COMMUNITY DEVELOPMENT COMMITTEE

WEDNESDAY, DECEMBER 13, 2023 at 6:30 p.m.

MISSION CITY HALL
6090 Woodson Street

Meeting In Person and Virtually via Zoom

This meeting will be held in person at the time and date shown above. This meeting will also be available virtually via Zoom (https://zoom.us/join). Information will be posted, prior to the meeting, on how to join at https://www.missionks.org/calendar.aspx. Please contact the Administrative Offices, 913-676-8350, with any questions or concerns.

PUBLIC COMMENTS

PLANNING COMMISSION ACTION ITEMS

(items will be included on the next legislative agenda for Council action)

1. Adoption of the Tomorrow Together 2040 Mission Comprehensive Plan – Brian Scott
   2040 Comprehensive Plan Existing Conditions Public Input Summary
   9/25/2023 Planning Commission Minutes

   The City has been working in partnership with a consulting team lead by Confluence on an update to its Comprehensive Land Use Plan – Tomorrow Together 2040 Comprehensive Plan – since March of 2020. The draft plan was presented to the Planning Commission at their September 25th meeting where it was recommended to the City Council for approval by a vote of 7-1.

2. Final Plat – Popeye's on Johnson Drive – 6821 Johnson Drive – (PC Case #23-24) - Brian Scott

   Approval of the final plat for Popeye's on Johnson Drive and acceptance of dedication of right-of-way and easements. This was considered by the Planning Commission at their November 27th meeting and recommended by a vote of 7-0 for approval by the City Council.

3. Special Use Permit – Digital Billboard – 6650 W. 47th Street - (PC Case #23-22) - Brian Scott

   The property located 6650 W. 47th street, north of I-35, is partly in Mission and partly in Kansas City, Kansas. The owner of the property recently submitted an application for a special use permit to install a digital billboard on the front portion of the property near the interstate. Billboards are permitted in any zoning district except residential with a special use permit. Billboards located near interstate highways are also regulated by state

statutes. The Planning Commission considered the application at their November 27th meeting and have recommended approval by the City Council by a vote of 7-0.

PUBLIC PRESENTATIONS / INFORMATIONAL ONLY

ACTION ITEMS

4. Acceptance of the November 1, 2023 Community Development Committee Minutes – Robyn Fulks (page 4)

   Draft minutes of the November 1, 2023 Community Development Committee meeting are included for review and acceptance.

5. Rock Creek Channel Preliminary Project Study Report (Woodson to Outlook) – Brent Morton/ Laura Smith

   March 2022, the Johnson County Stormwater Management Program (SMP) completed a Watershed Master Plan (WMP) for Watershed 1 which includes Mission. The WMP identified watershed characteristics and environmental deficiencies within the watershed and watershed risk related to flooding, water quality, stream erosion, and hydromodification. The Rock Creek Channel located in downtown Mission from Lamar Ave. To Reeds Rd. Received a preliminary flood risk score of 4.44 on a scale of 1 to 5.

   The SMP and Watershed 1 members approved the Preliminary Project Study (PPS) to develop and identify three alternative solutions and cost estimates to address flooding, water quality, and stream erosion along this section of the creek channel. Staff and Olsson representatives will present the findings, including the recommendation to submit Option 3 to the County for funding through the SMP. The project would be included in the 2026 Budget year, but it is important to submit now to ensure we can secure a place on the project funding list. The SMP program is designed to provide 50% cost sharing between the County and the City.

6. Powell Community Center (PCC) North Bathrooms Remodel – Penn Almoney

   The two north bathrooms in the PCC are original to the facility expansion in 2004. Rental groups, campers and program participants utilize these restrooms more than any other bathrooms throughout the facility. Counters, stall dividers, flooring and wall tile need to be replaced with materials that can withstand daily impacts and maintenance needs. Staff solicited quotes from ten bathroom remodeling contractors, and received two bids. Staff recommends approval of a contract with MAC General Contracting in an amount not to exceed $35,026 which was approved in the 2023 Parks + Recreation CIP and will be paid from Parks + Recreation Sales Tax funds.

7. Powell Community Center (PCC) Steam Sauna Retiling – Penn Almoney

   The 2023 Parks + Recreation CIP included plans to retile the PCC steam sauna floors, walls and seating which were originally installed in 1999. Staff received four bids and is recommending a contract with Alex Tile and Floor for sauna demolition and retiling in an amount not to exceed $12,960. Funds will be provided from the Parks + Recreation Sales Tax Fund.

8. CARS Agreement for the Roe Avenue (Johnson Drive to 63rd Street) 2024 CARS Project

   The City of Mission's proposed CARS project for 2024 is the Roe Avenue (Johnson Drive to 63rd Street) Street Rehabilitation Project. The proposed improvements include an Ultra-thin Bonded Asphalt Surface (UBAS) surface treatment, spot curb/cutter, stormwater improvements, traffic signal buyout and replacement, new sidewalk, and permanent pavement markings. The stormwater improvements include replacing aging corrugated metal pipe (CMP) that is rated 3.5 or higher. The Interlocal Agreement specifies the County's participation in the project for a total cost not to exceed $870,000 and commits the City's funds to the project. Approval of the interlocal agreement is the final step with the county to accept CARs funds for this project.

DISCUSSION ITEMS

OTHER

8. Department Updates - Laura Smith

Lea Loudon, Chairperson
Ben Chociej , Vice-Chairperson
Mission City Hall, 6090 Woodson St
913.676.8350

City of Mission	Item Number:	1.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Community Development	From:	Brian Scott

Action items require a vote to recommend the item to the full City Council for further action.

RE: Adoption of the "Tomorrow Together 2040 - Mission Comprehensive Plan"

RECOMMENDATION: Approve the ordinance formally adopting the "Tomorrow Together 2040 - Mission Comprehensive Plan."

DETAILS: Comprehensive plans have long been used as a tool for planning the future growth of cities. The traditional methodology for a comprehensive plan has been to examine current trends in population growth, business development, transportation systems, land use, and community facilities and then to develop a vision for what the city may look like at some point in the future. Based on that vision, recommendations are then developed for a systematic approach to the future growth of the city that may include future annexation of territory (if necessary), specific land uses and zoning, extensions or upgrades of roads and infrastructure, and location of community facilities such as parks and fire stations.

Mission's first comprehensive plan was adopted in 1968. Subsequent comprehensive plans were adopted in 1995, 1999 (update), 2007 and 2011 (update). The City embarked on the most recent update to its comprehensive plan in 2019. A request for proposals (RFP) was developed by staff with input from the Planning Commission and sent to prospective planning firms as well as advertised on the American Planning Association's website.

Proposals were evaluated by a selection committee and the top five firms were invited to the city for interviews. Confluence was ultimately selected based on their planning experience, team make-up, knowledge of our community, and the fact that they had recently completed similar studies for two neighboring communities (Roeland Park and Merriam). The City Council approved a contract with Confluence at the end of 2019 and the study began in March of 2020.

The project kick-off was a joint work session with the City Council and the Planning Commission to understand the purpose and components of a comprehensive plan. The joint work session was held on the eve of the coronavirus pandemic. Because of the rapidly evolving turn of events with the pandemic and stay-at-home orders issued by the Governor, the project was temporarily paused. The project resumed in the late summer of 2020 with the appointment of a steering committee.

A formal community kick-off meeting was held in October 2020 when the project website was unveiled. Community engagement was severely limited due to the social distancing requirements of the ongoing coronavirus pandemic. The project web page was able to fill that void by offering several on-line engagement tools including an interactive pin-map, visual preference survey, and budgeting tool.

Related Statute/City Ordinance:	KSA 12-747
Line Item Code/Description:	NA
Available Budget:	NA

City of Mission	Item Number:	1.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Community Development	From:	Brian Scott

Action items require a vote to recommend the item to the full City Council for further action.

The committee learned about the current demographic and economic make-up of the city, reviewed responses from the on-line engagement tools, discussed ideas about current development patterns and what they would like to see, and considered other topics around sustainability, transportation and mobility, and housing. The Steering Committee began to meet in person during the summer of 2021 to formulate a vision statement and develop recommendations in each of the key areas of the plan.

The vision statement and recommendations were presented to the public in an open house held in November of 2021. A final draft of the plan – known as “Tomorrow Together – 2040 Mission Comprehensive Plan” - was completed and presented to the City in the winter of 2022.

Due to staff transitions and an onslaught of development applications in 2022, review of the draft plan took longer than anticipated. Two joint Planning Commission and City Council work sessions were held in 2023, and senior management staff reviewed the draft plan prior to its presentation to the Planning Commission in September 2023.

Key themes from the “Tomorrow Together” plan include:

- Preservation of the natural environment through better storm water management practices, conservation and expansion of green space, and greater emphasis on sustainability measures that will reduce the community’s overall carbon footprint.

- Enhance mobility throughout the community for pedestrians, bicyclists, transit users, and others by creating stronger connections, slowing traffic, and providing greater safety.

- Support of a variety of housing options in the community by preserving existing housing stock while allowing for development of new housing stock that is appropriate for neighborhoods or commercial areas based on density and design.

- Encourage continued economic prosperity for the community by supporting existing businesses in the community and development of new businesses that align with the long-term vision for the community.

Each of these key themes are more fully explored in the six chapters of the plan which goals and suggested implementation strategies identified throughout.

- Natural Features and Environment
- Parks and Recreation
- Transportation and Mobility
- Economic Revitalization

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Line Item Code/Description:	NA
Available Budget:	NA

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- Housing and Neighborhoods
- Infrastructure Maintenance and Enhancements

Chapter 10 of the plan is the Implementation Plan where the recommendations are summarized and given a priority ranking. There are two appendices to the plan. Appendix A provides an analysis of the existing conditions of the community including population trends, demographics, housing, and economy, and Appendix B provides a summary of community input received from the on-line engagement tool as well as the open house that was held in November of 2021.

It is important to note that the "Tomorrow Together" plan represents a snapshot in time, but is not intended to be a static document. Comprehensive plans are meant to be living documents that evolve over time with the community. Ideas and concepts presented in the plan are meant to provide context for the recommendations that were based on extensive public or stakeholder input and professional experiential knowledge to stimulate further discussion and analysis.

Recommendations presented in the plan will require further review, analysis, and discussion based on changes in demographics, updated studies, continued public input, and on-going implementation. Implementation of the plan will ultimately be achieved through some action of the City such as a new service or program, a policy directive, or code change. Although we are completing the plan, we are just beginning the journey.

Planning Commission Action

The Planning Commission held a public hearing on the Comprehensive Plan draft at its September 2023 meeting. Chris Shires, a principal with Confluence and the project manager, provided an overview of the plan and its recommendations. Considerable discussion ensued regarding the proposed Future Land Use Map and in particular buffers around single-family areas.

The Planning Commission voted 6-0 (2 abstaining) to recommend approval to the City Council of the Tomorrow Together 2040 - Mission Comprehensive Plan with the following amendments:

1. Future Land Use Map:

    a. Change the land use designation for those properties north of 56th Street and east of Foxridge Drive from "Mixed Use High Density" (purple color) to "Medium Density Residential" (apricot).
    b. Extend the "Medium Density Residential" (apricot color) designation west of Lamar and north of Johnson Drive between the "Mixed-Use Medium Density" (Light Purple) abutting Johnson Drive and "Low Density Residential (Yellow)" so that everything south of 58th Street (or an line equivalent to 58th Street) is

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Line Item Code/Description:	NA
Available Budget:	NA

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"Medium Density Residential" up to those properties along the north side of Johnson Drive.

c. Correct the area that is identified as park on Beverly at 55th Street as an error.

2. Future Land Use Definitions:

   a. Change the land use definition for "Mixed Use Medium Density" to development no greater than three stories and no greater than 24 units/acre.

3. Implementation Plan:

   a. Under strategy 3B of Transportation and Mobility change the reference from NACTO Blueprint for Autonomous Urbanism to NACTO Urban Street Design Guidelines as language in the Comprehensive Plan

The City Council held a work session on November 15, 2023 to review the draft plan and the recommendation from the Planning Commission. During that work session staff presented a recommendation to accept recommendations 1 and 3 from the Planning Commission, but to leave the definition of "Mixed Use Medium Density" as recommended in the original draft of the plan. A copy of the memo from Brian Scott, Deputy City Administrator for Planning and Development Services, explains the staff's rational for not recommending rejection of the Planning Commissions proposed definition change.

The draft document linked to the packet reflects the changes recommended by the Planning Commission with a note on page 18 to revise the definition for "Mixed Use Medium Density" back to what was originally proposed. Staff has prepared an Ordinance for Council consideration with accepts recommendations 1 and 3 from the Planning Commission but rejects the recommendation related to the definition of "Mixed Use Medium Density." In order to approve the "Tomorrow Together 2040 – Mission Comprehensive Plan" excluding the change in the definition of "Mixed Use Medium Density" recommended by the Planning Commission the ordinance will require a 2/3 majority vote of the City Council.

CFAA CONSIDERATIONS/IMPACTS: The "Tomorrow Together - 2040 Mission Comprehensive Plan" identifies goals and strategies that align with the Community for All Ages initiative. Many of the recommendations from the plan such as preservation

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Available Budget:	NA

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and enhancement of park space, transportation and mobility, and housing support the goal of making Mission a community for all ages and are indicated as such with a the CFAA logo next to the recommendation.

Related Statute/City Ordinance:	KSA 12-747
Line Item Code/Description:	NA
Available Budget:	NA

MEMORANDUM

To: Laura Smith, City Administrator

From: Brian Scott, Deputy City Administrator – Planning and Development Services

Date: October 16, 2023

Regarding: Proposed Amendment to Medium Density Mixed-Use

The City of Mission initiated an update of its comprehensive plan in 2020. With assistance and guidance from Confluence, an established planning consulting firm recognized throughout the Midwest, the City undertook an extensive community engagement process that included a Steering Committee made up of community stakeholders and leaders, use of an interactive website to conduct a visual preference survey and interactive mapping tool, and a community open house. The plan developed from this process is the "Tomorrow Together – 2040 Mission Comprehensive Plan."

This plan was presented to the Planning Commission for their consideration at the September 25, 2023 meeting. Much of the discussion was focused on the proposed Future Land Use Map in the plan, and in particular proposed definitions of land use types. The intent of this memo is provide some contextual background on the proposed Future Land Use Map and land use definitions and then discuss in more detail the Planning Commission's proposed amendment to the definition of the Medium Density Mixed-Use land use type.

Proposed Future Land Use Map

A land use map is simply a map of the city showing various types of land uses such as residential, commercial, and industrial uses. Ideally, land uses are organized to take advantage of certain features of the city such as industrial land uses close to highway access or commercial uses along a main corridor. Land uses are also organized so that there is compatibility between uses, meaning that one land use is not placed next to another that may result in a negative impact to either. It is important to note that a land use map is not a zoning map. The land use map is more general and visionary in nature. A zoning map is more specific to permitted uses, set-backs, height restrictions, density, and massing of buildings.

The proposed future land use map in the Tomorrow Together plan does not differ much from the one in the current comprehensive plan. The land use pattern in the city is generally still the same and includes:

- low-density, residential use to the north and south of Johnson Drive;

- high-density, residential use predominately in the northwest corner of the city; and
- commercial uses along Johnson Drive and Martway Street through the center of the city.

The definition of the land use types, however, were discussed and revised during the development of the Tomorrow Together plan based on input from a visual preference survey, the community open house, and guidance from the Steering Committee. Those revised definitions were included in the draft plan that was presented to the Planning Commission at their September meeting.

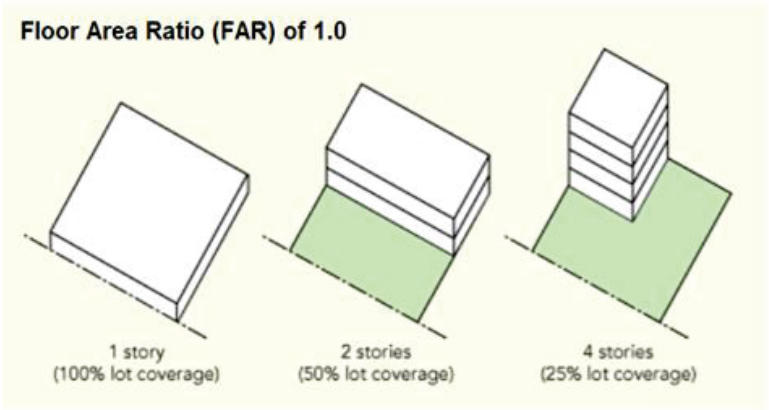
Definitions of Proposed Future Land Uses

The proposed definitions not only provide examples or a general description of the type of land use, but also provide the number of proposed dwelling units per acre for residential uses or the floor area ratio (FAR) for retail or office uses.

FAR can be a difficult concept to grasp even for those who are familiar with urban planning. FAR is the ratio of the total building square footage to the square footage of the parcel or lot that the building sits on. The greater the FAR the more building square footage is permitted to be on the lot.

A FAR 0.5 might be a single-story building that covers only half of the lot, such as the Hy-Vee grocery store. A FAR of 1.0 would be a single-story building that covers the entire parcel from front to back and side to side - think of some of the older buildings in downtown Mission along Johnson Drive that sit right at the sidewalk and right next to the adjacent building. However, a FAR of 1.0 could also be a four-story building that sits on only a quarter of the lot as shown in the diagram below:

Floor area ratio (FAR) *is the ratio of the floor area of a building to the area of the lot on which the building is located. For example, the diagram below illustrates three simple ways that a 1.0 FAR might be reached: one story covering the entire lot, 2 stories covering half of the lot, or 4 stories covering a quarter of the lot all result in the same FAR.*



Definitions of land use types as originally proposed in the Tomorrow Together Plan are as follows:

Low-Density Residential – Single-family or two-family, detached residential uses with a density of 3 to 6 dwelling units per acre.

Medium-Density Residential – Horizontally attached rowhouses or townhomes or the "missing middle" typology such as fourplexes or courtyard apartments with a density of 6 to 12 units per acre.

High-Density Residential – Vertically stacked residential apartments or condos with a density of 12 or more units per acre.

Commercial – Land uses such as retail, services, restaurants, and hotels. Expected density for these types of uses may be 0.25 FAR.

Office – Land uses that would encompass administrative or professional uses during normal business hours with a density of 0.25 FAR.

Business Park / Light Industrial – Medium or large-scale office and light industrial uses with a density of 0.30 FAR.

Mixed-Use Medium Density – Land uses that include a mix of housing, retail and / or office that is scaled to a more pedestrian orientation. The uses might include a single building with uses stacked (housing over retail) or a group of buildings with individual uses all within a cohesive development. Density for this type of land use may be 12 to 45 dwelling units per acre or a FAR of 1.0 to 3.0 for office or retail.

Mixed-Use High Density – Same concept as Mixed-Use Medium Density, but at a higher concentration. Density for this type of land use may be 50 or more dwelling units per acre, or an FAR of 3.0 to 10.0 for office or retail use.

Parks and Pathways – Parks, trails and other recreational areas.

Public and Semi-Public – Government owned land such as county and city facilities, schools, and churches.

