood inequality, and lack of resources.

Each scenario is depicted with a valuation graph that qualitatively expresses least valued to most valued ecosystem service. In each scenario, individual ecosystem services have different weighted values depending on the predicted issues. The goal is to show the trade-offs of services that might occur based upon the effects of scenario. With an understanding of which services can or need to have the most importance, specific design strategies can be made to adapt the site. Design vignettes, rather than a formal plan, visually show design elements that might be featured, and their spatial relationships within each scenario.

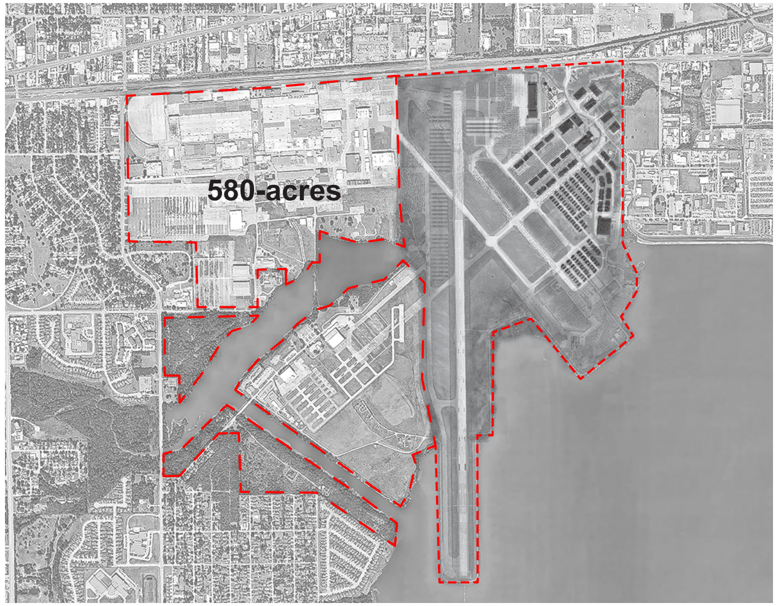


Figure 5.44: Remaining Portion of Site (Sundine, 2018)

Future Issues for Dallas

Environmental

- Water quality (Environment Texas n.d.) (ICPP 2014)
- Water scarcity (ICPP 2014)
- Heat waves, heat island (Environment Texas n.d.) (Vision North Texas 2010)
- Lack and loss of habitat (Environment Texas n.d.) (Vision North Texas 2010) (ICPP 2014)
- Natural disasters (Environment Texas n.d.) (ICPP 2014)
- Negative production of energy (Environment Texas n.d.)
- Air pollution (Environment Texas n.d.) (ICPP 2014)
- Sustaining Agriculture (Environment Texas n.d.) (ICPP 2014)

Social

- Neighborhood inequality (Macon 2017)
- Public health (ICPP 2014)
- Homelessness (Nicholson 2016)
- Rapid population growth (ICPP 2014)
- Lack of resources (water, food, shelter, energy) (ICPP 2014)
- Food security (ICPP 2014)

Envisioned Scenarios

- ***Scenario 01: Climate hazards worsen social tensions, causing negative outcomes of livelihood for people living in poverty of food, shelter, and water (ICPP 2014, 65, 69).***

- ***Scenario 02: The increase of population and negative impacts of climate have led to a strain on resources like energy, production of food, and clean water (ICPP 2014, 67).***

- ***Scenario 03: Continued increase of CO2 emissions have led to significant heat waves that negatively affect public health and production of resources (ICPP 2015, 59).***

- ***Scenario 04: Changes in the climate and rapid urbanization have altered species' geographic locations, migration patterns, and a degradation of habitat (ICPP 2014, 51).***

Long-Term Adaptive Scenario 01

Climate hazards worsen social tensions, causing negative outcomes of livelihood for people living in poverty of food, shelter, and water (ICPP 2014, 65, 69).

