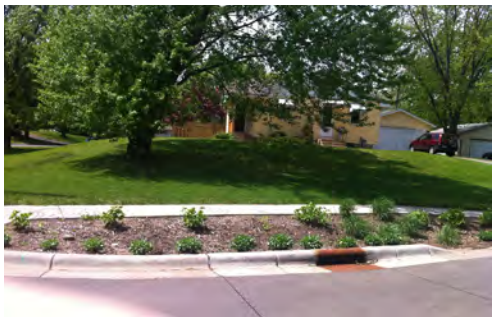
Building Support for Living Streets

Visual Preference Survey
in Casey Lake Neighborhood
North Saint Paul, MN





Authors: Emily Goellner, Cadence Peterson, Sean Rahn

PA 8081: Making Sustainable Transportation Work
Hubert H. Humphrey School of Public Affairs,
University of Minnesota Completed in Partnership with the Resilient Communities Project Faculty: Dr. Greg Lindsey

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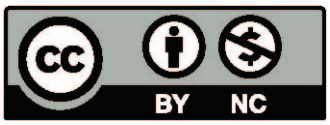
This project was supported by the Resilient Communities Project (RCP), a program at the University of Minnesota that convenes the wide-ranging expertise of U of M faculty and students to address strategic local projects that advance community resilience and sustainability. RCP is a program of the Center for Urban and Regional Affairs (CURA) and the Institute on the Environment.



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Resilient Communities Project
University of Minnesota
330 HHHSPA
301—19th Avenue South
Minneapolis, Minnesota 55455
Phone: (612) 625-7501
E-mail: rcp@umn.edu
Web site: http://www.rcp.umn.edu

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Notes

This Capstone Report along with a final paper written by Sean Rahn entitled “Visualizing Living Streets in North Saint Paul: A Visual Preference Survey In Casey Lake Neighborhood” fulfills Sean’s Masters MPlan degree requirements. Portions of Sean’s final paper can also be found in this Capstone Report. This report also fulfills the Emily Goellner and Cadence Peterson’s Master in Urban and Regional Planning degree requirements.

Rahn, Sean (2014). “Visualizing Living Streets in North Saint Paul: A Visual Preference Survey In Casey Lake Neighborhood.” Completed in Conjunction with the “Building Support for Living Streets-Visual Preference Survey in Casey Lake Neighborhood PA 8081 Capstone Report.” Hubert H. Humphrey School of Public Affairs, Minneapolis, MN on behalf of the City of North Saint Paul, MN in Partnership with the Resilient Communities Project.

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Executive Summary

This report describes new ideas and strategies for how to best engage the community of North Saint Paul in discussions that will lead to successful implementation of its approved Living Streets Policy and Plan. The first sections of this report provide context to the barriers that North Saint Paul has encountered in previous attempts to implement the Living Streets Plan. Understanding this context helps define the need to develop a better community engagement approach in the City.

Case studies are used to provide detail on strategies employed by local cities that have successfully implemented living streets. These case studies shed light on implementation strategies that could be successfully adapted in the City of North Saint Paul.

The bulk of this report focuses on a visual preference survey (VPS) conducted in the Casey Lake neighborhood of North Saint Paul. The VPS is a tool used to help citizens envision changes to their built environment and to collect data on their aesthetic preferences. The VPS used in this report focuses on design elements that can be adapted to living streets.

The VPS as a planning tool is discussed as well as the methodology and implementation strategies used to limit survey biases and errors in a visualized format. Strategies associated with selecting the study area as well as the design and implementation of the survey questionnaire are highlighted.

General survey findings show neighborhood preference and support for the incorporation of certain design elements of living streets in North Saint Paul. These design elements include raingardens, street narrowing, and intersections enhanced with crosswalks and bump outs. Other design elements such as street medians and off-street bike lanes were not seen as desirable by survey respondents.

Recommendations for future action include placing more of a focus on community engagement efforts early in the planning process. This can be done through the use of additional surveys and other mechanisms. Focusing engagement on a demonstration site, fostering living streets redesign "champions," and adapting designs to the context of each individual neighborhood are all keys to successful implementation.

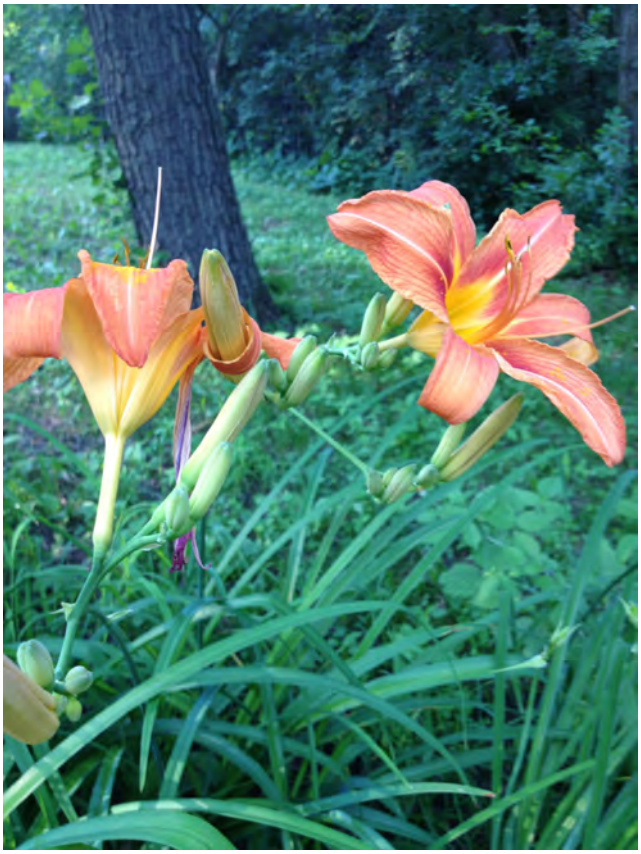
This report is a part of a Sustainable Transportation Capstone Project conducted by candidates for Masters in Urban and Regional Planning at the University of Minnesota in conjunction with the Resilient Communities Project, a year-long partnership between the City of North Saint Paul and the University of Minnesota.

Overview

Living streets build on the complete streets redesign concept. The complete streets philosophy seeks to improve the walkability and interconnectedness of neighborhoods and communities by creating safe transportation infrastructure for pedestrians, bicyclists and the motoring public. Living streets enhance this concept by incorporating designs that decrease impermeable surface and promote the infiltration and conveyance of stormwater. These practices have significant benefits for the health of surrounding watersheds.

The City of North Saint Paul was one of the first cities in the Twin Cities Metropolitan Area to adopt a Living Streets policy and redesign manual. As in most communities, the City takes a multi-year, phased approach to roadway resurfacing. This approach is outlined in the City's Capital Improvement Plan. As part of its Capital Improvement Plan, living streets design elements were intended to be incorporated into neighborhood streetscape reconstruction efforts. However, despite the City's relatively early adoption of living streets policies, North Saint Paul has fallen behind other metropolitan communities on implementation. The City has yet to incorporate living streets concepts and design elements in its redesign efforts.

In partnership with the Resilient Communities Project, three teams of students in Public Health, Architecture, and Urban and Regional Planning were assigned to develop recommendations for engaging decision makers and the public in the implementation of the Living Streets Plan. This report represents the product of the Urban and Regional Planning students, which focused on engagement strategies. The group narrowed the scope of the project to the Casey Lake neighborhood located in the northwest corner of North Saint Paul. The students began the community engagement process by conducting a VPS. Based on the overall findings, a set of recommendations was developed to further neighborhood engagement while highlighting the preferences of North Saint Paul residents.



Native plants are often planted in raingardens alongside living streets. Photo taken by capstone students in Afton State Park.

This report is divided into six parts. First, an overview of the project, which includes defining living streets design elements, the historical context of the living streets in North Saint Paul, and the challenges the capstone work is intended to help address. Second, a collection of case studies of neighboring communities that have successfully implemented living streets or complete streets policies. Third, a description of the visual preference survey as an engagement tool. Fourth, an explanation of the development and implementation of the visual preference survey for North Saint Paul which discusses the methodology including efforts to categorize findings and limit biases. Fifth an analysis the survey findings. The report concludes with an outline of strategy recommendations designed to assist North Saint Paul decision-makers in the incorporation of Living Street and Complete Street design elements into neighborhood streetscape redesign efforts.

This picture shows a living street in Maplewood, MN. The raingardens are newly constructed and the plantings are still sparse. Photo taken by capstone students in Maplewood, MN.

Complete Streets and Living Streets

Living street design elements have their foundation in the Complete Streets Movement, which began in 1971. The desire to create a safer environment for pedestrians and bicyclists using community streets prompted the Oregon legislature to enact the nation's first complete streets policy which states,

"Footpaths and bicycle trails, including curb cuts or ramps as part of the project, shall be provided wherever a highway, road or street is being constructed, reconstructed or relocated." (Oregon Statute 366.514)

Since then, at least 27 states, 42 regional planning organizations, 38 counties, and 379 municipalities across the United States have adopted complete streets policies either in the form of laws, resolutions, executive orders, or comprehensive plans (Seskin and Gordon-Coven, 2013). The complete streets approach to street design breaks down the traditional barriers separating highways, transit, biking and walking and instead focuses on the, "desired outcome of a transportation system that supports the safe use of the roadway for everyone" (Seskin and Gordon-Coven, 2013). These policies help guide planners, engineers and community leaders in prioritizing the construction of streetscape design elements that promote multiple modes of transportation. These elements include sidewalks, crosswalks, dedicated bike and bus lanes, crossing islands, transit stops, enhanced pedestrian signage, and other traffic calming safety elements such as road-narrowing, curb bump-outs, speed bumps, and short medians. Concepts such as "living streets" or "green streets", build on the complete street concept by incorporating stormwater management "best practices" to enhance the natural environment.

Photo of a living street in Maplewood, MN taken by capstone students.

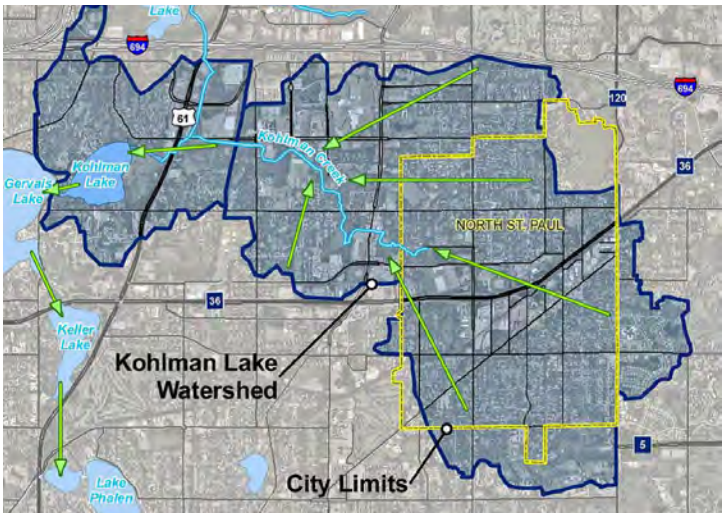
The City of North Saint Paul uses the term "living streets" to describe its visioning plan for future street redevelopment. The term connotes a street where people are active and nature is accommodated (North Saint Paul Living Street Plan, 2010). Design elements prominent in the city's Living Streets Plan include residential and boulevard raingardens, vegetated swales and catch basins, tree plantings and older tree retention, permeable/porous pavement, and sidewalk designs intended to meander through the natural environment. Living street plans seek to enhance the functionality of the public corridor by preserving traffic and parking uses while accommodating safe pedestrian use, bicyclists, and nature.

Stormwater from the Casey Lake neighborhood flowing directy into Casey Lake. Photo taken by capstone students.

One primary goal of incorporating living street design elements into street reconstruction is to infiltrate more rainwater on site and reduce runoff. The Ramsey-Washington Metro Watershed District estimates that the average residential lot in North Saint Paul will generate nearly 49,000 gallons of stormwater yearly. It is estimated that a 100 square foot raingarden will capture and infiltrate 9,000 gallons of stormwater runoff and will prevent 94% of sediment from entering the watershed with each rain event (Ramsey-Washington Metro Watershed District Raingarden II Plan and NDPES data). A raingarden of this size can also prevent up to 87% of phosphorous (which can initiate large algae blooms in lakes) and 49% of nitrates from entering the watershed with each rain event. In addition, cities such as North Saint Paul, in conjunction with the local watershed, have set a goal to infiltrate at least the first inch of rainfall onsite (Aichinger and Rozumulski, 2010). Raingardens, swales, trees, and permeable surfaces not only assist with helping meet this goal, but they bring a new aesthetic into a typical urban residential environment.

Living Streets in North Saint Paul

The challenge of implementing living and complete street policies does not typically lie with the design elements themselves, but with the political and cultural makeup of an individual community (McCann, 2013). Implementation of complete and living street designs in North Saint Paul is the primary focus of this capstone project. Therefore, it is valuable to analyze the reasons North Saint Paul rejected living street implementation in 2011.



Map showing North Saint Paul in the Kohlman Lake Watershed foud in the City of North Saint Paul's Living Streets Plan.

North Saint Paul's Living Streets Plan had its origin in neighboring Maplewood. In 2009, the Ramsey-Washington Metro Watershed District realized that decreasing water quality of Kohlmen Lake (now on Minnesota's impaired waters list) in Maplewood was destroying fish and wildlife habitat. They traced the cause of the impairments to polluted stormwater runoff from North Saint Paul's storm sewer system, which empties into Kohlmen Lake. Officials from the watershed began working with the City of North Saint Paul on a street reconstruction plan that would incorporate design elements intended to infiltrate as much stormwater where it falls as possible. (Trump, 2011). Raingardens would become a major feature of the plan.

At the same time, the City of North Saint Paul was finalizing the plan for its 20-year street reconstruction capital improvement strategy (see the Appendix). City staff were aware of complete streets efforts in cities like Rochester and Richfield. Staff realized that similar street enhancements could fit within the overall street improvement process in North Saint Paul. An engineering firm was contracted, a citizen led task force was appointed, and a North Saint Paul Living Streets design guide and planning document was created. The design guidlines incorporated raingardens, bike lanes, parking areas, curb extensions, street narrowing and sidewalks into an overall street redesign strategy for the City (North Saint Paul Living Street Plan, 2010).

The North Saint Paul Living Street Plan laid out policy rationales and benefits for the various design elements under consideration. Pedestrian safety, environmental protection, health and economic benefits were all discussed in order to provide a rationale

for the incorporation of living street design elements into the existing built environment. In addition, as North Saint Paul used assessments to fund a majority of its street improvements, sources of grant funding were identified to assist in offsetting any additional costs that could be attributed to the street improvements. The guide and overall living streets policy was approved by the City Council in the fall of 2010.

The City was poised to implement its newly approved living streets policy and vision on a section of 15th Avenue from McKnight Road to Margaret Street. This section of road was identified for reconstruction due to the age and condition of the street and utilities, which were over 80 years old. The City Council directed staff to prepare a feasibility study for the avenue that incorporated design elements laid out in the Living Streets Plan (NSP press release, 2011). In addition to bike lanes and sidewalks (NSP Bike and Sidewalk Plan available in the Appendix), the Plan proposed narrowing the streets from 30 feet to 22 feet. This would would eliminate parking on one side of the street. By reducing the amount of asphalt on the roadway, the City would save in resurfacing and ongoing maintenance costs. These savings would have been used to fund the raingardens and sidewalk construction. The estimated cost of the project was $1.9 million. The watershed secured $700,000 in Clean Water Fund grants and the remaining funds would be paid using North Saint Paul utility funds (Trump, 2011). The City intended to prevent adjacent residents from incurring any additional assessments for the incorporation of the living street design elements (Aichinger Interview, 2014).

The reconstruction of 15th Avenue was intended to be a demonstration project that would showcase living streets design elements to the entire community. It was hoped that the design elements would then be incorporated in further street reconstruction efforts in alignment with the capital improvement plan. However, nine months later, the City Council rejected the demonstration project on 15th avenue and has yet to realize any of its living streets policy goals.

15th Avenue today without any living streets design elements. Photo taken by capstone students.

Throughout the spring and summer of 2011, the Watershed District and the citizen task force that developed the Living Streets Plan held outreach workshops for the impacted residents. Door-knocking and information sharing were conducted among the 66 homes adjacent to 15th Avenue. Reconstruction plans were presented and some residents were identified as early supporters of street narrowing that would lead to a reduction of speed on the roadway. However, that outreach appeared to be too late in the process and too limited in scope. Only 39 homeowners chose to participate in the discussion, and of those 39, only 25 actively attended the town hall meetings. Six households were strongly opposed and actively encouraged the City Council and the mayor to reject the plan. The opposition focused on the perceived costs and maintenance (snow removal) of building new sidewalks where none currently exist (Horner, 2011). Other opponents felt that incorporating sidewalks into the streetscape would result in a loss of privacy by encouraging people to walk past their homes (Aichinger Interview, 2014). Ultimately, the plan was defeated at the City Council, and the resources designated for North Saint Paul went to neighboring Maplewood and were used to build their version of living streets.

Watershed officials acknowledge that the outcome was influenced by the political realities of the situation and not the benefits of the living streets. Successful implementation efforts around the county have found it essential to build confidence

15th Avenue in 2011. Taken from the City of North Saint Paul's Living Streets Plan.

Proposed 15th Avenue street redesign. Taken from the City of North Saint Paul's Living Streets Plan

and more generalized support for living and complete streets before getting to the project level. Identifying, engaging and mobilizing key project champions to provide positive reinforcement when opposition arises can help provide a counter argument to the typical vocal minority who will always remain opposed (McCann, 2013). The case studies described below illustrate the role that effective engagement can play in the implementation of a living streets policy.

Case Studies

Connect the Park! Implementing the Pedestrian and Bicycle System Implementation Plan in St. Louis Park, MN

Overview

The City of Saint Louis Park, Minnesota has recently been successful in implementing new sidewalks, trails, and bikeways throughout the community. For years, the community has been involved in envisioning, setting goals, and making action plans related to pedestrian and bicycle network improvements. The plan to improve the pedestrian and bicycle system is referred to as the Connect the Park! initiative. When some residents opposed specific sidewalk segments in the recently proposed plan, the City Council chose to continue moving forward. Staff and the City Council made refinements and concessions based on the extensive community input received about Connect the Park. Implementation of Connect the Park was successful in Saint Louis Park for many reasons.