As stated above, the proposed future land use map in the Tomorrow Together plan has not really changed from what is in place currently in the existing comprehensive plan. The most notable exception to that would be in the application of Mixed-Use High Density, which is now applied to all of the commercial properties on the west side of the city. This allows for future development of the west side commercial areas to be more in keeping with the vision of the Form Based Code overlay district that was adopted for this area over a decade ago.

The Mixed-Use Medium Density designation has also been applied to many of the properties in the downtown core and along Johnson Drive, areas that are identified as commercial or office use in the current land use map.

Planning Commission Amendment of the Mixed-Use Medium Density Definition

The Planning Commission proposed two amendments to the proposed Future Land Use Map that would extend Medium Density Residential use along the north side of Johnson Drive, west of Lamar and along Foxridge, north of 56th Street. The intent of this is to provide a buffer between the Low Density Residential uses and Medium and High Density Mixed-Uses. Staff is supportive of this amendment.

The Planning Commission expressed some reluctance to the application of Mixed-Use Medium Density in the downtown area of the city when the draft of the Tomorrow Together plan was presented to them in September. The concern was not so much the application of a mixed-use land type itself, but rather the proposed density of the Mixed-Use Medium Density at 12 to 45 dwelling units per acre or a FAR of 1.0 to 3.0 being too dense. After much discussion, the Planning Commission proposed that the definition for Mixed-Use Medium Density be amended to be no more than 24 dwelling units per acre and structures no taller than three stories.

The Planning Commission has reviewed a number of development applications over the past two years, mostly for multi-family residential projects in the downtown area. Though not always articulated clearly in the minutes, staff has sensed a general frustration amongst some members with the size and mass of the proposed developments, many of which exceed the density (both in height and number of units per acre) currently allowed in the zoning code and thus, require deviations for approval.

An example of that would be the Mission Bowl project, which was approved by the Planning Commission in 2020 at five-stories and 53 units per acre when the Main Street 2 (MS-2) zoning for the property permitted no more than three-stories or 35 units per acre. Likewise, that density was continued with the more recent submission for Mission Bowl Phase II, which would also be five-stories and 56 units per acre. There was even some discomfort among a few on the Commission about the 58/Nall apartment building that was approved at three-stories and 50 units per acre, which is compliant within the Downtown Neighborhood District zoning that the property was rezoned to.

Market Realities and Future Growth and Development

Developers are attracted to Mission because of the sense of place it offers as a result of intentional investment by the City over the last 15+ years. Access to restaurants, shops, and services within walking distance is appealing to many apartment dwellers (and even non-apartment dwellers). Supporting a vibrant and economically strong downtown requires residents living in and around the downtown (e.g., density).

This is especially true in a post-pandemic economic environment where office workers who once occupied Mission's downtown office buildings and frequented local businesses are opting to work from home. While there have been many news stories about the effects of this phenomenon in larger cities such as San Fransico and Chicago, it is occurring in Mission as well.

In addition to these factors, many developers are facing challenges with both changing market dynamics and financial constraints that result in larger buildings (height and density) being the only option to make their projects financially feasible. City staff has heard anecdotally from more than one development team that renters prefer to live alone as opposed to having a roommate, which is why many newer apartment buildings have 50% or more of their units as studios or one-bedrooms. In addition, the cost of land acquisition, construction, and financing have increased dramatically in the past several years, reaching the point that it is necessary to build larger buildings in order to rent enough apartments at market rate that a developer can realize a reasonable return on their investment.

When developing in Mission, most of these infill projects must be accomplished on lots that are one acre or less in size. When looking at these smaller lots, parking becomes one of the biggest challenges for the developer to overcome. The solution has become to build structured parking (ex: The Locale) or podium parking (ex: Mission Bowl.) These responses to parking have the benefit of making the most productive use of the available land and hiding the parking, which can be unsightly. However, these solutions often result in taller buildings.

Staff Recommendation

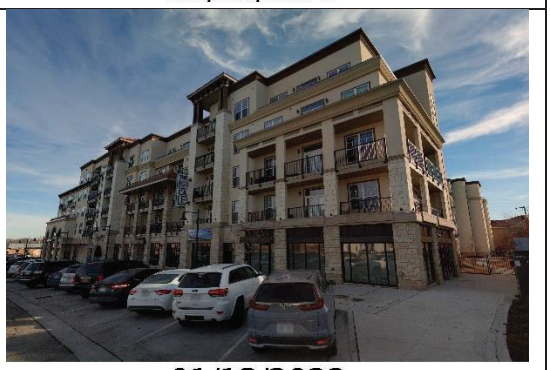
There is certainly a balance between needing and allowing larger development projects and maintaining the walkability and pedestrian scale that makes Mission so attractive. The Together Tomorrow Steering Committee struggled with this very issue. While many on the Committee were desirous of greater, quality density in the downtown area, they also realized the need to keep an element of the human scale which is why the Mixed-Use Medium Density land use was created and specified at 12 to 45 dwelling units per acre or a FAR of 1.0 to 3.0 for office or retail.

It should be noted, too, that many of the existing apartment buildings in and around the downtown area exceed the maximum of 24 units per acre that the Planning Commission is suggesting in the amended Mixed-Use Medium Density definition the Planning Commission included in their recommendation to the City Council.

While the amended definition may be reflective of the position of the current members of the Planning Commission it does not align with Mission's past visioning efforts, nor much of the conversation collected through the development of the Tomorrow Together Plan. Nor would it enable the type of growth needed to support the continued success and adaptation of Mission's downtown corridor that the Governing Body has repeatedly identified as a top priority. Staff is of

the opinion that the definition of Mixed-Use Medium Density as initially proposed in the Tomorrow Together plan (12 to 45 dwelling units per acre or a FAR of 1.0 to 3.0 for office or retail) should remain as is.

Location	Lot Size	Number of Units	Number of Units Per Acre	Building Height	
5905 W. 58th Street Built 1960	0.77 Acres	26 Units	33.8 Units Per Acre	Three Stories	 KF251208-3010 03/14/2004
5601 W. 58th Street (Mission Point Apt.) Built 1968	0.39 Acres	16 Units	41 Units Per Acre	Three Stories	 046-063-08-0-10-33-001.00-0 04/10/2010
5708 Outlook (Mission Point Apt.) Built 1973	0.40 Acres	17 Units	43 Units Per Acre	Three Stories	 01/19/2022

5954 Woodson Mission (Mission Hill Apt.) Built 1976	3.16 Acres	120 Units Across Four Buildings	38 Units Per Acre	Three Stories	 01/19/2022
5932 Outlook (At Home Apt.) Built 1966	0.77 Acres	27 Units	35 units Per Acre	Three Stories	 046-063-08-0-40-04-013.00-0 01/13/2016
5928 Reeds (Mission Woods Apt.) Built 1972	0.39 Acres	12 Units	31 Units Per Acre	Three Stories	 01/19/2022
6201 Johnson Drive (The Locale) Built 2019	2.65 Acres	200 Units	75 Units Per Acre	Five Stories	 01/13/2022

5399 Martway (Mission Bowl) Being Built	3.17 Acres	176 Units	55.5 Units Per Acre	Five Stories (four stories over podium parking)	
5808 Nall (58/Nall) Not Yet Built	1.54 Acres	77 Units	50 Units Per Acre	Three Stories	
5819 Nall (Mission Vale) Not Yet Built	0.98 Acres	19 Units	19 Units Per Acre	Two Stories	

CITY OF MISSION, KANSAS
ORDINANCE NO. ____

AN ORDINANCE ADOPTING THE "TOMORROW TOGETHER 2040 - MISSION COMPREHENSIVE PLAN" AS THE OFFICIAL COMPREHENSIVE PLAN OF THE CITY OF MISSION, KANSAS

WHEREAS, Section 12-747 of the Kansas State Statutes authorizes the Planning Commission of the City of Mission to develop a comprehensive plan for the orderly development of the city and specifically requires adoption of such plan before zoning and/or subdivision regulations can be adopted; and

WHEREAS, the City of Mission first adopted a comprehensive plan in 1968 and has adopted subsequent updates to that plan over the years; and

WHEREAS, the City of Mission embarked on its most recent update in March of 2020 with assistance from Confluence, a regionally recognized planning consulting firm; and

WHEREAS, the process for updating the plan utilized extensive community engagement including a steering committee composed of community stakeholders, an interactive website with a pin map and various survey tools, an community Direction Finder survey, and a community open house; and

WHEREAS, these efforts resulted in the "Tomorrow Together 2040 - Mission Comprehensive Plan" that was presented to the Planning Commission at a public hearing on September 25, 2023; and

WHEREAS; notice of the public hearing was duly given by publication in the official newspaper of the City as required by law; and

WHEREAS, after taking testimony at said public hearing and giving due consideration, the Planning Commission voted 6-0 (2 abstaining) to recommend to the City Council adoption of the "Tomorrow Together 2040 Mission Comprehensive Plan" with amendments; and

WHEREAS, the recommendations of the Planning Commission were reviewed during a Novmeber 15, 2023 City Council Work Session where Staff indicated support for two of the three amendments recommended by the Planning Commission, specifically rejecting the recommendation to revise the definition of "Mixed Use Medium

Density" and leaving it as originally presented in the Comprehensive Plan draft.

NOW, THEREFORE BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MISSION, KANSAS:

Section 1. Adoption of the Comprehensive Plan – Pursuant to K.S.A. 12-747, the Governing Body of the City of Mission, Kansas hereby adopts the "Tomorrow Together 2040 - Mission Comprehensive Plan" (Exhibit A) as presented accepting two of the three amendments proposed by the Planning Commission.

Section 2. Official Copy Kept on File - There is hereby incorporated by reference the City of Mission, Kansas "Tomorrow Together 2040 - Mission Comprehensive Plan;" prepared by the Community Development Department of the City of Mission and adopted by the Planning Commission on September 25, 2023 and amended by the City Council on December 20, 2023. An official copy of this Plan shall be kept on file at the Community Development Department Office – 6090 Woodson Road – to be open to inspection and available to the public during normal business hours.

Section 3. Annual Review of the Comprehensive Plan – Pursuant to K.S.A 12-747(d) the Planning Commission of the City of Mission, Kansas is hereby directed to review no less than annually the "Tomorrow Together 2040 - Mission Comprehensive Plan" and propose any amendments, extensions and/or additions as may be deemed appropriate to fulfill the goals of the plan and the City.

Section 4. Effective Date – This Ordinance shall take effect and be in force from and after its adoption and publication according to law.

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF MISSION, KANSAS on this 20th day of December 2023.

APPROVED BY THE MAYOR on this 20th day of December 2023.

_____

Solana Flora, Mayor

ATTEST:

_____

Robyn L. Fulks, City Clerk

APPROVED AS TO FORM:

_____

David Martin, City Attorney
Payne & Jones, Chartered
King 2 Building
11000 King Street
Overland Park, Kansas 66210

3.2 Future Land Use Definitions

Future Land Use Definitions

The Future Land Use Plan includes several land use categories. The definitions for each category are below as well as examples provided by Confluence. Examples with actual street address underneath are those found in Mission that fit the definition provided.

Low-Density Residential

Includes detached single-family residential, single-family residential bi-attached, single-family residential with one accessory dwelling unit, civic uses, schools, and churches.

Density: 3 to 6 dwelling units/acre

046-064-17-0-10-07-017.00-0 02/23/2016

6504 Woodson Drive

01/14/2022

5324 Woodson Drive

046-063-08-0-30-11-019.00-0 01/12/2016

6309 W. 62nd Terrace

KP13500000 0021A 01/19/2004

6300 and 6302 W. 49th St.

Medium-Density Residential

Residential Includes horizontally attached rowhouses and townhomes. Also includes "Missing Middle" housing typologies such as duplexes/ triplexes/fourplexes, courtyard apartments, cottage courts, and multi-plexes.

Density: 6 to 12 dwelling units/acre

046-064-17-0-10-19-010.00-0 04/02/2010

6306 Kennet Place
Kennet Place

4900 W. 60th Terrace
Roeland Court Townhomes

KP19500001 0002 01/19/2004

6312 W. 51st Street
Linconshire

01/19/2022

6228 Ash Street
Lido Villas

High-Density Residential

Category includes vertically attached residential apartments and condos.

Density: 12 or more dwelling units/ acre

046-063-05-0-20-04-004.00-0 01/29/2016

5100 Foxridge Drive
Silverwood Apts.

046-063-08-0-10-21-015.00-0 04/07/2010

5718 Outlook Street
Mission Pointe Apts.

Commercial

Includes typical retail uses such as sales or services, hotels, motels, and restaurants

01/14/2022

6800 Johnson Drive
Applebee Restaurant

046-063-08-0-10-29-011.00-0 01/16/2016

6004 Johnson Drive
Mack Hardware

Office

Activity during normal business hours that includes administrative, professional, and research; may serve as a transition from residential to commercial uses.

Density: 0.25 FAR

046-063-08-0-20-25-001.00-0 01/16/2016

5799 Broadmoor
KU Med Offices

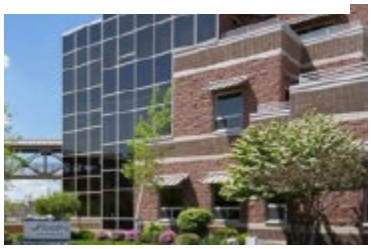
KP27500000 0019 03/14/2004

5830 Nall Avenue
Kremer Dental Offices

Business Park/Light Industrial

Includes typical medium- or large-scale office and light industrial uses.

Density: 0.30 FAR



5828 Reeds
Script Pro

Mixed-Use High-Density Includes pedestrian-friendly mix of housing, office, and retail uses in either a multi-story building (vertical mixed-use) or in a cohesive development of separate or attached buildings (horizontal mixed-use).

Density: 3.0 to 10.0 FAR for retail/ office and 50 or more dwelling units/acre for residential

01/13/2022

6201 Johnson Drive
The Locale

5399 Martway Street
Lanes at Mission Bowl

Mixed-Use Medium-Density Includes pedestrian-friendly mix of housing, office, and retail uses at medium densities in either a multi-story building (vertical mixed-use) or in a cohesive development of separate or attached buildings (horizontal mixed-use).

Density: 1.0 to 3.0 FAR for retail/ office and 12 to 45 dwelling units/ acre for residential

No Examples Currently in Mission

Parks and Pathways

This category includes parks, recreation land, and trail areas.

Public/Semi-Public

Includes government-owned land, schools, churches, museums, and institutions

City of Mission	Item Number:	2.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Community Development	From:	Brian Scott

Action items require a vote to recommend the item to the full City Council for further action.

RE: Final Plat – Popeye's on Johnson Drive – 6821 Johnson Drive (PC Case 23-24)

RECOMMENDATION: Adopt the Resolution accepting the Final Plat for Popeye's on Johnson Drive including the dedication of all rights-of-way, easements, and construction easements so noted on said plat.

DETAILS: Popeye's Louisiana Kitchen restaurant is currently located at 6821 Johnson Drive. The restaurant has been closed since the beginning of this year when the building sustained serious fire damage. After a thorough evaluation, the ownership group has opted to raze the exiting restaurant building and construct a new one.

A preliminary development (PC Case #23-16) was submitted to the City late this summer. It was considered by the Planning Commission at their July 2023 meeting and approved by the City Council in August.

At the time of preliminary development plan submission, staff requested that the applicant also submit an application to plat the property. In doing so, staff requested that additional right-of-way along Johnson Drive be dedicated to the City so that the sidewalk aligns with the sidewalk along that block to the east (in front of Natural Grocers). The preliminary plat was considered by the Planning Commission at the same time as the preliminary development plan and approved.

A final development plan and final plat were considered by the Planning Commission at their November 27th meeting. Both were approved by a 7-0 vote.

The final plat and acceptance of the additional dedication of right-of-way along Johnson Drive is now presented for City Council approval.

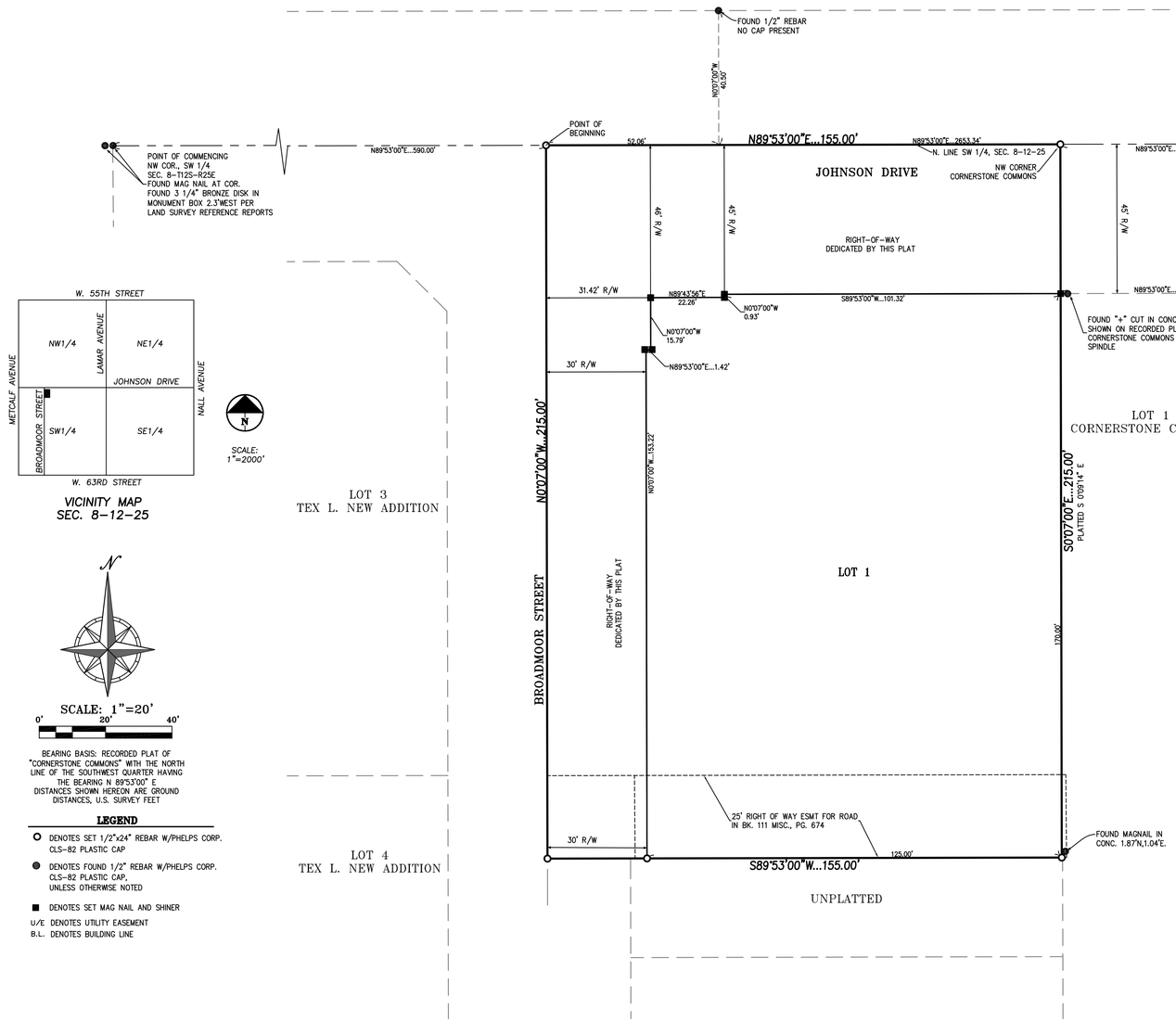
CFAA CONSIDERATIONS/IMPACTS: The City is requesting additional right-of-way along Johnson Drive for the purpose of having a wider sidewalk with street amenities such as landscaping. The wider sidewalk will provide more space for walking and a greater sense of security in that walkers will not be as close to the traffic along Johnson Drive. Walkability and safe modes of transportation is one of the pillars of the Community for All Ages initiative.