Valuation

From the rise of climate hazards effecting social elements, people who are living in poverty won't have an equal right to the essentials of food, shelter, and water. Due to the presented issues, provisioning and cultural services are of the most important. As the importance is placed on providing food, fresh water, social cohesion, and human well-being; the trade-offs will occur mainly in regulating and habitat services.

Some regulating and habitat services will not be of most importance. These services are not going to offer the most contribution to the present issues for people in need of food, water, and shelter.

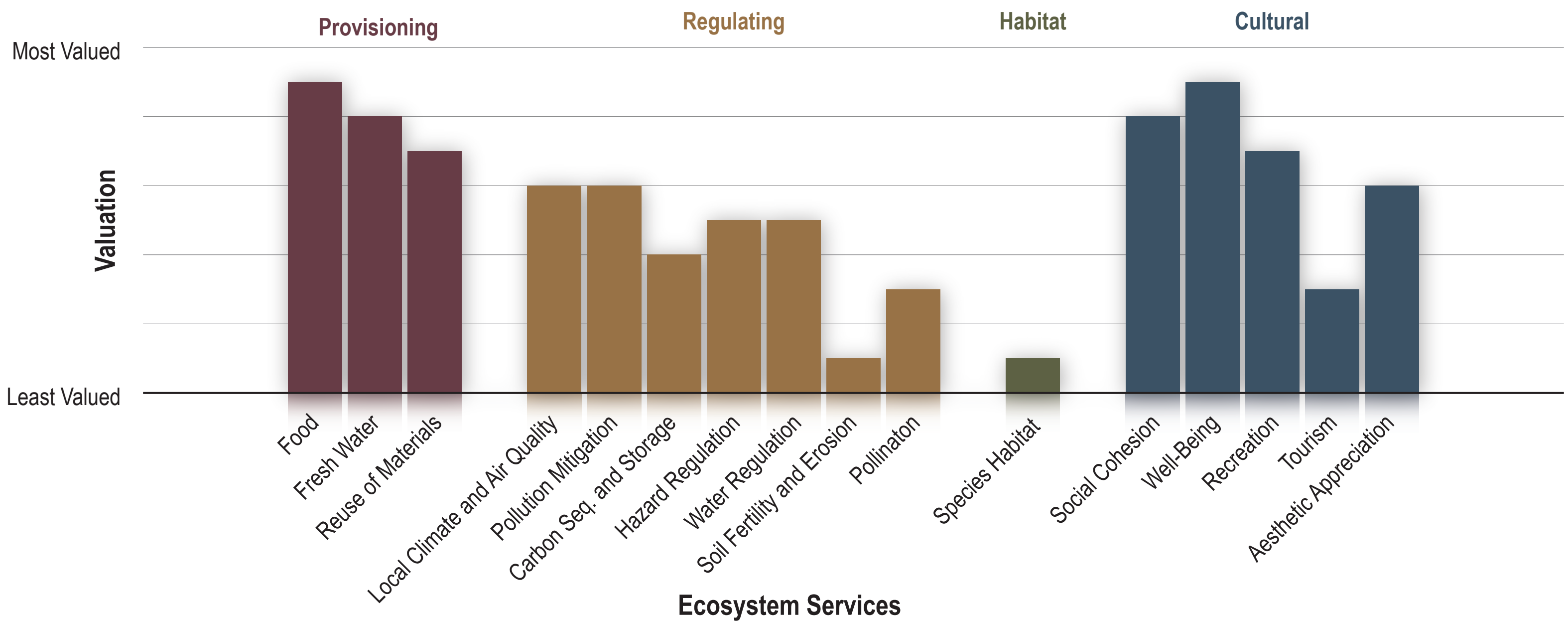


Figure 5.45: Scenario 01 Valuation (Sundine, 2018)

Design Strategies

This scenario focuses on providing a design consisting of diverse housing options and community gathering spaces, seeking to break down unequal rights between social classes.

Figure 5.46: Scenario 01 Spatial Planning (Sundine, 2018)

Long-Term Adaptive Scenario 02

The increase of population and negative impacts of climate have led to a strain on resources like energy, production of food, and clean water (ICPP 2014, 67).

