W E S T M I N S T E R

Staff Report

TO: The Mayor and Members of the City Council

DATE: March 13, 2013

SUBJECT: Briefing and Post-City Council Briefing Agenda for March 18, 2013

PREPARED BY: J. Brent McFall, City Manager

Please Note: Study Sessions and Post City Council briefings are open to the public, and individuals are welcome to attend and observe. However, these briefings are not intended to be interactive with the audience, as this time is set aside for City Council to receive information, make inquiries, and provide Staff with policy direction.

Looking ahead to Monday night's Briefing and Post-City Council meeting briefing, the following schedule has been prepared:

Dinner 6:00 P.M.

Council Briefing *(The public is welcome to attend.)* 6:30 P.M.

POST BRIEFING *(The public is welcome to attend.)*

PRESENTATIONS

1. Presentation by Federal Highway Administration on America's Great Outdoors: Feasibility Study for Connecting Urban Refuges to the Denver Greenway Trail Network
2. Street Lighting Study Results and Recommended Standards

CITY COUNCIL REPORTS

None at this time.

EXECUTIVE SESSION

1. Obtain Direction from City Council re proposed Economic Development Agreement pursuant to WMC 1-11-3(C)(4), WMC 1-11-3 (C)(7) and CRS 24-6-402(4)(e).

INFORMATION ONLY

1. 2012 Fourth Quarter City Council Expenditure Report

Items may come up between now and Monday night. City Council will be apprised of any changes to the post-briefing schedule.

Respectfully submitted,

Stephen P. Smithers
Acting City Manager

WESTMINSTER

Staff Report

City Council Study Session Meeting
March 18, 2013

SUBJECT: Presentation by Federal Highway Administration on America's Great Outdoors: Feasibility Study for Connecting Urban Refuges to the Denver Greenway Trail Network

PREPARED BY: Sarah Washburn, Landscape Architect II
Richard A. Dahl, Park Services Manager

Recommended City Council Action:

Listen to overview provided by Federal Highway Administration (FHWA) Staff and provide feedback regarding the multijurisdictional trail network proposed by the Department of Interior and developed by the FHWA).

Summary Statement

This report briefly describes the background and development of a Feasibility Study (attached), funded by the Central Federal Lands Highway Division (CFL) of the FHWA, for the western portion of a multi-modal trail to physically connect Rocky Mountain Arsenal and Rocky Flats National Wildlife Refuges as proposed by the Department of the Interior. Stakeholders for this western segment including the US Fish and Wildlife Service, Cities of Westminster and Arvada, the City and County of Broomfield, and Boulder and Jefferson Counties have all assisted in development of the Study.

Key points in this presentation are:

- President Obama launched the "America's Great Outdoors" (AGO) Initiative to develop a 21st Century Conservation and Recreation Agenda. Part of the Initiative's Vision is to "Connect Americans to the Great Outdoors." In 2011, Secretary of Interior Salazar proposed a "Rocky Mountain Greenway Trail" in response to the AGO Initiative to create a multi-modal trail linking Rocky Mountain Arsenal, Two Ponds, and Rocky Flats National Wildlife Refuges, with a greater vision to eventually expand into Rocky Mountain National Park.
- A Feasibility Study funded by the Federal Lands Highway Program (FLHP) was initiated by the CFL in 2012. The intent of the Study is to compile a guiding outline to allow the project to transition quickly into a design and compliance phase once construction funding is secured.
- The study process included stakeholders from all municipalities. City of Westminster Staff include Sarah Washburn as the primary liaison, with members of the City's internal Parks, Open Space and Trails (POST) Committee updated and solicited for feedback during the draft phase.

- A Steering Committee appointed by the Secretary and State Governor has also provided feedback to guide the Secretary's Vision. CFL is now engaging municipalities' Elected Officials for local support of this project and discussion about the next steps.

Expenditure Required: $0

Source of Funds: N/A

Policy Issue

Should City Council support further involvement of Staff time as liaison to the FHWA for planning and development of the Rocky Mountain Greenway Trail within the City limits?

Alternative

Staff recommends proceeding with further study and feasibility development of this trail as it would create multi-jurisdictional connections in the western portion of the City where few connections exist. Further, the trail study is fully coordinated and funded by the FHWA and no expenditure by the City is currently necessary. In the future, the FHWA will administer a $1.7 million trail construction grant with no associated capital cost to local jurisdictions other than Staff coordination time. Ongoing maintenance responsibilities will be requirements of local municipalities with logistics to be determined at a later date.

Background Information

As part of President Obama's 'America's Great Outdoors' (AGO) initiative, Secretary of Interior Salazar has made connecting urban refuges in the Denver Metro Area a top priority. One of the key focus areas to the initiative is closing the gaps in trail linkages between Rocky Mountain Arsenal National Wildlife Refuge (NWR), Rocky Flats NWR, and Two Ponds NWR. This regionally significant project envisions Rocky Flats eventually becoming the greater Open Space Gateway connecting the metro area population directly to the mountains via Rocky Mountain National Park.

In April 2011, Senior Advisor to Secretary Salazar engaged the City of Westminster in the vision for a "Rocky Mountain Greenway Trail" (RMG) linking the Rocky Mountain Arsenal and Rocky Flats National Wildlife Refuges. If constructed, this could be the first phase in a broader network connecting Denver, its western suburbs, Boulder, Estes Park, Rocky Mountain National Park, and all points in between. A politically-appointed Steering Committee was formed in the Fall of 2012 in an agreement between Secretary Salazar and Governor Hickenlooper to guide development of this project in the context of the Secretary and Governor's broader vision. While the US Department of Transportation and Department of Interior will continue to guide development of the AGO Initiative and this trail project, it is critical that the local communities drive the scope and scale of what is implemented in their respective jurisdictions.

The trail link between the RMG and the Rocky Mountain Arsenal on the east side is now complete and attention is now focused on improving the links to the west between Two Ponds and Rocky Flats National Wildlife Refuge. A Trail Feasibility Study for connecting Rocky Flats to the existing trail network in Denver and trails being planned for points west and the metro area was undertaken by the Central Federal Lands Highway Division of the FHWA and funded through the Federal Lands Highway Program. With Staff liaison involvement from all affected municipalities throughout the process, the Study is nearly complete.

A Trail Use Report with forecast travel demands on various trail sections as well as potential federal, state, local and private funds to design and construct the trail is forthcoming. Additionally, a Federal Transit Administration grant submitted by the US Fish and Wildlife Service in 2012 to assist in design and construction of the trail has been awarded. This $1.7 Million grant will be administered through the FHWA, with local agencies including the City of Westminster acting as core stakeholders without

responsibility or expectation for capital funding toward the project. Funding constraints may ultimately require the FHWA to proceed with a phased construction approach, potentially including utilization of less ideal existing trails, existing at-grade crossings, and other interim solutions.

Elijah Henley, Transportation Planning Team Lead with the Central Federal Lands Highway Division with the FHWA, will be in attendance at Monday's Post City Council Meeting to provide an overview of the Feasibility Study and solicit feedback.

Although Secretary Salazar will be stepping down, this project will continue to be a top priority for the Department of the Interior. This Feasibility Study supports the City's Strategic Plan Goals of "Financially Sustainable City Government Providing Exceptional Services" and "Beautiful and Environmentally Sensitive City."

Respectfully submitted,

Stephen P. Smithers
Acting City Manager

Attachment

America's Great Outdoors: Feasibility Study for Connecting Urban Refuges to the Denver Greenway Trail Network

Rocky Flats and Two Ponds National Wildlife Refuges

Draft Scoping Report

February 2013

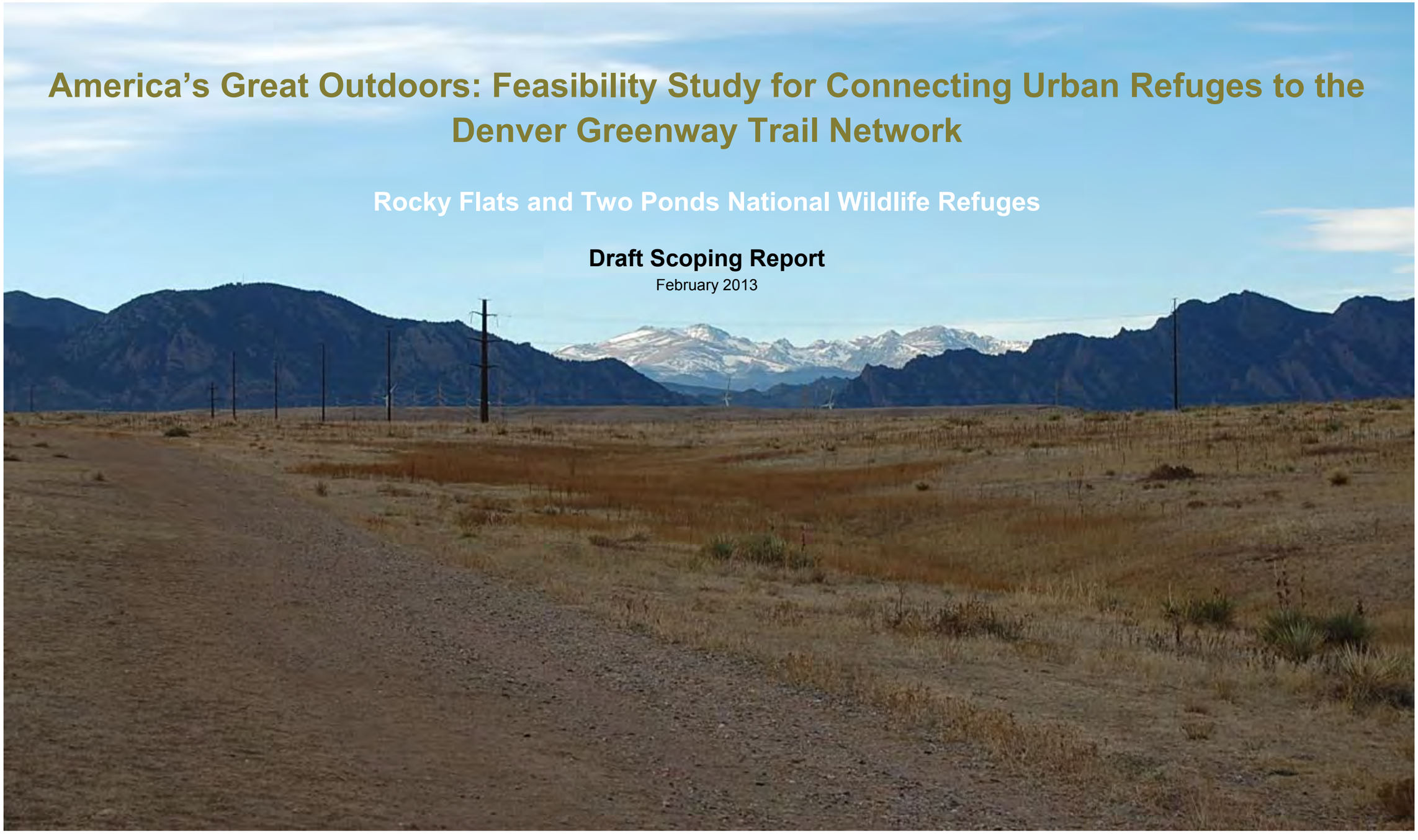


Table of Contents

List of Figures

List of Tables

This page intentionally left blank.

1. Introduction

The Rocky Mountain Greenway supports the America's Great Outdoors (AGO) initiative and ongoing efforts to better connect urban units of the National Wildlife Refuge System to the metropolitan areas in which they are located. As a part of this initiative, this project involves evaluating trail connections between Rocky Flats National Wildlife Refuge (NWR), Two Ponds NWR, and the adjacent Little Dry Creek Trail.

This scoping report summarizes the findings of the site visits, jurisdictional input, and evaluates existing facilities. This report describes the general start and end point of the existing trails; describes potential trail alignments and connections identified by partner jurisdictions during the site visits; and considers natural and cultural resources, and possible trail amenities.

The following principles were evaluated while scoping the conceptual trail alignments, trail connections, and potential trailheads:

- Provide a continuous, non-motorized, multi-use trail (accommodating, where feasible, wheeled uses and pedestrians) along the length of the trail. The trail shall conform to American Association of State Highway and Transportation Officials (AASHTO) trail design and construction standards. A minimum trail tread width of 10 feet should be accommodated wherever possible.
- The trail system should serve as a main spine trail from the Rocky Mountain Arsenal NWR running east and west to the Rocky Flats and Two Ponds NWRs. It should also connect to the Colorado Front Range Trail west of Rocky Flats, local trail loops, tributary trails, and safe on-street routes that lead to communities and other destinations along the length of the Little Dry Creek Trail, when feasible.
- Trails and trail facilities should be designed to minimize adverse impacts to the natural environment.
- All trail and trail improvements shall balance reasonable financial constraints with design excellence. Trails should be safe and economical to build and maintain.
- All trail improvements should be designed for minimal visual intrusion and impact on the surrounding environment.
- The trail should be properly designed and adequate to avoid/minimize user conflict and overcrowding.
- Where feasible, at-grade road crossings shall be avoided. Grade-separated crossings such as underpasses and overpasses shall be considered.
- Where feasible, the trail shall serve multiple objectives such as recreation, transportation, drainage way maintenance and emergency access.

1.1. Study area

The study area includes the City of Arvada, City of Westminster, City and County of Broomfield, City and County of Boulder, City of Superior, and Jefferson County, as shown in Figure 1. Two Ponds NWR is located in the City of Arvada at the southeast corner of Kipling Street and West 80th Avenue. Rocky Flats NWR is located in Jefferson County, southwest of the intersection of State Highway (SH) 128 and Indiana Street. The feasibility study area includes the area roughly bounded by Wadsworth Boulevard to the east, SH 93 to the west, West 80th Avenue to the south, and SH 128 to the north.

1.2. Site visits

A series of site visits were completed with staff from the City of Arvada, City of Westminster, City and County of Broomfield, City of Boulder, and Boulder County Open Space. The intent of these site visits was to work with agency staff to identify potential trail alignments and trailhead locations, identify areas of concern within trail networks, and identify any project constraints that may exist within each jurisdiction. Dates and locations of the site visits are listed in Table 1.

Table 1. Site visits

Date	Jurisdiction
October 29, 2012	City of Westminster
October 29, 2012	City and County of Broomfield
October 30, 2012	City of Arvada
October 30, 2012	Boulder County, Boulder County Open Space, and City of Boulder
November 28, 2012	Multi-jurisdictional

Prior to completing the site visits, data were collected from each agency regarding their existing trails, proposed connections, and alignments. Figure 2 displays the existing trail networks within the study area. Figure 3 shows the potential trail alignments based on community plans and input from project stakeholders.

Figure 4 through Figure 12 summarize the findings of the site visits. These figures show existing trail connectivity, proposed alignments, transit access, and areas of interest or concern.

Figure 1. Jurisdictional boundaries within the study area

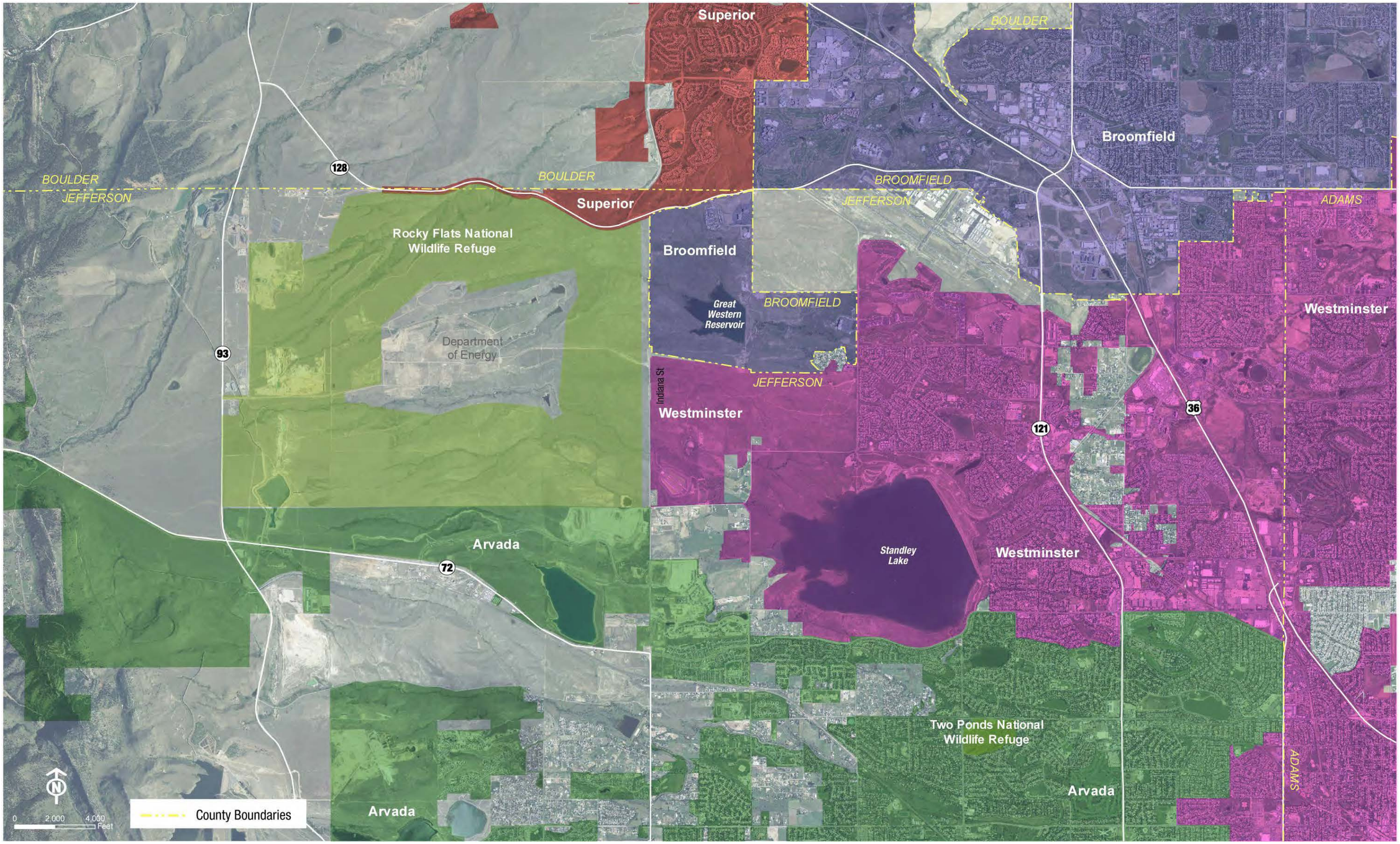


Figure 2. Existing trail network

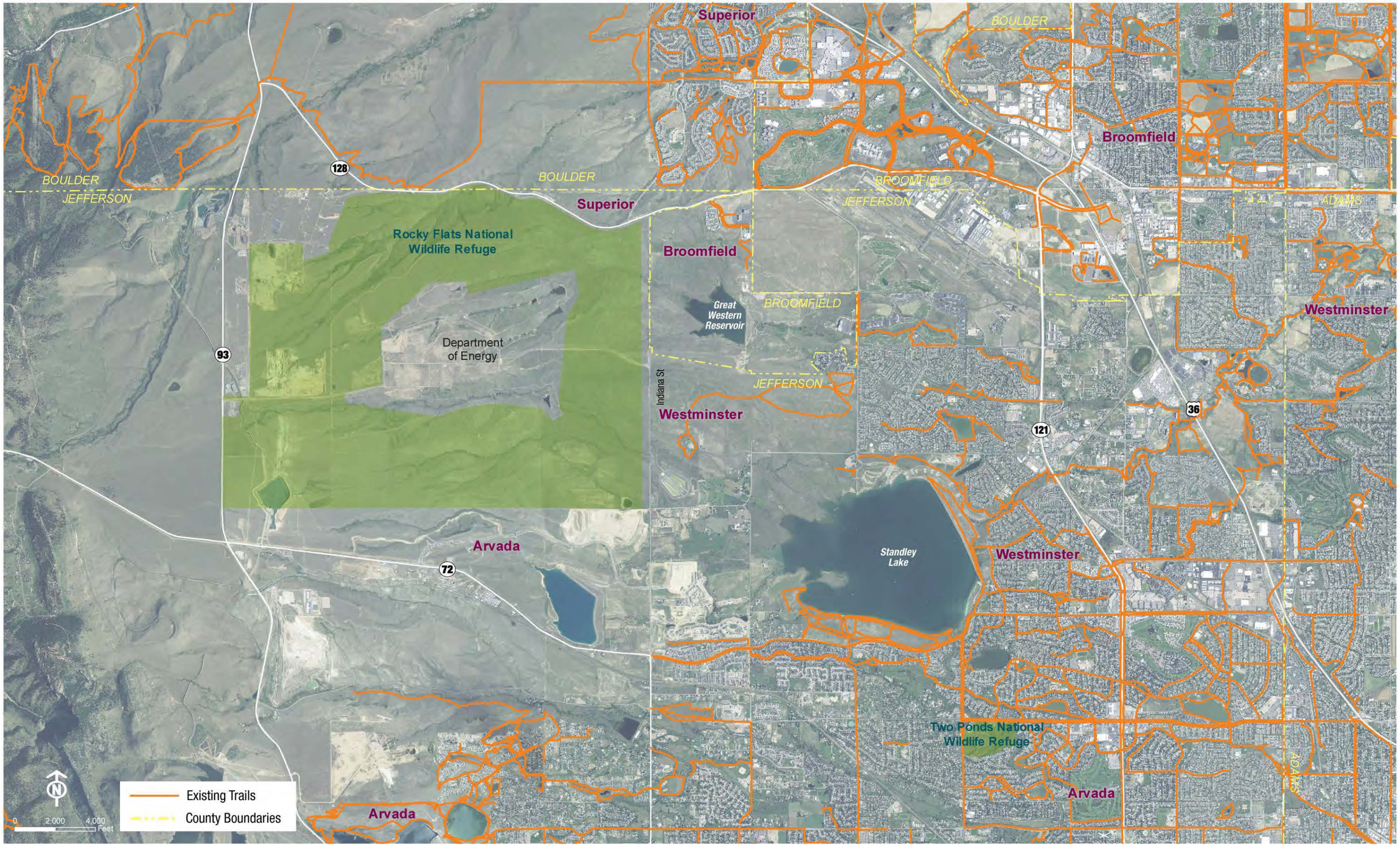
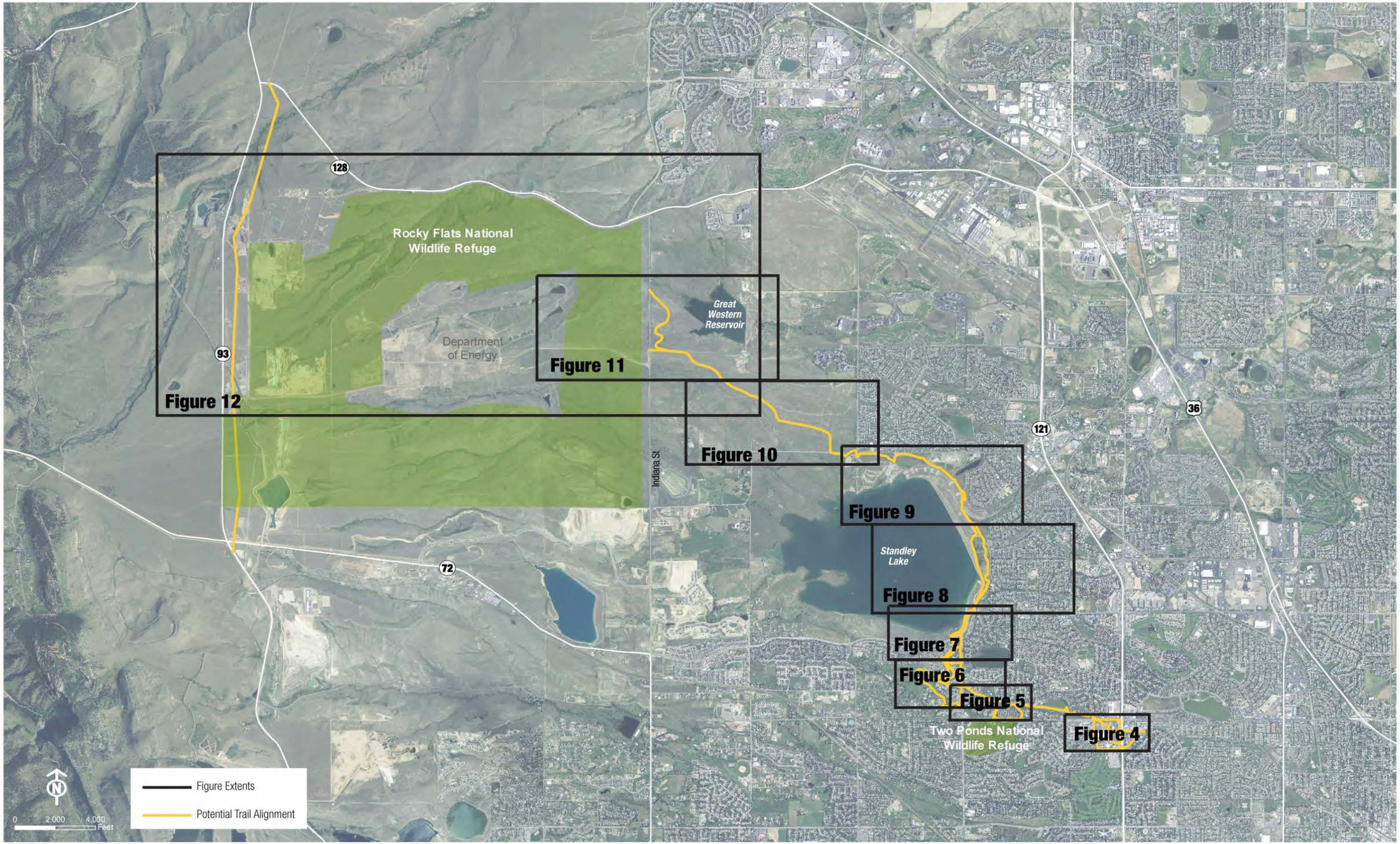


Figure 3. Potential trail alignments



1.2.1. City of Arvada

Two Ponds NWR is located in the City of Arvada in the southeast portion of the study area. The Little Dry Creek Trail is the main trail running east-west through the City of Arvada, a few blocks north of Two Ponds NWR. In order to connect Two Ponds NWR to Rocky Flats NWR, the Little Dry Creek Trail is the primary existing alignment considered.

Currently a gap exists in the off-street trail connectivity near Wadsworth Boulevard. The current off-street trail alignment along the Little Dry Creek drainageway ends at Vance Street. The trail continues on the attached sidewalk until the at-grade crossing of Wadsworth Boulevard at West 77th Avenue, where it becomes a sidewalk and on-street bike lane. The City of Arvada has expressed an interest in continuing the off-street connectivity by continuing the trail along the Little Dry Creek drainageway. This will require a below-grade crossing at Wadsworth Boulevard that will connect the Northridge Shopping Center on the southwest corner of West 80th Avenue and Wadsworth Boulevard to the Little Dry Creek Trail. Providing a grade-separated crossing along this alignment option will improve trail connectivity and the safety of the trail users.

The existing box culvert for the Little Dry Creek drainageway under Wadsworth Boulevard

Heading northwest from the Northridge Shopping Center at West 80th Avenue and Pomona Drive, the existing trail primarily runs parallel to Little Dry Creek through green space within an existing neighborhood, as shown in Figure 4. Two main options exist to connect trail users to Two Ponds NWR, as seen in Figure 5. A connection can be made south on Club Crest Drive and west on 80th Avenue or a connection can be made south on Hoyt Drive and east on West 80th Avenue to Two Ponds NWR. Both options are viable and sidewalks can be widened to accommodate a 10-foot wide multi-use path that leads to the refuge. If both alignments are improved, new signage can be added to guide users from the Little Dry Creek Trail to the "Two Ponds Loop." The City of Arvada recognizes the need for new and improved wayfinding and is prepared to provide this.

Additional opportunities exist to provide a trail alignment through a more natural environment along the Farmer's High Line Canal or the Croke Canal, as shown in Figure 6. While providing a trail alignment along the canals will enhance the user experience, it introduces a unique set of challenges. This alignment is within the right-of-way of the ditch companies and a significant amount of coordination and agreements will need to occur before moving forward with planning and design for an alignment along the canals. Multiple irrigation ditch crossings will be required to complete this proposed trail alignment. In addition, potential impacts to water quality and wildlife within this area will need to be identified.

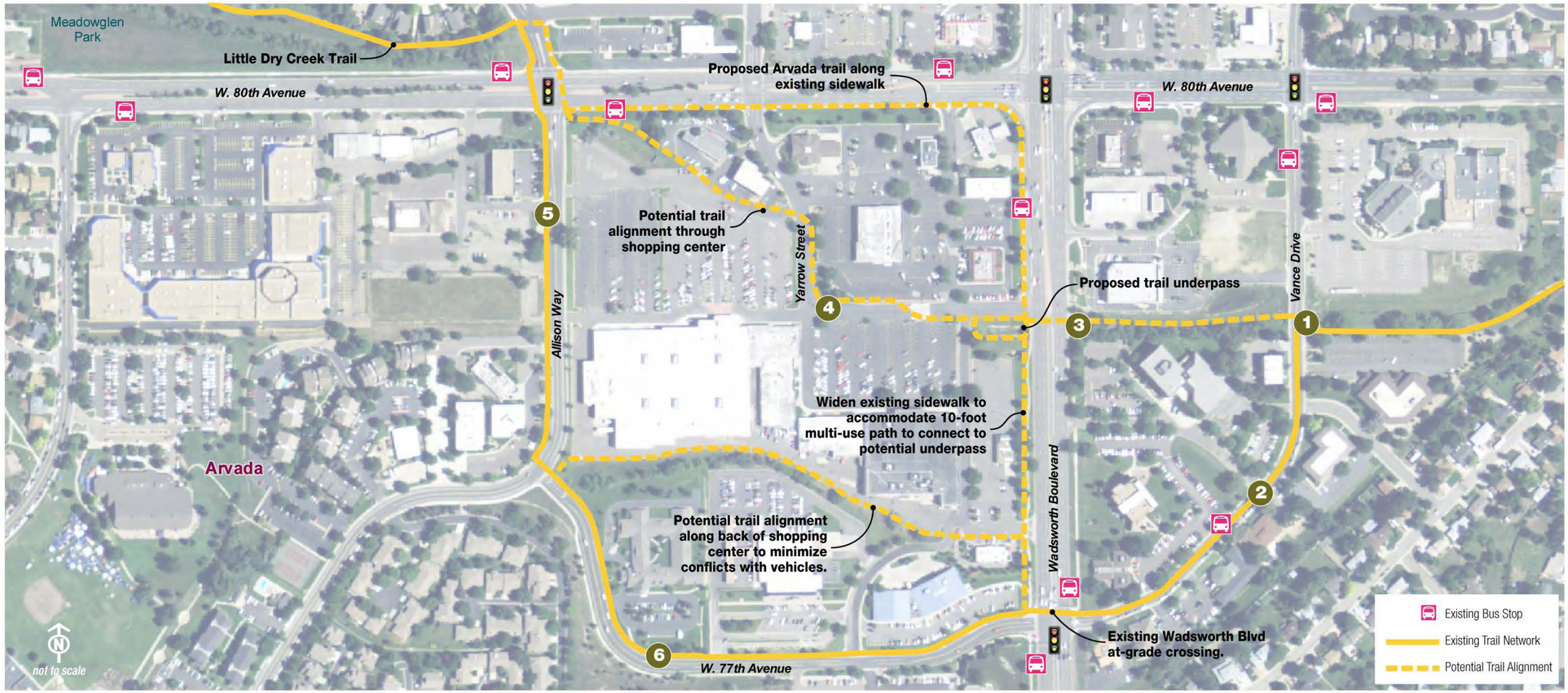
The City of Arvada has plans to develop a trailhead in the southwest corner of the Kipling Street and West 86th Parkway intersection, just north of the Standley Lake Library, as shown in Figure 7. Another alignment option will improve the existing, detached sidewalk on the west side of Kipling Street. If improvements are made to the sidewalk along Kipling Street north to West 86th Parkway, just past the Standley Lake Library, the Little Dry Creek Trail can be connected to the potential trailhead. This alignment can be used with minimal improvements while negotiations with the ditch companies take place. The existing sidewalk is shown in Figure 5, picture 1.

Between Arvada and Westminster the character of the proposed trail alignment transitions from a built environment to a more natural setting with extensive mountain views around Standley Lake. The existing connection between Arvada and Westminster is an at-grade crossing at the signalized intersection of Kipling Street and West 86th Parkway. With the addition of a trailhead at this location, it is anticipated that the number of trail users will increase, and a grade-separated crossing under West 86th Parkway is preferred.

Incorporate the natural environment to enhance user experience

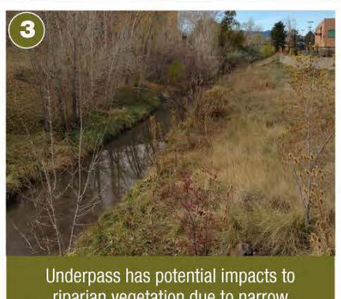
The trail alignment under the existing bridge at West 86th Parkway will require additional design considerations. These considerations include trail and bridge height clearances, construction in a possible floodplain, potential excavation adjacent to existing abutments, and trail user safety within the ditch company's right-of-way. If the bridge underpass is considered unfeasible, the existing sidewalk and bike lane along West 86th Parkway is a possible trail connection between Westminster and Arvada.

Figure 4. Start of trail, Northridge Shopping Center in Arvada

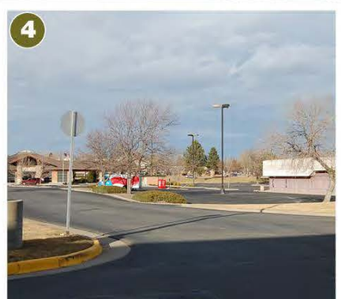


Existing Little Dry Creek Trail. Off-street,10-foot, multi-use path. Wayfinding signs are faded and illegible. Replace signs. View looking east.

Little Dry Creek Trail continues on attached sidewalk along Vance Street. View looking south.



Underpass has potential impacts to riparian vegetation due to narrow corridor and adjacent vegetation. Potential impacts to wildlife; located inside Preble's Meadow Jumping Mouse block clearance zone. View looking west.

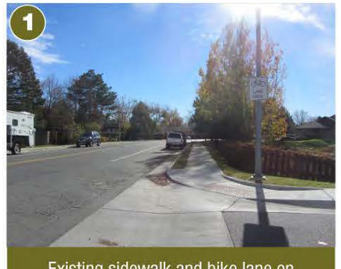


Yarrow Street through the North Ridge shopping center. View looking north.

Existing bike lane and attached sidewalk. Widen sidewalk to accommodate 10-foot multi-use path. View looking north.

Existing trail alignment, on street bikepath and sidewalk.

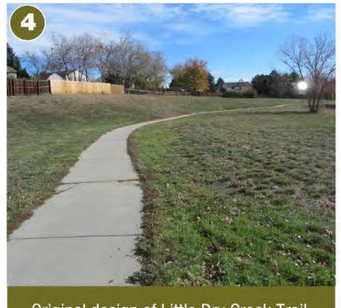
Figure 5. Potential Two Ponds loop



1 Existing sidewalk and bike lane on Club Crest Drive. Widen sidewalk to accommodate a 10-foot multi-use path. Path along Club Crest Drive, 80th Avenue, and Hoyt Way can form a future "Two Ponds Loop."

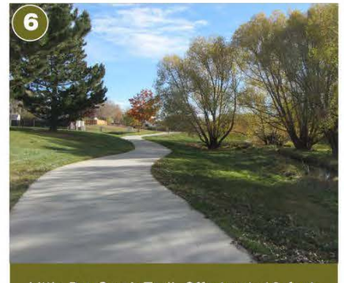
2 Sidewalk on 80th Avenue. Expand to accommodate a 10-foot multi-use path. View looking east from gated entrance to Two Ponds National Wildlife Refuge.

3 Improve sidewalk along Hoyt Way to include multi-use path. Sidewalk on west side is from curb line to fence line. Sidewalk on east side has more space for potential widening of sidewalk.



4 Original design of Little Dry Creek Trail. Trail in need of maintenance. Encourage regrowth of wetlands near creek. View looking east.

5 Existing at-grade crossing for the Little Dry Creek Trail. At-grade crossing marked with cross-walk and flashing beacon.

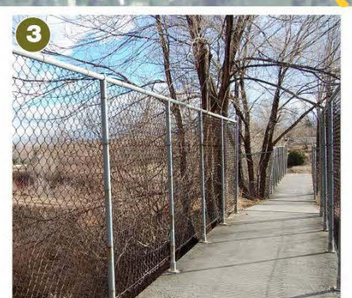


6 Little Dry Creek Trail. Off-street, 10-foot, multi-use path. Wetlands have been restored to a more natural condition as desired by the City of Arvada. View looking west.

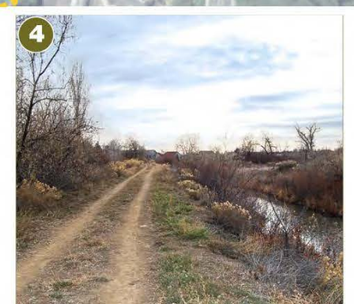
Figure 6. Farmer's High Line Canal and Croke Canal

1 Kipling Street underpass, looking west. Provides access to Little Dry Creek Trail and sidewalk on Kipling Street.

2 Connection to existing Little Dry Creek Trail. Improvements and crossings within ditch company right-of-way require extensive coordination and present a unique set of challenges.



3 Existing pedestrian crossing within ditch company right-of-way. Potential to widen crossing and logical location for future trail crossing.



4 Potential trail just east of the Croke Canal. Social trails indicate current use by pedestrians and cyclists.

5 Social trail indicates pedestrians are using ditch maintenance roads for access to and from the library.

6 Protect existing wildlife habitat, travel corridors, and nesting from increased pedestrian traffic.

Figure 7. Standley Lake Library and Arvada's proposed trailhead

1 Widen existing sidewalk to accommodate a 10-foot multi-use path. This trail alignment will not require involvement with the ditch companies and may be easier to implement.

2 Trailhead can incorporate natural features by enhancing existing cottonwood trees, native grass, and water. Existing noxious weeds, prairie dogs, and erosion may require restoration.

3 Protect existing wildlife habitat, travel corridors, and nesting from increased pedestrian traffic. Minimize visual impacts to surrounding residences.

4 Enhance connection between Standley Lake trails and Arvada. Create improved trail underpass and link users to natural habitat.

5 Provide benched multi-use path downslope from existing sidewalk near existing social trail alignment.

6 On-street bike lane and sidewalk on 86th Avenue parkway.

Social trail under 86th Parkway, which requires additional design considerations

1.2.2. City of Westminster

The City of Westminster is located in the center of study area and contains Standley Lake Regional Park and Westminster Hills Open Space. In order to feasibly connect Two Ponds NWR to Rocky Flats NWR, a trail alignment will likely go through these open spaces. The existing trail system in the Standley Lake Regional Park consists of multiple unpaved trails. The existing trails meander around Standley Lake and provide trail users access to recreation with multiple connections to adjacent neighborhoods and parks, as seen in Figure 8 and Figure 9.

A possible trail alignment option east and northeast of the Standley Lake is to follow the existing maintenance road at the base of the dam. The trail will need to be constructed as far from the dam embankment as possible to account for potential future dam expansion. Improvements to the existing unpaved trail system through Standley Lake Regional Park will provide connections to the trailhead located on West 100th Avenue and the Nature Center at Simms Street and West 100th Avenue. This intersection is the main entrance into Standley Lake Regional Park and has high use during the months of May through September creating a high potential for user conflicts between vehicles, towed boat traffic, pedestrians and cyclists.

Since the surface recreation rights for Standley Lake Regional Park are owned by the Farmer's Reservoir and Irrigation Company (FRICO) and have been leased to the City of Westminster for use as a recreation area, any new trail alignment will need to be discussed with FRICO. In addition, an Intergovernmental Agreement (IGA) governs the water use and is managed by the Standley Lake Operations Committee (SLOC). Members of the SLOC include officials from the City of Westminster, the City of Northglenn, the City of Thornton, Jefferson County and FRICO. Possible trail alignments will need to be discussed with SLOC and FRICO as they may require changes to the existing IGAs.

The non-standard intersection configuration and lack of pedestrian facilities at West 100th Avenue and Simms Street creates a safety concern for pedestrians and cyclists during busy summer months

The potential trail alignment heads northwest from the Nature Center into Westminster Hills Open Space. This will require a pedestrian crossing of West 100th Avenue that will likely be at-grade. The City of Westminster requires an offset of 1,350 feet from the intersection of West 100th Avenue and Simms Street for this particular pedestrian crossing at this design speed; therefore, the trail alignment will need to cross West 100th Avenue no closer than 1,350 feet west of this intersection to meet Westminster traffic requirements.

An environmental consideration at this location is a bald eagles' nest located in the northwest portion of the Standley Lake Regional Park. According to the National Bald Eagle Management Guidelines from the U.S. Fish and Wildlife Service, no buffer is needed for non-motorized recreation and human entry outside of breeding season; however, a 330-foot buffer should be maintained during breeding season. Both a 330-foot buffer and a 660-foot buffer are shown in Figure 9.

Another environmental consideration is the Westminster Hills Dog Park located northeast of Westminster Hills Open Space. In order to create separation from the off-leash dog park, the City of Westminster will require a city-standard, split-rail fence to be erected between the park and the trail.