Background

"Connect the Park!" is the city's 10-year Pedestrian and Bicycle System Implementation Plan to add additional sidewalks, trails, bike lanes and bikeways throughout the community. It was unanimously approved by City Council in July 2013 after extensive engagement with Council and numerous community members. Connect the Park! initiative will work toward implementing many of the elements of the Active Living Sidewalks and Trails Plan, which was completed in 2008. That plan was

People biking in Saint Louis Park. Image taken from: http://www.stlouispark.org/connect-the-park.html

created in a citywide visioning process that took place in Saint Louis Park from 2005 to 2007. Community members, elected officials, and staff have been engaged for many years around the goal of establishing a citywide grid-system of sidewalks approximately every ¼ mile and bicycle facilities every ½ mile.

Both the system plan and the set of general criteria for prioritizing the pedestrian and bike improvements was generated through community input from a Citizen Advisory Committee, community meetings, online survey responses, and meetings with the Planning Commission, the Parks and Recreation Advisory Commission, and City Council. Plan development and prioritization was tied directly to public health, safety and well-being. The following plan and goals were adopted in the Comprehensive Plan:

- Close gaps in neighborhoods' existing sidewalk networks
- Establish safe crossings of highways, arterial roads and rail corridors using innovative traffic calming strategies, improved traffic control systems, grade separations, etc.
- Create a cohesive, well-designed system that includes a coordinated approach for signs and orientation, standard designs for street crossings and additional "user-friendly" amenities such as rest areas, information kiosks and upgraded landscaping.
- Develop a Capital Improvement Plan based on priorities, needs and available resources.

Implementation of Connect the Park

The initiatives of Connect the Park! were incorporated into the City's Capital Improvement Plan and presented to City Council in July 2012. Council approved the preliminary plan, so staff began executing their communication plan and public input process. The communication plan for Connect the Park! is found in the appendix of this report. The Connect the Park! website was launched shortly after and included a general description of the purposes and goals of the program, maps of proposed projects, proposed schedule for construction, estimated costs, FAQ's, notifications of upcoming information meetings, and an the ability to leave comments. Staff also anticipated that many concerns would be raised and questions would be asked about the proposed plan, a document was drafted with a list of 24 expected issues and concerns.

The city staff hosted a citywide public information meeting and a meeting for each of the four Council wards in October and November of that year. Shortly after, a notice was mailed to properties along both sides of the streets where specific sidewalk segments were proposed. A significant amount of public input was gathered during this period.

In January 2013, City Council and staff met again to discuss the results of the public input process because there was a significant amount of opposition in wards 3 and 4 to

specific sidewalk segments in residential areas. Residents expressed concerns regarding property impacts, such as a loss of trees and landscaping, reduced privacy, increased costs, and questions of the overall value and need for the projects. In non-residential areas, very few if any comments of this nature were received. Comments regarding bikeways were generally positive, except for some locations in which parking would be restricted due to the proposed change.

City engineers at City of Saint Louis Park were familiar with these concerns. One engineer believed that residents liked the idea of connecting the network of sidewalks in theory, but not when it must be done on their own front yard. Some people fundamentally disagreed with the benefits of sidewalks, but this has been changing over time with shifting demographics (younger families and individuals).

Even with opposition for specific sidewalk segments, the City Council chose to move forward with the Plan while considering some refinements, which included:

1. Drop or push back certain sidewalk segments
2. Move forward with implementation of the plan with consideration of short term versus longer term improvements within the proposed 10-year plan
3. Continue moving the bikeway portion of the plan forward

To refine the plan, City staff was instructed by Council to consult the set of guiding principles for Connect the Park!, which was previously developed in partnership with Council. The guiding principles are included in the appendix of this report. Staff was also asked to re-review the prioritization criteria for improvements, which included:

Logo used to brand Connect the Park! Photo taken from : http://www.stlouispark.org/webfiles/image/engineering/connect_the_park_logo.jpg

1. Focus on key destinations: segments that serve multiple community gathering centers in the community (schools, parks, transit stops, commercial nodes, etc.).
2. Focus on transportation: routes that provide North-South connections through the community, into adjacent communities, and to key transit stops.
3. Focus on bicycling and walking: try to provide a "city-wide" grid system of ¼ mile for sidewalks and ½ mile for bicycles. Focus on improvements that fill gaps in the city pedestrian and bicycle networks, improve safety, and provide crossings of major highway and railroad barriers.

In July 2013, a year after the initial plan was proposed, Council unanimously adopted Connect the Park! and the 10-year Capital Improvements Plan. Some sidewalk segments were removed from the plan and some were delayed for further discussion.

The Connect the Park! Initiative is expected to cost $17 to $24 million in construction costs over the next decade, which does not include operational impacts for costs such as staffing, maintenance, plowing, and more. The project will be funded through the issuance of General Obligation Tax Exempt Bonds issued in 2014, 2019, and 2024. The bonds will be financed over a total of 15 years for approximately $5.7 to $8 million each year. A property tax levy will increase approximately 6.2% to 8.2% spread over 11 years. For a median valued residential homesteaded property (valued at $220,100), this would equate to approximately $57-$79 over the 11-year period based on 2013 information.

While there is still a cost to individual residents, it is not nearly as impactful as typical assessments are. City engineers maintain that some streets would never have received sidewalks without the citywide fees. When the individual is not assessed, it enables engineers to make design changes that are may require more capital but provide the opportunity for lower operational costs in the future.

Street signs in St. Louis Park taken by Communications staff


A St. Louis Park family crossing the street near Peter Hobart Elementary School. Photo taken by St. Louis Park Communications staff.

Moving Forward

Community engagement continues with Connect the Park! Public hearings are regularly scheduled in the neighborhoods undergoing construction. Later this year, an additional public process will be planned to gain further input from residents in the Lake Forest and Sorenson neighborhoods. During the public input process, residents in these areas requested the construction of sidewalks that were not shown on the proposed plan.

Improvements to the City's storm water collection system remain separate from sidewalk, bikeway, and trail improvements. The City of Saint Louis Park engineering staff is looking at ways to incorporate more innovative strategies into future plans. They hope to integrate the Stormwater Capital Improvement Plan with Connect the Park over time.

A street in St Louis Park planned for sidewalk improvements. Photo taken by St. Louis Park Communications staff.

Lessons Learned

- Changes to the pedestrian network in residential areas are "big pills to swallow" for many residents, which can put a great deal of pressure on local decision-makers. City Council and staff benefited from three key documents that were drafted in preparation for the addition of sidewalks, bikeways, and trails:
    1. Guiding Principles
    2. Expected Issues and Concerns
    3. Prioritization Criteria
- The leadership of elected officials, neighborhood groups, city commissions and committees, and engineering staff has significantly contributed to the success of Connect the Park. City Council chose to move forward with the plan by making necessary refinements/concessions on specific sidewalk segments that were opposed by many residents.
- Citywide rather than individual funding sources are more appropriate for improvements to sidewalks, trails, bikeways, and streets. This allows engineers to make more expensive design changes and mitigates opposition to projects.

75/76th Street Reconstruction in Richfield, MN

Background

The City of Richfield took advantage of a sewer reconstruction opportunity to accommodate the City's first street redesign with complete street elements. Richfield, working in conjunction with the Metropolitan Council Environmental Services and the Three Rivers Park District, refocused what started out as a sewer project to meet transportation improvement needs and help fulfill a complete streets vision.

In 2008, Hennepin County identified the need to construct a major regional sanitary sewer interceptor that would run across the City of Richfield from east to west. Pipeline projects that necessitate roadway replacement commonly replace the roadway in-kind, meaning that complete street design elements may be considered extraneous and the responsibility of the municipality (Edgerton and Mason, 2012). Richfield was tasked with designating a suitable corridor for construction.

Also on the drawing board at this time was a plan from the Three Rivers Park District to extend the Nine-mile Creek Regional Trail from Edina to Bloomington transecting the City of Richfield. Again, Richfield needed to designate a corridor that could accommodate a regional trail.

Richfield engineers and planners had the perfect corridor to meet both needs. The 75th/76th Street corridor was originally constructed after World War II as a parallel arterial to I-494. However, in the 1990s, a new arterial was developed one block away, leaving 75th/76th street as a flat, under-utilized four lane road with primarily residential housing on both sides. Residents complained of excessive speeding on the roadway as well as a general lack of safety for pedestrians as there were no sidewalks (Asher, 2011). As average daily traffic counts typically dipped to 3150, the planning department knew the roadway could be reduced to two lanes with plenty of space remaining to accommodate a regional trail. In addition, planners envisioned an opportunity to introduce the City to the complete streets concepts by creating sidewalks, bike lanes,

boulevard trees and raingardens. However, the challenge faced by Richfield was the same as North Saint Paul: how to achieve public support for complete street redesign and actually implement the vision?

Complete Streets Implementation

The City of Richfield began by applying the context sensitive solutions approach (CSS) to street redesign. The principles of CSS promote, "a collaborative, multidisciplinary process that involves all stakeholders in planning and designing transportation facilities." (Bochner et. al., 2010) Using this organic process, the planner seeks to integrate the community objectives while making decisions based on an understanding of trade-offs that may occur when involving community members with varying concerns and goals. Community members have input at every stage of the planning process as well as during final design and actual construction. The process and final result often yield high constituent/resident satisfaction which can help jumpstart future projects (Edgerton and Mason, 2012).

Richfield realized the CSS principles by first assigning a citizen-led transportation and planning advisory commission the task of interacting and leading discussions among the residents who live on 75th/76th Streets and the neighborhood as a whole. Mailings, notices and flyers were used to attract attendance at commission open houses. Rather than presenting engineer designed planning schematics, cross-sections or pre-formed design elements, the first meetings consisted of white boards and

76th Street in Richfield. Retrieved from : http://www.smartgrowthamerica.org/wp/wp-content/uploads/richfield-mn.png

brain storming work. The planning and engineering professionals designed the brain storming activities and stuck with the philosophy that the residents are the experts of what to include on their streets (Asher Interview, 2014). In between commission meetings, city staff developed working drafts of designs that engendered consensus for every segment of the roadway. According to the City Engineer, younger residents often challenged older residents over certain elements that encouraged mobility such as sidewalks and bike lanes. The engineer felt that these confrontations were necessary to arrive at consensus and that the commission offered an outlet for resistance to occur at this level without the need to involve the City Council (Asher Interview, 2014). Once construction began, contractors met weekly with residents on the corners of intersections to update on progress and incorporate changes where feasible. Flexibility in design, engineering and construction is key. For example,standard trail, curb and gutter and bike lane dimensions were altered to accommodate more diverse uses of the right-of-way (Edgerton and Mason, 2012).

Ultimately, the sewer line was built and utilities were located underground. The regional trail connections were approved, the street was narrowed to two lanes, bike lanes were approved, boulevard trees were added, street parking would occur only in the street segments where the adjoining residents wanted it, and intersection striping as well as pedestrian islands were created. Sidewalks and raingardens, however, were not included despite support from the planning department and younger residents. Those were two of the many trade-offs that were made during the process. The commission made its recommendations on the project to the City Council, and it was approved unanimously.

It should be noted that there were no city assessments on individual property owners for this project and no property takings were needed. There is a city-wide franchise fee in place to pay for the City's portion of the reconstruction. Federally funded street reconstruction bonds were obtained. Narrowing the street to two lanes saved $2 million off the estimated $6 million cost of the sewer work alone.

Bike lane in Richfield, MN. Retrieved from: http://icma-static.org/Images/d380/BlogPost/Photo/1806/bike%20lane.jpg

Going Forward

The City Engineer credits the 75th/76th Street reconstruction project for jump starting a complete streets boom in Richfield. Soon after the project was underway in 2009, the City of Richfield approved its complete streets policy and guiding principles. Master bike and sidewalk plans were also approved. As part of its ongoing Capital Improvement Plan, complete streets are taking shape on other high traffic corridors. 66th Street was reconstructed to include roundabouts, meandering sidewalks and bike lanes. The City seeks to incorporate "green" wherever possible and not overbuild for cars. Portions of Portland, Bloomington and Cedar Avenues will all go on "road diets", primarily with the addition of bike lanes (Walljasper, 2014). Short medians are under consideration for Portland Avenue. Xcel energy needs to rework utility lines on Nicollet, and a similar planning process to the 75th/76th Streets reconstruction is just getting underway (Asher Interview, 2014).

Lessons Learned

- Do not be overly ambitious on the first complete streets project. Seek to develop a single prototype street that includes complete street design elements rather than attempting to transform an entire neighborhood.
- For the prototype, look for opportunities to partner with other groups, (counties, the Metropolitan Council, utilities, park districts, watersheds etc…) even if a proposed project falls outside the typical capital improvement queuing process.
- Utilize CSS principles and strategies to involve adjacent and surrounding neighborhood residents; begin with an organic white-board process rather than fully conceptualized designs and elements. Remain flexible in design standards while still fulfilling the functional intent of those standards.
- Empower a citizen led group to call and run townhall meetings focused just on the project under consideration. Provide a structured outlet for disagreement and consensus building. Let the group make final recommendations to the City Council.

Four lane under-utilized 75th/76th street corridor prior to reconstruction", and photo caption bottom right, "75th/76th after reconstruction with complete street elements.

Living Streets in Maplewood, MN

Overview

Maplewood, a close neighbor of North Saint Paul, has successfully implemented a Living Streets policy which is very similar to what was proposed in North Saint Paul. The first project implemented under this policy is located in a neighborhood to the east of McKnight Road and Minnehaha Avenue. While Maplewood has a longer history of being active in public outreach surrounding watershed protection, the City encountered similar opposition to sidewalks and other aspects of the Living Streets Policy. Maplewood moved forward, but responded to community member's concerns. The result was a living streets design that was appropriate to the context of the neighborhood. Implementation was successful and the City now plans to implement living streets every time a street is up for resurfacing in the Capital Improvement Plan.

Background

Maplewood's Living Streets policy came out of a long and comprehensive planning process. The City's 2030 Comprehensive Plan laid out numerous long range goals including promoting access to parks and trails and laying out strong pedestrian corridors utilizing sidewalks and trails. The Living Streets Policy was built on these principles.

The City of Maplewood also has a strong history of active involvement in watershed protection. There are currently over 700 raingardens in the City. In addition, the Maplewood Mall is known across the country for using public art to educate visitors about the water cycle while filtering and conveying stormwater.

Public art designed to filter and convey stormwater at Maplewood Mall. Photo taken by capstone students.

Implementation

There was a long public process involved in writing the Living Streets Policy. Basic design features, such as street widths, were identified by city staff. The policy went through several commissions all of which held public meetings. The biggest issues identified were surrounding the new sidewalks. Residents opposed to sidewalks made many of the same arguments that heard in North Saint Paul. Residents who had lived in Maplewood for years without sidewalks questioned why they were necessary now. Other residents expressed concerns about being required to clear the snow. Others were concerned about losing land in their front lawns to sidewalk easements.

Maplewood's outreach process focused on addressing these concerns. City staff found that to promote sidewalks it was important to understand how the proposed sidewalks will fit into the big picture. Being able to clearly express why sidewalks would improve connections to schools, regional trails, parks or other locations was important.

The City responded to the concerns about snow clearing by not requiring residents to shovel. Residents still benefit from sidewalks for half of the year, but have no extra obligations to shovel. This past winter, the majority of residents still shoveled and in areas where the snow was not shoveled small footpaths made the sidewalks passable.

Finally, the City was careful to keep all designs in the existing street right of way. Because the streets were narrowed, enough space was opened up to create sidewalks without consuming any additional land. As a result, no easements were necessary.

There had been a lot of public outreach surrounding raingardens in recent years, so it was not difficult to gain support for that aspect of the Living Streets Policy. The majority of the raingardens in the Living Streets project were installed on a volunteer basis. The Ramsey-Washington Metro Watershed District worked with home owners to design the raingardens. Recently the Watershed District has been moving away from using the traditional variety of native grasses that simulate a prarie environment and towards using a smaller variety of plants in larger clusters. This makes the raingardens easier to

Picture of a native plant in Afton State Park taken by capstone students.

maintain and achieves a more formalized look that is preferred by many residents (Ahlborg & Passi, 2013). The Watershed District helps with maintenance for one or two years and uses that time to educate residents on how to maintain them. They also keep an eye on which raingardens need help and offer consultations. While the raingardens installed as a part of the Living Streets Project are new, the city has found that very few gardens from other projects have been filled in and the majority of the raingardens in the city are in good condition. As an extra incentive, homeowners are given a 30% credit on their stormwater utility fees which are done on a quarterly basis. The average stormwater utility fee is around $80 per year.

While some residents were initially concerned about the cost of living streets, it was quickly discovered that the project would not result in a financial burden. The City did a rough cost estimate of the Living Streets Project compared to the cost of resurfacing the existing street. They found that the Living Streets project was about $100,000 less expensive because of the reduced cost of maintaining the asphalt. Information about this cost estimate can be found in the Appendix. This information was communicated to the public and helped build support for the project. The trail projects associated with the living streets design are not funded through assessments. The City looks for outside sources including DNR trail grants and grants through the Safe Routes to School Program.

Raingarden on a street without sidewalks in Maplewood, MN. While the City hopes to create pedestrian connections, they consider the unique circumstances of each street and do not incorporate the same design elements everywhere. Picture taken by capstone students.

Moving Forward

Maplewood's next project will be west of Edgerton and north of County Road B. The neighborhood context is very different. The Minnehaha project is near a school, a nature center, and a recional trail. There are a lot of potential destinations that people will reach on foot. The Edgerton project is more isolated because of its proximity to Highway 36 and Interstate 35E. The neighborhood has less through traffic and no major destinations. The design responded to this context. The streets will be slightly wider with room for people to bike and walk on the streets. Sidewalks will be installed on County Road B and Edgerton to improve pedestrian connectivity on the busiest roads and new segments to surrounding trail corridors will be installed.

In the future, Maplewood will apply the Living Streets Policy to every street project. They will look at the policy and the neighborhood context to determine how living streets can best fit in the neighborhood.

The City is also looking into designing a program that will help them fund trail additions. They recently recieved a Safe Routes to School Grant to build a trail segment along County Road B and are looking into other funding sources.

Lessons Learned

- Part of why Maplewood's policy was so successful was that the City has a long history of implementing projects similar to living streets. North Saint Paul's first living streets project will likely be its most difficult. After residents are more familiar with the design and more educated about watershed quality it will be easier to build support.
- The public outreach process was crucial. Maplewood's Living Streets Policy applies to the entire city, but what constitutes a living street varies considerably given the context of the neighborhood. It is important to actively seek public input so that a design that it appropriate to the community can be identified.
- By fitting all design features into the existing street right-of-way the City was able to mitigate concerns that residents expressed about losing land to easements.
- Conducting an analysis of the cost of living streets can help build support by communicating how much money can be saved through road diets.
- When proposing new sidewalks it is important to think about what connections you are building and to use that to tell a story to residents. Will the new sidewalks allow neighborhood youth to walk to school? Will they improve access to surrounding parks and playgrounds? Will they connect to other established sidewalks and trail systems?