Valuation

Increased population in urban areas, has lead to a strain on resources that are a basic human need, such as green energy, food, and water. Thus ecosystem services become more focused on production of goods and energy, with less focus on providing habitat and cultural services.

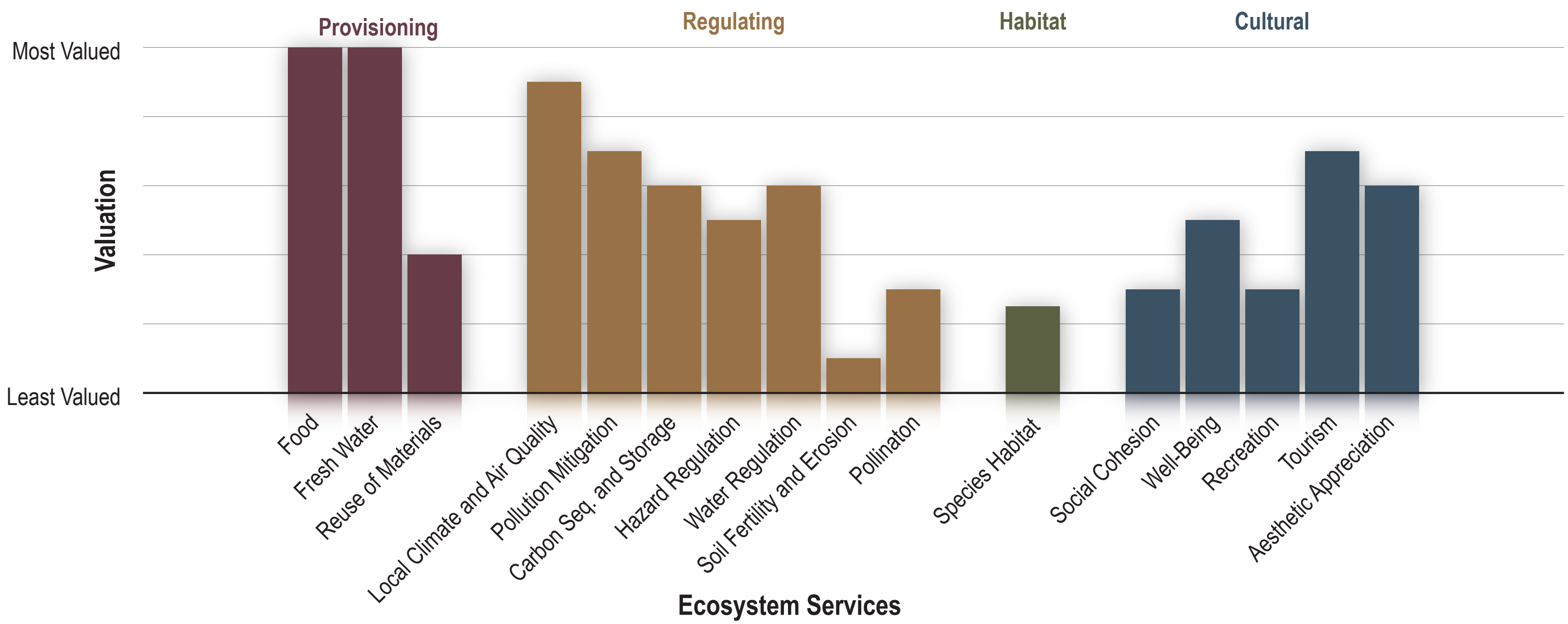


Figure 5.47: Scenario 02 Valuation (Sundine, 2018)

Design Strategies

This scenario focuses mainly on the production of energy and goods. This can be accomplished through wind turbines, solar panels, urban agriculture, and clean water production. Implementation and benefits of these elements can be a strong focus for the community and promoted through tourism and education.