Related Statute/City Ordinance:	Section 440.240 et. al. of the Mission Municipal Code
Line Item Code/Description:	
Available Budget:	

FINAL PLAT OF

POPEYE'S ON JOHNSON DRIVE

A SUBDIVISION OF LAND IN THE SOUTHWEST QUARTER
SECTION 8, TOWNSHIP 12 SOUTH, RANGE 25 EAST, IN THE
CITY OF MISSION, JOHNSON COUNTY, KANSAS



SCALE: 1"=20'
0' 20' 40'

BEARING BASIS: RECORDED PLAT OF "CORNERSTONE COMMONS" WITH THE NORTH LINE OF THE SOUTHWEST QUARTER HAVING THE BEARING N 89°53'00" E. DISTANCES SHOWN HEREON ARE GROUND DISTANCES, U.S. SURVEY FEET

LEGEND

- ○ DENOTES SET 1/2"x24" REBAR W/PHELPS CORP. CLS-82 PLASTIC CAP
- ● DENOTES FOUND 1/2" REBAR W/PHELPS CORP. CLS-82 PLASTIC CAP, UNLESS OTHERWISE NOTED
- ■ DENOTES SET MAG NAIL AND SHINER
- U/E DENOTES UTILITY EASEMENT
- B.L. DENOTES BUILDING LINE

AREAS		
PARCEL	AREA (S.F.)	AREA (AC.)
BNDY	33325.00	0.7650
LOT 1	21204.78	0.4868
R/W	12120.22	0.2782

DESCRIPTION

All that part of the Southwest Quarter of Section 8, Township 12 South, Range 25 East, in the City of Mission, Johnson County, Kansas, being more particularly described by Scott G Chrisman, LS-1306, on June 19, 2023, for project 230238, as follows:

Commencing at the Northwest corner of the Southwest Quarter of said Section 8; thence N 89°53'00" E, along the North line of said Southwest Quarter of said Section 8, a distance of 590.00 feet, to the point of intersection of the North line of the Southwest Quarter of said Section 8, and the centerline of Broadmoor Street, as now established, said point also being the Point of Beginning; thence, continuing along said North line, N 89°53'00" E, a distance of 155.00 feet, to the Northwest corner of CORNERSTONE COMMONS, a platted subdivision of land in the City of Mission, Johnson County, Kansas; thence S 0°07'00" E, a distance of 215.00 feet; thence S 89°53'00" W, a distance of 155.00 feet, to a point on the centerline of Broadmoor Street, as now established; thence N 0°07'00" W, along said centerline of said Broadmoor Street, a distance of 215.00 feet, to the Point of Beginning, containing 0.7650 acres, more or less, of unplatted land.

DEDICATION

The undersigned proprietors of the above described tract of land have caused the same to be subdivided in the manner shown on the accompanying plat, which subdivision and plat shall hereafter be known as "POPEYE'S ON JOHNSON DRIVE".

The undersigned proprietor of said property shown on this plat does hereby dedicate over, under, and through all parcels and parts of land indicated on said plat as streets, terraces, places, roads, drives, lanes, parkways and avenues not heretofore dedicated, a perpetual easement for the purpose of constructing, using, replacing, and maintaining public roadways, public ways and thoroughfares, including storm sewer, street lighting, sidewalks, trails, and appurtenant work in any part of the easement, including the right to clean, repair, maintain and replace the roadway, and for any future expansion of such facilities within the area of the easement together with the right of access to the easement and over the easement for these purposes. Where prior easement rights have been granted to any person, utility or corporation on said parts of the land so dedicated, and any pipes, lines, poles and wires, conduits, ducts or cables heretofore installed thereupon and therein are required to be relocated, in accordance with proposed improvements as now set forth, the undersigned proprietor hereby absolves and agrees to indemnify the City of Mission, Kansas, from any expense incident to the relocation of any such existing utility installations within said prior easement.

CONSENT TO LEVY

The undersigned proprietors of the above described land hereby agrees and consents that the Board of County Commissioners of Johnson County, Kansas, and the City of Overland Park, Johnson County, Kansas, shall have the power to release such land proposed to be dedicated for public ways and thoroughfares, or parts thereof, for public use, from the lien and effect of any special assessment, and that the amount of unpaid special assessments on such land so dedicated, shall become and remain a lien on the remainder of this land fronting or abutting on such dedicated public ways or thoroughfares.

EXECUTION

IN TESTIMONY WHEREOF, undersigned proprietors has caused this instrument to be executed on this _____ day of _____, 20___

CSM GROUP

By: _____
Felix Zamilkovsky, Member

ACKNOWLEDGEMENT

STATE OF KANSAS)
) SS
COUNTY OF JOHNSON)

BE IT REMEMBERED that on this _____ day of _____ , 20_____ , before me, the undersigned, a Notary Public in and for said County and State, came Felix Zamilkovsky, Member of, CSM Group, who is personally known to me to be such person who executed, as such officer, the within instrument on behalf of said company, and such person duly acknowledged the execution of the same to be the act and deed of the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year last above written.

Notary Public: _____ My Appointment Expires: _____

Print Name: _____

APPROVALS

Approved by the Planning Commission of the City of Mission, Johnson County, Kansas, this ___ day of_____, 20___ .

_____ _____
Chairman: Mike Lee Planning Commission Secretary: Kimberly Steffens

Approved by the Governing Body of the City of Overland Park, Kansas, this _____ day of_____, 20___ .

_____ Attest: _____
Mayor: Solana Flora City Clerk: Robyn Fulks

FLOOD NOTE:

THIS PROPERTY LIES WITHIN ZONE X, DEFINED AS AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, AS SHOWN ON THE FLOOD INSURANCE RATE MAP PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY FOR THE CITY OF MISSION, COMMUNITY NO. 200170, JOHNSON COUNTY, KANSAS, MAP NO. 20091C0023G, AND DATED AUGUST 3, 2009.

TITLE NOTE:

TITLE INFORMATION SHOWN HEREON WAS TAKEN FROM CHICAGO TITLE INSURANCE COMPANY COMMITMENT FOR TITLE INSURANCE NO. KCC230901 DATED APRIL 11, 2023 AT 08:00 A.M.

I, SCOTT G. CHRISMAN, HEREBY CERTIFY THAT IN APRIL 2023, I OR SOMEONE UNDER MY DIRECT SUPERVISION HAVE MADE A SURVEY OF THE ABOVE DESCRIBED TRACT OF LAND AND THE RESULTS OF SAID SURVEY ARE CORRECTLY REPRESENTED ON THIS PLAT.

SCOTT G. CHRISMAN
LICENSED
LS-1306
11/1/2023
KANSAS
LAND SURVEYOR

CERTIFICATE OF AUTHORIZATION
KANSAS
LAND SURVEYING – LS-82
ENGINEERING – E-391

CERTIFICATE OF AUTHORIZATION
MISSOURI
LAND SURVEYING-2007001128
ENGINEERING-2007005008

PEI
PLANNING
ENGINEERING
IMPLEMENTATION

PHELPS ENGINEERING, INC
1270 N. Winchester
Olathe, Kansas 66061
(913) 393-1155
Fax (913) 393-1166

Error Closure: 0.000001' North: 0.0000000' East: 0.0000000' Perimeter: 740' Precision 1: 740000000

November 27, 2023
Planning Commission

Staff Report

At A Glance

Applicant:
CSM Groups, DBA Popeye's Louisiana Kitchen

Location:
6821 Johnson Drive

Property ID:
KF251208-2052

Current Zoning:
C-2B

Proposed Zoning:
N/A

Current Land Use:
Drive-Through Restaurant/Vacant

Proposed Land Use:
N/A

N/A Public Hearing Required

Legal Notice:
N/A

Case Number:
23-24

Project Name:
Popeye's Final Plat

Project Summary:
The applicant proposes a dedication of additional right-of-way for public improvements on Johnson Drive.

Staff Contact:
Karie Kneller, Planner

Property Background and Information

The applicant, CSM Groups, dba Popeye's Louisiana Kitchen, has submitted an application for a final plat for the property located at 6821 Johnson Drive, on the southeast corner of Johnson Drive and Broadmoor Street. The preliminary plat was approved by the Planning Commission at its August 28, 2023 meeting and public hearing.

Project Proposal

The applicant proposes a replat of the former Popeye's drive-through restaurant site, with certain site improvements in the public right-of-way to meet the intent of the municipal code and Form Based Code overlay. Improvements include a widened pedestrian path, or pedestrian "plaza," and eliminating existing curb-cut on Johnson Drive. Park benches, pedestrian-scaled streetlights, and bike racks improve the pedestrian realm, and additional landscaping in the pedestrian right-of-way improves the walkability along Johnson Drive and Broadmoor Street.

Plan Review and Analysis

Mission Comprehensive Plan

The property lies within the FBC overlay district. The FBC takes precedence for development and performance standards over the municipal code for setback, height, architectural features, and priority of the pedestrian realm. The front and side street setbacks require a 0-to-10-foot setback, and the rear and side yard setbacks require a minimum of zero feet.

Analysis: The setbacks conform with the regulations set forth in the FBC. The right-of-way provided by the setback includes space for features that improve the pedestrian experience and attempt to meet the intent of the Comprehensive Plan.

Johnson Drive Design Guidelines

According to the requirements of the Johnson Drive Design Guidelines, sidewalks on Johnson Drive shall be a minimum of eight feet wide. Sidewalks on secondary streets such as Broadmoor shall be a minimum of five feet wide. Elements that enhance the pedestrian realm, including park benches, pedestrian-scaled streetlights, bike racks, and landscaping are required.

Analysis: The proposal provides an extended pedestrian "plaza" along Johnson Drive that will include outdoor seating, landscaping, street lighting, and bicycle amenities as part of the final development plan.

Municipal Code

Section 440.240 stipulates that following approval of the preliminary plat by the Planning Commission,

a final plat shall be considered by the Planning Commission and, upon approval, by the Governing Body for final approval. Section 440.260 stipulates that final plats shall be approved by the Planning Commission if it determines that:

1. The final plat substantially conforms to the approved preliminary plat
2. The plat conforms to all applicable requirements of the municipal code.
3. All submission requirements have been satisfied.
4. Approval of the final plat is affirmed by the majority of the Planning Commission.

Recommendation

Staff recommends that the Planning Commission vote to recommend approval of Case #23-24 Popeye's Final Plat.

Planning Commision Action

The Planning Commission will consider Case #23-24 Popeye's Final Plat at its November 27, 2023 meeting.

City Council Action

City Council will consider Case #23-24 at its December 20, 2023 meeting.

City of Mission	Item Number:	3.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Community Development	From:	Brian Scott

Action items require a vote to recommend the item to the full City Council for further action.

RE: Special Use Permit - Digital Billboard – 6650 W. 47th Terrace (PC Case #23-22)

RECOMMENDATION: Adopt the Resolution approving a special use permit for the installation and operation of a digital billboard on property located at 6650 W. 47th Terrace.

DETAILS: The property at 6650 W. 47th Terrace is located on the north side of I-35 and is split by the county line. A portion of the property sits in Mission and a portion in Kansas City, Kansas. The Best Drive Tire Store is located on the property.

An application was recently submitted to locate a digital billboard on the front portion of the property near I-35. Billboards are permitted with a special use permit in any zoning district except residential. There are no specific stipulations on size or height in City code, but there are requirements outlined in the state statutes governing the size, location, and operation of billboards along interstates and highways. This application complies with those requirements, but the applicant will need to obtain a sign permit from the Kansas Department of Transportation.

The sign is being located in an existing floodplain, but the applicant has submitted a “no rise letter” from an engineer certifying the sign will not have any negative flooding impact on surrounding property.

The Planning Commission considered the application for a special use permit to locate and operate a digital billboard on property at 6650 W. 47th Terrace at their meeting on November 27th. The application was approved by a vote of 7-0. The initial special use permit is for a period of ten (10) years. Once this period has expired, the special use permit may be renewed again if there are no objections or issues.

CFAA CONSIDERATIONS/IMPACTS: N/A

Related Statute/City Ordinance:	Chapter 430 of the Mission Municipal Code
Line Item Code/Description:	NA
Available Budget:	NA

CITY OF MISSION, KANSAS
ORDINANCE NO._____

AN ORDINANCE AUTHORIZING CERTAIN PROPERTY WITHIN THE CITY OF MISSION, KANSAS TO BE USED FOR OR OCCUPIED BY A SPECIAL USE

WHEREAS, an application for the establishment of a Special Use Permit has heretofore been made to occupy or use property located at 6650 W. 47th Terrace located in the City of Mission, Johnson County, Kansas for the following use or uses: Digital Billboard; and

WHEREAS, said property is currently zoned "M-1" General Industrial District wherein such uses are not permitted without a Special Use Permit; and

WHEREAS, notice of said original application was duly given as required by law by publication and mailing; and

WHEREAS, a public hearing was held pursuant to law before the Planning Commission of the City of Mission on November 27, 2023, and the recommendation of said Planning Commission was acted upon by the City Council of the City of Mission as required by law:

NOW, THEREFORE BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF MISSION, KANSAS:

Section 1. Special Use Permit Granted - Pursuant to Section 430.100 et. seq. and Section 445.180 et. seq. of the Mission Municipal Code, a Special Use Permit to locate and operate a digital billboard ("Sign") in accordance with the application (PC Case #23-22) on file with the Community Development Department of the City of Mission, 6090 Woodson, Mission, Kansas 66202, is hereby granted for the subject property as described below subject to the stipulations in Section 2 and all other laws and regulations.

Address:	6650 W. 47th Terrace
Property Tax ID:	KP13000000 0002
Legal Description:	FREEWAY INDUSTRIAL PARK LT 2 EX W 100' MIC 1018 2

Section 2. Stipulations of the Special Use Permit - The Special Use Permit referenced in Section 1 of this Ordinance is hereby granted subject to the following stipulations:

A. Applicant shall obtain a sign permit from the Kansas Department of Transportation as well as the City of Mission.

B. The Sign shall comply with K.S.A 68-2231 et. seq. as well as the City of Mission Municipal Code.

C. The Sign must display a static image for a minimum of eight (8) seconds and have an interval change time of two (2) seconds or less.

D. Erosion control during construction shall be sufficient to protect waterways and reduce runoff impact.

E. Maintenance and continued operation of the Sign shall be the responsibility of the property owner or owner's agent in perpetuity; the special use permit is transferrable.

F. Abandonment, including lack of maintenance or continued operation, shall nullify the special use permit within six (6) months.

G. The special use permit shall be effective following City Council approval for a period not to exceed ten (10) years, at which time the property owner may submit an application for continuation of the special use permit for another period of time to be determined.

Section 3. Zoning Remains - The approval of this Special Use Permit shall not change the zoning currently assigned to the property by the Official Zoning Map.

Section 4. Effective Date - This Ordinance shall take effect and be in force from and after its adoption and publication according to law.

PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF MISSION, KANSAS on this 20th day of December 2023**.**

APPROVED BY THE MAYOR on this 20th day of December 2023**.**

_____

Solana Flora, Mayor

ATTEST:

_____

Robyn L. Fulks, City Clerk

APPROVED AS TO FORM:

_____

David Martin, City Attorney
Payne & Jones, Chartered
King 2 Building
11000 King Street
Overland Park, Kansas 66210

November 27, 2023
Planning Commission

Staff Report

At A Glance

Applicant:
Interstate Holdings, LLC

Location:
6650 West 47th Terrace

Property ID:
KP13000000 0002

Current Zoning:
M-1

Proposed Zoning:
N/A

Current Land Use:
Light Industrial

Proposed Land Use:
N/A

[X] Public Hearing Required

Legal Notice:
November 7, 2023

Case Number:
23-22

Project Name:
Freeway Industrial Park Billboard Special Use Permit

Project Summary:
The applicant proposes a digital billboard sign on the subject property at 6650 West 47th Terrace. The site is currently developed with a light industrial warehouse building. The property lies in the 100-year floodplain.

Staff Contact:
Karie Kneller, Planner

Property Background and Information

The subject property is located at 6650 West 47th Terrace, on the north side of Interstate 35, west of the Lamar Street exit. The property is zoned M-1 "General Industrial." Adjacent properties located within the City of Mission are also zoned M-1. The existing structure straddles the Mission and Kansas City, Kansas boundaries and currently houses an office/warehouse business, Bestdrive Tire Store, according to the Land Based Classification Standards (LBCS). The subject property and adjacent properties lie within the 100-year floodway (AE) of Turkey Creek as designated by the Federal Emergency Management Agency (FEMA). Developments on properties in the floodway are required to obtain a "No-Rise" certificate from a professional engineer.

Project Proposal

The applicant proposes a new digital billboard on a developed property, within the City of Mission boundary, that would be located in the green space fronting 47th Terrace. The applicant included a "No-Rise" certificate in its submittal that supports data that shows no impact on the 100-year flood elevations, floodway elevations, and floodway widths of Turkey Creek. The proposed sign face is 15 feet high by 50 feet wide and stands 60 feet in total height with the column pipe pole. The pole is set back from the property line by 25 feet and the sign face is completely within the property boundaries.

Plan Review and Analysis

Mission Comprehensive Plan (2007)

The Mission Comprehensive Plan (2007) future land use map identifies the subject property as "Business Park/Research: Sub-Urban," defined as areas that contain high density office and service business, as well as some very limited light manufacturing typically in single-use suburban business park settings.

Analysis: The current land use is consistent with the Mission Comprehensive Plan (2007) future land use map and land use definition.

Mission Comprehensive Plan (2023 Draft Update)

The draft 2022 Comprehensive Plan identifies the subject property as Light Industrial/Warehouse. It is defined as typical medium- or large-scale office and light industrial uses.

Analysis: The current land use is consistent with the draft Mission Comprehensive Plan (2023).

Municipal Code

Under Article III, a digital billboard is defined in Mission's municipal code at §430.020 as a billboard which has a computer-controlled board that displays an image through the use of light emitting diode

(LED) display, or similar technology. Mission's municipal code requires a special use permit for billboards according to §445.180 Designated Use. Billboard signs are permitted in any district except for residentially zoned districts with a special use permit. Special uses may be approved by action of the City Council after recommendation from the Planning Commission, and may be approved with conditions. Conditions may include, but are not limited to the following §445.190(C)(1-8):

1. Requirements for special yards, open spaces, density, buffers, fences, walls and screening.
2. The installation of landscaping and maintenance.
3. Provisions for erosion control.
4. Limitations on ingress and egress movements into and out of the site and traffic circulation.
5. Limitation on signage.
6. Limitation on hours of operation and other characteristics of operation.
7. Conditions specifically listed under the individual special use.
8. Other conditions deemed necessary to ensure compatibility with surrounding land uses.