An example of the city standard splitrail fence, as seen at the trailhead to Standley Lake Regional Park

1.2.3. City and County of Broomfield

The potential trail alignment connecting the City of Westminster's open space and the City and County of Broomfield will likely begin at the southern border of the Great Western Open Space, near the Great Western Reservoir. An abandoned railroad grade runs east-west across the southern portion of the open space and could be used as a potential alignment. The rail bed is located along a natural highpoint across the open space, provides scenic views in all directions, and will require less earthwork than placing a trail alignment downslope toward the Great Western Reservoir. As the rail bed approaches Indiana Street, there is a cut in the terrain for Indiana Street, which is a logical location for a grade-separated crossing. A grade-separated overpass crossing is preferred at this location due to

existing grades and the speed of traffic along Indiana Street. This will provide a connection for trail users to the Rocky Flats NWR once it is open to the public.

Another potential alignment exists just west of the Great Western Reservoir. This trail alignment would follow the abandoned rail bed and then travel on the western side of the Great Western Reservoir towards Walnut Creek. This alignment will need to be located outside of the high water limit of the reservoir and consider the possibility of future reservoir expansion in order to avoid potential flooding of the trail. Currently, the proposed high water line is identified by the City and County of Broomfield at 5,640 feet, as shown in Figure 11. The trail alignment could meander around the reservoir just to the west of the high water line and access Rocky Flats NWR by an underpass near Walnut Creek.

To improve regional mobility and accessibility, the trail should connect to the potential trail identified within the Jefferson Parkway alignment and to the trails identified in the Rocky Flats NWR Comprehensive Conservation Plan (CCP). The Jefferson Parkway is a potential highway connection between the existing Northwest Parkway and C-470. The Parkway is planned to include a 10-foot wide, multi-use trail that extends along the parkway and eventually connects to the US 36 Trail, as identified in the environmental impact statement (EIS). The approximate alignment of Jefferson Parkway runs parallel to Indiana Street on the eastern side of Rocky Flats NWR and then heads northeast of the Great Western Reservoir towards the Northwest Parkway. The potential Jefferson Parkway alignment is identified in Figure 11 and Figure 12.

Any trail alignment should be coordinated with the Jefferson Parkway. The Jefferson Parkway has identified the underpass at Walnut Creek, however, due to grades in the area, the potential overpass south on Indiana Street is the preferred crossing. Further analysis will ultimately identify which crossing of Indiana Street is recommended.

1.2.4. U.S. Fish and Wildlife Service

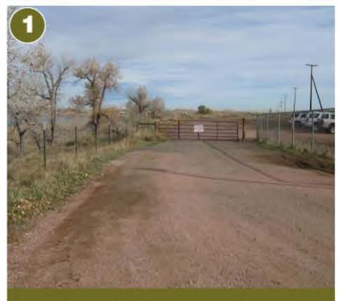
The U.S. Fish and Wildlife Service completed a CCP for the Rocky Flats NWR in 2007. A CCP is a planning document that describes the desired future conditions of a Refuge and provides long-range guidance and management direction. The CCP identifies six potential connections to the regional trail system, two of which are located along Indiana Street. One of the potential connections is identified along Indiana Street to connect to the future Westminster trail system. The other is identified to connect to the Great Western trail system, near Walnut Creek.

An additional connection is identified in the CCP along SH 128 near McCaslin Boulevard. This connection would allow users to connect to the Coalton Trail and the Boulder County trail network. Another connection is identified on the western side of the Refuge connecting to the Colorado Front Range Trail potential alignment. The FWS is in the process of updating the CCP for the Rocky Flats NWR. Through this update, the crossings identified as part of this report will be considered. Further analysis will identify which connections best serve the Refuge.

1.2.5. Jefferson County

Unincorporated Jefferson County is located in the northwest portion of the study area. In addition to an eastern connection to Rocky Flats NWR, Jefferson County has identified a proposed trail alignment along SH 93 as part of the Colorado Front Range Trail, as seen in Figure 12. The Colorado Front Range Trail is a Colorado State Parks initiative. Their vision is to create a multi-purpose trail from Wyoming to New Mexico that links communities, cultural and historic resources, parks, and open space along the Front Range. The proposed alignment runs parallel to Rocky Flats NWR, just west of the refuge along SH 93. If this connection is made, additional trail users from the north, south and west will be able to access Rocky Flats NWR and connect to the potential alignment east of Rocky Flats NWR leading through Broomfield, Westminster and Arvada to Two Ponds NWR.

Figure 8. Eastern Standley Lake



1 Existing gated entrance to Standley Lake maintenance road open to pedestrians and cyclists, but may have conflicts with maintenance vehicles.

2 Social trails in Standley Lake Regional Park. View looking west.

3 Existing footpath on dam wall. View looking west.

4 Existing connection to Oakhurst Park, part of the Land and Water Conservation Fund through the National Park Service. Path becomes paved half way along the trail. View looking east.

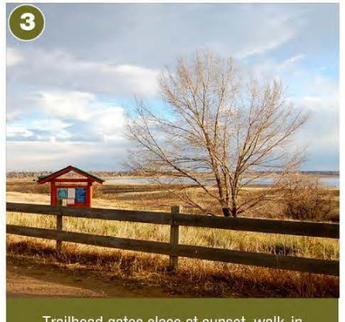
5 Approximate trail alignment along maintenance road at the base of the dam through the wetlands/open space. Maintenance road may be relocated depending on dam expansion.

6 Existing gravel maintenance road at the base of the dam. View looking north.

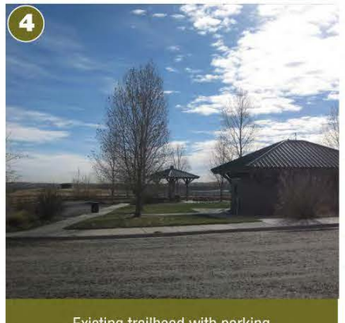
Figure 9. Standley Lake Regional Park

1 Wayne Carle Middle School as seen from the potential trail alignment in Standley Lake Regional Park. View looking northeast.

2 Existing check dams on the spillway. Increased grade as maintenance road climbs from the bottom of the spillway to the top of the dam.



3 Trailhead gates close at sunset, walk-in access anytime.

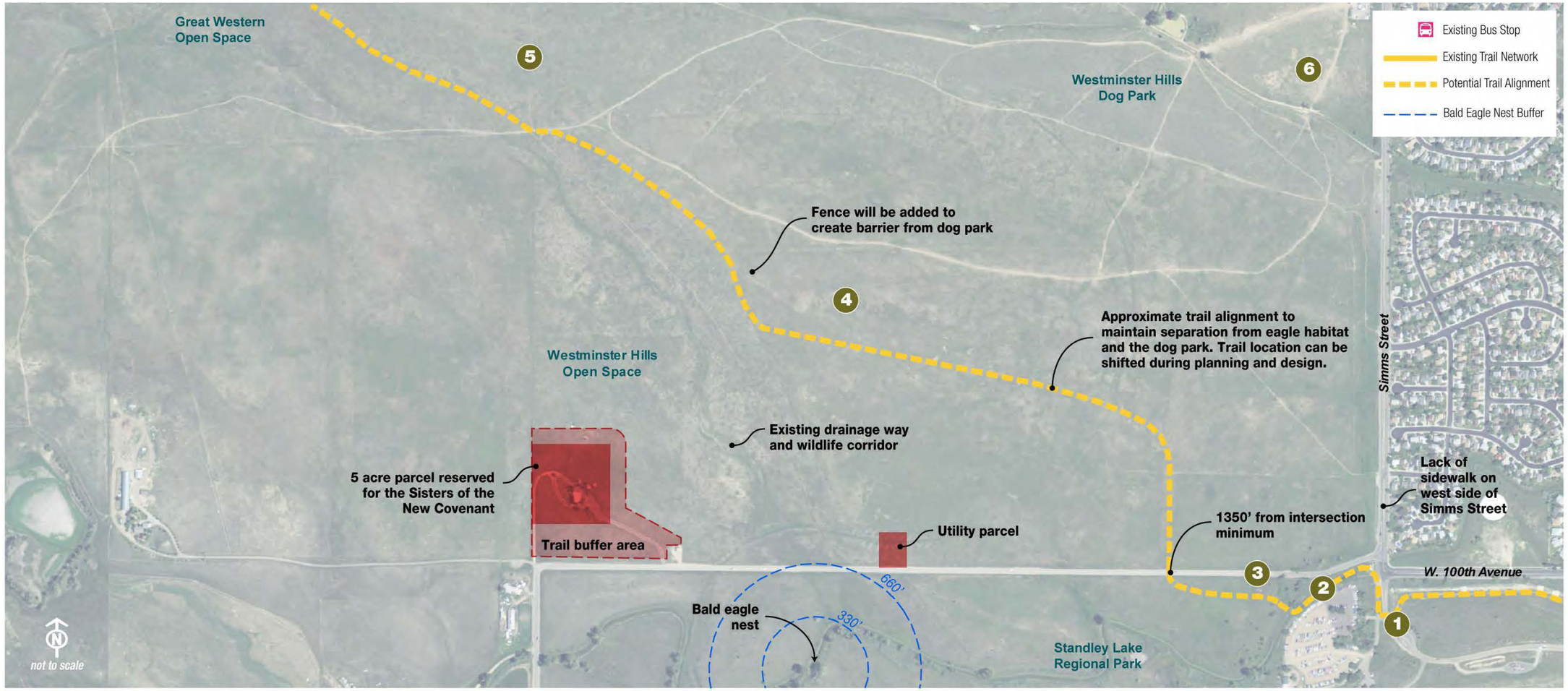


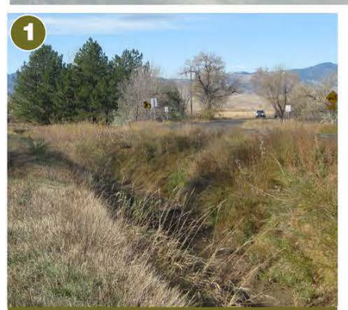
4 Existing trailhead with parking and facilities.

5 Non-standard intersection configuration and lack of sight distance may have a negative impact on safety at main entrance. Boaters back up during peak season to enter the park. Lack of pedestrian facilities at this intersection.

6 Ditch located behind the boat storage facility. Ditch must be crossed in order to get Westminster Hills Open Space.

Figure 10. Westminster Hills Open Space





Ditch is a barrier between potential trail alignment and 100th Avenue. View looking west.

Potential ditch crossing location. Secure the adjacent boat storage. View looking southwest.

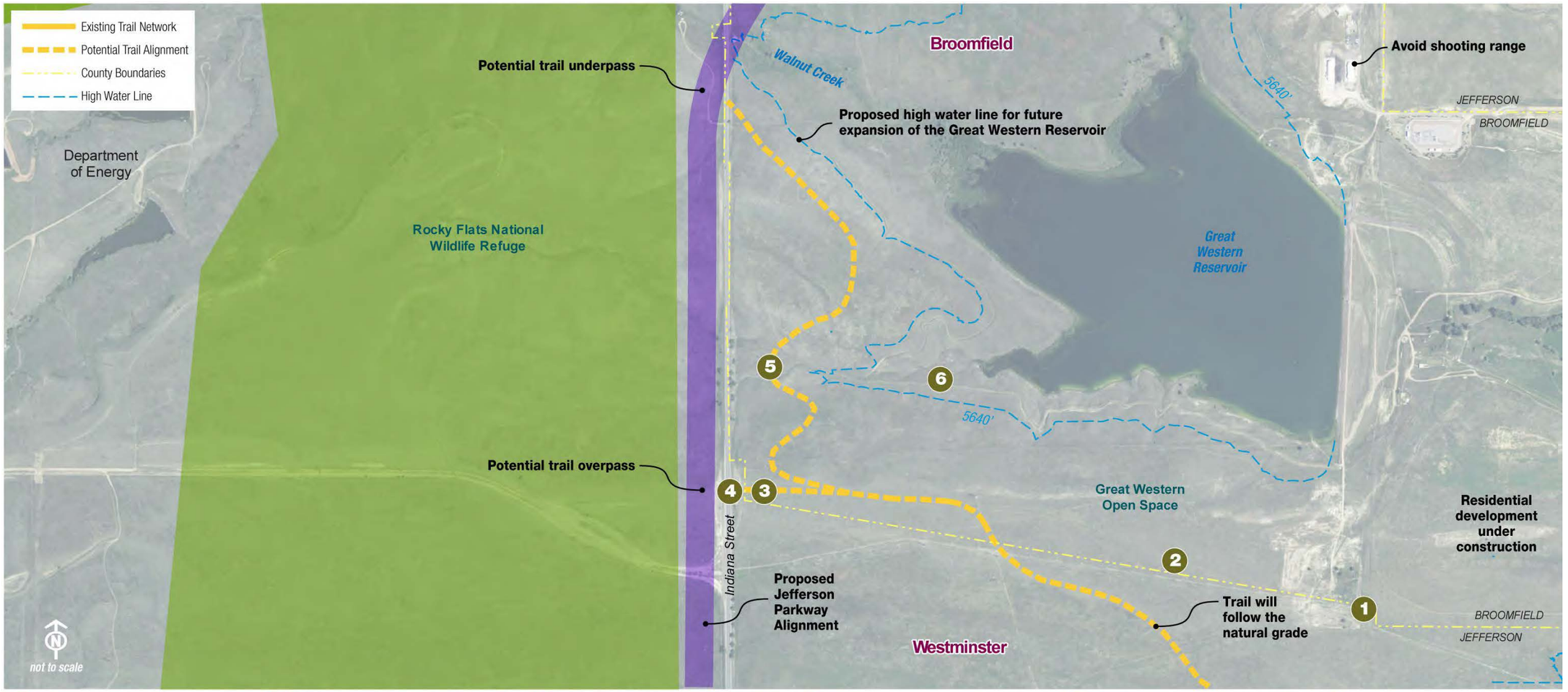
Proposed at-grade crossing of 100th Avenue. Crossing should be located at least 1350 feet from intersection as required by Westminster.

Footpath through open space. View looking north.

Existing fence line designating the boundary of the Westminster Hills dog park. View looking north toward connection to Broomfield open space.

Westminster Hills dog park. Separate trail alignment from dog park with City of Westminster standard two-rail open space fencing to avoid user conflicts.

Figure 11. Great Western Reservoir and eastern Rocky Flats Wildlife Refuge



1 Connection of Westminster and Broomfield open space. View looking east.

2 Follow railroad bed westward towards Rocky Flats. This alignment incorporates views of the mountains.

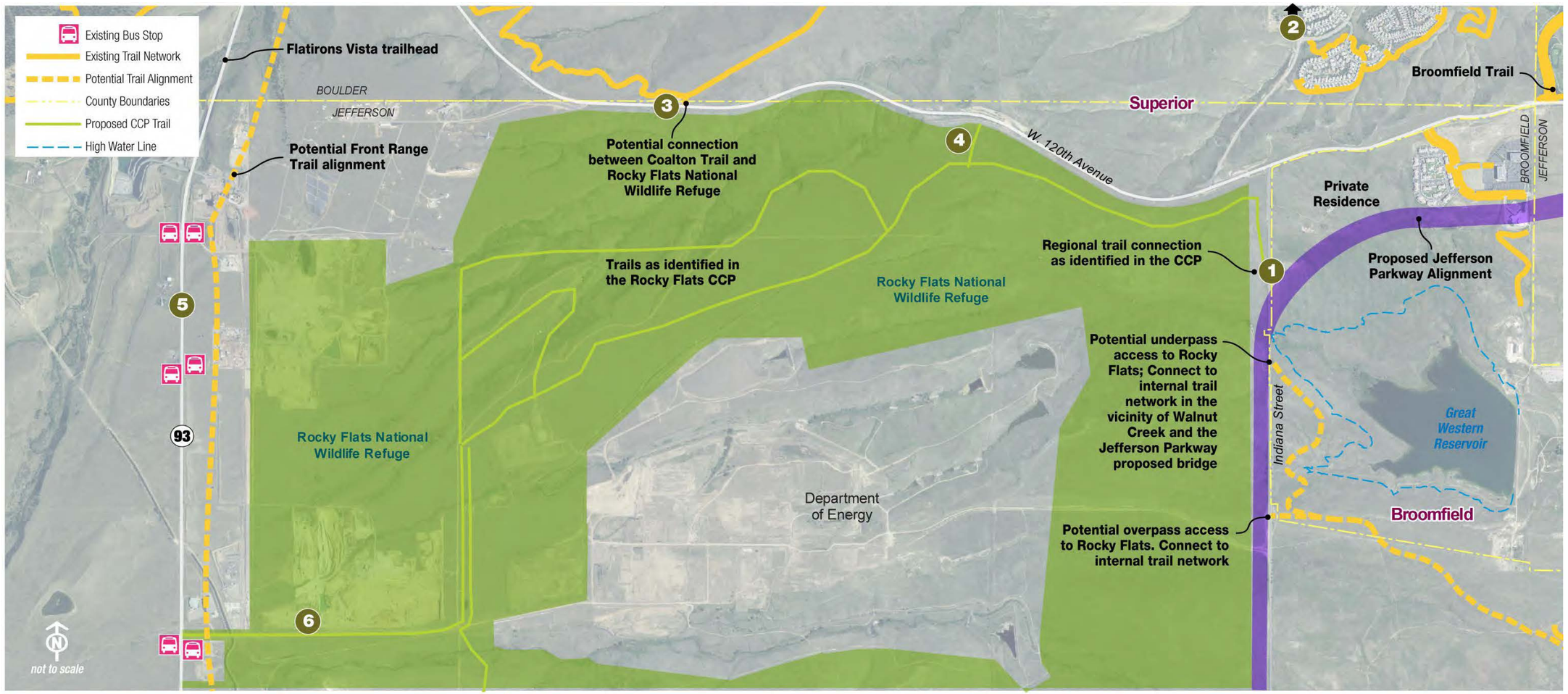
3 Cut for Indiana Street is a logical location for potential grade separated crossing Rocky Flats. This crossing will be coordinated with the Jefferson Parkway.

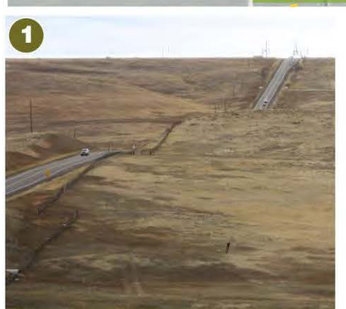
4 Vertical profile and high speeds on Indiana Street reduce the potential for a safe at-grade crossing.

5 Alternative trail alignment to connect to multi-use path identified in the Jefferson Parkway Environmental Impact Statement.

6 Great Western Reservoir. Future reservoir expansion needs to be considered. View looking east.

Figure 12. Northern Rocky Flats Wildlife Refuge

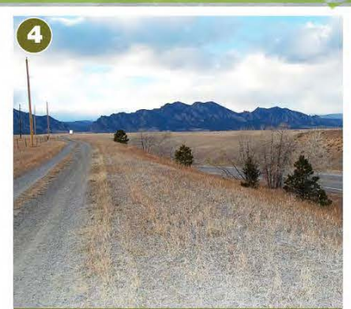




Steep grades on Indiana Street and McCaslin Boulevard may limit the ability to include a trail along these roads.

Existing Coalton trailhead with connections to Coal Creek Trail, Rock Creek Trail and the US 36 bikeway.

View from 120th Avenue looking east into Boulder County Open Space. Potential connection between Coalton Trail and Rocky Flats National Wildlife Refuge.



Identified access in the Rocky Flats CCP

Potential alignment for Front Range Trail on SH 93. View looking south.

Proposed entrance into Rocky Flats National Wildlife Refuge identified in the CCP. View looking east.

WESTMINSTER

Staff Report

Post City Council Meeting
March 18, 2013

SUBJECT: Street Lighting Study Results and Recommended Standards

PREPARED BY: Mike Normandin, Transportation Engineer
Ben Goldstein, Management Analyst

Recommended City Council Action

Listen to the presentation on the street lighting study and provide feedback to Staff on the recommended standards.

Summary Statement

- In November of 2011, the City hired a consultant, Clanton & Associates, Inc., to prepare a Street Light Standards Study.

- The purpose of the study was twofold, with the first part focused on reviewing the City's street lighting and develop street lighting spacing standards for new and existing lighting. The second area of focus was on conducting an initial analysis on the cost of converting existing street lighting in the City to more energy efficient lighting, such as LED or metal halide. Clanton & Associates findings will provide guidance on how to help control the escalating energy and maintenance costs associated with street lighting.

- One of the tasks of the study was to conduct an evening tour of chosen locations to discuss street lighting issues and lighting levels. This required City Staff working with electric utility providers on the installation of four new LED lighting test sites. As City council may recall, the tour was conducted on November 7, 2012 in an effort to take advantage of earlier nights provided by daylight savings time. Tour participants filled out subjective survey evaluations for each location. City Council and City Staff members from various Departments participated in this exercise.

- The results of the survey as well as an overview of the proposed street lighting standards and initial results of the cost analysis for converting street lights to a more energy efficient lighting type will be presented to City Council at the March 18th Post City Council Meeting. Clanton and Associates, the City's consultant, will be in attendance. The results of the street lighting tour and survey and the recommended street lighting standards are attached.

Expenditure Required: $0

Source of Funds: N/A

Policy Issue

Should the City continue to look for ways to improve safety, reduce energy consumption, and save money through new technologies available in street lighting?

Alternative

City Council could opt to continue to work with Xcel Energy representatives at their pace to find more efficient ways to provide street lighting. In addition City Council could tell Staff to discontinue their work in developing lighting design standards for new and existing street lighting. These alternatives are not recommended as Xcel Energy has little incentive to provide more efficient street lighting options. The City has seen consistent escalation in energy and maintenance costs associated with street lighting.

Background Information

City Council will find attached the Draft Street Lighting Design Guide and Lighting Tour results for their review prior to the presentation by Clanton & Associates at the March 18th Post City Council Meeting. The Draft Guide, along with the results from the Lighting Tour and preliminary analysis on converting to more efficient lighting technologies, will be covered in-depth on March 18. City Councils feedback will be useful for Staff to evaluate how they should proceed in the implementation of the proposed design standards and the pursuit of more efficient street lighting technology.

The City spends in excess of $2,000,000 annually for energy and maintenance costs for the approximately 7,900 street lights located within the City. Since most street lights are owned by Xcel Energy, the City has very limited control over managing the costs associated with maintenance activities. City Staff is interested in identifying potential ways to reduce the energy and maintenance costs and has moved forward with the preparation of a Street Lighting Standards Study. The study provides valuable information that will be used to evaluate existing and future conditions and also provides evaluation tools that will be used to analyze the financial implications.

The components of the study were:

- Evaluation of existing conditions
- Review of current and emerging lighting technologies
- Development of outdoor lighting standards and guidelines
- Development of adaptive lighting guidelines (i.e., automatic dimming capabilities)
- Communication of results with City Council and City staff

In the short term, City Staff proposes that the City establish ownership for street lighting in new development areas and on capital improvement projects that include street lighting. Four pilot projects utilizing LED type street lighting were launched in conjunction with the street lighting tour and survey. Another LED street lighting pilot project will be implemented in the recently approved Longsview residential development that is located in the vicinity of 122nd Avenue and Zuni Street. The proposed lighting design standards were used to identify the type of lighting that was installed. These lighting standards are focused on energy efficiency and are capable of accommodating lower maintenance costs. There may be strategies that will allow for the modification of existing, Xcel-owned lighting that could result in future energy and maintenance savings.

In the long term, the information developed in this study will assist City staff and City Council in evaluating the merit of pursuing the eventual ownership of all of the street lighting in the City. The primary tool to be utilized is an ongoing Life Cycle cost analysis that will provide information needed to determine the feasibility of moving forward. The goal of such an effort would be to substantially decrease the energy and maintenance costs.

Energy efficient street lighting technology is evolving at a rapid pace. Consideration should be given to updating the street lighting standards in the next three to five years.

The Street Lighting Standards Study meets Council's Strategic Plan goals of a Financially Sustainable City Government; and Beautiful and Environmentally Sensitive City, by providing information needed to develop sustainable infrastructure.

Respectfully submitted,

Stephen P. Smithers
Acting City Manager

Attachments

CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

December 13, 2012

Mike Normandin
City of Westminster
4800 West 92nd Avenue
Westminster, CO 80031

Westminster Street Lighting: Site Survey Summary & Results

Mike,

On Wednesday, November 7th, representatives from the City of Westminster attended a street lighting survey. This survey included eight sites in Westminster and Broomfield with different types of street lighting layouts and equipment. The intent of these surveys was to evaluate the quality and preference of white light sources, such as LED and Metal Halide (MH), as compared to the current standard High Pressure Sodium (HPS) street lighting that is used throughout the City of Westminster.

The survey results indicate a strong preference for white light sources (both LED and MH) over current HPS street lighting on streets and in parking lots with continuous lighting. The streets and parking lot with LED and MH sources and continuous lighting rated significantly better than HPS for comfort, uniformity, color rendering, color preference, and overall preference, while providing equivalent perception of safety, even at lower light levels.

The one residential area with LED was generally not preferred. The distant spacing with large areas of darkness between light poles and glare from the luminaire were noted as reasons for the low ratings. We suggest that the City of Westminster evaluate other alternative LED luminaires to replace current HPS residential lighting, rather than expanding the use of the LED luminaire installed by United Power in the Quail Hill Residential Area.

The following report and attached appendices provide more detailed information on the process, results and conclusions for each of the test areas.

Sincerely,

Dane R. Sanders, PE
Principal
Clanton & Associates, Inc.

Attachments: Appx A – Photos of Test Areas.pdf
Appx B – Subjective Evaluation Form.pdf
Appx C – Lighting Measurements.pdf
Appx D – Survey Results by Question.pdf
Appx E – Survey Results by Test Area.pdf

4699 Nautilus Court South, Suite 102, Boulder, CO 80301 Tel 303-530-7229 Fax 303-530-7227

Process

- **Sites**
  Eight survey sites were chosen with different lighting layouts and sources to provide a variety of typical street lighting configurations that are typical throughout the City of Westminster. See Appendix A for Test Area Photos.

Test Area	Lamp	Luminaire	Pole Geometry	Layout	Spacing
Test Area 1: 144th & Huron	HPS 250W 2200K	Lumec Domus Series with Flat Lens	- 25' Pole Height - Side Arm Mounted - (1) Luminaire per pole	Opposite Layout	140 ft to 180 ft
Test Area 2: Quail Hill	LED 78W 4000K	LED Retrofit Kit	- 18' Pole Height - Post-top Mounted - (1) Luminaire per pole	Non-Continuous	n/a
Test Area 3: Sheridan & 136th	MH 250W 3000K MH 70W 3000K	Lumec Domus Series with Flat Lens	- 30' Pole Height - 6' Bracket Arm - (2) Luminaires per pole	Median Street Poles w/ Sidewalk Pedestrian Poles	110 ft Both Street Lights & Pedestrian Lights
Test Area 4: Sheridan & 117th	HPS 250W 2200K	Cobrahead with Drop-Lens	- 35' Pole Height - 10' Mast Arm - (2) Luminaires per pole	Median Layout	200 ft
Test Area 5: 104th & Wolff (LED)	LED 91W 4000K	Decorative Teardrop	- 35' Pole Height - 8' Mast Arm - (2) Luminaires per pole	Median Layout	170 ft
Test Area 6: 104th & Wolff (HPS)	HPS 250W 2200K	Decorative Teardrop	- 35' Pole Height - 8' Mast Arm - (2) Luminaires per pole	Median Layout	170 ft
Test Area 7: 92nd Ave.	LED 130W 4000K	Cobrahead with Flat Lens	- 35' Pole Height - 8' Mast Arm - (1) Luminaire per pole	Staggered Layout	270 ft to 300 ft
Test Area 8: City Hall Parking Lot Dimmed to 50%	LED 158W 4000K	Shoebox Post-Top with LED Retrofit Kit	- 30' Pole Height - Post Top Mounted - (1) Luminaire per pole	Opposite Parking Lot Layout	140 ft X 140 ft

- **Participants**
  Fifteen representatives from the City participated in the survey. The representatives included: the Mayor, Traffic Department, Planning Department, Police Department, and Fire Department.

- **Survey Questions**
  The subjective survey that was used for the demonstration was originally developed by Dr. Peter Boyce of the Lighting Research Center for parking lot lighting survey, and modified by Clanton & Associates for street lighting demonstrations. This survey has been used to

evaluate the street lighting in Anchorage, Alaska; San Diego, California; San Jose, California; and Roseville, California.

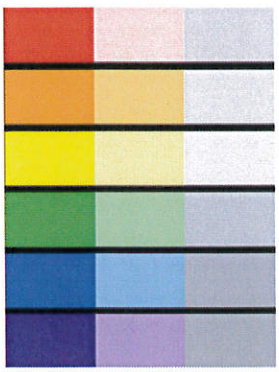
The subjective survey asks participants a series of general questions based upon where they live, demographic questions, and site condition questions. Then for each test area that a participant evaluates, thirteen questions are asked. Participants evaluated each statement on a scale of 1 to 5 (strongly disagree to strongly agree, respectively). The following list of statements comprises the subjective survey. See Appendix B for the full version of the subjective survey.

1. It would be safe to walk here, alone, during daylight hours. (Baseline Question)
2. It would be safe to walk here, alone, during darkness hours. (Positive Question)
3. The lighting is comfortable. (Positive Question)
4. There is too much light on the street. (Negative Question)
5. There is not enough light on the street. (Negative Question)
6. The light is uneven (patchy). (Negative Question)
7. The light sources are glaring. (Negative Question)
8. It would safe to walk on the sidewalk here at night. (Positive Question)
9. I cannot tell the colors of things due to the lighting. (Negative Question)
10. The lighting enables safe vehicular navigation. (Positive Question)
11. I like the color of the light. (Positive Question)
12. I would like this style of lighting on my city streets. (Positive Question)
13. How does the lighting in this area compare with the lighting of similar Westminster city streets at night? (Positive Question)

Seven of the questions are asked in a positive manner, such that a high rating indicates a positive attribute of the lighting system. Five of the questions are asked in a negative manner, such that a high rating indicates a negative attribute of the lighting system. The ratings of these positive and negative questions are important to understand for the analysis of the surveys.

- **Color Reference**

A color board was used to provide a visual reference for question #9, "I cannot tell the colors of things due to the lighting." This color board consists of primary and secondary colors, both saturated and unsaturated, and a grey reference with the same reflectance value as the unsaturated color next to it. Under lighting with poor color rendering, the unsaturated colors would look the same as the adjacent grey rectangle.



Color Reference Board

- **Lighting Measurements**
  In addition to collecting the survey responses, Clanton & Associates also field-measured roadway luminance, luminaire luminance, and sidewalk illuminance in each test area. These measurements are used to compare the perception of participants with measured lighting values. See Appendix C for all lighting measurements.

- **Survey Analysis**
  The subjective survey was given to participants on the night of the survey. Each participant rated the statement on a scale of 1 to 5 where a "1" represented strongly disagreeing with the statement and a "5" represented strong agreement. The statements address the perception of safety, comfort, glare, preference for light color and color rendering, and overall style.

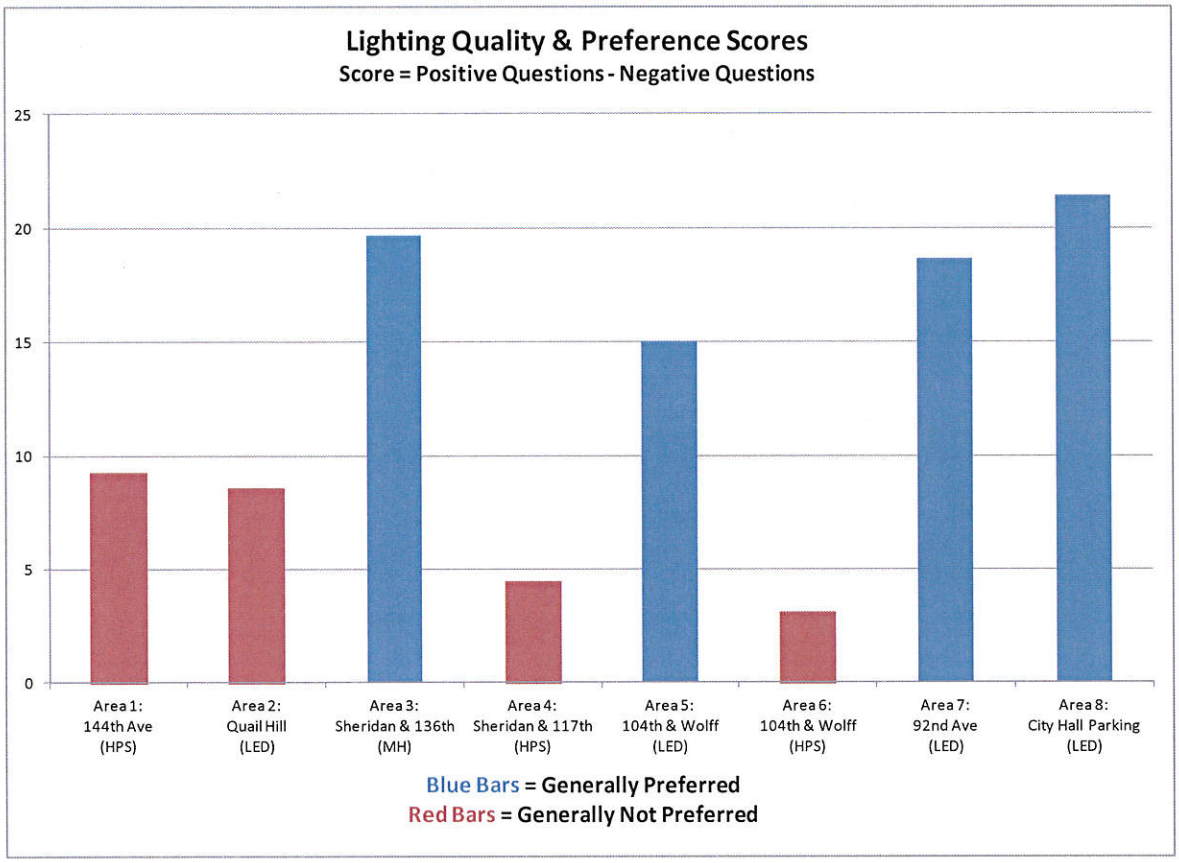
  - Scoring
    Each site has an overall score based on survey responses. The score is determined by adding the ratings for Positive Questions and subtracting the ratings for Negative Questions.

    Sum(Positive Questions) – Sum(Negative Questions)

  - Question-by-Question Comparison
    For more specific comparisons, the ratings for each question are compared amongst all sites to determine the common trends of preference and quality perception between sites.

Results & Conclusions

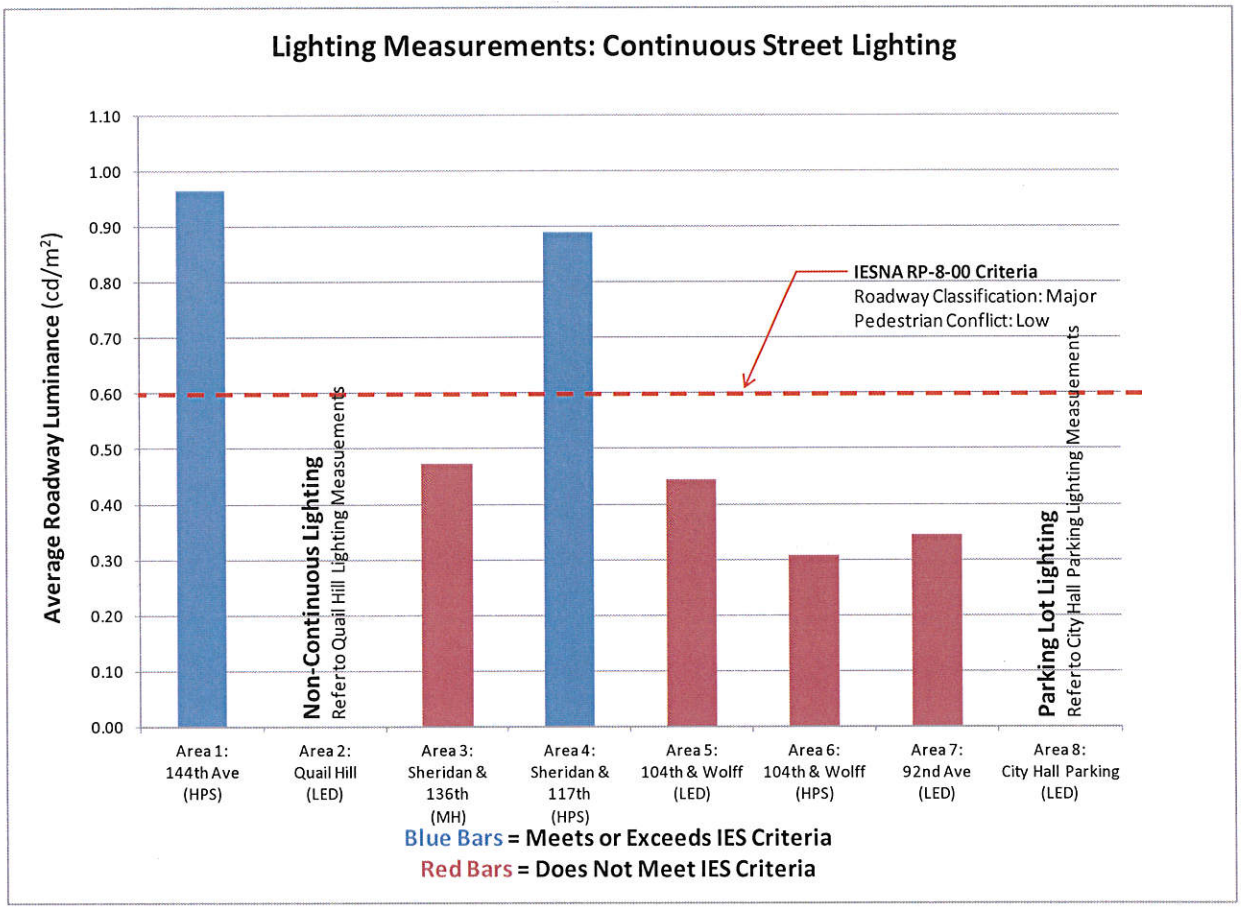
- **Survey Scoring**



The survey results indicate an overwhelming preference for streets with continuous, white-light street lighting amongst the City of Westminster representatives. The most interesting of these results is the significant difference in perceived lighting quality and preference between Areas 5 & 6 on 104th Ave, where both sites have the same lighting equipment and layout, but Area 5 is LED (consuming 91 Watts per luminaire) and Area 6 is HPS (consuming 295 Watts per luminaire). This dramatic difference strongly suggests that good LED street lighting can save significant energy while also improving the perceived quality of street lighting.

The one area with white light LEDs not preferred by survey participants is the Quail Hill Residential area. This site has one isolated LED luminaire. Based on survey comments, this location is too dark, and the luminaire creates more glare and feels less comfortable than the other sites. We suggest that the City of Westminster evaluate other alternative LED luminaires to replace current HPS residential lighting, rather than expanding the use of this type of LED luminaire installed by United Power in the Quail Hill Residential Area.

- **Lighting Measurements**
  - **Continuous Street Lighting**



Of the sites surveyed with continuous street lighting, only two sites meet or exceed the Illuminating Engineering Society (IES) Recommended Practice criteria per RP-8-00 "American National Standard Practice for Roadway Lighting". Both of the sites that exceed the lighting criteria have 250W HPS lamps. In the surveys, these sites rated lower than the white-light sites that fall below the IES Criteria. These divergent results suggest that there is no correlation between meeting criteria and quality and preference of street lighting, especially when comparing HPS and white light sources.

These results support findings from other previous LED and white light studies in street lighting environments that compare visibility performance by measuring visual detection distances under HPS and white light sources (San Jose, San Diego, Seattle sponsored by NEEA). The results from these studies show that detection distances experienced under 400W HPS are comparable to those experienced under 130W LED, even when dimmed to 50% or less.

- **Lighting Measurements (Continued)**

  - **Quail Hill Residential Lighting**

		Horizontal Illuminance (footcandles)			Vertical Illuminance (footcandles)	
Area	Lamp Type	Eh,avg	Eh,avg/ Eh,min	Eh,max/ Eh,min	Ev,avg	Ev,min
IES RP-8 Criteria (Local, Low)		0.40	6.0	n/a	n/a	0.10
Area 2: Quail Hill	LED	0.62	30.9	93	0.36	0.05

With only one light pole in the vicinity, the non-continuous lighting cannot be directly compared to IES Criteria. These measurements were taken in a 60' radius around the light pole.

  - **City Hall Parking Lot Lighting**

		Horizontal Illuminance (footcandles)			Vertical Illuminance (footcandles)	
Area	Lamp Type	Eh,avg	Eh,min	Eh,max/ Eh,min	Ev,avg	Ev,min
IES RP-20 Criteria (Basic Security)		n/a	0.2	20	n/a	0.10
Area 8: City Hall Parking (50%)	LED	1.21	0.17	29	n/a	n/a
Area 8: City Hall Parking (100%)	LED	2.01	0.25	34	n/a	n/a

During the surveys, the City Hall Parking Lot Lighting was dimmed to 50%. Lighting measurements were taken both at 50% and 100% light output. At the 50% dimmed level, this parking lot lighting comes very close to meeting the IES criteria for parking lots with "basic security".

- **Subjective Evaluation Question-by-Question Comparison**
  The following conclusions are derived from the results of the Subjective Evaluation Survey, comparing the responses to each question at all sites. The charts used for this Question-by-Question Comparison can be found in Appendix D – Survey Results by Question.

  Q1: It would be safe to walk here, alone, during daylight hours.
  - Participants strongly agreed that all areas were safe during daylight hours.

  Q2: It would be safe to walk here, alone, during darkness hours.
  - Participants generally agreed that all areas felt safe during darkness hours.
  - Area 2: Quail Hill (LED), and Area 6: 104th & Wolff (HPS) rate slightly lower than the rest.

