

SHAWNEE MISSION SCHOOL DISTRICT
GREEN INFRASTRUCTURE PLAYBOOK

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INTRODUCTION

SHAWNEE MISSION SCHOOL DISTRICT

WHY GREEN INFRASTRUCTURE AT SCHOOLS?

Implementing Green Infrastructure on school district properties provides a number of transformative benefits from an ecological and social standpoint. School facilities offer a unique opportunity to model best practices in green infrastructure for both the future workforce and surrounding communities, and help expand the network of green infrastructure strategies at a regional and increasingly impactful scale. The opportunity to demonstrate GI first hand to students and visitors is a vital educational opportunity. School districts are typically large land-holders, with a variety of facilities spread over a geographic area, which means successful GI projects can be piloted on individual sites, and then exported across the district to create exponential benefits.

The Shawnee Mission School District in particular was chosen for this Playbook entry because the district has embraced the opportunity to design sustainable sites to increase student achievement, improve environmental quality and serve the community, beginning with the development of the Center for Academic Achievement (CAA).

HOW TO USE THIS PLAYBOOK

Shawnee Mission began investing in GI by developing the Center for Academic Achievement as a pilot project for the Shawnee Mission School District. This playbook explores adaptive management strategies for how to maintain and adapt the CAA's current green infrastructure system to continue to improve performance over time, and how these strategies can be implemented district-wide, both on school sites, and on sites adjacent to school properties that can connect these facilities to surrounding communities. Similar to the analysis conducted for the Rock Island Corridor, the team created a methodology to prioritize school sites for future green infrastructure projects, where these strategies can be implemented for maximum benefit. Similar to the Rock Island playbook, these strategies are specific to the CAA and the Shawnee Mission School District but have broad applicability for other school districts seeking a roadmap for implementing GI strategies at a site and district scale.



Shawnee Mission School District Center for Academic Achievement



Bioswale feature at the CAA

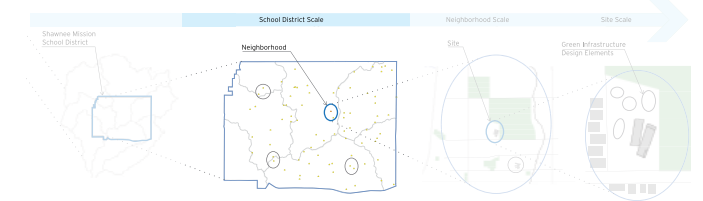


School Garden Example in New Jersey

INTRODUCTION

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



CONTEXT

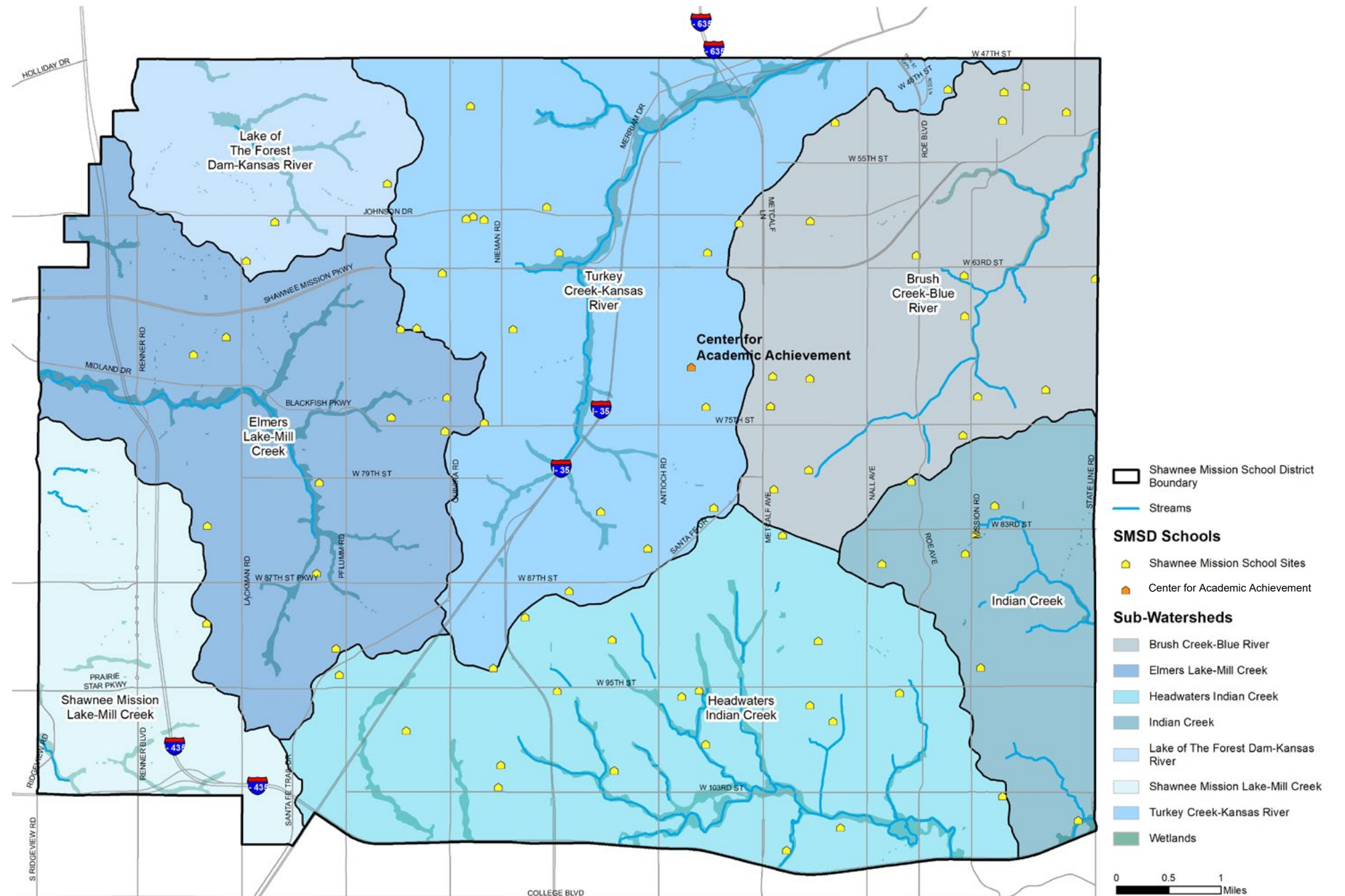
The Shawnee Mission School District intends to design sustainable sites using state-of-the-art ecological design principles to increase student achievement, improve environmental quality and serve the community. Further, the Shawnee Mission School District aims to contribute to promoting sustainable landscapes throughout the greater Kansas City region. As a centrally located metropolitan school district, straddling seven watersheds (shown at right) and sharing its eastern border with Missouri, the district embraces this opportunity to lead.

Shawnee Mission has already shown its dedication to green infrastructure principles by developing the Center for Academic Achievement (CAA), which includes site stormwater management, native plantings, food production and community connectivity. The CAA is an important first step for Shawnee Mission and gives the school district the advantage of having a living green infrastructure laboratory where design applications and management strategies can be explored and then exported to different sites throughout the district and community.

This playbook is described in two parts. The first part defines CAA's existing green infrastructure and connections to the community, while focusing on opportunities for adaptive landscape management. The second part discusses how these green infrastructure design and adaptive management strategies can be implemented district-wide, and illustrates an approach for identifying future green infrastructure projects on school sites near high value ecological areas elsewhere in the school district.

GREEN INFRASTRUCTURE: 1 - Ideation and Planning Stage

The earlier that all involved parties come together, the more interconnection of design and implementation can occur. It is often the case that one or two projects have already started and created some momentum, as in the case of this Shawnee Mission School District example. In this situation, the process begins with getting up to speed on the work that has already been completed (a green infrastructure landscape) and setting goals that define next opportunities. The next set of projects then grows from the goals and process established.



INTRODUCTION

SHAWNEE MISSION SCHOOL DISTRICT

KEY CONSIDERATIONS AND ISSUES

- *Multi-modal interactions:* Access to safe routes and zones where vehicular, bicycle and pedestrian interactions are needed near schools and throughout the community.
- *Vehicular impact on sites:* Conventional development and transportation projects add impermeable surfaces and divert natural water flows, often carrying road runoff with sediment, oil and grease into streams.
- *Management strategy:* Conventional guidance and communication tools have had limited effectiveness in managing green infrastructure installations.
- *Education/curriculum:* Integration of green infrastructure strategies and curriculum for students and professionals needs further development.
- *Metrics and values of green infrastructure:* Difficulties remain in conveying the true benefits of green infrastructure compared to conventional design and construction.
- *Human health and wellness:* Access to native and productive landscapes that promote active lifestyles and healthy eating are lacking in the region.

BENEFITS AND METRICS

- *Multi-modal interactions:* Providing strategies for safe vehicular, bike, and pedestrian interactions at activity nodes, and supporting *Safe Routes to School* efforts in the region. Metrics include tracking pedestrian and biking traffic counts over time as infrastructure and access points are constructed.
- *Vehicular impact on sites:* Enhancing design and maintenance plans for bioremediation zones on-site, and creating multiple methods of capturing and mitigating impacts of vehicular runoff on-site. Metrics include monitoring of water quality and runoff quantities at green infrastructure sites and on sensitive sites downstream in watershed.
- *Management strategy:* Developing an adaptive management strategy that is accessible to diverse audiences and distributed through multiple media. Metrics include measuring implemented projects over time throughout the school district, engagement of facilities staff and faculty, and cultural shift in green infrastructure adoption of adaptive management strategies.
- *Education/curriculum:* Refining school-related curriculum and professional education programs that support a robust and adaptive site management strategy and that teach the benefits of green infrastructure. Metrics include engagement of students including career path tracking, integration of curriculum tied to site and district-wide learning, and perceived ownership of the land by students and neighbors.
- *Metrics and values of green infrastructure:* Developing tools that monitor and capture data, and then convey the broad beneficial impacts of implementing green infrastructure strategies. Metrics include improvement to water quality, stormwater flows, increased habitat, and increased community engagement and well-being.
- *Human health and wellness:* Demonstrating new opportunities in the community to engage in active lifestyles, both physically and socially. Metrics include surveys to determine effectiveness of outreach, incentivized use of tracking devices and wearables, and opportunities to engage in wellness programs (in person or via mobile devices).

PARTNERS, PROJECTS, PROGRAMS AND NEIGHBORHOOD AMENITIES

The projects and organizations listed here have the potential to support these green infrastructure strategies and benefit from them.

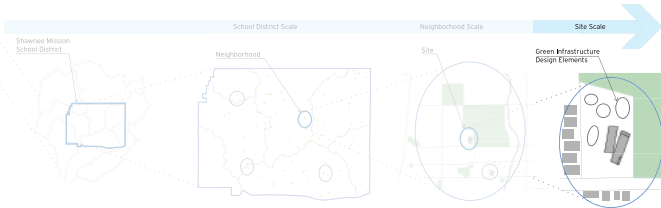
- Antioch Acres Park
- Antioch Park
- CAA Curriculum: Engineering, Health Sciences, Biotechnology, Culinary Arts, Animation and Interactive Media, Project Blue Eagle Firefighting / EMT
- CAA Services: Shawnee Mission School District Fitness and Wellness Centers
- City of Overland Park, Kansas
- East Antioch Elementary School
- Johnson County Health & Environment LiveWell Programs
- Johnson County Parks & Recreation
- Johnson County Stormwater Management
- Johnson County Sustainability Programs
- K-State Horticulture Research & Extension Center
- Kansas Department of Transportation
- Kansas State University
- Marty Park/Pool
- Milburn Golf & Country Club
- Neighborhood Associations
- Overland Park Public Works Department
- Safe Routes to School Program
- Shawnee Mission School District administrators, faculty, students and school communities
- Shawnee Mission School District staff (including grounds crews, building custodians, etc.)

PROJECT SITE

CENTER FOR ACADEMIC ACHIEVEMENT

SHAWNEE MISSION SCHOOL DISTRICT

SITE SCALE



SCHOOLS AND SCHOOL DISTRICTS

Schools offer a unique opportunity to model best practices in healthy land management and active living. The Shawnee Mission School District is unique in the Kansas City metropolitan area in its commitment to sustainability, health and well-being at the highest levels of the district administration. Mapping natural areas, waterways, and trails, modeling sustainable land management, and inviting community input into identifying ways to increase walking and connectivity via transportation alternatives will make these opportunities known and more accessible to the greater community.

CENTER FOR ACADEMIC ACHIEVEMENT

The opportunities at the Center for Academic Achievement (CAA), in particular, stem from the district’s strategic plan to implement their priorities of efficiency, student achievement, and sustainability, as well as the momentum of five of the seven signature programs offered at the CAA that are related to integrated green infrastructure strategies: Engineering, Health Sciences, Biotechnology, Animation and Interactive Media, and Culinary Arts. The high presence of administrative decision-makers at this site also make the lessons exhibited here extremely accessible to an audience with the capacity to act on them.

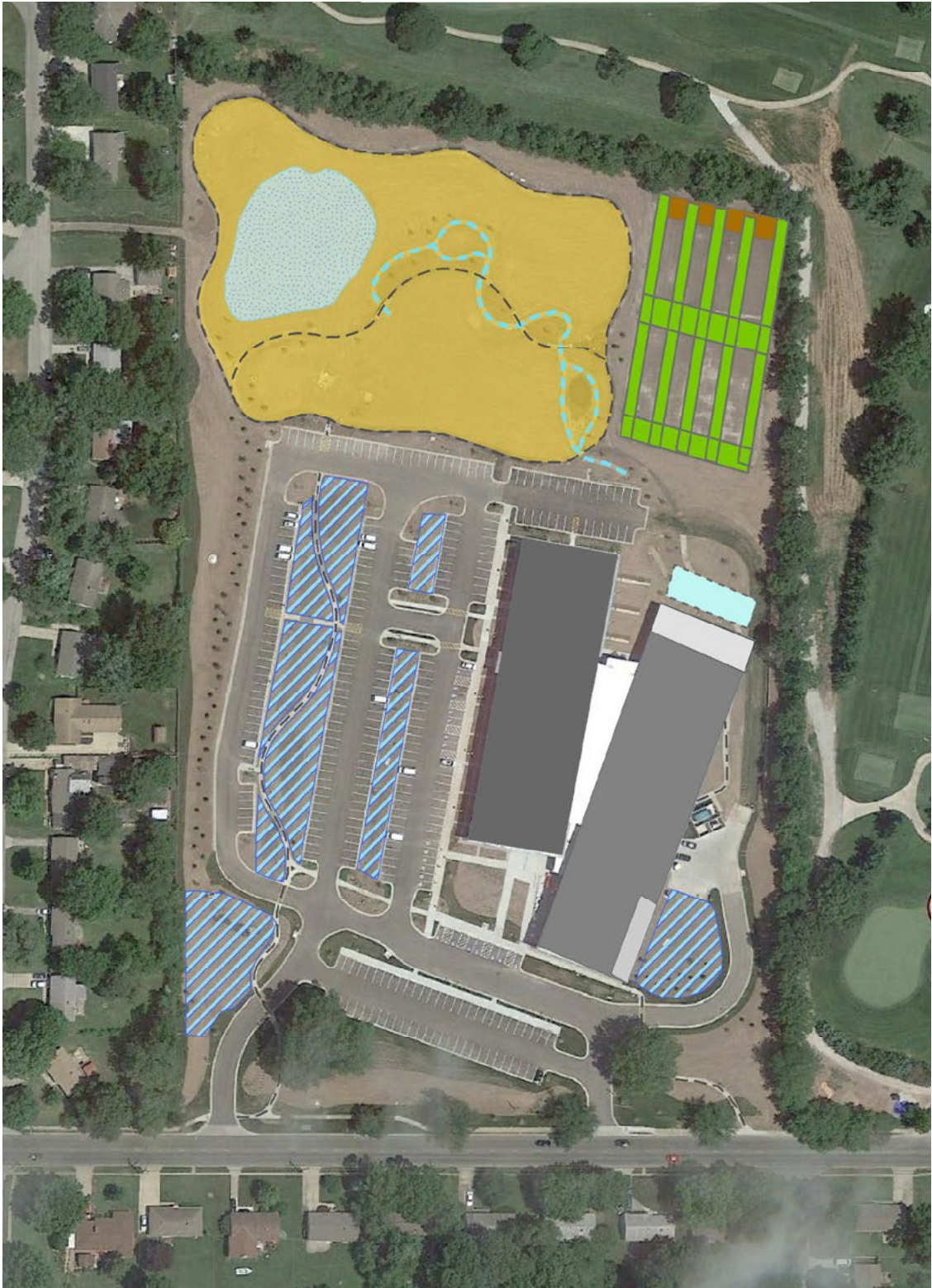
The site includes a 1.3-acre farm that is run by students and a quarter-mile walking trail. The site is open to the surrounding community evenings and weekends year-round. Among the district’s goals is to provide green infrastructure workforce training to staff and students, serving as a model for public and private land management. The students in the Culinary Arts curriculum are trained in managing the farm and all aspects of the new on-site restaurant, Broadmoor Bistro, as well as marketing produce and products at the local farmers market.