Analysis: The property is currently developed as office/warehouse under the LBCS. Staff has not observed, nor made aware of, erosion control issues or limitations regarding ingress or egress into or out of the site. The billboard use on the site is considered a separate use not associated with the current land use. There is vegetated buffer in the right-of-way between I-35 and the frontage road (47th Terrace) of the property.

Additionally, under "Criteria for Considering Applications," §440.140(E), the Planning Commission and City Council shall give consideration to pertinent criteria, such as:

1. The character of the neighborhood.
2. The zoning and uses of nearby properties and the extent to which the proposed use would be in harmony with such zoning and uses.
3. The suitability of the property for the uses to which it has been restricted under the applicable zoning district regulations.
4. The extent to which approval of the application would detrimentally affect nearby properties.
5. The length of time the property has remained vacant as zoned.
6. The relative benefit to the public health, safety and welfare by retaining applicable restrictions on the property as compared to the destruction of the value of the property or hardship to the owner association with denying its request.

7. The Master Plan or Comprehensive Plan.

8. The extent to which the proposed use would adversely affect the capacity or safety of that portion of the road network influenced by the use or present parking problems in the vicinity of the property.

9. The recommendation of the professional staff.

10. The extent to which utilities and services, including, but not limited to, sewers, water service, police and fire protection and parks and recreation facilities, are available and adequate to serve the proposed use.

11. The extent to which the proposed use would create excessive stormwater runoff, air pollution, water pollution, noise pollution or other environmental harm.

12. The extent to which there is a need for the use in the community.

13. The economic impact of the proposed use on the community.

14. The ability of the applicant to satisfy any requirements applicable to the specific use imposed pursuant to the zoning district regulations.

Analysis: It is Staff's determination that the application for a special use permit meets all applicable criteria in §440.140 under the following circumstances: character and zoning of surrounding area is compatible with the use in an industrial/warehouse setting along a major interstate highway; the zoning restrictions are suitable for the current land use, as well as the proposed billboard land use under consideration; approval of the application would not conceivably detrimentally affect nearby properties, as there is precedent for billboards in nearby locations and along major interstate highways in the region that are consistent with the use in the proposed area; The property is not currently vacant, but additional build-out of buildings on property in the area would not be advisable due to the impact on the floodway, thereby restricting the owner's ability to generate additional revenue on the site; the Comprehensive Plan is compatible with the proposed use according to the 2007 Plan and the 2023 Draft Update; there are no anticipated safety issues beyond possible driver distractions along the interstate (see U.S Department of Transportation Federal Highway Administration study as part of the attached packet); electric utilities are in place on-site and the billboard would not create additional stormwater, air pollution, water pollution, noise pollution, or other environmental harm; staff does not identify a need or economic need for the use in the community; the required "No-Rise" certificate has been provided with the application.

Kansas State Statute Article 22, 68-2234 pertains to the sign standards as applicable for the proposed billboard sign. The statute covers configuration, size, spacing, and lighting in order to ensure the sign does not obscure traffic signs and signals or create safety hazards (see statute and Kansas Department of Transportation outdoor advertising guidelines as part of the attached packet).

Analysis: The proposed sign shall adhere to all applicable state statutes to maintain the special use permit.

Under Mission municipal code at §430.140 Removal of Obsolete or Abandoned Signs, if a structure or premise is abandoned for a six-month period of time signs shall be deemed obsolete and abandoned. The owner shall be responsible for removing any such signs.

Analysis: The billboard sign in this case is not associated with the building or structure on premises; however, should the sign be abandoned of its specific use as advertising or if it is abandoned due to lack of maintenance, the special use permit would cease to be valid after a six-month period.

Under §445.210 of the City's municipal code, Special Use Permits may be for a specified time period or continual. Revocation of a Special Use Permit may be granted if any of the following conditions are met:

- Non-compliance with any applicable requirement
- Non-compliance with any special conditions imposed at the time of approval
- Violation of any provisions of the Code
- Where conditions of the neighborhood have changed to the extent that approval would be unwarranted
- Violation of any State or Federal law or regulation

Recommendation

Staff recommends that the Planning Commission recommend approval of the electronic billboard to the City Council with the following conditions:

1. Applicant shall obtain a sign permit from the Kansas Department of Transportation as well as the City of Mission.
2. The Sign shall comply with all K.S.A 68-2231 et seq as well as the City of Mission Municipal Code.
3. The sign must display a static image for a minimum of (8) eight seconds and have an interval change time of (2) two seconds or less.
4. Erosion control during construction shall be sufficient to protect waterways and reduce runoff impact.
5. Maintenance and continued operation of the billboard shall be the responsibility of the property owner or owner's agent in perpetuity; the special use permit is transferrable.

6. Abandonment, including lack of maintenance or continued operation, shall nullify the special use permit within six months.

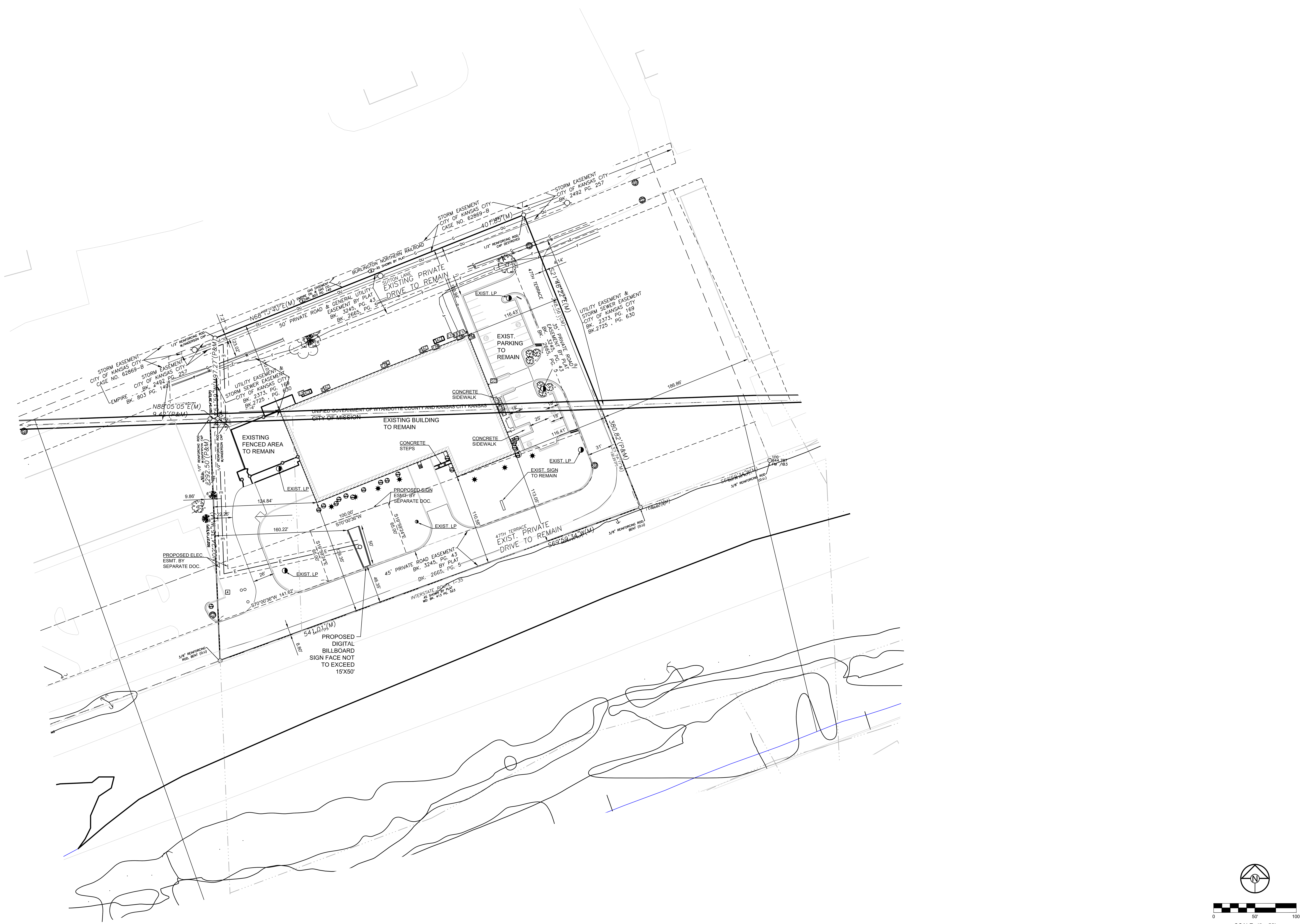
7. The special use permit shall be effective following City Council approval for a period not to exceed 10 years, at which time the property owner shall submit an application for continuation of the special use permit in perpetuity or until the property is redeveloped.

Planning Commision Action

The Planning Commission will consider the application for Case #23-22 Freeway Industrial Park Billboard during a public hearing at its November 27, 2023 meeting.

City Council Action

Following Planning Commission recommendation, the City Council will hear Case #23-22 at its December 20, 2023 meeting.



SCHLAGEL

ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS
14920 West 107th Street • Lenexa, Kansas 66215
(913) 492-5158 • Fax: (913) 492-8400
WWW.SCHLAGELASSOCIATES.COM

PREPARED BY:

SCHLAGEL & ASSOCIATES, P.A.

FREEWAY INDUSTRIAL PARK LOTS 2 & 7
MONOPOLE DIGITAL BILLBOARD
PRELIMINARY DEVELOPMENT PLAN & SUP
6650 W 47TH TERRACE MISSION, KANSAS

REVISION DATE	DESCRIPTION
1 DATE	DESCRIPTION 1
2	
3	
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6	
7	
8	
9	

DRAWN BY: SCH
CHECKED BY: SCH
DATE PREPARED: 9-21-2023
PROJ. NUMBER: 23-187

VICINITY PLAN

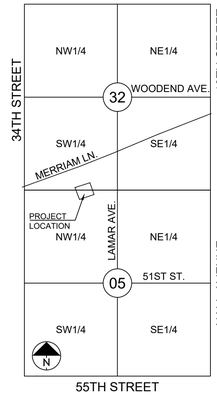
SHEET C1.0

I:\PROJECTS\2023\23-187\3.0 Design\3.0 DWG Plans\2.0 PDP\23-187 PDP SUP.dwg, VICINITY PLAN, 9/21/2023 8:42:00 AM, 1:1

LEGAL DESCRIPTION FROM ALTA PROVIDED BY OWNER

ALL OF LOT 2, FREEWAY INDUSTRIAL PARK, A SUBDIVISION IN MISSION, JOHNSON COUNTY, KANSAS

LOT 7, FREEWAY INDUSTRIAL PARK, A SUBDIVISION IN THE CITY OF KANSAS CITY, WYANDOTTE, KANSAS



SECTION 05-12-25
SECTION 32-11-25

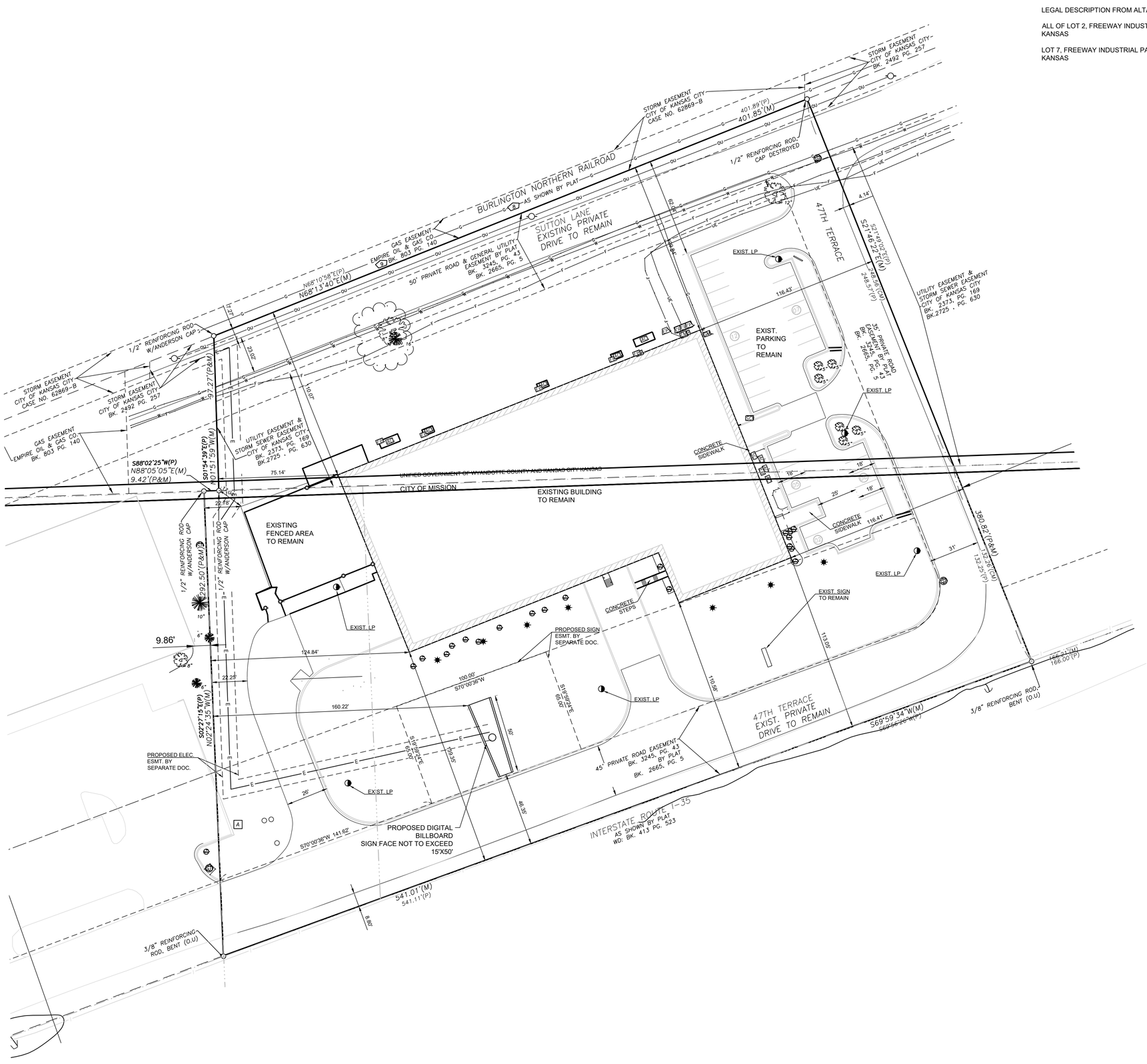
LOCATION MAP
SCALE 1" = 2000'

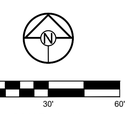
SITE DATA

EXISTING ZONING	M-1 MISSION M-2 UGWYCOKCK
SITE AREA FROM ALTA SURVEY PROVIDED BY OWNER	4.0686 ACRES (177,227 S.F.)
EXISTING BUILDING AREA	32,084 S.F.
EXISTING FAR	.181
PARKING SPACES REQUIRED (SEC 410.130.H)(1 SPACE PER 500 S.F.)	64 SPACES
EXISTING PARKING SPACES	32 SPACES

GENERAL NOTES:

1. FLOOD NOTE: The Johnson County portion of the site lies within Flood Zone AE Base Flood Elevations Determined with a Base Flood elevation of 854.0 feet as shown on FEMA Firm panel 20091C0008G Panel No. 8 of 161 dated August 3, 2009. The Wyandotte County a portion of the site lies within Other Flood Areas Zone "X" Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile and a portion of the site appears to lie within Other Areas Flood Zone "X" Areas determined to be outside the 0.2% annual chance floodplain Or Flood Zone "D" Areas in which flood hazards are undetermined but possible as shown on FEMA Firm panel 20209C0170D panel 170 of 210 dated September 2, 2011. The FEMA HEC-RES MODEL indicates that all of the site is within Flood Zone AE Base Flood Elevations Determined with a Base Flood elevation of 854.0 feet.
2. Boundary data from ALTA survey provided by owner.
3. Adjacent property lines, buildings and paved surfaces from JOCO AIMS and DOTMAPS.
4. Topography and adjacent plat and improvements from JOCO AIMS.
5. Existing utilities have been shown to the greatest extent possible based upon ALTA survey provided by owner.
6. All new on-site wiring and cable shall be placed underground per the city codes and ordinances.





SCALE: 1" = 30'

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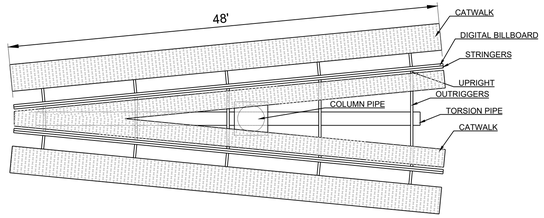
MONOPOLE DIGITAL BILLBOARD
PRELIMINARY DEVELOPMENT PLAN & SUP
6650 W 47TH TERRACE MISSION, KANSAS

REVISION DATE	DESCRIPTION
DATE	DESCRIPTION 1

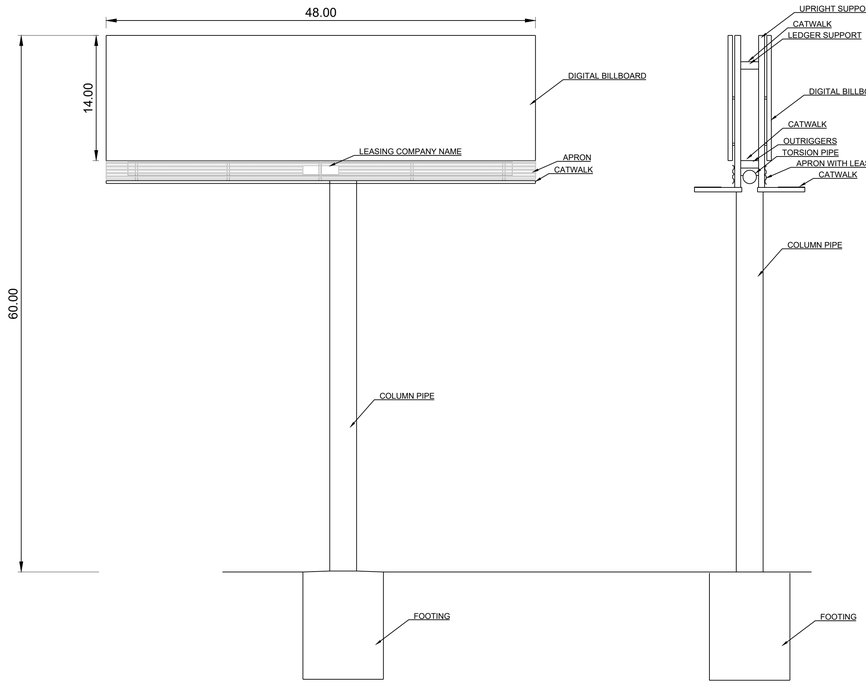
DRAWN BY: SCH
CHECKED BY: SCH
DATE PREPARED: 9-21-2023
PROJ. NUMBER: 23-187

SITE PLAN

SHEET
C2.0



PLAN VIEW



FRONT VIEW

I-35 HIGHWAY SIDE VIEW

NOTE: THIS DRAWING IS TO ONLY SHOW GENERAL DESIGN AND IS NOT FOR PERMITS OR CONSTRUCTION.