  Q3: The lighting is comfortable.
  - Sites with white light sources (LED & MH) rated as the most comfortable.
  - Area 4: Sheridan & 117th (HPS) rated least comfortable, and also has the highest light level.
  - At 104th & Wolff (Areas 5 & 6) the LED rated as more comfortable than HPS with otherwise identical lighting systems.

  Q4: There is too much light on the street.
  - None of the streets rated as significantly too much light.
  - Some people agreed that lighting in Area 4: Sheridan & 117th was too much light.

  Q5: There is not enough light on the street.
  - Area 2: Quail Hill (LED) was rated as the darkest site with a non-continuous lighting layout, followed by Area 6: 104th & Wolff (HPS) with continuous lighting.
  - Participants responded that all other areas had enough light on the street.

  Q6: The light is uneven (patchy).
  - All areas with continuous LED lighting rated well for good uniformity (not patchy).
  - Area 1: 144th Avenue (HPS) & Area 6: 104th & Wolff (HPS) (both HPS) were considered uneven (patchy).
  - Area 5: 104th & Wolff (LED) rated as more uniform than Area 6: 104th & Wolff (HPS), however, the LED measured as less uniform. Except for the difference of light source, both of these areas have the same lighting system.
  - These results suggest that white light sources are perceived as more uniform than HPS.

  Q7: The light sources are glaring.
  - Participants considered Site 4: Sheridan & 117th (HPS) as most glaring.
  - Some considered Site 5: 104th & Wolff (LED) as glaring.

Q8: It would be safe to walk on the sidewalk here at night.

- Generally, all areas were considered to be safe to walk alone on sidewalk at night, however, Area 2: Quail Hill (LED) and Area 6: 104th & Wolf (HPS) felt least safe.
- Area 5 (LED) was rated as somewhat safer than Area 6 (HPS) with the same lighting systems.

Q9: I cannot tell the colors of things due to the lighting.

- Participants generally agreed that colors could not be seen well in Area 4: Sheridan & 117th (HPS), which is the brightest HPS area.
- Participants generally agreed that colors can be seen well in white light (LED or MH) street lighting.

Q10: The lighting enables safe vehicular navigation.

- Generally, all areas were considered safe for vehicular navigation.
- Sites with white light sources (LED & MH) were generally considered safer than HPS for vehicular navigation.
- Light level does not seem to correspond to perception of safe vehicular navigation since some areas with lower light levels were rated safer than some areas with higher light levels.

Q11: I like the color of the light.

- The color of white light sources (LED & MH) are strongly preferred over HPS.

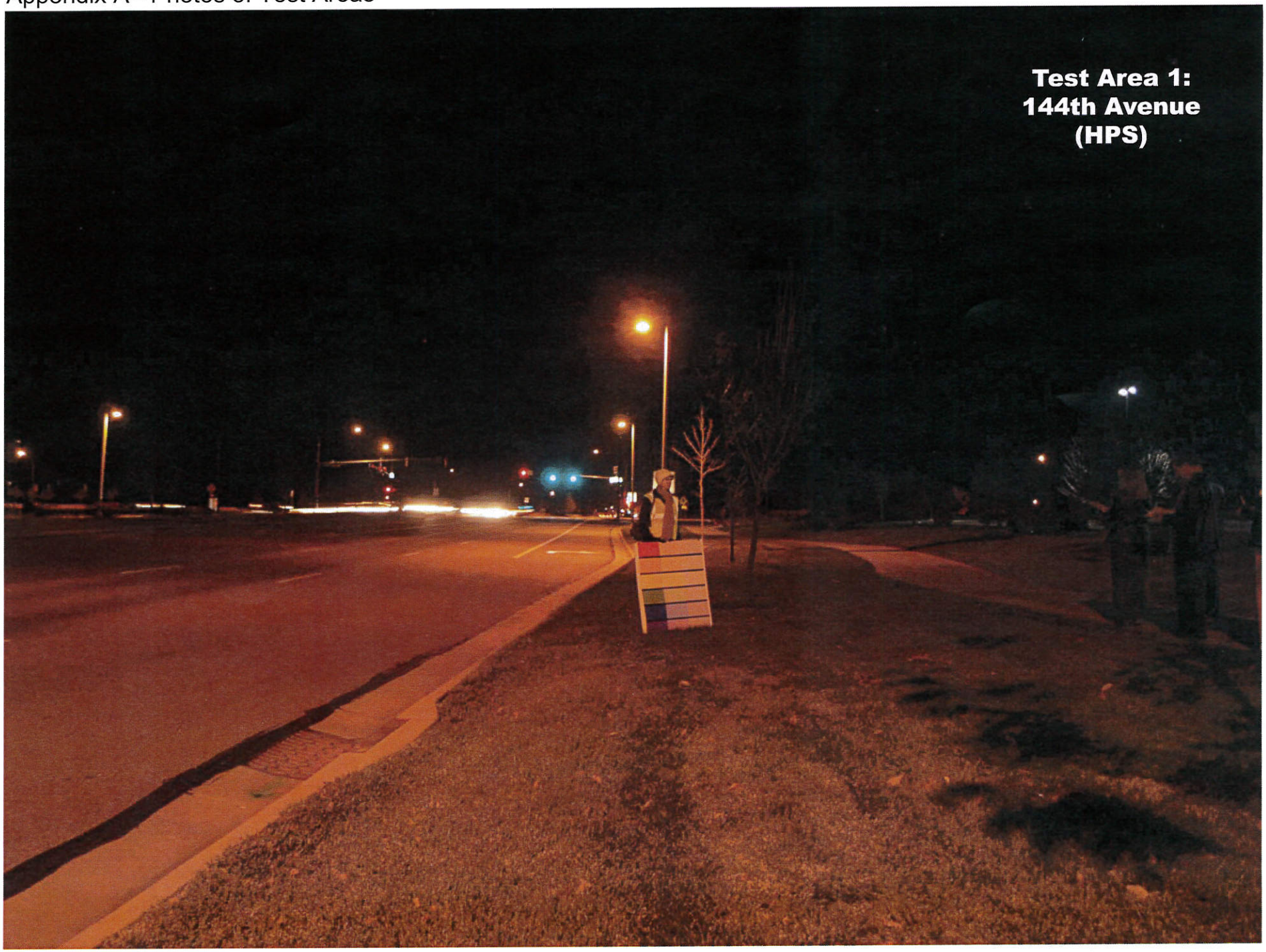
Q12: I would like this style lighting on my city streets.

- The style of white light sources (LED & MH) are strongly preferred over HPS.

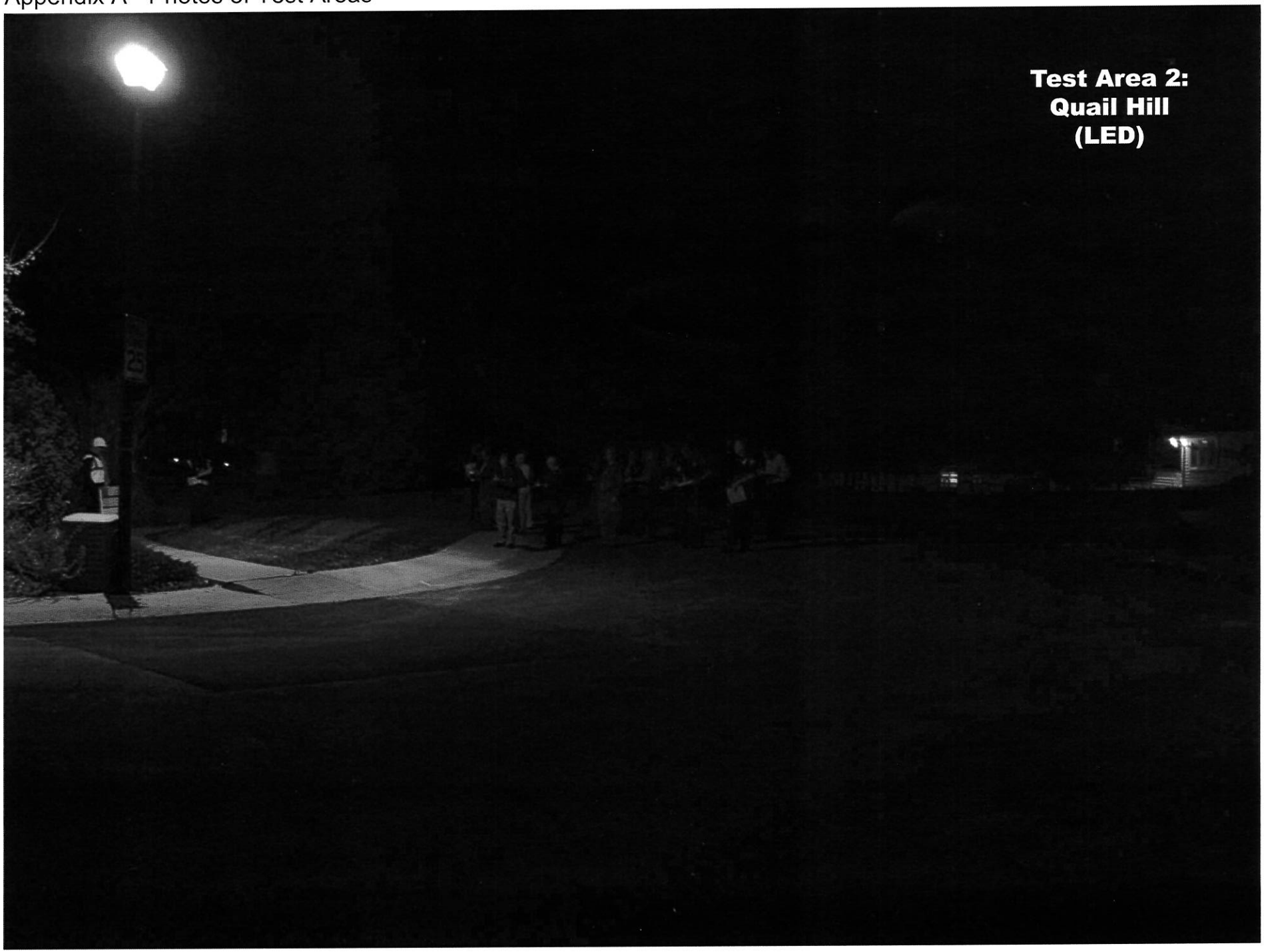
Q13: How does the lighting in this area compare with the lighting of similar Westminster city streets at night?

- The Areas with continuous white light were considered to be better than other Westminster streets at night.

Appendix A - Photos of Test Areas

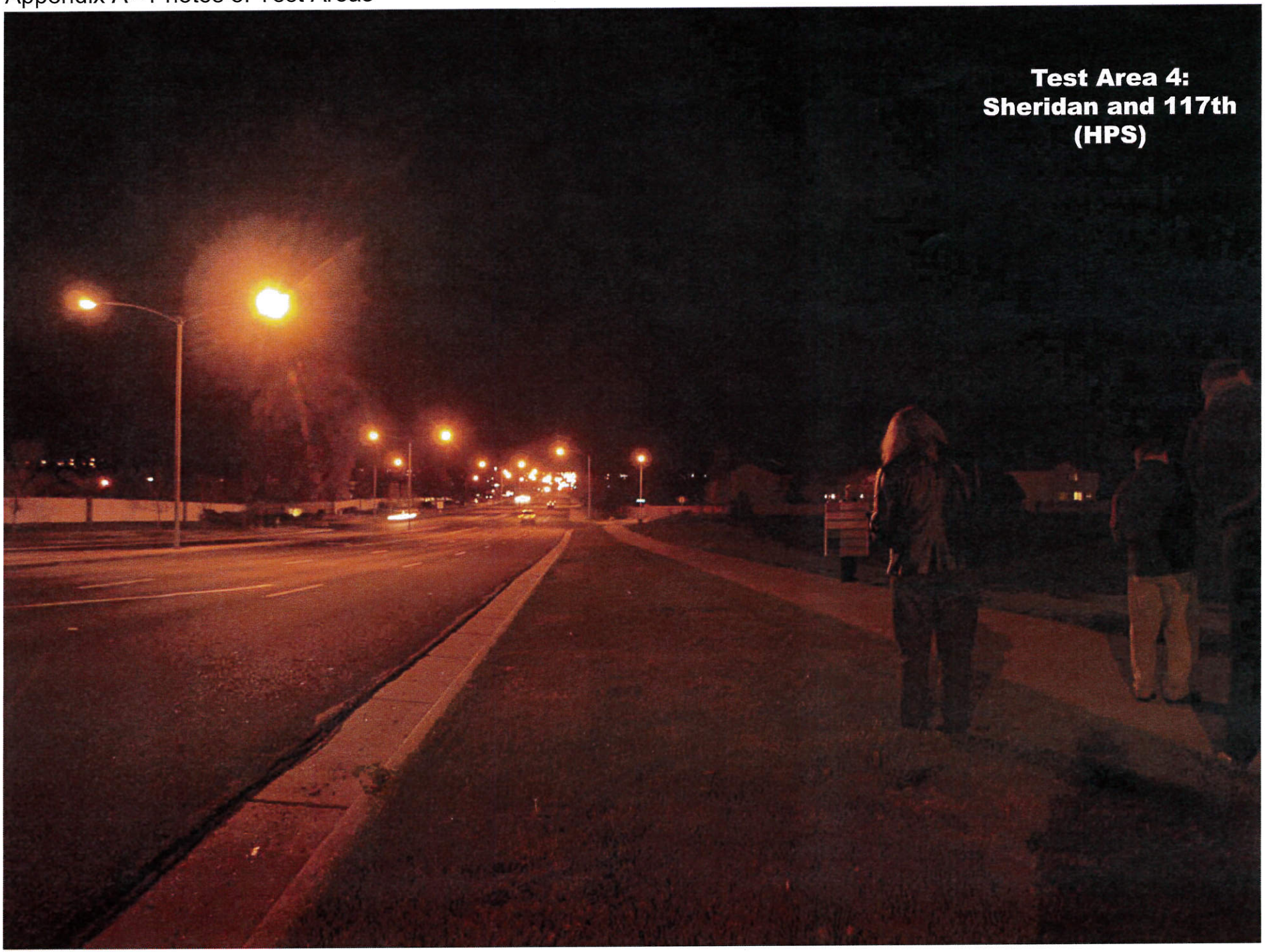


Appendix A - Photos of Test Areas

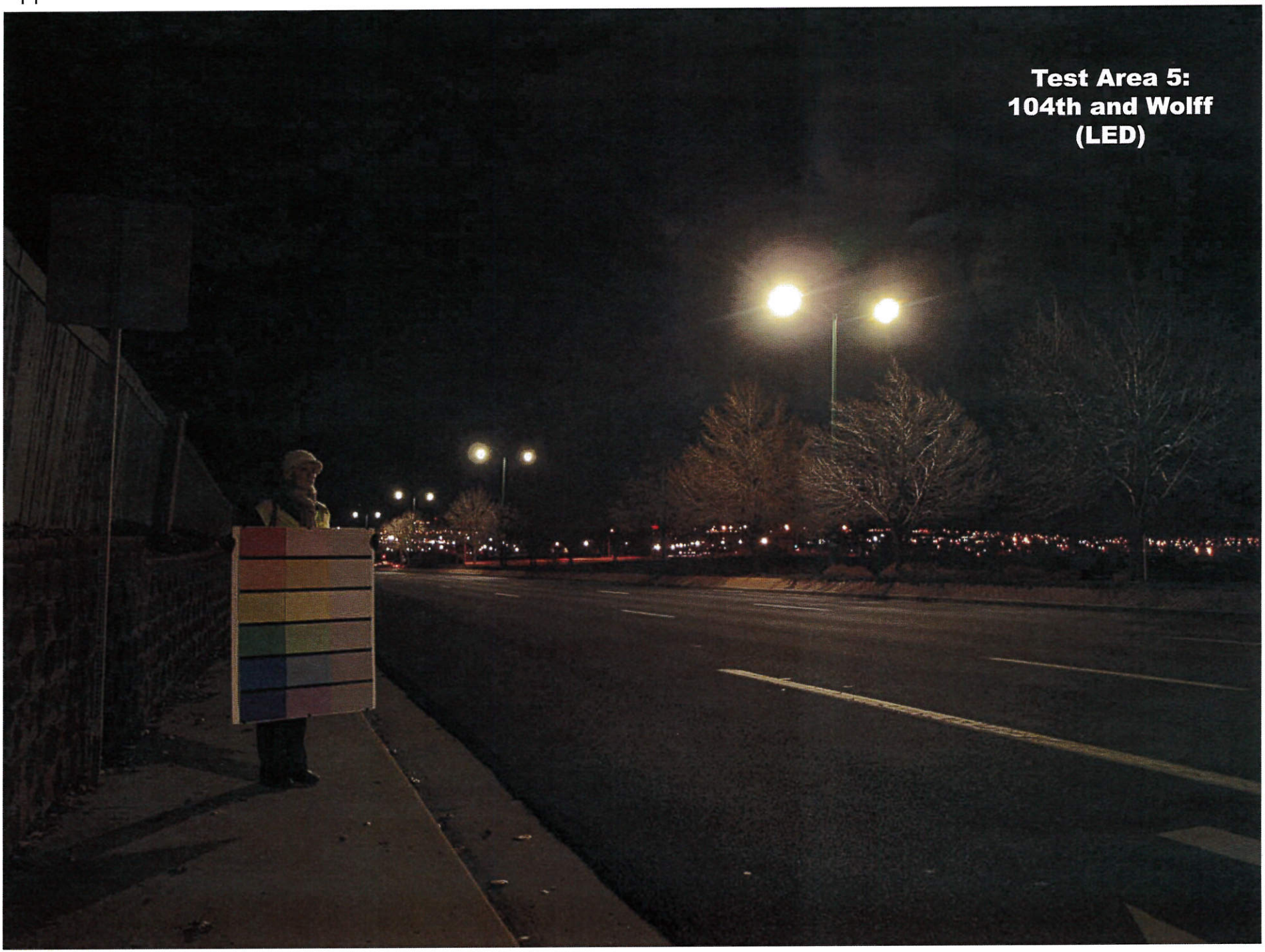


Appendix A - Photos of Test Areas

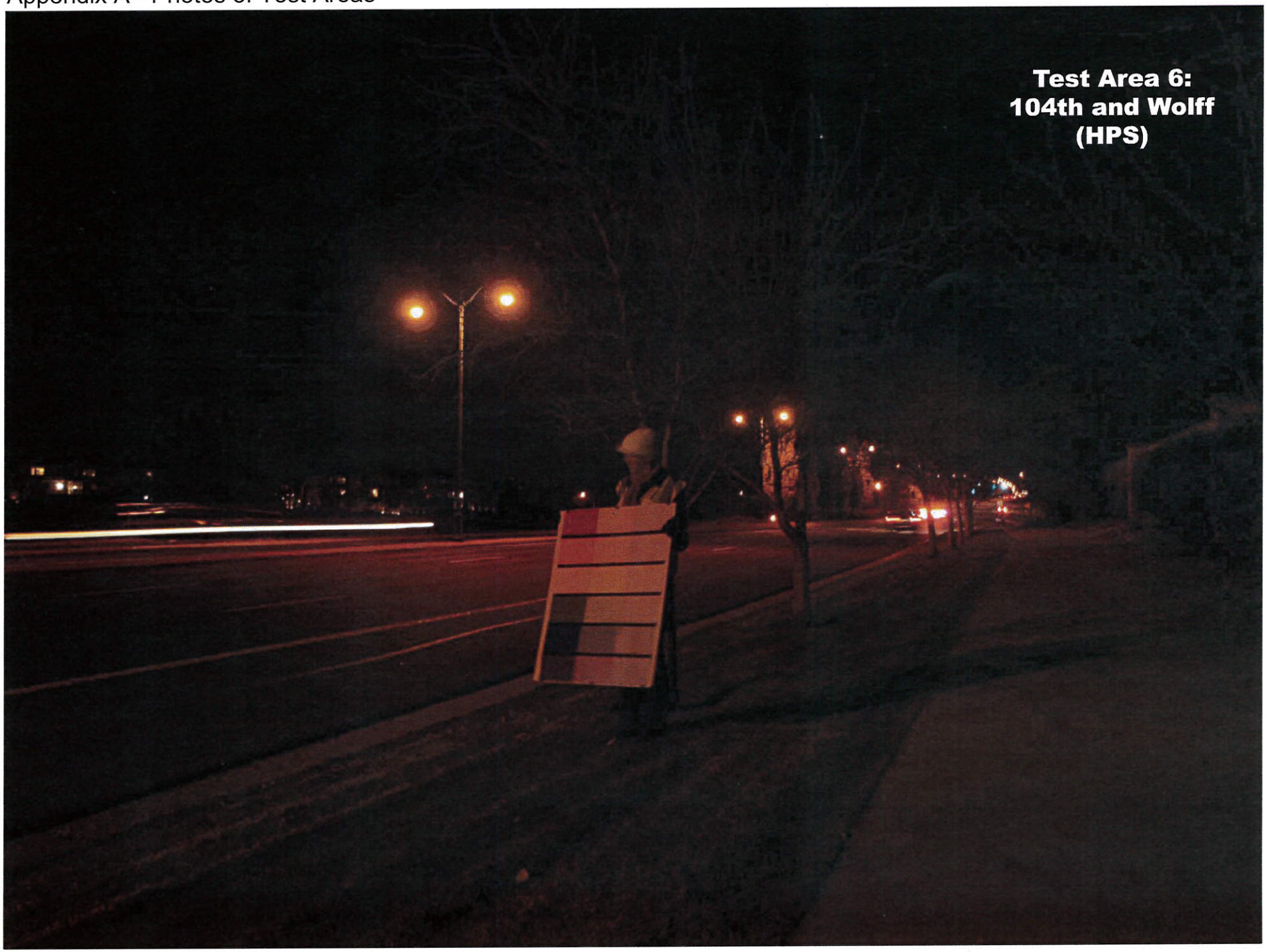
Appendix A - Photos of Test Areas



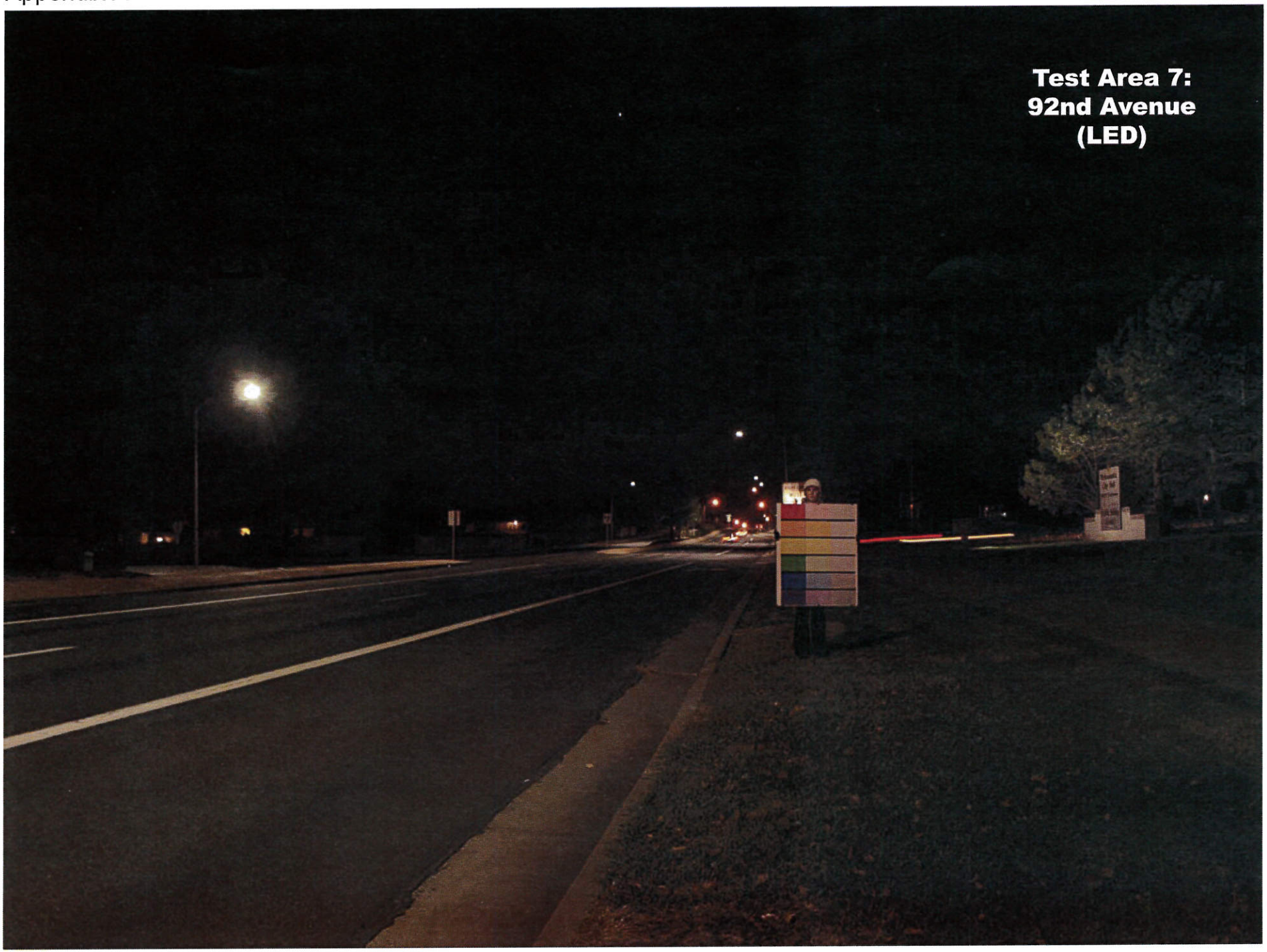
Appendix A - Photos of Test Areas



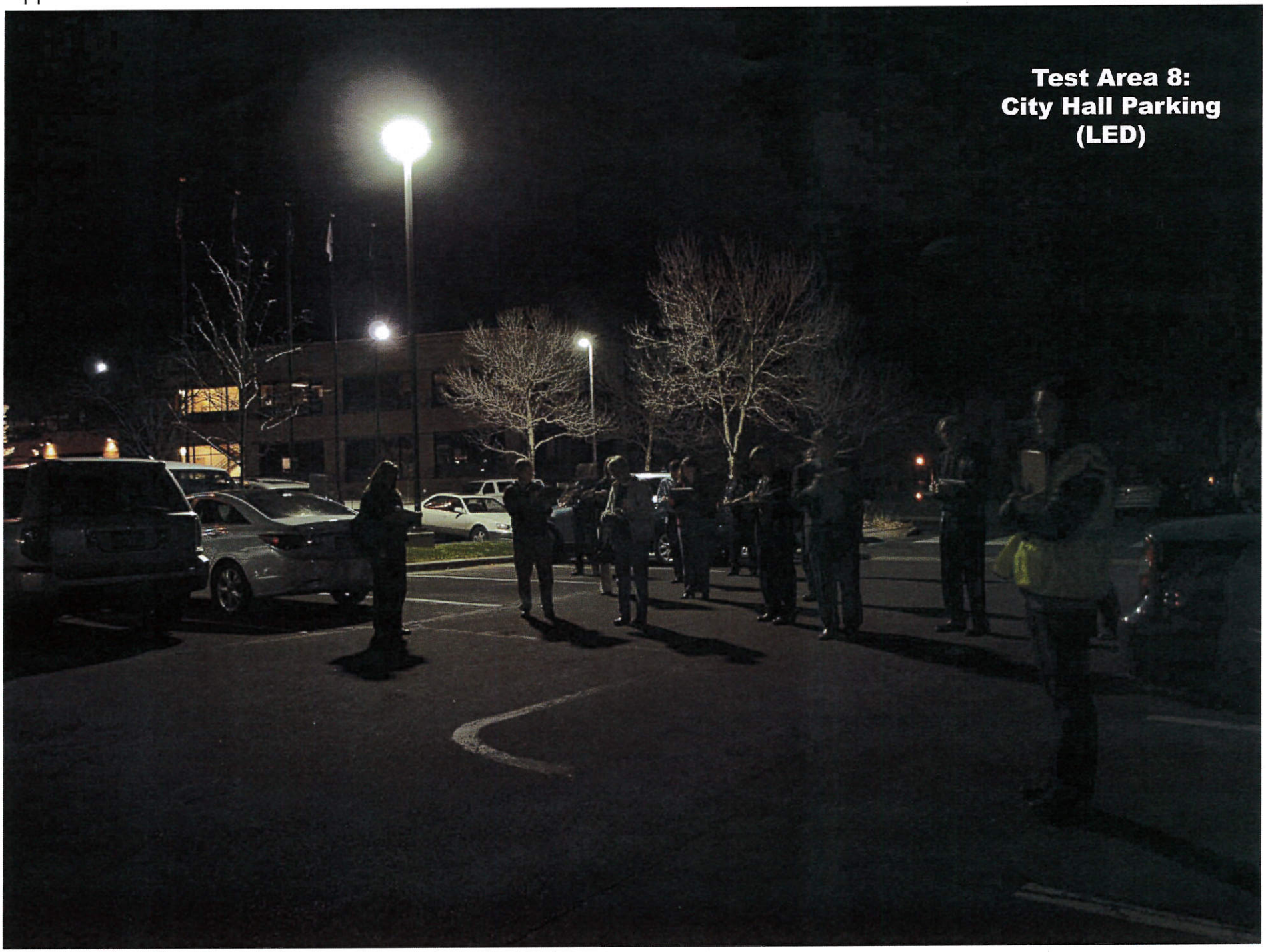
Appendix A - Photos of Test Areas



Appendix A - Photos of Test Areas



Appendix A - Photos of Test Areas



COVER PAGE

City of Westminster: Nighttime Street Lighting Subjective Evaluation

First Name		Surveyor #
Last Name		

The City of Westminster and Clanton & Associates, thank you for participating in this lighting survey! We are trying to understand the effect of different lighting systems for potential application throughout the City. The main goal is to understand visual quality, perception, and acceptance of various street lighting systems. Please respond to each of the questions with that goal in mind.

General Questions

G1. Do you live in the City of Westminster? Yes _____ No_____

G2. Do you live within two blocks of any test area(s)? Yes _____ No_____

If Yes, which test area(s)? Please list test area #'s _____

G3. Do you work in the lighting industry? (design, manufacturer, specification, sales) Yes _____ No_____

G4. Do you have LED streetlights in your neighborhood? Yes _____ No_____

Demographic Questions

D1	*Gender*	M	F	*(circle one)*
D2	*Age*			*(in years)*
D3	*Zip Code*			

Site Questions

S1. Weather conditions --- Clear _____ Cloudy_____ Rain_____ Fog_____

S2. Ground conditions --- Streets Dry _____ Streets Wet_____

CLANTON & ASSOCIATES
LIGHTING DESIGN AND ENGINEERING

WESTMINSTER

Appendix B - Subjective Evaluation Form

TEST AREA 1

	Rate Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	No Opinion
1	*It would be safe to walk here, alone,* ***during daylight hours.***	O	O	O	O	O	O
2	*It would be safe to walk here, alone, during darkness hours.*	O	O	O	O	O	O
3	*The lighting is comfortable.*	O	O	O	O	O	O
4	*There is too much light on the street.*	O	O	O	O	O	O
5	*There is not enough light on the street.*	O	O	O	O	O	O
6	*The light is uneven (patchy).*	O	O	O	O	O	O
7	*The light sources are glaring.*	O	O	O	O	O	O
8	*It would be safe to walk on the sidewalk here at night.*	O	O	O	O	O	O
9	*I* ***cannot*** *tell the colors of things due to the lighting.*	O	O	O	O	O	O
10	*The lighting enables safe vehicular navigation.*	O	O	O	O	O	O
11	*I like the color of the light.*	O	O	O	O	O	O
12	*I would like this style lighting on my city streets.*	O	O	O	O	O	O

13. How does the lighting in this area compare with the lighting of similar Westminster city streets at night?

Much worse Worse About the same Better Much Better

14. Write additional comments below.

Appendix C - Lighting Measurements

Lighting Measurements: Arterials (Continuous Street Lighting)

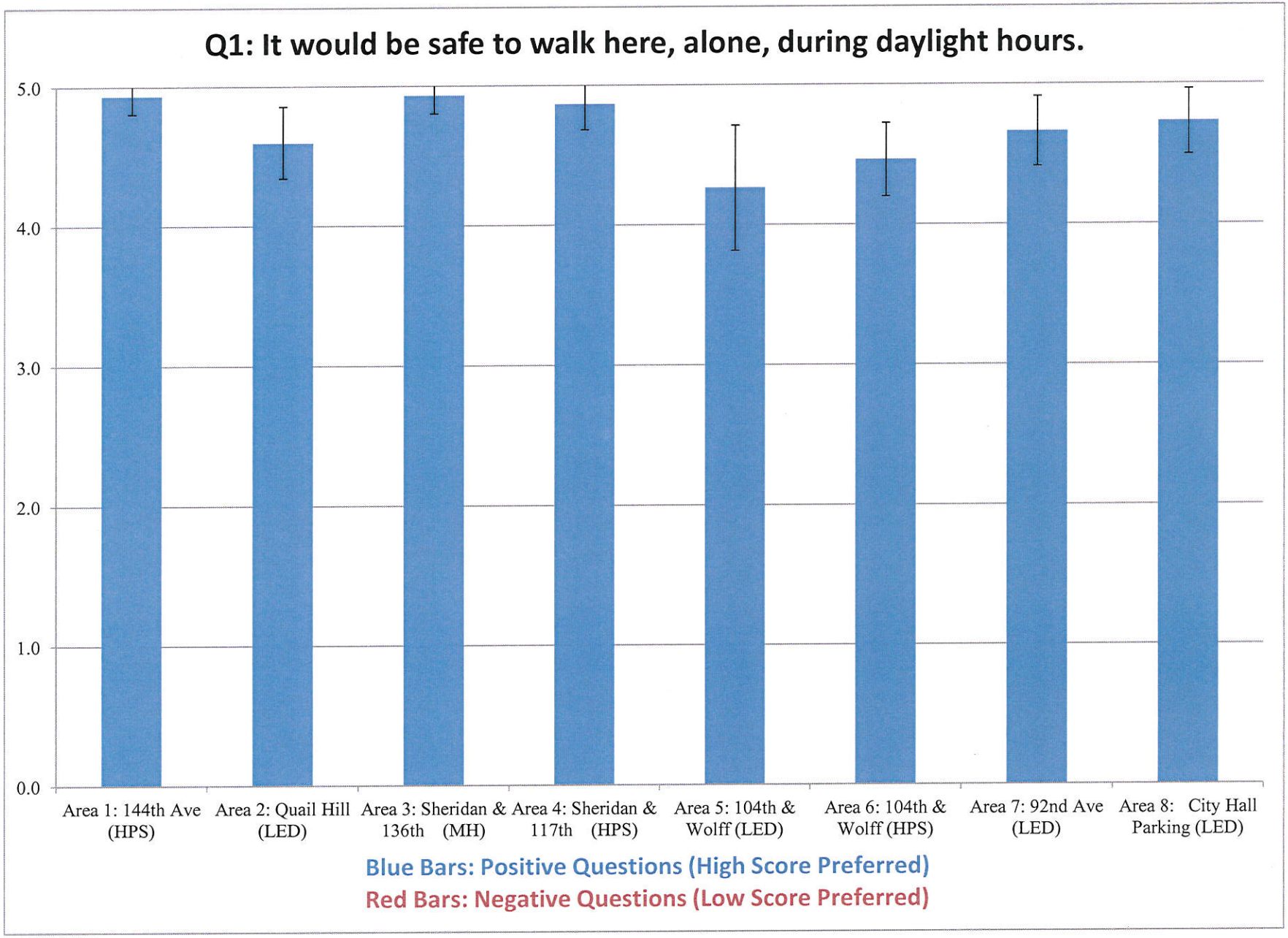
			Street Luminance (cd/m^2)			Sidewalk Illuminance (Eh = Horizontal, Ev = Vertical) (footcandles)				
Area	Lamp Type	Luminaire Luminance (cd/m^2)	Lavg	Lavg/ Lmin	Lmax/ Lmin	Eh,avg	Eh,avg/ Eh,min	Eh,max/ Eh,min	Ev,avg	Ev,min
IES RP-8 Criteria (Major, Low)	n/a	n/a	0.60	3.5	6.0	0.40	4.0	n/a	n/a	0.20
Area 1: 144th Ave (HPS)	HPS		0.97	2.8	7.2	0.73	4.6	6.4	0.45	0.11
Area 2: Quail Hill (LED)		6,042	Non-Continuous Lighting							
Area 3: Sheridan & 136th (MH)	MH		0.47	3.2	10.0	0.37	2.2	4.1	0.21	0.04
Area 4: Sheridan & 117th (HPS)	HPS	72,950	0.89	2.3	5.1	0.52	1.0	1.1	0.56	0.32
Area 5: 104th & Wolff (LED)	LED	8,266	0.45	3.0	6.9	0.33	1.5	2.2	0.31	0.11
Area 6: 104th & Wolff (HPS)	HPS	12,900	0.31	2.2	4.4	0.36	2.3	3.1	0.30	0.11
Area 7: 92nd Ave (LED)	LED		0.34	3.4	7.0	0.24	2.0	3.2	0.17	0.11
Area 8: City Hall Parking (LED)	LED		Not Street Lighting							

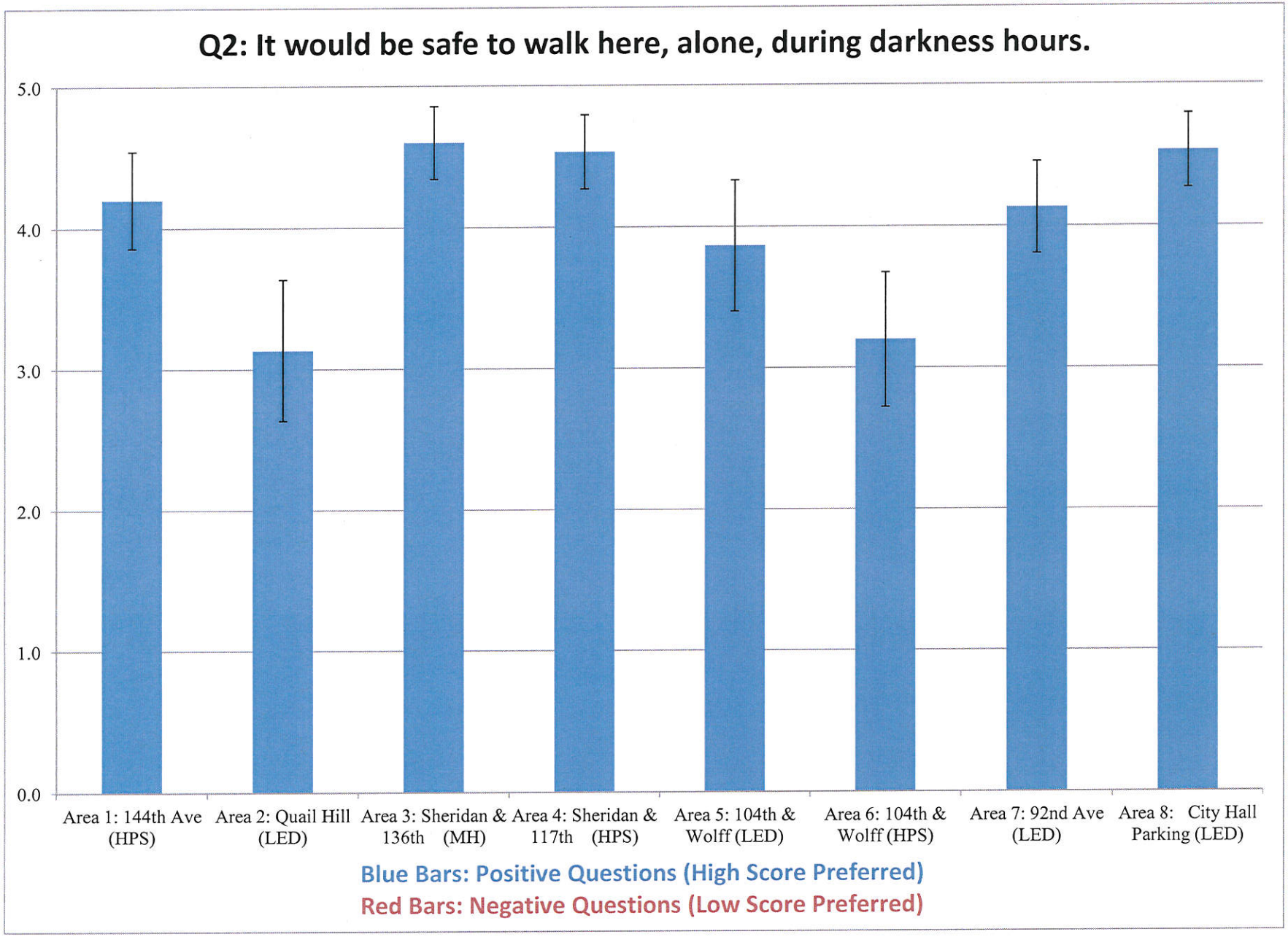
Lighting Measurements: Residential (Non-Continuous Street Lighting)