The CAA site map at right shows the current programs and green infrastructure strategies implemented. The site contains a series of strategies including a parking lot with vehicular stormwater runoff going into bioswales, a cistern collecting rainwater, and a native landscape that contains a dry stream bed and detention pond.

GREEN INFRASTRUCTURE: 2 - Design Stage

When projects are in a design phase, it is crucial to define the key points of influence within the project that focus first on where the most important human and ecological values and needs are within the defined project area. Next, identify specific design solutions that can be incorporated to adapt the design to a state of greater health, and for greater connectivity to other solutions in the future. This relies on an open and flexible mindset of existing and new design team members as well as familiarity with the solutions recommended and their impact on cost, schedule and maintenance.

- Administration
- Classes
- Student-run Bistro
- Engineering
- Bioswales
- Detention Pond
- Cistern
- Native Plantings
- Farm & Orchard
- Sheds
- Dry Stream Bed
- Walking Trail

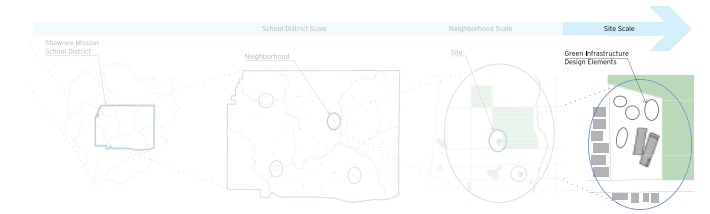


PROJECT SITE

CENTER FOR ACADEMIC ACHIEVEMENT

SHAWNEE MISSION SCHOOL DISTRICT

SITE SCALE



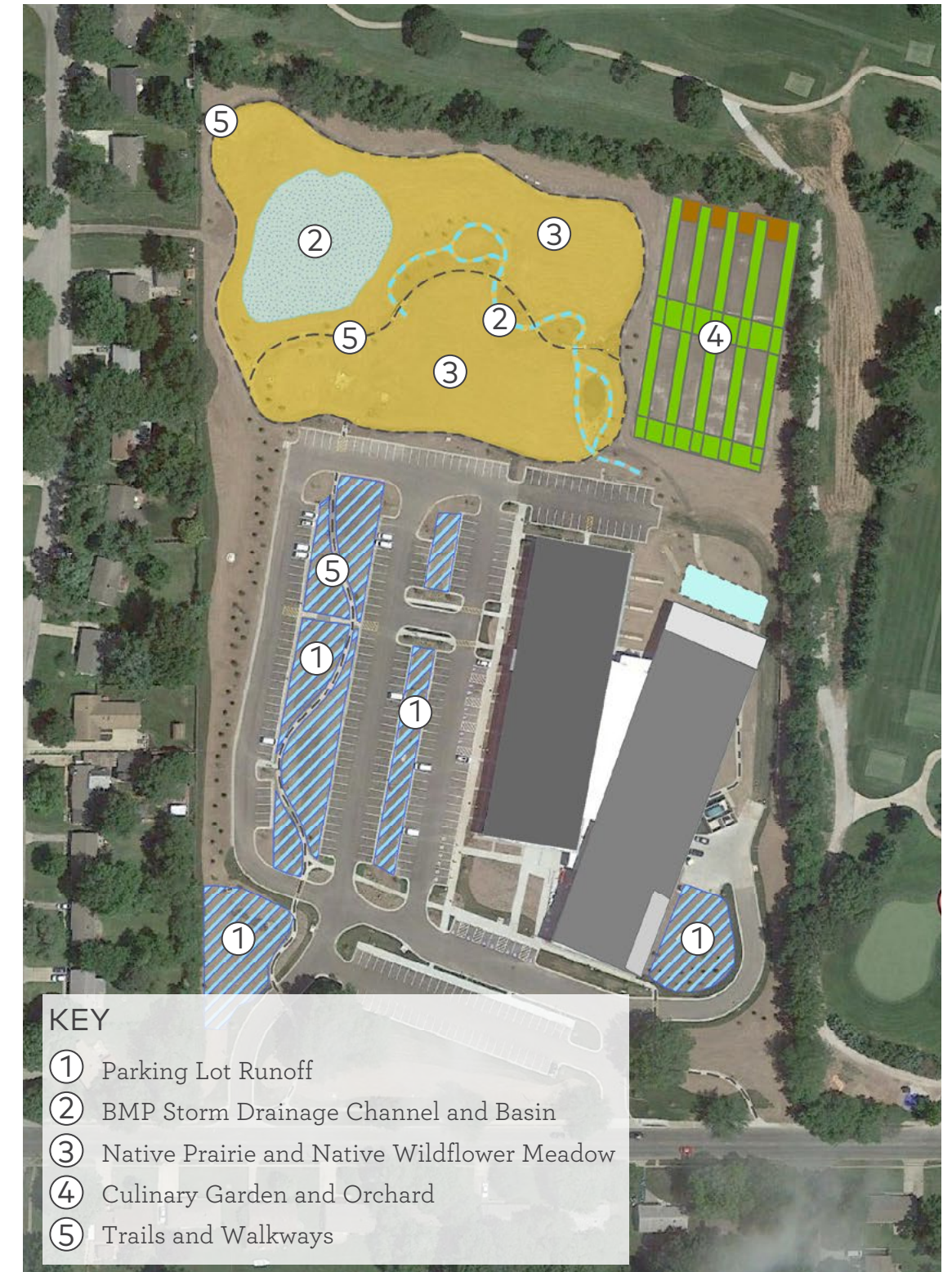
GREEN INFRASTRUCTURE IMPLEMENTATION AND ADAPTIVE MANAGEMENT

The CAA site is an example of green infrastructure implementation. As mentioned prior, an adaptive management approach provides a framework for monitoring green infrastructure installations and responding as needed when design elements are underperforming. The adjacent map and following pages identify adaptive management strategies that apply to specific issues of this site, and can be used as a tool for the school district when other school sites apply similar types of green infrastructure design elements.

Adaptive management planning for the long term at CAA can be organized by objectives as listed below. Examples of inspection issues and adaptive maintenance approaches are provided later in this document for each of the main green infrastructure features. (Note that an Establishment and Maintenance Guide was prepared by the original design team (Vireo) to cover vegetation care during establishment and years one through three.)

Objectives and monitoring parameters include:

- Direct stormwater to water quality BMPs.
 - On-site and off-site evidence of erosion, flooding extent/duration/frequency.
- Manage site water to encourage infiltration and minimize runoff.
 - On-site storage volumes and rates of infiltration in relation to weather patterns.
 - Locations and frequencies of off-site flows.
- Support healthy soils, habitat and aesthetic quality of native plant areas, farm and orchard areas.
 - Number and relative cover of non-native species; native species richness; and extent of bare ground.
 - Bird, pollinator, and insect counts and diversity.
 - Soil organic matter content across site, at depths and over time.
 - Food and native plant productivity (pounds per acre) comparisons.
 - Visitor experience and community involvement.
- Collect and share CAA's green infrastructure experience widely.
 - Extent and types of design modifications (and costs).
 - Purpose and types of educational monitoring data collected and evaluated (costs).
 - Cost per square foot of maintenance per year.



PROJECT SITE CENTER FOR ACADEMIC ACHIEVEMENT

ADAPTIVE MANAGEMENT STRATEGY



PARKING LOT RUNOFF FEATURES

Parking lot curb cuts direct water into vegetated swales. Water flowing into the entry points then needs to either be spread or directed down a channel feature into the Best Management Practices (BMP) storm drainage system.

Inspection

- Routine inspection of runoff entry points for evidence of rills or deeper gullies forming. Observe source of problem and flow patterns during rain event if possible.

Maintenance

- Use hand grading or raking to stabilize soils and establish/re-establish fine grading to meet design intent with positive drainage and without rills or gullies. Establish/re-establish vegetation and stone.
- Revegetate with seeding or replanting during growing season; note that optimal planting months may vary from traditional plants used, but March 1 through August 31 is generally recommended for native plants in Kansas and Missouri.

Adaptive Management

- If concentrated flow persists and/or is related to design issue, work with design engineer to consider additional curb cuts and/or additional spreader/pre-treatment filters. Additional stone may be necessary to reduce runoff velocities before water reaches planting.
- Erosion control measures and/or a combination of plugs and seed may be necessary for plant establishment.

GREEN INFRASTRUCTURE: 3 - Maintenance Stage

After the implementation of green infrastructure projects, there are many touchpoints to increase their benefits over time. These living systems require regular stewardship and maintenance that is very different from a more conventional approach to landscape maintenance. The adaptive landscape management plan conceptualized for Shawnee Mission School District provides a Playbook example of how to provide annually increasing benefit to both the educational curriculum as well as the health and biodiversity of the land and waterways. These increasing benefits impact not only the schools but also the connectivity of the surrounding neighborhoods and provide a how-to model for even more projects to be initiated and developed.

PROJECT SITE CENTER FOR ACADEMIC ACHIEVEMENT

ADAPTIVE MANAGEMENT STRATEGY



BMP STREAM CHANNEL AND DETENTION BASIN

Water flowing from the paved parking and catchment areas flows along channel features into detention basins.

Inspection

- At least annually and/or after large rainfall events, check buildup of sediment and debris that can clog flows.

Maintenance

- Clear relatively small debris accumulations as needed.

Adaptive Management

- If standing water persists in areas that were not designed for pools (e.g., greater than 1.5-2 feet) or sediment occupies ~20% of water quality design volume, or drainage is poor, more significant cleanout may be needed. Small pools may be drawn down to a water level that allows sediment to dry. Once dry, sediment can be removed. De-water sediment before disposal to minimize transportation costs and hazards, or spread on-site as a soil amendment if it will not re-accumulate in drainages and ponds.

PROJECT SITE CENTER FOR ACADEMIC ACHIEVEMENT

ADAPTIVE MANAGEMENT STRATEGY



NATIVE VEGETATION AREAS

The native wildflower and grass areas in the vegetated swales along the stormwater channel and basins help filter trash, pollutants and sediments. Meadow plantings provide additional habitat and aesthetic benefits along with soil health and potential to capture and store carbon. Planting adjacent to walkways is often more visible with a higher demand on fullness, vigor, and orderliness. Plant species growth habit and/or weather impacts can cause herbaceous plants to “flop” or grow over walkways.

Inspection

- Weed species (types and coverage).
- Plant vigor and diversity.
- Trail encroachment, safety considerations; assess if extent and height of overgrowth impacts circulation, user comfort, and/or aesthetics.

Maintenance

- Hand weeding/edge trimming (string trimming).
- Mow one to two times per year as needed (typically in spring and fall) to remove excess dead material (compost in farm areas). Conditions may require spot trimming or a narrow trim or mow strip adjacent to specific walkways. Trimming or mowing height, frequency, and timing should be established based on plant species and growth cycle. Trimming or mowing should also avoid seasonal nesting activity of ground-nesting birds and seasonal larval stage of pollinators. For Kansas and Missouri, the USDA recommends avoiding mowing between mid-April and the first or second week of August to protect birds and other species, although some species may nest into early September. It is highly recommended to walk areas to be mowed to visually identify nesting activities before mowing, as this is the best way to identify site-specific species and nesting patterns.
- If possible, a burn in the second or third year of establishment is recommended to control woody tree growth and enrich soils. For longevity of the site, burning should be conducted periodically, every two to five years.

Adaptive Management

- Reseed/replant wildflower zones if diversity and abundance decline over time. The planting window in this region is relatively wide, with March 1 through August 31 being applicable for most species. It may take two to five years to reach a mature community of native plants, so patience is a virtue.
- Experiment with compost types and applications to enrich soils if needed in compacted/poor quality areas. This can be done throughout the growing season.
- Engage non-traditional partners to build capacity through educational outreach, healthy living programs, “bartering” and volunteer service programs.
- Trimming or mowing height and frequency should *not* match that of turfgrass.



PROJECT SITE CENTER FOR ACADEMIC ACHIEVEMENT

ADAPTIVE MANAGEMENT STRATEGY



PAVED AREAS

Trails, sidewalks, and the interface with green infrastructure edges can require maintenance to remove silt and soil deposits, cracking and other potential safety and aesthetic concerns.

Inspection

- Inspect that soil meets specifications and correct as necessary. Testing may be necessary if warranted by inspection.
- For areas adjacent to walkways, inspect or test for soil compaction.

Maintenance

- Establish/re-establish fine grading to meet design intent with positive drainage and without rills or runnels. Establish/re-establish vegetation.

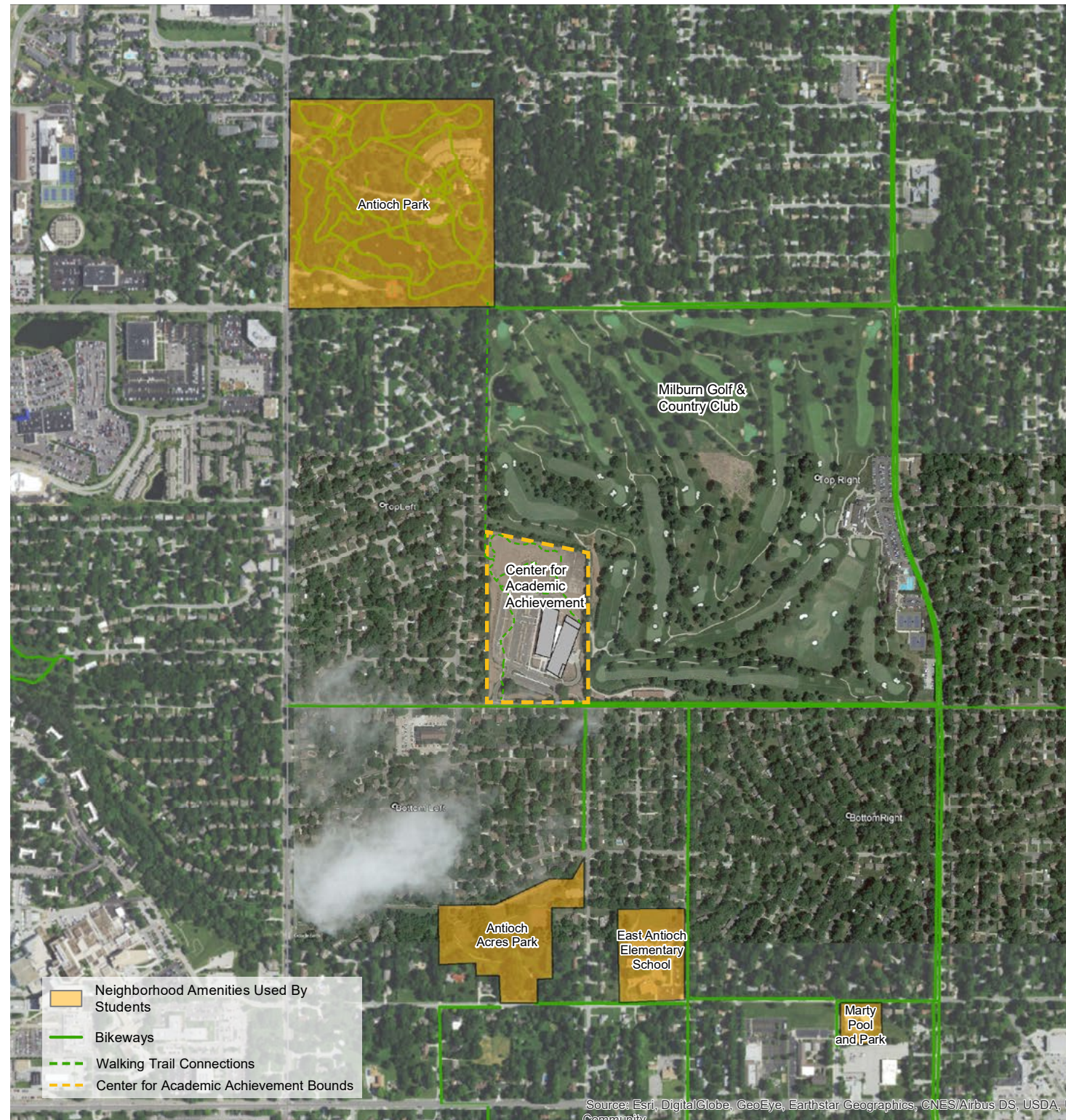
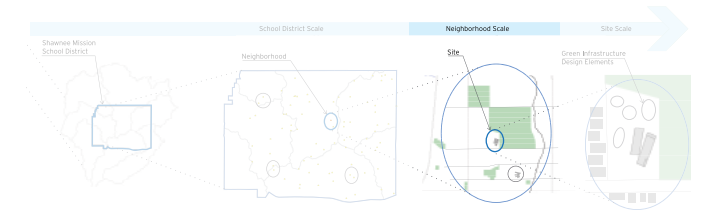
Adaptive Management

- Erosion control measures and/or a combination of plugs and seed may be necessary for plant establishment. Additional stone may be necessary to reduce runoff velocities before water reaches planting.
- Consider landscape modification to address persistent bare soil adjacent to walkways if it is more visible and has a higher aesthetic.