PREPARED BY:

FREEWAY INDUSTRIAL PARK LOTS 2 & 7
MONOPOLE DIGITAL BILLBOARD
PRELIMINARY DEVELOPMENT PLAN & SUP
6650 W 47TH TERRACE MISSION, KANSAS

REVISION DATE	DESCRIPTION
DATE	DESCRIPTION 1

DRAWN BY:	
CHECKED BY:	
DATE PREPARED:	8-21-2023
PROJ. NUMBER:	23-187

DIGITAL BILLBOARD DESIGN DETAILS

SHEET 1

SCHLAGEL
ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS

September 20, 2023

Karie Kneller
City of Mission
6090 Woodson Street
Mission, Kansas 66202

RE: STORMWATER MANANGEMENT STUDY
FREEWAY INDUSTRIAL PARK LOTS 2 & 7 MONOPOLE DIGITAL BILLBOARD
PRELIMINARY DEVELOPMENT PLAN & SUP

Dear Karie:

Per City of Mission requirements, we are submitting the following storm water letter in support of the PDP & SUP application for Freeway Industrial Park Lots 2&7 Monopole Digital Billboard. The billboard is located at 6650 W. 47th Terrace Mission, KS 66203 on a 4.07-acre site. The Northwestern portion of the site does lie within the City of Kansas City limits.

The site currently drains from North to South with slopes ranging from 0% to 5% and eventually drains into KDOT ROW and across I-35 to Turkey Creek. With the construction of the proposed signage the drainage patterns will remain the same. A detailed map of the drainage patterns is in Appendix A. The proposed sign will be approximately 50' tall. However, the proposed pole that will hold the sign is proposed to be 3.0' in diameter. This equates to approximately 7 square feet of added impervious area.

There is FEMA identified floodplain located on the proposed property per Flood Insurance Rate Map Panel No. 20091C0008G. The proposed sign is to be located within the Zone AE floodplain. However, the sign is located within an ineffective flow location. Per city requirements a No-Rise certification letter is being submitted with this report.

After the sign has been constructed the site will have a 7 sq ft increase in impervious area on a total of 177,289 sq ft site. This correlates to a 0.003% increase in the impervious area. Given there is a minimal increase in impervious areas the proposed improvements can be considered negligible for stormwater and storm quality requirements.

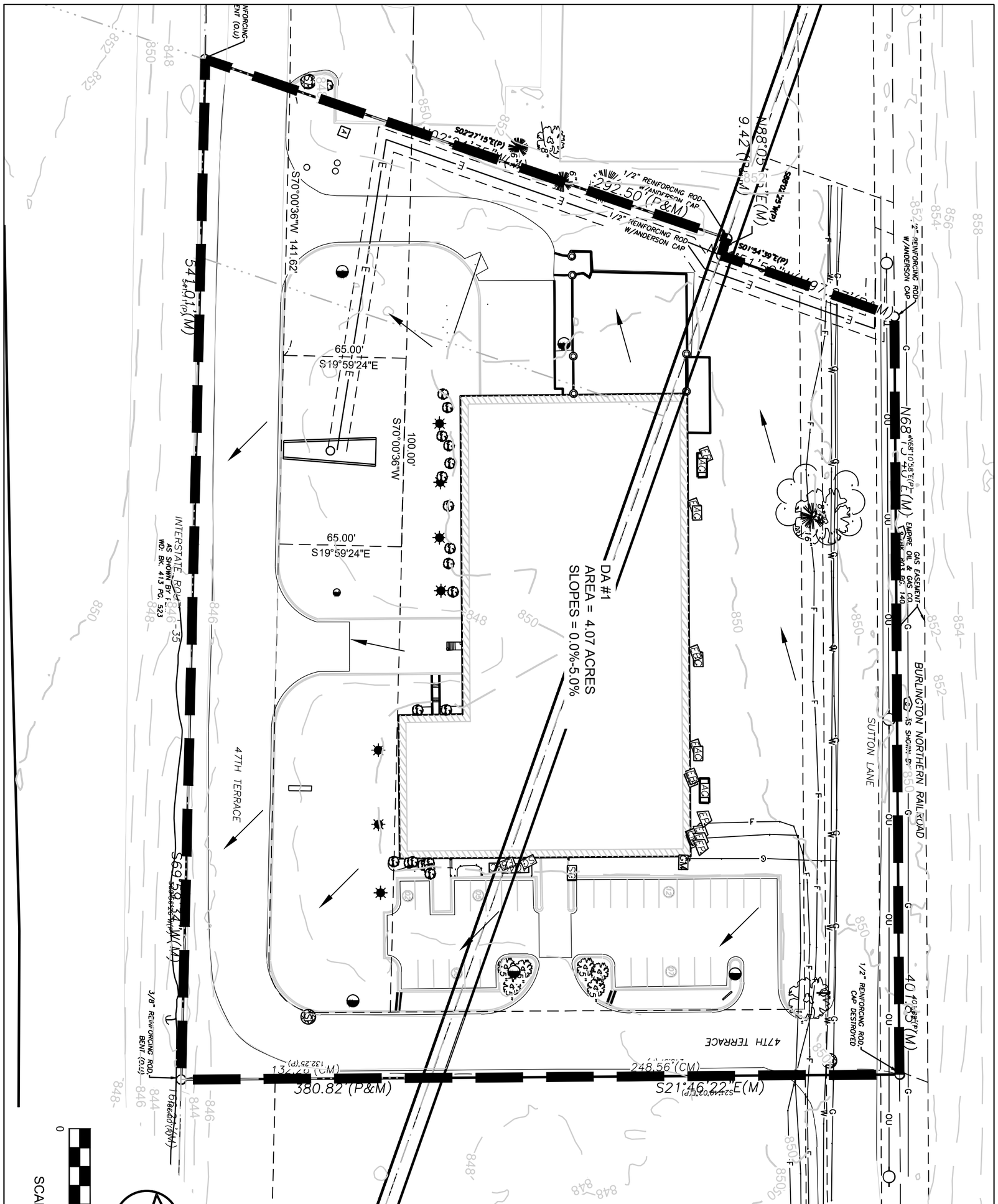
In conclusion, there is a minimal increase in the impervious area between the existing site and after the proposed sign is constructed. We would request that the minimal increase be considered negligible, and that the stormwater management and storm water quality requirements not be applicable to the proposed project.

If you have any questions regarding the study or the information presented, please contact me. Thank You.

Sincerely,

SCHLAGEL & ASSOCIATES, P.A.

Jake A. Hattock, P.E.
Project Engineer
Direct Dial 913-322-7155



SHEET 1	HYDRO MAP	DRAWN BY: JAH DATE PREPARED: 09.20.2023 PROJ. NUMBER: 23-187	FREEWAY INDUSTRIAL PARK LOTS 2 & 7 MONOPOLE DIGITAL BILLBOARD PRELIMINARY DEVELOPMENT PLAN & SUP 6650 W 47TH TERRACE MISSION, KANSAS

SCHLAGEL
ENGINEERS PLANNERS SURVEYORS LANDSCAPE ARCHITECTS
14920 West 107th Street Lenexa, Kansas 66215
(913) 492-5158 Fax: (913) 492-8400
WWW.SCHLAGELASSOCIATES.COM
Kansas State Certificates of Authority
#E-296 #LA-29 #LS-54

ENGINEERING "NO-RISE" CERTIFICATION

This is to certify that I am a duly qualified engineer licensed to practice in the State of Kansas.

It is to further certify that the attached technical data supports the fact that proposed Freeway Industrial Park Billboard (Name of Development) will not impact the 100-year flood elevations, floodway elevations and floodway widths on Turkey Creek (Name Of stream) at published sections in the Flood Insurance Study for Merriam, City of (Name of Community), dated Aug 3, 2009 and will not impact the 100-year flood elevations, floodway elevations, and floodway widths at unpublished cross-sections in the vicinity of the proposed development.

09/21/2023
(Date)

Jake Hattock
(Signature)

PROJECT ENGINEER
(Title)

seal:

14920 W. 107TH STREET, LENEXA, KANSAS 66215
(Address)

Kansas
Department of Transportation

Advertising Signs In Kansas

Outdoor Advertising

State Regulations

Commercial Advertising

Sign Applications

Sign Licenses and Renewals

Options and Alternatives

Table of Contents

— ATTENTION —

This brochure is only a guideline for outdoor advertising and is not intended to be inclusive of all applicable laws. Sign applicants and owners are responsible for knowing the laws and ordinances that control signage. If there is a conflict between this brochure and any federal, state, or local laws or ordinances, the law or ordinances will prevail. Please call KDOT if you have any questions.

Statutory Authority

Why is the Kansas Department of Transportation involved with outdoor advertising?

As part of the Highway Beautification Act (also known as the Lady Bird Johnson Act), federal law requires all states to provide continuing, effective control of outdoor advertising (Title 23, U.S. Code, Section 131). Failure to comply may result in a 10 percent reduction in Kansas's Federal Highway funds.

What is Outdoor Advertising?

Outdoor Advertising is signs, displays, and devices in areas visible from and adjacent to the federal-aid primary system in existence on June 1, 1991 and any highway which is not on such system but which is on the national highway system. These signs are controlled in order to protect the public investment on such highways, and to promote the safety and recreation value of public travel, and to preserve natural beauty.

What type of signs does this apply to in Kansas?

Kansas licenses three types of signs, legal conforming, direction, and official. Each has its own specific rules that apply.

◊ Legal conforming signs are signs that are in commercial or industrial zoned areas. These signs require an application and fee, and an additional biennial licensing fee.

◊ Directional and official signs require a sign application and fee but are exempt from licensing fee. Owned by official agencies.

Sign Application

Why do I need a sign application (permit to build) and license?

As part of Kansas law K.S.A. 68-2231 et seq revised in 2006 you are required to submit an application and be approved before you can erect a sign adjacent to a controlled route in Kansas.

Who needs to obtain an application to build a sign?

Anyone who wants to build a sign adjacent to controlled routes in Kansas.

Where do I get an application form?

You can either call one of the numbers listed on Page 11 or by accessing the Internet at www.ksdot.org/bureaus/burRow/beaut/ just click on Sign Application.

How much does it cost?

The fee to submit an application is $250.00 per sign. In addition, a sign license fee is required once your application and sign location have been approved by KDOT. This fee is $20.00 for signs with total square feet up to 32. $75.00 for signs with a total of 33 to 300 square feet and $150.00 for signs over 301 square feet. This fee is good for a two year period.

What do I need to do to apply for an application to build a sign?

In additional to filling out your sign application you will need to:

- ◊ send in a sketch or photo of the proposed sign

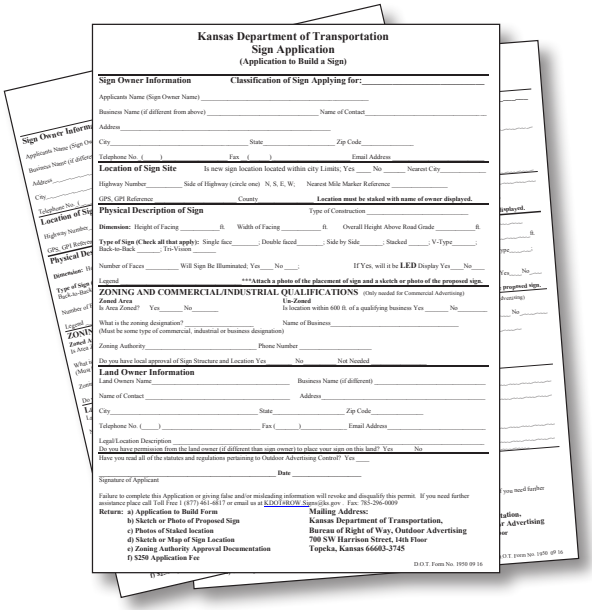
- ◊ send in photo(s) of the staked location
- ◊ send in a sketch or map of the sign location
- ◊ send in zoning authority approval documentation
- ◊ send in the $250 Application Fee
- ◊ send in the Certificate of Title for signs over 300 square feet

How long do I have to build a sign?

You have 180 days to build your sign following the approval of your application and the issuance of your sign license.

Why do I need to have a green sign tag attached to my sign structure?

This green sign tag is also your license tracking number. This number allows easy viewing knowledge that your sign complies with state regulations.



Kansas Department of Transportation
Sign Application
(Application to Build a Sign)

Sign Owner Information **Classification of Sign Applying for:**

Applicants Name (Sign Owner Name)

Business Name (if different from above) Name of Contact

Address

City State Zip Code

Telephone No. ( ) Fax ( ) Email Address

Location of Sign Site In new sign location located within city Limits; Yes No Nearest City

Highway Number Side of Highway (circle one) N, S, E, W; Nearest Mile Marker Reference

GPS, GPI Reference County **Location must be staked with name of owner displayed.**

Physical Description of Sign Type of Construction

Dimension: Height of Facing ft. Width of Facing ft. Overall Height Above Road Grade ft.

Type of Sign (Check all that apply): Single face ; Double faced ; Side by Side ; Stacked ; V-Type ; Back-to-Back ; Tri-Vision

Number of Faces Will Sign Be Illuminated; Yes No : If Yes, will it be **LED** Display Yes No

Legend ***Attach a photo of the placement of sign and a sketch or photo of the proposed sign.**

ZONING AND COMMERCIAL/INDUSTRIAL QUALIFICATIONS (Only needed for Commercial Advertising)

Zoned Area **Un-Zoned**

Is Area Zoned? Yes No Is location within 600 ft. of a qualifying business Yes No

What is the zoning designation? Name of Business

(Must be some type of commercial, industrial or business designation)

Zoning Authority Phone Number

Do you have local approval of Sign Structure and Location Yes No Not Needed

Land Owner Information

Land Owners Name Business Name (if different)

Name of Contact Address

City State Zip Code

Telephone No. ( ) Fax ( ) Email Address

Legal/Location Description

Do you have permission from the land owner (if different than sign owner) to place your sign on this land? Yes No

Have you read all of the statutes and regulations pertaining to Outdoor Advertising Control? Yes

Date

Signature of Applicant

Failure to complete this Application or giving false and/or misleading information will revoke and disqualify this permit. If you need further assistance please call Toll Free 1 (877) 461-6817 or email us at KDOTHRUW.Signs@ks.gov Fax: 785-296-0309

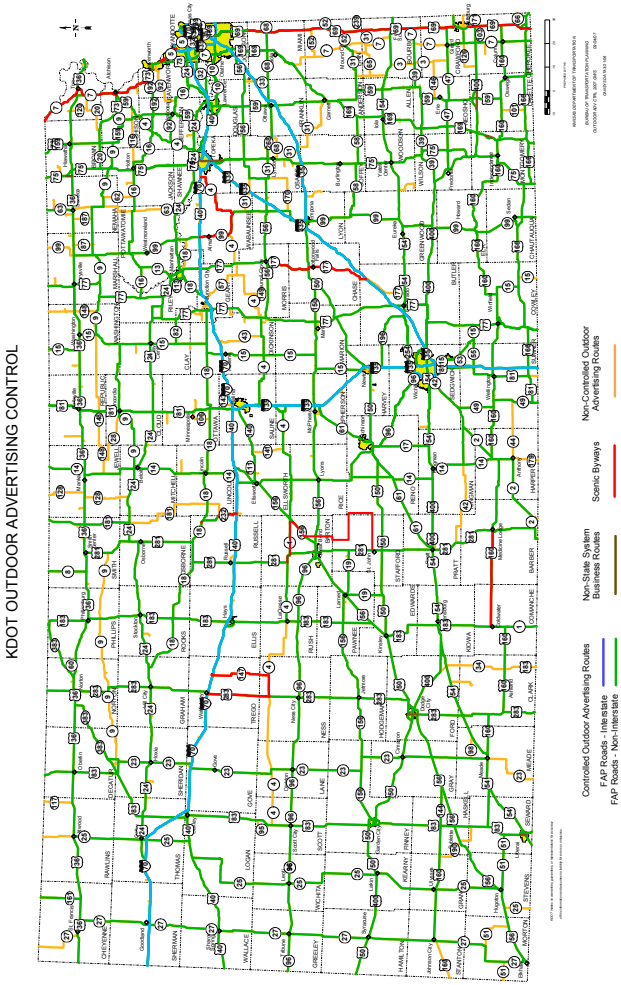
Return: a) Application to Build Form
b) Sketch or Photo of Proposed Sign
c) Photos of Staked location
d) Sketch or Map of Sign Location
e) Zoning Authority Approval Documentation
f) $250 Application Fee

Mailing Address:
Kansas Department of Transportation,
Bureau of Right of Way, Outdoor Advertising
700 SW Harrison Street, 14th Floor
Topeka, Kansas 66603-3745

D.O.T. Form No. 1950 09 16

What roads require a sign to be licensed?

In Kansas this applies to all Interstate roads along with most State routes. For a map of controlled roads go to www.ksdot.org/bureaus/burRow/beaut/ and click on KDOT Outdoor Advertising Control map. All highways designated as part of the National Highway System (NHS) are subject to control. The NHS includes all interstate and many of the former primary highways. Most primary highways that are subject to control are not a part of the NHS.



Where can I put a sign?

You can put a sign on property zoned as commercial or industrial that is off the right-of-way. (See prohibited signs and areas)

Can I put a sign on my property?

Signs advertising the products and activities conducted on the property on which they are located are referred to as "on premise" signs and are not subject to this act. A KDOT license is not required but you may need local government approval.

Can I put a sign on someone else's property?

You can put a sign for your business or someone else's business along a state highway. This is called outdoor advertising. You must submit an application and be approved to build a sign.

- ◊ The sign must follow local ordinance and, if required, you must have a local permit.
- ◊ The sign site must be on zoned or unzoned commercial or industrial property.
- ◊ You must have the owner's permission.
- ◊ There must be a visible, licensed business or industry that has been in operation for at least six months on the property (if the area is unzoned).

What are some of the restrictions that apply to outdoor advertising?

Outdoor advertising signs placed along state highways:

- ◊ Can be no larger than 900 total square feet. Directional signs cannot exceed 150 square feet.
- ◊ Can have a sign face no more than 30 feet high and no wider than 60 feet.
- ◊ Can not exceed 50 feet above the road grade. This includes border, trim and embellishment, but does not include base or apron, supports or other structural members.
- ◊ Must comply with spacing standards
- ◊ The sign cannot contain flashing, intermittent, or moving lights, including animated or scrolling advertising.

What are the restrictions that apply specifically to Electronic (LED) signs?

The signs must display a static image for a minimum of eight seconds, and have an interval change time of two seconds or less. Electronic signs must be at least 1,000 feet apart. Only sign structures that are classified Legal Conforming may be modified to LED/ACF with approval.

Where are outdoor advertising signs prohibited?