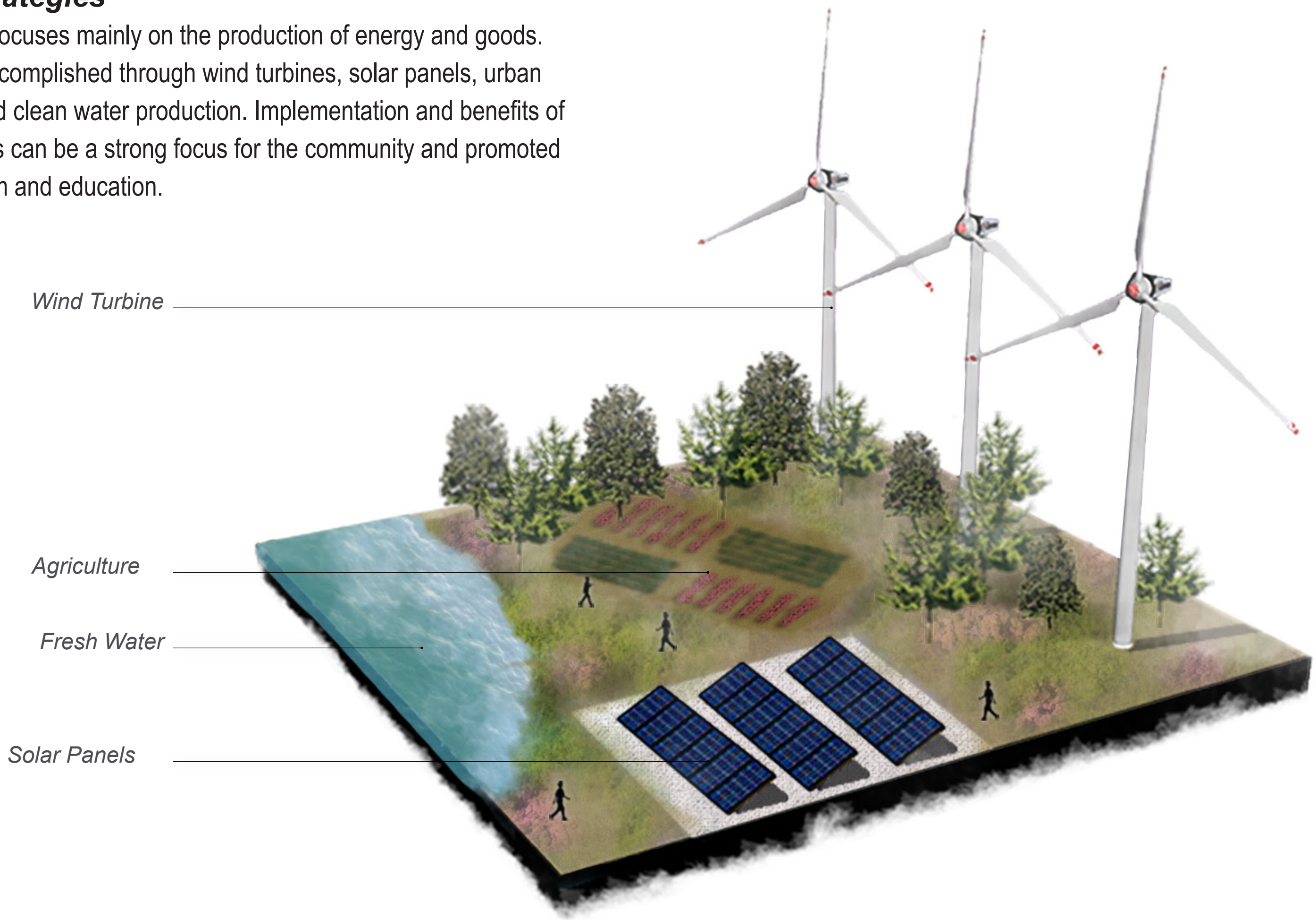


Figure 5.48: Scenario 02 Spatial Planning (Sundine, 2018)

Long-Term Adaptive Scenario 03

Continued increase of CO_2 emissions have led to significant heat waves that negatively affect public health and production of resources (ICPP 2014, 59).