FOCUS AREA NEIGHBORHOOD

CENTER FOR ACADEMIC ACHIEVEMENT

NEIGHBORHOOD
SCALE



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, U Community

NETWORK CONNECTORS

Network Connectors are green infrastructure solutions that address multiple challenges in the highlighted opportunity areas and link the areas together to strengthen the watershed-scale system of benefits. In the Shawnee Mission School District, the following opportunities are present:

- 1 Implement education and demonstration hubs of green infrastructure solutions (i.e., parks, schools, community centers, campuses).
- 2 Remove weed and landscape ordinance barriers to native plantings.
- 3 Coordinate parks and trail planning that prioritizes habitat connection opportunities.
- 4 Coordinate with state Departments of Transportation and transportation authorities to address safe multi-modal interaction, specifically within communities and near schools.
- 5 Continue long-term investment in transit infrastructure such as bus rapid transit and light rail.
- 6 Implement green and complete streetscapes, including pedestrian and bicycle infrastructure.
- 7 Create replicable guidelines to address adaptive management and maintenance of school properties.
- 8 Create partnerships and programs for all-ages wellness programs that streamline access to healthcare, local sustainable food, and spark a culture of health.
- 9 Employ diverse educational programs targeted towards grounds crews, building custodians, and design and construction professionals regarding green infrastructure best practices.
- 10 Partner with schools and communities to promote local food production and engagement in natural systems.

SURROUNDING NEIGHBORHOOD COMMUNITY CONNECTIONS

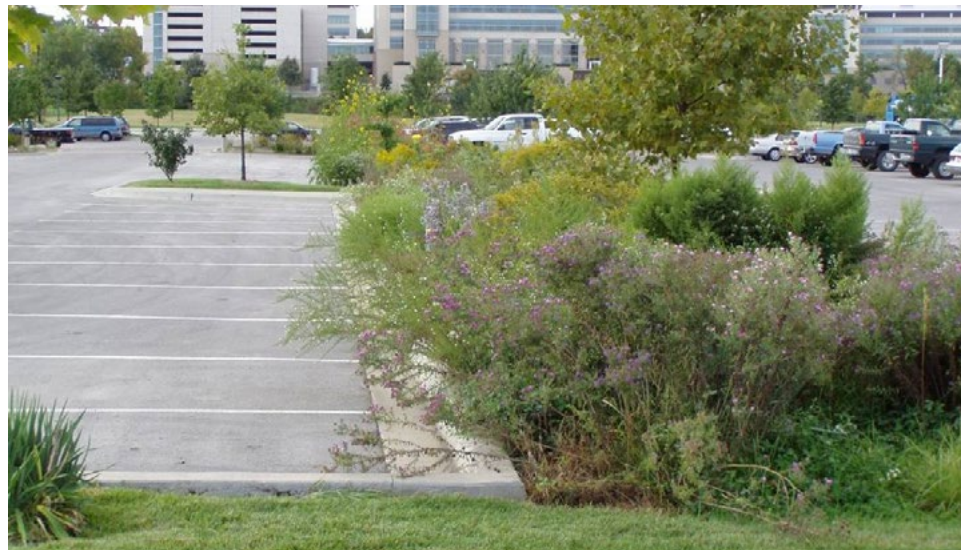
The Center for Academic Achievement site and surrounding neighborhood provide an ideal testing ground for site-specific strategies that can be replicated throughout the Shawnee Mission School District. The district's commitment to sustainability, health and well-being ensure a long-term commitment to addressing green infrastructure opportunities at both site and district scales, including:

- A Vehicular Runoff with Green Infrastructure.
- B Multi-Modal Interactions.
- C Educational Opportunities for Students, Professionals, Community.
- D Monitoring for Data-Based Cost Benefit Analysis.

These green infrastructure strategies are applicable both district-wide and throughout the metropolitan region, while demonstrating the potential for connections to the surrounding community. The following pages expand on the strategies the school district explored at the Center, ones that are closely linked with the immediately adjacent neighborhoods and which can be replicated at the site scale of individual properties and also extended into the neighborhoods and transportation systems that connect the entire Kansas City metro.

NEIGHBORHOOD COMMUNITY CONNECTIONS

CENTER FOR ACADEMIC ACHIEVEMENT



Simple bioswales at the Anita B. Gorman Discovery Center in Kansas City, Missouri capture stormwater runoff from the parking lot for retention and infiltration. The parking lots are standard asphalt with flat curbs graded to direct water into these vegetated zones, which are planted with native plant species.

A VEHICULAR RUNOFF WITH GREEN INFRASTRUCTURE

Impervious surfaces resulting from traditional development have transformed the hydrological landscape of our region; increasing runoff volumes, changing watersheds, and introducing pollutants. All of these create impacts that are felt downstream at an ever-expanding scale. Transportation systems, especially paved streets and parking lots, account for large percentages of a city's impervious surfaces (as high as 60 percent of land cover in some urban areas). These systems therefore represent an enormous opportunity for integrating green infrastructure to minimize and mitigate negative impacts. The continued evolution of multi-modal transportation options within the Shawnee Mission School District provides an opportunity to showcase multiple methods of capturing and mitigating impacts of vehicular runoff, and these strategies can also apply to bike and pedestrian facilities.

Green infrastructure strategies must be integrated into planned repairs and improvements of transportation systems. Roadways, parking lots, and other paved vehicular surfaces should be designed to direct water into green infrastructure elements, in order to increase site infiltration, increase the capacity for short and long term storage for slow release or reuse, and to increase evapotranspiration. The design of the integrated landscape zones that capture this water not only provides the opportunity to decrease the direct impact of stormwater on aging drainage infrastructure and the impacts of soil erosion, it helps rebuild resilient and restorative landscapes that renew soil health and habitat.

A major challenge and opportunity is the training of designers, school district staff, and volunteers for implementation and maintenance of green infrastructure. Key concepts for an understanding of green infrastructure and its application to mitigate hardscape runoff include the following:

Bioretention and Biofiltration

In addition to controlling peak stormwater discharge, well designed and constructed bioretention and biofiltration zones provide benefits by using regional and local planting palettes, soils, and hydrological patterns to model pre-development conditions. This improves water quality and allows for water to infiltrate through soils to replenish groundwater. It also creates additional benefits: the rebuilding of native plant communities and habitats, improved air quality, and reduction of heat island effects caused by pavement.

PARTNERS

- City of Overland Park, Kansas
- Johnson County Health & Environment LiveWell Programs
- Johnson County Parks & Recreation
- Johnson County Stormwater Management
- Johnson County Sustainability Programs
- Johnson County Stormwater Management
- Kansas Department of Transportation
- Overland Park Public Works Department
- Shawnee Mission School District staff (including grounds crews, building custodians, etc.)



NEIGHBORHOOD COMMUNITY CONNECTIONS

CENTER FOR ACADEMIC ACHIEVEMENT



A bio-retention channel in Greensburg, Kansas utilizes a wide street right-of-way to capture and treat stormwater from the public street and high school property. A pedestrian bridge allows users to experience the green infrastructure as a design element.



The Kansas City, Missouri Water Services Campus parking lot is a local precedent and resource for the installation, maintenance, and performance monitoring of multiple pervious pavement systems.

Although design of green infrastructure design elements depends greatly on context and site conditions, the major components often include¹:

- Grass buffer zones to reduce runoff velocity and remove suspended solids.
- Vegetation zones to aid in absorbing water through the process of evapotranspiration and removal of excess nutrients through nutrient cycling.
- Shallow ponding areas that provide storage of excess stormwater flows and its subsequent evaporation, and also aids in the additional settlement of particulate matter.
- Organic mulch layers that encourage micro biological degradation of petroleum-based pollutants, aids in pollutant filtration and reduces soil erosion.
- Engineered or amended soils to support vegetation growth along with nutrient uptake and provision for water storage; soils should include some clay to absorb pollutants such as hydrocarbons, heavy metals, and nutrients.
- Sand beds provide drainage and aeration of planting soil as well as an aid in flushing pollutants.
- Underdrain systems in some applications to remove excess treated water to storm drain system or receiving waters.

¹Sources: Low Impact Development (LID) Center, Lake Superior Streams Organization

Pervious Pavements

Pervious pavements are effective in reducing runoff and improving water quality, and can greatly enhance larger green infrastructure systems. They are typically most effective in areas with light traffic levels such as low speed roads, parking lots, sidewalks and public plazas. They have been used and studied less in areas exposed to high levels of truck traffic. They are useful in dense urban areas where open space for vegetated solutions is more limited. It is also worth noting that properly designed and maintained pervious pavements have performed well in cold climates, and have even been shown to delay the formation of frost layers due to the air in the aggregate base acting as an insulating layer.

The green infrastructure benefits of pervious pavements include: the reduction of runoff quantity; a reduction of total suspended solids, phosphorus, nitrogen, metals and process oil loads flowing into receiving watersheds; and a reduction in runoff temperatures.

The most commonly used systems are permeable interlocking pavers, pervious concrete, and pervious asphalt, all of which have been effectively installed in this region. The design parameters of these pavement types are similar, with each being built on a subbase with void space to collect, store, and subsequently release or infiltrate water. Each requires specialized maintenance, including the periodic removal of sand and other materials that clog pores and reduces performance over time. Applications may differ, with pervious concrete more common in higher traffic areas where pervious asphalt and pavers are more typically used in low traffic areas. Paver systems are particularly susceptible to damage from vehicular turning motions, which should be a design consideration.

PAVING RESOURCES

Pervious Asphalt

- *Porous Asphalt BMP Fact Sheet* (Dauphin County Conservation District): <http://www.dauphincd.org/swm/BMPfactsheets/Porous%20Asphalt%20fact%20sheet.pdf>.
- *Porous Asphalt Fact Sheet* (UNH Stormwater Center): https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/porous_ashpalt_fact_sheet.pdf.

Pervious Concrete

- *Porous Concrete BMP Fact Sheet* (Dauphin County Conservation District): <http://www.dauphincd.org/swm/BMPfactsheets/Porous%20Concrete%20fact%20sheet.pdf>.
- *Pervious Concrete Fact Sheet* (UNH Stormwater Center): https://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/unhsc_pervious_concrete_fact_sheet_4_08.pdf.

Pervious Paver

- *Permeable and Porous Concrete Pavers* (ConcreteNetwork.com): https://www.concretenetwork.com/concrete/porous_concrete_pavers/.
- *Hardscape and Pavers* (Portland Cement Association): <http://www.concretethinker.com/applications/Hardscape-Pavers.aspx>.

Turf Reinforcing Grid

- *Turf Reinforcement Mesh* (TYPAR): <http://www.typargeosynthetics.com/products/ground-reinforcement-mesh/turf-protecta-turf-reinforcement-mesh.html>.

NEIGHBORHOOD COMMUNITY CONNECTIONS

CENTER FOR ACADEMIC ACHIEVEMENT



Planting Strategies

Proper plant selection can help maximize the effectiveness of natural stormwater systems. Considerations include pollutant tolerance and remediation abilities, water levels, maintenance requirements, cover, slope, and site context.

During planting and establishment, invasive species, especially those adapted to wet conditions, should be identified and removed. Existing native vegetation can be worked into topsoil. Planting areas should be loose, un-compacted, and high in organic material. Leaving the surface of the graded bio-retention features rough can benefit the establishment of plants. Rye or similar plants can provide temporary cover, or specifically Virginia Wild Rye for intermediate cover, while permanent vegetation is being established. During the first year of growth, mowing down vegetation to a height of 8" can aid in establishment by reducing competition from weeds that may be faster-growing than desired native vegetation. Many excellent guides exist that can help select appropriate plants for the region.

Applications

Parking Lots and Utility Areas

Vegetated buffers, edges, and islands in these paved areas all provide opportunities for capturing, treating, and infiltrating stormwater. Using vegetated zones for stormwater capture and treatment can be more cost effective than pervious pavement systems. Parking lots in particular are opportunities to implement pervious pavement systems. These systems are often most effective in parking stall areas (where vehicular turning motions are less), and can be combined with conventional paving to create underground storage and treatment zones.

Urban Streets

Collecting stormwater off of urban streets can be accomplished with the creation of curb inlets into bioretention zones. In urban areas, these tend to be constructed as street planter elements, or as bumpouts at the ends and centers of city blocks in coordination to street parking. (See complete streets guidelines for more information). As in suburban areas, access to larger open space areas can be opportunities to collect and store larger volumes of water, with vegetated space and pervious pavement areas being equally viable options.

Suburban Streets and Roads

Similar to urban streets, the opportunity exists to capture water off of impervious vehicular zones into bioretention and biofiltration zones adjacent to roadways. Often in suburban typologies, space exists for larger, less formal bioswale structures, which can reduce costs due to reduced hardscape construction. Another potential strategy is the elimination of curb and gutter construction, which reduce costs and allow for water to flow unobstructed into green infrastructure zones. In lighter traffic areas, pervious pavement becomes a more viable option.

Federal and State Highways

Along these roads, graded swales and bio-filtration collection utilizing plantings that are appropriate for green infrastructure strategies are effective options.

PLANTING RESOURCES

- See Kansas Native Plant Initiative resources: <http://www.kansasnativeplantsociety.org/resources.php>.
- Ernst Seeds Resource Center: <https://www.ernstseed.com/resources/>.
- *Five Steps to Successful Prairie Meadow Establishment* (Prairie Nursery): <http://www.prairienursery.com/resources-and-guides/seeds-and-seed-mixes/documents/five-steps-to-successful-prairie-establishment.pdf>.
- *Native Vegetation Establishment and Enhancement Guidelines* (Minnesota Board of Water & Soil Resources): http://www.bwsr.state.mn.us/native_vegetation/seeding_guidelines.pdf.
- *Reconstructing a Tallgrass Prairie: A Seeding Guide for Missouri* (Shaw Nature Reserve / Missouri Department of Conservation): <http://www.missouribotanicalgarden.org/portals/0/Shaw%20Nature%20Reserve/PDFs/horticulture/NLM%20Ch1.pdf>.