Visual Preference Survey as a Planning Tool

This project seeks to reinvigorate the living streets discussion among city leaders and residents of North Saint Paul. Students sought an approach that would allow residents to envision living street design elements in a standard streetscape while also allowing them to show their preferences for individual design elements. This was accomplished through the use of a visual preference survey (VPS).

The U.S. Department of Transportation defines a VPS as a technique that assists the community or neighborhood in determining which components of a plan or project environment contribute positively to a community's overall image or features (USDOT, 2002). The technique is based on the development of one or more visual concepts or design elements of a proposed plan or project. Once the design elements are developed in a visual format they are shown in a public setting or door-to-door.

The VPS process was developed by Anton Nelessen, an architect and planner at Rutgers University in the late 1970s. In one of his earliest incarnations of the survey, he was contracted by the City of Metuchen, New Jersey, to assist in the redevelopment of the downtown and surrounding suburban residential infrastructure (DePalma, 1989). He developed the tool as a visioning technique providing residents with the ability to articulate their impression of the present community image and to help build consensus for its future character (Nelessen, 1994). Nelessen felt that too often, comprehensive planning and land use design efforts focused on desired fiscal benefits and costing analysis with little attention paid to physical, visual, psychological and ecological considerations of the residents. The VPS was designed to provide a balance between financial considerations and design aesthetics. As originally conceived, the VPS process

VPS survey adapted to a public meeting format. The VPS is displayed on posters on the wall around the meeting. Participants are able to respond to the VPS while consuming snacks during the unstructured meeting time. Photo taken by William Risse.

asked residents to literally give a thumbs up or down to images shown at a townhall meeting (Nelessen, 1994). The process has been refined using a Likert Scale, to give residents the ability to rate a series of images as acceptable or unacceptable for the community. The degree to which an image is positive or negative is reflected in an assigned value (e.g. +3 versus +2 or -1). Images that people do not feel strongly about can be rated as neutral or 0. Once the sums, averages and standard deviations are calculated and analyzed, it is determined which images are positively or negatively rated. As a result, participants can express judgments and possibly reach a consensus about visual design features, which may be incorporated in the goals, objectives, and design guidelines for a plan or project. This consensus, which Nelessen calls the "common vision", also provides planners with an understanding of what a particular community wants and is willing to accept in the built environment. (Nelessen and Constantine, 1993).

The images used should depict the functional characteristics of the community as reflected in local zoning requirements, however they should not consist entirely of images that strongly contrast. Nelessen determined images that appear closely related can reveal subtle variations that distinguish a positive image from a negative one (Nelessen, 1994). As a comprehensive community visioning tool, Nelessen sought public input on all manner of community design elements from building style and materials to setbacks, signing, streetscape and

Participants in Saint Louis Park in October 2013 were asked to complete a VPS which was designed to assess preferences for bicycle infrastructure. Rather than asking participants to make an aesthetic judgment, the VPS asked how comfortable they would feel biking on different streetscapes. Participants publicly display their rankings by placing stickers on the VPS poster. This may have biased the results. This VPS also did not use "before" and "after" images so it is unclear whether or not extraneous variables impacted the results.

Despite its methodological flaws, the VPS helped ignite a discussion about bicycle safety and helped planners collect other forms of feedback that will be used in the planning process.

Photos taken by capstone students in Saint Louis Park, Minnesota.

landscape designs. The VPS visioning process provides a starting point for community stakeholders to begin the planning process for the future design of their communities. "In the years since the Metuchen project, working with many different communities, we have found that the VPS enables citizens, government officials and developers to participate in creating a common vision — for either a large development project, a part of the community or, even, the entire community." (Nelessen and Constantine, 1994) However, does a survey based on visual cues accurately capture the true perceptions of the participant? Visualization is increasingly used by professionals in interactive design and planning work (Tyrvainen, 2006). Successful communication often depends on presenting understandable information to all participants. Aesthetic perception and evaluation of the environment occurs mainly through the sense of sight and no specialized training or education is needed for the public to participate in a visualization process (Tyrvainen, 2006). In addition, one suggested benefit of using a visual survey is that it may decrease conceptual misunderstandings in relation to participatory planning processes (Tahvanainen, et. al. 2001). For example, negative preconceptions of raingarden design may be ameliorated through the use of accurate imagery as opposed to verbal cues alone.

Video imaging or photomontage visualization (photo manipulations), which is used in our North Saint Paul VPS, uses computer software to manipulate digital images to create the design element under consideration. Studies on visual imagining techniques have shown that the pictures produced are open to inaccuracy and perspective distortion. S.R.J. Shepard, in his work entitled, *Guidance for Crystal Ball Gazers, developing a Code of Ethics for Landscape Visualization*, advocates for robustness in image depictions that present accuracy, representativeness, visual clarity, interest and legitimacy in order to provide imageries useful in the decision making process (Shephard, 2001). The visual preference survey is a perception-based assessment tool, the product of which, "…is a combination of the features of the visual image interacting with the psychological (perceptual, cognitive, emotional) processes of the observer." (Daniel, 2001) Representational validity studies using high resolution, high realistic visualizations have

Photo of a St. Louis Park street taken by capstone students. A VPS could be used to determine whether or not residents would like sidewalks, raingardens, or other living streets design elements.

supported aesthetic quality assessments that correlate highly with the direct observation of landscape components (e.g. Bishop and Hull, 1991, Bishop and Leahy, 1989, Daniel and Meitner, 2001, Orland, 1993, Vining and Orland, 1989). Viewing a high quality image of a landscape design approximates direct observation of the element under review. Hence the perceptions and rankings of the visual aesthetic of the image in question would not radically differ from viewing the item directly.

In the context of collaborative planning, "in order to evaluate the effect of any particular change…it is important that the visualization medium allows only one aspect of the landscape to change at a time." (Tyrvainen, 2006) In the case of North Saint Paul, creating "before" and "after" imagery allows participants to evaluate a single streetscape design element holding all other variables in the image (lighting, color, infrastructure) constant. As in every survey, strategies to limit biases are also are employed and will be discussed in more depth in the methodology section.
Building on the VPS as an instrument, multivariate regression (ordinary least squares) can be used to help further explain differences in image content in a statistical sense. Using statistical techniques to determine the mathematical relationships that exist between image components and the scenic preferences of observers may help explain why certain image elements engender positive or negative preferences (Arriaza, et. al. 2004). In such analysis, the dependent variable tends to be the average score for a given image, while independent variables based on image content/components are determined. Correlations between variables are analyzed and statistically significant results may help explain the relationship between an image component and the overall reaction and rating of the survey participant.

Furthering a planner's ability to explain data received through a VPS, a methodology was recently developed using relatively new statistical software that estimates a cross-classified random effects model, which is a form of a hierarchical model (Ewing, et.

al. 2007). Such a model works well when an outcome varies systematically in two dimensions; in the case of a visual preference survey, the scenes and the viewers are the two dimensions. The model seeks to better explain the relationship between a viewer and their "nested" scores for all the images. The variances between viewers and scenes are analyzed, and rather than focus on viewer preferences for street characteristics, the model operationally defines the elements (tree canopy, curb extensions, sidewalk width, parking, commercial uses) that constitute what viewers consider constitute a "mainstreet". Based on a calculated "mainstreet" score, the authors of the methodology devised a formula that when applied to city streets, could guide planners in the development or redevelopment of streets to be more in line with aesthetics associated with "mainstreets". Since its inception, the VPS process has been used by numerous municipalities and planning functions around the world that seek to better understand residents' perceptions of the built environment as well as help set development goals for the future. The VPS is an effective tool used to initially engage citizens in the community planning process while also helping foster an understanding of design choices available (Steiner and Butler, 2010). It helps create a format for an eventual discussion over the cost and benefits of highly rated design preferences. It can also be used to build support for projects while explaining how design elements can work and fit within a typical streetscape.

Residents participating in a Visual Preference Survey at a Community Meeting, retreived from www.sandyspringscitycenter.org.

Methodology

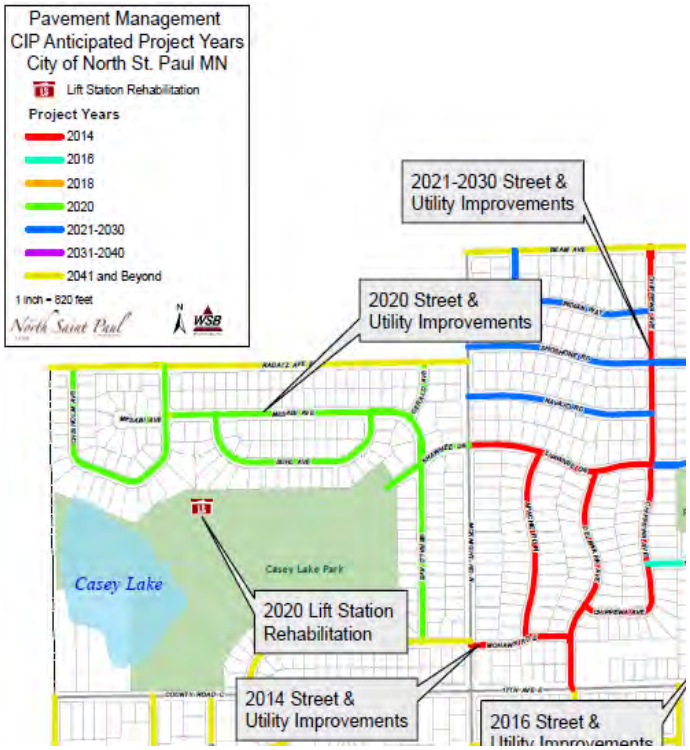
Defining the Sample Frame

Based on a case study analysis of successful living streets implementation efforts in other Minnesota communities, we concluded that focusing implementation efforts on a small neighborhood was a key to success. It was important to designate a residential street as a showplace or prototype to demonstrate how living street design elements can be accommodated and potentially expanded throughout the community.

The residents of four residential streets in the Casey Lake neighborhood makeup the sample frame for the North Saint Paul VPS. This area of focus for our survey was chosen based on the timing of street improvements from the City's Capital Improvement Plan, a demographic analysis of residents, and the overall existing built environment. This sample frame meets the standard frame criteria in that it is all inclusive--potentially including every member of the population to be surveyed; and exclusive--in the sense that only those in the population are included (Alreck and Settle, 2004).

Because the intent was to encourage developing living street design elements on a prototype residential street in the near-term, we first needed to examine the City's timeline for street redevelopment (see the CIP-Capital Improvement Plan in the Appendix). We focused on designated redevelopment areas in 2016, 2018 and 2020. We also examined the current built environment of those streets, noting areas that already have curb and gutter and/or sidewalks as well as how compact and walkable the areas are in order to facilitate the ease of survey delivery. Finding an area already connected to the Gateway Trail System was a consideration because it provides for added interconnectedness and ease in pedestrian and bike recreation.

In terms of demographic analysis, a meta-analysis of empirical literature on environmental aesthetics (a component of living street design) suggests that there



Casey Lake neighborhood shown on a map taken from the City of North Saint Paul's Capital Improvement Plan.

is already a very high degree of aesthetic preference consensus among many demographic groups (gender, political affiliation, ethnic affiliation, students and nonstudent adults) (Stamps, 2009). The students chose to examine three main criteria in our demographic analysis broken down on the census block level: household income, median resident age and percent of household with children and teens. The students combined this information with the CIP data and developed a decision matrix which is seen in Table 1 in the Appendix.
We ultimately based our decision of the sample frame study area on three main points of consideration. First, 2018 and 2020 street redevelopment dates were preferable because they provide additional lead time to fully engage the residents on living streets before the technical design process needs to begin. Second, we chose to prioritize areas where the built environment already was relatively connected with sidewalks in order to provide a better chance of avoiding the same resistance that ultimately scuttled the living street project on 15th Avenue. Finally, we prioritized areas with a lower median age and a relatively high percentage of households with children and teens, concluding that walkability (a key living street component) to school and neighborhood parks would be desirable for those younger families.

Key Components of the Casey Lake Neighborhood:

- Relatively compact—123 houses on four residential streets
- Capital improvement plans calls for street reconstruction in 2020
- Sidewalks, curb, gutter and boulevards are present on both sides of three out of the four streets
- Median resident age is 44.5, 3.5 years younger than households in the areas slated for street reconstruction in 2018
- Neighborhood connected to Gateway Trail System

Casey Lake Park is adjacent to our study area. Photo taken by capstone students.

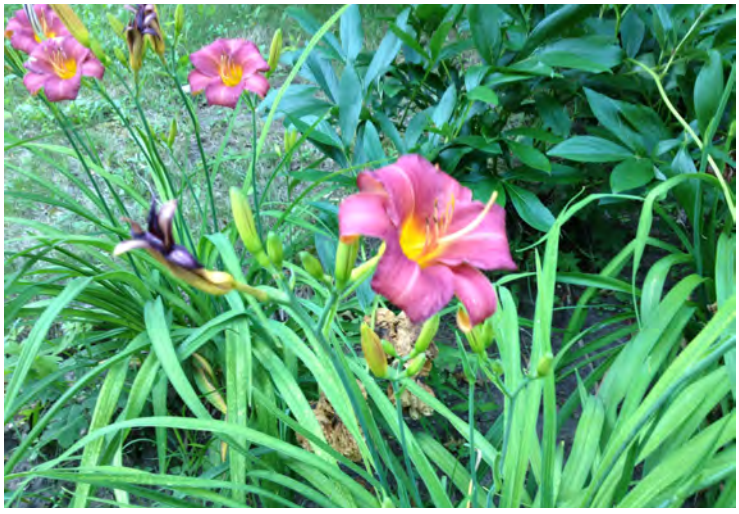
Controlling Biases and Image Selection

As mentioned previously, the VPS is a technique that allows participants to rate slide images with the purpose of determining the relative desirability of various streetscape design elements.

One challenge in conducting a VPS is selecting a manageable number of design elements to test in a manner that introduces as few outside variables as possible. Limiting the amount of variables (image range) tested will help produce more reliable and usable results. Having too many variables in a single image could bias the results (the range effects bias), as the design element under study will not be isolated and respondents may react to extraneous imagery. If too many extraneous elements are included in the image, the results cannot be relied upon as wholly indicative of the preference for a particular element. "The range effects bias can be prevented by restricting each person to viewing a single stimulus." (Poulton, 1973)

As mentioned previously, this study used photomontage visualization techniques to limit bias and create the design element under study. Working in conjunction with the students from the College of Design, the students took digital images from existing residential streetscapes and used Adobe Photoshop to overlay or remove the alternative design elements under consideration. Weather conditions were manipulated to make all the images appear slightly overcast (neutral) while road surfaces were made identical, removing cracks, blemishes, uneven paving and coloring. The ability to create or adjust digital images helps ensure that viewers stay focused on the design elements under consideration (Steiner and Bulter, 2010).

The quality and composition of the photos show elements from typical perspectives, i.e., the sidewalk or the street of a residential neighborhood. The "after" photos show a convincing image that allows respondents to accurately indicate their preferences, while not being overly artistic in nature or containing extraneous items which could bias the rating with unrelated preferences for visual graphic design. In total, 24 images were developed including 11 "before" and "after" image pairs.



Typical raingarden plantings in Minnesota. Photo taken by capstone students in Afton State Park.

Living street design elements were chosen based on city approved goals for residential neighborhoods listed in the comprehensive plan and the living streets design plan. Images were chosen based on their fit in one of these categories:

- Healthy Residents and Neighborhood Walkability:Meandering sidewalks, bike lanes
- Neighborhood Safety: Road narrowing-speed control, medians, crosswalks with curb bumpouts
- A Cleaner Environment: Raingardens, meander sidewalks around raingarden features, permeable pavement

While not the primary focus of this report, a discussion of living street design elements would not be complete without briefly mentioning empirical data that supports the positive outcomes of including such elements in street redesign in the context of the city's planning goals and the imagery used in the VPS.

The Gateway Trail passes through North Saint Paul and provides residents with a connection to the regional trail system. Photo taken by capstone students.

Students crossing an intersection, retrieved from: www.dot.ny.gov.

Healthy Residents and Neighborhood Walkability

Creating a pleasing network of sidewalks and bike lanes encourages mobility and can lead to increases in health among neighborhood residents. A recent multilevel study using a national dataset concluded that walkability, bikeability and safe neighborhood environments positively correlate with increased exercise and weight control (Doyle and Schlossberg, 2007). Walking and cycling for daily travel offer an affordable, reliable and theoretically feasible way to achieve recommended physical activity levels (Lee, 2013). As an added benefit, an economic study using a hedonic regression technique determined that houses adjoining streets with above-average levels of walkability command a premium of about $4,000 to $34,000 over houses with just average levels of walkability in typical metropolitan areas (Cortright, 2009).

North Saint Paul has established walkability as a planning goal:

North Saint Paul Comprehensive Plan Goals 4 and 9:

"Achieve a functional, aesthetic and balanced system which includes pedestrian ways, sidewalks and trails…" and "Establish a climate and an urban pattern for active living to create and sustain changes in land use design, building design, transportation, public policies and project to cultivate, support and integrate physical activity into daily life."

North Saint Paul Living Streets Design Objective 2, 4, 5:

"Convert some parking lanes for bike & pedestrian circulation. Create bike lanes/ trails along major roads," and "Connect schools, parks, etc…with sidewalks and bike routes," and "Meander new sidewalks around existing trees…"

The North Saint Paul VPS tested two different styles of bike lane design.

On-street bike lane in Northfield, MN, retrieved from www.blox-images. newyork1.vip.townnews.com

Neighborhood Safety

Creating safer neighborhoods for pedestrians through street redesign that slows traffic, reduces accidents and promotes driver awareness is standard goal for any community. Refocusing street use from a car-centric perspective to incorporate uses by all is a main component of complete/living street redesign.

A 2010 Federal Highway Administration study found that road diets, which narrow roads by reducing the number of traffic lanes, can reduce crash frequencies by an average of 29 percent, an improvement that can be attributed to dedicated turn lanes and reduced overall travel speeds (USDOT, 2010) Additional analysis suggests that increased walkability of neighborhoods, especially for seniors, may lead to more car-pedestrian accidents unless micro-scale design elements (better cross-walks, signage, speed controls) are also incorporated in the overall network (Lee, 2013).

North Saint Paul acknowledges the need to slow traffic in the North Saint Paul Living Streets Design Objectives 3 and 6:

"Use curb bump outs & other techniques as appropriate to slow traffic," & "Reduce the amount of pavement to maintain and replace in the future."

The North Saint Paul VPS tested several traffic calming and driver awareness devices, including enhanced crosswalk features with curb bump outs, street narrowing and a median/pedestrian island.

Curb bump outs slowing traffic in downtown North Saint Paul. Photo taken by capstone students.