There are certain signs prohibited by law. The following is a partial listing of some of the areas signs are not allowed, such as:

- ◊ Along scenic byways
- ◊ In the right-of-way of any highway
- ◊ In any location that hinders the clear, unobstructed view of approaching or merging traffic, or obscures from view any traffic sign or other official sign.
- ◊ Within a stream or drainage canal.
- ◊ In any location that obscures the view of any connecting highway or intersection.

Are there signs that are exempt from this program?

Yes, some signs that are visible from controlled highways are exempt from this program. They include:

- ◊ Signs advertising the sale or lease of property on which they are located.
- ◊ Signs advertising the products and activities conducted on the property on which they are located. These signs are referred to as "on premise" signs.
- ◊ LOGO and TODS signs authorized under the Motorist Information Signs Act.

Sign Licenses and Renewals

How much do they cost?

Once the initial sign license fee is paid, a license fee will be due every 2 years. This fee is $20.00 for signs with total square feet up to 32. $75.00 for signs with a total of 33 to 300 square feet and $150.00 for signs over 301 square feet. An invoice will be sent to each sign owner, of the structure, 60 days prior to the expiration date. A $50 past due fee will be assessed 30 days after the expiration date for unpaid invoices. The $50 late fee will be accessed each month for the first two months. Once an invoice is 60 days past due the license will be terminated and the sign will be subject to removal.

What if I lose a tag or my tag is stolen?

If you lose a tag or if your tag is stolen, a Sign License Replacement Plate Application form along with a $25.00 fee shall be submitted. The license fee must be current prior to submitting a replacement plate application.

Can a sign be transferred to another owner?

Yes almost all signs can be transferred to another owner. A Sign Transfer Application form must be filled out and submitted to KDOT to process a sign owner transfer. There is no fee for transfers.

TODS (Tourist Oriented Directional) and LOGO (Business Activities) Signs

◊ TODS signs are available along the state highway system to provide directional information to tourist-oriented businesses, seasonal agricultural products, services, and attractions that cannot be seen from the highway. TODS signs are not allowed along interstate highways.

◊ LOGO signs are available to eligible businesses who's activities include gas, food, lodging, camping, and other attractions at eligible interchanges on the Interstate system.

If you are interested in a TODS or a LOGO sign please contact: www.kansas.interstatelogos.com

How do we apply for a Vegetation Permit?

If you would like to get more information regarding a vegetation permit, please contact our office or go to www.ksdot.org/bureaus/burRow/VegMan for more information.

Who do I contact?

Kansas Department of Transportation
Bureau of Right of Way, Outdoor Advertising
700 SW Harrison Street
Topeka KS 66603-3745
Toll Free: 1-877-461-6817
Email: KDOT#ROW.Signs@ks.gov
Fax: 785-296-6946
Hearing Impaired - 711
www.ksdot.org/bureaus/burRow/beaut/

DRIVER VISUAL BEHAVIOR IN THE PRESENCE OF COMMERCIAL ELECTRONIC VARIABLE MESSAGE SIGNS (CEVMS)

SEPTEMBER 2012

U.S. Department of Transportation
Federal Highway Administration

FHWA-HEP-16-036

FOREWORD

The advent of electronic billboard technologies, in particular the digital Light-Emitting Diode (LED) billboard, has necessitated a reevaluation of current legislation and regulation for controlling outdoor advertising. In this case, one of the concerns is possible driver distraction. In the context of the present report, outdoor advertising signs employing this new advertising technology are referred to as Commercial Electronic Variable Message Signs (CEVMS). They are also commonly referred to as Digital Billboards and Electronic Billboards.

The present report documents the results of a study conducted to investigate the effects of CEVMS used for outdoor advertising on driver visual behavior in a roadway driving environment. The report consists of a brief review of the relevant published literature related to billboards and visual distraction, the rationale for the Federal Highway Administration research study, the methods by which the study was conducted, and the results of the study, which used an eye tracking system to measure driver glances while driving on roadways in the presence of CEVMS, standard billboards, and other roadside elements. The report should be of interest to highway engineers, traffic engineers, highway safety specialists, the outdoor advertising industry, environmental advocates, Federal policymakers, and State and local regulators of outdoor advertising.

Monique R. Evans
Director, Office of Safety
Research and Development

Nelson Castellanos
Director, Office of Real Estate
Services

TECHNICAL DOCUMENTATION PAGE

1. Report No. FHWA-HRT-	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Driver Visual Behavior in the Presence of Commercial Electronic Variable Message Signs (CEVMS)		5. Report Date 6. Performing Organization Code
7. Author(s) William A. Perez, Mary Anne Bertola, Jason F. Kennedy, and John A. Molino		8. Performing Organization Report No.
9. Performing Organization Name and Address SAIC 6300 Georgetown Pike McLean, VA 22101		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of Real Estate Services Federal Highway Administration 1200 New Jersey Avenue SE Washington, DC 20590		13. Type of Report and Period Covered 14. Sponsoring Agency Code
15. Supplementary Notes The Contracting Officer's Technical Representatives (COTR) were Christopher Monk and Thomas Granda.		

16. Abstract

This study was conducted to investigate the effect of CEVMS on driver visual behavior in a roadway driving environment. An instrumented vehicle with an eye tracking system was used. Roads containing CEVMS, standard billboards, and control areas with no off-premise advertising were selected. Data were collected on arterials and freeways in the day and nighttime. Field studies were conducted in two cities where the same methodology was used but there were differences in the roadway visual environment. The gazes to the road ahead were high across the conditions; however, the CEVMS and billboard conditions resulted in a lower probability of gazes as compared to the control conditions (roadways not containing off-premise advertising) with the exception of arterials in Richmond where none of the conditions differed from each other. Examination of where drivers gazed in the CEVMS and standard billboard conditions showed that gazes away from the road ahead were not primarily to the billboards. Average and maximum fixations to CEVMS and standard billboards were similar across all conditions. However, four long dwell times were found (sequential and multiple fixations) that were greater than 2,000 ms. One was to a CEVMS on a freeway in the day time, two were to the same standard billboard on a freeway once in the day and once at night; and one was to a standard billboard on an arterial at night. In Richmond, the results showed that drivers gazed more at CEVMS than at standard billboards at night; however, in Reading the drivers were equally likely to gaze towards CEVMS or standard billboards in day and night. The results of the study are consistent with research and theory on the control of gaze behavior in natural environments. The demands of the driving task tend to affect the driver's self-regulation of gaze behavior.

17. Key Words Driver visual behavior, visual environment, billboards, eye tracking system, commercial electronic variable message signs, CEVMS, visual complexity	18. Distribution Statement No restrictions.

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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LIST OF ACRONYMS AND SYMBOLS

CEVMS	Commercial Electronic Variable Message Sign
EB	Empirical Bayes
DCZ	Data Collection Zone
ROI	Region of Interest
LED	Light-Emitting Diode
IR	Infra-Red
CCD	Charge-Coupled Device
MAPPS	Multiple-Analysis of Psychophysical and Performance Signals
GEE	Generalized Estimating Equations
FHWA	Federal Highway Administration
DOT	Department of Transportation

EXECUTIVE SUMMARY

This study examines where drivers look when driving past commercial electronic variable message signs (CEVMS), standard billboards, or no off-premise advertising. The results and conclusions are presented in response to the three research questions listed below:

1. Do CEVMS attract drivers' attention away from the forward roadway and other driving-relevant stimuli?

2. Do glances to CEVMS occur that would suggest a decrease in safety?

3. Do drivers look at CEVMS more than at standard billboards?

This study follows a Federal Highway Administration (FHWA) review of the literature on the possible distracting and safety effects of off-premise advertising and CEVMS in particular. The review considered laboratory studies, driving simulator studies, field research vehicle studies, and crash studies. The published literature indicated that there was no consistent evidence showing a safety or distraction effect due to off-premise advertising. However, the review also enumerated potential limitations in the previous research that may have resulted in the finding of no distraction effects for off-premise advertising. The study team recommended that additional research be conducted using instrumented vehicle research methods with eye tracking technology.

The eyes are constantly moving and they fixate (focus on a specific object or area), perform saccades (eye movements to change the point of fixation), and engage in pursuit movements (track moving objects). It is during fixations that we take in detailed information about the environment. Eye tracking allows one to determine to what degree off-premise advertising may divert attention away from the forward roadway. A finding that areas containing CEVMS result in significantly more gazes to the billboards at a cost of not gazing toward the forward roadway would suggest a potential safety risk. In addition to measuring the degree to which CEVMS may distract from the forward roadway, an eye tracking device would allow an examination of the duration of fixations and dwell times (multiple sequential fixations) to CEVMS and standard billboards. Previous research conducted by the National Highway Traffic Safety Administration (NHTSA) led to the conclusion that taking your eyes off the road for 2 seconds or more presents a safety risk. Measuring fixations and dwell times to CEVMS and standard billboards would also allow a determination as to the degree to which these advertising signs lead to potentially unsafe gaze behavior.

Most of the literature concerning eye gaze behavior in dynamic environments suggests that task demands tend to override visual salience (an object that stands out because of its physical properties) in determining attention allocation. When extended to driving, it would be expected that visual attention will be directed toward task-relevant areas and objects (e.g., the roadway, other vehicles, speed limit signs) and that other salient objects, such as billboards, would not necessarily capture attention. However, driving is a somewhat automatic process and conditions generally do not require constant, undivided attention. As a result, salient stimuli, such as CEVMS, might capture driver attention and produce an unwanted increase in driver distraction. The present study addresses this concern.

This study used an instrumented vehicle with an eye tracking system to measure where drivers were looking when driving past CEVMS and standard billboards. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant variables to characterize these visual stimuli extensively. Unlike previous studies on digital billboards, the present study examined CEVMS as deployed in two United States cities. These billboards did not contain dynamic video or other dynamic elements, but changed content approximately every 8 to 10 seconds. The eye tracking system had nearly a 2-degree level of resolution that provided significantly more accuracy in determining what objects the drivers were looking at compared to an earlier naturalistic driving study. This study assessed two data collection efforts that employed the same methodology in two cities.

In each city, the study examined eye glance behavior to four CEVMS, two on arterials and two on freeways. There were an equal number of signs on the left and right side of the road for arterials and freeways. The standard billboards were selected for comparison with CEVMS such that one standard billboard environment matched as closely as possible that of each of the CEVMS. Two control locations were selected that did not contain off-premise advertising, one on an arterial and the other on a freeway. This resulted in 10 data collection zones in each city that were approximately 1,000 feet in length (the distance from the start of the data collection zone to the point that the CEVMS or standard billboard disappeared from the data collection video).

In Reading, Pennsylvania, 14 participants drove at night and 17 drove during the day. In Richmond, Virginia, 10 participants drove at night and 14 drove during the day. Calibration of the eye tracking system, practice drive, and the data collection drive took approximately 2 hours per participant to accomplish.

The following is a summary of the study results and conclusions presented in reference to the three research questions the study aimed to address.

Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?

- On average, the drivers in this study devoted between 73 and 85 percent of their visual attention to the road ahead for both CEVMS and standard billboards. This range is consistent with earlier field research studies. In the present study, the presence of CEVMS did not appear to be related to a decrease in looking toward the road ahead.

Do glances to CEVMS occur that would suggest a decrease in safety?

- The average fixation duration to CEVMS was 379 ms and to standard billboards it was 335 ms across the two cities. The average fixation durations to CEVMS and standard billboards were similar to the average fixation duration to the road ahead.

- The longest fixation to a CEVMS was 1,335 ms and to a standard billboard it was 1,284 ms. The current widely accepted threshold for durations of glances away from the road ahead that result in higher crash risk is 2,000 ms. This value comes from a NHTSA

naturalistic driving study that showed a significant increase in crash odds when glances away from the road ahead were 2,000 ms or longer.

- Four dwell times (aggregate of consecutive fixations to the same object) greater than 2,000 ms were observed across the two studies. Three were to standard billboards and one was to a CEVMS. The long dwell time to the CEVMS occurred in the daytime to a billboard viewable from a freeway. Review of the video data for these four long dwell times showed that the signs were not far from the forward view while participant's gaze dwelled on them. Therefore, the drivers still had access to information about what was in front of them through peripheral vision.

- The results did not provide evidence indicating that CEVMS, as deployed and tested in the two selected cities, were associated with unacceptably long glances away from the road. When dwell times longer than the currently accepted threshold of 2,000 ms occurred, the road ahead was still in the driver's field of view. This was the case for both CEVMS and standard billboards.

Do drivers look at CEVMS more than at standard billboards?

- When comparing the probability of a gaze at a CEVMS versus a standard billboard, the drivers in this study were generally more likely to gaze at CEVMS than at standard billboards. However, some variability occurred between the two locations and between the types of roadway (arterial or freeway).

- In Reading, when considering the proportion of time spent looking at billboards, the participants looked more often at CEVMS than at standard billboards when on arterials (63 percent to CEVMS and 37 percent to a standard billboard), whereas they looked more often at standard billboards when on freeways (33 percent to CEVMS and 67 percent to a standard billboard). In Richmond, the drivers looked at CEVMS more than standard billboards no matter the type of road they were on, but as in Reading, the preference for gazing at CEVMS was greater on arterials (68 percent to CEVMS and 32 percent to standard billboards) than on freeways (55 percent to CEVMS and 45 percent to standard billboards). When a gaze was to an off-premise advertising sign, the drivers were generally more likely to gaze at a CEVMS than at a standard billboard.

- In Richmond, the drivers showed a preference for gazing at CEVMS versus standard billboards at night, but in Reading the time of day did not affect gaze behavior. In Richmond, drivers gazed at CEVMS 71 percent and at standard billboards 29 percent at night. On the other hand, in the day the drivers gazed at CEVMS 52 percent and at standard billboards 48 percent.

- In Reading, the average gaze dwell time for CEVMS was 981 ms and for standard billboards it was 1,386 ms. The difference in these average dwell times was not statistically significant. In contrast, the average dwell times to CEVMS and standard billboards were significantly different in Richmond (1,096 ms and 674 ms, respectively).

The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (e.g., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.

It also should be noted that, like other studies in the available literature, this study adds to the knowledge base on the issues examined, but does not present definitive answers to the research questions investigated.

INTRODUCTION

"The primary responsibility of the driver is to operate a motor vehicle safely. The task of driving requires full attention and focus. Drivers should resist engaging in any activity that takes their eyes and attention off of the road for more than a couple of seconds. In some circumstances even a second or two can make all the difference in a driver being able to avoid a crash." – US Department of Transportation[(1)]

The advent of electronic billboard technologies, in particular the digital Light-Emitting Diode (LED) billboard, has prompted a reevaluation of regulations for controlling outdoor advertising. An attractive quality of these LED billboards, which are hereafter referred to as Commercial Electronic Variable Message Signs (CEVMS), is that advertisements can change almost instantly. Furthermore, outdoor advertising companies can make these changes from a central remote office. Of concern is whether or not CEVMS may attract drivers' attention away from the primary task (driving) in a way that compromises safety.

The current Federal Highway Administration (FHWA) guidance recommends that CEVMS should not change content more frequently than once every 8 seconds.[(2)] However, according to Scenic America, the basis of the safety concern is that the "…distinguishing trait…" of a CEVMS "… is that it can vary while a driver watches it, in a setting in which that variation is likely to attract the drivers' attention away from the roadway."[(3)]This study was conducted to provide the FHWA with data to determine if CEVMS capture visual attention differently than standard off-premise advertising billboards.

BACKGROUND

A 2009 review of the literature by Molino et al. for the FHWA failed to find convincing empirical evidence that CEVMS, as currently implemented, constitutes a safety risk greater than that of conventional vinyl billboards.[(4)] A great deal of work has been focused in this area, but the findings of these studies have been mixed.[(4,5)] A summary of the key past findings is presented here, but the reader is referred to Molino et al. for a comprehensive review of studies prior to 2008.[(4)]

Post-Hoc Crash Studies

Post-hoc crash studies use reviews of police traffic collision reports or statistical summaries of such reports in an effort to understand the causes of crashes that have taken place in the vicinity of some change to the roadside environment. In the present case, the change of concern is the introduction of CEVMS to the roadside or the replacement of conventional billboards with CEVMS.

The literature review conducted by Molino et al. did not find compelling evidence for a distraction effect attributable to CEVMS.[(4)] The authors concluded that all post-hoc crash studies are subject to certain weaknesses, most of which are difficult to overcome. For example, the vast majority of crashes are never reported to police; thus, such studies are likely to underreport crashes. Also, when crashes are caused by factors such as driver distraction or inattention, the involved driver may be unwilling or unable to report these factors to a police investigator.

Another weakness is that police, under time pressure, are rarely able to investigate the true root causes of crashes unless they involve serious injury, death, or extensive property damage. Furthermore, to have confidence in the results, such studies need to collect comparable data before and after the change, and, in the after phase, at equivalent but unaffected roadway sections. Since crashes are infrequent events, data collection needs to span extended periods of time both before and after introduction of the change. Few studies are able to obtain such extensive data.

Two recent studies by Tantala and Tantala examined the relationship between the presence of CEVMS and crash statistics in Richmond, Virginia, and Reading, Pennsylvania.[6,7] For the Richmond area, 7 years of crash data at 10 locations with CEVMS were included in the analyses. The study used a before-after methodology where most sites originally contained vinyl billboards (before) that were converted to CEVMS (after). The quantity of crash data was not the same for all locations and ranged from 1 year before/after to 3 years before/after. The study employed the Empirical Bayes (EB) method to analyze the data.[8] The results indicated that the total number of crashes observed was consistent with what would be statistically expected with or without the introduction of CEVMS. The analysis approach for Reading locations was much the same as for Richmond other than there were 20 rather than 10 CEVMS and 8 years of crash statistics. The EB method showed results for Reading that were very similar to those of Richmond.

The studies by Tantala and Tantala appear to address many of the concerns from Molino et al. regarding the weaknesses and issues associated with crash studies.[4,6,7] For example, they include crash comparisons for locations within multiple distances of each CEVMS to address concerns about the visual range used in previous analyses. They used EB analysis techniques to correct for regression-to-mean bias. Also, the EB method would better reflect crash rate changes due to changes in average daily traffic and the interactions of these with the roadway features that were coded in the model. The studies followed approaches that are commonly used in post-hoc crash studies, though the results would have been strengthened by including before-after results for non-CEVMS locations as a control group.

Field Investigations

Field investigations include unobtrusive observation, naturalistic driving studies, on-road instrumented vehicle investigations, test track experiments, driver interviews, surveys, and questionnaires. The following focuses on relevant studies that employed naturalistic driving and on-road instrumented vehicle research methods.

Lee, McElheny, and Gibbons undertook an on-road instrumented vehicle study on Interstate and local roads near Cleveland, Ohio.[9] The study looked at driver glance behavior in the vicinity of digital billboards, conventional billboards, comparison sites (sites with buildings and other signs, including digital signs), and control sites (those without similar signage). The results showed that there were no differences in the overall glance patterns (percent eyes-on-road and overall number of glances) between the different sites. Drivers also did not glance more frequently in the direction of digital billboards than in the direction of other event types (conventional billboards, comparison events, and baseline events) but drivers did take longer glances in the direction of digital billboards and comparison sites than in the direction of conventional billboards and baseline sites. However, the mean glance length toward the digital billboards was less than

1,000 ms. It is important to note that this study employed a video-based approach for examining drivers' visual behavior, which has an accuracy of no better than 20 degrees.[10] While this technique is likely to be effective in assessing gross eye movements and looks that are away from the road ahead, it may not have sufficient resolution to discriminate what specific object the driver is looking at outside of the vehicle.