NEIGHBORHOOD COMMUNITY CONNECTIONS

CENTER FOR ACADEMIC ACHIEVEMENT



Ⓑ MULTI-MODAL INTERACTIONS

The continued evolution in the development of multi-modal transportation systems in the Kansas City metro and the Shawnee Mission School District provide an important framework for implementing a broad set of green infrastructure strategies to maximize the benefits to social and ecological systems. These opportunities range from the creation of new trail connections to the retrofitting and reconstruction of neighborhood streets and larger arterials and highways. These projects must be planned and designed with an understanding of the ecological and hydrological context, and may take many forms. Within the Shawnee Mission School District, some of the key opportunities for implementing green infrastructure strategies are:

- Identification of secondary access points and ways between community amenities to increase the opportunities for more diverse connections between neighborhoods and school district facilities. The CAA is a useful precedent for this, in which a neighborhood parcel was identified to create a trail connection between the site and neighborhood sidewalks that opened access to a green infrastructure showcase to the community.
- Support for ongoing “Safe Routes to School” efforts throughout the school district and the enhancement of these efforts by identifying site and neighborhood specific design strategies to incorporate green infrastructure and practices that enhance bike and pedestrian safety. Creating green infrastructure strategies along these routes would also create powerful educational opportunities to showcase green infrastructure implementation in children’s everyday lives, and help familiarize these strategies, their appearance, and their benefits with younger generations.
- Strategies for safe vehicular, bike, and pedestrian interactions at activity nodes throughout the community, especially at trail heads, community nodes, and activity centers such as the CAA, Marty Pool, and other community centers in the area. As multi-modal transportation becomes more prevalent, the thoughtful design of these interactions becomes increasingly important.

PARTNERS

- Antioch Acres Park
- Antioch Park
- City of Overland Park, Kansas
- East Antioch Elementary School
- Johnson County Health & Environment LiveWell Programs
- Johnson County Parks & Recreation
- Johnson County Stormwater Management
- Johnson County Sustainability Programs
- Johnson County Stormwater Management
- Kansas Department of Transportation
- Marty Park / Pool
- Milburn Golf & Country Club
- Neighborhood Associations
- Safe Routes to School Program



NEIGHBORHOOD COMMUNITY CONNECTIONS

CENTER FOR ACADEMIC ACHIEVEMENT



© EDUCATIONAL OPPORTUNITIES FOR STUDENTS, PROFESSIONALS, COMMUNITY

- Integration of broad green infrastructure principles in curriculum.
- Stewardship strategies, including connecting community to sustainable food initiatives, and cost-benefit education.
- Educational program for district-wide grounds crews and building custodians.
- Introduction to student career paths in green infrastructure and related fields through summer internship programs / jobs.
- Website for online community and web-based education geared towards professionals associated with the Shawnee Mission School District and other like professionals that are stewarding green infrastructure, including all phases of design, construction, management, education/outreach, contracting, inspections, and costing.
- On-site signage strategies for students, faculty, staff and visitors.
- Enhanced curriculum that encourages on-site participation in care of green infrastructure.

PARTNERS

- CAA Signature Programs
- East Antioch Elementary School
- Johnson County Stormwater Management
- K-State Horticulture Research & Extension Center
- Kansas State University
- Neighborhood Associations
- SMSD Faculty and Students
- SMSD Grounds Crews and Building Custodians



PARTNERS

- CAA Signature Programs
- East Antioch Elementary School
- Johnson County Stormwater Management
- K-State Horticulture Research & Extension Center
- Kansas Department of Transportation
- Kansas State University
- Shawnee Mission School District Faculty and Students



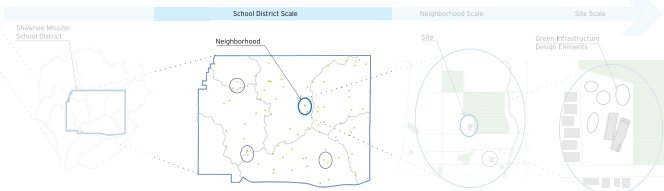
© MONITORING FOR DATA-BASED COST BENEFIT ANALYSIS

- Ecological, social, health and educational benefits of exposure to natural environment.
- Productive landscapes, including agriculture, recreation, habitat, and stormwater management.
- Research partnerships with universities focusing on the relationship between human and natural systems, efficacy of stormwater management practices, effectiveness of green and complete streets, and so on.
- Opportunities for community members to support maintenance and monitoring of grounds through partnership.

GEOGRAPHICAL ANALYSIS CONTEXT

SHAWNEE MISSION SCHOOL DISTRICT

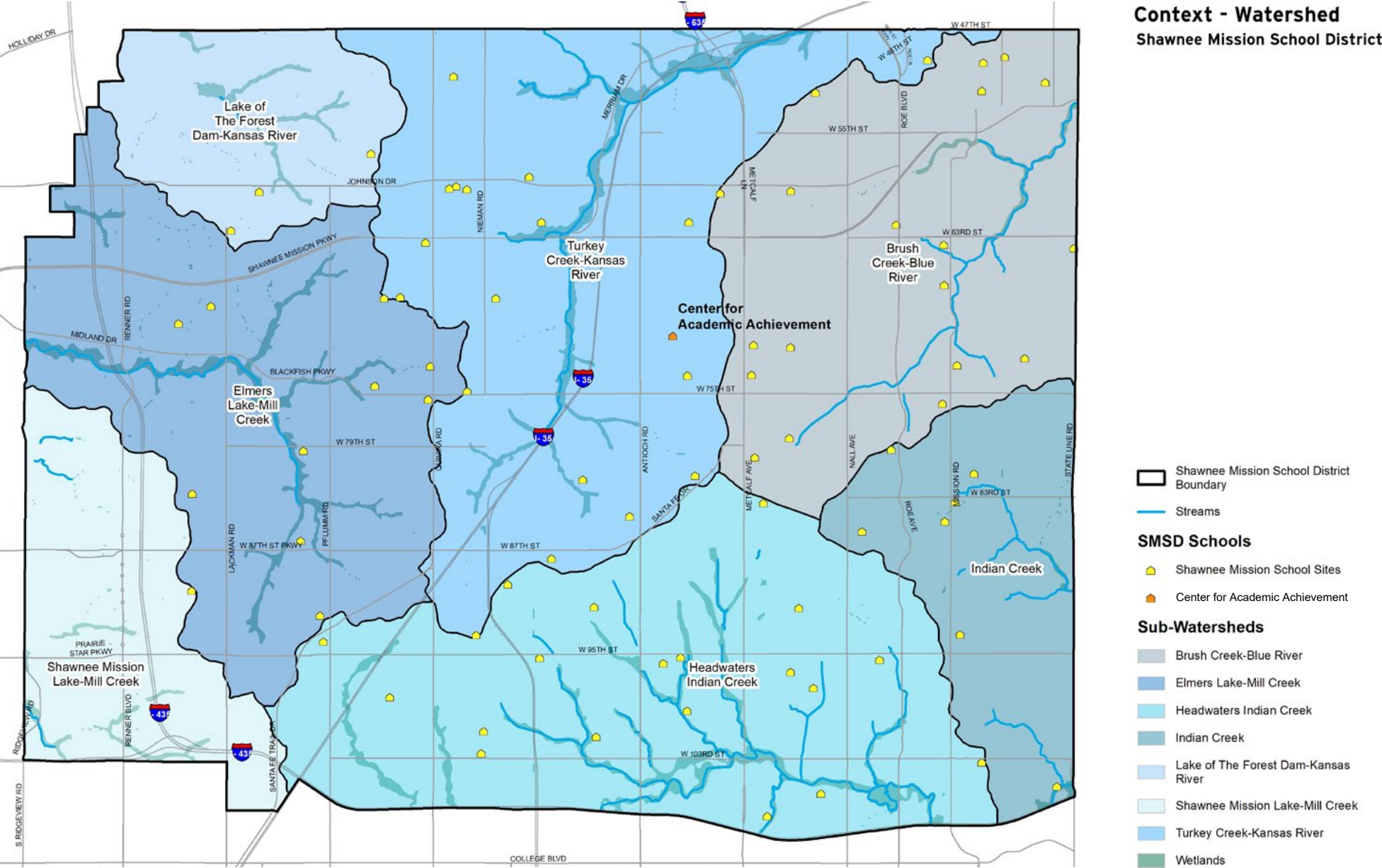
SCHOOL DISTRICT SCALE



CONTEXT OVERVIEW

The Shawnee Mission School District spans multiple watersheds and many ecological zones. The district’s commitment to implementing green infrastructure on its properties has the potential to create systematic positive environmental impacts. The following part of this playbook will look at how the district can identify priority schools and other district properties for future green infrastructure projects that provide opportunities to link to nearby conservation and restoration initiatives, and evaluate the potential of green infrastructure strategies district-wide. The maps in this section illustrate the proximity and overlap of Shawnee Mission School District properties with important ecological conservation and restoration zones, providing greater regional context and clarity to the impact these projects could make.

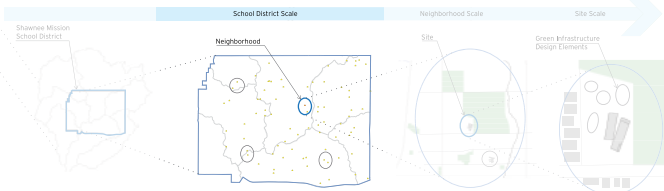
Importantly, the Shawnee Mission School District also spans multiple municipalities and as the district leads by example in implementing projects across their district, these projects have the potential to influence many ordinances, policies, regulations, and development practices within each municipality.



GEOGRAPHICAL ANALYSIS CONTEXT

SHAWNEE MISSION SCHOOL DISTRICT

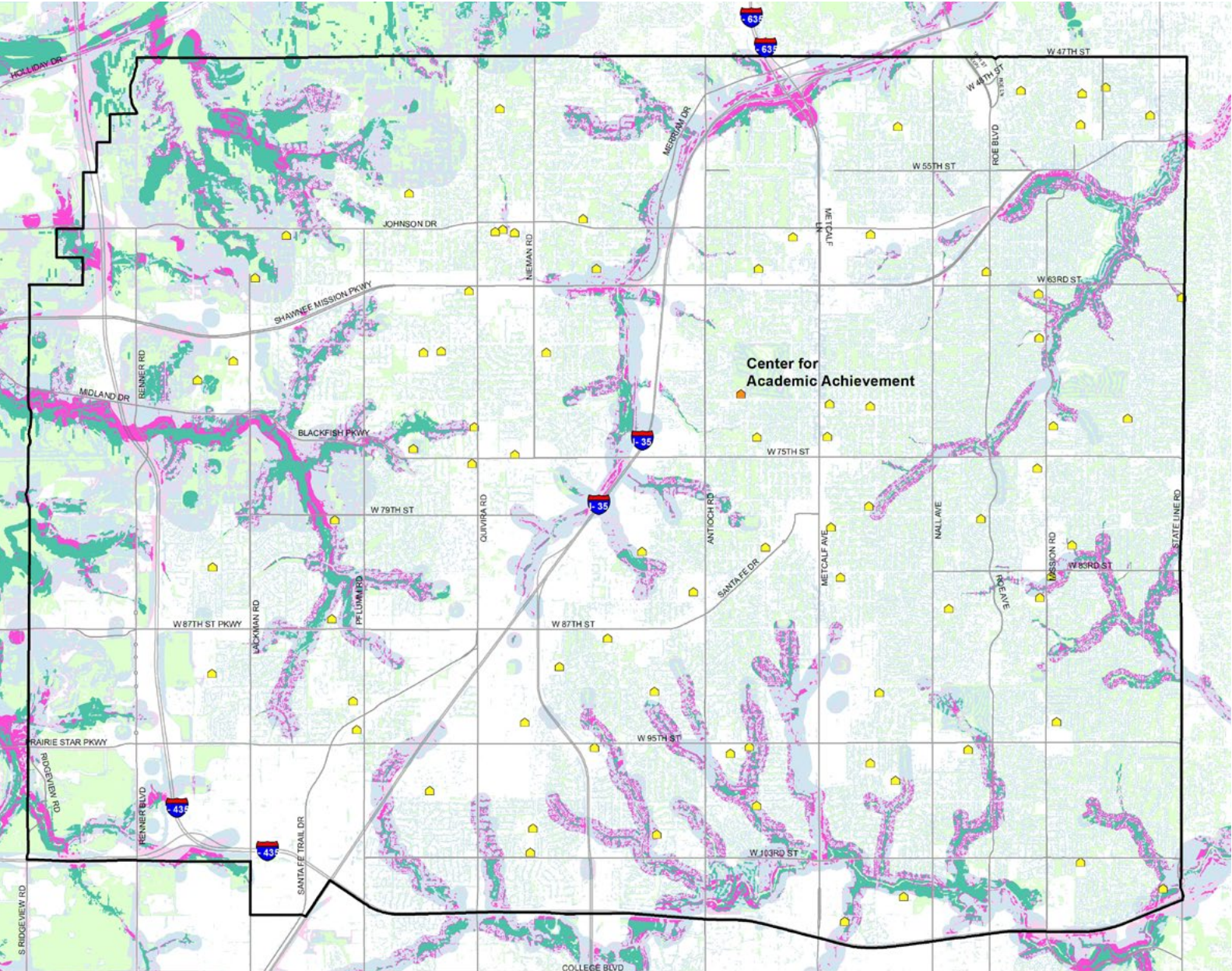
SCHOOL DISTRICT SCALE



ECOLOGICAL VALUE AREAS

This map depicts ecological conservation and restoration priority areas throughout the school district, and quantifies the amount of high value ecological area within one-quarter-mile of each school. High value ecological areas in proximity to a school provides an opportunity to functionally connect green infrastructure on school properties to nearby ecosystems and to create educational opportunities for students within a walkable distance.

Conservation priority is defined by how many of the following conditions are present: streams, lakes, wetlands, floodplains, existing forest, large herbaceous patches, caves and karst, glades, areas providing high clean water benefits, and areas providing high wildlife benefits. A moderate conservation priority area is defined by the presence of one to two of these conditions. High conservation priority areas are comprised of three or more of these conditions. Restoration priority is defined by conservation priority areas in proximity to the following ecological impacts or needs: impervious surfaces, major roads, high forest restoration priority. In the Shawnee Mission School District, high conservation and restoration priority areas are generally concentrated along streams and rivers and their surrounding riparian floodplains. A moderate restoration priority area is defined by an otherwise moderate conservation priority area with two types of ecological impacts/needs. High restoration priority areas are comprised of otherwise high priority conservation areas with one or more ecological impacts/needs.