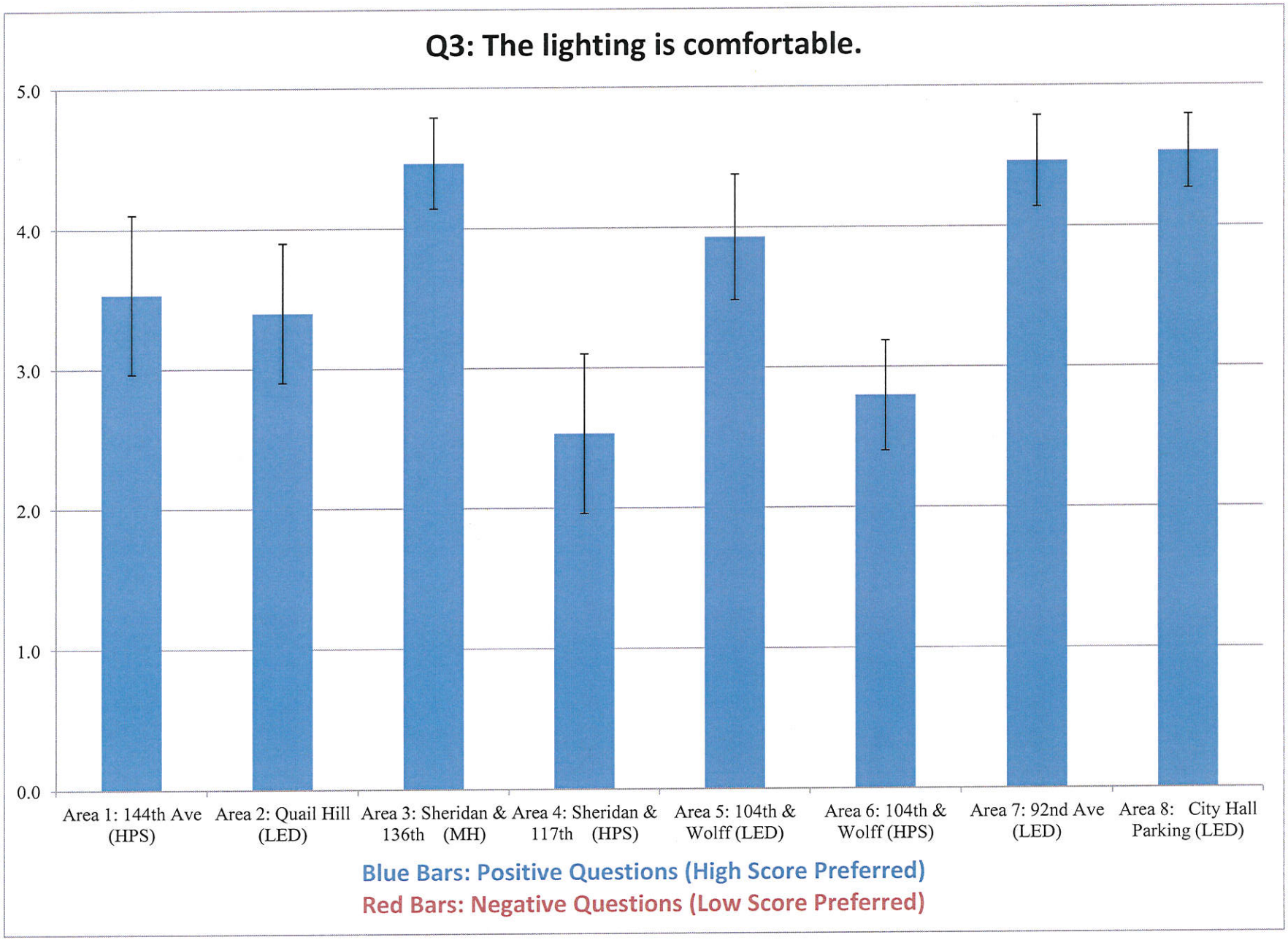
		Horizontal Illuminance (footcandles)			Vertical Illuminance (footcandles)	
Area	Lamp Type	Eh,avg	Eh,avg/ Eh,min	Eh,max/ Eh,min	Ev,avg	Ev,min
IES RP-8 Criteria (Local, Low)		0.40	6.0	n/a	n/a	0.10
Area 2: Quail Hill	LED	0.62	30.9	93	0.36	0.05

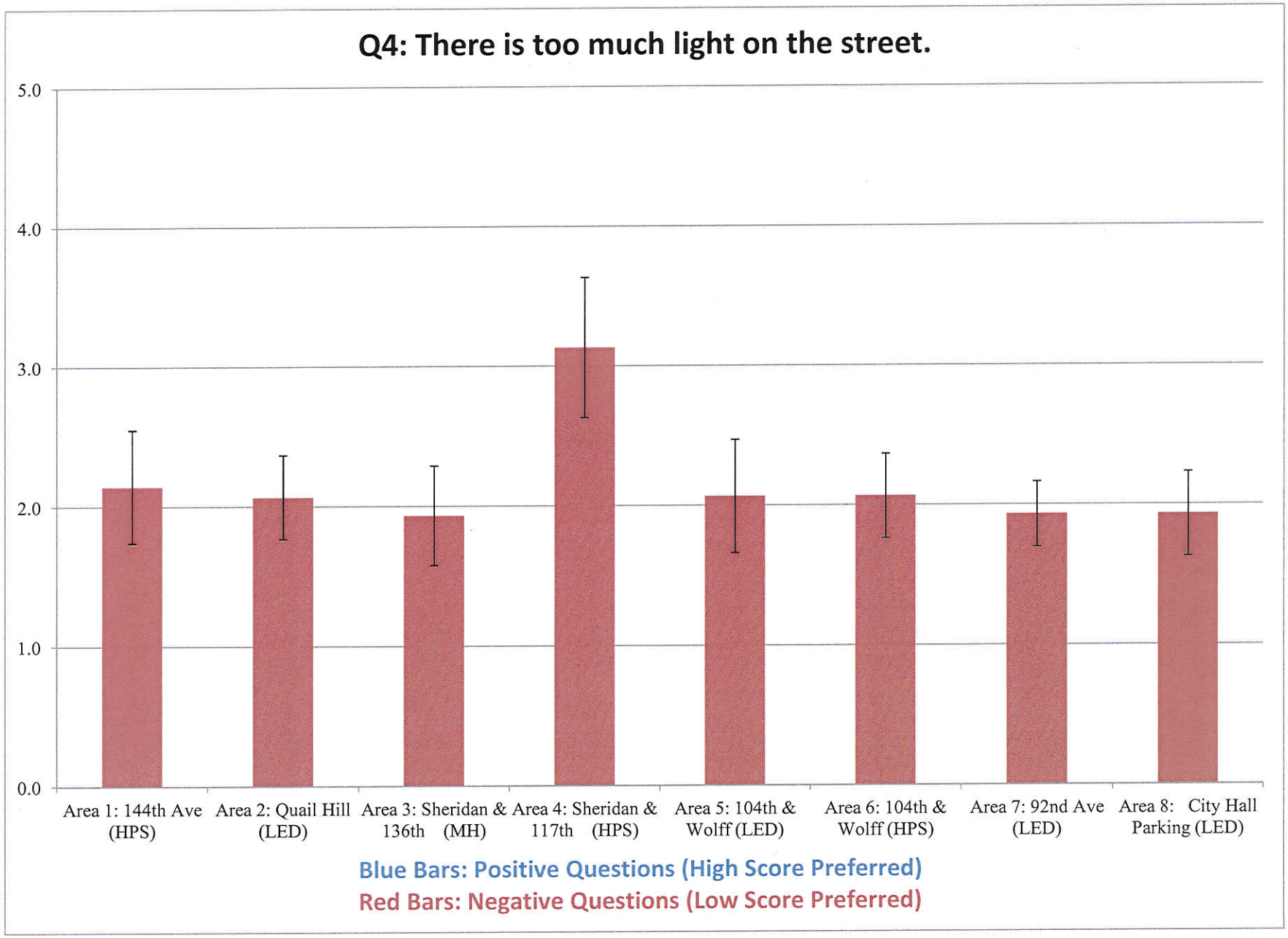
Lighting Measurements: Parking Lot Lighting

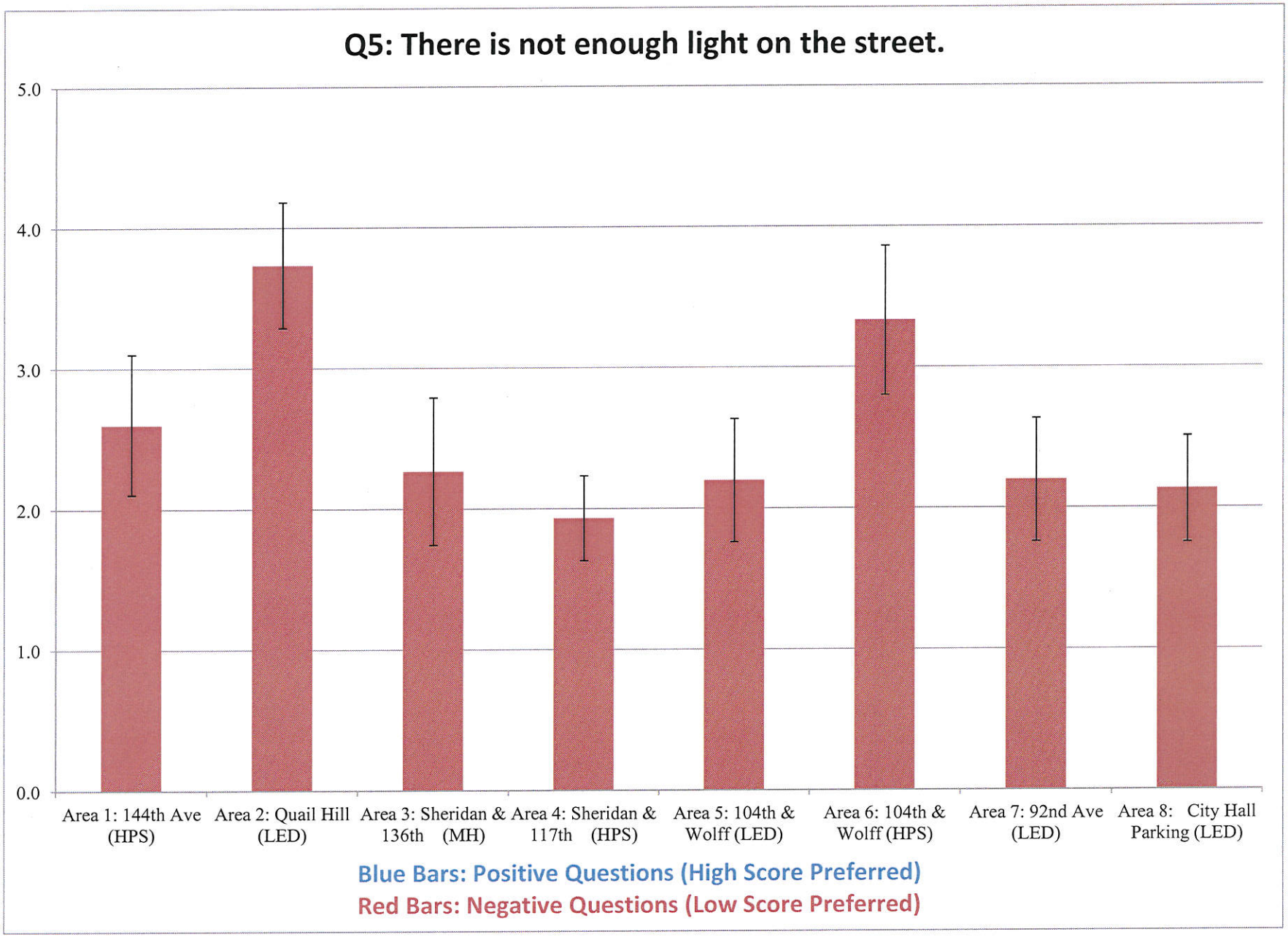
		Horizontal Illuminance (footcandles)			Vertical Illuminance (footcandles)	
Area	Lamp Type	Eh,avg	Eh,min	Eh,max/ Eh,min	Ev,avg	Ev,min
IES RP-20 Criteria (Basic Security)		n/a	0.2	20	n/a	0.10
Area 8: City Hall Parking (50%)	LED	1.21	0.17	29	n/a	n/a
Area 8: City Hall Parking (100%)	LED	2.01	0.25	34	n/a	n/a

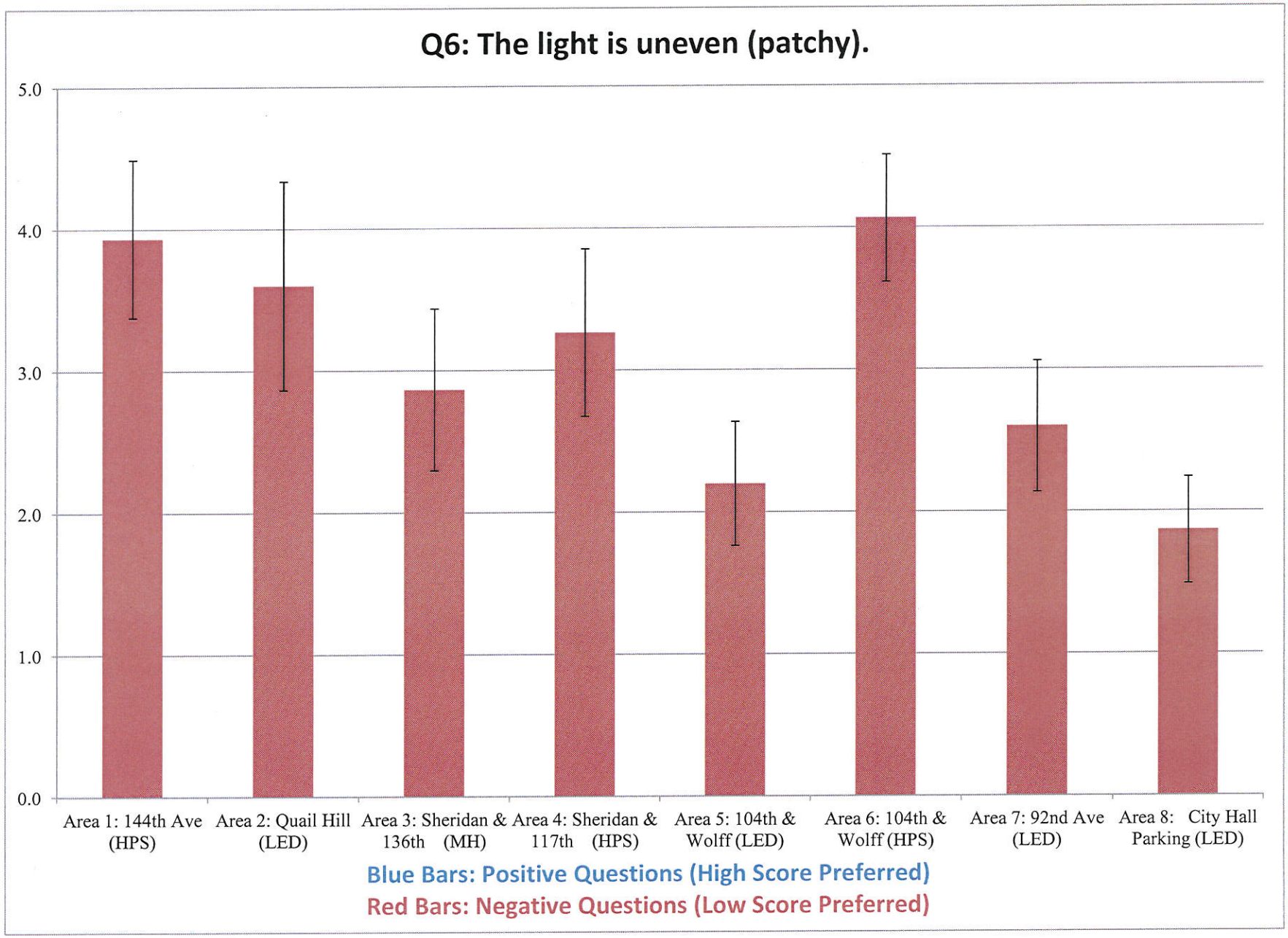

Q1: It would be safe to walk here, alone, during daylight hours.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

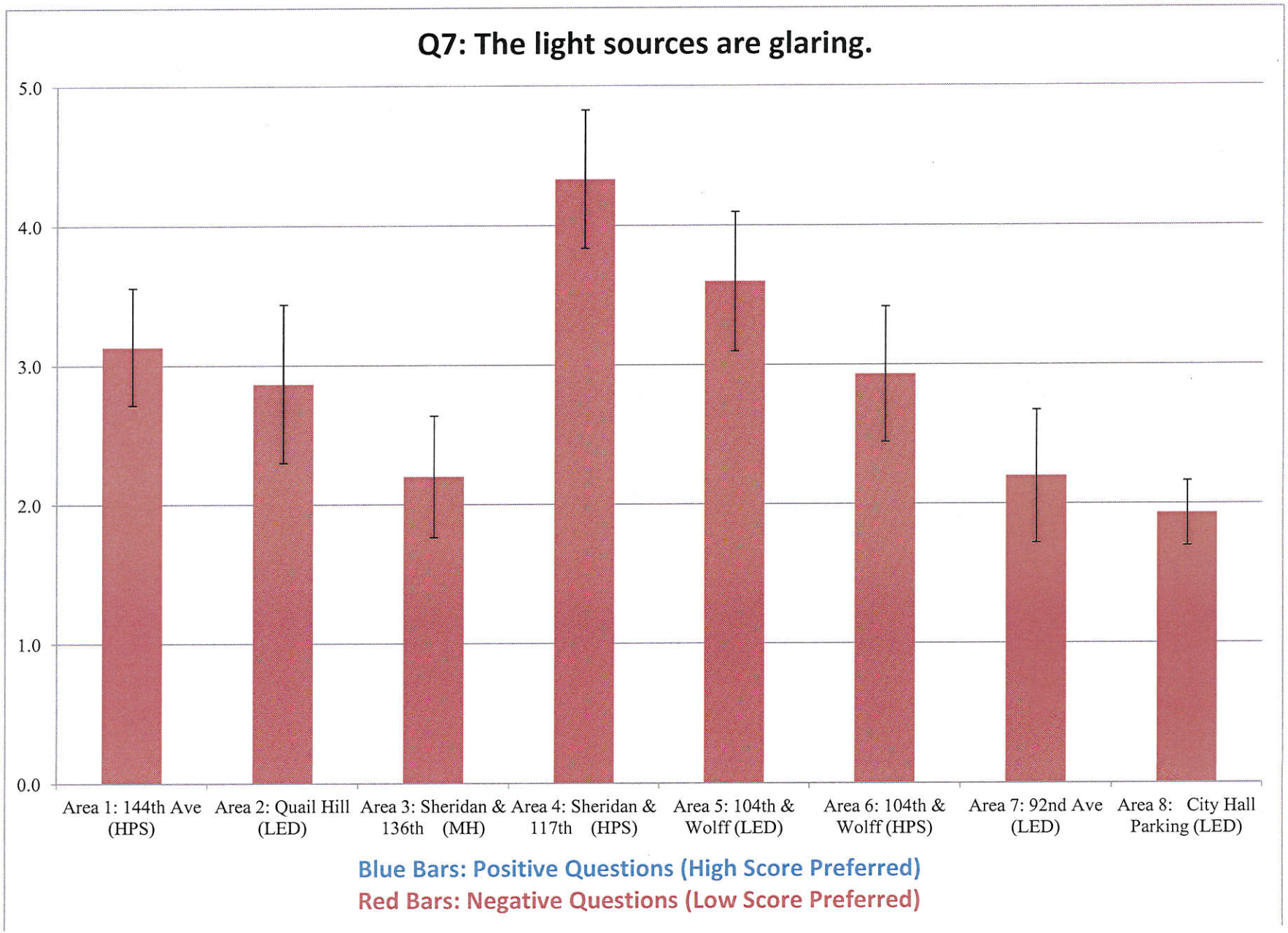

Q2: It would be safe to walk here, alone, during darkness hours.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

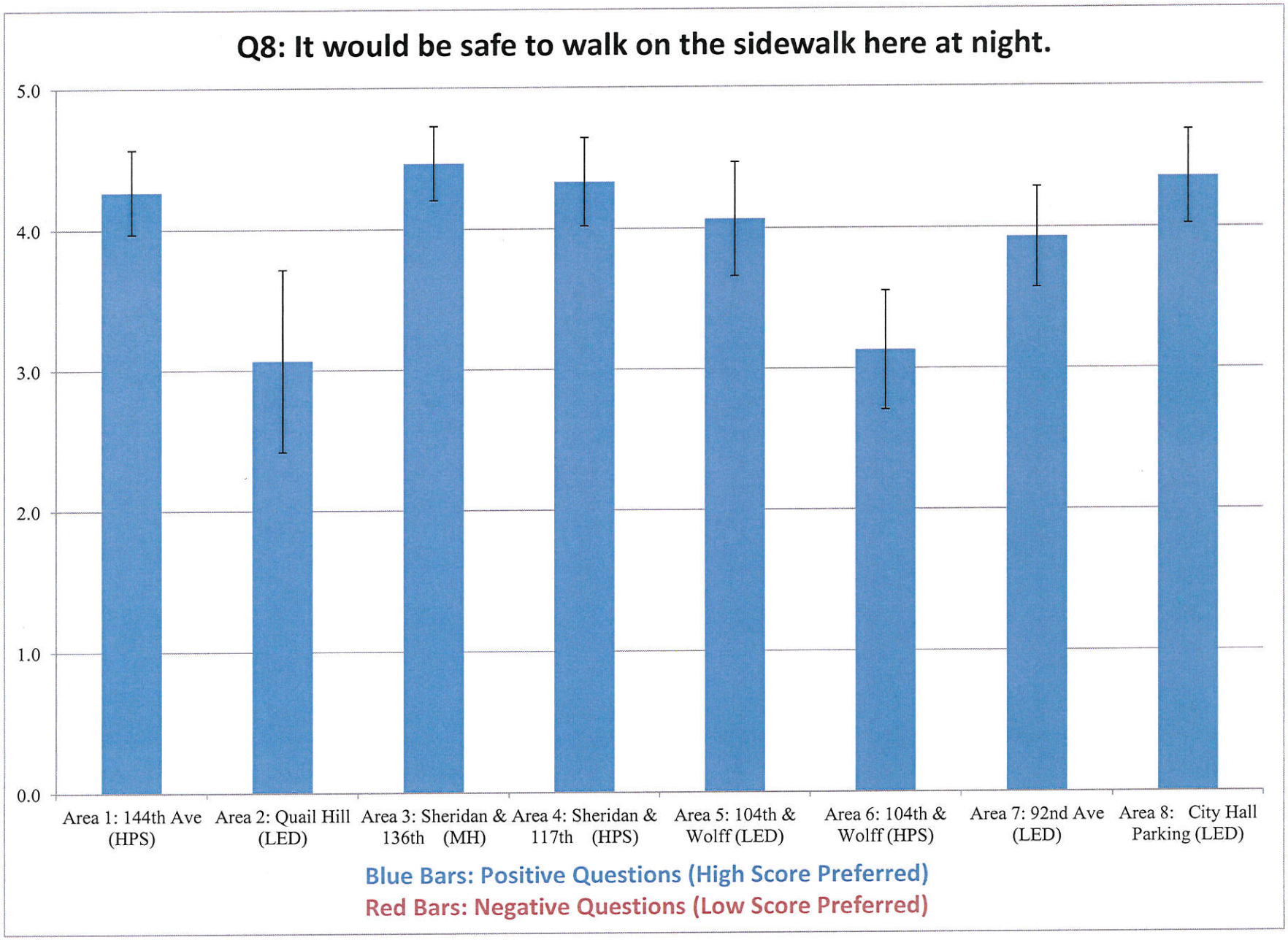

Q3: The lighting is comfortable.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

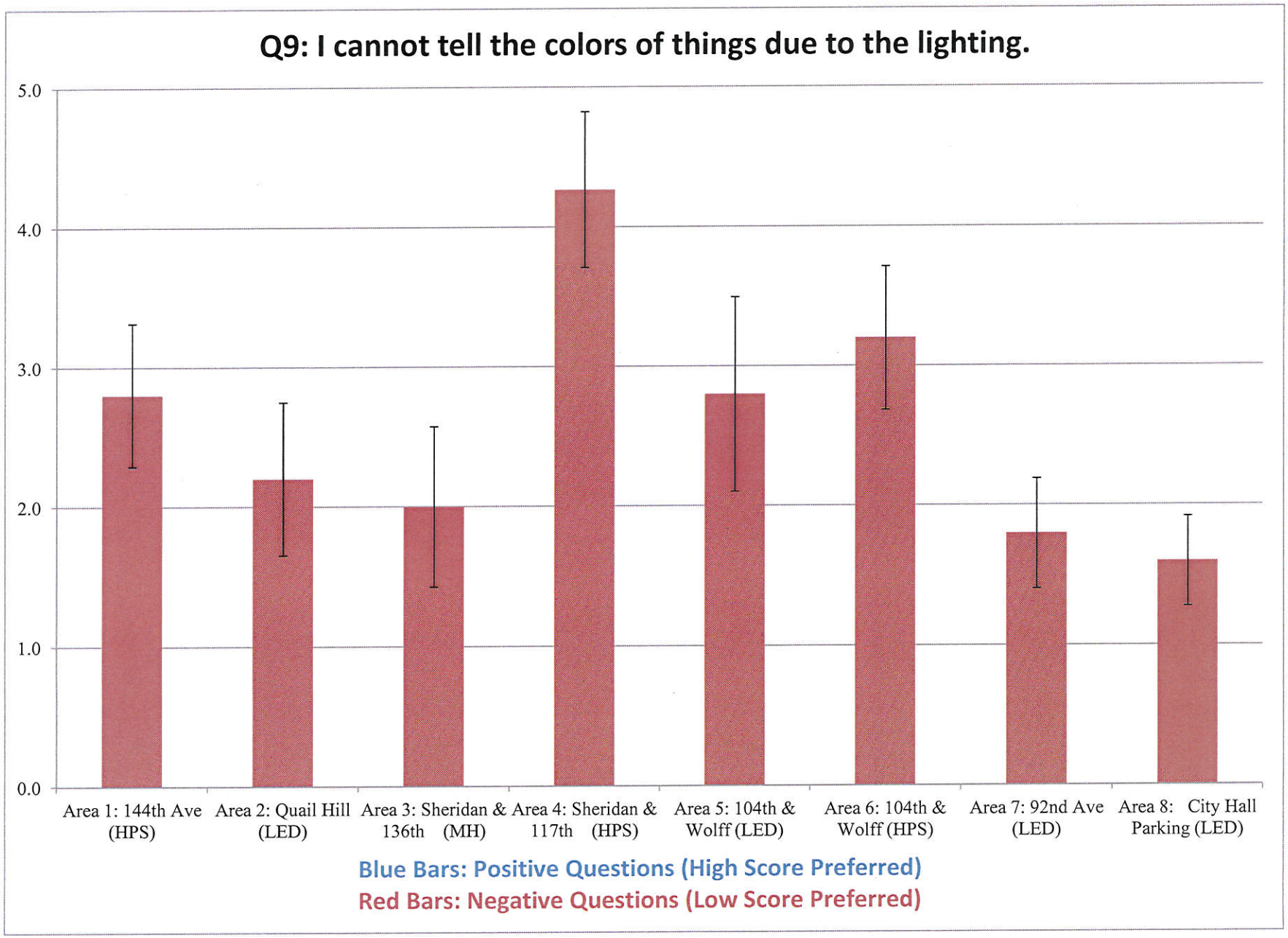

Q4: There is too much light on the street.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

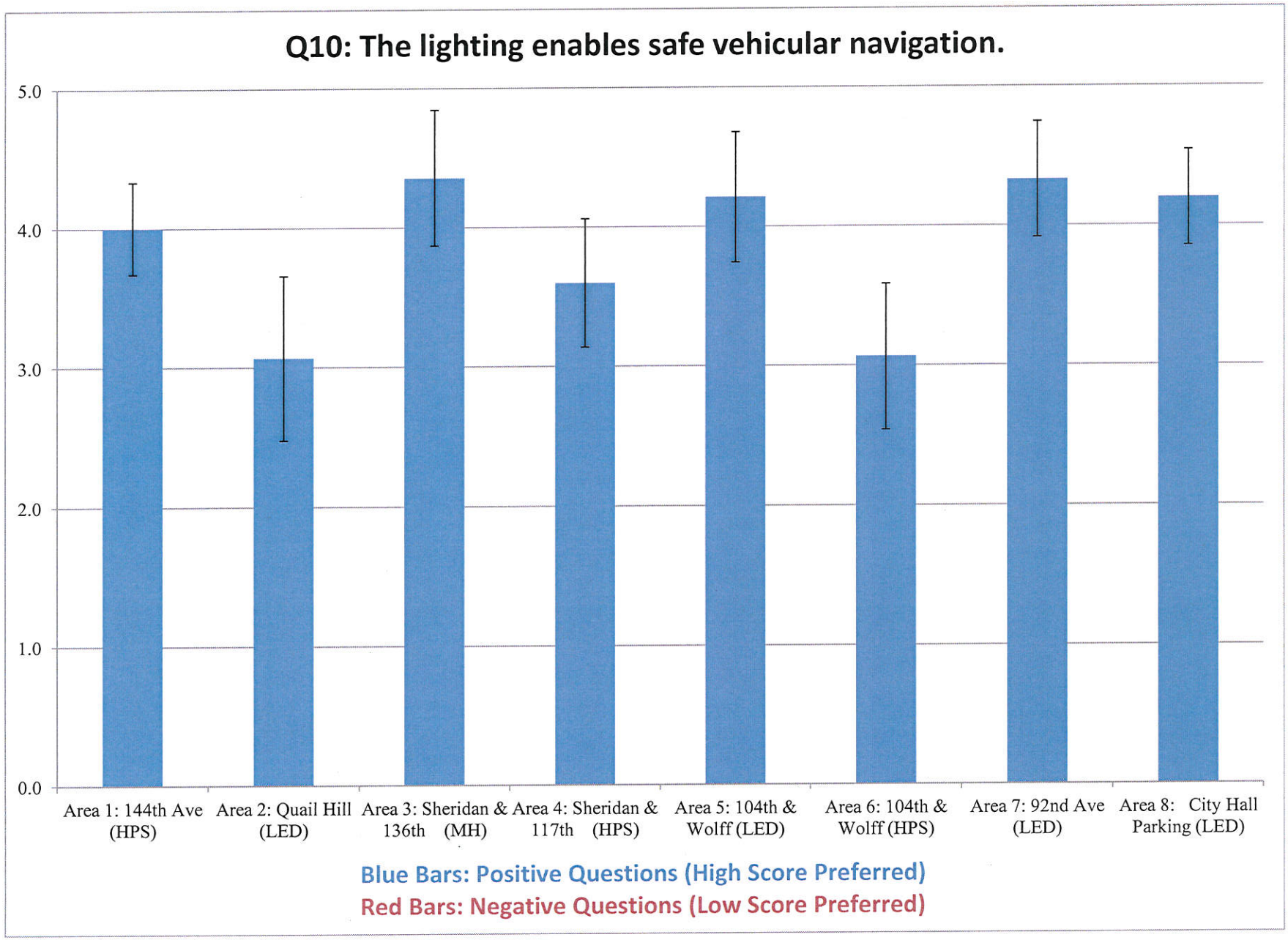

Q5: There is not enough light on the street.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

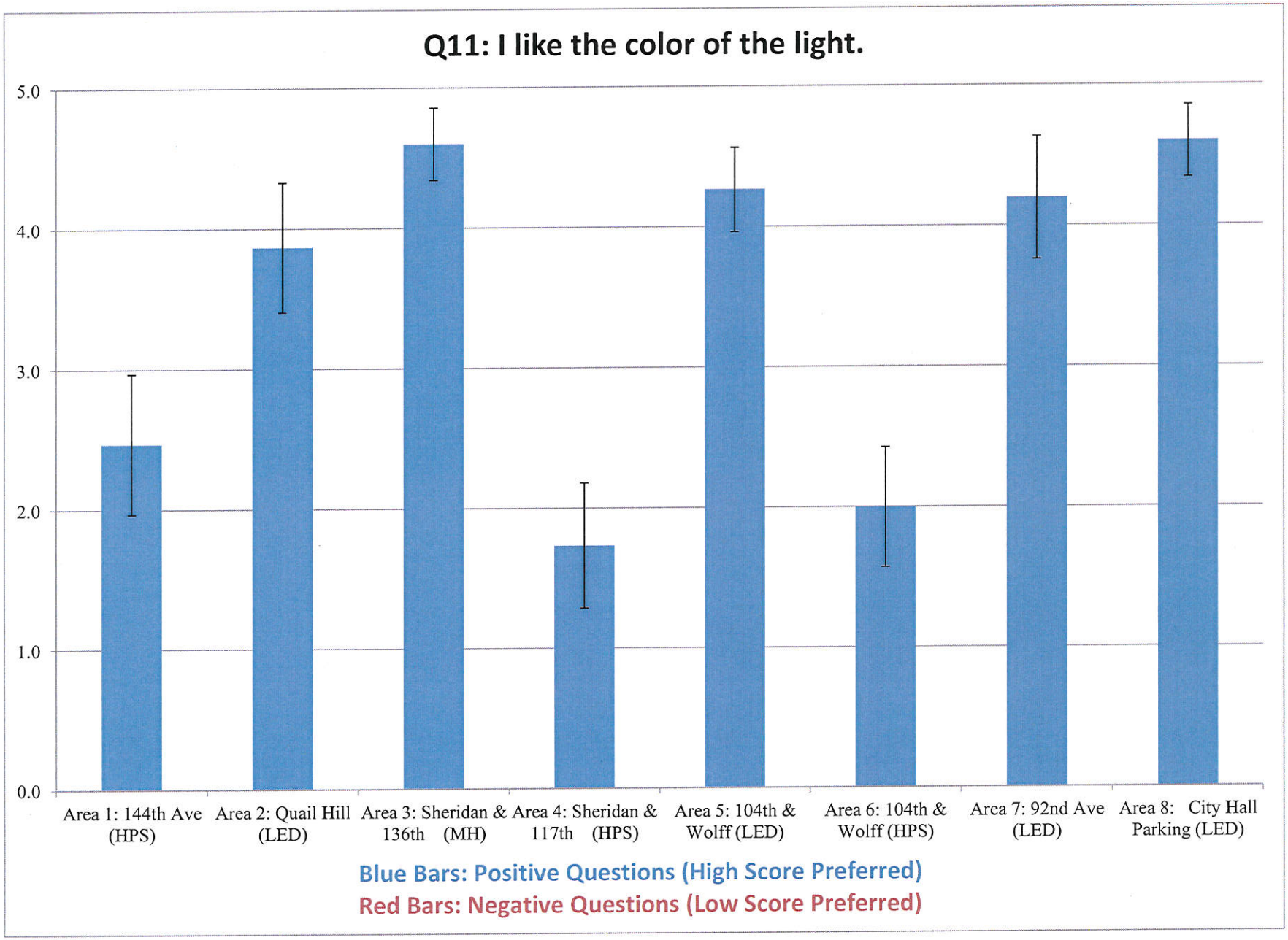

Q6: The light is uneven (patchy).
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

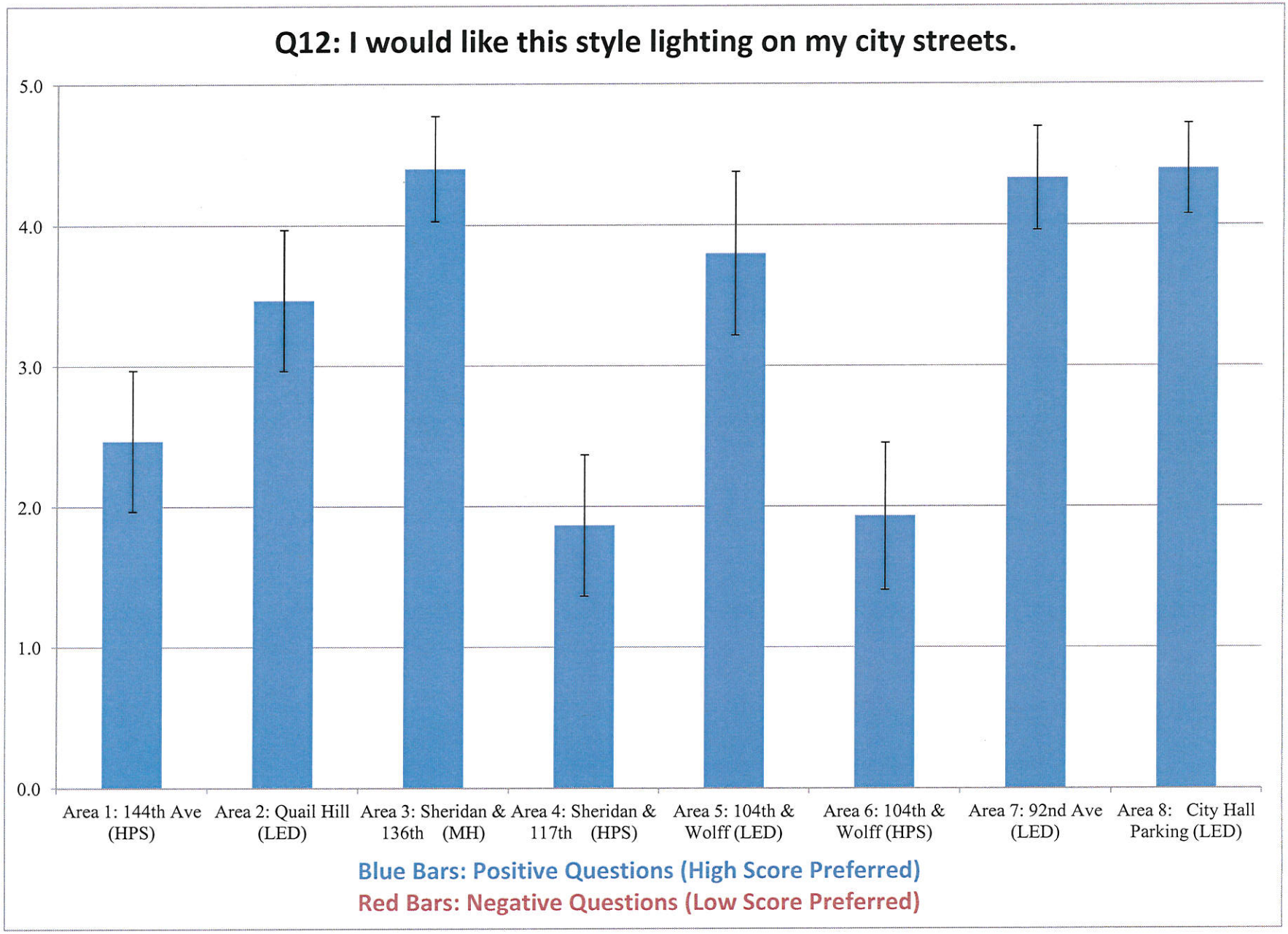

Q7: The light sources are glaring.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

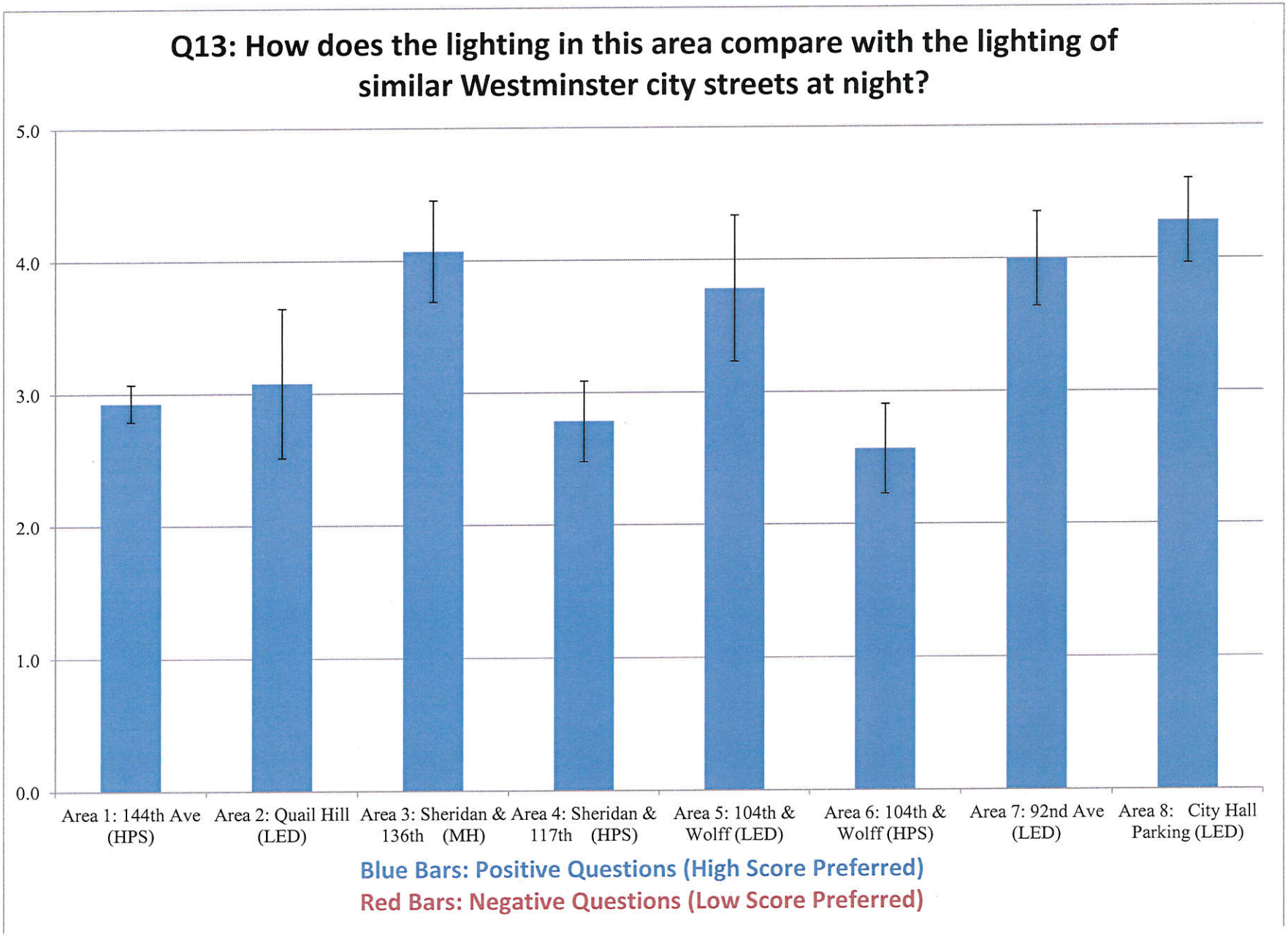

Q8: It would be safe to walk on the sidewalk here at night.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