Valuation

The public's well-being will be the central focus; thus, provisioning services will be at a higher value to help combat increased emissions and undesirable heat waves. Trade-offs may impact food, fresh water, and habitat due to the focus on decreasing CO_2 emissions.

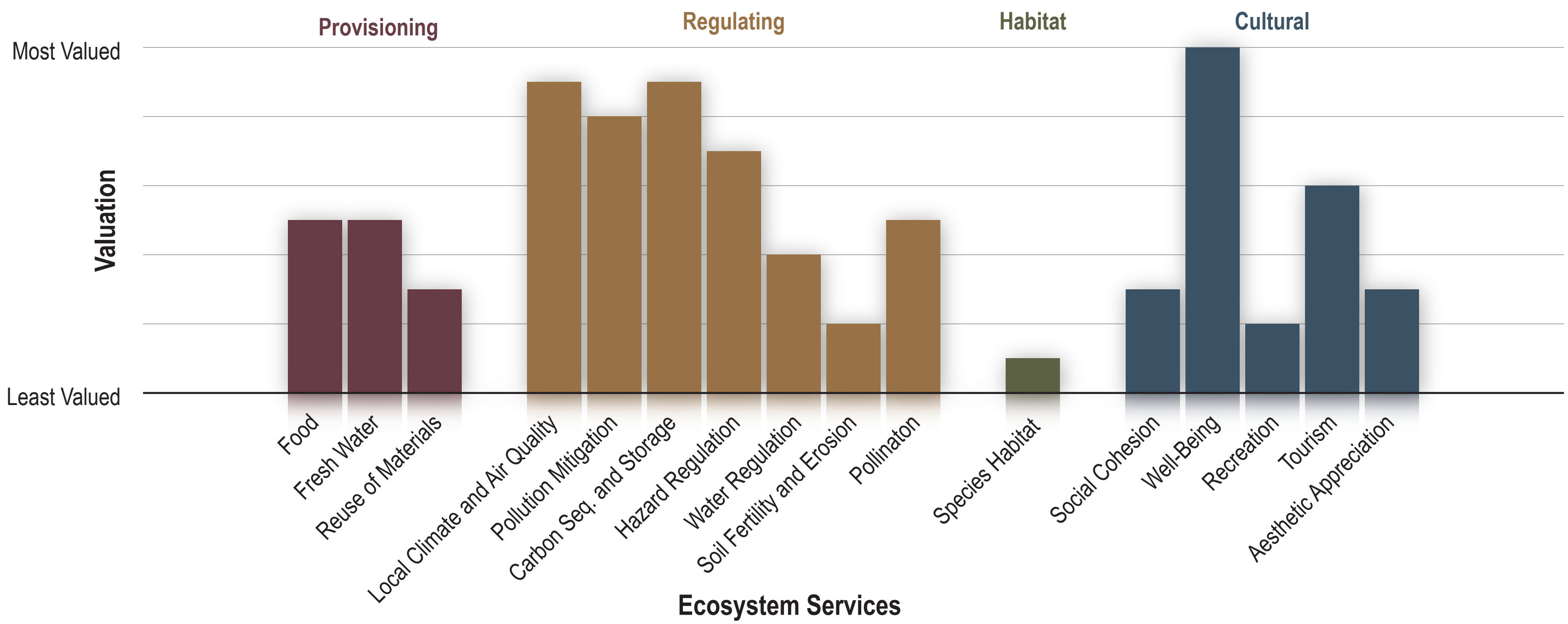


Figure 5.49: Scenario 03 Valuation (Sundine, 2018)

Design Strategies

To moderate heat waves and combat elevated CO_2 emissions, this scenario focuses on providing elements such as trees and shade structures for human well-being. Vegetation and green energy can be effective in mitigating the CO_2 pollution too.

Figure 5.50: Scenario 03 Spatial Planning (Sundine, 2018)

Long-Term Adaptive Scenario 04

Changes in the climate and rapid urbanization have altered species' geographic locations, migration patterns, and a degradation of habitat (ICPP 2014, 51).