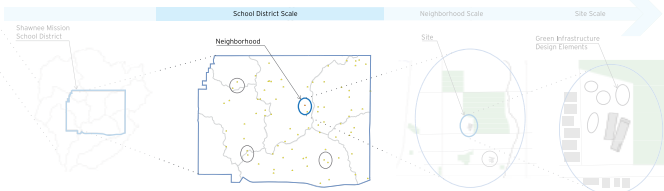
Ecological Value Areas
Shawnee Mission School District

- Ecological Value Areas**
- Conservation Priority: High
 - Conservation Priority: Moderate
 - Restoration Priority: Moderate
 - Restoration Priority: High
- SMSD Schools**
- Shawnee Mission School Sites
 - Center for Academic Achievement

GEOGRAPHICAL ANALYSIS CONTEXT

SHAWNEE MISSION SCHOOL DISTRICT

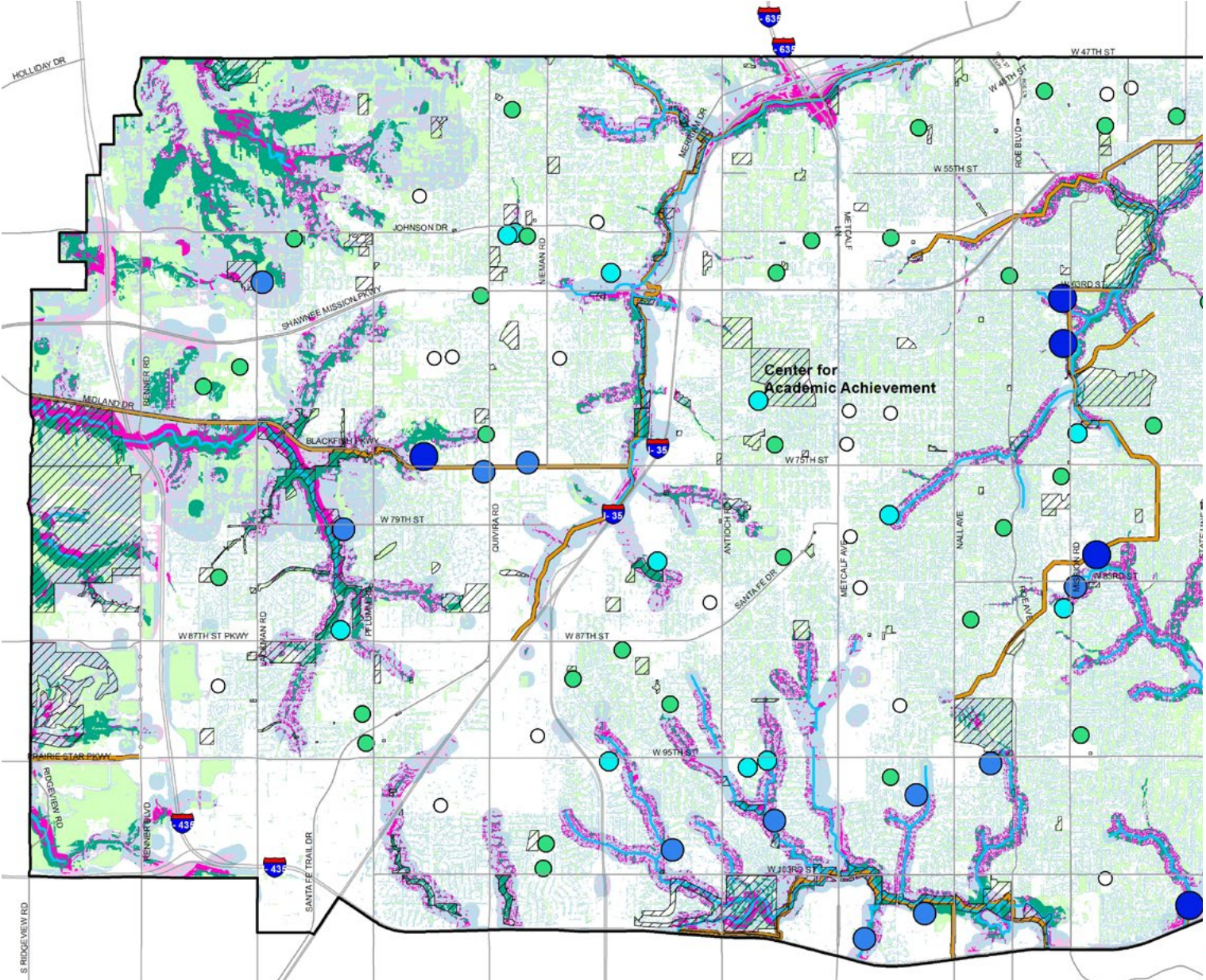
SCHOOL DISTRICT SCALE



SCHOOLS INTERSECTION WITH HIGH ECOLOGICAL VALUE AREAS

High ecological value area within one-quarter-mile of each school is defined as the presence of a high conservation priority area (as described previously), parks, land adjacent to streams (of any condition), and land adjacent to proposed MetroGreen trails. Schools with the highest acreage of nearby high ecological value area are generally in close proximity to streams and floodplains, a few are also near proposed MetroGreen trails. The CAA ranks as low to moderate in this analysis of adjacent ecological value, with 200 to 400 acres of high ecological value area, driven primarily by the tree canopy of the adjacent Milburn Country Club. However, school visitors come from a wide area, so the demonstration value of the site makes up for its somewhat lower priority location and highlights how some green infrastructure strategies will be locally opportunistic, yet still significant on a larger, regional scale.

This map can be used to help identify priority schools for future green infrastructure projects that provide opportunities to link to nearby conservation and restoration initiatives. Schools in close proximity to dark pink areas shown at right could offer opportunities for community improvements for flood control and/or service learning through restoration of natural areas. Large green patches and park sites near schools suggest locations where green infrastructure treatments could be designed to connect a network of functional areas, e.g., by creating stepping stones for pollinator habitat on school properties. A list of school addresses that have more high ecological value areas nearby are listed in the Appendix. (Some of the areas noted relate to private schools within the Shawnee Mission School District boundaries.)



Schools Intersection with High Ecological Value Areas
Shawnee Mission School District

- Shawnee Mission School District Boundary
- Schools w/ High Value Eco Areas w/in 1/4 mile**
(High value eco= parks, streams, proposed Metrogreen Trails, and high value conservation areas)
- > 600 acres
- > 400 acres to 600
- > 200 to 400 acres
- > 0 to 200 acres
- Schools without High Value Ecological Areas nearby
- Parks
- Streams
- Proposed MetroGreen Trails

OPPORTUNITY AREA SHAWNEE MISSION SCHOOL DISTRICT

ADAPTIVE MANAGEMENT APPROACH - DISTRICT SCALE

INTRODUCTION

Site design for some Shawnee Mission School District properties employed sustainable design principles including green infrastructure for stormwater management. Because these design elements are living systems, they will require stewardship and proper care to maintain, otherwise decreased functions can occur. For new sites, oversight can begin during design and installation, and with the establishment of an adaptive management program that includes monitoring. The frequency of care varies and includes preventative, routine/predictive, and reactive or emergency response. There are numerous existing resources available on green infrastructure best practices and maintenance, as provided in the adjacent resources list.

Maintenance cost is a common question during green infrastructure planning. According to a recent survey, the American Society of Civil Engineers found a wide range of green infrastructure maintenance costs. Several factors affect these costs depending on site-specific conditions and agency practices.¹ Another cost factor is the size of facilities being maintained, where larger installations were found to be somewhat more cost effective. Similarly, cost efficiencies could be achieved if management strategies are applied at a larger district scale.

The adaptive management approach recommended in this section for the Center for Academic Achievement is based on monitoring of green infrastructure installations and responding as needed when treatment elements are underperforming. The purpose of the selected strategies is to build on landscape planning conducted to date with a focus on adaptive management approaches that incorporate training, education, and capacity building for the school district and community. The recommended strategies will not only inform response actions, but will be used to increase data on functional landscapes, encourage student participation, and inform future designs adaptable to the growing body of information and anticipated shifts in climate.

The district-wide opportunity is to increase this approach to multiple facilities in an effort to build stewardship capacity, share lessons learned, and achieve potential cost efficiencies.

¹ <http://ascelibrary.org/doi/book/10.1061/9780784414897>

RESOURCES FOR ADAPTIVE MANAGEMENT STRATEGIES

There are a number of excellent existing resources for planning, design and implementation of green infrastructure practices and adaptive management strategies, including:

- *A Tale of Two Rain Gardens* (Journal of Environmental Management): <http://www.sciencedirect.com/science/article/pii/S0301479716303644?via%3Dihub>.
- *Cost of Maintaining Green Infrastructure* (ASCE Library): <https://ascelibrary.org/doi/book/10.1061/9780784414897>.
- *Ernst Seeds Resource Center*: <https://www.ernstseed.com/resources/>.
- *Five Steps to Successful Prairie Meadow Establishment* (Prairie Nursery): <http://www.prairienursery.com/resources-and-guides/seeds-and-seed-mixes/documents/five-steps-to-successful-prairie-establishment.pdf>.
- *GeoPlatform Stormwater BMP Performance Database* (U.S. EPA): <https://www.epa.gov/water-research/geoplatform-stormwater-bmp-performance-database-0>.
- *Green Infrastructure Operations and Maintenance* (U.S. EPA): <https://www.epa.gov/green-infrastructure/green-infrastructure-operations-and-maintenance>.
- *Green Values - National Stormwater Management Calculator* (Center for Neighborhood Technology): http://greenvalues.cnt.org/national/cost_detail.php.
- *Manual of Best Management Practices for Stormwater Quality* (APWA/MARC): http://kcmetro.apwa.net/content/chapters/kcmetro.apwa.net/file/specifications/bmpmanual_oct2012.pdf. See especially pp. 8-49.
- *Native Vegetation Establishment and Enhancement Guidelines* (Minnesota Board of Water & Soil Resources): http://www.bwsr.state.mn.us/native_vegetation/seeding_guidelines.pdf.
- *Reconstructing a Tallgrass Prairie: A Seeding Guide for Missouri* (Shaw Nature Reserve / Missouri Department of Conservation): <http://www.missouribotanicalgarden.org/portals/0/Shaw%20Nature%20Reserve/PDFs/horticulture/NLM%20Ch1.pdf>.
- *Stormwater Facility Maintenance Program* (Department of Environmental Protection, Montgomery County, Maryland): <https://www.montgomerycountymd.gov/water/stormwater/maintenance.html>.
- *Stormwater Wet Pond and Wetland Management Guidebook* (U.S. EPA): <https://www3.epa.gov/npdes/pubs/pondmgmtguide.pdf>.
- *Using Adaptive Management to Meet Conservation Goals* (USDA Natural Resource Conservation Service): https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_013594.pdf.

OPPORTUNITY AREA SHAWNEE MISSION SCHOOL DISTRICT

ADAPTIVE MANAGEMENT APPROACH - DISTRICT SCALE

INTRODUCTION

To expand adoption of the adaptive management approach, district-wide programs could be organized around design review and installation, routine maintenance activities, resiliency planning, and monitoring as described here.

DESIGN REVIEW AND INSTALLATION

Overall Description

Best practices for green infrastructure design are well-documented (see separate page on Design Elements), but site-specific conditions and installation issues can result in underperforming functions and undesirable aesthetics. Where green infrastructure has already been designed and installed, a retroactive design and installation review is one possibility for compiling lessons learned into a format that can be communicated across the school district.

Strategies

- Independent design reviews throughout the design development process can help identify potential weaknesses to be addressed early on. When design issues arise after installation, retrofits and modifications can help make improvements. For example, at the Center for Academic Achievement, it appears that discussions with an advisor and the designer would be useful to explore retrofits to spread flow and stabilize soils in some parking lot runoff locations where flow enters the vegetated swales.
- Contractor training and certifications are another way to help ensure that skilled installations occur and problems such as soil compaction and poor “field fitting” are prevented. Future school projects could benefit from the Center developing a list of contractor and inspector skill requirements.

ROUTINE ACTIVITIES

Overall Description

As vegetation becomes established, weeding and other establishment maintenance will be reduced, giving way to less intensive maintenance activities. These are typically activities that do not require extensive training.

Strategies

- Stormwater basin/pond trash and debris may be addressed through periodic “community cleanup days” with student and community volunteers. Similarly, weed pulls in the vegetated swales could be conducted in organized events possibly connected to the farm.
- Woody tree control can be accomplished either through burning (see below) or by hand removal on an annual basis.
- Hand weeding will be required less intensively once native plant beds are fully established, but this activity will still be important every three to four weeks during growing months. The intensity of this activity will continue to decrease annually as weeds are eliminated from the soilbank and native vegetation eliminates competition.
- Mulching should occur as needed, based on visual monitoring. This will become more sporadic as plant communities are established.
- Erosion control will also be managed based on visual inspection of the site, with the use of erosion blankets and replanting of plugs (rather than seed) being recommended in high erosion areas.
- Burning should be considered if possible, every three to five years after establishment to eliminate woody plants and enrich the soils.
- Pervious pavement, when it is utilized, should be inspected and maintained annually. Vacuuming by a professional is recommended annually to remove sediment and sand from pore space to keep pavements at optimal performance. It is also critical to communicate with winter maintenance crews to establish pavement types to avoid over-plowing and to eliminate the use of sand in winter pavement treatments.

RESILIENCY PLANNING & MONITORING

Overall Description

Given changing climate patterns, increased extreme weather events are occurring more frequently. Instead of designing for average rainfall events or 100-year flooding, some designers are beginning to plan for 500-year flood events. Regardless of the design criteria, some disturbances are natural and should be anticipated.

Strategies

- Monitoring activities could be conducted by the students including installing a climate station to relate trends in site runoff to event sizes. Monitoring parameters could include runoff volumes/duration/timing, water quality indicators, and soil health. Nearby universities may be able to assist in setting up and evaluating the precipitation monitoring.
- The Shawnee Mission School District Wellness Program may be able to establish health indicators to track benefits to visitors and volunteers after walking or working at the site. Again, nearby universities could help supplement high school student capabilities.
- For future projects, the CAA monitoring plan could be used as a template for other schools to adopt as early as during the design process. Ideally, facilities will begin the process of resiliency planning and include a monitoring plan with a list of indicators and thresholds for when response actions are required.
- Informal monitoring and citizen science participation could be facilitated through development of a mobile device app.

OPPORTUNITY AREA SHAWNEE MISSION SCHOOL DISTRICT

ADAPTIVE MANAGEMENT APPROACH - DISTRICT SCALE

NOTE: There are numerous guides available to assist with development and implementation of design elements, a small sampling of which are included here.



STORMWATER SYSTEMS

Refer to the following resources: *Manual of Best Management Practices for Stormwater Quality* (APWA/MARC), *Green Infrastructure Operations and Maintenance* (U.S. EPA), *A Tale of Two Rain Gardens* (Journal of Environmental Management).



TRAILS

Trail classes include: 1-Minimal/Undeveloped Trail; 2-Simple/Minor Development Trail; 3-Developed/Improved Trail; 4-Highly Developed Trail; 5-Fully Developed Trail. Refer to <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=27584.wba> (specifically refer to Different Trail Design Parameters: Page 28 Appendix A).



NATIVE PRAIRIE

Refer to the following resources: *Ernst Seeds Resource Center*, *Five Steps to Successful Prairie Meadow Establishment* (Prairie Nursery), *Reconstructing a Tallgrass Prairie: A Seeding Guide for Missouri* (Shaw Nature Reserve / Missouri Department of Conservation), *Native Vegetation Establishment and Enhancement Guidelines* (Minnesota Board of Water & Soil Resources).



WILDFLOWERS & GRASSES

Refer to the following resources: *Ernst Seeds Resource Center*, *Reconstructing a Tallgrass Prairie: A Seeding Guide for Missouri* (Shaw Nature Reserve / Missouri Department of Conservation).



NATURAL STORMWATER CONVEYANCE

See *Stormwater Wet Pond and Wetland Management Guidebook* (U.S. EPA). Also, *West Virginia Stormwater Management and Design Guidance Manual*, 4.2.7 Regenerative Stormwater Conveyance System (RSC) AWRA, *Water Resources IMPACT*, September 2009, Volume 11, Number 5.



CULINARY GARDEN AND ORCHARD

See University of Missouri Extension “Urban Agriculture Best Practices and Possibilities”: http://extension.missouri.edu/foodsystems/documents/urbanagreport_072012.pdf. Also, CultivateKC at: <http://www.cultivatekc.org/>.

SUMMARY

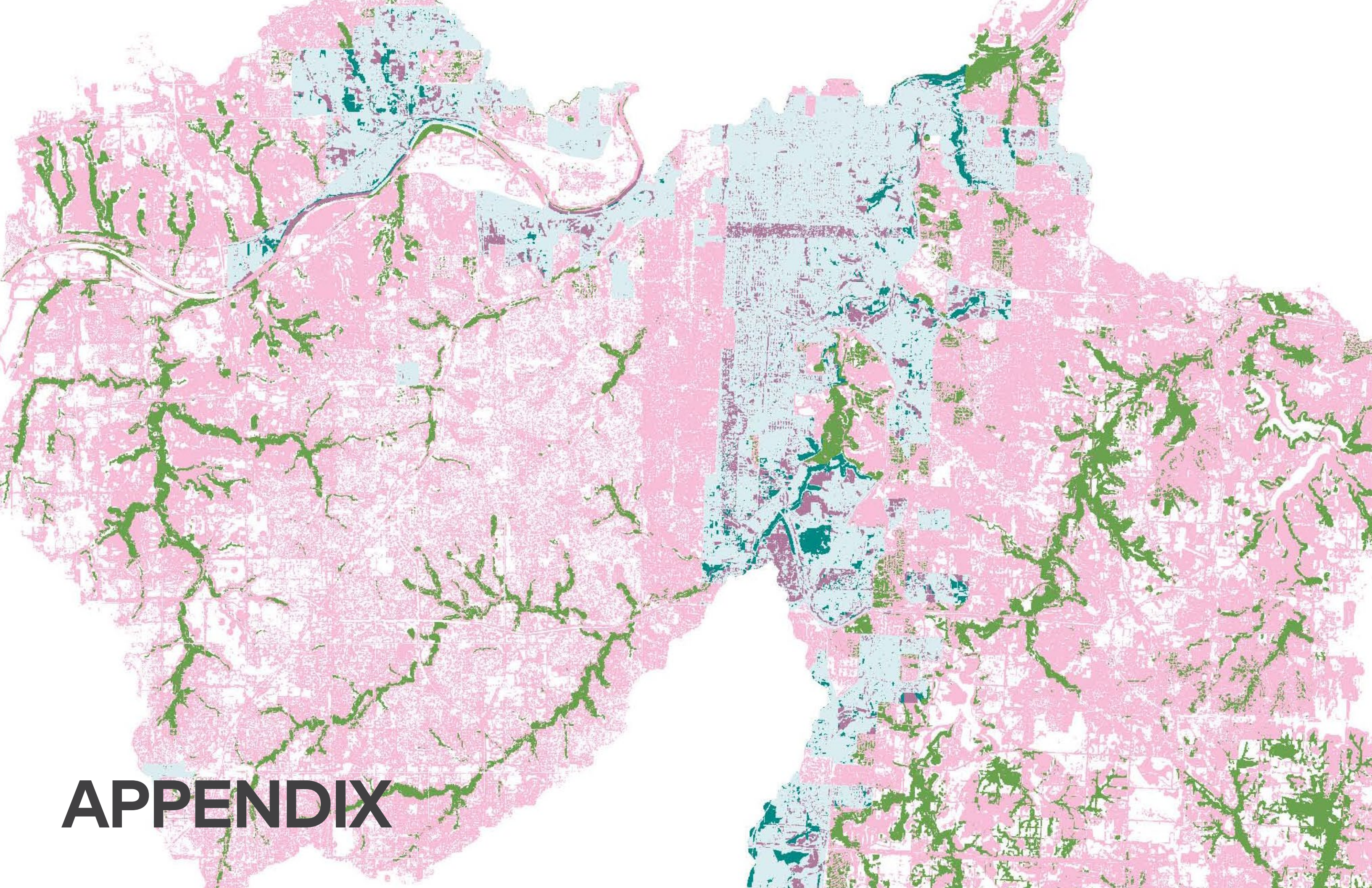
SHAWNEE MISSION SCHOOL DISTRICT

School facilities offer a unique opportunity to model best practices in green infrastructure for both the future workforce and surrounding communities. The Shawnee Mission School District has embraced the opportunity to lead by promoting sustainable landscapes and using ecological design principles to increase student achievement, improve environmental quality, and serve the community.