Vegetated median helping calm traffic and providing a pedestrian refuge in Roseville, MN. Photo taken by capstone students.

A Cleaner Environment

A primary source of pollutants in lakes and rivers comes from community stormwater run-off. Impermeable surfaces (roofs and roads) encourage rainwater to flow as surface runoff, rather than allowing it to infiltrate into the ground. Lawn chemicals containing nitrates and phosphates as well as automobile pollutants are washed into the watershed from residential lots and streets. Best Management Practices (BMPs) are approaches to drainage that uses a variety of techniques to control surface water runoff (and consequent pollution problems) from the urban environment. A common BMP strategy to reduce stormwater runoff is to treat or mitigate runoff at its source, or where the rain falls (US EPA, 2012). In a residential context, raingardens and vegetated swales help infiltrate stormwater on site. A well-maintained and vegetated raingarden with native plantings will infiltrate more water than bare areas or grass alone (Virahsawmy, et. al., 2013). Permeable pavement treatments also have been shown to reduce surface runoff volume significantly compared to impervious asphalt or concrete by allowing stormwater to more readily infiltrate into the ground (US EPA, 2000). Large urban street trees intercept and store rainwater at the source as well as filter pollutants in the canopy and root zone. A typical medium-sized tree can intercept as much as 2380 gallons of rainfall per year (US Forest Service, 2002). Meandering hard surface sidewalks around BMP design features, including raingardens and mature trees, will help infiltration and limit runoff. North Saint Paul has clear environmental protection goals:

North Saint Paul Comprehensive Plan Goal 7 and 8:

"Enhance and expand the park, open space and trail system…" and "Protect and enhance the lakes, wetlands, woods and wildlife and promote actions, practices and developments which tend to sustain the environment."

Water flowing from the Casey Lake neighborhood into Casey Lake. Picture taken by capstone students.

North Saint Paul Living Streets Design Objective 1, 2, 5, 6:

"Infiltrate at least the 1st inch of rainfall from city streets near the street edge," and "Convert some parking lanes for water treatment..." and "Protect and retain existing trees; meander new sidewalks around existing trees…" and "Use vegetation and other physical features to create a look unique to the city."

The North Saint Paul VPS tested four raingarden designs that include curb-cuts, which allow street runoff to flow into the garden. A permeable street pavement image was tested as well as meandering sidewalks around raingardens.

Photo taken in Casey Lake neighborhood by capstone students.

Native plants in Afton State Park, photo taken by capstone students.

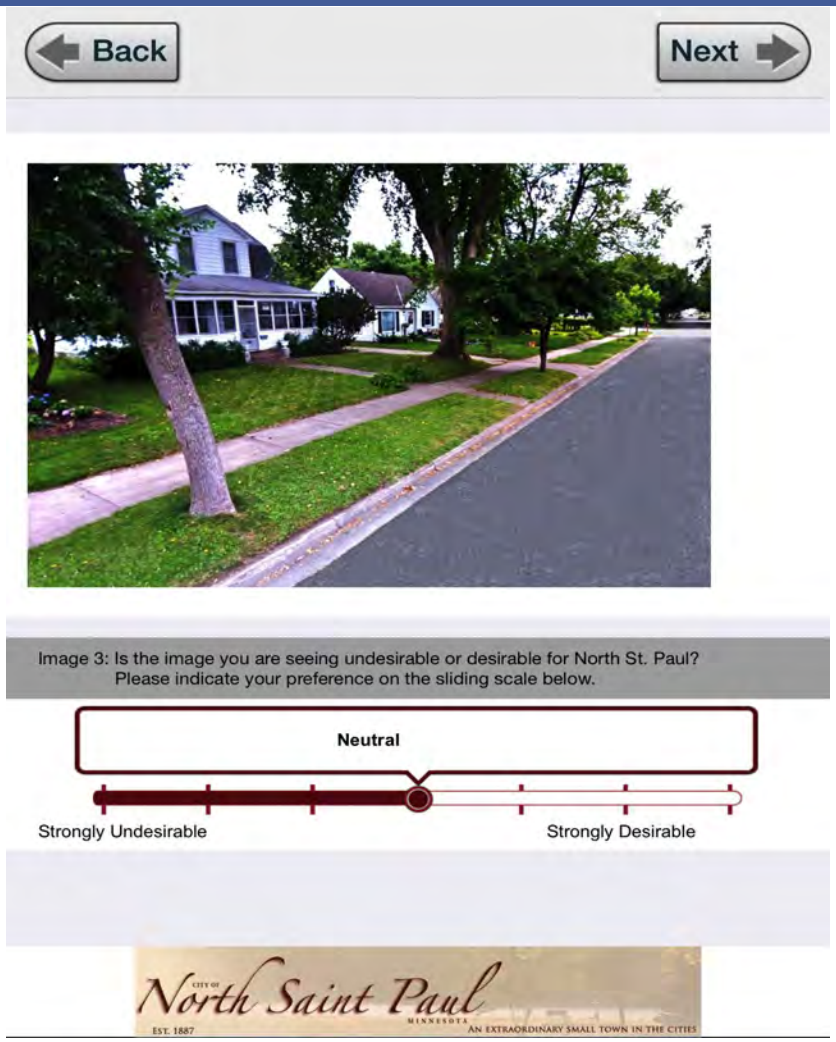
Play area in Casey Lake Park, an environmentally sensitive area which has been designed to protect Casey Lake from polluted runoff. Photo taken by capstone students.

Survey Design and Data Collection

Best practices in survey design dictate that in order to maximize the reliability of responses it is necessary to provide clear and consistent prompts to respondents. Instructions and questions need to be focused, brief and clear (Alreck and Settle, 2004). The VPS used for this research uses a statement at the beginning outlining the overall intent of purpose of the survey which was followed by short-form one sentence ranking criteria reminder near the photos that was value neutral in terms of the images presented.

As previously mentioned, a Likert Scale rating was used to capture the subjective perceptions of the respondents in a quantifiable form. We used a 7 point rating scale (-3 very unattractive to +3 very attractive, with a neutral 0 value) with descriptive labels consistent with survey prompts in terms of value neutrality. Image desirability for North Saint Paul was the question under study. As is typical in standard survey design (Alreck and Settle, 2004), we concluded with four numeric and single select demographic (biographic) questions related to number of the persons in the household, status as an owner or renter, age and income.

An attempt was made to minimize the starting point bias and presentation order effects bias through the use of calibration images and randomization. Studies suggest that respondents are generally less favorable towards questions that appear at the beginning of a survey, treating them as an anchor when evaluating later questions in a sequence (Veronesi, et. al., 2010, Tversky and Kahneman, 1974). To minimize the starting point bias, a calibration (or decoy) image was used first that depicted a typical residential streetscape with no enhancements. The image was also meant to help acclimate the viewer to the process (Herzog, 1989), and was not used in the overall calculations of survey findings. The presentation order effects bias presumes that the relative position of an item in an inventory of questions may uniquely influence the way in which a respondent reacts (Landon, 1970, Manning et al, 2002). Respondents may reveal one set of norms if the order in which photographs are presented depicts greater impacts first (i.e. street narrowing), followed by lesser impacts (i.e. raingardens), than if the order were reversed. Viewer routine and fatigue may also set in causing later images to not be viewed as independently as they should be. One method to control for this bias is to vary or randomize the order of the images displayed from one respondent to the next (Alreck and Settle, 2004). Limitations on the software used to conduct the VPS prevented us from randomizing images after every completed survey. However, we were able to prepare and conduct multiple versions of the survey where the images appeared in random order varying from one version of the survey to the next (each image was assigned a number and a random number



Screenshot of the VPS as it appeard on the iPad application.

generator was used to select image order). In advance of finalizing the surveys, the surveys were tested for comprehension and ease of use by self-selected individuals known to the members of the capstone group.

In order to ease data collection and prevent certain types of interviewer error (data recording error, scale interpretation error), the survey was administered using an iPad application developed through iSurvey.com. The iSurvey software allows multiple users to simultaneously collect and automatically download survey results to a cloud-based server after the completion of every survey. Data was automatically geo-coded and time-stamped. The data could then be examined at any time and uploaded into Excel or other statistical software packages.

The door to door survey was conducted April 13-19, 2014, by the three members of our North Saint Paul Living Streets capstone group. Completed surveys were obtained from 80 residents from 79 households representing 65% of the Casey Lake neighborhood households. The number of individual question responses generated totaled 2240. On average, each survey was completed in ten minutes.

Findings

The VPS is an effective tool for engaging citizens in the community planning process while also helping foster an understanding of design choices available. As a visioning technique however, the findings do not project a pure statistical representation of a random sampling of all North Saint Paul residents. The findings are an approximation of the relative preferences of those in the Casey Lake neighborhood who chose to participate in the survey. Reactions and attitudes toward an image are derived from individual life experiences, community norms, and motivations to either maintain or change the built environment of the neighborhood.

The Casey Lake neighborhood appears to be fairly homogeneous. In terms of survey result demographics, 52.5% of the participants were fifty one years old or older and 79% had annual incomes above $60,000. Eighty-one percent were homeowners and the average household size totaled 2.91 occupants.

The process of analyzing the data began by uploading the data into excel and aligning the image ratings from the various survey versions used so that all data for each image was aligned in columns. The standard calculation protocol is as follows:

1. First, the mean or average rating of the Likert Scale scores for each image is calculated
2. Second, the mode and standard deviation from the mean are calculated. The standard deviation score compared against the average standard deviation of the entire image set is helpful in comparing imagery with similar mean scores. A lower standard deviation than the average is interpreted to mean that there is more consensus among the participants on the rating score for a given image. After comparing the rating score of each image, those images with a higher average rating and relatively low standard deviation are considered to be the most desirable and vice versa for negatively rated images.
3. Third, by calculating differences from the mean in the "before" and "after" image sets possible to compair across image sets to determine which "after" image engendered a greater difference from its "before." (All VPS images and scoring data is found in the Appendix)

To analyze the mean score for each image based on demographic characteristics, the results were uploaded into SPSS. The crosstab function was used to show the mean score for each image broken down by age, family income, status as an owner or renter, and household size.

Off-steet bike path and sidewalk in Roseville, MN. Photo taken by capstone students

As mentioned previously, seven living streets design elements were tested:

- Designated bike paths (on and off street)
- Raingardens (in season and out of season)
- Permeable street pavement
- Road narrowing
- Enhanced intersections with curb treatments and bumpout
- Undivided long median
- Straight sidewalks and meandering sidewalks around raingardens Based on a comparison of the mean scores, standard deviations and difference from the mean (see Table 2 for a data comparison chart), the following conclusions can be drawn.

Well-Maintained Raingardens Seen as Desirable

Four image pairs showed streetscapes with and without well-maintained raingardens. In three of the four cases, respondents prefered the images with raingardens to the images with traditional lawns.

Well-maintained raingardens with curb cuts were most desirable to the residents of the Casey Lake neighborhood. The “after” image of the raingarden shown below not only had the largest mean score (1.2375) of all the images tested, it also showed the greatest difference from the mean score of the “before” image (.9125). The standard deviation of 1.407 was below the average standard deviation for all the images, demonstrating that the image engendered positive desirability consensus among the residents.

Mean score	.33
Mode	2
Standard deviation	1.77

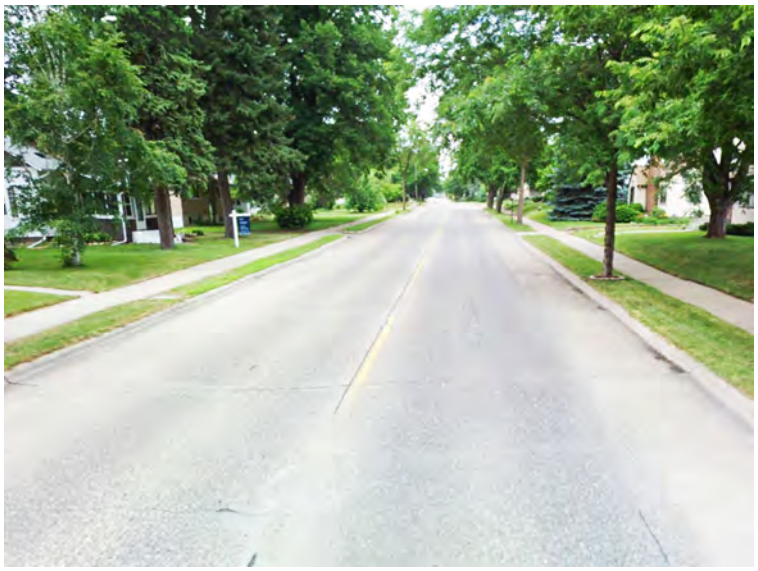
Mean score	1.24
Mode	2
Standard deviation	1.41
Difference from base photo mean	.91

This raingarden image pair shows a raingarden on a street boulevard, which is not private property, but is typically maintained by the property owner. Consistent with the overall findings on the preference of raingardens, the after image of this raingarden had the 2nd highest mean score (1.1625).

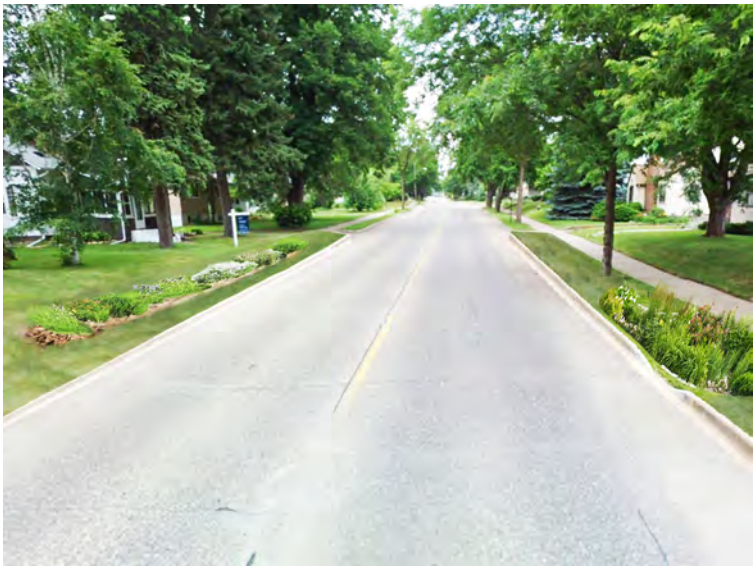
Mean score	.95
Mode	2
Standard deviation	1.30

Mean score	1.16
Mode	2
Standard deviation	1.44
Difference from base photo mean	21

Even though this image pair appears closely related, consistent with Nelessen's summation, even subtle variances in imagery can lead to conclusive outcomes. Although with a slightly lower mean score (.85) than previous images of raingardens, the "after" image demonstrates the second highest increase in the mean score from the "before" (.3125) with even a slightly lower standard deviation than Raingarden 1.



Mean score	.54
Mode	0
Standard deviation	1.11



Mean score	.85
Mode	1
Standard deviation	1.37
Difference from base photo mean	.31

This image pair shows that even the flooded raingarden receives a higher mean score than the “before” image. The comparatively higher standard deviation for the “after” photo indicates that there was less consensus on this image.

Mean score	.83
Mode	1
Standard deviation	1.39

Mean score	.63
Mode	3
Standard deviation	1.85
Difference from base photo mean	-.20

Demographic Breakdown of preference for raingardens

Homeowners and renters

Generally speaking, homeowners responded more positively to raingardens than renters. Both owners and renters gave the raingarden that was visibly flooded a lower average desirability score than the base photo. The scores for this image may have been biased by the fact that the base photo did not show any visible flooding. This is inconsistent with the realities of raingardens, which infiltrate water at a faster rate than the turfgrass shown in the base photo. Given an identical volume of rain, the base photo should have shown more flooding than the raingarden. Owners gave the smaller raingarden an higher score than the base photo whereas renters gave it a lower score. Both owners and renters ranked the photos of lush well-maintained raingardens higher than their base photo. The increase in the score was higher for owners than it was for renters. These results are summarized in the tables to the right.

Table 1.1: Flooded raingarden

	Average (base photo)	Average (raingarden)	Difference
Owner (n=65)	.92	.74	-.18
Renter (n=8)	.38	.00	-.38
Neither (n=4)	.75	.00	-.75

Table 1.2: Smaller rangarden

	Average (base photo)	Average (raingarden)	Difference
Owner (n=65)	.57	1.06	.49
Renter (n=8)	.13	.00	-.13
Neither (n=4)	1.00	-.50	-1.5

Table 1.3: Lush well-maintained raingarden

	Average (base photo)	Average (raingarden)	Difference
Owner (n=65)	1.05	1.29	.24
Renter (n=8)	.50	.13	-.37
Neither (n=4)	.75	1.50	.75

Table 1.4: Lush well-maintained raingarden

	Average (base photo)	Average (raingarden)	Difference
Owner (n=65)	.37	1.37	1.00
Renter (n=8)	.25	.63	.38
Neither (n=4)	.25	1.00	.75

North Saint Paul neighborhood under study, photos taken by capstone students.

Household Income

Because of our small sample size and the large number of refusals, there were very few respondents from some of the income categories. This makes it more difficult to discern patterns based on median household income. There were no clear patterns in the scores for the flooded raingarden. Some income groups gave the image a higher score than the base photo, other income groups gave it a lower score. All income groups except for the $0-$30,000 per year group gave higher scores to the smaller raingarden than to the base photo. All income groups gave higher scores to the lush well-maintained raingardens than to the base photos.

Table 2.1: Flooded raingarden

Household Income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	.25	1.67	1.42
$30,001-$60,000 (n=14)	1.36	.36	-1.00
$60,001-$90,000 (n=22)	1.00	.55	-.45
$90,001-$120,000 (n=15)	.53	.93	.40
$120,000 +	1.00	3.00	2.00
Neither	.95	2.42	-.53

Planting represents typical raingarden foliage in MN. Photo taken in Afton State Park by capstone students.

Table 2.2: Smaller raingarden

Household Income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	.33	.00	-.33
$30,001-$60,000 (n=14)	.50	1.29	.79
$60,001-$90,000 (n=22)	.68	.91	.23
$90,001-$120,000 (n=15)	.47	.80	.33
$120,000 +	3.00	3.00	.00
Neither	.37	.58	.21

Table 2.3: Lush well-maintained raingarden

Household Income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	1.00	2.00	1.00
$30,001-$60,000 (n=14)	.93	1.29	.36
$60,001-$90,000 (n=22)	.91	1.18	.27
$90,001-$120,000 (n=15)	1.07	1.27	.20
$120,000 +	3.00	3.00	.00
Neither	1.05	.95	-.11

Table 2.4: Lush well-maintained raingarden

Household Income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	.33	2.00	1.67
$30,001-$60,000 (n=14)	1.21	1.57	.36
$60,001-$90,000 (n=22)	-.14	1.23	1.36
$90,001-$120,000 (n=15)	-.13	1.07	1.20
$120,000 +	1.00	2.00	1.00
Neither	.47	1.11	.37

Age

As with median household income, the large number of age categories coupled with our small sample size mean that not all age groups have a large number of respondents. All age groups gave the flooded raingarden a lower average score except for those under 20 and those over 60. The smaller rain gardens received a higher average score than the base photo from every age group. The lush well-maintained rain gardens received higher average scores than their base photos from almost all age groups. Both of the lush well-maintained raingardens received a lower score from the younger than 20 group and one received a lower score from the 41-50 age group.