Beijer, Smiley, and Eizenman evaluated driver glances toward four different types of roadside advertising signs on roads in the Toronto, Canada, area.[11] The four types of signs were: (a) billboard signs with static advertisements; (b) billboard advertisements placed on vertical rollers that could rotate to show one of three advertisements in succession; (c) scrolling text signs with a minor active component, which usually consisted of a small strip of lights that formed words scrolling across the screen or, in some cases, a larger area capable of displaying text but not video; and (d) signs with video images that had a color screen capable of displaying both moving text and moving images. The study employed an on-road instrumented vehicle with a head-mounted eye tracking device. The researchers found no significant differences in average glance duration or the maximum glance duration for the various sign types; however, the number of glances was significantly lower for billboard signs than for the roller bar, scrolling text, and video signs.

Smiley, Smahel, and Eizenman conducted a field driving study that employed an eye tracking system that recorded drivers' eye movements as participants drove past video signs located at three downtown intersections and along an urban expressway.[12] The study route included static billboards and video advertising. The results of the study showed that on average 76 percent of glances were to the road ahead. Glances at advertising, including static billboards and video signs, constituted 1.2 percent of total glances. The mean glance durations for advertising signs were between 500 ms and 750 ms, although there were a few glances of about 1,400 ms in duration. Video signs were not more likely than static commercial signs to be looked at when headways were short; in fact, the reverse was the case. Furthermore, the number of glances per individual video sign was small, and statistically significant differences in looking behavior were not found.

Kettwich, Kartsen, Klinger, and Lemmer conducted a field study where drivers' gaze behavior was measured with an eye tracking system.[13] Sixteen participants drove an 11.5 mile (18.5 km) route comprised of highways, arterial roads, main roads, and one-way streets in Karlsruhe, Germany. The route contained advertising pillars, event posters, company logos, and video screens. Mean gaze duration for the four types of advertising was computed for periods when the vehicle was in motion and when it was stopped. Gaze duration while driving for all types of advertisements was under 1,000 ms. On the other hand, while the vehicle was stopped, the mean gaze duration for video screen advertisements was 2,750 ms. The study showed a significant difference between gaze duration while driving and while stationary: gaze duration was affected by the task at hand. That is, drivers tended to gaze longer while the car was stopped and there were few driving task demands.

The previously mentioned studies estimated the duration of glances to advertising and computed mean values of less than 1,000 ms. Klauer et al., in his analysis of the 100-Car Naturalistic Driving Study, concluded that glances away from the roadway for any purpose lasting more than 2,000 ms increase near-crash/crash risk by at least two times that of normal, baseline driving.[14]

Klauer et al. also indicated that short, brief glances away from the forward roadway for the purpose of scanning the driving environment are safe and actually decrease near-crash/crash risk.[14] Using devices in a vehicle that draw visual attention away from the forward roadway for more than 2,000 ms (e.g., texting) is incompatible with safe driving. However, for external stimuli, especially those near the roadway, the evaluation of eye glances with respect to safety is less clear since peripheral vision would allow the driver to still have visual access to the forward roadway.

Laboratory Studies

Laboratory investigations related to roadway safety can be classified into several categories: driving simulations, non-driving-simulator laboratory testing, and focus groups. The review of relevant laboratory studies by Molino et al. did not show conclusive evidence regarding the distracting effects of CEVMS.[4] Moreover, the authors concluded that present driving simulators do not have sufficient visual dynamic range, image resolution, and contrast ratio capability to produce the compelling visual effect of a bright, photo-realistic LED-based CEVMS against a natural background scene. The following is a discussion of a driving simulator study conducted after the publication of Molino et al.[4] The study focused on the effects of advertising on driver visual behavior.

Chattington, Reed, Basacik, Flint, and Parkes conducted a driving simulator study in the United Kingdom (UK) to evaluate the effects of static and video advertising on driver glance behavior.[15] The researchers examined the effects of advertisement position relative to the road (left, right, center on an overhead gantry, and in all three locations simultaneously), type of advertisement (static or video), and exposure duration of the advertisement. (The paper does not provide these durations in terms of time or distance. The exposure duration had to do with the amount of time or distance that the sign would be visible to the driver.) For the advertisements presented on the left side of the road (recall that drivers travel in the left lane in the UK), mean glance durations for static and video advertisements were significantly longer (approximately 650 to 750 ms) when drivers experienced long advertisement exposure as opposed to medium and short exposures. Drivers looked more at video advertisements (about 2 percent on average of the total duration recorded) than at static advertisements (about 0.75 percent on average). In addition, the location of the advertisements had an effect on glance behavior. When advertisements were located in the center of the road or in all three positions simultaneously, the glance durations were about 1,000 ms and were significantly longer than for signs placed on the right or left side of the road. For advertisements placed on the left side of the road, there was a significant difference in glance duration between static (about 400 ms) and video (about 800 ms). Advertisement position also had an effect on the proportion of time that a driver spent looking at an advertisement. The percentage of time looking at advertisements was greatest when signs were placed in all three locations, followed by center location signs, then the left location signs, and finally the right location signs. Drivers looked more at the video advertisements relative to the static advertisements when they were placed in all three locations, placed on the left, and placed on the right side of the road. The center placement did not show a significant difference in percent of time spent looking between static and video.

Summary

The results from these key studies offer some insight into whether CEVMS pose a visual distraction threat. However, these same studies also reveal some inconsistent findings and potential methodological issues that are addressed in the current study. The studies conducted by Smiley et al. showed drivers glanced forward at the roadway about 76 percent of the time in the presence of video and dynamic signs where a few long glances of approximately 1,400 ms were observed.[12] However, the video and dynamic signs used in these studies portray moving objects that are not present in CEVMS as deployed in the United States. In another field study employing eye tracking, Kettwich et al. found that gaze duration while driving for all types of advertisements that they evaluated was less than 1,000 ms; however, when the vehicle was stopped, mean gaze duration for advertising was as high as 2,750 ms.[16] Collectively, these studies did not demonstrate that the advertising signs detracted from drivers' glances forward at the roadway in a substantive manner while the vehicle was moving.

In contrast, the simulator study by Chattington et al. demonstrated that dynamic signs showing moving video or other dynamic elements may draw attention away from the roadway.[15] Furthermore, the location of the advertising sign on the road is an important factor in drawing drivers' visual attention. Advertisements with moving video placed in the center of the roadway on an overhead gantry or in all three positions (right, left, and in the center) simultaneously are very likely to draw glances from drivers.

Finally, in a study that examined CEVMS as deployed in the United States, Lee et al. did not show any significant effects of CEVMS on driver glance behavior.[9] However, the methodology that was used likely did not employ sufficient sensitivity to determine at what specific object in the environment a driver was looking.

None of these studies combined all necessary factors to address the current CEVMS situation in the United States. Those studies that used eye tracking on real roads had animated and video-based signs, which are not reflective of current off-premise CEVMS practice in the United States.

STUDY APPROACH

Based on an extensive review of the literature, Molino et al. concluded that the most effective method to use in an evaluation of the effects of CEVMS on driver visual behavior was the instrumented field vehicle method that incorporated an eye tracking system.[4] The present study employed such an instrumented field vehicle with an eye tracking system and examined the degree to which CEVMS attract drivers' attention away from the forward roadway.

The following presents a brief overview and discussion of studies using eye tracking methodology with complex visual stimuli, especially in natural environments (walking, driving, etc.). The review by Molino et al. recommended the use of this type of technology and method; however, a discussion laying out technical and theoretical issues underlying the use of eye tracking methods was not presented.[4] This background is important for the interpretation of the results of the studies conducted here.

Standard and digital billboards are often salient stimuli in the driving environment, which may make them conspicuous. Cole and Hughes define attention conspicuity as the extent to which a stimulus is sufficiently prominent in the driving environment to capture attention. Further, Cole and Hughes state that attention conspicuity is a function of size, color, brightness, contrast relative to surroundings, and dynamic components such as movement and change.[17] It is clear that under certain circumstances image salience or conspicuity can provide a good explanation of how humans orient their attention.

At any given moment a large number of stimuli reach our senses, but only a limited number of them are selected for further processing. In general, attention can be focused on a stimulus because it is important for achieving some goal, or because the properties of the stimulus can attract the attention of the observer independent of their intentions (e.g., a car horn may elicit an orienting response). When the focus of attention is goal directed, it is referred to as top-down. When the focus of attention is principally a function of stimulus attributes, it is referred to as bottom-up.[18]

In general, billboards (either standard or CEVMS) are not relevant to the driving task but are presumably designed to be salient stimuli in the environment where they may draw a driver's attention. The question is to what degree CEVMS draw a driver's attention away from driving-relevant stimuli (e.g., road ahead, mirrors, and speedometer) and is this different from a standard billboard? In his review of the literature Wachtel leads one to consider CEVMS as stimuli in the environment where attention to them would be drawn in a bottom-up manner; that is, the salience of the billboards would make them stand out relative to other stimuli in the environment and drivers would reflexively look at these signs.[19] Wachtel's conclusions were in reference to research by Theeuwees who employed simple letter stimulus arrays in a laboratory task.[20] Research using simple visual stimuli in a laboratory environment are very useful for testing different theories of perception, but often lack direct application to tasks such as driving. The following discusses research using complex visual stimuli and tasks that are more relevant to natural vision as experienced in the driving task.

A recent review of stimulus salience and eye guidance by Tatler et al. shows that most of the evidence for the capture of attention by the conspicuity of stimuli comes from research in which the stimulus is a simple visual search array or in which the target is uniquely defined by simple visual features.[21] In other words, these are laboratory studies that use letters, arrays of letters, or simple geometric patterns as the stimuli. Pure salience-based models are capable of predicting eye movement endpoint in simple displays, but are less successful for more complex scenes that contain task-relevant and task-irrelevant salient areas.[22,23]

Research by Henderson et al. using photographs of actual scenes showed that subjects looked at non-salient scene regions containing a search target and rarely looked at salient non-task-relevant regions of the scenes.[24] Salience of the stimulus alone was not a good predictor of where participants looked. Additional research by Henderson using photographs of real world scenes also showed that subjects fixated on regions of the pictures that provided task-relevant information rather than visually salient regions with no task-relevant information. However, Henderson acknowledges that static pictures have many shortcomings when used as surrogates for real environments.[25]

Land's review of eye movements in dynamic environments concluded that the eyes are proactive and typically seek out information required in the second before each new activity commences.[26] Specific tasks (e.g., driving) have characteristic but flexible patterns of eye movement that accompany them, and these patterns are similar between individuals. Land concluded that the eyes rarely visit objects that are irrelevant to the task, and the conspicuity of objects is less important than the objects' roles in the task. In a subsequent review of eye movement and natural behavior, Land concluded that in a task that requires fixation on a sequence of specific objects, the capture of gaze by irrelevant salient objects would, in general, be an obtrusive nuisance.[22]

The literature examining gaze control under natural behavior suggests that it is principally top-down driven, or intentional.[24,25,26,22,21,27] However, top-down processing does not explain all gaze control or eye movements. For example, imagine driving down a two-lane country road and a deer jumps into the road. It is most likely that you will attend and react to this deer. Unplanned or unexpected stimuli capture our attention as we engage in complex natural tasks. Research by Jovancevic-Misic and Hayhoe showed that human gaze patterns are sensitive to the probabilistic nature of the environment.[28] In this study, participants' eye movement behavior was observed while walking among other pedestrians. The other pedestrians were confederates and were either safe, risky, or rogue pedestrians. When the study began, the risky pedestrian took a collision course with the participant 50 percent of the time, and the rogue pedestrian always assumed a collision course as he approached the participant, whereas the safe pedestrian never took a collision course. Midway through the study the rogue and safe pedestrians exchanged roles but the risky pedestrian role remained the same. The participants were not informed about the behavior of the other pedestrians. Participants were asked to follow a circular path for several laps and to avoid other pedestrians. The study showed that the participants modified their gaze behavior in response to the change in the other pedestrians' behavior. Jovancevic-Misic concluded that participants learned new priorities for gaze allocation within a few encounters and looked both sooner and longer at potentially dangerous pedestrians.[28]

Gaze behavior in natural environments is affected by expectations that are derived through long-term learning. Using a virtual driving environment, Shinoda et al. asked participants to look for stop signs while driving an urban route.[29] Approximately 45 percent of the fixations fell in the general area of intersections during the simulated drive, and participants were more likely to detect stop signs placed near intersections than those placed in the middle of a block. Over time, drivers have learned that stop signs are more likely to appear near intersections and, as a result, drivers prioritize their allocation of gazes to these areas of the roadway.

The Tatler et al. review of the literature concludes that in natural vision, a consistent set of principles underlies eye guidance. These principles include relevance or reward potential, uncertainty about the state of the environment, and learned models of the environment.[21] Salience of environmental stimuli alone typically does not explain most eye gaze behavior in naturalistic environments.

In sum, most of the literature concerning eye gaze behavior in dynamic environments suggests that task demands tend to override visual salience in determining attention allocation. When extended to driving, it would be expected that visual attention will be directed toward task-relevant areas and objects (e.g., the roadway, other vehicles, speed limit signs, etc.) and other

salient objects, such as billboards, will not necessarily capture attention. However, driving is a somewhat automatic process and conditions generally do not require constant undivided attention. As a result, salient stimuli, such as CEVMS, might capture driver attention and provide an unwarranted increase in driver distraction. The present study addresses this concern.

Research Questions

The present research evaluated the effects of CEVMS on driver visual behavior under actual roadway conditions in the daytime and at night. Roads containing CEVMS, standard billboards, and areas not containing off-premise advertising were selected. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant visual characteristics. The present study examined CEVMS as deployed in two United States cities. Unlike previous studies, the signs did not contain dynamic video or other dynamic elements. In addition, the eye tracking system used in this study has approximately a 2-degree level of resolution. This provided significantly more accuracy in determining what objects the drivers were looking at than in previous on-road studies examining looking behavior (recall that Lee et al. used video recordings of drivers' faces that, at best, examined gross eye movements).[9]

Two studies are reported. Each study was conducted in a different city. The two studies employed the same methodology. The studies' primary research questions were:

1. Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?

2. Do glances to CEVMS occur that would suggest a decrease in safety?

3. Do drivers look at CEVMS more than at standard billboards?

EXPERIMENTAL APPROACH

The study used a field research vehicle equipped with a non-intrusive eye tracking system. The vehicle was a 2007 Jeep® Grand Cherokee Sport Utility Vehicle. The eye tracking system used (SmartEye® vehicle-mounted infrared (IR) eye-movement measuring system) is shown in figure 1.[(30)] The system consists of two IR light sources and three face cameras mounted on the dashboard of the vehicle. The cameras and light sources are small in size, and are not attached to the driver in any manner. The face cameras are synchronized to the IR light sources and are used to determine the head position and gaze direction of the driver.

Figure 1. Eye tracking system camera placement.

As a part of this eye tracking system, the vehicle was outfitted with a three-camera panoramic scene monitoring system for capturing the forward driving scene. The scene cameras were mounted on the roof of the vehicle directly above the driver's head position. The three cameras together provided an 80-degree wide by 40-degree high field of forward view. The scene cameras captured the forward view area available to the driver through the left side of the windshield and a portion of the right side of the windshield. The area visible to the driver through the rightmost area of the windshield was not captured by the scene cameras.

The vehicle was also outfitted with equipment to record GPS position, vehicle speed, and vehicle acceleration. The equipment also recorded events entered by an experimenter and synchronized those events with the eye tracking and vehicle data. The research vehicle is pictured in figure 2.

Figure 2. FHWA's field research vehicle.

EXPERIMENTAL DESIGN OVERVIEW

The approach entailed the use of the instrumented vehicle in which drivers navigated routes in cities that presented CEVMS and standard billboards as well as areas without off-premise advertising. The participants were instructed to drive the routes as they normally would. The drivers were not informed that the study was about outdoor advertising, but rather that it was about examining drivers' glance behavior as they followed route guidance directions.

Site Selection

More than 40 cities were evaluated in the selection of the test sites. Locations with CEVMS displays were identified using a variety of resources that included State department of transportation contacts, advertising company Web sites, and a popular geographic information system. A matrix was developed that listed the number of CEVMS in each city. For each site, the number of CEVMS along limited access and arterial roadways was determined.

One criterion for site selection was whether the location had practical routes that pass by a number of CEVMS as well as standard off-premise billboards and could be driven in about 30 minutes. Other considerations included access to vehicle maintenance personnel/facilities, proximity to research facilities, and ease of participant recruitment. Two cities were selected: Reading, and Richmond.

Table 1 presents the 16 cities that were included on the final list of potential study sites.

Table 1. Distribution of CEVMS by roadway classification for various cities.

State	*Area*	*Limited Access*	*Arterial*	*Other* (1)	*Total*
VA	Richmond	4	7	0	11
PA	Reading	7	11	0	18
VA	Roanoke	0	11	0	11
PA	Pittsburgh	0	0	15	15
TX	San Antonio	7	2	6	15
WI	Milwaukee	14	2	0	16
AZ	Phoenix	10	6	0	16
MN	St. Paul/Minneapolis	8	5	3	16
TN	Nashville	7	10	0	17
FL	Tampa-St. Petersburg	7	11	0	18
NM	Albuquerque	0	19	1	20
PA	Scranton-Wilkes Barre	7	14	1	22
OH	Columbus	1	22	0	23
GA	Atlanta	13	11	0	24
IL	Chicago	22	2	1	25
CA	Los Angeles	3	71	4	78

(1) Other includes roadways classified as both limited access and arterial or instances where the road classification was unknown. *Source:* www.lamar.com and www.clearchannel.com

In both test cities, the following independent variables were evaluated:

- **The type of advertising.** This included CEVMS, standard billboards, and no off-premise advertising. (It should be noted that in areas with no off-premise advertising, it was still possible to encounter on-premise advertising; e.g., for gas stations, restaurants, and other miscellaneous stores and shops.)

- **Time of day.** This included driving in the daytime and at night.

- **The functional class of roadways in which off-premise advertising signs were located.** Roads were classified as either freeway or arterial. It was observed that the different road classes were correlated with the presence of other visual information that could affect the driver's glance behavior. For example, the visual environment on arterials may be more complex or cluttered than on freeways because of the close proximity of buildings, driveways, and on-premise advertising, etc.

READING

The first on-road study was conducted in Reading. This study examined the type of advertising (CEVMS, standard billboard, or no off-premise advertising), time of day (day or night) and road type (freeway or arterial) as independent variables. Eye tracking was used to assess where participants gazed and for how long while driving. The luminance and contrast of the advertising signs were measured to characterize the billboards in the current study.

METHOD

Selection of Data Collection Zone Limits

Data collection zones (DCZ) were defined on the routes that participants drove where detailed analyses of the eye tracking data were planned. The DCZ were identified that contained a CEVMS, a standard billboard, or no off-premise advertising.