The adaptive management strategies created for the Shawnee Mission School District and the on-the-ground experience and lessons that will continue to be learned at the Center for Academic Achievement will position the district to adapt these strategies for other schools and facilities throughout the district. As other impactful school sites that have ecological value (both from a conservation and restoration standpoint) are identified and developed, the opportunity for incorporating and connecting these green infrastructure strategies to surrounding communities, and to other conservation and restoration initiatives, will continue to grow, expanding the network of green infrastructure strategies at a regional and increasingly impactful scale.

Shawnee Mission School District is in a unique position to influence decision-makers in their district, the municipalities that are part of their district, and other districts that look to them as a model throughout the region. As Shawnee Mission measures the benefits of sustainable landscapes and the practices to manage them, they will share these lessons learned with students, teachers, families, neighbors, elected officials, local businesses and collaborators from other districts. Through a strong educational partner, it is possible that action, measurement, and policy can go hand-in-hand to increase water quality, air quality, habitat quality, food quality, and access to safe and inspiring walking and biking paths for the region.





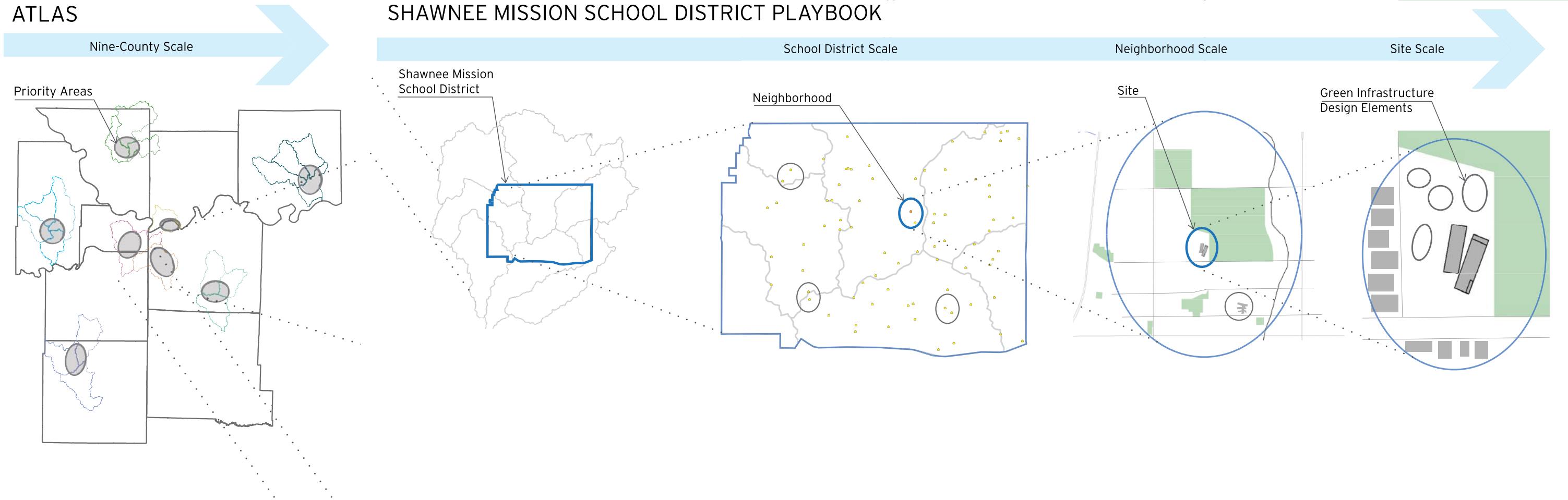
APPENDIX

STUDY OF SCALES

GREEN INFRASTRUCTURE PLAYBOOK

SCALE DIAGRAM

Below is the scale diagram for the Shawnee Mission School District, and on the following page is a glossary describing the scales and terms used throughout the Playbook.



GLOSSARY OF TERMS (ordered by scale)

Atlas: A set of maps that help identify priority areas for integrated green infrastructure strategies at a regional scale.

Playbook: A framework that demonstrates replicable approaches for implementing green infrastructure for ecological and socioeconomic benefits using nested scales of analysis.

Priority Area: Based on a watershed-scale analysis, these locations are selected for further study based on the established criteria of momentum, need, access and proximity set forth in Phase 1 of the Green Infrastructure Framework.

Watershed: Natural drainage area boundaries developed by the U.S. Geological Survey are the foundation of the Playbook because they group priority areas and partners based on ecological and hydrological relationships that go beyond municipal/political boundaries. In the first map of each playbook, multiple watershed boundaries are illustrated.

Corridor Scale: For the Rock Island playbook, this is the largest scale within multiple watersheds that identifies a common focus for infrastructure improvements along a common transit zone.

Opportunity Area: Within each priority area of a watershed, there are often multiple clusters of opportunities that merit further analysis to identify a starting point that will have the greatest potential for immediate impact. For the Rock Island playbook, this translates to the scale of a transit corridor. For the Shawnee Mission School District, this translates to the school district boundaries.

Sub-Corridor Scale: This scale is a more manageable area to comprehend the benefits of integrated green infrastructure within the context of specific neighborhoods and partnerships with local stakeholders.

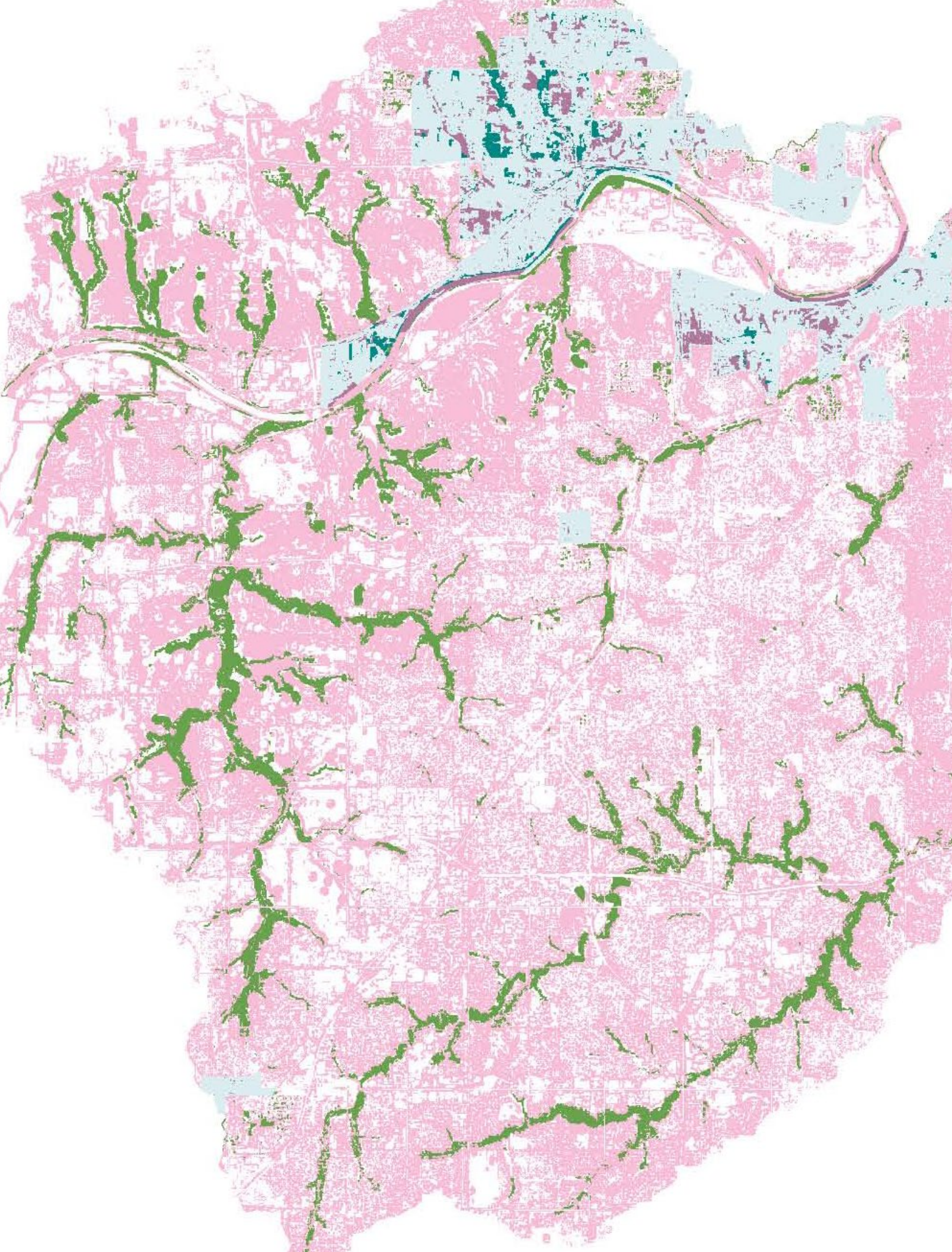
School District Scale: For the Shawnee Mission playbook, this scale allows the school administration to understand the breadth of green infrastructure implementation across their property holdings and the municipalities within which they operate.

Focus Area: Within an opportunity area, this is the neighborhood or community-scale area that is used to establish connections between projects and to develop recommendations for implementable site-specific green infrastructure strategies. Both the Rock Island and Shawnee Mission School District playbooks illustrate this scale through the context of adjacent neighborhoods.

Network Connectors: These are a list of green infrastructure solutions that work together within an area to address multiple challenges and link smaller project sites together to strengthen the network of watershed-scale benefits.

Neighborhood Scale: The neighborhood scale is critical to green infrastructure implementation because of the engagement required of local landowners and stakeholder organizations to steward the work and champion the benefits for people and nature.

Site Scale: Within a focus area or neighborhood, this scale is where on-the-ground implementation occurs for fundable projects that address site-specific needs while contributing to the integrated green infrastructure approach that is envisioned for all other scales.



GEOGRAPHIC DATA

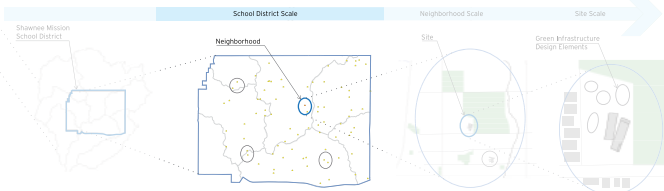
INTRODUCTION

This Appendix contains maps with geographic information for the Shawnee Mission School District project. This data was used, in conjunction with stakeholder interviews and site visits, to produce the Playbook guidance for this project. While this data is not an empirically comprehensive process of analysis, these inputs result in the design of integrated strategies that are well-suited to the place and people, and have support from local organizations for implementation.

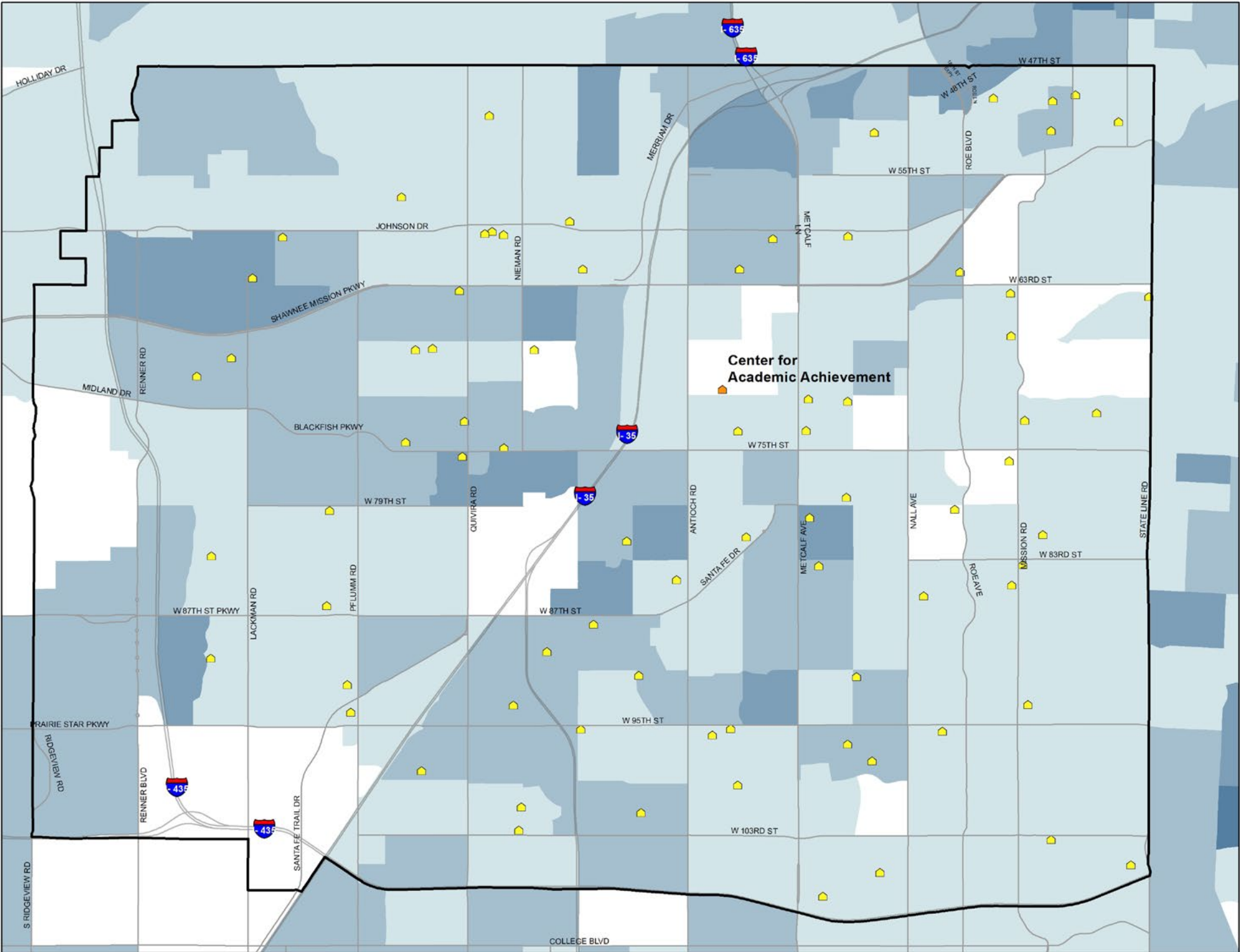
PERCENT MINORITY POPULATION

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



Minority populations were mapped as one component of social need. Historically, minority communities are places of particular vulnerability, where health, education, access to opportunity and equity needs are pronounced.