Valuation

Though the focus is on habitat creation, some provisioning and regulating services can be used alongside as well, including food and carbon sequestration. Trade-offs may impact social cohesion and human well-being.

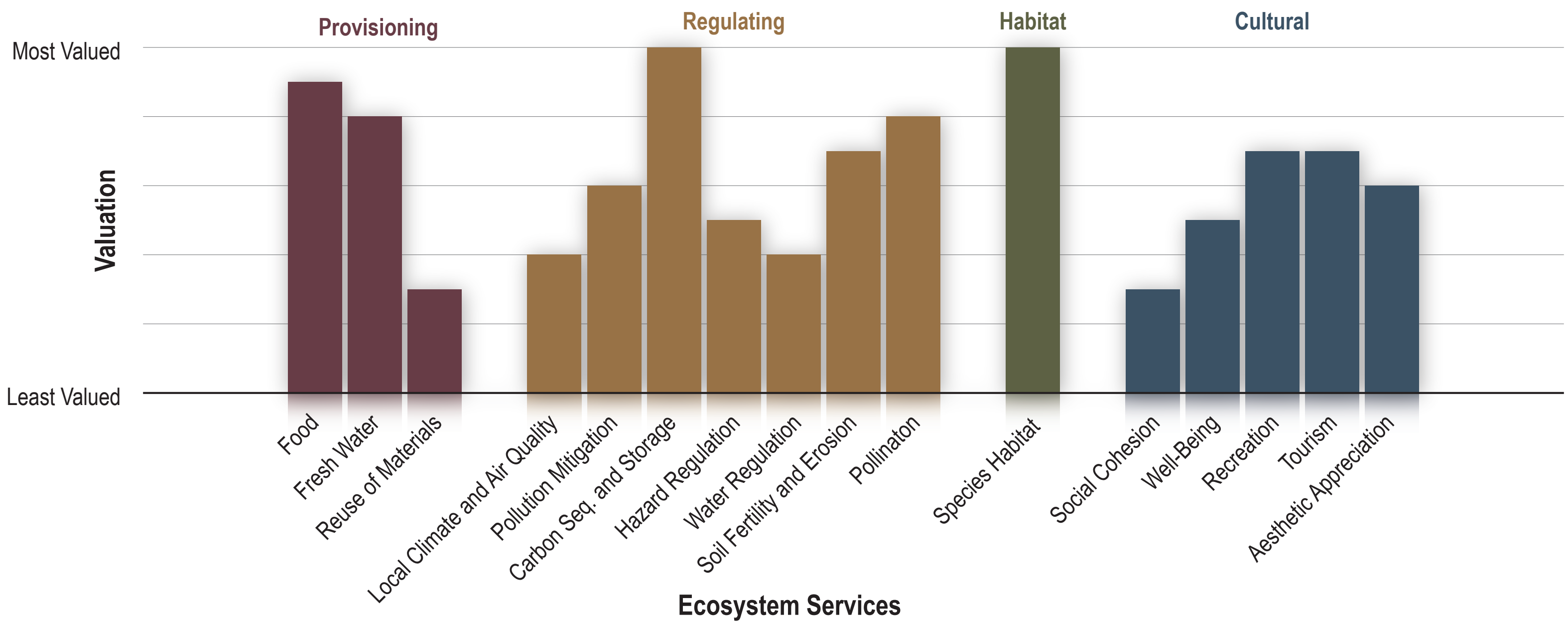


Figure 5.51: Scenario 04 Valuation (Sundine, 2018)

Design Strategies

This scenario is a space mainly delineated for habitat, but design elements for the community can be implemented through recreation, tourism, and education as well.