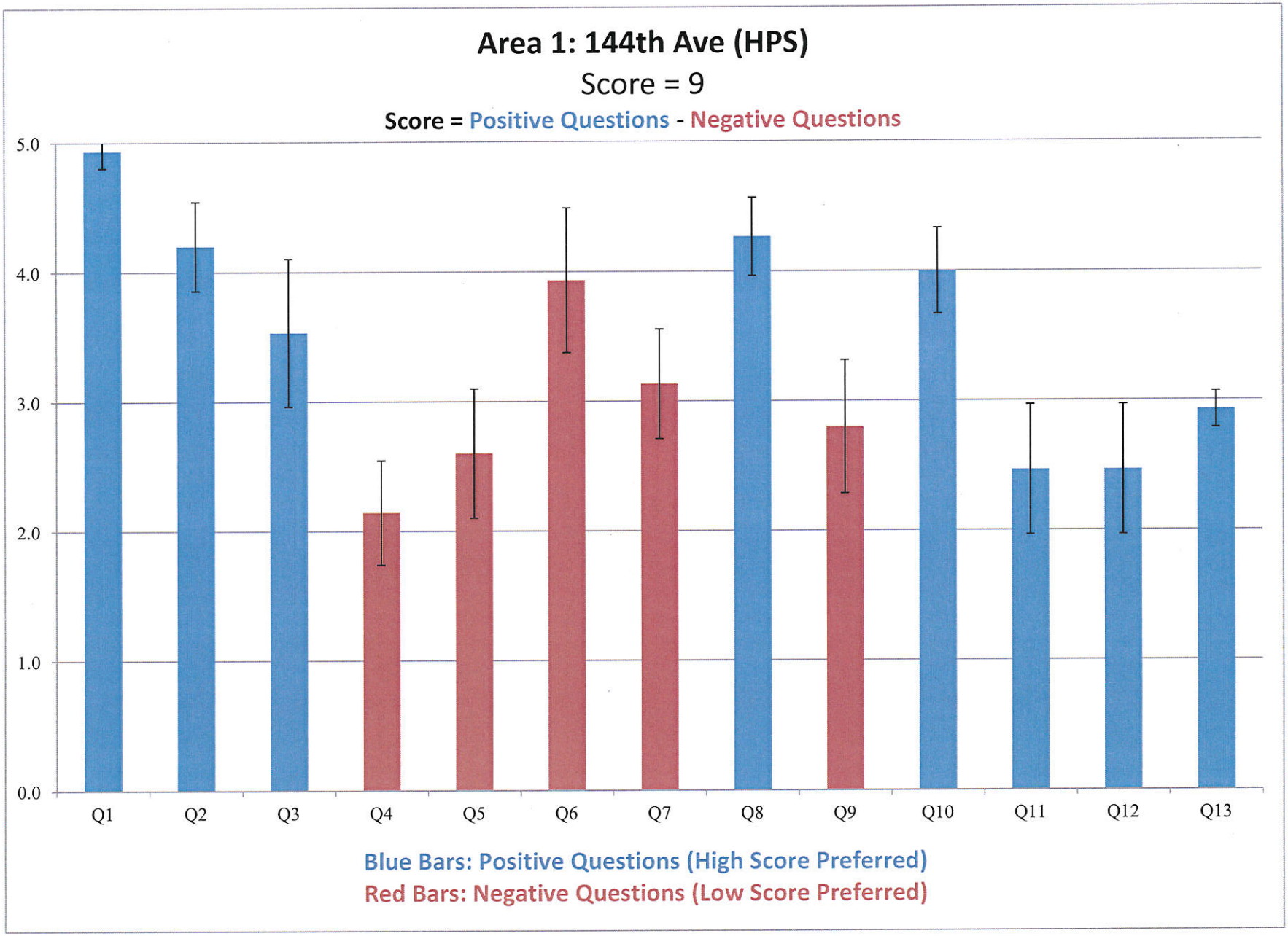

Q9: I cannot tell the colors of things due to the lighting.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

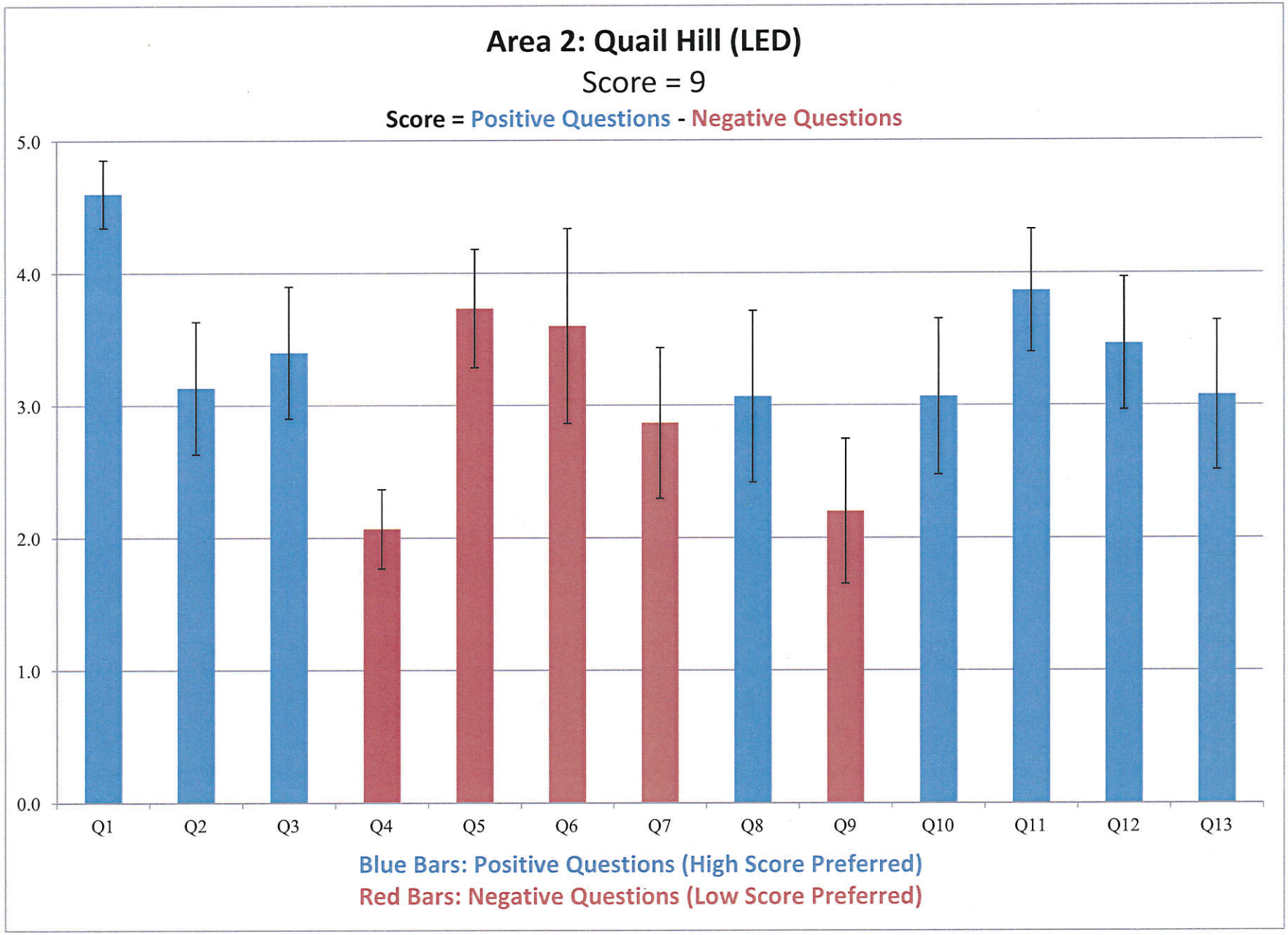

Q10: The lighting enables safe vehicular navigation.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

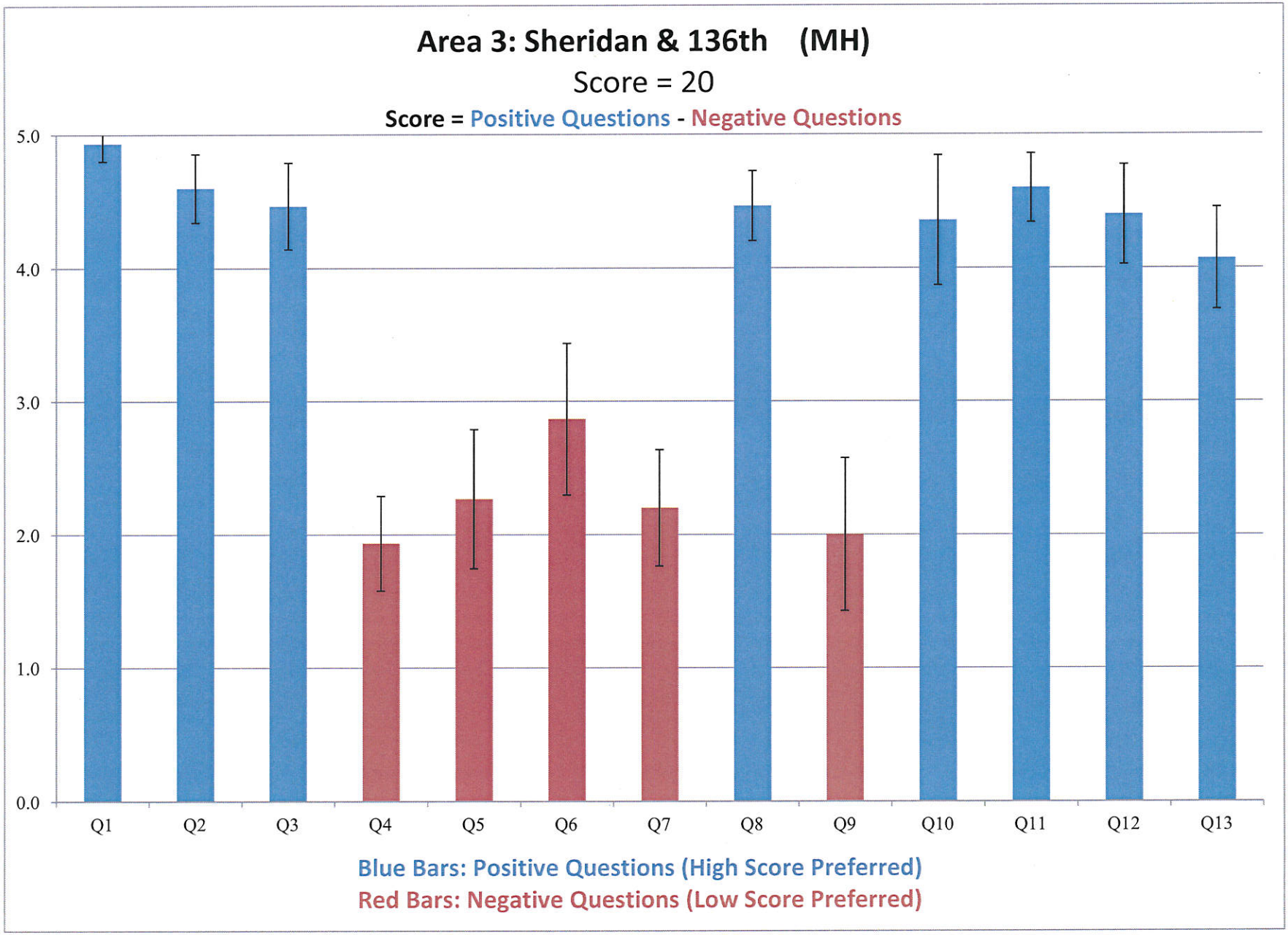

Q11: I like the color of the light.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

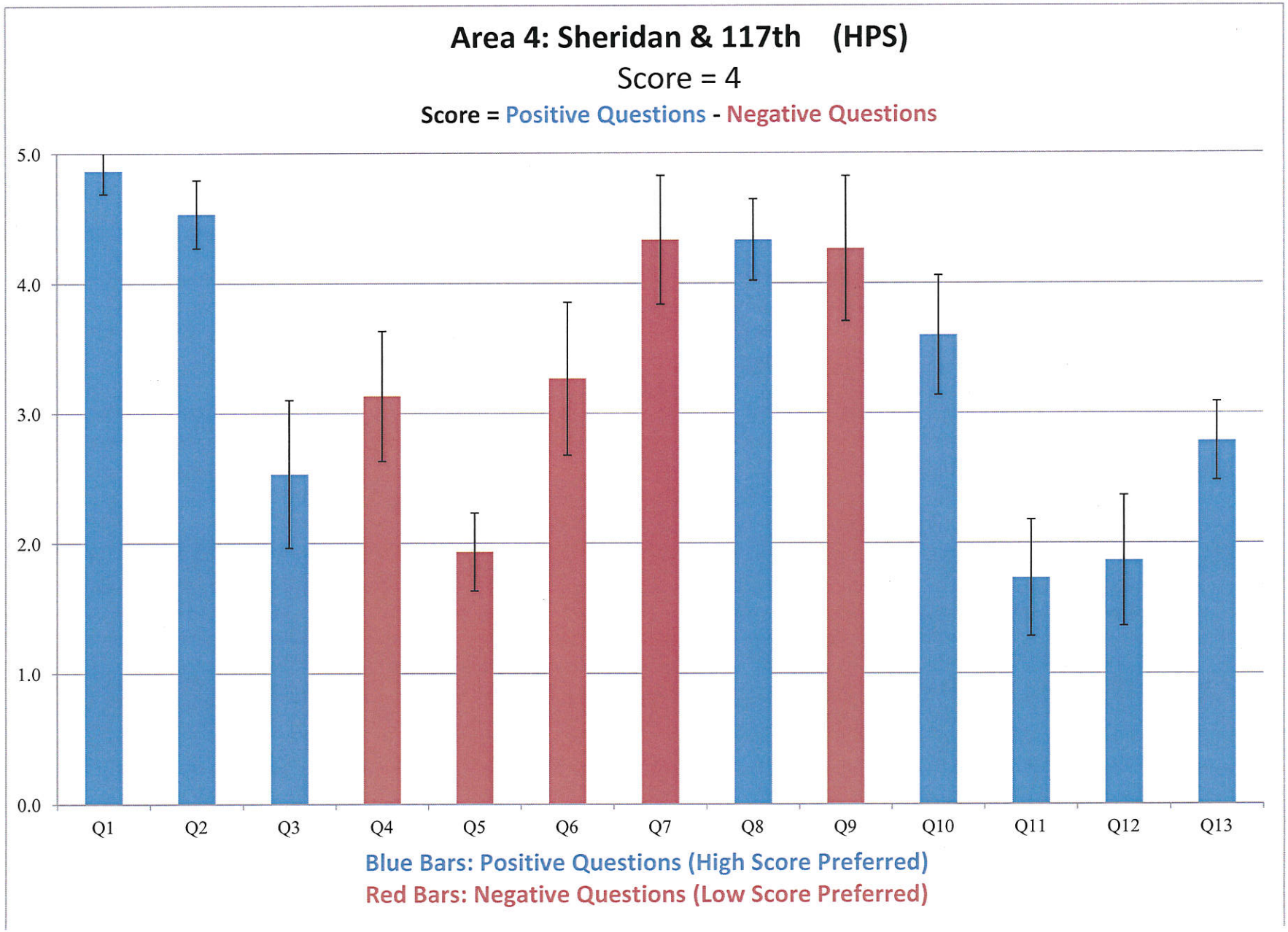

Q12: I would like this style lighting on my city streets.
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

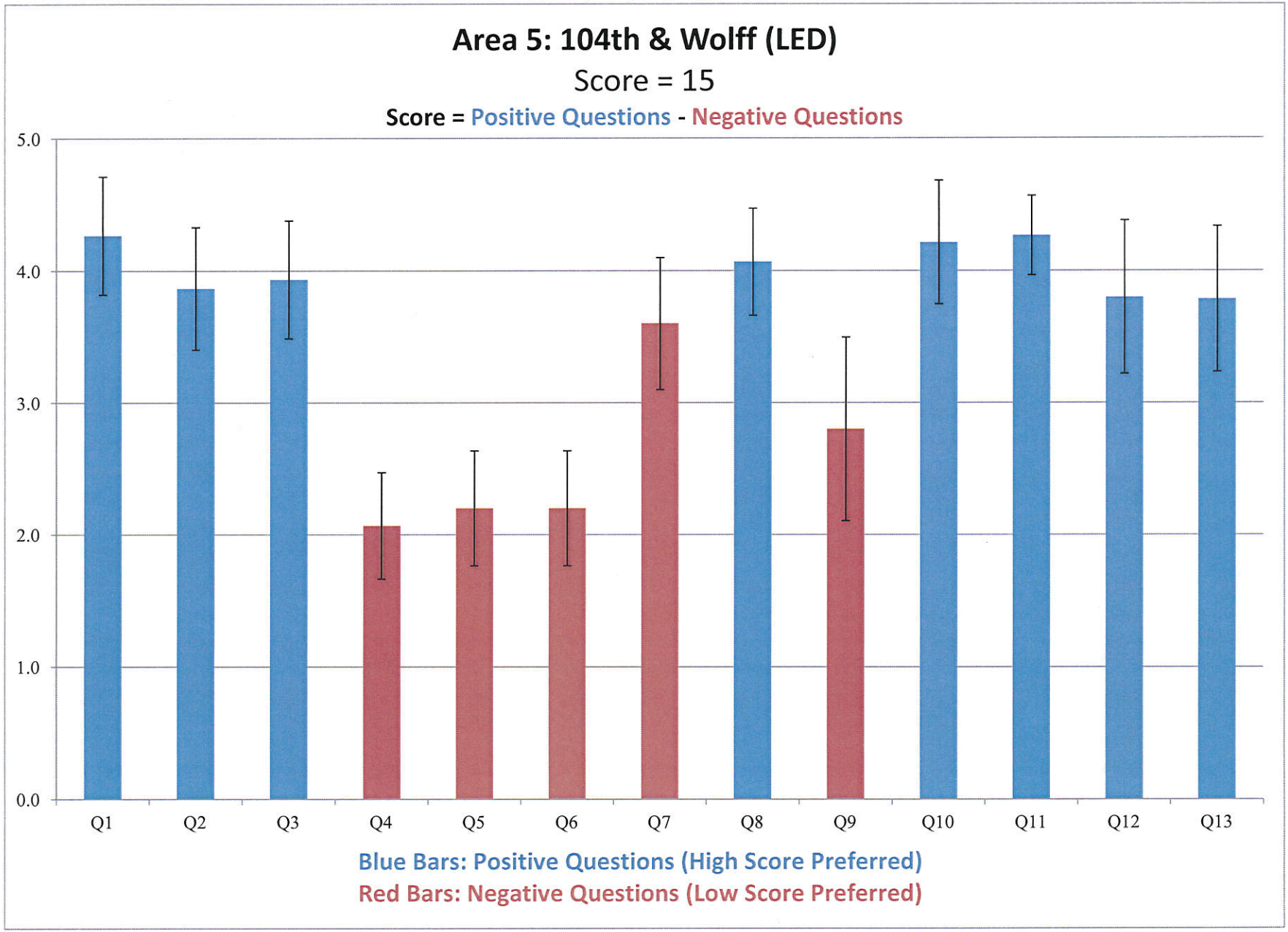

Q13: How does the lighting in this area compare with the lighting of similar Westminster city streets at night?
5.0
4.0
3.0
2.0
1.0
0.0
Area 1: 144th Ave (HPS)
Area 2: Quail Hill (LED)
Area 3: Sheridan & 136th (MH)
Area 4: Sheridan & 117th (HPS)
Area 5: 104th & Wolff (LED)
Area 6: 104th & Wolff (HPS)
Area 7: 92nd Ave (LED)
Area 8: City Hall Parking (LED)
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

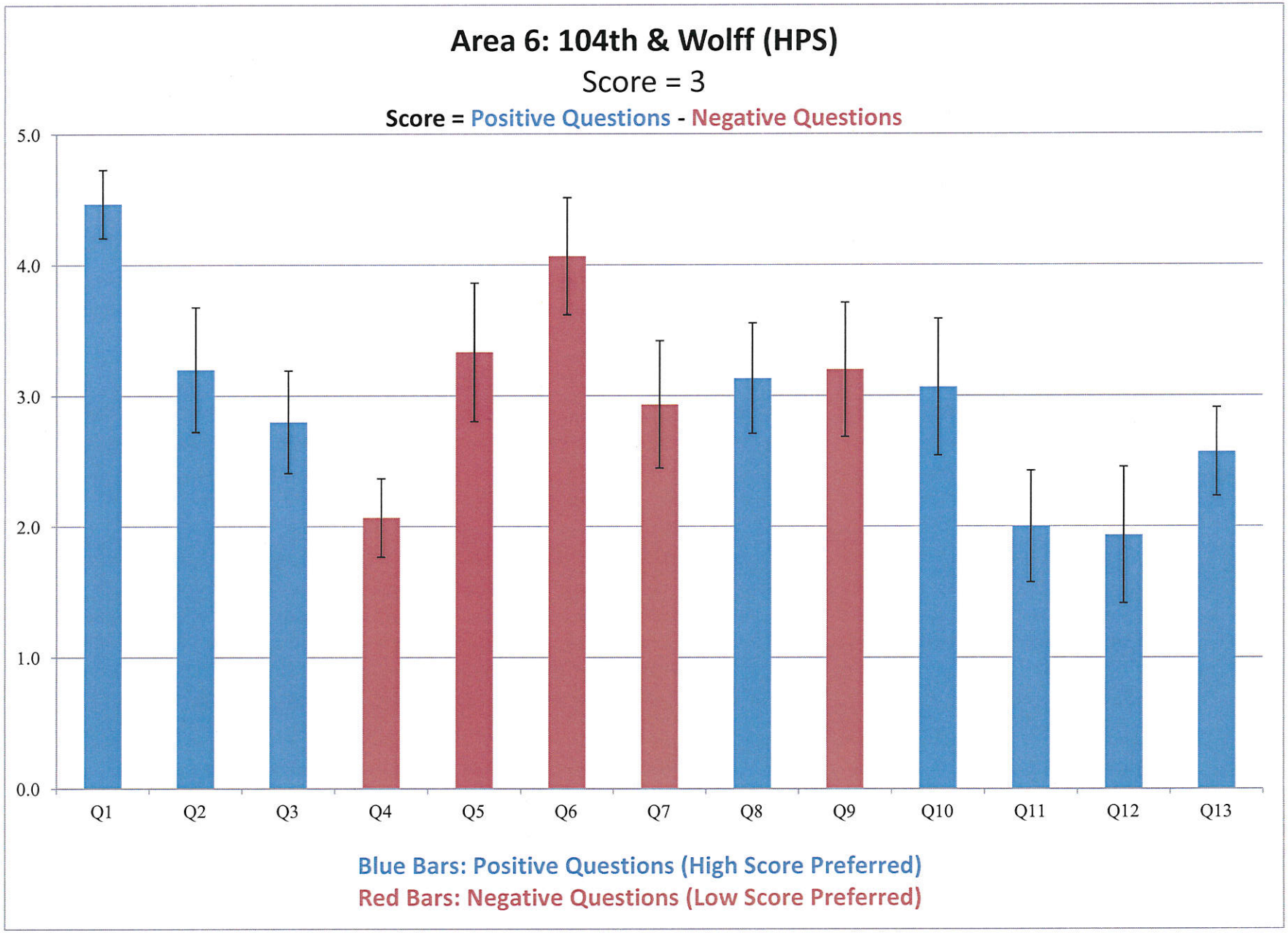

Area 1: 144th Ave (HPS)
Score = 9
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

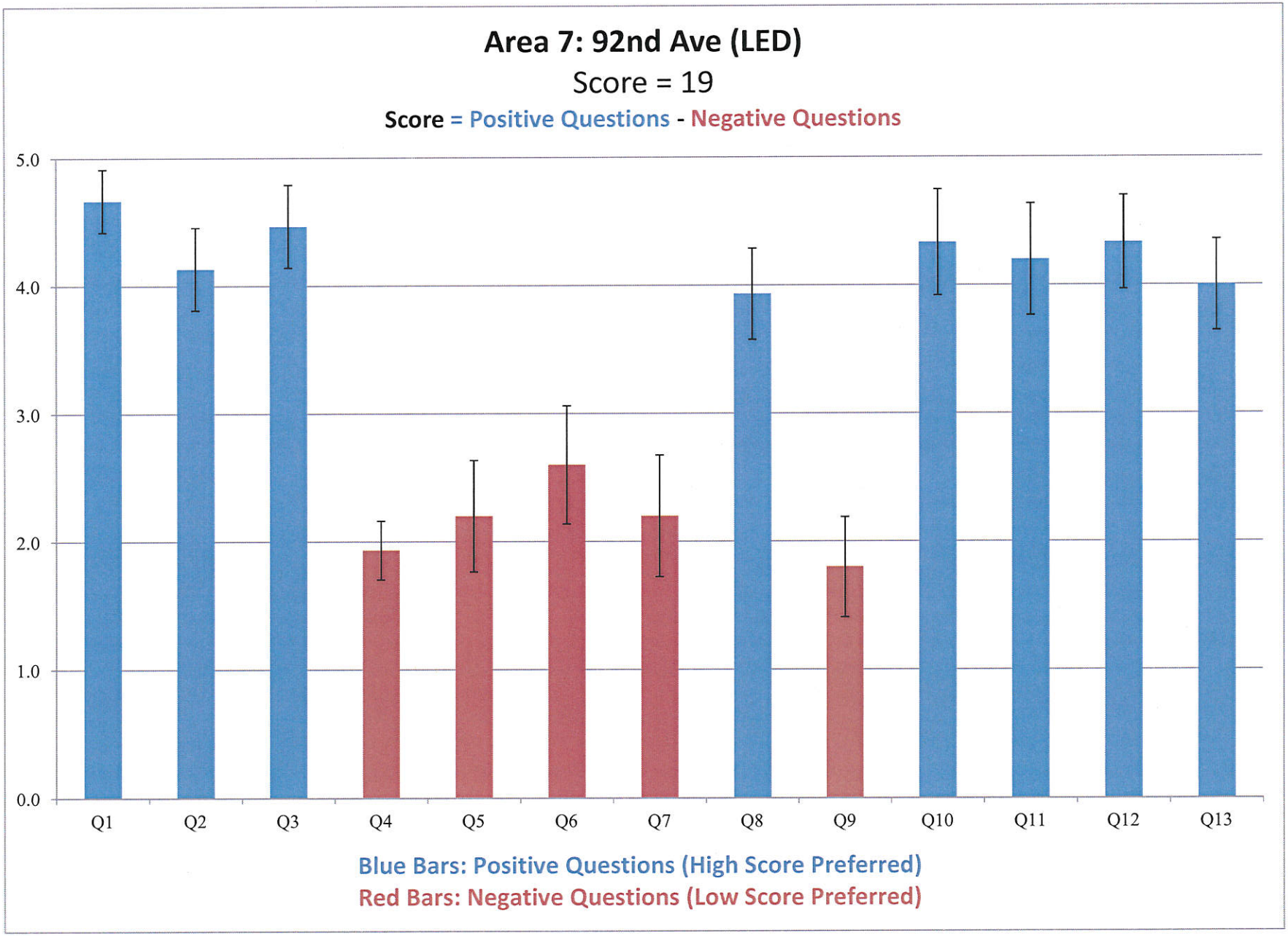

Area 2: Quail Hill (LED)
Score = 9
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

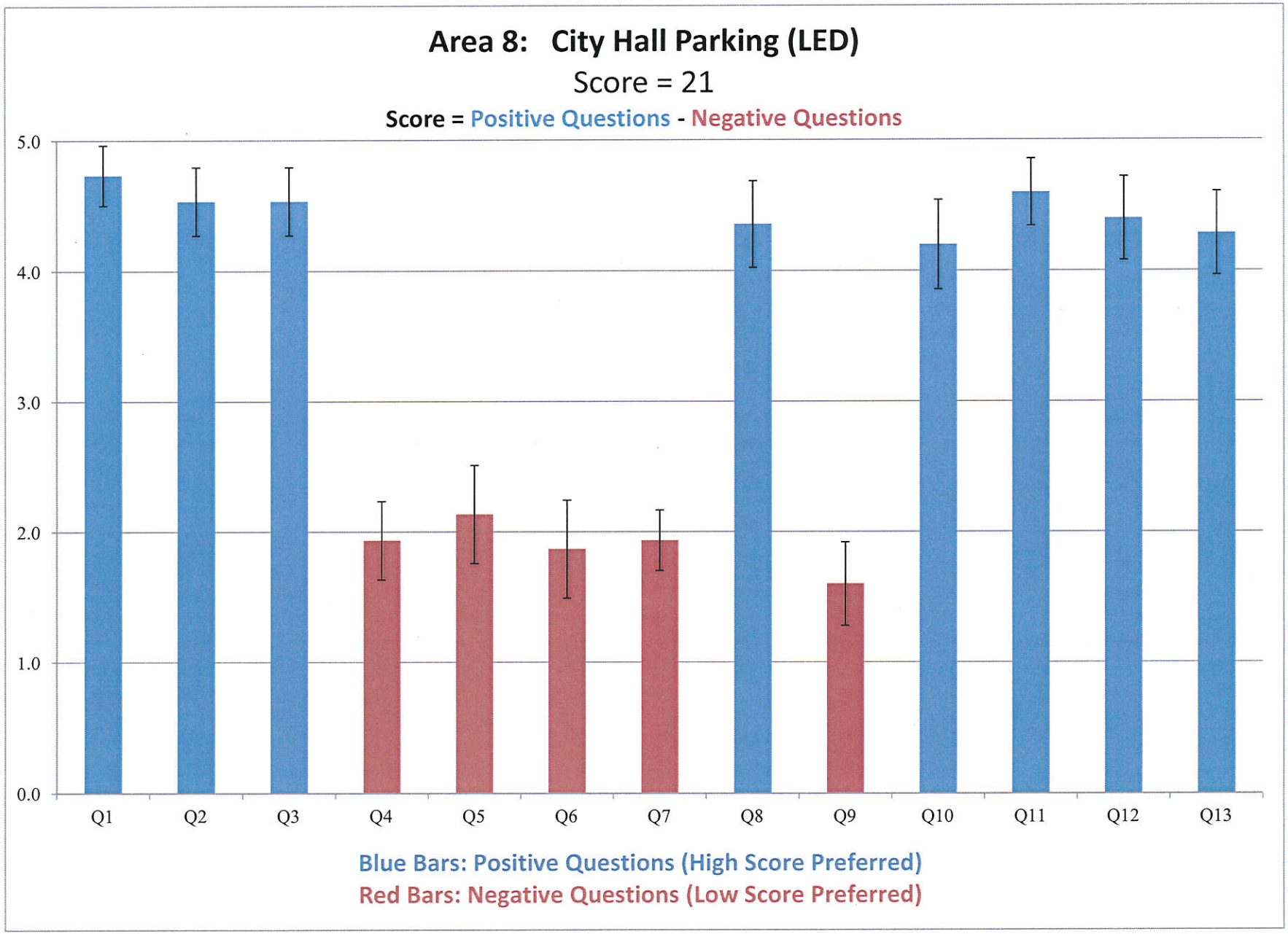

Area 3: Sheridan & 136th (MH)
Score = 20
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)


Area 4: Sheridan & 117th (HPS)
Score = 4
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)


Area 5: 104th & Wolff (LED)
Score = 15
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)


Area 6: 104th & Wolff (HPS)
Score = 3
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)


Area 7: 92nd Ave (LED)
Score = 19
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)


Area 8: City Hall Parking (LED)
Score = 21
Score = Positive Questions - Negative Questions
5.0
4.0
3.0
2.0
1.0
0.0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Blue Bars: Positive Questions (High Score Preferred)
Red Bars: Negative Questions (Low Score Preferred)

City of Westminster
Proposed Street Lighting Design Guide

March 2013

WESTMINSTER

Contents

Section 1: Purpose & Goals

The primary goal of street and roadway lighting is to enhance traffic and pedestrian visibility and safety. Recent developments in lighting technology and visibility research have combined to create an opportunity for cities to reduce the financial and environmental impacts of street lighting while also enhancing visibility and safety.

This Street Lighting Design Guide offers a step-by-step approach to direct City Planners, Engineers, and Developers toward a successful upgrade of the City's street lighting system, with the intent to:

- **Reduce Energy** – using efficient and adaptive technology.
- **Reduce Costs** – for both street lighting energy and maintenance.
- **Reduce Environmental Impacts** – by reducing negative effects of light pollution, light trespass, glare, and carbon emissions.
- **Provide Appropriate Lighting** – by delivering enough light only when, and where it is needed.
- **Provide Enhanced Visibility** – for motorists, cyclists and pedestrians.

The objective of this Guide is to establish both new installation (performance) and retrofit (prescriptive) guidelines, which accomplish visibility goals and limit design variations. This will maintain a uniformity of appearance, reduce the number of replacement components which must be stocked, reduce energy use and light pollution, and prevent costly duplication of design effort. The Guide addresses both new construction and retrofit which keeps the same pole spacing and mounting heights. Retrofit will most likely be the primary use of the guide. The designer should also consider potential adverse lighting impacts on adjacent properties when locating luminaires.

The use of light emitting diode (LED) technology for city street lighting is becoming more widespread. While touted for their energy efficiency, the combination of LEDs with advanced control technology, appropriate changes to lighting criteria, and a better understanding of human mesopic (low light level) visibility creates an enormous potential for energy savings and improved motorist and pedestrian visibility.

Lighting Technology Advancements

Over the last 5-10 years, the lighting industry has introduced new technologies that improve efficacy, visibility characteristics, and lifetime of lighting equipment. These improvements have great potential to reduce energy and maintenance costs for city street lighting. Most of the technology improvements have been centered on LEDs.

LED Efficacy

LED efficacy (the amount of light generated per watt of electricity) continues to increase dramatically as the technology and deployment improves. However, efficacy varies dramatically with the color temperature (cooler or warmer light appearance) of the LED. Due to the current manufacturing process, cooler colors result in higher efficacies than warmer colors. As of 2012, the Department of Energy reported cool white LEDs (5000K) with an average of 144 lumens per watt and warm white (3000K) with an average of 111 lumens per watt.

Color

While efficacy of LEDs increases with cool white (or bluish white) color, public preference typically favors warm white. Ignoring this preference in favor of higher efficacies, manufacturers' marketing media push 5000K and 6000K light sources to gain a competitive edge. This results in installations that produce light very efficiently but in a color that most people find to be harsh, glaring, and uncomfortable.

Lamp Life

The lifetime of LEDs ranges from 50,000 hours to 80,000+ hours, exceeding conventional street lighting technology by 2 to 4 times. The life of LEDs depends most on how effectively the luminaire dissipates heat. Lower temperatures extend the life of LEDs, therefore dimming will extend the life of LEDs.

Dimming

LEDs are easy to dim with a dimmable 0-10V driver. This offers the tunability of lighting levels and energy use when there is less traffic and pedestrian activity late at night, when light sources are new (they put out maximum amount of life before they age) or after a snow storm when reflected light has increased. Tuning lighting to the correct level saves energy.

Advanced Controls for Street Lighting

Network control of exterior lighting provides another layer of energy savings potential to street lighting systems. Most street luminaires use photosensors that detect a drop in ambient daylight, causing the luminaire to switch on. At dawn, the same sensor turns off the luminaire. Although this is a straight-forward solution, it results in the light source being activated at full power all night. Additionally, photosensors are typically the most likely component of the system to fail. Networked lighting controls link groups of luminaires together with either radio frequency or by power line carrier. When dimmable sources (such as LED) are controlled in this netwok, the luminaires can be dimmed or turned off as a group, or individually.

Adaptive Lighting Standards

For some time, the Illuminating Engineering Society (IES) criteria has outlined decreasing light level requirements for decreasing levels of pedestrian and motorist conflict. However, technology has never allowed for such a change to light levels after installation. A roadway lighting design provides the appropriate amount of light for the worst set of design conditions. Additionally, because light output diminishes with time (lumen depreciation), traditional design practice results in an initial light output that exceeds the requirement so that the light level will still be met when the light output has depreciated at the end of the light source life. Dimming control or "tuning" these light sources now can provide the designed light level at all times, accounting for decreasing late night pedestrian activity and lumen depreciation over the life of the light source.

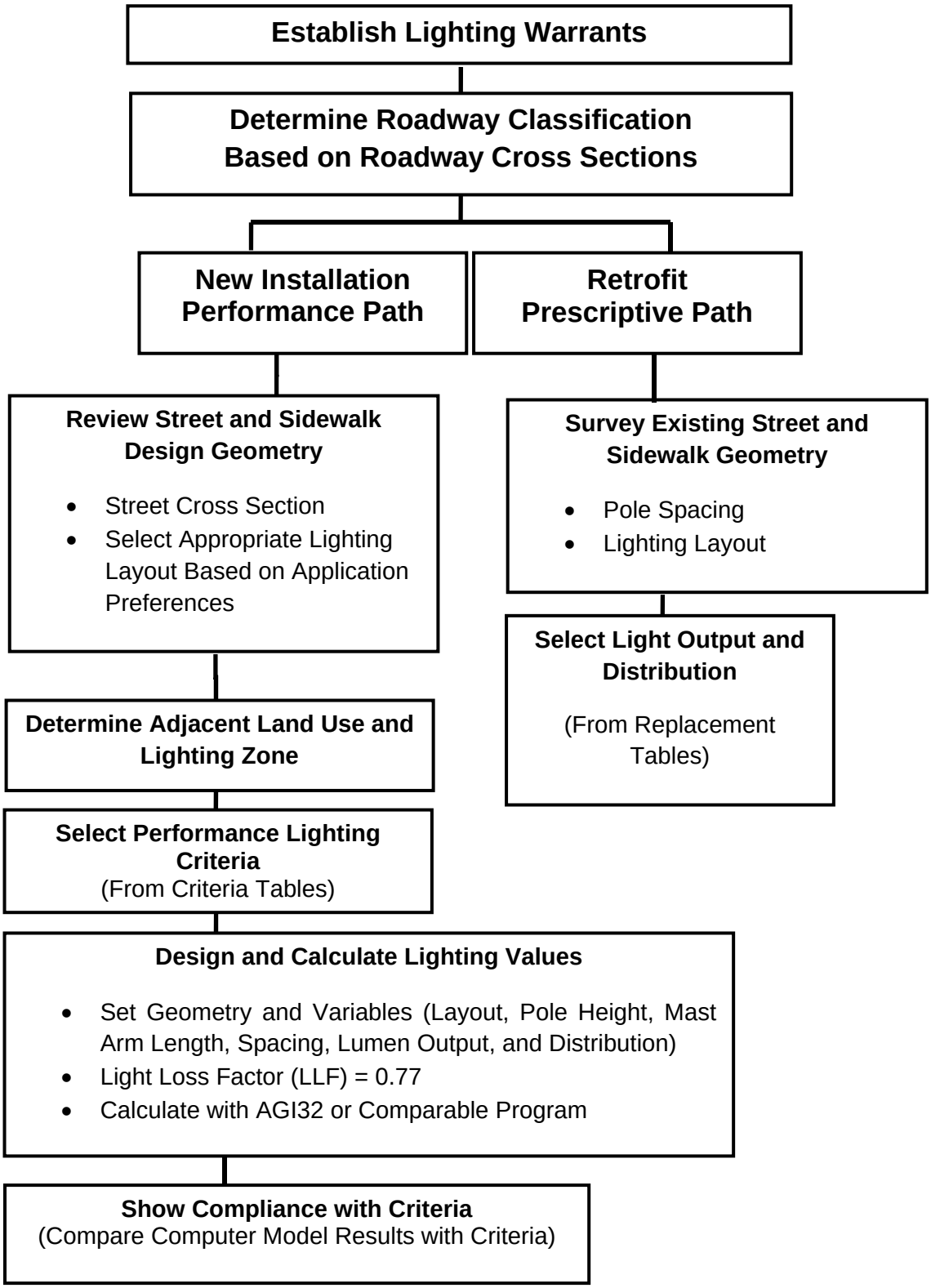
Refer to the Westminster Adaptive Lighting Design Guide for recommendations and strategies for adaptive tuning of street lighting.

White Light Effectiveness

LEDs produce a white light as opposed to the yellow light produced by the high pressure sodium (HPS) sources commonly used in North American cities. With the revision of IES Technical Memorandum (TM 12-12), “Spectral Effects of Lighting on Visual Performance at Mesopic Lighting Levels”, the IES recognized that some spectral distributions provide better visibility under mesopic (low light level) conditions than others. Although difficult to pinpoint, TM-12-12 documents a method for calculating the effective luminance (amount of light reflected off the pavement) of a roadway lighting design. This means that designers can design for lower light levels when using a white light source and achieve the same level of visibility provided by higher light levels produced by a high pressure sodium (HPS) light source.

The energy savings from this combination of efficient LED sources, controls, adaptive standards, and white light effectiveness far exceeds the potential of the efficient technology alone and provides the basis for achieving the intent and goals of this Street Lighting Design Guide.