Generally speaking, these results support the conclusion that raingardens would be supported by the majority of North Saint Paul residents. While there were some instances where raingardens received lower average scores than their base photos, the majority of the homeowner/renter, income, and age cohorts supported the majority of the raingardens. The least popular raingarden was the flooded raingarden. Because the base photo did not show flooding, this does not give any indication as to whether or not Casey Lake residents prefer raingardens to turf grass in the same weather conditions.

Table 3.1: Flooded raingarden

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	.00	3.00	3.00
21-30 (n=10)	1.30	.00	-1.30
31-40 (n=11)	.82	.36	-.45
41-50 (n=12)	.58	.17	-.42
51-60 (n=15)	1.27	.47	-.80
61-70 (n=18)	.61	1.00	.39
70 + (n=9)	.89	1.67	.78

Table 3.2: Smaller raingarden

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	.00	.00	.00
21-30 (n=10)	1.00	.50	.40
31-40 (n=11)	.18	.82	.73
41-50 (n=12)	.42	.58	.50
51-60 (n=15)	.20	1.33	1.27
61-70 (n=18)	.78	.94	.89
70 + (n=9)	.78	1.00	.22

Table 3.3: Lush well-maintained raingarden

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	1.00	.00	-1.00
21-30 (n=10)	.80	.90	.10
31-40 (n=11)	1.18	1.36	.18
41-50 (n=12)	1.67	1.25	-.42
51-60 (n=15)	.60	1.20	.60
61-70 (n=18)	.83	1.11	.28
70 + (n=9)	1.11	1.44	.33

Table 3.4: Lush well-maintained raingarden

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	2.00	.00	-2.00
21-30 (n=10)	-.30	.80	1.10
31-40 (n=11)	.00	1.45	1.45
41-50 (n=12)	-.17	1.33	1.50
51-60 (n=15)	.07	1.20	1.13
61-70 (n=18)	1.28	1.39	.11
70 + (n=9)	.56	1.56	1.00

Out of Season Raingardens Seen as Less Desirable

As may be expected, out of season raingardens before bloom appear less aesthetically pleasing and consequently less desirable than during summer peak foliage. This is reflected in the results on the right.

Some participants may have interpreted the raingarden as one that is poorly maintained. Although both images have negative mean scores close to neutral, the “after” image scores slightly lower than the “before”.

Mean score	-.03
Mode	0
Standard deviation	1.55

Mean score	-.09
Mode	1
Standard deviation	1.55
Difference from base photo mean	-.06

This image pair of out of season raingardens shows that both images have a positive mean desirability score (.9 and .375) with more consensus than the first out of season raingarden images. Taken together, image perspective and scale may have impacted these results as the first out of season raingarden is depicted to be much closer than viewing out of season raingarden 2 from across the intersection. Taken separately, even though a straight sidewalk with no raingarden rated higher, a meandering sidewalk with an out of season raingarden, at least when viewed from a short distance, still can be desirable.

Mean score	.90
Mode	2
Standard deviation	1.25

Mean score	.38
Mode	1
Standard deviation	1.50
Difference from base photo mean	-.53

Demographic breakdown

Owners and Renters

Both owners and renters gave off-season raingardens lower desirability scores than their base photos. These results are summarized in the tables below.

Household Income

Off-season raingardens are seen as undesirable by all income groups. Respondents with an income between $90,001-$120,00 gave the first raingarden an average score 0.40 points higher than its "before" photo. All other income groups rated both raingardens lower than their "before" photos. These results are summarized in the tables to the right.

Table 4.1: Raingarden on street

	Average (base photo)	Average (raingarden)	Difference
Owner	.02	-.05	-.07
Renter	-.13	-.25	-.12
Neither	-.25	-1.00	-.75

Table 4.2: Raingarden at corner

	Average (base photo)	Average (raingarden)	Difference
Owner	.95	.42	-.53
Renter	.63	.25	-.38
Neither	1.00	.50	-.50

Table 5.1: Raingarden on street

Household income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	-.33	-1.33	-1.00
$30,001-$60,000 (n=14)	.50	-.14	-.64
$60,001-$90,000 (n=22)	-.14	-.23	-.09
$90,001-$120,000 (n=15)	-.20	.20	.40
$120,000+ (n=1)	3.00	3.00	.00
Refuse (n=19)	1.05	1.00	-.05

Table 5.2: Raingarden on corner

Household income	Average (base photo)	Average (raingarden)	Difference
$0-$30,000 (n=3)	1.00	.33	-.67
$30,001-$60,000 (n=14)	.43	.00	-.43
$60,001-$90,000 (n=22)	1.05	.23	-.82
$90,001-$120,000 (n=15)	1.27	1.00	-.27
$120,000+ (n=1)	3.00	3.00	.00
Refuse (n=19)	.79	.47	-.32

Photo taken in North Saint Paul by capstone students.

Age

There are no clear patterns in the average scores given to off-season raingardens based on age. The raingardens decreased the average scores given by most age groups. The raingarden on the street caused a slight increase in the scores given by respondents aged 21-30, 61-70, and 70+. This raingarden also caused a larger increase in the score given by the respondent who was younger than 20.

The raingarden at the corner caused a slight increase in the average scores given by respondents aged 31-40 and no change in the score given by the respondent who was younger than 20.

Table 6.2: Raingarden on street

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	-1.00	1.00	2.00
21-30 (n=10)	0.00	.10	.10
31-40 (n=11)	.91	.55	-.36
41-50 (n=12)	.17	-.50	-.67
51-60 (n=15)	-.13	-.67	-.53
61-70 (n=18)	-.44	-.17	.28
70 + (n=9)	.00	.33	.33

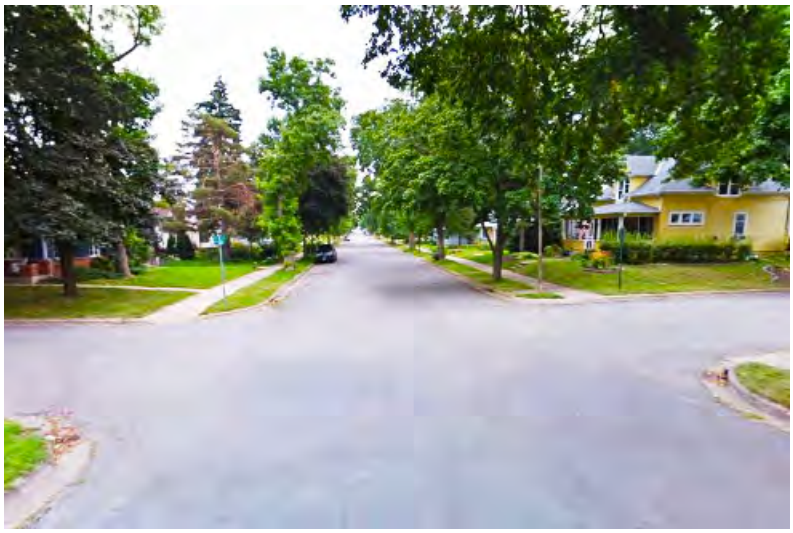
Table 6.2: Raingarden at corner

Age	Average (base photo)	Average (raingarden)	Difference
Younger than 20 (n=1)	.00	.00	.00
21-30 (n=10)	1.00	.10	-.90
31-40 (n=11)	.64	.82	.18
41-50 (n=12)	1.33	.67	-.67
51-60 (n=15)	.73	.07	-.67
61-70 (n=18)	1.11	.44	-.67
70 + (n=9)	.67	.56	-.11

Photo taken in Casey Lake Park by capstone students.

Enhanced Intersections Preferred over Standard

As depicted in this image pair, an enhanced intersection with curb bumpouts and crosswalk treatments is rated more positively than the “before” image. However, the “after” image had the highest standard deviation score of all the images, which suggests that there is not much consensus—participants rated it either very high or low. A mode score of “2” suggests that the most common score of the image shows moderate desirability, hence our general finding that enhanced intersections are preferred. However more study may be needed to determine the exact configuration which would garner stronger support.



Mean score	.478
Mode	0
Standard deviation	1.37

Mean score	.65
Mode	2
Standard deviation	1.99
Difference from base photo mean	.18

Demographic breakdown

Owners and renters

Owners and renters responded similarly to the before and after images for the enhanced intersections . Both owners and renters gave the intersection a lower average score than the before image. The average score given by renters decreased more significantly than the average score given by owners. Owners gave the before image an average rating of 1.10 and the after image an average rating of .82. Renters gave the before image a rating of .07 and the after image a rating of .75.

The four respondents who were neither owners nor renters gave the before image an average rating of 1.33and the after image an average rating of -1.75.

	Average (base photo)	Average (enhanced intersection)	Difference
Owner	1.10	.82	-.28
Renter	.07	.75	-.68
Neither	1.33	-1.75	3.08

Household Income

All income groups except for the lowest income group of $0-$30,000 per year rated the enhanced intersection more positively than the "before" image. The second lowest income group of $30,001-$60,000 per year showed the lowest increase in desirability, rating the enhanced intersection an average of only 0.07 points more desirable than the base image. These results indicate that higher income groups find the enhanced intersection more desirable than lower income groups. In addition, the 19 respondents who refused to report an income ranked the enhanced intersection as less desirable than the "before" image.

Age

Respondents aged 40 and under gave the highest increase in rankings between the enhanced intersection and the "before" image. The mean ranking for respondents aged 41-50 as 0.25 points lower for the enhanced intersection than for the "before" image. The mean ranking for respondents aged 61-70 was 0.67 points lower for the enhanced intersection. Respondents aged 51-60 and 70 or older gave the enhanced intersection slightly higher average rankings than the "before" image.

Table 8.1: Enhanced intersection

Household income	Average (base photo)	Average (enhanced inter-section)	Difference
$0-$30,000 (n=3)	.67	-2.33	-3.00
$30,001-$60,000 (n=14)	.29	.36	.07
$60,001-$90,000 (n=22)	.23	1.14	.91
$90,001-$120,000 (n=15	.53	1.20	.67
$120,000 + (n=1)	2.00	3.00	1.00
Refuse (n=19)	.58	.47	-.11

Table 9.1: Enhanced intersection

Age	Average (base photo)	Average (enhanced inter-section)	Difference
Younger than 20 (n=1)	.00	2.00	2.00
21-30 (n=10)	-.40	1.00	1.40
31-40 (n=11)	.09	1.18	1.09
41-50 (n=12)	.58	.33	-.25
51-60 (n=15)	.47	.73	.27
61- 70 (n=18)	.89	.22	-.67
70+ (n=9)	.89	1.00	.11

These results show that there is a general preference for the design features present in the enhanced intersection, but that there is not a lot of consensus. Generally, younger residents and residents with a higher median household income are more likely to prefer the enhanced intersection over the "before" image. Further research that isolates individual design elements may help the City identify a design that will receive support from a broader segment of the population.

Narrower Streets Preferred

Both “after” images shown here depict traffic calming devices. Narrowing the street (by approximately 33%) rated slightly higher (.0875) than a typical wider street. The narrow street image with wider boulevards more accurately reflects the already relatively narrow streets of the Casey Lake neighborhood.

The long median in the second “after” image, however, was not desirable. As depicted, this type of median appears to drastically restrict driving lanes while leaving little room for on-street parking. Anecdotally, more than one participant volunteered that the image reminded them of neighborhoods in Saint Paul and Minneapolis and would not be appropriate for North Saint Paul. This image had the lowest mean score and the second greatest difference from the mean than all the images. Standard deviations for all the images show general consensus.

Base photo

Mean score	.64
Mode	0
Standard deviation	1.27

Street narrowed by 30%

Mean score	.73
Mode	1
Standard deviation	1.22
Difference from base photo mean	.09

Street divided by median

Mean score	-.84
Mode	-3
Standard deviation	1.37
Difference from base photo mean	-1.48

Demographic breakdown

Owners and Renters

Both owners and renters responded negatively to the median and positively to the narrowed street. The decrease in rankings for the street median was greater for homeowners than it was for renters. Homeowners gave the street median an average score 1.59 points lower than the "before" image, renters gave the median an average score of .75 points lower. This difference may be due to the fact that homeowners, who are more directly impacted by assessments, were more influenced by the perceived cost of the median than renters. The narrowed street had a greater impact on the average score given by renters than by homeowners. Homeowners gave the narrowed street an average score of 0.26 points higher than the before image and renters gave the narrowed street an average score of 0.74 points higher than the before image. These results are summarized in the tables to the right.

Table 10.1: Street median

	Average (base photo)	Average (street median)	Difference
Owner	.74	-.85	-1.59
Renter	.00	-.75	-.75
Neither	.75	-2.00	-2.75

Table 10.2: Narrowed street

	Average (base photo)	Average (narrowed street)	Difference
Owner	.74	1.00	.26
Renter	.00	.74	.74
Neither	.75	.50	-.25

Photo taken in Casey Lake Park by capstone students.

Typical street in the Casey Lake neighborhood. Photo taken in North Saint Paul by capstone students.

Plantings represent typical raingarden foliage. Photo taken in Afton State Park by capstone students.

Photo represents typical housing stock in Casey Lake neighborhood. Photo taken in North Saint Paul by capstone students.

Household Income

All income groups gave significantly lower averaged scores to the street median than to its "before" image with the exception of the $120,000+ income group, which gave no change in ranking. Because only one respondent reported a median household income higher than $120,00 per year, it is impossible to draw conclusions about this income group. The narrowed streets had a smaller impact on the rankings given by all income groups. the $30,001-$60,000 per year income groups gave the narrowed street an average score 0.36 points lower than the "before" image. There was no change in average scores or a slight increase in average scores for all other income groups.

Table 11.1: Street median

Household income	Average (base photo)	Average (street median)	Difference
$0-$30,000 (n=3)	.33	-2.33	-2.67
$30,001-$60,000 (n=14)	.36	-.71	-1.07
$60,001-$90,000 (n=22)	.82	-1.14	-1.95
$90,001, $120,000 (n=15)	.80	-1.00	-1.80
$120,000+ (n=1)	3.00	3.00	.00
Refuse (n=19)	.74	-.52	-1.26

Table 11.2: Narrowed street

Household income	Average (base photo)	Average (street median)	Difference
$0-$30,000 (n=3)	.33	.33	.00
$30,001-$60,000 (n=14)	.36	.00	-.36
$60,001-$90,000 (n=22)	.82	1.05	.23
$90,001, $120,000 (n=15)	.80	.80	.00
$120,000+ (n=1)	3.00	3.00	.00
Refuse (n=19)	.74	.79	.-05

Age

All age groups gave the street median a lower average score than the "before" image. The difference between scores was over a full point for all age groups except for those aged 70 or older who gave the street median an average score of 0.44 points lower than the "before" image.

There was more variation in the impact that the narrowed street had on average rankings. The narrowed street had the most impact on the average scores those aged 21-30 who gave the narrowed street an average ranking of 0.80 points higher than the before image. those aged 61-70 gave the narrowed street as slightly higher ranking than the before image. Respondents younger than 20 and between the ages of 31 and 40 gave the before and after images the same average rankings. All other age groups gave the narrowed street slightly lower average scores than the "before" image.

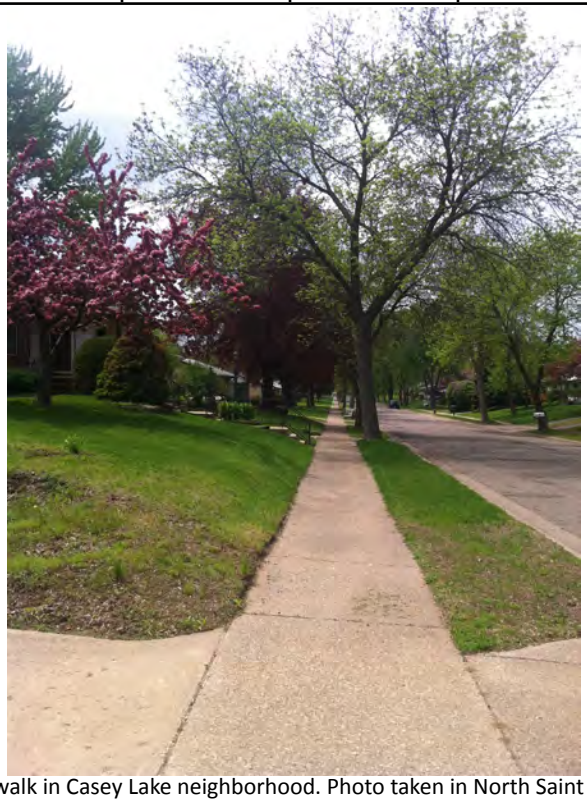
These results suggest that there is consensus among homeowners and renters and across income groups that street medians are undesirable and narrowed streets are desirable. The narrowed street was viewed most favorably by the 21-30 age group, but the narrowed street did not drop the ranking by more than 0.33 points for any age group. In addition, the narrowed street received overall positive scores from every age group.

Table 12.1: Street median

Age	Average (base photo)	Average (street median)	Difference
Younger than 20 (n=1)	.00	.00	.00
21-30 (n=10)	.20	-1.40	-1.60
31-40 (n=11)	1.00	-.55	-1.55
41-50 (n=12)	.67	-1.25	-1.92
51-60 (n=15)	.47	-1.13	-1.60
61-70 (n=18)	.72	-1.17	-1.89
70 + (n=9)	1.11	.67	-.44

Table 12.2: Narrowed street

Age	Average (base photo)	Average (street median)	Difference
Younger than 20 (n=1)	.00	.00	.00
21-30 (n=10)	.20	1.00	.80
31-40 (n=11)	1.00	1.00	.00
41-50 (n=12)	.67	.33	-.33
51-60 (n=15)	.47	.40	-.07
61-70 (n=18)	.72	.83	.11
70 + (n=9)	1.11	1.00	-.11



Sidewalk in Casey Lake neighborhood. Photo taken in North Saint Paul by capstone students.