Figure 5.52: Scenario 04 Spatial Planning (Sundine, 2018)

Long-Term Adaptive Scenarios

Summary

The goal of imagining scenarios was to illustrate how the Ecosystem Services Urban Design Framework could be applied in different scenarios to achieve a myriad of potential outcomes. When the need to physically design for when a future scenario arises, an understanding of the present site conditions and actual Dallas issues should be revisited and well understood. Though the framework is flexible in its use, it needs to be calibrated to actual conditions. Additionally, as new phases are active, aspects of the short-term site design should be reevaluated to see if the site is preforming as desired or if alterations need to be made.

Figure 5.53: Long-Term Adaptive Scenario Vignettes (Sundine, 2018)

6.0

Conclusion

Conclusion

Project Significance & Outcomes

Ecosystem services are central to human well-being and the stewardship of the natural environment. The Ecosystem Services Urban Design Framework can help encourage the cultivation of ecosystem services through design. When used as a primary design strategy, for decommissioned airfields and urban brownfield sites, the Ecosystem Services Urban Design Framework can present new design opportunities for short-term activation and long-term adaptability. This process can continue to make the public and policymakers more aware and understand the complexity of ecosystem services and the benefits that can be derived from tangible forms of design. The implementation of metrics to assess the performance of ecosystem services in design will help designers better understand how we can best utilize each service in different scenarios.

The short-term design strategy proposed for the Dallas Air Naval Station will provide the community added value and activate essential ecosystem services. Moreover, in doing so will help address some of Dallas's current environmental and social issues. The design meets affordable housing needs; creates community spaces through recreation and food; provides habitat to threatened species; promotes mitigation of pollution spread; and, builds resiliency for the site to become adaptable in the future. The long-term adaptive scenarios show the potential value of individual ecosystem services and the trade-offs that might occur in Dallas during the next century. By not singularly focusing on the 'end result' of a typical design, the open-endedness of an adaptive design allows flexibility to respond to unpredictable future scenarios.

The use of ecosystem services in design can be implemented at a variety scales and site locations. This research and projective design argues the use of ecosystem services in design is possible. The implementation at the Dallas Air Naval Station shows the use of ecosystem services for urban brownfield sites. Hopefully, this project can inform future design proposals that use ecosystem services to become more adaptive and multifunctional.

Project Limitations

One of the challenges of integrating ecosystem services into a design are trade-offs that might occur. Heavily valuing or prioritizing one service may come at the expense of another. It may be difficult to provide a proper balance across ecosystem service categories depending on site conditions and programmatic needs. Another challenge is the performance of ecosystem services. Just because a design attempts to maximize the benefits of an ecosystem service, does not mean the results are guaranteed, ecosystems are dynamic and can be unpredictable.

Quantifying and valuing the benefits of ecosystem services is challenging. There are no standard metrics or agreed upon assessment tools, which opens the door to potential subjectivity and bias in assessment. My projective assessment of value, for each adaptive scenario, was based on informed estimates. However, many factors would play into an actual assessment. Perhaps one of the most significant challenges for assessing benefits is that ecosystems are dynamic and change through time. Something of benefit today may be entirely different in a few years' time, due to internal processes and external factors.

Like ecosystems, cities themselves are dynamic and everchanging. Planning for future needs can be difficult. Turning toward literature can help identify predicted issues, but until the time comes, we may not know the full impacts and extent of social, environmental, and economic challenges. Designers need to be well equipped to create designs that can change and adapt based on current needs.

This design challenge will be a necessity for interdisciplinary teams. A limitation of this project was my one perspective as a landscape architect. Ideally engineers, ecologists, biologists, planners, architects, and others would be part of the development and application of an Ecosystem Services Urban Design Framework.

Understanding a site's specific conditions can be difficult due to the lack data collection in the field. Decommissioned airfields and urban brownfield sites can include many unknowns that will only be found through an in-depth site study. In an ideal application of the Ecosystem Services Urban Design Framework, the work would be well informed by accurate data and site research.

Conclusion

Future Research

From the continued recognition of ecosystem services in literature, we still need a more in-depth study of incorporating ecosystem services into urban planning and design. We designers are not often equipped with the tools for applying metrics and long-term assessments. Interdisciplinary teams need to be formed to evaluate the benefits and metrics of ecosystem services in built works. This continued interdisciplinary research can encourage identifying a set of core metrics for designers to assess the success and failures of our built works.