Section 2: How to Use this Design Guide



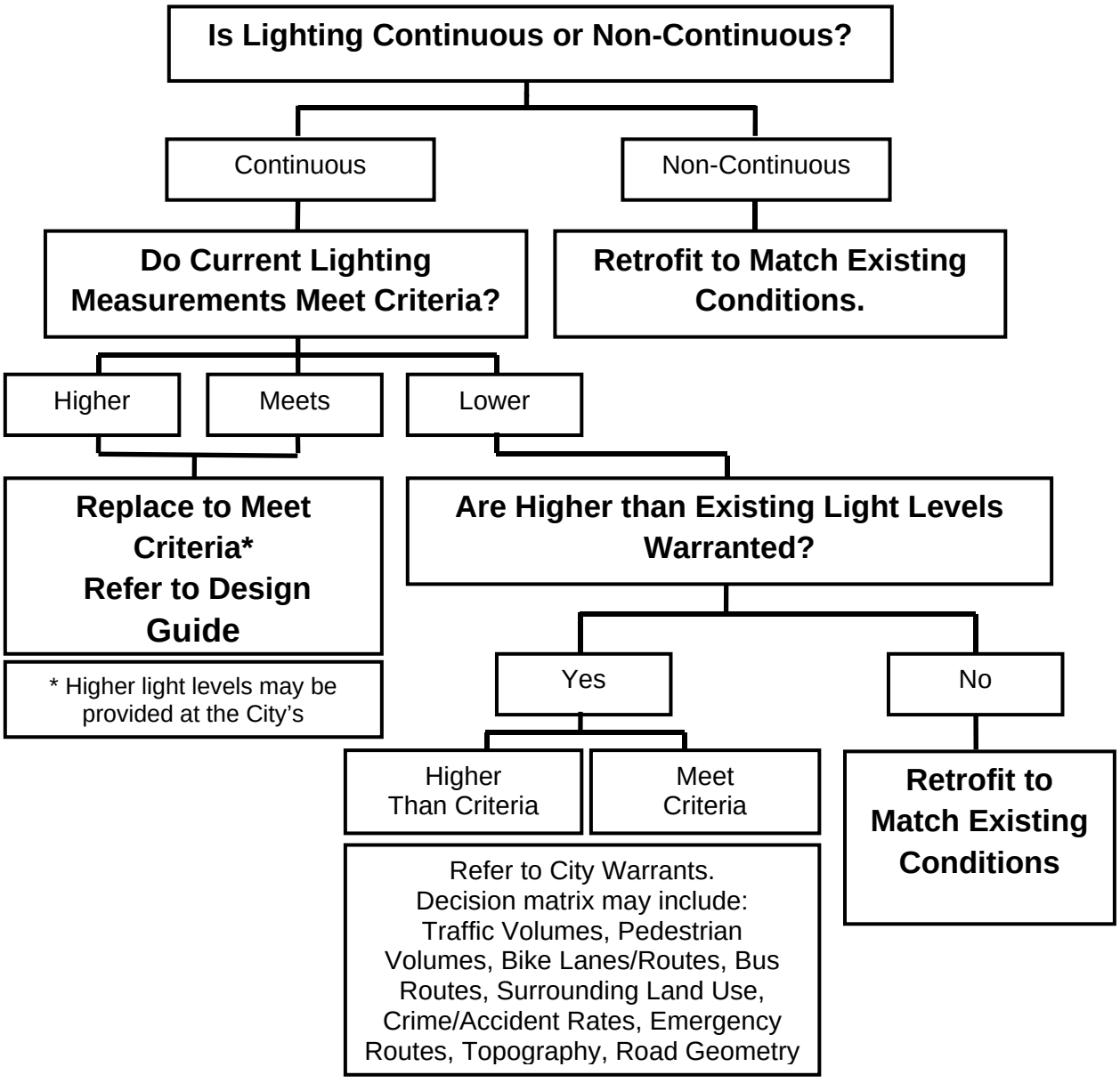
Design Guide

Lighting Warrants

Based on the roadway type and context, a particular section of roadway may or may not require lighting. If it does, it may only require non-continuous lighting rather than continuous lighting.

In addition to the criteria presented in this guide, the Municipal Traffic Engineer may at his/her sole discretion impose alternate standards and criteria when deemed appropriate to protect the safety and welfare of the public. The following charts outline how to determine lighting warrants for both retrofit applications and new construction.

PRESCRIPTIVE PROJECTS (RETROFIT)



PERFORMANCE PROJECTS (NEW CONSTRUCTION)

	Adjacent Land Use	High Conflict	Med Conflict	Low Conflict
Arterial	**Commercial**	Continuous	Continuous	Non-Continuous
	Industrial	Continuous	Continuous	Non-Continuous
	Residential	Continuous	Non-Continuous	Non-Continuous
	Open Space	Continuous	Non-Continuous	Not Warranted
Collector	**Commercial**	Continuous	Continuous	Non-Continuous
	Industrial	Continuous	Non-Continuous	Non-Continuous
	Residential	Non-Continuous	Non-Continuous	Non-Continuous
	Open Space	Non-Continuous	Non-Continuous	Not Warranted
Local	**Commercial**	Continuous	Non-Continuous	Non-Continuous
	Industrial	Non-Continuous	Non-Continuous	Non-Continuous
	Residential	Non-Continuous	Non-Continuous	Non-Continuous
	Open Space	Non-Continuous	Non-Continuous	Not Warranted

Roadway Lighting Criteria and Layout Tables

Lighting Equipment

The following table describes the general requirements for each of the three luminaire types: cobraheads, teardrops, and post tops. These are equipment requirements that apply to the luminaire regardless of application or layout. Refer to the *City of Westminster's Lighting Pole Styles Catalog (January 2012)* for the Luminaire Type References.

Luminaire Type	Backlight (B)	Uplight (U)	Glare (G)	Color Temperature (K)	Color Rendering (CRI)	Photometric Distribution
Cobraheads (Types M1, M3, M4, M15, W1, W2)	Varies based on classification and layout	0	2	3800K – 4300K	70	Varies based on classification
Teardrops (Types M13, M14)	Varies based on classification and layout	1	2	3800K – 4300K	70	Type III Medium
Post tops (Type F1)	1	1	1	3800K – 4300K	70	Type III Medium

Pole Layouts

For retrofit projects, the pole layout cannot be modified. However, when considering new installation, the following table describes the most appropriate pole layout based on luminaire type and the adjacent land use. Lighting zone may also be considered when selecting the layout. While the street lighting criteria is consistent as major arterials pass through different land uses, the layout, and backlight rating may change, per direction from the City, based on the adjacent land use. Median pole configurations may be used for the best visibility, but this also increases light trespass. Opposite configurations provide a good balance of good visibility and minimal light trespass to adjacent properties. The following table shows the ideal pole configuration based on luminaire type and application.

Pole Layout	Luminaire Type(s)	Adjacent Land Use and Lighting Zone			
		Commercial (LZ2 & 3)	Industrial (LZ2)	Residential (LZ 1 & 2)	Open Space (LZ1)
Median	M15, M13, M14	Preferred	Preferred		
Opposite	M1, M3, M4, W1, W2			Preferred	Preferred
Staggered	M1, M3, M4, W1, W2	Staggered layouts are not preferred for new construction because visibility is reduced compared to opposite or median layouts.			

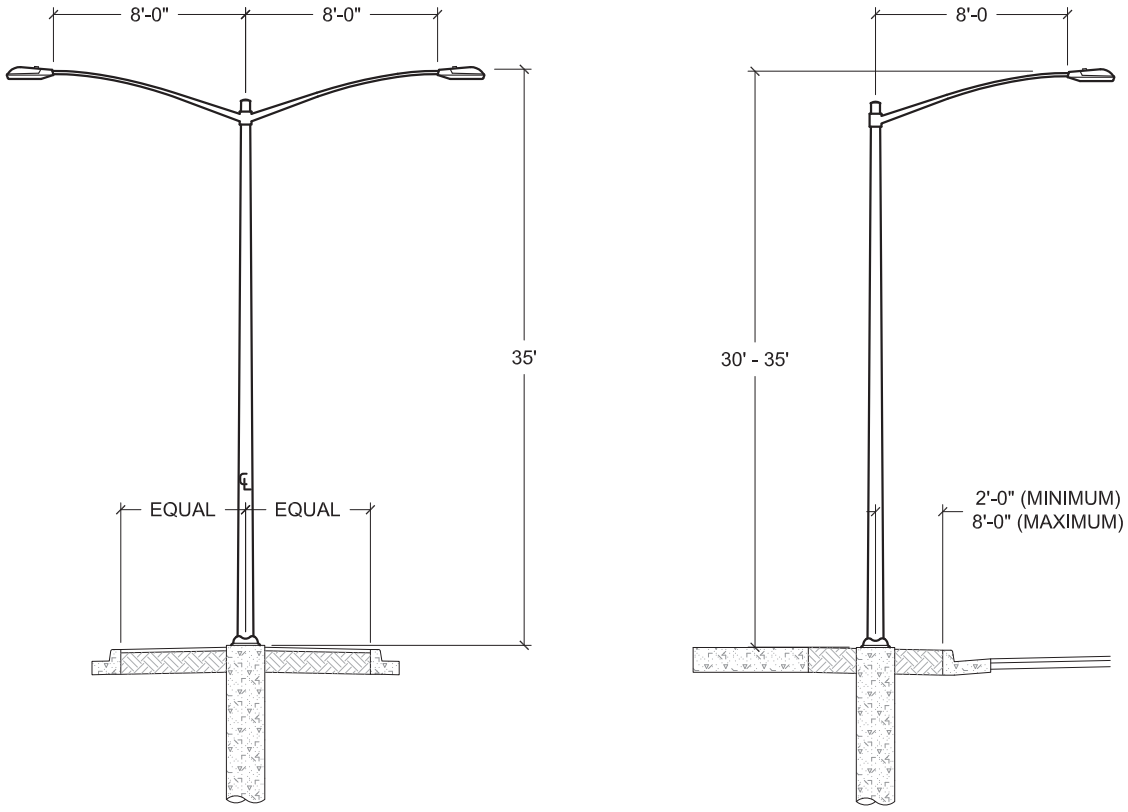
Layout Tables

The layout tables are organized first by Method (Performance for new construction, and Prescriptive for retrofit), then by roadway classification (Major Arterial, Minor Arterial, Collector, and Local) and by pole configuration (median, opposite, and staggered). The criteria in these tables vary between 75% and 100% of IES criteria based on a survey conducted in the City of Westminster, coordination City Engineers and City Attorney, and supported by visibility research comparing white light and high pressure sodium.

Performance Criteria (New Construction)

Major Arterial (6-Lane) - Cobrahead

Replace Types: M1, M3, M4, M15, W1, W2



Median Layout **Opposite / Staggered Layout**

Target Criteria: Major Arterial (6-Lane)			
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**
0.65*	7.0	4.0	B3-U0-G2**

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

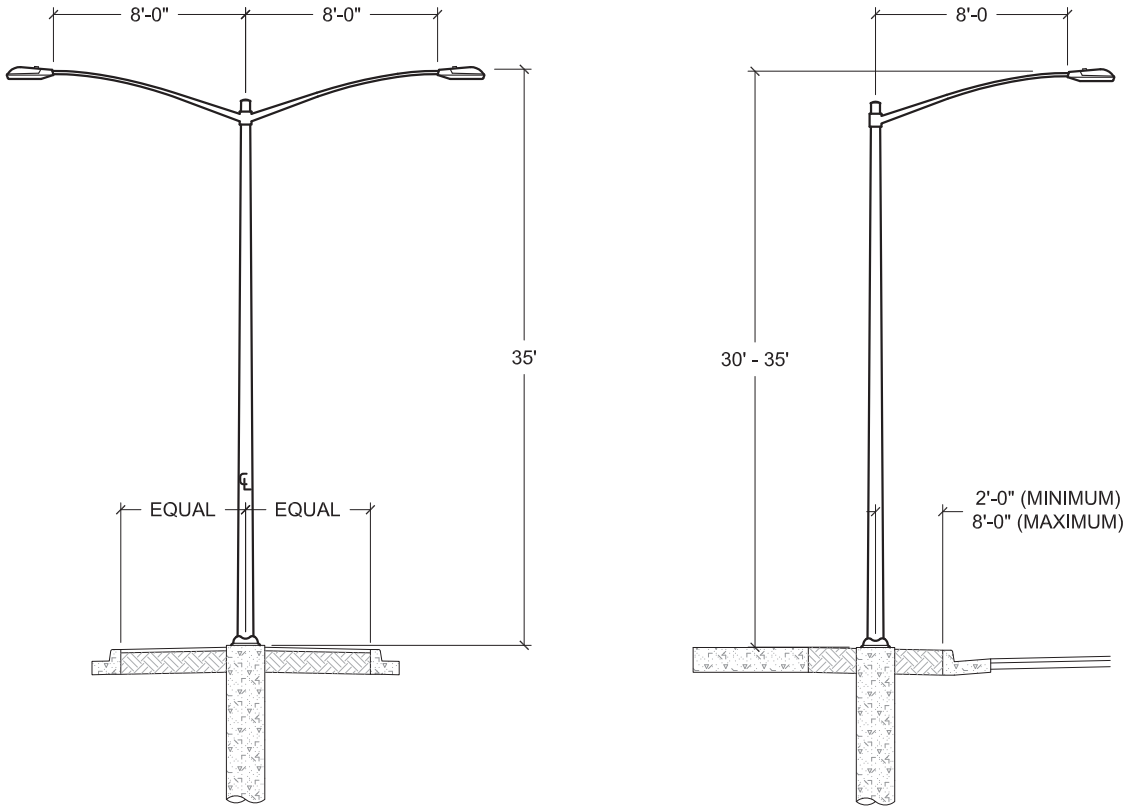
** For opposite / staggered layouts, if adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

	Maximum Luminaire Wattage		
Pole Spacing	**Median**	**Opposite**	**Staggered**
150	110	110	
200	170	170	150
250	210	210	170
300			190
350			210

Performance Criteria (New Construction)

Major Arterial (4-Lane) - Cobrahead

Replace Types: M1, M3, M4, M15, W1, W2



Median Layout **Opposite / Staggered Layout**

Target Criteria: Major Arterial (4-Lane)			
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**
0.65*	7.0	4.0	B3-U0-G2**

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

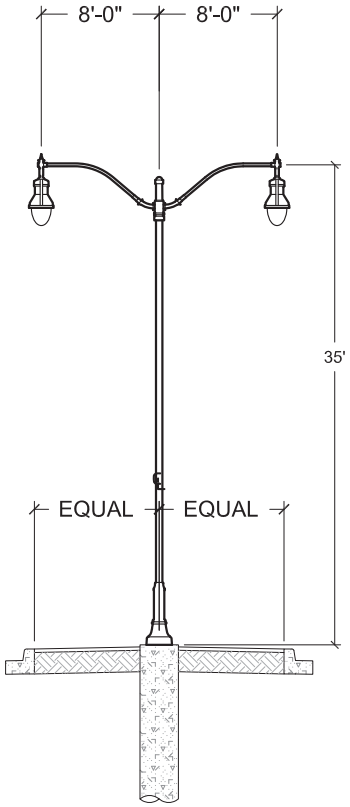
** For opposite / staggered layouts, if adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

	Maximum Luminaire Wattage		
Pole Spacing	**Median**	**Opposite**	**Staggered**
150	100	100	
200	140	120	120
250	180	170	170
300			200
350			240

Performance Criteria (New Construction)

Major Arterial (4-Lane) - Decorative Teardrop

Replace Types: M13, M14



Median Layout

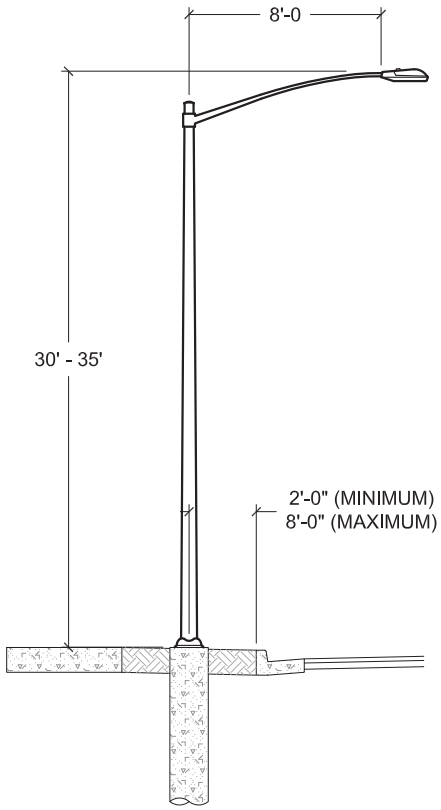
Target Criteria: Major Arterial (4-Lane)				
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**	**Maximum Luminaire Wattage**
0.65*	7.0	4.0	B2-U1-G2	140

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Performance Criteria (New Construction)

Minor Arterial - Cobrahead

Replace Types: M1, M3, M4, W1, W2



Opposite / Staggered Layout

Target Criteria: Minor Arterial			
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**
0.6*	6.0	3.5	B3-U0-G2**

* Average luminance is the IESNA recommended maintained luminance value for roadway classification type

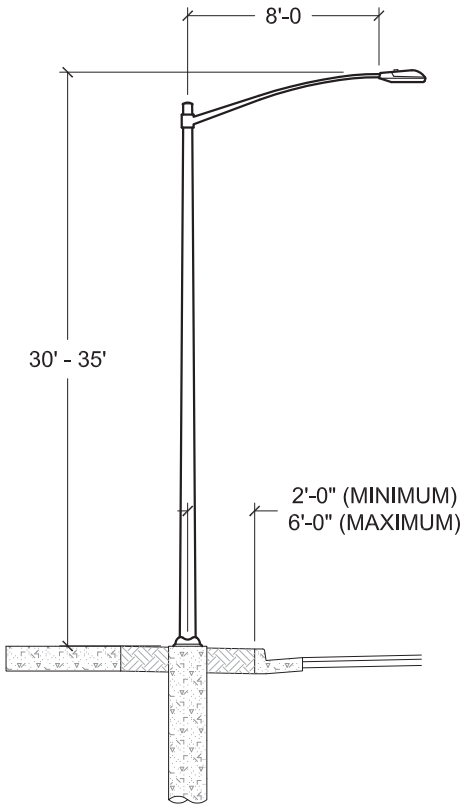
** If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

	Maximum Luminaire Wattage	
Pole Spacing	**Opposite**	**Staggered**
150	90	
200	110	110
250	160	160
300		190
350		210

Performance Criteria (New Construction)

Major Collector - Cobrahead

Replace Types: M1, M3, M4, W1, W2



Opposite / Staggered Layout

Target Criteria: Major Collector			
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**
0.45*	6.0	3.5	B2-U0-G2**

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

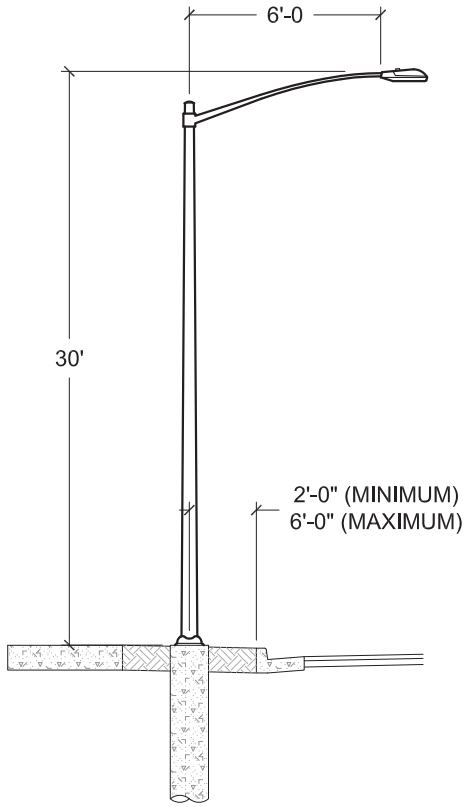
** If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

	Maximum Luminaire Wattage	
Pole Spacing	**Opposite**	**Staggered**
150	60	
200	70	85
250	100	90
300		100
350		110
400		110

Performance Criteria (New Construction)

Minor Collector - Cobrahead

Replace Types: M1, M3, M4, W1, W2



Opposite / Staggered Layout

Target Criteria: Minor Collector			
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**
0.45*	6.0	3.5	B2-U0-G2**

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

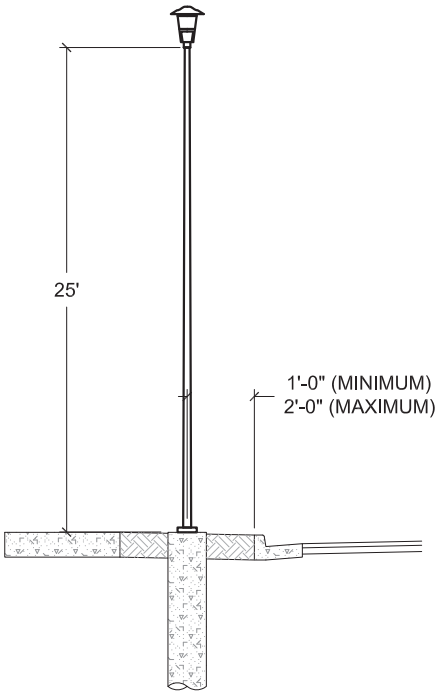
** If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

	Maximum Luminaire Wattage	
Pole Spacing	**Opposite**	**Staggered**
150	45	
200	60	70
250	90	80
300		90
350		90
400		100

Performance Criteria (New Construction)

Local - Decorative Post Top

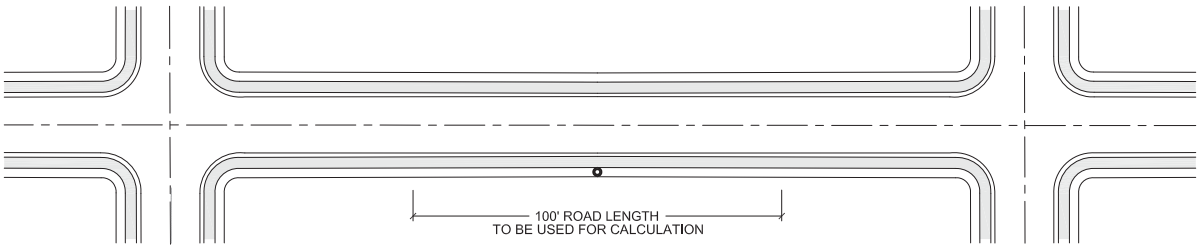
Replace Types: F1



Isolated Locations

Target Criteria: Local				
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**	**Maximum Luminaire Wattage**
0.3*	N/A	6.0	B1-U1-G1	60

* Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type.
Roadway illumination calculation is for a 100’ length of roadway, 50’ on either side of pole.

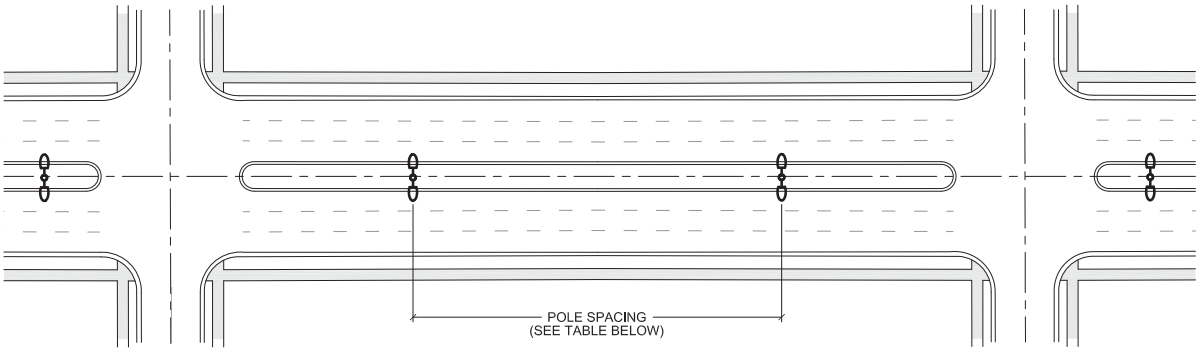


Prescriptive Criteria (Retrofit)

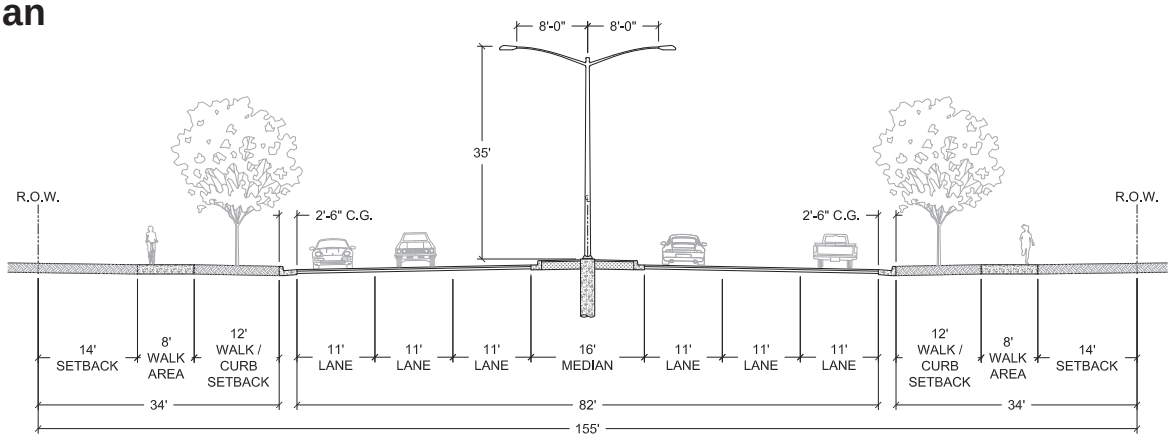
Major Arterial (6-Lane) - Cobrahead

Median Layout

Replace Type: M15



Plan



Section

Major Arterial (6-Lane): Median Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Sheridan Boulevard	150	Median	8500	110	Type II, Medium	B3-U0-G2
Sheridan Boulevard	200	Median	11000	170	Type II, Medium	B3-U0-G2
Sheridan Boulevard	250	Median	16000	210	Type II, Medium	B3-U0-G2

Target Criteria: Major Arterial (6-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

* Target criteria is provided for use during RFP and luminaire qualification only

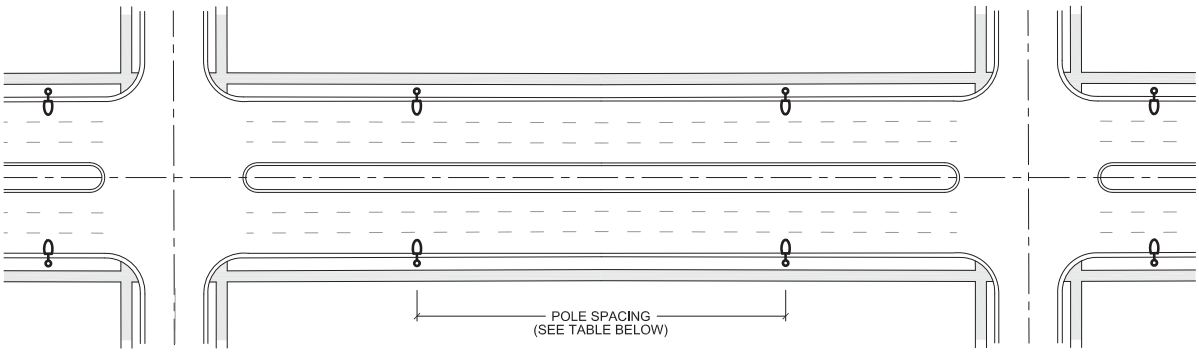
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

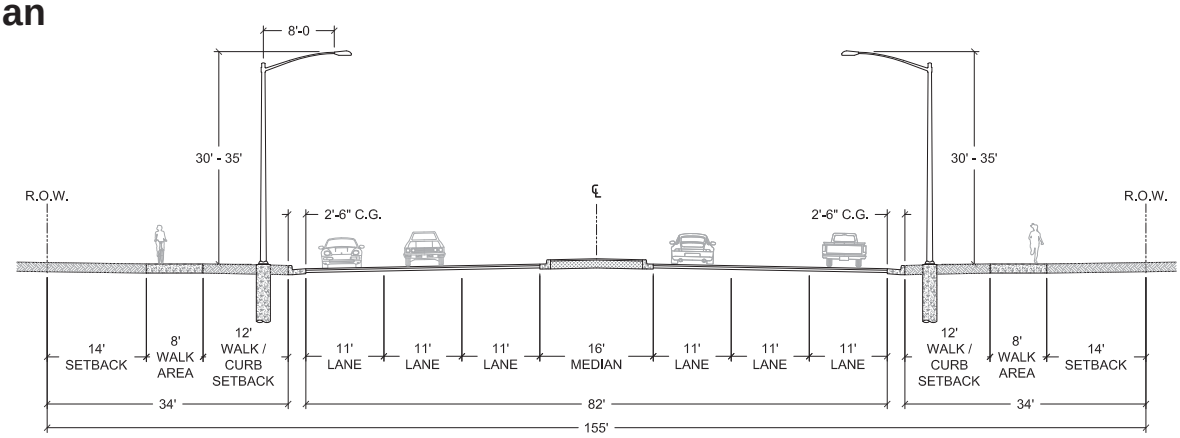
Major Arterial (6-Lane) - Cobrahead

Opposite Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Arterial (6-Lane): Opposite Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Sheridan Boulevard	150	Opposite	8500	110	Type II, Medium	B3-U0-G2*
Sheridan Boulevard	200	Opposite	11000	170	Type II, Medium	B3-U0-G2*
Sheridan Boulevard	250	Opposite	16000	210	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no hgher than B1-U0-G1

Target Criteria: Major Arterial (6-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

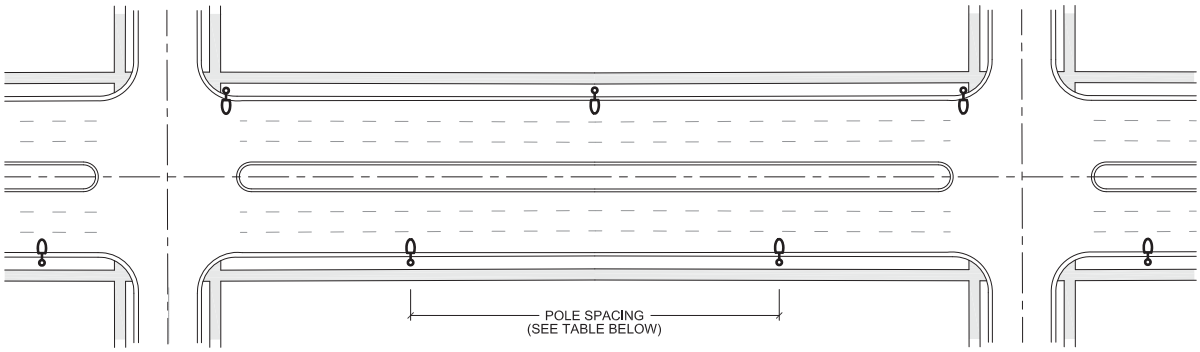
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

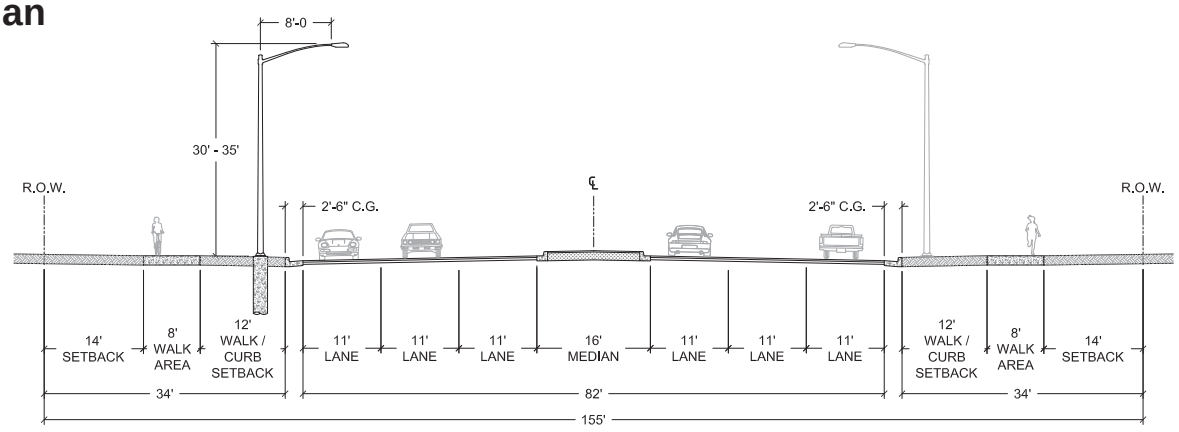
Major Arterial (6-Lane) - Cobrahead

Staggered Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Arterial (6-Lane): Staggered Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Sheridan Boulevard	200	Staggered	11000	150	Type II, Medium	B3-U0-G2*
Sheridan Boulevard	250	Staggered	12000	170	Type II, Medium	B3-U0-G2*
Sheridan Boulevard	300	Staggered	14000	190	Type II, Medium	B3-U0-G2*
Sheridan Boulevard	350	Staggered	16000	210	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Major Arterial (6-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

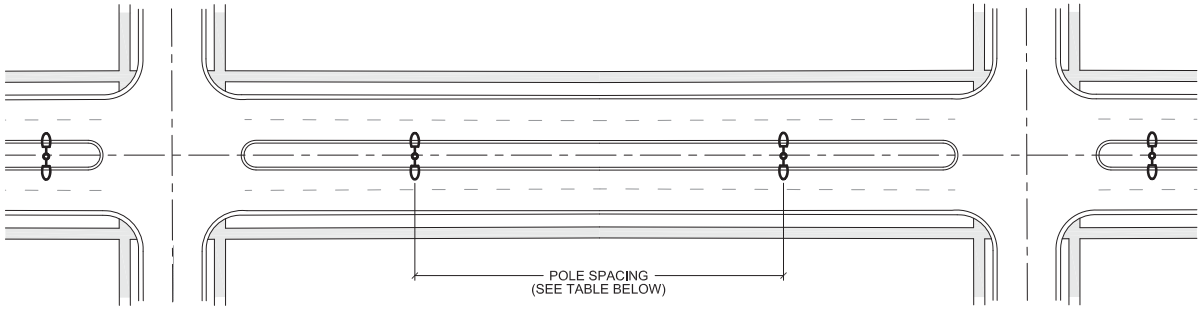
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

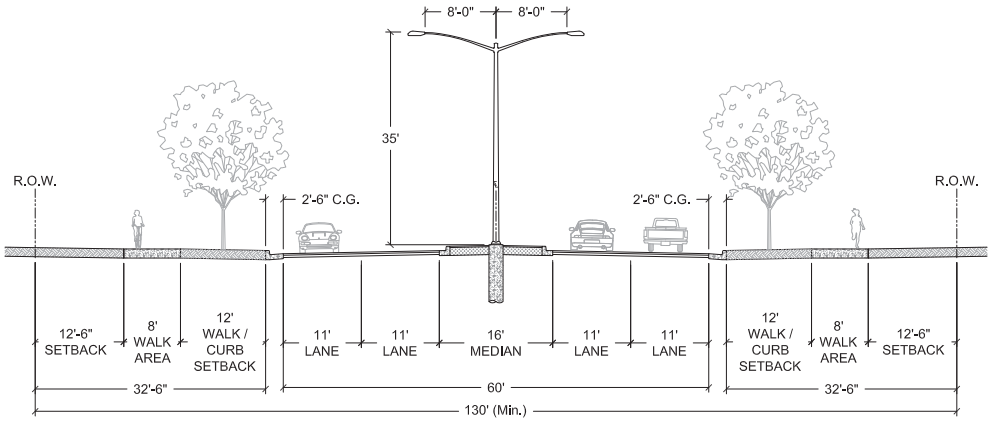
Major Arterial (4-Lane) - Cobrahead

Median Layout

Replace Type: M15



Plan



Section

Major Arterial (4-Lane): Median Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Huron Street	150	Median	7000	100	Type II, Medium	B2-U0-G2
Huron Street	200	Median	10000	140	Type II, Medium	B3-U0-G2
Huron Street	250	Median	13000	180	Type II, Medium	B3-U0-G2

Target Criteria: Major Arterial (4-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

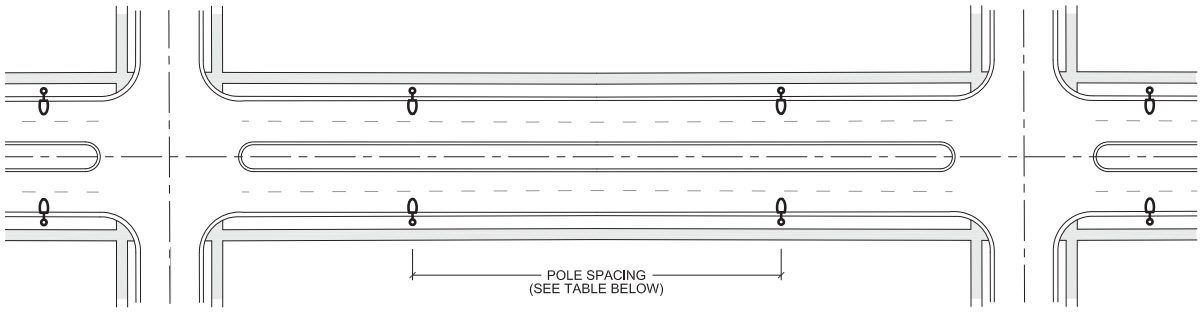
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

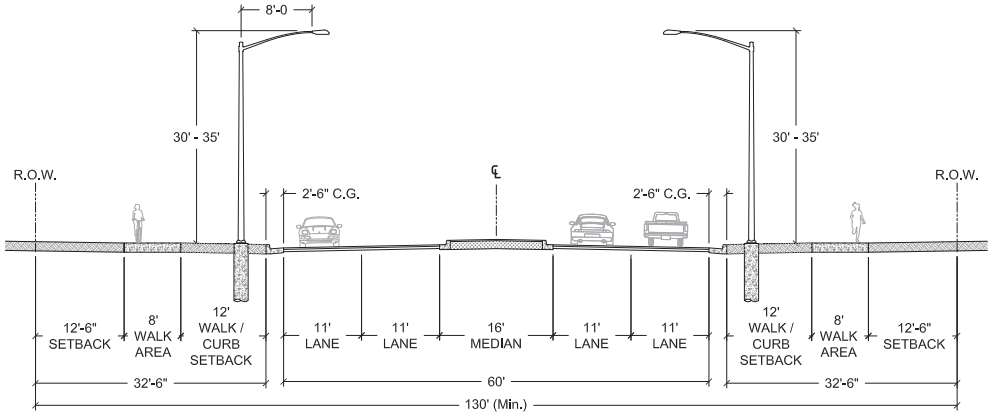
Major Arterial (4-Lane) - Cobrahead

Opposite Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Arterial (4-Lane): Opposite Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Huron Street	150	Opposite	7000	100	Type II, Medium	B2-U0-G2*
Huron Street	200	Opposite	9000	120	Type II, Medium	B3-U0-G2*
Huron Street	250	Opposite	12000	170	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Major Arterial (4-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

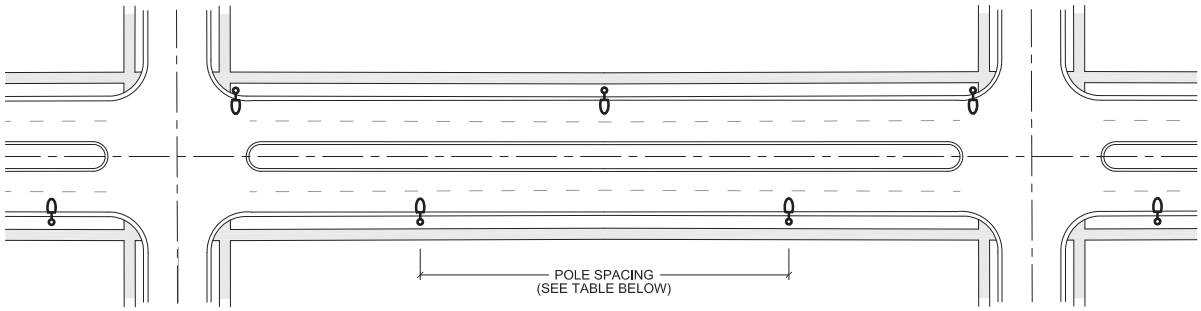
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

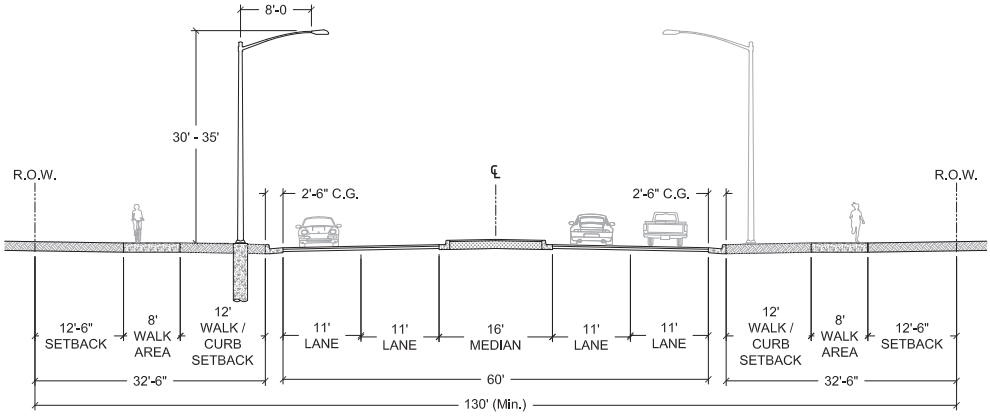
Major Arterial (4-Lane) - Cobrahead

Staggered Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Arterial (4-Lane): Staggered Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Huron Street	200	Staggered	9000	120	Type II, Medium	B3-U0-G2*
Huron Street	250	Staggered	12000	170	Type II, Medium	B3-U0-G2*
Huron Street	300	Staggered	15000	200	Type II, Medium	B3-U0-G2*
Huron Street	350	Staggered	17000	240	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