Bike Paths Viewed More Favorably On-Street

"After" images here imply that bike paths reduce the desirability of the streetscape. In situations where bike paths are necessary to make crucial connections between destinations like parks, schools and regional trail systems, designated bikes paths on the street are more desirable than bike paths on the sidewalk. As depicted, an on-street bike path still has a positive mean score of .625 (albeit still lower than the "before" image). The off-street bike lane had the greatest difference from the mean than any pair of images tested (-1.825) while having the second lowest mean score of (-.7875). Some of the reaction towards this image may have been because of the pavement type depicted (asphalt) or to the "designating" of a residential sidewalk for biking purposes.

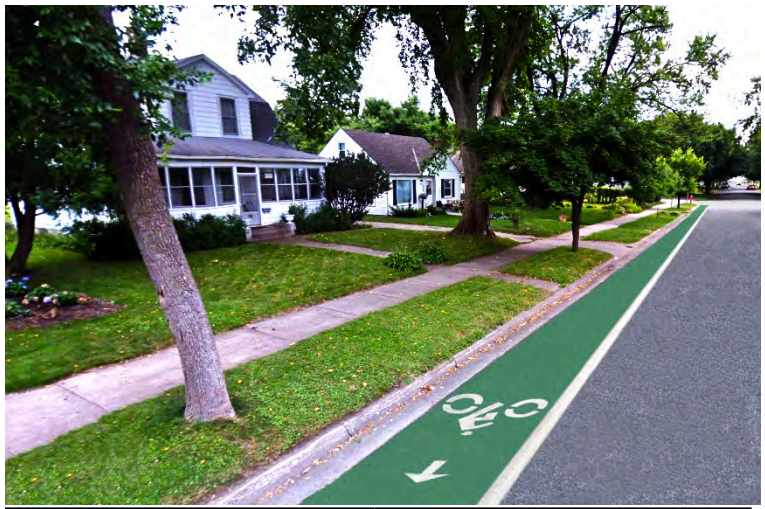
Off-street bike path

Mean score	-.79
Mode	-2
Standard deviation	1.73
Difference from base photo mean	-1.83

Base photo

Mean score	1.04
Mode	2
Standard deviation	1.25

On-street bike path



Mean score	.63
Mode	1
Standard deviation	1.75
Difference from base photo mean	-.41

Demographic breakdown

Owners and Renters

Both bike lanes received lower average rankings than the "before" image from both owners and renters. Both owners and renters gave the bike lane on the sidewalk a lower average score than the bike lane on the street. Both bike lanes reduced the average score given by homeowners more than they reduced the average score given by renters. These results are summarized in the tables below.

	Average (base photo)	Average	Difference
Owner	1.06	.68	-.38
Renter	.88	.63	-.25
Neither	1.00	.00	-1.00

	Average (base photo)	Average	Difference
Owner	1.06	-.82	-1.88
Renter	.88	-.25	-1.13
Neither	1.00	-1.25	-2.25

Household Income

The painted bike lane slightly increased the average score given by respondents with a household income from $30,001-$60,000 and $90,001-$120,000. The painted bike lane slightly reduced the average score given by households with an income from $0 -$30,000, from $60,001-$90,000, and for those who refused to report an income.

In contrast the bike lane on the sidewalk significantly reduced the average score given by all of these income groups. Neither bike lane changed the average score given by the respondent with a household income over $120,000 per year.

Household income	Average (base photo)	Average (street median)	Difference
$0-$30,000 (n=3)	.67	.33	-.33
$30,001-$60,000 (n=14)	.57	.64	.07
$60,001-$90,000 (n=22)	1.18	1.00	-.18
$90,001, $120,000 (n=15)	1.13	1.27	.13
$120,000+ (n=1)	3.00	3.00	0.00
Refuse (n=19)	1.21	-.16	-1.37

Household income	Average (base photo)	Average (street median)	Difference
$0-$30,000 (n=3)	.67	-1.00	-1.67
$30,001-$60,000 (n=14)	.57	-.29	-.86
$60,001-$90,000 (n=22)	1.18	-1.09	-2.27
$90,001, $120,000 (n=15)	1.13	-.93	-2.07
$120,000+ (n=1)	3.00	3.00	.00
Refuse (n=19)	1.21	-.68	-1.89

Age

The painted bike lane decreased the average ranking given by respondents aged 21-30, 41-50, and 61-70 by between 0.67 and 0.92 points. The painted bike lane caused no change in the average ranking given by the respondent younger than 20 and the respondents older than 70. The painted bike lane slightly increased the average rankings given by respondents aged 31-40 and 51-60. In contrast the bike lane on the sidewalk caused greater decreases in the average ranking given by every age group. These results are shown in the tables to the right.

Age	Average (base photo)	Average (street median)	Difference
Younger than 20 (n=1)	1.00	1.00	.00
21-30 (n=10)	1.70	.90	-.80
31-40 (n=11)	1.09	1.27	.18
41-50 (n=12)	1.17	.25	-.92
51-60 (n=15)	.53	.73	.20
61-70 (n=18)	.89	.22	-.67
70 + (n=9)	1.00	1.00	.00

Age	Average (base photo)	Average (street median)	Difference
Younger than 20 (n=1)	1.00	.00	-1.00
21-30 (n=10)	1.70	-.40	-2.10
31-40 (n=11)	1.-9	-.82	-1.91
41-50 (n=12)	1.17	-.92	-2.08
51-60 (n=15)	.53	-1.13	-1.67
61-70 (n=18)	.89	-1.06	-1.94
70 + (n=9)	1.00	.22	-.78

Photos taken at the Ramsey-Washington Metro Watershed District office in Little Canada by capstone students.

Permeable Pavement Viewed as Less Desirable than Standard Pavement

While still slightly positive, the depiction of a permeable street in the "after" image shows that it is less desirable than a standard, well-paved street to residents of the Casey Lake neighborhood based on the mean scores. The higher standard deviation (1.928) indicates that there is not much consensus on permeable pavers, at least at this magnitude of use. Again, anecdotally speaking, a number of participants commented that the street looked "expensive" even if acknowledging the positive aesthetic qualities. In addition, some residents also commented on anticipated high maintenance costs of such a surface during the winter.

Mean score	.53
Mode	0
Standard deviation	1.48

Mean score	.23
Mode	1
Standard deviation	1.93
Difference from base photo mean	-.3

Demographic Breakdown

Owners and renters

Homeowners viewed permeable pavers less favorably than renters. Homeowners gave the permeable pavers an average ranking 1.22 points lower than the before photo. Renters gave the pavers an average score 1.25 points higher than the before photo. One possible explanation for this difference is that homeowners might have been more sensitive to the perceived difference in the cost of the two images. While respondents were asked to respond based on which images they found the most desirable, it is often difficult to ignore other factors when making a judgment.

	Average (base photo)	Average	Difference
Owner	.66	-.55	-1.22
Renter	-.13	1.13	1.25
Neither	-.25	-.75	-.50

Household income	Average (base photo)	Average (street median)	Difference
$0-$30,000 (n=3)	.33	1.00	.67
$30,001-$60,000 (n=14)	.14	.86	.72
$60,001-$90,000 (n=22)	.41	.50	.09
$90,001, $120,000 (n=15)	.40	-.47	-.87
$120,000+ (n=1)	2.00	1.00	-1.00
Refuse (n=19)	.95	.21	-.74

Household income

The impact of permeable pavers broken down by income is summarized in the table to the right. These results that permeable pavers may be more supported in lower-income neighborhoods.

Age

Respondents from younger age groups viewed permeable pavers more favorably than respondents from higher age groups. Respondents aged 21-30 and 31-40 rated the permeable pavers 1.20 and 0.91 points higher than the before image. All other age groups gave the permeable pavers a lower average score than the base image.

Age	Average (base photo)	Average (street median)	Difference
Younger than 20 (n=1)	1.00	.00	-1.00
21-30 (n=10)	-.30	.90	1.20
31-40 (n=11)	.00	.91	.91
41-50 (n=12)	.42	-.25	-.67
51-60 (n=15)	.73	.40	-.33
61-70 (n=18)	.61	-.61	-1.22
70 + (n=9)	1.67	.78	-.89

Path connecting the Casey Lake neighborhood to Casey Lake. Photo taken by capstone students.

Multiple Living Street Elements can be Desirable Together

This image was placed at the very end of the survey as a concluding, composite image. It was not paired with a "before" image. Rather than test a specific design element, the image is used as an experiment to test in general, a number of living street design elements at once. The image depicts a reality where a number of elements work together to create a "flow" to the streetscape. Meandering sidewalks, curb cuts, and narrowing of the street present a more "complete" approach to what a living street can look like. Ironically, the image was taken from neighboring Maplewood and the elements depicted in the photo were created using the financial resources rejected when North Saint Paul dropped its initial attempt at living street implementation in 2011. Although lacking in consensus, out of the 23 images ranked in the survey, this composite image came in 4th in terms of mean score.

Individuals who are neither owners nor renters viewed the composite photo less favorably than owners and renters. Owners gave the image an average score of 1.11, renters gave the image an average score of .88, and individuals who were neither owners nor renters gave the image an average score of -1.50.

All income groups gave the composite photo positive average scores. Respondents with a household income between $0 and $30,000 per year gave the photo an average score of .33. Respondent between $30,001 and $60,000 gave the photo an average ranking of 1.36. Respondents with a household income between $60,001 and $90,000 gave the photo an average score of 1.00. Respondents with a household income between $90,001 and $120,000 gave the photo an average score of .53. The respondent a household income greater than $130,000 gave the photo an average score of 1.00. Respondents who refused to report their household income gave the photo an average score of .95.

Respondents from all age groups gave the composit photo positive or neutral average scores. The respondent younger than 20 gave the photo a score of 0.00. Those aged 21-30 gave the photo an average score of 1.30. Respodents aged 31-40 gave the photo an average score of .82. Respondents between 41 and 50 gave the photo an average score of .58. Those between 51 and 60 gave the photo an average score of 1.27. Respondents aged 61-70 gave the photo an average score of .61. Respondents older than 70 gave the photo an average scoreof .89.

Regression Analysis

An attempt was made to mathematically assess the importance of individual elements in explaining preferences for certain images. Tables 3-5 contain data and outcomes related to an ordinary least squares regression done in Microsoft Excel. The mean score for all the images is the dependent variable for such a regression, while nine independent living street variables (or predictors) were identified and scored as a "0" not present in the image or a "1" if the image contained the variable (see Table 3). Using Excel to run a correlation analysis (Table 4) determining Pearson's correlation coefficient of the independent variables used in the regression show that many of the variables are not strongly correlated with one another (except for raingardens and curb treatments as all raingardens contained at least one curb cut). Having stand-alone independent variables is desired as strongly correlated independent variables will not add to the explanation of the overall analysis.

Running a regression analysis of the independent variables helps attempt to explain the degree of variability between the mean score differences from one image to the next. After running the regression (Table 5) overall, an adjusted r-square of .52 shows that just over 50% of the mean scores of the images are explained by the independent variables selected, which means that a large proportion of the variations is due to factors not included in the study. The very act of

Native Plantings similar to what might be planted in raingardens. Photo taken by capstone students.

calculating the mean score prior to using it as the dependent variable may explain some of variance, and hence a lower adjusted r-squared value in the regression. The f-statistic shows a 1.6% probability that the entire outcome of the regression is merely by chance, which is low, indicating significance at the 95% level. On closer examination of the independent variables, the one variable having the largest effect on the mean score is an image containing a living raingarden. Living raingardens have a positive coefficient of .77 and a p-value of .04, indicating that there is a 96% chance that viewing a living raingarden has a positive effect on the mean score (holding all other independent variables constant). Images depicting street narrowing also are positive but less significant (B=.28; p-value=.26). Conversely, medians (B= -1.8; p-value=.002), bike lanes (B= -.83; p-value=.01), and out of season raingardens (B= -.188 p-value=.67) each have a negative effect on the mean score according to the results.

Summary of Findings

Casey Lake Neighborhood residents are receptive to living street design elements. Based on our VPS findings, the elements with the highest preference rating and best likelihood of gaining acceptance in this neighborhood include:

- Raingardens with curb cuts
- Enhanced Intersections with bumpouts
- Narrowed Streets

Residents appear familiar with raingardens, perhaps through the work of the watershed or by visiting neighboring communities where they are more commonplace in a residential setting. Choosing raingardens as a desirable neighborhood feature exemplifies the desire to live in and commute through an aesthetically pleasing variegated landscape. Residents may also be more educated on the function of the raingarden as a filter, preventing pollutants from further harming nearby Casey Lake and other waterways. It should be mentioned however, that raingardens need maintenance and while off season raingardens may be acceptable, poorly maintained gardens may not be tolerated. Narrowed streets and enhanced intersections fit well in this neighborhood. As the residential streets are already fairly narrow, it would appear based on these findings that the residents would also be more accepting of narrowing arterial streets and other "feeder" roadways surrounding the area. Enhanced intersections as depicted

Townhall meetings for planning design are typically conducted early in the planning process. Photo retreived from www.sandyspringscitycenter.org.

in the survey would directly complement the extensive sidewalk network already in place while underscoring safety by slowing traffic and making drivers more aware of pedestrians.

Living street elements that engendered some support, but require more education and visioning work to incorporate include:

- On-street bike paths
- Permeable surfaces

It stands to reason that biking is a common activity in this neighborhood considering the ease of access to the Casey Lake park and neighboring Gateway trail system. However designated bike paths on the residential streets would be a completely new element to introduce to the community. Such paths may be more suited to arterial roads to help connect parks, schools and others

neighborhoods. Aesthetically, people liked the look of permeable surfaces, but cost and maintenance are a strong consideration, especially when contemplating such material for a road surface. More community education as to maintenance and cost of permeable surfaces is needed before it should be attempted on a widespread basis. A limited use of such pavers on sidewalks or intersection bump outs may be more appropriate and acceptable to begin.

Design elements that met with the most resistance include:

- Long street medians
- Off street designated bike paths

Certain arterial streets may be more suited for short medians that provide pedestrian islands and help slow traffic. The long median depicted in the survey appeared to eliminate on street parking, which was not supported. Off street designated bike paths also appeared to limit the use of what is typically a considered a pedestrian sidewalk. Different design and imagery surrounding bike paths may elicit more positive results.
In conclusion, applying the visual preference survey to living street design concepts proved to be a good visioning tool, enabling residents in a particular neighborhood of North Saint Paul to rate their preferences and voice their opinion on streetscape redesign for their community. Engaging the citizenry early in the planning process is key to overcoming misinformation and misunderstandings while building support for new design
concepts that fall in line with desired goals of healthy residents, neighborhood safety and environmental protection. The VPS was designed for that very purpose, to provide a better understanding of new concepts by using accurate visual imagery to depict design options for the future. Giving residents a choice and a voice early enough in the process helps narrow the focus for decision makers to what may be possible and acceptable.

North Saint Paul can now use the visual preference survey developed for the Casey Lake neighborhood as a template to conduct similar outreach and visioning exercises in other parts or the community. If the city chooses to select the neighborhood as a demonstration area for its next attempt at living street implementation, it now has baseline living street design preference responses to use in reengagement efforts.

Recommendations

Community members build a raingarden together, retreived from http://blog.wbsurfcamp.com/wp-content/uploads/2008/11/rain-garden-construction.jpg.

North Saint Paul has taken initial steps toward realizing living streets in their community by approving a living streets policy and design plan. However, turning policy into practice is often challenging when attempting to implement new concepts and designs. Below are recommendations for continued action based on research and findings from the Casey Lake neighborhood and the visual preference survey.

Promote Design Process over Projects

The watershed and city's joint effort on 15th Avenue identified the project (include living street design in street redevelopment on 15th Avenue); however based on successful living street implementation research, they didn't have enough process in place with the neighborhood to sustain the effort once opposition mounted. Neighborhood outreach can start simply with a visualization survey, and/or a townhall meeting, but one cannot predetermine how the design will take shape prior to this effort. A more organic, bottom-up context sensitive approach is needed in order to begin the planning process with the goal of realizing a new vision for the neighborhood streetscape.

Designate Prototype Neighborhood and Street for Implementation

The previous effort in North Saint Paul identified 15th Avenue. However, beyond the fact that the street was in line for redevelopment, it doesn't appear that any other consideration was given as to whether or not this was the best area to begin implementing living streets. Does the built environment contain elements that may ease additional living street design implementation (e.g. sidewalks, trails, enhanced intersections)? Is there an existing environmentally sensitive amenity nearby that residents may wish to protect or better connect to (e.g. lake, park)? Is the neighborhood compact enough so that residents beyond the impacted street can be involved and help champion the project? Is the demographic make-up of the neighborhood such that younger families or families with children are present and may support a more walkable and pedestrian safe environment? Is there a third party (e.g. utility, watershed, park district) with resources eyeing a potential project in the community who can help offset costs for neighborhood street redevelopment with living street elements? Establishing a prototype or demonstration neighborhood has been shown in other communities to ignite living/complete street interest in other areas.

Identify Champions and Keep Them Involved

Involving members of the neighborhood before the project is designed not only helps foster interest and engagement, is also helps planners identify strong proponents. Champions need to be nurtured through ongoing contact, education and project updates. Such neighborhood champions lend a legitimate voice that can reframe living streets to fit the context of their particular neighborhood. They can help identify others who may be supportive and willing to speak to the objections of opponents. During reconstruction, and even once reconstruction is complete, champions can speak to the positive nature of the process and help ignite the next round of planning discussions in a new neighborhood.

Bike lane in Redmond, WA, retreived from www.redmond.gov.

Show Willingness to Compromise in Order to Implement Living Street Design within the Existing Built Environment

Through the use of the North Saint Paul visual preference survey, residents of the Casey Lake neighborhood identified raingardens, street narrowing and enhanced intersections as desirable attributes to include in the streetscape while objecting to medians and off street bike paths. Other neighborhoods may strongly object to sidewalks but may be willing to support raingardens. Flexibility in design is key. Not all living street elements approved in the design plan can or should occur in any given neighborhood at any one particular time. Setback requirements, curb and gutter treatments, sidewalk width, signage etc…all should be up for debate when working with a neighborhood on redesign. Incorporating living streets design elements is transformative work. Remaining flexible and open to change will not only benefit existing residents, but will help North Saint Paul rebuild its neighborhoods for future generations.

Native plantings in a raingarden at the Ramsey-Washington Metro Watershed District office in Little Canada, MN. Photo taken by capstone students.

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Photo taken at the Ramsey-Washington Metro Watershed District office by capstone students.

Photo taken in North Saint Paul by capstone students.