Metrics that relate directly to built infrastructure will show the public and policy makers visible performance benefits that ecosystem services can provide. In urban design, applying ecosystem services can continue to be used as experimental design strategies that will build upon existing research. We need more critically assessed precedents to help better understand how to implement and justify out work.

Project Reflection

The process of defining a project from the ground up has taught me a lot professionally and personally. The profession of landscape architecture is continuing to grow and will become more critical in addressing future issues that cities will be facing. Landscape architects have the capabilities to think and work across scales and disciplines. Thus, making them well poised for leadership in future urban design issues.

Personally, the project has taught me a lot about how to continue to push my thinking forward, developing more ways to communicate my work, and simplifying my thoughts making it easier for others to understand. In professional practice, ecosystem services are not a primary focus in implementing design strategies that contribute to the benefit of human well-being. As I progress through my career, a personal goal to make would to become a designer that pushes for the implementation of ecosystem services concepts in design and building upon the foundation of utilizing ecosystem services as design strategies. This research reflects an accumulation of all the tools and knowledge that I have learned over the past five years and will continue to learn throughout my career.

Appendices

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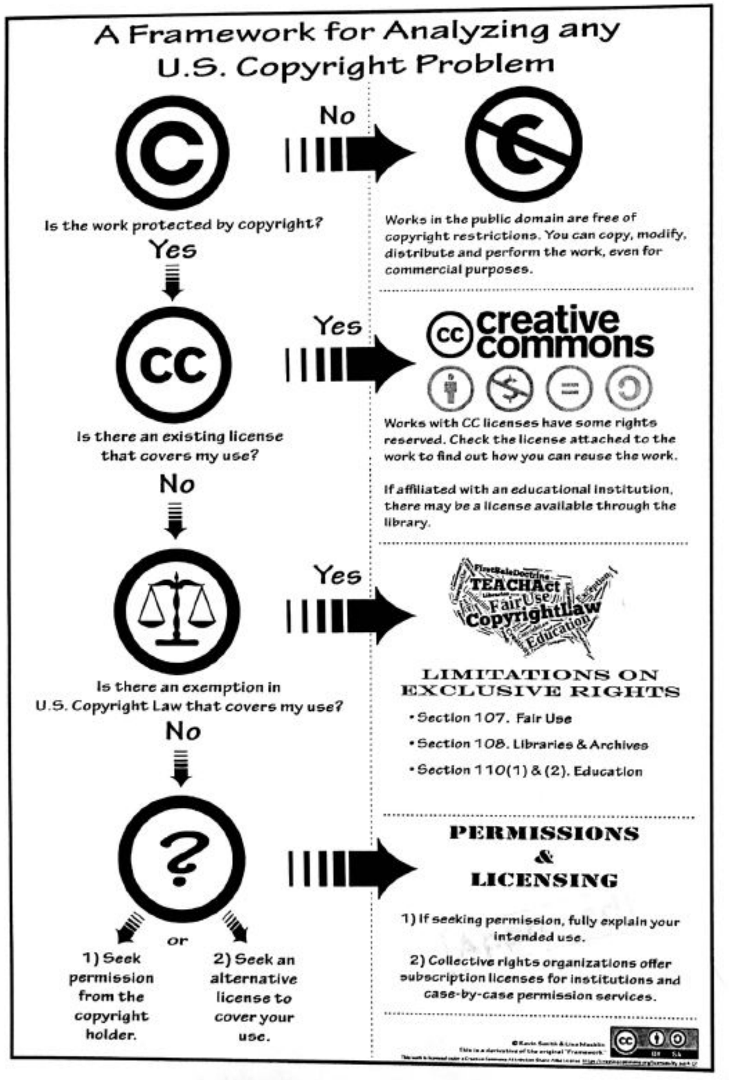

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