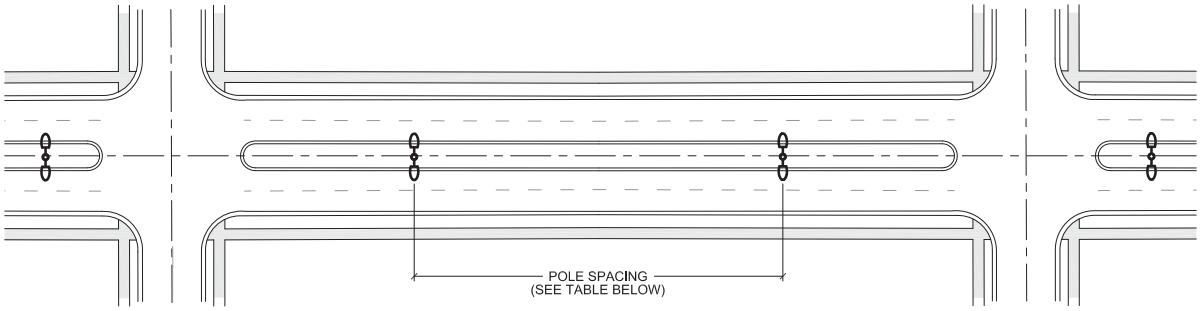
Target Criteria: Major Arterial (4-Lane)*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.65**	7.0	4.0

* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

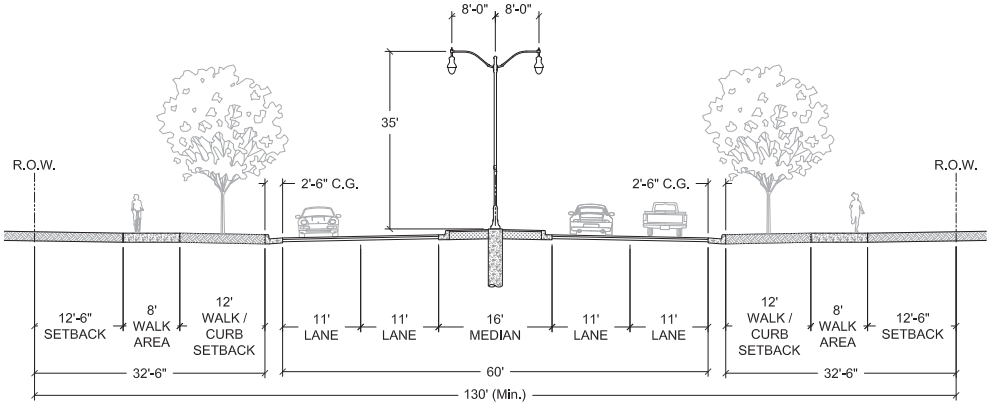
Prescriptive Criteria (Retrofit)

Major Arterial (4-Lane) - Decorative Teardrop Median Layout

Replace Types: M13, M14



Plan



Section

Major Arterial (4-Lane): Median Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
W. 104th Avenue	160	Median	9500	140	Type III, Medium	B2-U1-G2

Target Criteria: Major Arterial (4-Lane)*				
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**	**Maximum BUG Rating**	**Maximum Luminaire Wattage**
0.65**	7.0	4.0	B2-U1-G2	140

* Target criteria is provided for use during RFP and luminaire qualification only

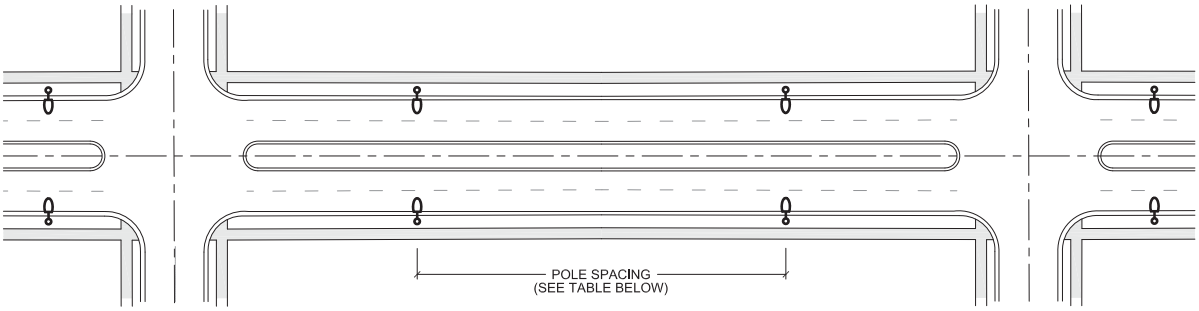
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

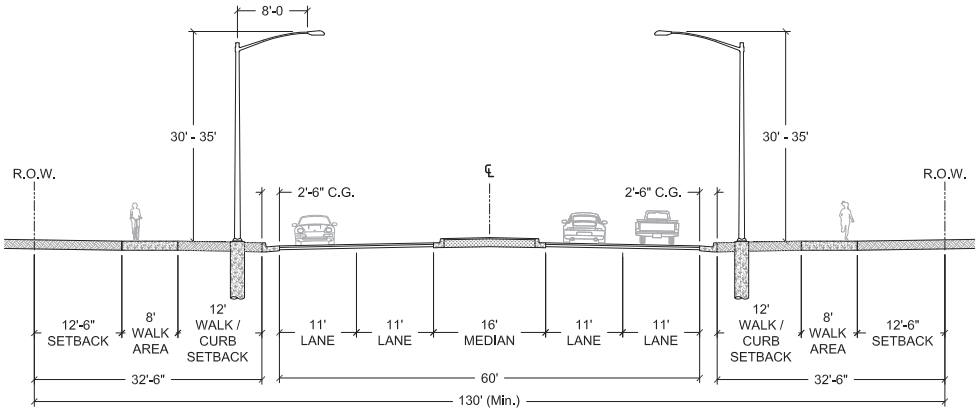
Minor Arterial - Cobrahead

Opposite Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Minor Arterial: Opposite Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
97th Avenue	150	Opposite	6000	90	Type II, Medium	B2-U0-G2*
97th Avenue	200	Opposite	7500	110	Type II, Medium	B2-U0-G2*
97th Avenue	250	Opposite	11800	160	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Minor Arterial*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.6**	6.0	3.5

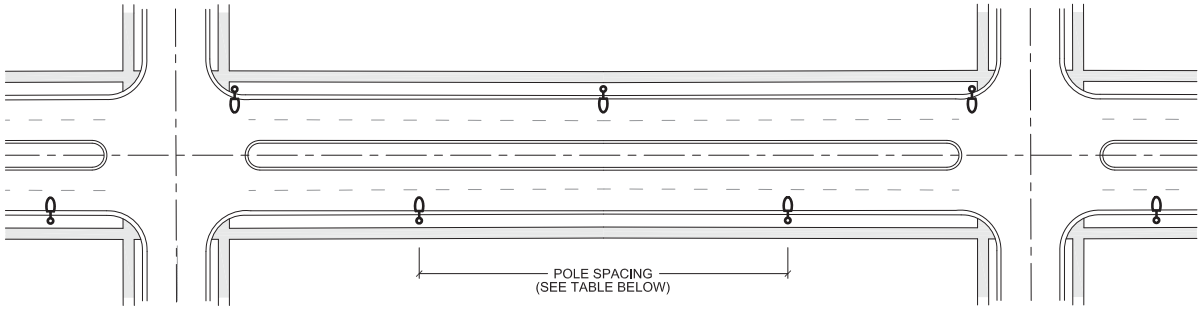
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

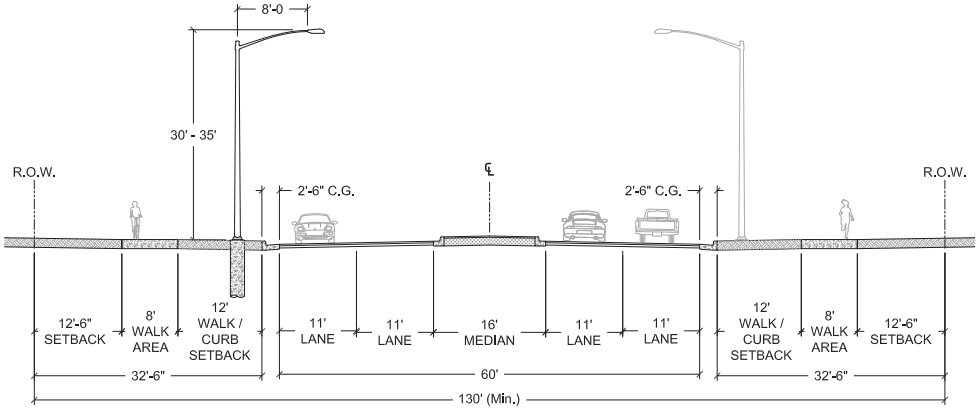
Minor Arterial - Cobrahead

Staggered Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Minor Arterial: Staggered Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
97th Avenue	200	Staggered	7500	110	Type II, Medium	B2-U0-G2*
97th Avenue	250	Staggered	11800	160	Type II, Medium	B3-U0-G2*
97th Avenue	300	Staggered	14000	190	Type II, Medium	B3-U0-G2*
97th Avenue	350	Staggered	16000	210	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Minor Arterial*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.6**	6.0	3.5

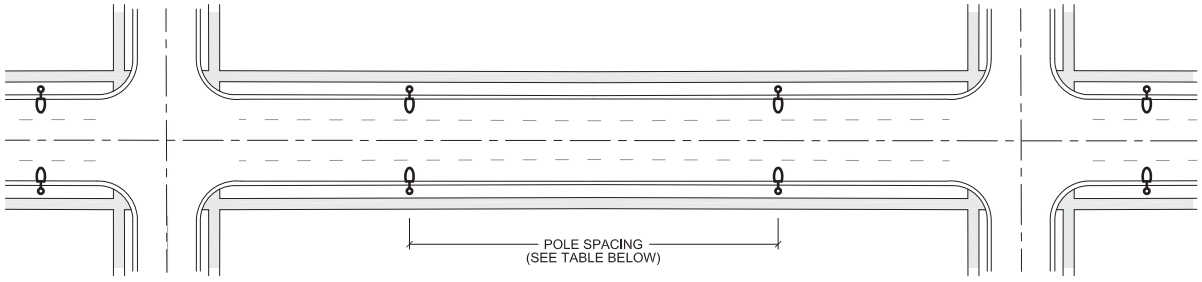
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

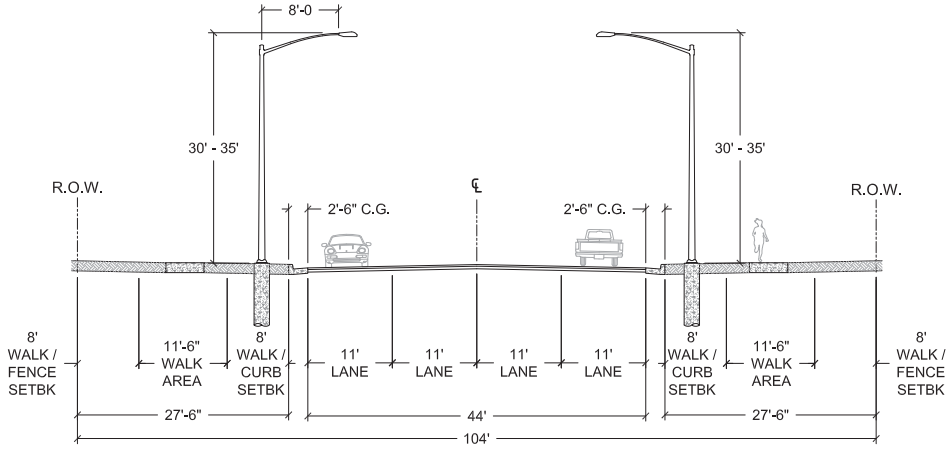
Major Collector - Cobrahead

Opposite Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Collector: Opposite Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
80th Avenue	150	Opposite	4500	60	Type II, Medium	B1-U0-G2*
80th Avenue	200	Opposite	5000	70	Type II, Medium	B2-U0-G2*
80th Avenue	250	Opposite	6500	100	Type II, Medium	B2-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Major Collector*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.45**	6.0	3.5

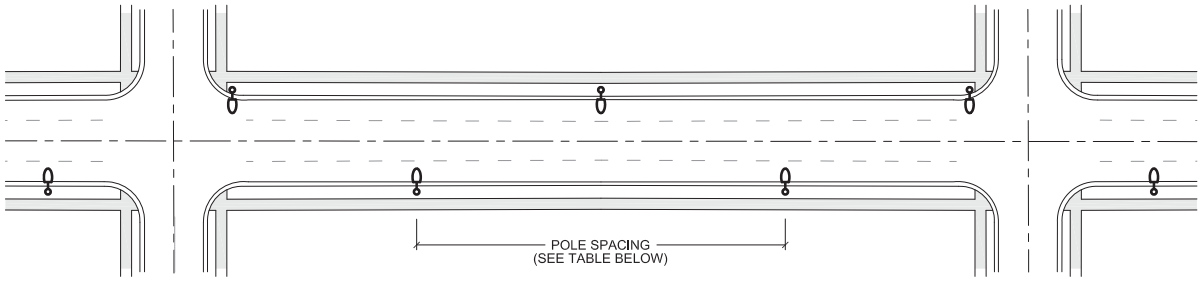
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

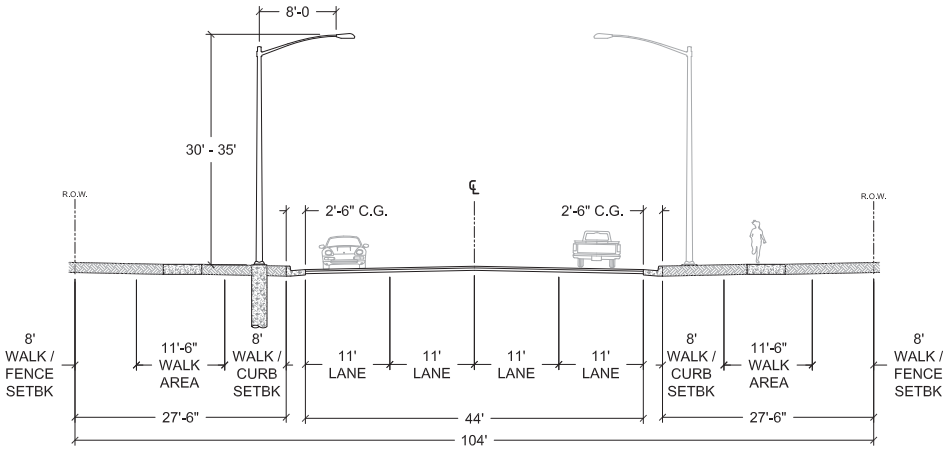
Major Collector - Cobrahead

Staggered Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Major Collector: Staggered Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
80th Avenue	200	Staggered	5500	85	Type II, Medium	B2-U0-G2*
80th Avenue	250	Staggered	6000	90	Type II, Medium	B2-U0-G2*
80th Avenue	300	Staggered	6500	100	Type II, Medium	B2-U0-G2*
80th Avenue	350	Staggered	7500	110	Type II, Medium	B2-U0-G2*
80th Avenue	400	Staggered	8000	110	Type II, Medium	B3-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Major Collector*		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.45**	6.0	3.5

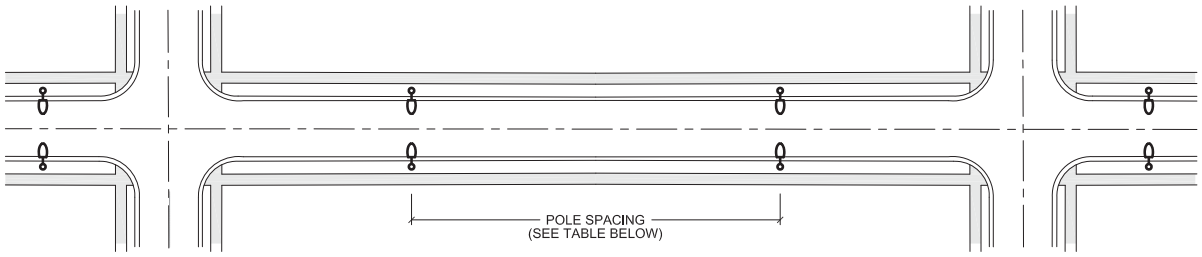
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

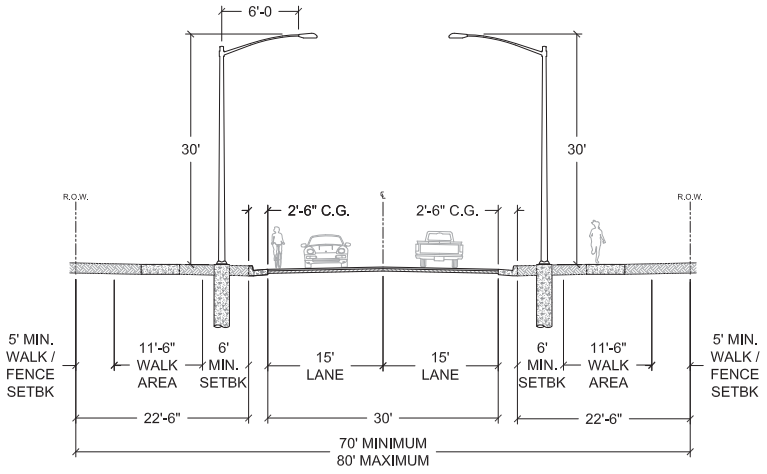
Minor Collector - Cobrahead

Opposite Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Minor Collector: Opposite Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Lowell Boulevard	150	Opposite	3000	45	Type II, Medium	B1-U0-G2*
Lowell Boulevard	200	Opposite	4500	60	Type II, Medium	B1-U0-G2*
Lowell Boulevard	250	Opposite	6000	90	Type II, Medium	B2-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Minor Collector		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.45*	6.0	3.5

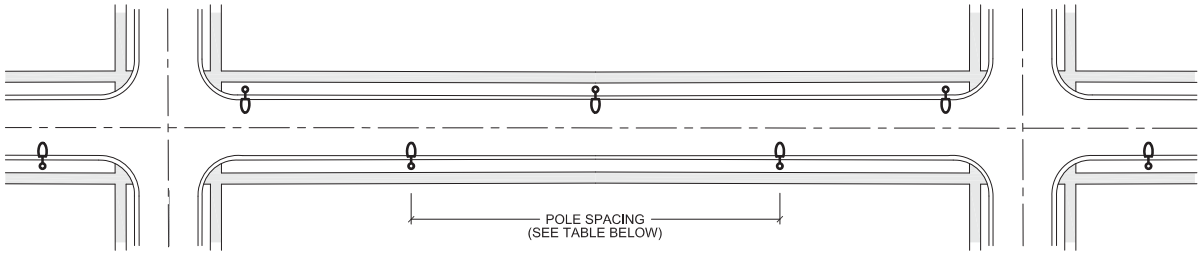
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

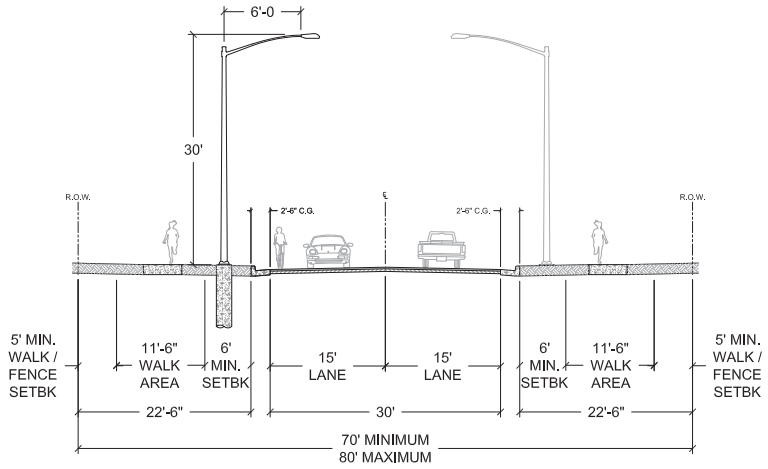
Minor Collector - Cobrahead

Staggered Layout

Replace Types: M1, M3, M4, W1, W2



Plan



Section

Minor Collector: Staggered Layout						
Example Roadway	**Pole Spacing**	**Pole Layout**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Lowell Boulevard	200	Staggered	5000	70	Type III, Medium	B2-U0-G2*
Lowell Boulevard	250	Staggered	6500	80	Type III, Medium	B2-U0-G2*
Lowell Boulevard	300	Staggered	6000	90	Type II, Medium	B2-U0-G2*
Lowell Boulevard	350	Staggered	6000	90	Type II, Medium	B2-U0-G2*
Lowell Boulevard	400	Staggered	6500	100	Type II, Medium	B2-U0-G2*

* If adjacent to residential areas BUG rating shall be no higher than B1-U0-G1

Target Criteria: Minor Collector		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.45*	6.0	3.5

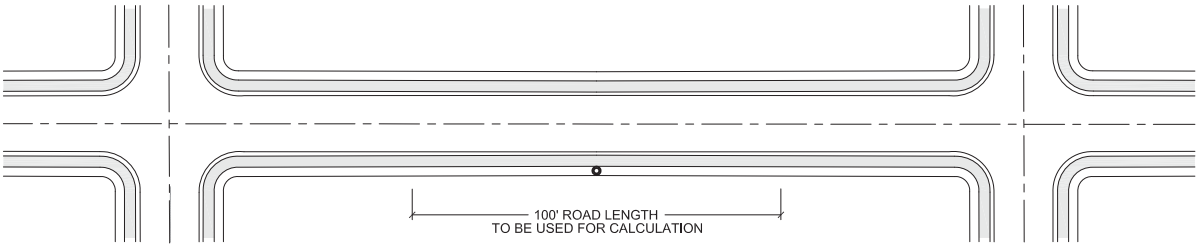
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Prescriptive Criteria (Retrofit)

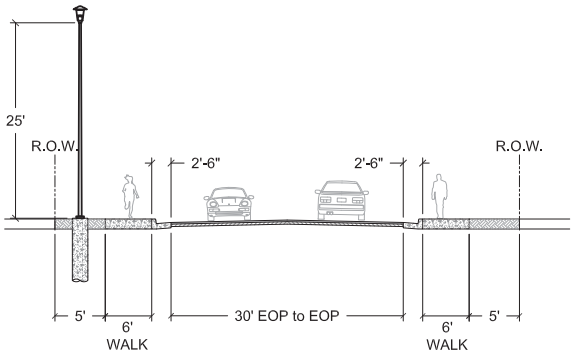
Local - Decorative Post Top

Isolated Locations

Replace Type: F1



Plan



Section

Local: Isolated Locations					
Example Roadway	**Pole Spacing**	**Approx. Lumen Output**	**Max. Watts**	**Photometric Distribution**	**Max. BUG Rating**
Newton Street	N/A	4000	60	Type III, Medium	B1-U1-G1

Target Criteria: Local		
Average Luminance	**Max:Min Ratio**	**Avg:Min Ratio**
0.3*	N/A	6.0

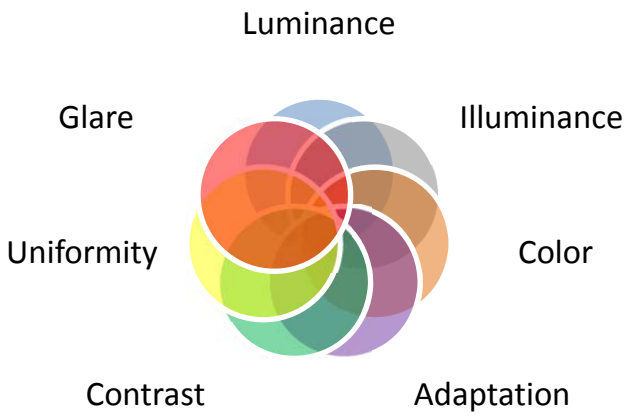
* Target criteria is provided for use during RFP and luminaire qualification only
** Average luminance is approximately 75% of the IESNA recommended maintained luminance value for roadway classification type

Section 3: Design Considerations

The following section of Design Considerations is intended as a brief introduction to street lighting and nighttime visibility issues for City of Westminster Traffic Engineers. High quality street lighting design must first provide good visibility and safety for drivers and pedestrians. These Design Considerations include visibility, criteria, maintenance, light trespass and light pollution, and electrical issues.

Visibility

Effective visibility in the nighttime environment depends on the control of seven different factors: glare, luminance, uniformity, illuminance, contrast, color, and adaptation. One factor is not necessarily more important than another; rather all must be adequately addressed to produce effective visibility.



Task Visibility

Task visibility describes how size, brightness, and contrast of a particular activity affect the lighting required to view that activity. It should be noted that the ability to actually perform a task well includes other non-visual human factors such as skills and experience, independent of task visibility. Large tasks such as seeing vehicles generally require less brightness, contrast, and illuminance, to be performed. Small detailed tasks such as reading directional signs may require increased brightness, contrast, and illuminance.

The luminance or brightness of a task increases the task visibility. Brighter tasks are easier to see, so long as it is not so much brighter than its surroundings that it becomes uncomfortable or a source of direct glare. As task contrast decreases, the light level required to see it will increase. If the contrast is too low, it will be difficult to distinguish various components of the task, reducing visibility. The task of driving requires the detection of hazards and a clear view of the surrounding traffic and road conditions.

Way Finding

Way finding refers to the process of determining locations and directions. Visual guidance provided by the lighting system and the visual elements illuminated will improve wayfinding. This guidance may be illuminated signage that directs motorists to various destinations or it may be more subtle aids such as continuity and hierarchy of lighting equipment that reinforces areas of similar use or traffic density. By using the same luminaires for areas of the same use, a consistent pattern is established that visually guides and orients pedestrians as well as motorists.

Color (Spectral Distribution)

White Light Effectiveness

There are three different types of visual responses: photopic (day vision), scotopic (night vision), and mesopic (combination of night and day vision). The majority of exterior lighting falls within the mesopic range. In mesopic vision, peripheral vision and detection of motion is greatly enhanced with shorter wavelength light (blue light) versus longer wavelength light (orange or red light). White light sources (such as LED, metal halide, induction and fluorescent) produce light in all wavelengths making them ideal nighttime lighting sources. For all exterior lighting applications where peripheral vision is important such as detecting pedestrians and animals on the side of the road, white light (rather than yellow or orange light) is recommended.

IES TM-12-12

The Illuminating Engineering Society (IES) released a Technical Memorandum (TM) in 2012 that provides a calculation method for evaluating effectiveness light sources for the mesopic visual range. This Technical Memorandum (IES TM-12-12: Spectral Effects of Lighting on Visual Performance at Mesopic Lighting Levels) publishes a table of Effective Luminance Factors (ELFs) for different light sources at multiple luminance levels within the mesopic visual range.

According to the IES Roadway Committee, these factors can be applied to roads and streets within the City that have speed limits under 35 mph. These factors are important because it is through them that the effectiveness of white light can be measured. Nighttime vision is more sensitive to white light, meaning less white light is required to see at nighttime when compared to non-white light sources. Therefore, white light can provide equivalent or better visibility with less energy as compared to the orange hue of typical high pressure sodium (HPS) street lighting.

Virginia Tech Street Lighting Visibility Research

The Virginia Tech Transportation Institute, along with Clanton & Associates, Inc., has conducted street lighting experiments to compare visibility performance and public opinion of different light sources in real street environments. For the visibility performance testing, participants ride as passengers in a test vehicle traveling at 35 mph and are asked to press a button as soon as they see a small rectangular object on the shoulder of the road. The test vehicle is set up with lighting measurement equipment and GPS to record illuminance and luminance of the street environment and identify the detection distance, or distance at which participants visually detect the target objects. These experiments have been conducted in Anchorage, AK, San Jose, CA, San Diego, CA, and Seattle, WA. The data from all of these experiments consistently show that LED and other white light sources at 140W – 165W provide comparable visual detection distance as 400W HPS light sources, and over two-times the detection distance of 250W HPS light sources. Even when the white light sources are dimmed to 50% and even 25% of their maximum light output, they still significantly outperformed 250W HPS light sources in visual detection distance.

White Light Effectiveness for Westminster

The visibility research by Virginia Tech suggests a much more significant benefit to white light sources for street lighting, as compared to the 250W HPS light source (that is standard in the City of Westminster), than the IES TM-12-12 publication outlines. For this

Design Guide, the target average luminance lighting criteria has typically been reduced by 25% from IES Roadway Lighting Criteria. This reduction provides greater energy savings than would be achieved using the ELFs from the IES TM-12-12, yet still provides adequate light levels to allow for adaptive dimming during times of low traffic and pedestrian volume. Refer to the Adaptive Lighting Design Guide for dimming levels and strategies.

Color Rendering & Identification

The color appearance of an object depends on the spectrum of the light source illuminating it. Broad spectrum white light sources render colors more accurately than light sources with narrow band spectrums. Color Rendering Index (CRI) is a metric that describes how accurately a light source renders color. The photo below shows a red car that is illuminated by a broad spectrum white light source on the front and a narrow band spectrum low pressure sodium source on the side. Since low pressure sodium has a CRI of less than zero due to its poor color rendering, the side of this red car appears brown rather than red. Using broad spectrum light sources with high CRI for street lighting is particularly important to police for accurate color identification.

LED light sources with a CRI of 70 or greater renders colors much more accurately than a typical high-pressure sodium lamp with a CRI of approximately 20. White light also provides better identification of colors and objects and produces a color preferred by the citizens surveyed.

Color Temperature

Color Temperature refers to the color appearance of a light source. For instance, a low color temperature (3000K) is similar to a warm or more reddish light similar to an incandescent lamp A higher color temperature (5000K) is a bright bluish white light, similar to metal halide headlamps. A neutral white color temperature (4000K) is similar to full moonlight.

Glare

Direct Glare

Direct glare is caused by excessive or undesirable light entering the eye from a bright light source and has a very detrimental effect on visibility. The potential for direct glare exists anytime one can see a light source. With direct glare, the eye has a harder time seeing contrast and details. A lighting system designed solely on lighting levels tends to aim more light at higher viewing angles, thus producing more potential for glare.

Causes of direct glare include an exposed bright light source such as a dropped-lens cobrahead or floodlight. Direct glare can be minimized with careful equipment selection as well as placement. For roadway lighting applications, use luminaires that minimize glare (G2 or less) and are fully shielded (U0) to direct light downward towards the ground.

Indirect Glare

Indirect or reflected glare is caused by light reflecting off the pavement in such a manner that the contrast is washed out. Any light source can cause reflected glare depending on the viewing angle of the motorist. However, unshielded streetlights have an increased potential of reflected glare, especially on wet pavement, and cause it at more viewing angles. Reflected glare will wash out lines on the road, especially on wet pavement, and limit a driver's ability to see contrast. Like direct glare, indirect glare can be minimized with the type and layout of lighting equipment.

Luminance

Luminance is the brightness of a light source, surface, or object in an individual's field of view. It is measured in units of candela per square meter (cd/m2). It is dependent on the viewing angle between the object or surface and the viewer's eye. This measure is important because, unlike illuminance, this quantity is actually seen. A luminance meter, as shown in the adjacent photo, measures luminance in the field.

In roadway lighting, pavement luminance refers to how bright the pavement appears to motorists. Higher pavement luminance gives the motorist more visual information on the roadway boundaries and conflict areas such as crosswalks and intersections.

Uniformity

Lighting uniformity refers to the evenness of light. Our eyes are continually adapting to the brightest object in our field of view. Any object lighted to 1/10 the level of the immediate surroundings appears noticeably darker. For roadway lighting, good uniformity indicates evenly lighted pavement. However, good visibility requires contrast of an object against the background. An environment with perfectly uniform lighting provides low contrast and lower visibility. To create enough contrast for good visibility, a less uniform roadway surface may be better. There should be a balance between uniform perception and detecting objects on the road, although in roadway applications, uniformity is often less important. Uniformity criteria are typically described as ratios of maximum to minimum and average to minimum luminance or Illuminance.

Illuminance

Illuminance refers to the light level, or density of light (lumens/ft^2) falling on a surface. It is measured in footcandles (fc). Horizontal illuminance refers to the amount of light falling on a horizontal surface such as pavement. Vertical illuminance refers to the amount of light falling on a vertical surface such as signs and pedestrians. Traditionally, illuminance has been the sole basis of lighting design. However, we see brightness (luminance); we don't see lighting levels or footcandles. Therefore, illuminance is no longer recommended as the design method for roadways. However, vertical illuminance is still used as criteria where visibility of pedestrians is most important such as at crosswalks and street intersections. Illuminance is measured by an illuminance meter as shown in the photo above.

Contrast

Contrast is the difference between two adjacent luminance values. High contrast is necessary for good visibility. An example of high contrast is freshly painted pavement markings on new asphalt. If the contrast becomes excessively high such as an overhead sign luminaire aimed towards oncoming traffic, the brighter light source can become a source of glare. Differences in color also produce a visible contrast, even when both objects have similar luminance values. In the photos below, the black and white image shows that the luminance of the flower and background are very similar. Only when the color is rendered does the color contrast of the yellow flower make it highly visible next to its background.

Adaptation

Adaptation refers to the eye's ability to adjust between changes in luminance. Our eye will automatically adjust to the brightest object in our field of view. Glare from headlights or fixed lighting can affect one's ability to adapt to lower surface luminance. This is especially true as one ages. Another form of adaptation occurs when driving from a lighted area to a non-lighted section of roadway. In this case, the lighted area should slowly transition to darker by allowing adaptation time. Off roadway brightness, such as driving past a brightly lighted gas station or LED sign, can also cause adaptation issues.

Criteria

IES Roadway Recommended Practice (IES RP-08)

For roadways meeting warrants for streetlighting outlined in 5.5C or applications not given prescriptive guidance, a designer must use performance based criteria. The following information is based on the recommended criteria of the Illuminating Engineering Society(IES) RP-08 Roadway Lighting and set up in a format based on the International Commission on Illumination (CIE) roadway recommendations.

Calculation Methods

There are two primary methods, published in the ANSI/IES RP-08 American National Standard Practice for Roadway Lighting, to calculate the effectiveness of a roadway lighting design; Luminance Method and Illuminance Method. As part of the Luminance Method, there are two secondary metrics that can be used to further evaluate roadway lighting, which are Veiling Luminance Ratio and Small Target Visibility (STV). For simplicity, the Westminster Street Lighting Design Guide is mostly based on average luminance and luminance uniformity. On local streets only, where lighting is non-continuous, the Design Guide uses illuminance as the criteria. The other calculation methods are described here as an educational tool only. Commercially available computer programs can be used to model roadway geometry and lighting layouts and perform point-by-point calculations for each of the calculation methods described in this section. These programs permit multiple luminaires and can take buildings and other obstacles into account. Most programs generate CAD-compatible site isofootcandle (or isolux) plots and analytical statistics related to illuminance and uniformity.

Luminance Method

The Luminance Method is preferred for roadway lighting design and calculations. This method represents what motorists see and results in quality roadway lighting systems. This method also requires luminance uniformity and a veiling luminance analysis.

To calculate the luminance values of a design, a computer program must be used. The program will need the type of roadway pavement that will be used. Then the user must define a grid of points. The program will then calculate the luminance of each point in the grid as it is seen from a distant observer. An average value of all of these points will also be calculated so that it can be compared to the project criteria. It is important to understand that the calculated luminance is dependent on the direction from which the point is being viewed. In some designs, it may therefore be necessary to calculate the luminance in both directions of traffic flow.

Veiling Luminance Ratio

Veiling Luminance Ratio is a measure of disability glare. It compares the amount of light entering a motorist's eye to the brightness or luminance of the roadway surface. If too much light is entering one's eye, then light scatters providing a veil of light such that it is difficult to see objects on the road pavement. Luminaires that are not fully shielded or have a high G rating have the greatest potential for disability glare.

Small Target Visibility (STV)

Small Target Visibility is another design metric that is to be used for further support of a luminance design. STV represents the latest methodology to quantify the combined effect of all

of the visibility factors. It not only assesses luminance and luminance ratio uniformity (as described above), but also addresses veiling luminance. The more luminance differences on a roadway, the greater the chance an object will be detected either with positive contrast or by silhouette. The combination of pavement brightness, reduced disability glare, and object detection is the best assurance of effective lighting. Like luminance, a lighting computer program must be used to calculate STV. The process is much like the luminance method where a pavement type must be selected and a point grid defined. The STV calculation will produce a value of Visibility Level (VL). This value increases with improved visibility. The calculated value must be greater than or equal to the criteria.

Illuminance Method

For this design guide, illuminance is used as the criteria only for Local streets with non-continuous lighting. This method, however, is not recommended for continuous street lighting because it does not address the brightness that is actually observed. Illuminance is the oldest method of calculation. It was readily used because of the ease of calculation and measurement. Unfortunately, illuminance does not predict motorist visibility since it only calculates incident light and not roadway brightness. Because this is the easiest value to measure however, illuminance should be calculated when field validation is necessary. Design for minimum vertical illuminance is still recommended in pedestrian areas such as intersections and crosswalks. In these cases, the criteria state the required amount of light on the pedestrian crossing the street, not the roadway surface.

Energy Efficiency

Energy consumption in lighting systems results from two components: the amount of power that the light source draws and the amount of time the light source is activated. Both of these issues can be addressed to improve the energy efficiency of the overall system.

Light sources vary in efficacy – the amount of light produced per watt of electricity consumed, expressed in units of lumens per watt (LPW, or lms/W). Many luminaire manufacturers and engineers consider only the efficacy when comparing different light sources. When comparing efficacy of LED and other traditional light sources, such as HPS, metal halide, and induction, it is important to compare luminaire efficacy, not lamp efficacy. In addition to comparing luminaire efficacy, it is also important to calculate the roadway luminance and apply white light effectiveness in low light (mesopic) levels for street and roadway lighting to evaluate the effectiveness of the luminaire optical distribution. This can result in some white light sources having higher visibility per watt than high pressure sodium, especially under low light levels.

The other approach to reducing energy use comes from controlling the light so that street lighting is on only when necessary. Dimming during certain hours, when and where pedestrian conflict is low, is an option for LED and induction light sources. Network controls and astronomical time clocks are the most reliable control methods to ensure that street lighting is not on during the day. Refer to the Westminster Adaptive Lighting Design Guide for more discussion on lighting controls.

Maintenance

Maintenance must be considered in the design process. By selecting long-life sources such as LED and induction, the frequency of re-lamping can be limited and the associated labor and material costs reduced.

Group re-lamping or group light source replacement should be the principal method of periodically replacing lights in a given area. The group maintenance frequency should be based on ensuring intended lighting levels are maintained above minimum levels. Spot maintenance on one outage only is not recommended in this regard because lighting levels will tend to eventually fall below intended levels.

Another aspect of maintenance involves the dirt and dust that can accumulate inside luminaires. Because street lighting will rarely, if ever, be cleaned, luminaires must have adequate ingress protection (IP) against dust and water. This IP rating should be at least 64 for all street lighting luminaires. This rating means that the luminaire is dust-tight and water-tight from water sprayed in any direction. Any rating number higher than this provides additional protection from water ingress.

Light source and driver, ballast, or power generator types should be consolidated across luminaire types to minimize the number of various components that need to be stocked by the maintenance team. In addition to light source replacement, the next most likely element that must be replaced is the photocell if used. These should also be stocked and the number of types minimized.

Light Trespass / Light Pollution

Light Trespass

Light trespass is defined as stray light that crosses a property boundary. The most obtrusive form of light trespass that may result in complaint calls from citizens is often caused by an excessively bright luminaire that is unshielded and distributes light into a bedroom window. Uncontrolled light sources are usually the cause of light trespass. However, even a controlled, fully shielded luminaire may cause light trespass if not properly located. In cases where the location of a light standard cannot be changed, additional shielding may be necessary to prevent light trespass. Luminaires have a backlight (B rating - refer to Luminaire Classification: B.U.G. Ratings section for further details) which refers to the amount of light distributed behind the luminaire. To minimize light trespass behind a luminaire, B0 and B1 ratings have the least amount of backlight and are recommended in residential neighborhoods. Increasing the height of a light standard will also increase the potential for light trespass. As the luminaire is raised, its brightness can be seen from a greater area. Not only does light trespass cause neighbor annoyance, but it also increases light pollution.

Another form of light trespass is luminaire brightness or glare (G rating - refer to Luminaire Classification: B.U.G. Ratings section for further details). G0 and G1 ratings are recommended in residential neighborhoods. No greater than G2 rating should be used for the majority of other street and pedestrian lighting.

Light Pollution
To minimize light pollution, use only fully shielded or Uplight Rating of zero (U0 rating - refer to Luminaire Classification: B.U.G. Ratings section for further details) luminaires for street lighting. No greater than U3 ratings may be used in limited areas for decorative streetlighting. . Do not overlight areas because reflected light can also result in complaints and poor visibility.

Light pollution and sky glow are caused by light aimed directly up into the sky and by light reflected from the ground or objects. Any addition of light will add to light pollution. However, it is the direct component (rather than reflected) that is the most significant cause of light pollution. Unshielded luminaires are major contributors to sky glow. Overlighting, even with shielded or U0 luminaires, reflects unnecessary light into the atmosphere and also adds to sky glow.

To minimize light pollution, first minimize the overall amount of light. Exterior lighting should be used only where and when it is needed. Define the lighting requirements of each city area and provide only the necessary lighting. Lighting should be controlled with network dimming controls (preferable), astronomical time clocks, or photocells (least preferable). Use fully shielded (U0) luminaires for roadway lighting to reduce glare and stray light.

The light spectrum also affects the potential for light pollution from the perspective of astronomers. The International Dark Sky Association has asked that exterior lighting designers and specifiers minimize light sources that produce wavelengths lower than 500 nanometers (blue light). This blue portion of the spectrum increases the amount of skyglow and interference with many astronomical observations. The spectral output of a light source is controlled entirely by the light source manufacturer. A designer can only select a source with minimal impact.