Appendix

NORTH SAINT PAUL VPS IMAGES AND RESULTS

Visual Preference Survey
Living Street Design Elements Rated by North St. Paul Casey Lake Neighborhood Residents

Before Image Raingarden 1

Mean Score: .325

-3 -2 -1 0 1 2 3

Mean Score	.325
Mode	2
Std. Dev.	1.770
Diff frm Mean	--

After Image Raingarden 1

Mean Score: 1.2375

-3 -2 -1 0 1 2 3

Mean Score	1.2375
Mode	2
Std. Dev.	1.407
Diff frm Mean	.9125

Before Image Street 1

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.5375
Mode	0
Std. Dev.	1.113
Diff frm Mean	--

After Image Street 1

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.85
Mode	1
Std. Dev.	1.37
Diff frm Mean	.3125

Before Image Raingarden 2

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.95
Mode	2
Std. Dev.	1.301
Diff frm Mean	--

After Image Raingarden 2

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	1.1625
Mode	2
Std. Dev.	1.444
Diff frm Mean	.2125

Before Image Intersection

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.475
Mode	0
Std. Dev.	1.368
Diff frm Mean	--

After Image Intersection

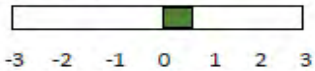
Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.65
Mode	2
Std. Dev.	1.987
Diff frm Mean	.175

Before Image Street 2

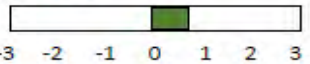
Mean Score:



Mean Score	.6375
Mode	0
Std. Dev.	1.265
Diff frm Mean	--

After street 2 (narrow)

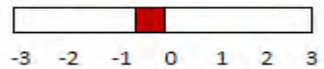
Mean Score:



Mean Score	.725
Mode	1
Std. Dev.	1.221
Diff frm Mean	.0875

After Image Street 2 (median)

Mean Score:



Mean Score	-.8375
Mode	-3
Std. Dev.	1.368
Diff frm Mean	-1.475

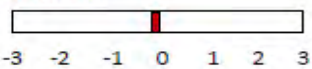
Before Out of Season Raingarden

Mean Score:

Mean Score	-.025
Mode	0
Std. Dev.	1.550
Diff frm Mean	--

After Out of Season Raingarden

Mean Score:



Mean Score	-.0875
Mode	1
Std. Dev.	1.5524
Diff frm Mean	-.0625

Before Raingarden Swale

Mean Score:

Mean Score	.825
Mode	1
Std. Dev.	1.394
Diff frm Mean	--

After Raingarden Swale

Mean Score:

Mean Score	.625
Mode	3
Std. Dev.	1.851
Diff frm Mean	-.2

Before Permeable Pavement

Mean Score:

Mean Score	.525
Mode	0
Std. Dev.	1.475
Diff frm Mean	--

After Permeable Pavement

Mean Score:

Mean Score	.225
Mode	1
Std. Dev.	1.928
Diff frm Mean	-.3

Before Bike Lanes

Mean Score:

Mean Score	1.037
Mode	2
Std. Dev.	1.247
Diff frm Mean	--

After Bike Lanes (street)

Mean Score:

Mean Score	.625
Mode	1
Std. Dev.	1.745
Diff frm Mean	-.4125

After Bike Lanes (Offstreet)

Mean Score:

Mean Score	-.7875
Mode	-2
Std. Dev.	1.733
Diff frm Mean	-1.825

Before Out of Season Raingarden 2

Mean Score:

Mean Score	.9
Mode	2
Std. Dev.	1.248
Diff frm Mean	--

After Out of Season Raingarden 2

Mean Score:

Mean Score	.375
Mode	1
Std. Dev.	1.495
Diff frm Mean	-.525

Calibration Image

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	Not factored
Mode	Not factored
Std. Dev.	Not factored
Diff frm Mean	--

Final Image-Multiple Elements

Mean Score:

-3 -2 -1 0 1 2 3

Mean Score	.95
Mode	2
Std. Dev.	1.720
Diff frm Mean	--

NORTH SAINT PAUL DEMOGRAPHICS AND DECISION MATRIX

North St. Paul Select Census Block Demographics

Census Block	Median Income of Census Block group	Median House Price of block group	# of HH in block	Average family size	Median age	% children and teens	CIP Improve date	Location
042601-1-014	$83,750	$192,100	27	2.78	39.5	27.5%	2018	Bounded on the north and west by Longview St, Helen st to the east, and 19th Ave to the south
42601-1-012	$83,750	$192,100	16	2.38	54.5	7.89%	2018	Bounded on the north by 19th ave, 2nd st to the west,1st st to the east and 17th Ave to the south *Note both 1st and 2nd streets have sidewalks on both sides of the street
42601-1-013	$83,750	$192,100	18	3.38	36.5	33.34%	2018	Bounded by 19th ave to the north, 1st st to the east, Helen St to the west, and 17th Ave to the south
42602-1-004	$78,355	$225,400	34	2.88	43.8	24.7%	2018	Bounded by E. Poplar Ave to the north, Helen st to the west, Lake Blvd to the east, and 19th ave to the south *Block is designated as an area served by the Gateway Trail
42602-1-003	$78,355	$225,400	19	2.75	50.2	18.7%	2018	Bounded by Lydia Ave to the north, Bellaire Ave to the west, Lake Blvd to the east and E. Poplar Ave to the south *Note streets have C&G, no sidewalks *Block is designated as an area served by the Gateway Trail
42602-1-001	$78,355	$225,400	25	2.80	51.8	22.39%	2018	Bounded by Silver Lake to the east, E. Swan Ave and Lake Blvd to the west and 19th ave to the south *Block fronts Silver Lake and Gateway trail connections
42601-2-005	$55,848	$223,500	22	2.85	41.5	20.37%	2020	Bounded on the north by Mesaba Ave and the south, east and west by Buhl Ave *Note both Mesaba and Buhl Avenues have sidewalks on both sides of the street. *Block is north of Casey Lake and Gateway Trail Connection
42601-2-002	$55,848	$223,500	30	2.96	46.5	22.61%	2020	Bounded on the north by Radatz Ave and the south, east and west by Chisholm Ave *Note Chisholm has sidewalks on both side of the street, Radatz has just C&G *Block is northwest of Casey Lake and Gateway Trail Connections
42601-2-006	$55,848	$223,500	28	2.96	45.5	22.37	2020	Bounded on the north by E Shamrock Dr, McKnight on the east, Gerald Ave on the west and E Mohawk Rd on the south *Note McKnight as a sidewalk on western side of the street *Block is east of Casey Lake and Gateway Trail Connections

If one makes the assumption that households with an overall lower median age and with children in the home may be more open to the living streets interconnected concept, then the areas shaded in yellow and orange would be a good area to consider (CIP 2016 and CIP 2018).

If the goal is to create better connections to the Gateway trail system regardless of the current infrastructure, then the green areas should be considered (CIP 2018).

If the goal is to create better connections to the Gateway trail system using existing sidewalk infrastructure, and have enough time to engage the citizens and obtain support for living streets, then the orange areas should be considered (CIP 2020).

NORTH SAINT PAUL VPS DATA SUMMARY CHART

Image name	Sum	Mode	Average	Standard Dev		Diff from Mean	Rank based on Diff
Before Bike Lane	83	2	1.0375	1.24721208			
After bike lane (street)	50	1	0.625	1.74569996		-0.4125	9
After bike lane (offstreet)	-63	-2	-0.7875	1.7334662		-1.825	12
Before Intersection	38	0	0.475	1.36849728			
After Intersection	52	2	0.65	1.98793831	*	0.175	4
Before Raingarden Swale	66	1	0.825	1.39415598			
After Raingarden Swale	50	3	0.625	1.85127394		-0.2	7
Before Street 2	51	0	0.6375	1.2653488			
After Street 2 (narow)	58	1	0.725	1.22189933	*	0.0875	5
After Street 2 (median)	-67	-3	-0.8375	1.96451914		-1.475	11
Before Raingarden 1	26	2	0.325	1.770182			
After Raingarden 1	99	2	1.2375	1.4074283	*	0.9125	1
Before Street 1	43	0	0.5375	1.11314073			
After Street 1	68	1	0.85	1.37886396	*	0.3125	2
Before Raingarden 2	76	2	0.95	1.30141111			
After Raingarden 2	93	2	1.1625	1.44470881	*	0.2125	3
Before out of season RG	-2	0	-0.025	1.55062258			
After out of season RG	-7	1	-0.0875	1.55240728		-0.0625	6
Before Peremable Pavement	42	0	0.525	1.47532447			
After Permeable Pavement	18	1	0.225	1.92895984		-0.3	8
Before out of season RG 2	72	2	0.9	1.24879689			

After out of season RG 2	30	1	0.375	1.49577464		-0.525	10
Image1 (calibration)	18	0	0.225	1.49238574			
Final-Multiple elements	76	2	0.95	1.7203179			
Average Standard Deviation=	1.5275						
*=denotes "after" image with a higher positive mean average than "before" image							

CORRELATION AND REGRESSION TABLES

Variable Measurement Table 3

Image #	Mean rating	Straight Sidewalk	Living Raingardens	Bike lanes	Curb treatments	Dead Raingardens	Pavement treatments	Meandering Sidewalk	Street Narrowing	Median		Variable	Scoring
Before Bike Lane	1.0375	1	0	0	0	0	0	0	0	0		Straight Sidewalk	No straight sidewalk =0; Straight sidewalk=1
After Intersection	0.65	1	0	0	1	0	1	0	1	0		Living raingarden Present	No living raingarden =0; Living raingarden=1
After Raingarden Swale	0.625	0	1	0	1	0	0	1	0	0		Bike Lanes	No bike =0; bike land=1
After bike lane (street)	0.625	1	0	1	0	0	1	0	1	0		Curb treatment	No curbtreatment =0; curbtreatment including curb cuts=1
Before Intersection	0.475	1	0	0	0	0	0	0	0	0		Dead or out of season raingarden	No dead reaingarden=0; Dead reaingarden present=1
After Street 2 (median)	-0.8375	1	0	0	0	0	0	0	1	1		Pavement treatment	No pavement treatment=0; Pavement treatment including
Before Raingarden 1	0.325	0	0	0	0	0	0	0	0	0		Meandering Sidewalk	No meandering sidewalk= 0; Meandering sidewalk = 1
After out of season RG	-0.0875	1	0	0	1	1	0	1	0	0		Street Narrowing	No narrowing= 0; Street narrowing = 1
After Street 2 (narow)	0.725	1	0	0	0	0	0	0	1	0		Median	No Median= 0; Median = 1
Before Street 1	0.5375	1	0	0	0	0	0	0	0	0			
Before Raingarden 2	0.95	1	0	0	0	0	0	0	0	0			
(offstreet)	-0.7875	0	0	1	0	0	0	0	0	0			
After Street 1	0.85	1	1	0	1	0	0	0	0	0			
Before out of season RG	-0.025	1	0	0	0	0	0	0	0	0			
Before Peremable Pavement	0.525	0	0	0	0	0	0	0	0	0			
Before out of season RG 2	0.9	1	0	0	0	0	0	0	0	0			
After Raingarden 2	1.1625	1	1	0	1	0	0	0	0	0			
Before Street 2	0.6375	1	0	0	0	0	0	0	0	0			
After out of season RG 2	0.375	0	0	0	0	1	0	1	0	0			
After Raingarden 1	1.2375	0	1	0	1	0	0	0	0	0			
After Permeable Pavement	0.225	0	0	0	0	0	1	0	0	0			
Before Raingarden Swale	0.825	0	0	0	0	0	0	1	0	0			
Final Image	0.95	0	1	0	0	0	0	1	0	0			

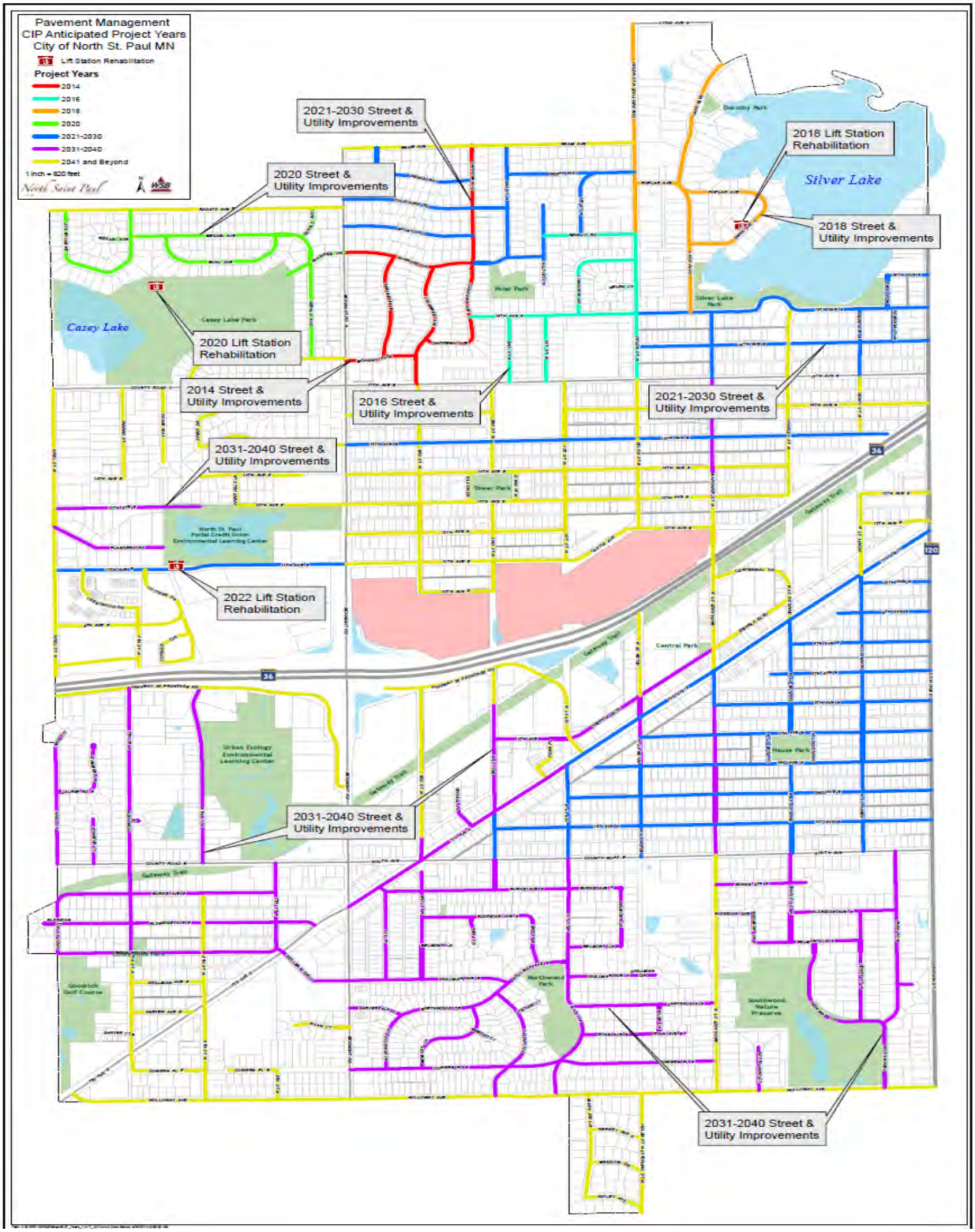
Correlation Analysis

	Straight Sidewalk	*Living Raingardens*	*Bike lanes*	*Curb treatments*	*Dead Raingardens*	*Pavement treatments*	*Meandering Sidewalk*	*Street Narrowing*	*Median*
Straight Sidewalk	1								
Living Raingardens	-0.225374468	1							
Bike lanes	-0.068732175	-0.16265001	1						
Curb treatments	0.070567483	0.647098434	-0.183339699	1					
Dead Raingardens	-0.068732175	-0.16265001	-0.095238095	0.168061391	1				
Pavement treatments	0.046004371	-0.20412415	0.338648106	0.063913749	-0.119522861	1			
Meandering Sidewalk	-0.441358333	0.233333333	-0.162650012	0.166993144	0.585540044	-0.204124145	1		
Street Narrowing	0.367883604	-0.24182542	0.265497122	-0.011357771	-0.141598465	0.503496546	-0.241825417	1	
Median	0.170940865	-0.11236664	-0.065795169	-0.126660099	-0.065795169	-0.082572282	-0.112366644	0.464660189	1