Percent Minority Population Shawnee Mission School District

- Shawnee Mission School District Boundary
- SMSD Schools**
- Shawnee Mission School Sites
- Center for Academic Achievement
- Percent of Minority Population**
- 1% - 12%
- 12% - 27%
- 27% - 50%
- 50% - 76%
- 76% +

0 0.5 1 Miles

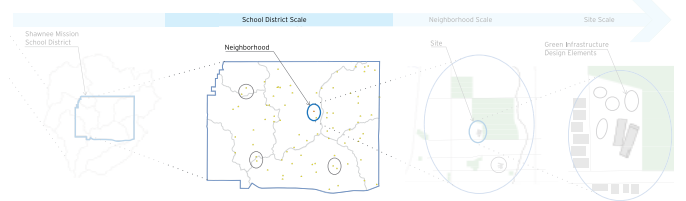
bnim Biohabitats BIKE WALK **KC**

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer

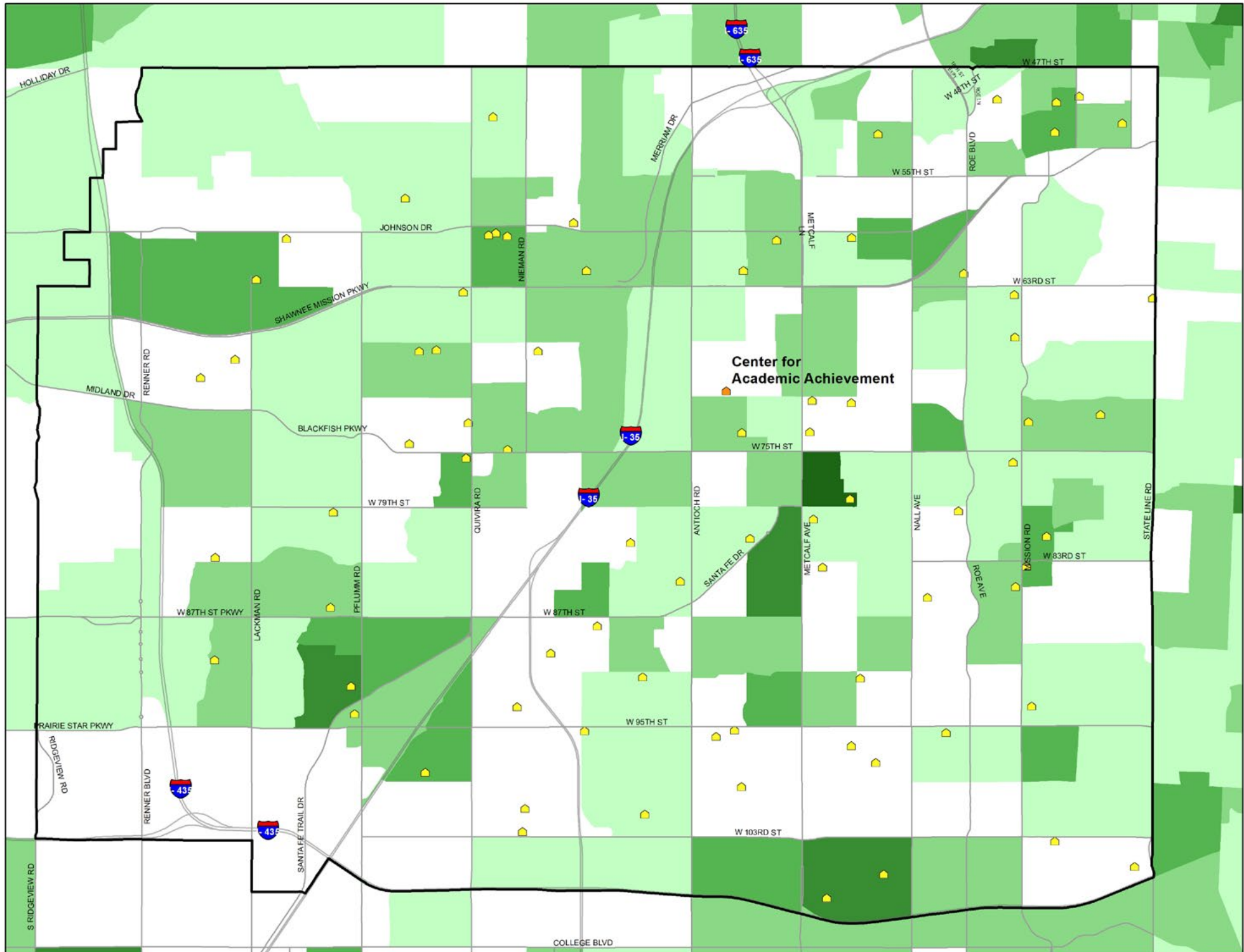
PERCENT OF ZERO-VEHICLE HOUSEHOLDS

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



Zero-vehicle households were mapped as one component of social need. Zero-vehicle households are those who use alternative transportation modes by necessity rather than by choice, and so represent an important consideration when identifying connections and green infrastructure opportunities.



Percent of Zero-Vehicle Households
Shawnee Mission School District

- Shawnee Mission School District Boundary
- SMSD Schools**
- Shawnee Mission School Sites
- Center for Academic Achievement
- Percent of Zero-Vehicle Households**
- 1% - 4%
- 4% - 11%
- 11% - 21%
- 21% - 34%
- 34% +

0 0.5 1 Miles

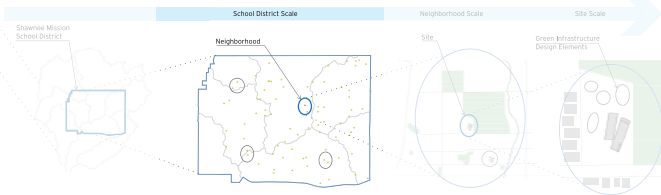
bnim Biohabitats BIKE WALK KC

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer

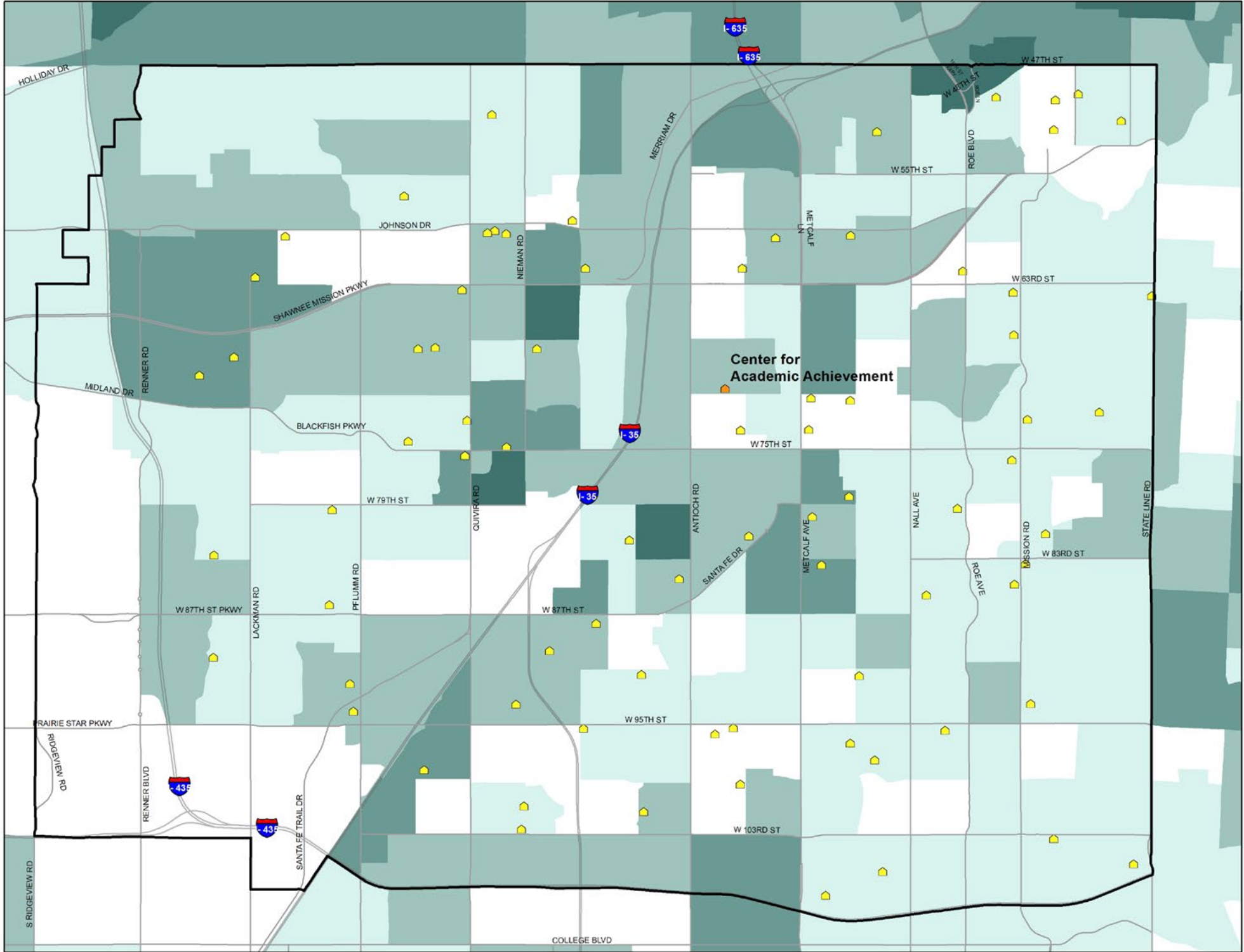
PERCENT OF POPULATION WITH INCOME BELOW POVERTY

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



Poverty was mapped as one component of social need. Areas of poverty are places of particular vulnerability, where health, education, access to opportunity and equity needs are pronounced.



Percent of Population with Income Below Poverty
Shawnee Mission School District

- Shawnee Mission School District Boundary
- SMSD Schools**
 - Shawnee Mission School Sites
 - Center for Academic Achievement
- Percent in Poverty**
 - 1% - 6%
 - 6% - 15%
 - 15% - 27%
 - 27% - 42%
 - 42% +

0 0.5 1 Miles

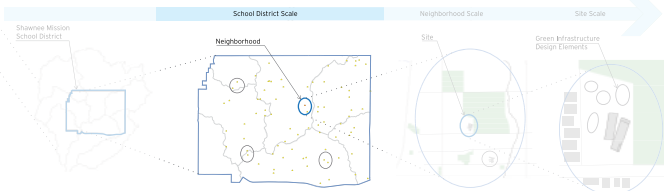
bnim Biohabitats BIKE WALK KC

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer

SOCIAL NEED INTERSECTION ANALYSIS

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE

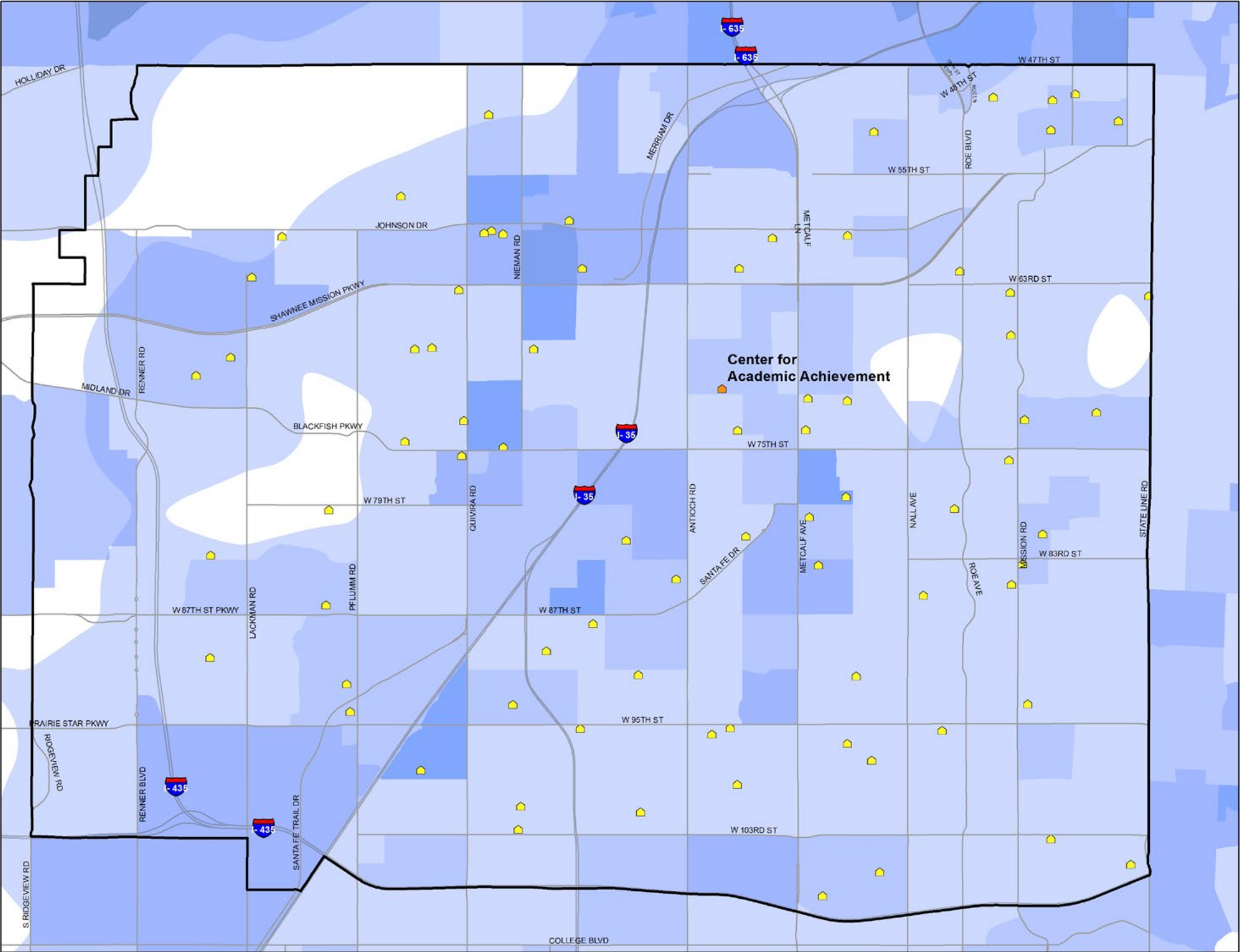


Social need was modeled along with data for the watersheds and analyzed the following social factors:

- Poverty.
- Hazardous Waste.
- Population Loss.
- Health Indicators.
- Food Deserts.
- Educational Attainment.
- Zero-Vehicle Households.
- Minority Populations.

On this map, the darker the blue the higher number of intersection/overlap of these social factors.

The data sets of Health Indicators and Food Deserts were selected as proxies for access to healthcare and healthy environments. Hazardous waste was selected as a proxy for the nexus between land use, environmental conditions, and human health. Population loss, poverty, and patterns that imply minority segregation were selected as proxies for economic disinvestment and vulnerability. Educational Attainment was selected as a proxy for access to education. Zero-vehicle households was selected as a proxy for general access to opportunity and services. Areas identified with high levels of intersection are identified as high social need and therefore a priority for using green infrastructure to address social needs.