Lighting Zones

LZ0: No ambient lighting

Areas where the natural environment will be seriously and adversely affected by lighting. Impacts include disturbing the biological cycles of flora and fauna and/or detracting from human enjoyment and appreciation of the natural environment. Human activity is subordinate in importance to nature. The vision of human residents and users is adapted to the darkness, and they expect to see little or no lighting. When not needed, lighting *should* be extinguished.

Lighting Zone 0 should be applied to areas in which permanent lighting is not expected and when used, is limited in amount of lighting and the period of operation. LZ0 typically includes undeveloped areas of open space, wilderness parks and preserves, areas near astronomical observatories, or any other area where the protection of a dark environment is critical. Special review should be required for any permanent lighting in this zone. Some rural communities may choose to adopt LZ0 for residential areas.

LZ1: Low ambient lighting

Areas where lighting might adversely affect flora and fauna or disturb the character of the area. The vision of human residents and users is adapted to low light levels. Lighting may be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, most lighting should be extinguished or reduced as activity levels decline.

Lighting Zone 1 pertains to areas that desire low ambient lighting levels. These typically

include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/storage areas typically with limited nighttime activity. LZ1 may also include the developed areas in parks and other natural settings.

LZ2: Moderate ambient lighting

Areas of human activity where the vision of human residents and users is adapted to moderate light levels. Lighting may typically be used for safety and convenience but it is not necessarily uniform or continuous. After curfew, lighting may be extinguished or reduced as activity levels decline.

Lighting Zone 2 pertains to areas with moderate ambient lighting levels. These typically include multifamily residential uses, institutional residential uses, schools, churches, hospitals, hotels/motels, commercial and/or business areas with evening activities embedded in predominately residential areas, neighborhoods serving recreational and playing fields and/or mixed use development with a predominance of residential uses. LZ2 may be used to accommodate a district of outdoor sales or industry in an area that would otherwise be classified as LZ1.

LZ3: Moderately high ambient lighting

Areas of human activity where the vision of human residents and users is adapted to moderately high light levels. Lighting is generally desired for safety, security and/or convenience and it is often uniform and/or continuous. After curfew, lighting may be extinguished or reduced in most areas as activity levels decline.

Lighting Zone 3 pertains to areas with moderately high lighting levels. These typically include commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas.

LZ4: High ambient lighting

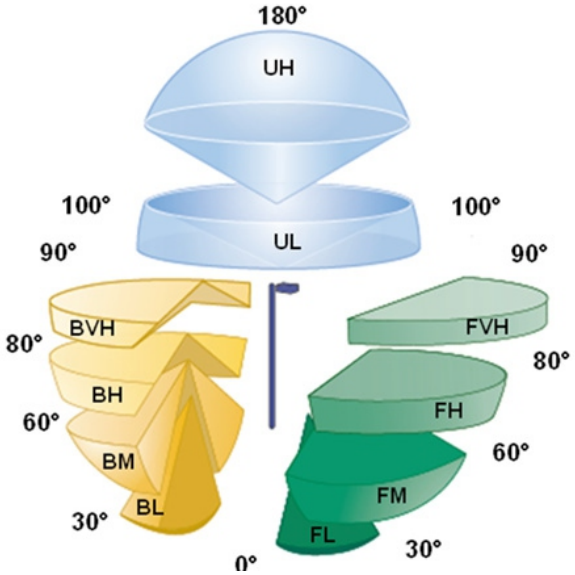
For The City of Westminster, there are no areas where LZ4 is appropriate. This description is provided for information only, and is not recommended.

Areas of human activity where the vision of human residents and users is adapted to high light levels. Lighting is generally considered necessary for safety, security and/or convenience and it is mostly uniform and/or continuous. After curfew, lighting may be extinguished or reduced in some areas as activity levels decline.

Lighting zone 4 pertains to areas of very high ambient lighting levels. LZ-4 should only be used for special cases and is not appropriate for most cities. LZ-4 may be used for extremely unusual installations such as high density entertainment districts, and heavy industrial uses.

Luminaire Classifications: B.U.G. Ratings (IES TM-15-11)

In 2005, the IES began working on improving their system for classifying obtrusive or wasted light from luminaires. The original system, which included the ratings full cutoff, cutoff, semi-cutoff and non cutoff were based on percentage of up-light. The new classification system expands the analysis of luminaire distribution to better evaluate the obtrusive effects of Backlight (B), Uplight (U) and Glare (G) to create the B.U.G. Rating system. This B.U.G. Rating system, published as IES TM-15-11 Luminaire Classification System for Outdoor Luminaires, strengthens the classification by moving away from lighting percentage to the actual amount of light (lumens) that is emitted in particular vertical zones (zonal lumens) and by introducing backlight and glare ratings in addition to only uplight.



As this is a relatively new rating system, and many people may not be familiar with it, more explanation of how the rating system works is provided here. For example, some people are familiar with terms such as “full cutoff” and they may expect this street lighting design guide to include those terms. It is important that all groups involved in outdoor and roadway lighting recognize that older terms and concepts were inadequate for the complex tasks of controlling light pollution and trespass. It is recommended that the new B.U.G. Rating system, adopted in TM-15-11, be used intact and exclusively for the Westminster Street Lighting Design Guide.

To achieve a U0 rating using the B.U.G. Rating system requires zero lumens distributed upward and also requires low lumen output in glare zones (creating a more stringent requirement than the previous “full cutoff” classification) for lighting zones 0, 1 and 2, but allows a minor amount of uplight in lighting zone 3. In lighting zone 3, the amount of allowed uplight is enough to permit the use of very well shielded luminaires that have a decorative drop lens or chimney so that dark sky friendly lighting can be installed in places where luminaires with historic or traditional character are required.

The lumen limits established for each lighting zone apply to all types of lighting within that zone. This includes, but is not limited to, street lighting, specialty lighting, façade lighting, security lighting and the front row lighting for auto dealerships. B.U.G. Rating limits are defined for each luminaire and are based on the internal and external design of the luminaire, its aiming, and the initial luminaire lumens of the specified luminaires.

The three components of B.U.G. Ratings are based on IES TM-15-11:

Backlight (B), which can create light trespass onto adjacent sites from luminaires located near a property boundary. The B Rating takes into account the amount of light in the Backlight Low (BL), Backlight Medium (BM), and Backlight High (BH) zones, which are in the direction of the

luminaire OPPOSITE from the area intended to be lighted. For luminaire locations further than 2.5 times the mounting height, the B Rating does not apply.

Uplight (U), which is often light that is wasted, creating artificial sky glow rather than useful light. The U Rating does not apply to outdoor and roadway lighting in applications with canopies, ceiling or tunnels, but are intended for uncovered applications. The Lower uplight zone (UL) causes the most sky glow and negatively affects for professional and academic astronomy. Light distributed in this UL zone passes through the more atmosphere, creating more scattered light and sky glow. High uplight (UH), if not reflected off a surface, is mostly energy waste. The U rating defines the amount of light into the upper hemisphere with greater concern for the light at or near the horizontal angles.

Glare (G), which can be annoying or visually disabling. The G Rating takes into account the amount of front light in the FH and FVH zones as well as backlight in the BH and BVH zones.

(Key: UH=Uplight High, UL=Uplight Low, BVH=Backlight Very High, BH=Backlight High, BM=Backlight Medium, BL=Backlight Low, FVH=Forward Light Very High, FH=Forward Light High, FM=Forward Light Medium, FL=Forward Light Low.)

At the 90-180 degree ranges:

- Zone 0 allows no light above 90 degrees.
- Zone 1 allows only 10 lumens in the UH and UL zones, 20 lumens total in the complete upper hemisphere. (This is roughly equivalent to a 5 W incandescent lamp).
- Zone 2 allows only 50 lumens in the UH and UL zones, 100 lumens total (less than a 25W incandescent lamp).
- Zone 3 allows only 500 lumens in the UH and UL zones, 1000 lumens total (about the output of a 75W incandescent bulb).
- Zone 4 allows 1,000 lumens in the UH and UL zones, 2000 lumens total (about the output of a 100W incandescent bulb).

Roadway Classifications

The following definitions describe each type of roadway classification from the Illumination Engineering Society of North American (IESNA) RP-8 Recommended Practice for Roadway Lighting and the City of Westminster.

Arterials:

Major arterials accommodate significant movements of traffic not served by expressways or freeways which connect areas of principal traffic generation and important rural roadways leaving the city. Major streets are designed mainly for the movement of through traffic, which may include light rail transit, but also normally performs a secondary function of providing access to abutting properties. Even though abutting property has access to the facility, parking and loading may be restricted or prohibited to improve the capacity for moving traffic. The number of lanes depends on the volume of traffic though majors are generally planned to contain four or more travel lanes. Average daily traffic volumes range from 7,500 to 50,000 vehicles.

Collectors:

A street which serves internal traffic movements within an area and connects this area with the major and local streets. Collectors do not handle long through trips but do provide access to abutting properties. Traffic control devices may be installed to protect or facilitate traffic on a collector street. Two or four lane streets can be accommodated on a collector. Average daily traffic volumes range from 2,000 to 16,000 vehicles.

Local:

A street having the primary function of providing access to immediately adjacent land. Local streets may be divided into subclasses according to the type of land served, such as residential and industrial. One lane of traffic in each direction is the standard for local streets. Average daily traffic volumes range from 50 to 2,000 vehicles.

Electrical Considerations

Power Quality

Reactive and non-linear loads such as LED lighting systems can cause poor power quality. Exterior LED implementation issues do not quite compare with the issues experienced in interior applications, but there are still concerns for implementation. The main concern with exterior applications is voltage droop during a brownout condition where the LED intelligent driver may accommodate a wide range of voltages, potentially adversely affecting the power balance for a utility.

Total Harmonic Distortion (THD)

Total harmonic distortion (THD) is a result of turning non incandescent lamps on/off abruptly, causing a spike in current occurring 120 times a second. The third harmonic is the most important to reduce, since it contributes the majority of the current. When the spike occurs, the unbalanced current flows through the neutral conductor. If THD is not addressed, neutral conductors may be overloaded, and transformers and circuit breakers may overheat. It is recommended that all luminaires have a THD ≤ 20%.

Power Factor (PF)

Power factor (PF) is the ratio of Real Power (watts) to Apparent Power (volt-amps). Electrical loads with a low power factor draw more currents (amps) that is not used by the load, but is wasted, typically as heat in the distribution wiring. All light sources that have ballasts, generators, or drivers (such as fluorescent, metal halide, high pressure sodium, induction and LED) have an associated power factor. It is recommended that all luminaires have a power factor PF≥ 0.9.

Full Power vs. Dimming

There are several different types of dimming systems for LED lamps and luminaires. The most problematic is the leading edge dimming controls which produces over six times the repetitive peak current as the LED dims. Harmonic distortion is also introduced in the electrical distribution system. It is recommended to have 0-10V dimmable drivers.

Definitions

Candela: the SI unit of luminous intensity, equal to one lumen per steradian (lm/sr).

Candela per square meter (cd/m^2): lighting unit that represents the intensity or brightness of an object or light source (luminance).

Color Rendering: an expression for the effect of a light source on the color appearance of objects – how well the light source shows colors compared to a black body radiator (e.g. an incandescent light source). It is measured on a scale from 0-100, with 100 being the color rendering index (CRI) for a black body radiator.

Color Temperature: the numerical (Kelvin) designation for the warm or cool color of a light source. Warm (or orange tinted) sources have low color temperatures and cool (blue tinted) sources have a high color temperature. Color Temperature is derived from the color emitted by a black body radiator when heated to a certain temperature, measured in Kelvin.

Continuous Lighting: a street lighting system made up of regularly spaced luminaires along the street. Criteria typically defines minimum and maximum illuminance or luminance values and overall uniformity along the lighted area.

Efficacy: the quotient of the total luminous flux emitted to the total light source power input. It is expressed in lumens per watt.

Footcandle: a unit of illuminance equal to 1 lumen/ft^2.

Glare: The visual sensation created by luminance (or brightness) that is significantly higher than the surrounding luminance that the eyes are adapted to, causing annoyance, discomfort, or loss in visual performance and visibility (disability glare).

Illuminance: the density of the light (lumens/ft^2 or lumens/m^2) falling onto a point on a surface. Commonly measured in the horizontal or vertical plane and measured in footcandles (lumens/ft^2) or lux (lumens/m^2).

Life Cycle Cost: an economic analysis of an investment that covers all of its costs and benefits over the expected life of the equipment or system. Unlike a simple payback analysis, it accounts for maintenance and energy even after the system may have paid for itself in projected savings.

Lifetime: the life value assigned to a particular type of light source. This is commonly a statistically determined estimate of average or of median operational life. For LED sources, it is the statistical time before the light output has reduced to 70% of its initial light output.

Light Pollution: light emitted directly from a luminaire or reflected from a surface that goes into the night sky, increasing skyglow. While the direct light is the single largest contributor to light pollution, overlighting and the resulting ground reflected light also increases this environmental impact.

Light Trespass: wasted light directed into undesirable areas on a property or onto adjacent properties.

Lumen: the measure of visible light (luminous flux) emitted from a light source. Luminous flux accounts for the sensitivity of the human eye to perceive different wavelengths of light.

Luminance: the quantity (intensity per area) of light emitted from a source or reflected off of a surface or object measured in cd/m^2 or nits.

Non-Continuous Lighting: a street lighting system characterized by way-finding and the indication of hazards or changes in traffic. It does not require uniform lighting over a particular area but rather located at intersections or other potential hazards.

Steradian: three dimensional solid angular unit of measurement. A full sphere has a solid angle of 4π steradians.

W E S T M I N S T E R

Staff Report

Information Only Staff Report
March 18, 2013

SUBJECT: 2012 Fourth Quarter City Council Expenditure Report

PREPARED BY: Ben Goldstein, Management Analyst
Valerie White, Administrative Secretary

Summary Statement:

- This report is for City Council information only and requires no action by City Council.
- The attached document is a listing of all 2012 City Council posted expenditures from January 1 through December 31, 2012. As a result of year-end closeout procedures, the completion of the fourth quarter report was delayed.

Background Information:

The following report is a listing of City Council expenditures by each account for January 1 through December 31, 2012, as posted by March 1, 2013. As of March 1, 2013, 100% of 2012 had elapsed and Council spent 81.02%, or $193,124, of its revised 2012 budget that totals $238,369.

The budget is a planning tool and represents a best estimate regarding actual expenditures. If you have any questions about items included in this report, please contact Ben Goldstein at 303-658-2007 or at bgoldstein@cityofwestminster.us.

The quarterly expenditure report for City Council ties to the Strategic Plan Goal of a "Financially Sustainable City Government Providing Exceptional Services," as Staff and Council work together to continually find greater efficiency in City operations.

Respectfully submitted,

Stephen P. Smithers
Acting City Manager

Attachment

4th Quarter 2012 City Council Expenditure Report

(as of March 1, 2013)

SALARIES - MAYOR/COUNCIL			(ACCT: 10001010.60800.0000)	
EXPENDITURE		**DATE**	**DESCRIPTION**	**PAID TO:**
-$3,248.20		01/01/12	2011 YE Salary Accr Reverse	Council
$3,498.06		01/01/12	Salaries	Council
$3,498.06		01/15/12	Salaries	Council
$3,498.06		01/29/12	Salaries	Council
$3,498.06		02/12/12	Salaries	Council
$3,498.06		02/26/12	Salaries	Council
$3,498.06		03/11/12	Salaries	Council
$3,498.06		03/25/12	Salaries	Council
$3,498.06		04/08/12	Salaries	Council
$3,498.06		04/22/12	Salaries	Council
$3,498.06		05/06/12	Salaries	Council
$3,498.06		05/20/12	Salaries	Council
$3,498.06		06/03/12	Salaries	Council
$3,498.06		06/17/12	Salaries	Council
$3,498.06		07/01/12	Salaries	Council
$3,498.06		07/15/12	Salaries	Council
$3,498.06		07/29/12	Salaries	Council
$3,498.06		08/12/12	Salaries	Council
$3,498.06		08/26/12	Salaries	Council
$3,498.06		09/09/12	Salaries	Council
$3,498.06		09/23/12	Salaries	Council
$3,498.06		10/07/12	Salaries	Council
$3,498.06		10/21/12	Salaries	Council
$3,498.06		11/04/12	Salaries	Council
$3,498.06		11/18/12	Salaries	Council
$3,498.06		12/02/12	Salaries	Council

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$3,498.06			12/16/12	Salaries	Council	
$3,498.06			12/30/12	Salaries	Council	
$249.86			12/31/12	2012 YE Salary Accrual	Council	
$91,449.28			TOTAL		*% of account budget expended year-to-date*	*98.97%*
$92,400.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*38.76%*
$950.72			BALANCE			
COUNCIL ALLOWANCE				**(ACCT: 10001010.61100.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$1,043.00			01/10/12	Council Allowance	Council	
$1,043.00			01/18/12	Council Allowance	Council	
$1,043.00			02/01/12	Council Allowance	Council	
$1,043.00			02/15/12	Council Allowance	Council	
$1,043.00			02/29/12	Council Allowance	Council	
$1,043.00			03/14/12	Council Allowance	Council	
$1,043.00			04/11/12	Council Allowance	Council	
$1,043.00			04/25/12	Council Allowance	Council	
$1,043.00			05/09/12	Council Allowance	Council	
$1,043.00			05/23/12	Council Allowance	Council	
$1,043.00			06/06/12	Council Allowance	Council	
$1,043.00			06/20/12	Council Allowance	Council	
$1,043.00			07/03/12	Council Allowance	Council	
$1,043.00			07/18/12	Council Allowance	Council	
$1,043.00			08/01/12	Council Allowance	Council	
$1,043.00			08/15/12	Council Allowance	Council	
$1,043.00			09/12/12	Council Allowance	Council	
$1,043.00			09/26/12	Council Allowance	Council	
$1,043.00			10/10/12	Council Allowance	Council	
$1,043.00			10/24/12	Council Allowance	Council	

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$1,043.00			11/07/12	Council Allowance	Council	
$1,043.00			11/20/12	Council Allowance	Council	
$1,043.00			12/05/12	Council Allowance	Council	
$1,043.00			12/19/12	Council Allowance	Council	
$25,032.00			TOTAL		*% of account budget expended year-to-date*	*100.00%*
$25,032.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*10.50%*
$0.00			BALANCE			
MILEAGE REIMBURSEMENT				**(ACCT: 10001010.61200.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$105.06			04/10/12	Mileage reimbursement - Jan-Mar	Herb Atchison	
$195.50			04/17/12	Mileage reimbursement - Jan-Feb	Nancy McNally	
$72.00			04/17/12	Mileage reimbursement - March	Nancy McNally	
$26.75			04/19/12	Incorrect rate on previous reimbursement	Nancy McNally	
$86.19			07/03/12	Mileage reimbursement - Apr-June	Herb Atchison	
$197.58			07/24/12	Mileage reimbursement - April	Nancy McNally	
$275.28			07/24/12	Mileage reimbursement - May	Nancy McNally	
$91.57			07/24/12	Mileage reimbursement - June	Nancy McNally	
$259.05			12/31/12	Mileage reimbursement - June July	Nancy McNally	
$114.24			12/12/12	Mileage reimbursement - Sept	Nancy McNally	
$91.29			12/12/12	Mileage reimbursement - Oct	Nancy McNally	
$104.55			12/12/12	Mileage reimbursement - Nov-Dec	Nancy McNally	
$146.52			12/31/12	Mileage reimbursement - Sept-Dec	Mary Lindsey	
$1,765.58			TOTAL		*% of account budget expended year-to-date*	*58.85%*
$3,000.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*1.26%*
$1,234.42			BALANCE			

EXPENDITURE			DATE	DESCRIPTION	PAID TO:
MEETING EXPENSES				(ACCT: 10001010.61400.0000)	
EXPENDITURE			DATE	DESCRIPTION	PAID TO:
$72.00			02/07/12	1/25 ADCOG Dinner - McNally, Briggs, Lindsey	City Of Federal Heights
$150.00			02/22/12	2/7 MNCC Breakfast - McNally, Lindsey, Briggs, Winter, Atchison	MNCC
$1,800.00			4/9/2012	Citizen Summit Invoice 12-0206	Lyle Sumek & Associates
$5.28			04/09/12	Drinks for ACMCYA Reception (Walmart)	Visa
$53.38			04/11/12	2/29 Legislative Briefing - Sen Hudak, McNally, McFall & Smithers	Petty Cash
$65.91			04/11/12	4/9 Dessert for ACMCYA Reception	Costco
$2.72			04/16/12	4/13 Polis Legislative Briefing - Water	Mary Joy Barajas
$75.00			04/17/12	5/4 Law Day Breakfast - McNally, Briggs, Kaiser, Lindsey	Adams/Broomfield Bar Associati
$46.00			04/18/12	3/28 Legislative Briefing - Sen Steadman, McNally, McFall, Tomlinson and Smithers	Panera
$40.00			04/20/12	4/25 Goodwill Power of Work Luncheon - Kaiser	Goodwill HQ
$3,717.95			05/23/12	5/9 Telephone Townhall event	Telephone Town Hall Meeting, Inc 915/143335
$505.80			05/23/12	5/23 Council dinner with District 50 (Legacy Grill)	Visa
$28.84			06/04/12	2/6 Cookies for Community Summit	King Soopers
$347.34			06/04/12	2/6 Council Community Summit	Rosati's Pizza
$75.00			06/13/12	6/1 Children's Outreach Project Annual Breakfast - McNally, Briggs, Lindsey	Community First/Giving First
$1,508.82			06/14/12	4/27-28 banquet services - Strategic Planning Retreat	Heritage Grill
$90.00			06/27/12	6/29 DC Breakfast - Lindsey, Atchison, Briggs	MNCC
$73.00			07/17/12	6/5 HSB Organization Interviews	Double D's
$50.00			07/31/12	4/25 ADCOG Dinner - Lindsey, Atchison	City of Commerce City

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$100.00			08/06/12	7/25 ADCOG Dinner - Lindsey, Atchison, McNally, Briggs	City of Northglenn	
70.00			08/29/12	9/5 CML Dist. 3 Meeting - Briggs, Lindsey	City of Boulder	
$75.00			08/30/12	10/1 MNCC FederalLegislative Debate Breakfast - Atchison, Briggs, Lindsey	MNCC	
$55.00			09/18/12	9/6 JEC Council Education Forum - Briggs	123 Sign Up/JEC	
$220.00			09/18/12	10/4 Annual JEC Lunch - Atchison, Briggs, Lindsey, Kaiser	123 Sign Up/JEC	
$125.00			09/25/12	11/3 Butterfly Pavilion Annual Gala - Briggs	Butterfly Pavilion	
$100.00			10/01/12	10/17 MNCC Taste of Chamber - Briggs (2), Major (2)	MNCC	
$90.00			10/16/12	Reclass DC Breakfast 062912		
$120.00			11/13/12	10/24 ADCOG Dinner - McNally, Atchison, Briggs, Lindsey	City of Thornton	
(35.00)			12/11/12	12/11/12 Reimbursement for Ashley Reimers for Legislative Dinner	City of Westminster	
$400.00			12/17/12	10/5 Wine Tasting Event - McNally (2), Atchison (2), Briggs (2), Major (2), Winter (2)	Westminster Legacay Foundation	
$120.00			12/19/12	12/7 MNCC Legislative Priorities Breakfast - McNally, Briggs, Lindsey, Winter	MNCC	
$27.37			12/30/12	6th Annual 36 Commuting Solutions Legislative Breakfast	Mary Lindsey	
$1,005.00			12/31/12	12/4 Legislative Dinner	The Grill at Legacy Ridge	
$11,179.41			TOTAL		*% of account budget expended year-to-date*	*82.50%*
$13,550.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*5.68%*
$2,370.59			BALANCE			

EXPENDITURE			DATE	DESCRIPTION	PAID TO:
CAREER DEVELOPMENT				**(ACCT: 10001010.61800.0000)**	
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**
$85.00			01/05/12	CML Effective Governance Training - Herb Atchison	CML
$1,317.08			03/12/12	MCC Lobbying Trip-Washington DC (Feb 14-16) (Lodging $638.90, Air $516.40, Car $7.50, Transportation $20.00, Mileage $23.31, Misc. $102.97, Tips $8.00)	Nancy McNally
$2,195.54			03/28/12	NLC Washington DC (Mar 10-14) (Reg $595.00, Lodging $1140.44, Air $359.60, Misc. $71.00, Tips $9.00, Expenses for Other Councillors $20.50)	Nancy McNally
$2,317.48			03/28/12	NLC Washington DC (Mar 10-14) (Reg $545.00, Lodging $1140.44, Air $339.60, Trans $53.00, Meals $129.44, Tips $10.00, Cash Advance $100.00)	Bob Briggs
$1,258.82			03/28/12	CML Breckenridge (June 19-22) (Reg $250.00, Lodging $778.59, Mileage $98.23, Meals $132.00)	Nancy McNally
$382.00			03/28/12	CML Breckenridge (June 19-22) (Reg $250.00, Meals $132.00)	Mary Lindsey
$235.35			03/28/12	NLC - Council meals being allocated from Smithers NLC Expense Report	Steve Smithers
$2,497.03			04/09/12	NLC Washington DC (Mar 10-14) (Reg $565.00, Lodging $1140.44, Air $347.60, Trans $109.50, Misc. $70.00, Meals $249.87, Expenses for Other Councillors $14.62)	Herb Atchison

EXPENDITURE			DATE	DESCRIPTION	PAID TO:
$2,426.48			04/09/12	NLC Washington DC (Mar 10-14) (Reg $445.00, Lodging $1390.00, Air $359.60, Car Rental $40.00, Mileage $28.86, Trans $20.00, Meals $143.01)	Scott Major
(35.10)			12/11/12	4/5/12 NLC Conference Spouse Meal Reimbursement/Scott Major	City of Westminster
$2,055.17			04/10/12	NLC Washington DC (Mar 10-14) (Reg $610.00, Lodging $990.36, Air $328.60, Mileage $28.86, Trans $44.04, Meals/Tips $53.31)	Mary Lindsey
$2,811.83			04/24/12	NLC Washington DC (Mar 10-14) (Reg $875, Lodging $1140.44, Air $402.60, Trans $81.00, Meals $312.79)	Mark Kaiser
$964.51			04/30/12	CML Breckenridge (June 19-22) (Reg $300.00, Lodging $435.51, Mileage $111.00, Meals $118.00)	Bob Briggs
$237.01			07/10/12	6/20 Young Elected Officials Network	Faith Winter
$810.39			07/17/12	3/29 Young Elected Officials Policy Conference	Faith Winter
$240.00			12/31/12	This is a travel reclass - Travel report did not clear correctly - per Pcard descriptions NLC	Nancy McNally
$555.00			12/19/12	NLC Conference, Boston MA (Reg. $555) - did not attend conference unable to secure refund due to deadline;	Bob Briggs
$460.00			12/19/12	NLC Conference, Boston MA (Reg. $460) - did not attend conference unable to secure refund due to deadline;	Herb Atchison
$1,820.55			12/31/12	NLC Conference, Boston MA (Reg. $825; lodging $498.14; airfare $339.60; meals/tips $102.85; mileage/parking/train $54.96)	Mary Lindsey

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$2,334.54			12/31/12	NLC Conference, Boston MA (Reg. $680; lodging $996.28; airfare $364.60; meals $268.66; mileage/parking/train $25)	Mark Kaiser	
$1,711.65			12/17/12	NLC Conference, Boston MA (Reg. $625; lodging $498.14; airfare $364.60; meals $141.53; mileage/parking/train $82.38)	Nancy McNally	
$26,680.33			TOTAL		*% of account budget expended year-to-date*	*55.35%*
$48,205.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*20.22%*
$21,524.67			BALANCE			
TELEPHONE				**(ACCT: 10001010.66900.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$20.00			01/10/12	Council iPad - McNally	Verizon Wireless	
$20.00			01/10/12	Council iPad - Briggs	Verizon Wireless	
$20.00			01/10/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			01/10/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			01/10/12	Council iPad - Major	Verizon Wireless	
$20.00			02/01/12	Council iPad - Atchison	Verizon Wireless	
$20.00			02/27/12	Council iPad - McNally	Verizon Wireless	
$20.00			02/27/12	Council iPad - Briggs	Verizon Wireless	
$20.00			02/27/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			02/27/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			02/27/12	Council iPad - Major	Verizon Wireless	
$20.00			03/02/12	Council iPad - Atchison	Verizon Wireless	
$20.00			03/09/12	Council iPad - McNally	Verizon Wireless	
$20.00			03/09/12	Council iPad - Briggs	Verizon Wireless	
$20.00			03/09/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			03/09/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			03/09/12	Council iPad - Major	Verizon Wireless	

EXPENDITURE			DATE	DESCRIPTION	PAID TO:
$20.00			04/02/12	Council iPad - Atchison	Verizon Wireless
$20.00			04/09/12	Council iPad - McNally	Verizon Wireless
$20.00			04/09/12	Council iPad - Briggs	Verizon Wireless
$20.00			04/09/12	Council iPad - Lindsey	Verizon Wireless
$20.00			04/09/12	Council iPad - Kaiser	Verizon Wireless
$20.00			04/09/12	Council iPad - Major	Verizon Wireless
$20.00			05/02/12	Council iPad - Atchison	Verizon Wireless
$20.00			05/09/12	Council iPad - McNally	Verizon Wireless
$20.00			05/09/12	Council iPad - Briggs	Verizon Wireless
$20.00			05/09/12	Council iPad - Lindsey	Verizon Wireless
$20.00			05/09/12	Council iPad - Kaiser	Verizon Wireless
$20.00			05/09/12	Council iPad - Major	Verizon Wireless
$20.00			06/02/12	Council iPad - Atchison	Verizon Wireless
$20.00			06/09/12	Council iPad - McNally	Verizon Wireless
$20.00			06/09/12	Council iPad - Briggs	Verizon Wireless
$20.00			06/09/12	Council iPad - Lindsey	Verizon Wireless
$20.00			06/09/12	Council iPad - Kaiser	Verizon Wireless
$20.00			06/09/12	Council iPad - Major	Verizon Wireless
$20.00			07/09/12	Council iPad - Atchison	Verizon Wireless
$20.00			07/09/12	Council iPad - McNally	Verizon Wireless
$20.00			07/09/12	Council iPad - Briggs	Verizon Wireless
$20.00			07/13/12	Council iPad - Lindsey	Verizon Wireless
$20.00			08/10/12	Council iPad - Kaiser	Verizon Wireless
$20.00			08/10/12	Council iPad - Major	Verizon Wireless
$20.00			08/10/12	Council iPad - Atchison	Verizon Wireless
$20.00			08/12/12	Council iPad - McNally	Verizon Wireless
$20.00			09/02/12	Council iPad - Briggs	Verizon Wireless
$20.00			09/10/12	Council iPad - Lindsey	Verizon Wireless
$20.00			09/10/12	Council iPad - Kaiser	Verizon Wireless
$20.00			09/10/12	Council iPad - Major	Verizon Wireless
$20.00			09/12/12	Council iPad - Atchison	Verizon Wireless

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$20.00			10/09/12	Council iPad - McNally	Verizon Wireless	
$20.00			10/09/12	Council iPad - Briggs	Verizon Wireless	
$20.00			10/09/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			10/09/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			10/12/12	Council iPad - Major	Verizon Wireless	
$20.00			10/16/12	Council iPad - Atchison	Verizon Wireless	
$20.00			11/09/12	Council iPad - McNally	Verizon Wireless	
$20.00			11/09/12	Council iPad - Briggs	Verizon Wireless	
$20.00			11/09/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			11/09/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			11/12/12	Council iPad - Major	Verizon Wireless	
$20.00			11/16/12	Council iPad - Atchison	Verizon Wireless	
$20.00			12/09/12	Council iPad - McNally	Verizon Wireless	
$20.00			12/09/12	Council iPad - Briggs	Verizon Wireless	
$20.00			12/09/12	Council iPad - Lindsey	Verizon Wireless	
$20.00			12/09/12	Council iPad - Kaiser	Verizon Wireless	
$20.00			12/12/12	Council iPad - Major	Verizon Wireless	
$20.00			12/16/12	Council iPad - Atchison	Verizon Wireless	
$1,320.00			TOTAL		*% of account budget expended year-to-date*	*38.26%*
$3,450.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*1.45%*
$2,130.00			BALANCE			
PC REPLACEMENT FEE				**(ACCT: 10001010.66950.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$1,750.00			01/31/12	PC Replacement Fee	PC Replacement Fee	
$1,750.00			TOTAL		*% of account budget expended year-to-date*	*100.00%*
$1,750.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*0.00%*
$0.00			BALANCE			

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
SPECIAL PROMOTIONS				**(ACCT: 10001010.67600.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$30.00			02/13/12	Senior Hub	Senior Hub	
$1,000.00			03/07/12	Art Project for Public Safety Center - contribution	Westminster Public Safety Recognition Foundation	
$200.00			07/16/12	Mary Ciancio Golf Tournament	Community Reach Center	
$1,230.00			TOTAL		*% of account budget expended year-to-date*	*35.14%*
$3,500.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*1.47%*
$2,270.00			BALANCE			
OTHER CONTRACTUAL SERVICE				**(ACCT: 10001010.67800.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$500.00			01/18/12	Adams County - MMCYA Sponsorship	Adams County	
$600.00			02/07/12	After Prom Sponsorship	Standley Lake High School	
$200.00			03/12/12	After Prom Sponsorship	Jefferson Academy	
$10,000.00			03/13/12	2012 Council Contribution	North Metro Arts Alliance	
$2,150.00			03/31/12	Annual Banquet Sponsorship	Metro North Chamber	
$600.00			04/16/12	After Prom Sponsorship	Westminster High School	
$500.00			05/07/12	Golf Tournament Sponsorship	Front Range Community College	
$500.00			05/29/12	Mary & Jim Bennett Golf Tournament	Hyland Hills	
$16.02			06/12/12	6/14 Balloons for We're All Ears Event	Fun Services	
$1,120.00			07/11/12	Waterworld Tickets	District 50	
$5,000.00			07/16/12	2012 contribution for ACYI program	Adams County Youth Initiative	
$328.95			07/16/12	7/12 We're All Ears Council Outreach Event	Fun Services	
$156.00			07/16/12	7/20 We're All Ears Council Outreach Event	Fun Services	
$493.95			07/17/12	6/14 We're All Ears Council Outreach Event	Fun Services	
$750.00			07/18/12	J and Nancy Heil Tribute Golf Tournament	Westminster Legacy Foundation	

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$600.00			07/24/12	Larry Silver Memorial Golf Tournament	LSMGT (The Optimist Club)	
$1,000.00			08/01/12	2012 Annual Banquet Sponsorship - 2 Silver Tables	Westminster Public Safety Recognition Foundation	
$1,250.00			08/13/12	Golf Tournament Sponsorship	Westminster Rotary Club	
$2,000.00			12/13/12	Sponsorship of the 2012 Flu Vaccanine Campaingn	St. Anthony North Foundation	
$195.00			12/31/12	Westminster Faire Ad	Colorado Community Media	
$27,959.92			TOTAL		*% of account budget expended year-to-date*	*69.06%*
$40,484.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*16.98%*
$12,524.08			BALANCE			
SUPPLIES				**(ACCT: 10001010.70200.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$3.08			02/01/12	Portrait for H. Atchison	Walmart.Com	
$9.74			02/13/12	Council Photos	Walmart.Com	
$22.87			02/27/12	Kitchen Supplies	Target	
$14.31			06/13/12	Sympathy Cards	Party City	
$37.08			06/14/12	Council Outreach - tableclothes cleaning	Majestic Cleaners	
$32.45			06/14/12	Supplies	Office Max	
$14.80			06/14/12	New Plaques - Court - Winter, Atchison	Action Awards & Engraving	
$37.44			06/14/12	Photo update - Court - Winter, Atchison	Creative Framing	
$78.50			06/14/12	5/30 500 Business Cards - Lindsey/500 Envelopes	Print Shop Charges	
$27.47			07/16/12	7/16 DCR - Council Dinner Napkins	Petty Cash	
$855.34			09/17/12	Employee Appreciation Flying Discs - Mapleleaf Productions	Nancy McNally	
$69.90			10/10/12	Flowers for former Councillor Gary Smith funeral	Cherry Blossoms	
$10.47			10/10/12	Jessica Ridgeway Ribbons	Michaels	
$24.94			12/31/12	Office Supplies	Office Max	
$29.99			12/31/12	Council's Holiday Card	American Greetings	

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$78.24			12/31/12	Office Supplies	Office Max	
$1,346.62			TOTAL		*% of account budget expended year-to-date*	*35.93%*
$3,748.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*1.57%*
$2,401.38			BALANCE			
FOOD				**(ACCT: 10001010.70400.0000)**		
EXPENDITURE			**DATE**	**DESCRIPTION**	**PAID TO:**	
$58.35			02/27/12	1/9 Council Dinner	Li's Chinese	
$74.95			02/27/12	1/23 Council Dinner	Double D's	
62.56			02/29/12	Council Soda and Coffee	Highland Estates Coffee	
$8.00			03/16/12	Chips for Council Dinner	Subway	
$6.82			05/17/12	Cookies for Council Dinners	Petty Cash	
$93.84			05/30/12	Council Soda	Canteen Refreshments	
$128.30			06/04/12	6/4 Council Dinner/HSB Board Meeting	The Garlic Knot	
$54.00			06/11/12	6/11 Council Dinner	Wishbone	
$79.94			06/13/12	5/7 Council Dinner	Los Lagos	
$78.50			06/13/12	5/14 Council Dinner	Double D's	
$43.97			06/13/12	5/21 Council Dinner	Black Jack Pizza	
$56.00			06/14/12	2/13 Council Dinner	Wishbone	
$54.45			06/14/12	2/22 Council Dinner B&C Interviews	Papa J's	
$47.47			06/14/12	2/27 Council Dinner	Black Jack Pizza	
$74.94			06/14/12	3/5 Council Dinner	Los Lagos	
$16.07			06/14/12	Cookies for Council Dinners	King Soopers	
$53.60			06/14/12	3/19 Council Dinner	Li's Chinese	
$86.50			06/14/12	3/26 Council Dinner	Double D's	
$54.00			06/14/12	4/09 Council Dinner	Wishbone	
$54.70			06/14/12	4/16 Council Dinner	Papa J's	
$53.60			06/14/12	4/23 Council Dinner	Li's Chinese	
$24.00			06/14/12	Cookies for Council Dinners	King Soopers	

EXPENDITURE			DATE	DESCRIPTION	PAID TO:
$78.20			06/14/12	Council Soda	Canteen Refreshments
$156.40			06/14/12	Council Soda	Canteen Refreshments
$70.42			06/25/12	6/25 Council Dinner	Los Lagos
$5.00			06/26/12	6/25 Council Dinner Tip	Los Lagos
$56.00			07/02/12	7/2 Council Dinner	The Garlic Knot
$59.45			07/09/12	7/9 Council Dinner	Papa J's
$89.50			07/16/12	7/16 Council Dinner	Double D's
$61.30			07/23/12	7/23 Council Dinner	Li's Chinese
$21.44			07/24/12	Cookies for Council Dinners	Walmart
$51.95			08/06/12	8/6 Council Dinner	Black Jack Pizza
$78.20			08/08/12	Council Soda	Canteen Refreshments
$72.94			08/13/12	8/13 Council Dinner	Los Lagos
$54.45			08/20/12	8/20 Council Dinners	Papa J's
$17.19			08/20/12	8/20 Council Snacks	Walmart
$54.00			08/27/12	8/27 Council Dinner	Wishbone
$61.30			09/10/12	9/10 Council Dinner	Li's Chinese
$60.93			09/17/12	9/17 Council Dinner	Black Jack Pizza
$14.75			09/18/12	Cookies for Council Dinners	Petty Cash
$20.29			09/18/12	Cookies for Council Dinners	Petty Cash
$22.16			09/19/12	Cookies for Council Dinner	Petty Cash
$128.66			09/27/12	9/24 Council Dinner	Chili's
$11.47			10/01/12	Cookies for Council Dinner	Petty Cash
$117.89			10/01/12	10/1 Council Dinner	The Garlic Knot
$86.40			10/03/12	Council Soda	Canteen Refreshments
$62.11			10/08/12	10/8 Council Dinner	Boston Market
$61.30			10/15/12	10/15 Council Dinner	Li's Chinese
$51.95			10/22/12	10/22 Council Dinner	Black Jack Pizza
$78.43			11/05/12	11/05 Council Dinner	Los Lagos
$60.00			11/12/12	11/12 Council Dinner	Dickey's BBQ
$61.30			11/19/12	11/19 Council Dinner	Li's Chinese
$78.50			11/26/12	11/26 Council Dinner	Double D's

EXPENDITURE			DATE	DESCRIPTION	PAID TO:	
$50.00			12/03/12	12/3 Council Dinner	Wishbone	
$57.60			12/05/12	Council Soda	Canteen Refreshments	
$78.35			12/10/12	12/10 Council Dinner	Los Lagos	
$5.00			12/10/12	12/10 Council Dinner	Los Lagos	
$51.95			12/17/12	12/17 Council Dinner	Black Jack Pizza	
$3,411.34			TOTAL		*% of account budget expended year-to-date*	*68.23%*
$5,000.00			BUDGET	2012 APPROVED BUDGET	*% of total City Council budget*	*2.10%*
$1,588.66			BALANCE			
$238,369.00			**TOTAL 2012 CITY COUNCIL BUDGET**			
$193,124.48			**TOTAL 2012 CITY COUNCIL EXPENDITURES THROUGH 12/31/12**			
$45,244.52			**BALANCE**			
81.02%			**PERCENT OF BUDGET EXPENDED THROUGH 12/31/12**			