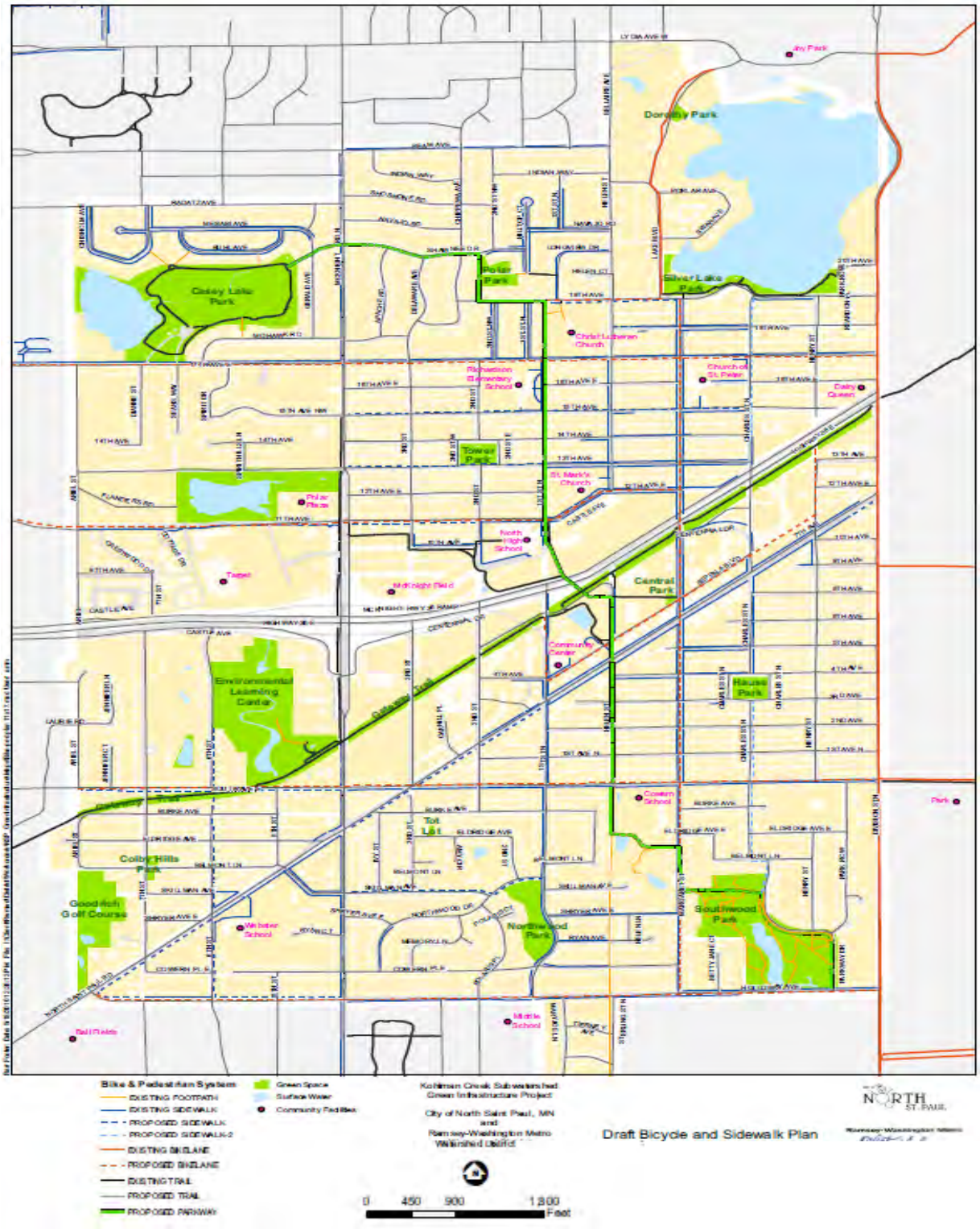
Regression Analysis

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.84827302							
R Square	0.71956712							
Adjusted R Square	0.52542129							
Standard Error	0.37077994							
Observations	23							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	9	4.585832571	0.509537	3.706323	0.016340259			
Residual	13	1.787210908	0.137478					
Total	22	6.373043478						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.40283874	0.184681018	2.181268	0.048123	0.003859658	0.801818	0.003859658	0.801817823
Straight Sidewalk	0.21679389	0.209944849	1.032623	0.320609	-0.236764379	0.670352	-0.236764379	0.670352165
Living Raingardens	0.77135019	0.341389943	2.25944	0.041674	0.033822057	1.508878	0.033822057	1.508878324
Bike lanes	-0.833886	0.31340943	-2.66069	0.019609	-1.510965882	-0.15681	-1.510965882	-0.15680606
Curb treatments	-0.3736164	0.297299328	-1.2567	0.230974	-1.015892562	0.26866	-1.015892562	0.268659737
Dead Raingardens	-0.1881441	0.431868419	-0.43565	0.670236	-1.12113908	0.744851	-1.12113908	0.744850912
Pavement treatments	0.09979723	0.318941425	0.312901	0.759319	-0.589233825	0.788828	-0.589233825	0.78882829
Meandering Sidewalk	0.0074666	0.296021883	0.025223	0.98026	-0.632049795	0.646983	-0.632049795	0.646983001
Street Narrowing	0.38300334	0.329727094	1.161577	0.266291	-0.329328739	1.095335	-0.329328739	1.095335418
Median	-1.840136	0.485492773	-3.79024	0.002249	-2.888979343	-0.79129	-2.888979343	-0.7912926

NORTH SAINT PAUL CAPITAL IMPROVEMENT PLAN



NORTH SAINT PAUL BICYCLE AND SIDEWALK PLAN



City of St. Louis Park
Connect the Park!
Communications Plan

Sidewalk, Trails, and Bikeways
July 2012

A Branded Initiative
As the Sidewalk, Trails and Bikeways plan is a long-term, multi-faceted initiative, it's important that the city establish an identity for it that will be recognizable to community members for years to come. This will also help the public understand that each smaller project is part of something larger. The Communications Division is currently developing a logo and taglines that will be consistent with the city's overall brand but also give an identity to the multi-year initiative under the "Connect the Park" name. Taglines will focus on the initiatives roots in Vision St. Louis Park and on the specific components of the initiative.

Three Phases
There are three phases or components of communication messages/deployment. Some overlap and many tools will be used across phases, but the essential elements are as follows:

Phase One – Educate the public about the roots of the plan (i.e. Vision), explain the work that has been done and the Council's goals for the initiative. This is a citywide effort that will also aim to educate the community about the various components of the plan, the benefits and answer the "why" question and show the overall picture about this initiative.

Phase Two – Educate the public about the specific elements contained in the initiative, projected costs and physical impacts (i.e. loss of right of way, parking, etc.). This communication will be tailored to four quadrants of the city either based on Ward boundaries or other boundaries deemed appropriate by Public Works staff.

Phase Three – Educate the public about the specific elements affecting them in their neighborhoods or on their streets. The most local element of the Communication Plan, this portion will be conducted much like we conduct communications for any street or utility project with meetings and mailings directed at affected parties.

Goals

- To remind residents about the city's Vision, previous work already completed on the sidewalks and trail plan, and the Council's commitment to the long-term vision of a connected community
- Educate residents about the components of the proposed plan (Sidewalks, trails, bike lanes & bikeways)
- To inform residents about new proposed Sidewalk, Trails, and Bikeways in St. Louis Park
- To obtain resident input regarding the proposed Sidewalk, Trails, and Bikeways in St. Louis Park

Communication tools to be utilized in plan

- News release
- Website

- Cable Television
- Social Media
- Neighborhood Newsletters
- Park Perspective
- Staff Presentations
    - Generate list of organizations

- Brochures/Posters
    - Mailed to all residents
    - Handed out at city events
- Maps
- Open Houses

Strategies

News Release – The news release will be issued to the Sun-Sailor, Patch, Star Tribune and local television stations to announce that the city is seeking input on a 10-year plan. A map and project list will be included. ***PHASE 1***

Website – The city will utilize a project website that will include a main article about the initiative (likely based off of the original press release), upcoming events, maps, pdf documents of publications and Council reports related to the initiative, and a list of all of the proposed projects with details (as each project is undertaken). The site will also include a Frequently Asked Questions area that will develop over time, and ways to provide feedback (email/phone) will include staff contacts. ***PHASES 1, 2, 3***

The city will use a separate domain name for the initiative – www.ConnectThePark.org in its branding initiative. This won't be a separate website, but the domain name will be redirected to the project page on the city's website allowing for easy access. The city has used other domain names for marketing purposes such as beautifythepark.org and parkTV.org in the past with success.

Additionally, the proposal will be highlighted on the spotlight of the homepage of stlouispark.org as space is available (usually for a couple of weeks at a time), especially around major events such as public meetings.

Cable Television – We'll highlight the proposed plan in several ways:

- Scripted Public Service Announcement (Commercial) with voiceovers that will run on the Cable TV system, be embedded to the website and shared on social media. This will be an introduction to the "Connect the Park" Initiative and explain how the public can learn more. ***PHASE 1***
- Regular promotion through our weekly "Park Update" program which is shared on the Cable TV system, the website and social media. ***PHASES 1, 2, 3***
- Create a Cable TV Billboard announcement (the informational screens that run on the Cable TV system in between programming) ***Phases 2,3***

Social Media – Social media has become a powerful tool for the city now with nearly 4,500 people inside and outside of the community utilizing them. A series of informal messages linked to our main website article to promote the proposed plan will be utilized. ***Phases 1, 2, 3***

Neighborhood Newsletters – The content of the initial news release, which contains the basic information about the proposed plan, plus a link to the website, will be provided to neighborhood leaders for inclusion in their publications and websites. Additional information will be relayed to the Community Liaison for inclusion in regular communication with neighborhood leaders. ***Phases 2, 3***

Park Perspective – The content of the initial news release, which contains the basic information about the proposal, plus a link to the website, will be included in the August Park Perspective. Photos will be included and the content will be reworked into a basic Q & A format. In the November Park Perspective, a brief update, including any upcoming meetings will be included in the newsletter. After that time, the Park Perspective will be used as a tool for printed updates and to reference the website. It's expected that at least once annually, probably the spring/summer edition each year, the Park Perspective will be utilized for a more extensive update that outlines the planned projects for each year. ***Phases 1, 2, 3***

Flyer / Brochure – A full-color educational brochure will be created highlighting the plan elements proposed for construction, the City's Vision and overall education about the reasons for creating and implementing the plan. This brochure will be mailed to all St. Louis Park households and businesses. ***Phase 1***

Four separate mailings will then be created that deal specifically with projects proposed in the four separate wards (or other quadrants as determined by staff). These mailings will include maps and specific project details and timelines in local area. ***Phase 2***

Poster – Staff will create a full-color 11 x 17 poster containing some details of the proposal and references to ConnectThePark.org and hung in city buildings and other locations throughout the community. ***Phase 1***

Maps – Staff from the Information Resources and Public Works departments will collaborate on both printed and interactive online maps for the public to utilize. ***Phases 1, 2, 3***

Staff Presentations – Staff will provide project presentations to neighborhood and community groups as requested. ***Phases 1, 2, 3***

Open Houses – The city will hold four public meetings (one each in each of the four wards or quadrants as determined by staff). ***Phases 2,3***

Timeline

July

- Staff prepares communication tools (publications, videos, maps, website, posters etc.)

August

- News release issued
- Park Perspective Article
- Website project page launched
- Initial overview publication sent to neighborhoods
- Posters debut

September

- Public Service Announcement Debuts
- TV Billboard announcements begin (highlight meeting dates, website, maps)
- Information shared with neighborhood leaders
- Ward/Quadrant information sent to residents (prior to Public Meetings)
- Public Meetings Begin

October

- Public meetings continue

November

- Park Perspective article

Ongoing

- Social media
- Cable TV
- Website
- Park Perspective

City of St. Louis Park
Connect the Park
Expected Issues and Concerns
Sidewalks, Bikeways, and Trails

Expected issues, concerns, and suggestions related to proposed Sidewalks, Bikeways, and Trails:

1. Sidewalk maintenance (snow removal)
2. Adverse property impacts:
    - reduced yard size
    - removal of trees
    - alterations to walls and fences
    - reduced aesthetics
    - reduced property values
3. Cost - too costly, do not raise taxes
4. Closeness of walks or trails to homes/buildings
5. Driveways will become too short to park cars
6. Concern over increase in outsiders and crime
7. Necessity - there is no need for walks or trails - walk in the street
8. Safety concerns over:
    - additional vehicle/pedestrian conflicts at driveways
    - children falling off retaining walls
9. Discourteous or disrespectful use of walks and trails by users
10. Bicycle traffic will cause or increase congestion
11. Adverse impacts to the character or culture of a neighborhood
12. Put walks/trails at the curbline
13. Put walks on just one side of a street
14. Narrow up walks/trails
15. Do more "on street trails"
16. Narrow up streets
17. Consider one-way streets
18. Eliminate or restrict street parking in some areas
19. Some sidewalks should be removed from the proposal
20. Some sidewalks should be added to the Proposal
21. Locate walks/trails elsewhere – where more appropriate
22. Show more importance to major street crossings
23. Let neighborhoods decide what is best in their respective area
24. Do less, this is too much

City of St. Louis Park
Connect the Park
Guiding Principles
Sidewalks, Bikeways, and Trails

Design & Construction:

1. Current Designs:
   - Sidewalk - 6' concrete with 7' grass boulevard
   - Trail - 10' bituminous with 7' grass boulevard
2. Design Options (when necessary):
   - Narrow grass boulevard up to nothing (eliminate)
   - Narrow sidewalks up to 5' in width
   - Narrow trails up to 8' in width
3. Minimize parking restrictions associated with Bikeway designations
4. Facilities to be ADA accessible.
5. Narrow existing streets to accepted standards
   - Restrict or eliminate parking (when necessary).
6. Curve sidewalks/trails to avoid tree removals.
7. Forester determines tree viability (remove or trim).
8. Leave trees, walks, fences, etc. wherever possible.
9. Relocate or bury utilities in lieu of moving walk or trail.
10. Avoid right of way acquisition whenever possible.
11. Improvements should not decrease public safety.
12. Retaining wall need and ownership to be determined per existing Council policy.
13. Design and construct facilities as adopted by Council unless Council directs otherwise.

Maintenance:

1. Facilities to be maintained to Ordinance requirements or better.
2. All sidewalk and trail repairs are City responsibility and at City cost.
3. Community sidewalk and trail snow removal will be by the City at city cost.
4. Neighborhood sidewalk snow removal will be by residents at resident cost.

Impervious Surface Reduction:

COST BENEFIT

Standard Design *versus* Optimized Design

32'	Street Width	24'
4	Acres Impervious	3
13,000	Cubic Feet of Runoff (in thousands)	9,800
12.8	Pounds of Total Phosphorus in Runoff	9.6
$80,000	Annualized 50-yr Cost per mile	$65,000
0¢	Surplus Funds (cents per dollar)	27¢
none	Incentives	*Street Trees* *Plantings* *Bike Infrastructure* *Pathways* *Neighborhood Amenities* *More Projects...*

Myths vs. Facts

Low-volume residential streets cannot be narrowed for safety reasons and because of emergency vehicle requirements.

Narrower streets slow traffic, which improves safety. Emergency vehicles often travel in narrow drive lanes- like where 2 cars are parked directly opposite each other.

Living streets cost more than a traditional street.

The cost tradeoff between pavement reduction and green infrastructure can result in projects that cost the same, or even less than a wider street.

Every street is a candidate for narrowing.

Local low-volume residential streets without major parking demands may be the best candidates for most communities.

For more information:

Bradley, Scott. "Minnesota GreenStep Cities." Complete Green Streets. Minnesota Pollution Control Agency. Web. 1 Aug 2013. <http://greenstep.pca.state.mn.us/bestPracticesDetail.cfm?bpid=11>.

Living Streets Demonstration. Ramsey-Washington Metro Watershed District. Web. 1 Aug 2013. <http://www.rwmwd.org/index.asp?Type=B_BASIC&SEC={FD1328AC-CEEF-455E-A806-BCEF42A2A1B6}>.

Thompson, Michael. "City of Maplewood MN Living Streets Policy." City of Maplewood, 28 Jan 2013. Web. 1 Aug 2013. <http://www.ci.maplewood.mn.us/DocumentCenter/View/8955>.

Contact Info:

Cliff Aichinger, Administrator
Ramsey Washington Metro Watershed District
P: 651.792.7950
www.rwmwd.org

Ramsey-Washington Metro Watershed District

Reducing Impervious Surface: STREETS

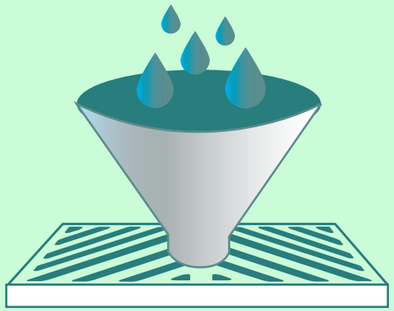
What's the Problem?

Not only does impervious surface have a negative effect on water quality, but building oversized roads costs cities money that could be invested in amenities that improve neighborhood character and increase property values.

55% of water runs off

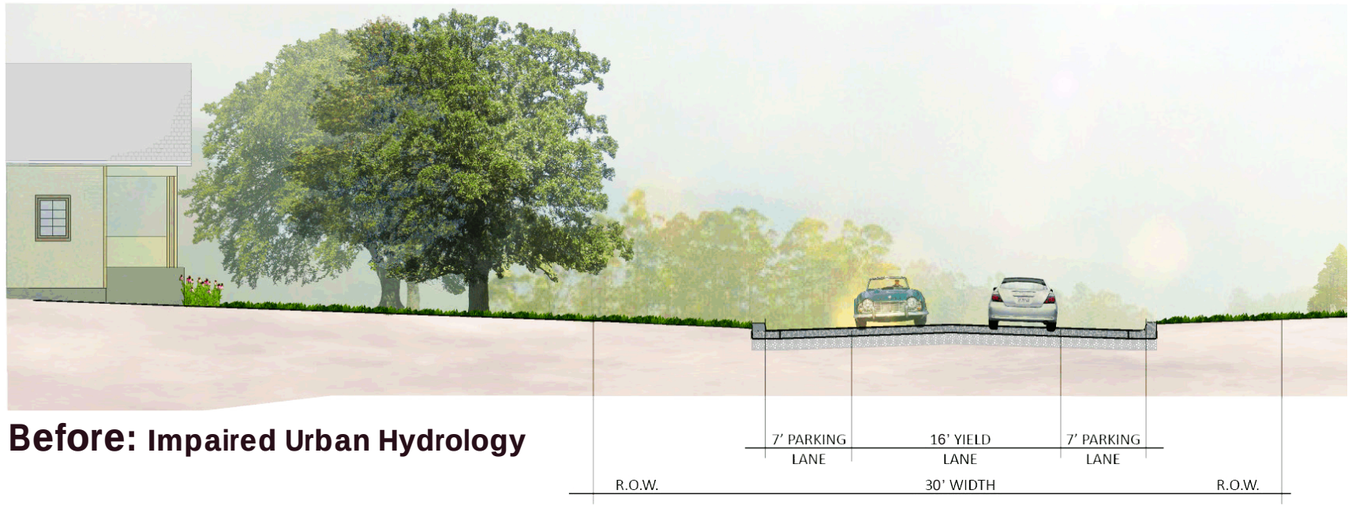
30% of water evaporates

15% filtered or infiltrated



Most streets are like funnels, directing rainwater straight into storm sewers. Eventually that runoff ends up in our lakes and streams. Untreated rainwater carries harmful pollutants to the places we like to swim, fish, or go boating.

Typical Street Transformation



Before: Impaired Urban Hydrology

After: Living Streets Hydrology

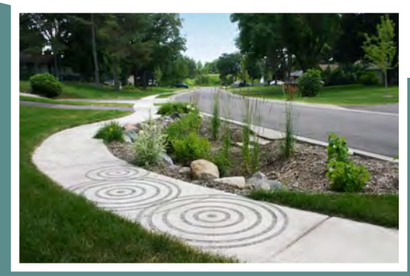
What's the Solution?

The most effective way to reduce runoff pollutants is to treat them at the source. Optimizing street width by eliminating unused parking, but retaining it where necessary, helps to do this. Reducing impervious surfaces results in a smaller volume of runoff, lessens the amount of required stormwater treatment, and allows rainwater to be used as a resource instead of a waste product. Narrowing streets creates more space in the right-of-way and dollars in the budget for green infrastructure.

- Air & Water Pollution
- Urban Heat Island Effect
- Stormwater Treatment Cost
- Roadway Maintenance Cost
- Roadway Construction Cost
- Environmental Footprint
- Traffic Speeds

Reducing Pavement Allows Budget For:

- Street Trees
- Walkability
- Bike Safety
- Green Infrastructure
- Carbon Sequestration
- Groundwater Recharge
- Neighborhood Amenities



Maplewood Living Street Demonstration Project: Constructed in 2012

Eliminating 1 Acre of Impervious Surface Saves:

15 million gallons water
Like filling 23 olympic sized swimming pools

2 million kWh energy
Like powering 237 homes for 1 year

220 tons CO_2
Like taking 46 cars off the road for 1 year