**Intersection of Social Need
Shawnee Mission School District**



- Shawnee Mission School District Boundary
- SMSD Schools**
 - Shawnee Mission School Sites
 - Center for Academic Achievement

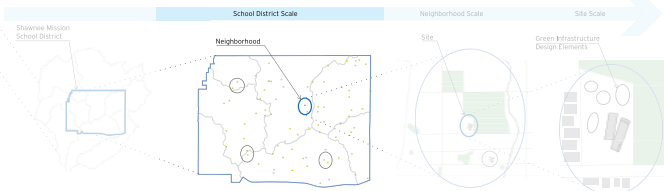
0 0.5 1 Miles

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer

ECOLOGICAL VALUE AREAS

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



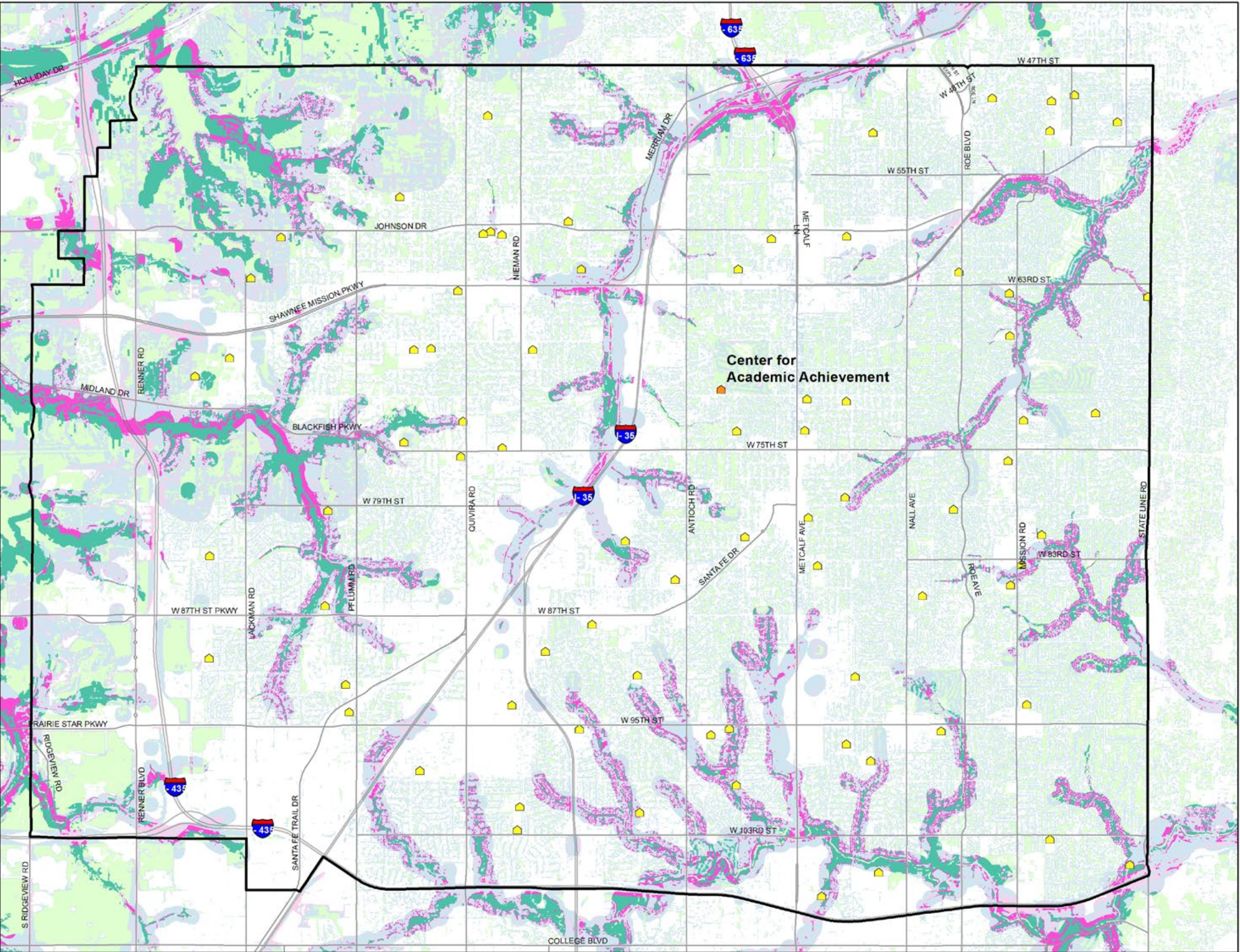
This map was created to show the intersections between value and need. Areas with moderate and high ecological value and no impacts or needs are considered a conservation priority (light and dark green). Areas with moderate and high ecological value that do have impacts or needs are considered a restoration priority (pink and magenta).

The factors of high ecological value include:

- Streams.
- Lakes.
- Wetlands.
- Floodplains.
- Existing Forest.
- Large Herbaceous Patches.
- Caves and Karst.
- Glades.
- Clean Water Benefits.
- Wildlife Benefits.

The factors of ecological impact or need are:

- Impervious Surface.
- Major Roads.
- Highest Forest Restoration Priority.



Ecological Value Areas Shawnee Mission School District

Ecological Value Areas

- Conservation Priority: High
- Conservation Priority: Moderate
- Restoration Priority: Moderate
- Restoration Priority: High

Shawnee Mission School District Boundary

SMSD Schools

- Shawnee Mission School Sites
- Center for Academic Achievement

0 0.5 1 Miles

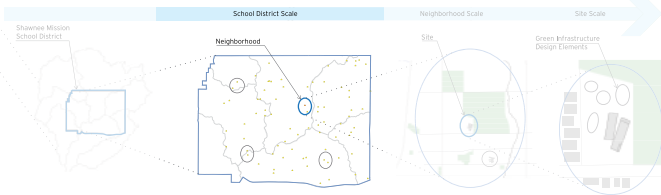
bnim Biohabitats BIKE WALK KC

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer, The Conservation Fund

SCHOOLS INTERSECTION WITH ECOLOGICAL VALUE AREAS

SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



Shawnee Mission School District schools* with high ecological value areas nearby include:

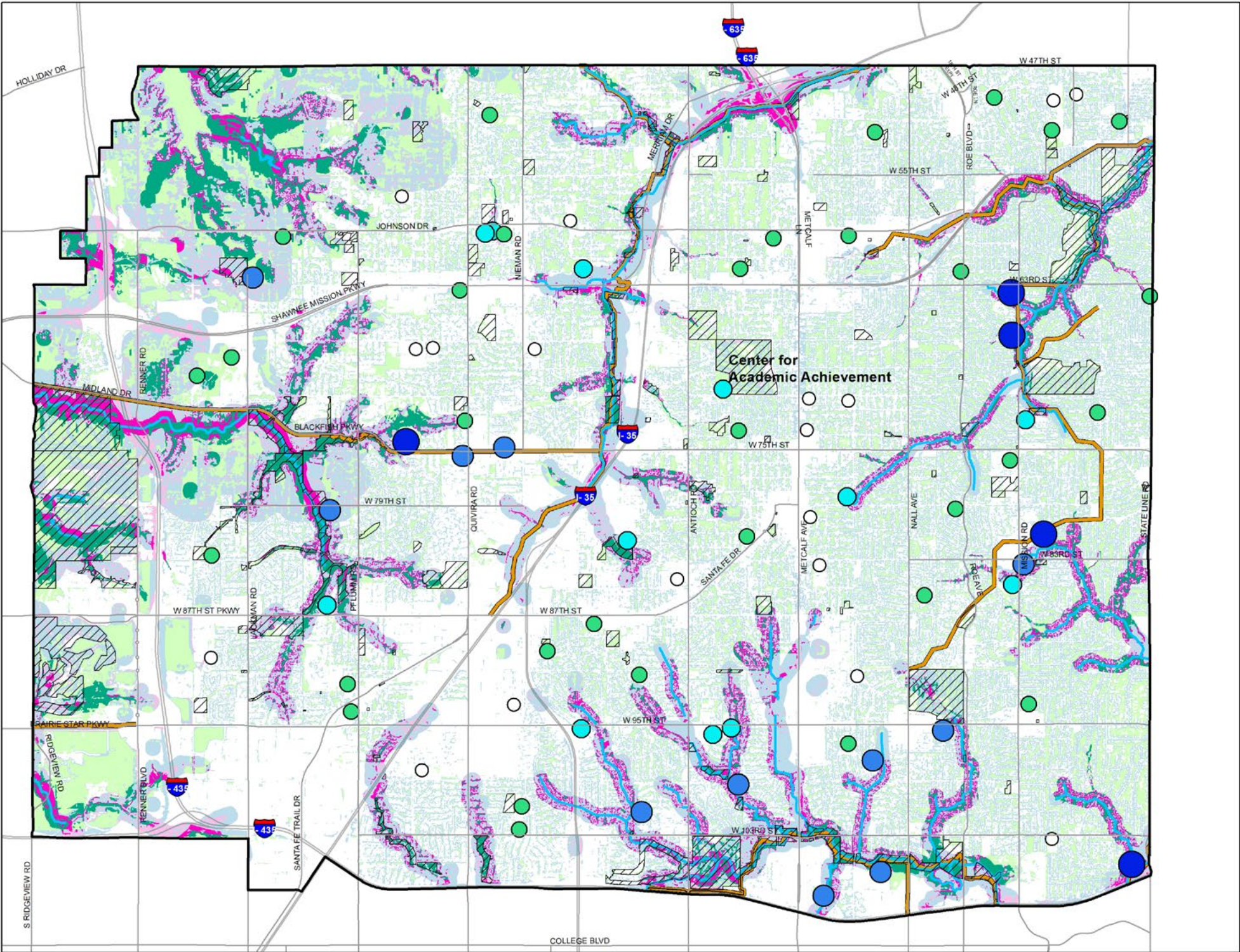
- > 600 Acres**
 - Indian Hills Middle - 6400 Mission Road, Shawnee Mission, KS 66208
 - Corinth Elementary - 8301 Mission Road, Shawnee Mission, KS 66206
 - Prairie Elementary - 6642 Mission Road, Shawnee Mission, KS 66208

- 400-600 Acres**
 - Shawnee Mission South High - 5800 W. 107th St, Shawnee Mission, KS 66207
 - Mill Creek Elementary - 13951 W. 79th St., Shawnee Mission, KS 66215
 - Trailwood Elementary - 5101 W. 95th St., Shawnee Mission, KS 66207
 - Brookridge Elementary - 9920 Lowell, Shawnee Mission, KS 66212
 - Trailridge Middle - 7500 Quivira Road, Shawnee Mission, KS 66216
 - Shawnee Elementary - 11230 W. 75th St., Shawnee Mission, KS 66214
 - Indian Woods Middle - 9700 Woodson, Shawnee Mission, KS 66207

Ecological value is only one aspect to consider as stated in the Playbook. Momentum, need, and access should also be considered around a project.

* Note: Some circles indicate private schools that fall within the Shawnee Mission School District boundaries..

Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer, The Conservation Fund



Schools Intersection with High Ecological Value Areas Shawnee Mission School District

- Shawnee Mission School District Boundary
- Schools w/ High Value Eco Areas w/in 1/4 mile**
(High value eco= parks, streams, proposed Metrogreen Trails, and high value conservation areas)
- > 600 acres
- > 400 acres to 600
- > 200 to 400 acres
- > 0 to 200 acres
- Schools without High Value Ecological Areas nearby
- Parks
- Streams
- Proposed MetroGreen Trails

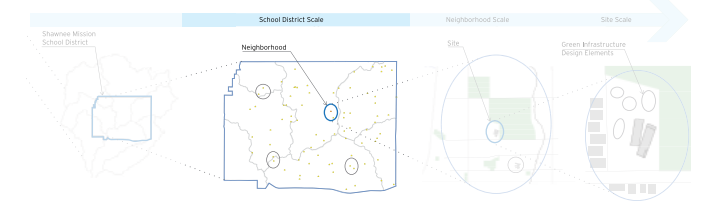
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INTERSECTION OF ECOLOGICAL AND SOCIAL NEED

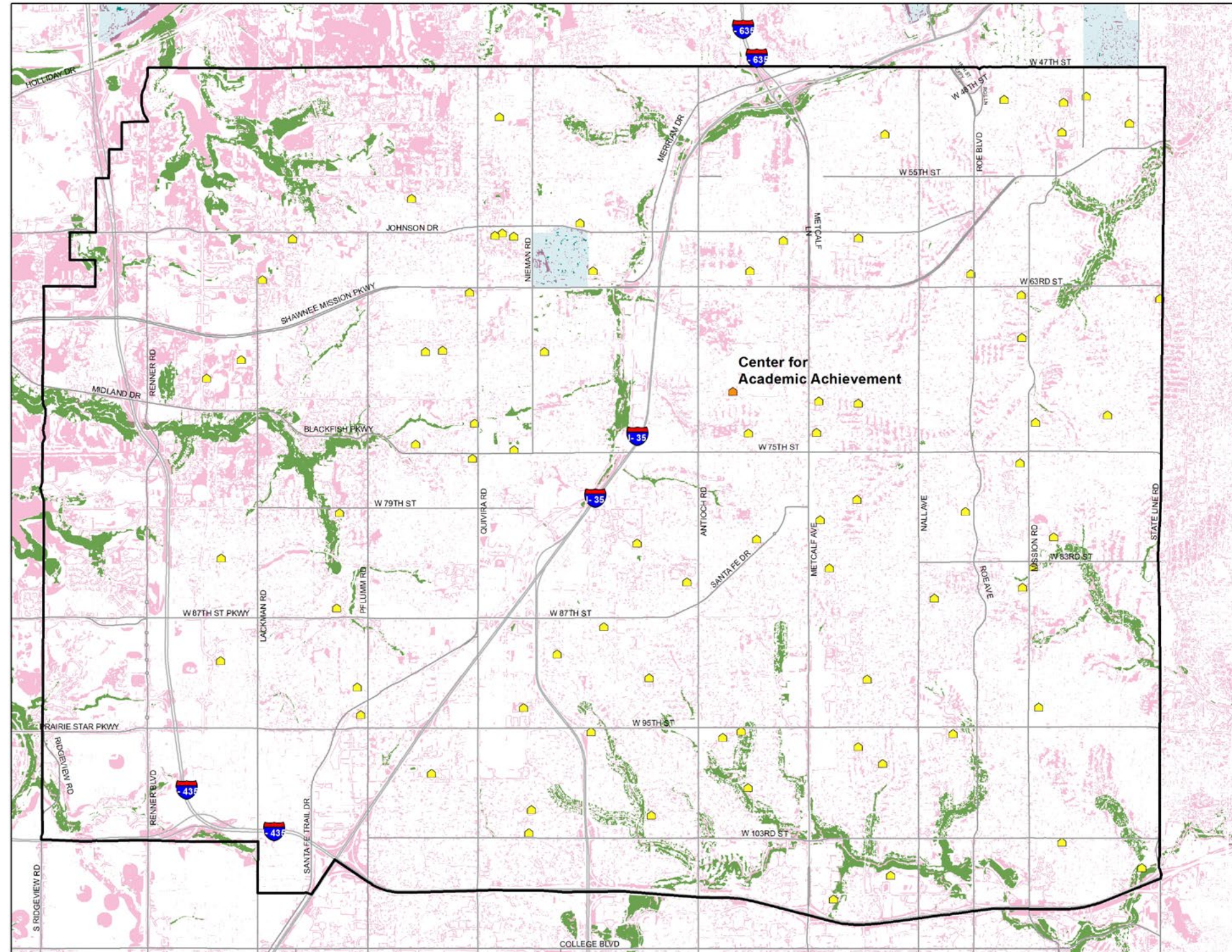
SHAWNEE MISSION SCHOOL DISTRICT

SCHOOL DISTRICT SCALE



The primary purpose of this analysis is to find areas of the greatest intersection of need, so the areas of black, dark teal, and dark purple indicate areas of high interest in this study.

The quantitative analysis used was an intersection analysis to view ecological value and need and social need jointly and holistically. This is a trivariate map, where each unique color represents a different combination of intersection. Light pink indicates the presence of high value ecological resources and conservation needs, but no other need intersection. Green and blue indicate ecological need for restoration and social need, respectively. Darker shades are used to represent greater intersection: dark teal for areas of social and restoration intersection, and dark purple for social and conservation intersection. Black indicates an intersection of all three needs, which does not occur as restoration and conservation values do not typically overlap.



Intersection of Ecological and Social Need Shawnee Mission School District



Shawnee Mission School District Boundary

SMSD Schools

- Shawnee Mission School Sites
- Center for Academic Achievement

Intersection of Ecological and Social Need

Intersection Analysis

- Higher Ecological Need/Restoration
- Higher Ecological Value/Conservation
- Higher Social Need
- Intersection of Restoration & Social Need
- Intersection of Conservation & Social Need
- Intersection of Restoration & Conservation
- Intersection of Restoration, Conservation, & Social Need

0 0.5 1 Miles



Data Sources: ACS 2015 5-year Block Group, MARC, KCMO Parcel Viewer, The Conservation Fund