The rationale for selecting the DCZ limits took into account the geometry of the roadway (e.g., road curvature or obstructions that blocked view of billboards) and the capabilities of the eye tracking system (2 degrees of resolution). At a distance of 960 ft (292.61 m), the average billboard in Reading was 12.8 ft (3.90 m) by 36.9 ft (11.25 m) and would subtend a horizontal visual angle of 2.20 degrees and a vertical visual angle of 0.76 degrees, and thus glances to the billboard would just be resolvable by an eye tracking system with 2 degrees of accuracy. Therefore 960 ft was chosen as the maximum distance from billboards at which a DCZ would begin. If the target billboard was not visible from 960 ft (292.61 m) due to roadway geometry or other visual obstructions, such as trees or an overpass, the DCZ was shortened to a distance that prevented these objects from interfering with the driver's vision of the billboard. In DCZs with target off-premise billboards, the end of the DCZ was marked when the target billboard left the view of the scene camera. If the area contained no off-premise advertising, the end of the DCZ was defined by a physical landmark leaving the view of the eye tracking systems' scene camera.

Table 2 shows the data collection zone limits used in this study.

Advertising Conditions

The type of advertising present in DCZs was examined as an independent variable. DCZs fell into one of the following categories, which are listed in the second column of table 2:

- **CEVMS**. These were DCZs that contained one target CEVMS. Two CEVMS DCZs were located on freeways and two were located on arterials. Figure 3 and figure 4 show examples of CEVMS DCZs with the CEVMS highlighted in the pictures.

- **Standard billboard**. These were DCZs that contained one target standard billboard. Two standard billboard DCZs were located on freeways and two were located on arterials. Figure 5 and figure 6 show examples of standard billboard DCZs; the standard billboards are highlighted in the pictures.

- **No off-premise advertising conditions**. These DCZs contained no off-premise advertising. One of these DCZs was on a freeway (see figure 7) and the other was on an arterial (see figure 8).

Table 2. Inventory of target billboards with relevant parameters.

DCZ	*Advertising Type*	*Copy Dimensions (ft)*	*Side of Road*	*Setback from Road (ft)*	*Other Standard Billboards*	*Approach Length (ft)*	*Type of Roadway*
1	CONTROL	N/A	N/A	N/A	N/A	786	Freeway
6	CONTROL	N/A	N/A	N/A	N/A	308	Arterial
3	CEVMS	10'6" x 22'9"	L	12	0	375	Arterial
5	CEVMS	14'0" x 48'0"	L	133	1	853	Freeway
9	CEVMS	10'6" x 22'9"	R	43	0	537	Arterial
10	CEVMS	14'0" x 48'0"	R	133	1	991	Freeway
2	Standard	14'0" x 48'0"	L	20	0	644	Arterial
7	Standard	14'0" x 48'0"	R	35	1	774	Freeway
8	Standard	10'6" x 22'9"	R	40	1	833	Arterial
4	Standard	14'0" x 48'0"	L	10	0	770	Freeway

**N/A indicates that there were no off-premise advertising in these areas and these values are undefined.*

Figure 3. DCZ with a target CEVMS on a freeway.

Figure 4. DCZ with a target CEVMS on an arterial.

Figure 5. DCZ with a target standard billboard on a freeway.

Figure 6. DCZ with a target standard billboard on an arterial.

Figure 7. DCZ for the control condition on a freeway.

Figure 8. DCZ for the control condition on an arterial.

Photometric Measurement of Signs

Two primary metrics were used to describe the photometric characteristics of a sample of the CEVMS and standard billboards present at each location: luminance (cd/m^2) and contrast (Weber contrast ratio).

Photometric Equipment

Luminance was measured with a Radiant Imaging ProMetric 1600 Charge-Coupled Device (CCD) photometer with both a 50 mm and a 300 mm lenses. The CCD photometer provided a method of capturing the luminance of an entire scene at one time.

The photometric sensors were mounted in a vehicle of similar size to the eye tracking research vehicle. The photometer was located in the experimental vehicle as close to the driver's position as possible and was connected to a laptop computer that stored data as the images were acquired.

Measurement Methodology

Images of the billboards were acquired using the photometer manufacturer's software. The software provided the mean luminance of each billboard message. To prevent overexposure of

images in daylight, neutral density filters were manually affixed to the photometer lens and the luminance values were scaled appropriately. Standard billboards were typically measured only once; however, for CEVMS multiple measures were taken to account for changing content.

Photometric measurements were taken during day and night. Measurements were taken by centering the billboard in the photometer's field of view with approximately the equivalent of the width of the billboard on each side and the equivalent of the billboard height above and below the sign. The areas outside of the billboards were included to enable contrast calculations.

Standard billboards were assessed at a mean distance of 284 ft (ranging from 570 ft to 43 ft). The CEVMS were assessed at a mean distance of 479 ft (ranging from 972 ft to 220 ft). To include the background regions of appropriate size, the close measurement distances required the use of the 50 mm lens whereas measurements made from longer distances required the 300 mm lens. A significant determinant of the measurement locations was the availability of accessible and safe places from which to measure.

The Weber contrast ratio was used because it characterizes a billboard as having negative or positive contrast when compared to its background area.[31] A negative contrast indicates the background areas have a higher mean luminance than the target billboard. A positive contrast indicates the target billboard has a higher mean luminance than the background. Overall, the absolute value of a contrast ratio simply indicates a difference in luminance between an item and its background. From a perceptual perspective luminance and contrast are directly related to the perception of brightness. For example, two signs with equal luminance may be perceived differently with respect to brightness because of differences in contrast.

Visual Complexity

Regan, Young, Lee and Gordon presented a taxonomic description of the various sources of driver distraction.[32] Potential sources of distraction were discussed in terms of: things brought into the vehicle; vehicle systems; vehicle occupants; moving objects or animals in the vehicle; internalized activity; and external objects, events, or activities. The external objects may include buildings, construction zones, billboards, road signs, vehicles, and so on. Focusing on the potential for information outside the vehicle to attract (or distract) the driver's attention, Horberry and Edquist developed a taxonomy for out-of-the-vehicle visual information. This suggested taxonomy includes four groupings of visual information: built roadway, situational entities, natural environment, and built environment.[33] These two taxonomies provide an organizational structure for conducting research; however, they do not currently provide a systematic or quantitative way of classifying the level of clutter or visual complexity present in a visual scene.

The method proposed by Rozenholtz, Li, and Nakano provides quantitative and perhaps reliable measures of visual clutter.[34] Their approach measures the feature congestion in a visual image. The implementation of the feature congestion measure involves four stages: (1) compute local feature covariance at multiple scales and compute the volume of the local covariance ellipsoid, (2) combine clutter across scale, (3) combine clutter across feature types, and (4) pool over space to get a single measure of clutter for each input image. The implementation that was used employed color, orientation and luminance contrast as features. Presumably, less cluttered

images can be visually coded more efficiently than cluttered images. For example, visual clutter can cause decreased recognition performance and greater difficulty in performing visual search.[35]

Participants

In the present study participants were recruited at public libraries in the Reading area. A table was set up so that recruiters could discuss the requirements of the experiment with candidates. Individuals who expressed interest in participating were asked to complete a pre-screening form, a record of informed consent, and a department of motor vehicles form consenting to release of their driving record.

All participants were between 18 and 64 years of age and held a valid driver's license. The driving record for each volunteer was evaluated to eliminate drivers with excessive violations. The criteria for excluding drivers were as follows: (a) more than one violation in the preceding year; (b) more than three recorded violations; and (c) any driving while intoxicated violation.

Forty-three individuals were recruited to participate. Of these, five did not complete the drive because the eye tracker could not be calibrated to track their eye movements accurately. Data from an additional seven participants were excluded as the result of equipment failures (e.g., loose camera). In the end, usable data was collected from 31 participants (12 males, M = 46 years; 19 females, M = 47 years). Fourteen participants drove at night and 17 drove during the day.

Procedures

Data were collected from two participants per day (beginning at approximately 12:45 p.m. and 7:00 p.m.). Data collection began on September 18, 2009, and was completed on October 26, 2009.

Pre-Data Collection Activities

Participants were greeted by two researchers and asked to complete a fitness to drive questionnaire. This questionnaire focused on drivers' self-reports of alertness and use of substances that might impair driving (e.g., alcohol). All volunteers appeared fit.

Next, the participant and both researchers moved to the eye tracking calibration location and the test vehicle. The calibration procedure took approximately 20 minutes. Calibration of the eye tracking system entailed development of a profile for each participant. This was accomplished by taking multiple photographs of the participant's face as they slowly rotate their head from side to side. The saved photographs include points on the face for subsequent real-time head and eye tracking. Marked coordinates on the face photographs were edited by the experimenter as needed to improve the real-time face tracking. The procedure also included gaze calibration in which participants gazed at nine points on a wall. These points had been carefully plotted on the wall and correspond to the points in the eye tracking system's world model. Gaze calibration relates the individual participant's gaze vectors to known points in the real world. The eye tracking system uses two pulsating infrared sources mounted on the dashboard to create two corneal glints that are used to calculate gaze direction vectors. The glints were captured at 60 Hz. A second set

of cameras (scene cameras), fixed on top of the car close to the driver's viewpoint, were used to produce a video scene of the area ahead. The scene cameras recorded at 25 Hz. A parallax correction algorithm compensated for the distance between the driver's viewpoint and the scene cameras so that later processing could use the gaze vectors to show where in the forward scene the driver was gazing.

If it was not possible to calibrate the eye tracking system to a participant, the participant was dismissed and paid for their time. Causes of calibration failure included reflections from eye glasses, participant height (which put their eyes outside the range of the system), and eyelids that obscure a portion of the pupil.

Practice

After eye-tracker calibration, a short practice drive was made. Participants were shown a map of the route and written turn-by-turn directions prior to beginning the practice drive. Throughout the drive, verbal directions were provided by a GPS device.

During the practice drive, a researcher in the rear seat of the vehicle monitored the accuracy of eye tracking. If the system was tracking poorly, additional calibration was performed. If the calibration could not be improved, the participant was paid for their time and dismissed.

Data Collection

Participants drove two test routes (referred to as route A and B). Each route required 25 to 30 minutes to complete and included both freeway and arterial segments. Route A was 13 miles long and contained 6 DCZs. Route B was 16 miles long and contained 4 DCZs. Combined, participants drove in a total of 10 DCZs. Similar to the practice drive, participants were shown a map of the route and written turn-by-turn directions. A GPS device provided turn-by-turn guidance during the drive. Roughly one half of the participants drove route A first and the remaining participants began with route B. A 5 minute break followed the completion of the first route.

During the drives, a researcher in the front passenger seat assisted the driver when additional route guidance was required. The researcher was also tasked with recording near misses and driver errors if these occurred. The researcher in the rear seat monitored the performance of the eye tracker. If the eye tracker performance became unacceptable (i.e., loss of calibration), then the researcher in the rear asked the participant to park in a safe location so that the eye tracker could be recalibrated. This recalibration typically took a minute or two to accomplish.

Debriefing

After driving both routes, the participants provided comments regarding their drives. The comments were in reference to the use of a navigation system. No questions were asked about billboards. The participants were given $120.00 in cash for their participation.

DATA REDUCTION

Eye Tracking Measures

The Multiple-Analysis of Psychophysical and Performance Signals (MAPPS™) software was used to reduce the eye tracking data.[36] The software integrates the video output from the scene cameras with the output from the eye tracking software (e.g., gaze vectors). The analysis software provides an interface in which the gaze vectors determined by the eye tracker can be related to areas or objects in the scene camera view of the world. Analysts can indicate regions of interest (ROIs) in the scene camera views and the analysis software then assigns gaze vectors to the ROIs.

Figure 9 shows a screen capture from the analysis software in which static ROIs have been identified. These static ROIs slice up the scene camera views into six areas. The software also allows for the construction of dynamic ROIs. These are ROIs that move in the video because of own-vehicle movement (e.g., a sign changes position on the display as it is approached by the driver) or because the object moves over time independent of own-vehicle movement (e.g., pedestrian walking along the road, vehicle entering or exiting the road).

Static ROIs need only be entered once for the scenario being analyzed whereas dynamic ROIs need to be entered several times for a given DCZ depending on how the object moves along the video scene; however, not every frame needs to be coded with a dynamic ROI since the software interpolates across frames using the 60-Hz data to compute eye movement statistics.

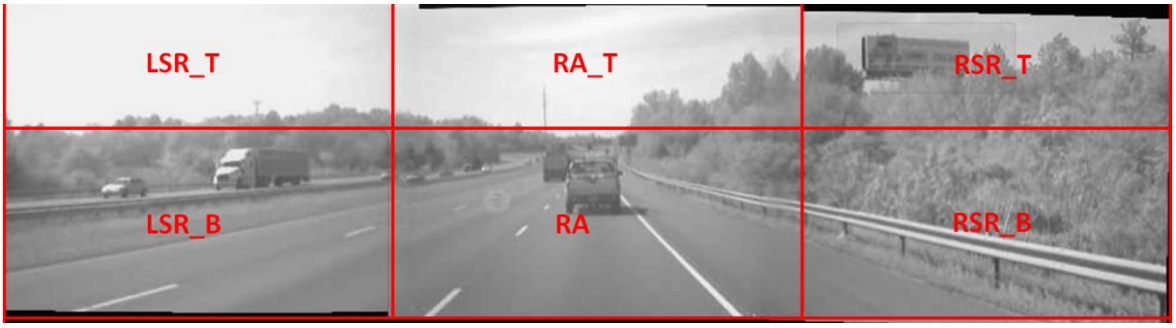

Figure 9. Screen capture showing static ROIs on a scene video output.

The following ROIs were defined with the analysis software:

Static ROIs

These ROIs were entered once into the software for each participant. The static ROIs for the windshield were divided into top and bottom to have more resolution during the coding process. The subsequent analyses in the report combines the top and bottom portion of these ROIs since it appeared that this additional level of resolution was not needed in order to address research questions:

- Road ahead: bottom portion (approximately 2/3) of the area of the forward roadway (center camera).

- Road ahead top: top portion (approximately 1/3) of the area of the forward roadway (center camera).

- Right side of road bottom: bottom portion (approximately 2/3) of the area to the right of the forward roadway (right camera).

- Right side of road top: top portion (approximately 1/3) of the area to the right of the forward roadway (right camera).

- Left side of road bottom (LSR_B): bottom portion (approximately 2/3) of the area to the left of the forward roadway (left camera).

- Left side of road bottom (LSR_T): top portion (approximately 1/3) of the area to the left of the forward roadway (left camera).

- Inside vehicle: below the panoramic video scene (outside of the view of the cameras, but eye tracking is still possible).

- Top: above the panoramic video scene (outside of the view of the cameras, but eye tracking is still possible).

Dynamic ROIs

These ROIs are created multiple times within a DCZ for stimuli that move relative to the driver:

- Driving-related safety risk: vehicle which posed a potential safety risk to the driver, defined as a car that is/may turn into the driver's direction of travel at a non-signalized or non-stop-controlled intersection (e.g., a car making a U-turn, a car waiting to turn right, or a car waiting to turn left). These vehicles were actively turning or entering the roadway or appeared to be in a position to enter the roadway.

- Target standard billboard: target standard billboard that defines the start and end of the DCZ.

- Other standard billboard: standard billboard(s) located in the DCZ, other than the target standard billboard or the target digital billboard.

- CEVMS: target digital billboard that defines the start and end of the DCZ.

The software determines the gaze intersection for each 60 Hz frame and assigns it to an ROI. In subsequent analyses and discussion, gaze intersections are referred to as gazes. Since ROIs may overlap, the software allows for the specification of priority for each ROI such that the ROI with the highest priority gets the gaze vector intersection assigned to it. For example, an ROI for a CEVMS may also be in the static ROI for the road ahead.

The 60 Hz temporal resolution of the eye tracking software does not provide sufficient information to make detailed analysis of saccade characteristics,[1] such as latency or speed. The analysis software uses three parameters in the determination of a fixation: a fixation radius, fixation duration, and a time out. The determination begins with a single-gaze vector intersection. Any subsequent intersection within a specified radius will be considered part of a fixation if the minimum fixation duration criterion is met. The radius parameter used in this study was 2 degrees and the minimum duration was 100 ms. The 2-degree selection was based on the estimated accuracy of the eye tracking system, as recommended by Recarte and Nunes.[37] The 100 ms minimum duration is consistent with many other published studies; however, some investigators use minimums of as little as 60 ms.[37,38] Because of mini-saccades and noise in the eye tracking system, it is possible to have brief excursions outside the 2 degree window for a fixation. In this study, an excursion time outside the 2-degree radius of less than 90 ms was ignored. Once the gaze intersection fell outside the 2-degree radius of a fixation for more than 90 ms, the process of identifying a fixation began anew.

Other Measures

Driving Behavior Measures

During data collection, the front-seat researcher observed the driver's behavior and the driving environment. The researcher used the following subjective categories in observing the participant's driving behavior:

- **Driver Error:** signified any error on behalf of the driver in which the researcher felt slightly uncomfortable, but not to a significant degree (e.g., driving on an exit ramp too quickly, turning too quickly).

- **Near Miss:** signified any event in which the researcher felt uncomfortable due to driver response to external sources (e.g., slamming on brakes, swerving). A near miss is the extreme case of a driver error.

- **Incident:** signified any event in the roadway which may have had a potential impact on the attention of the driver and/or the flow of traffic (e.g., crash, emergency vehicle, animal, construction, train).

These observations were entered into a notebook computer linked to the research vehicle data collection system.

Level of Service Estimates

For each participant and each DCZ the analyst estimated the level of service of the road as they reviewed the scene camera video. One location per DCZ was selected (approximately halfway through the DCZ) where the number of vehicles in front of the research vehicle was counted. The procedure entailed (1) counting the number of travel lanes visible in the video, (2) using the

[1] During visual scanning, the point of gaze alternates between brief pauses (ocular fixations) and rapid shifts (saccades).

skip lines on the road to estimate the approximate distance in front of the vehicle that constituted the analysis zone, and (3) counting the number of vehicles present within the analysis zone. Vehicle density was calculated with the formula:

> Vehicle Density = [(Number of Vehicles in Analysis Zone)/(Distance of Analysis Zone in ft/5280)]/Number of Lanes.

Vehicle density is the number of vehicles per mile per lane.

Vehicle Speed

The speed of the research vehicle was recorded with GPS and a distance measurement instrument. Vehicle speed was used principally to ensure that the eye tracking data was recorded while the vehicle was in motion.

RESULTS

Results are presented with respect to the photometric measures of signs, the visual complexity of the DCZs, and the eye tracking measures. Photometric measurements were taken and analyzed to characterize the billboards in the study based on their luminance and contrasts, which are related to how bright the signs are perceived to be by drivers.

Photometric Measurements

Luminance

The mean daytime luminance of both the standard billboards and CEVMS was greater than at night. Nighttime luminance measurements reflect the fact that CEVMS use illuminating LED components while standard billboards are often illuminated from below by metal halide lamps. At night, CEVMS have a greater average luminance than standard billboards. Table 3 presents summary statistics for luminance as a function of time of day for the CEVMS and standard billboards.

Contrast

The daytime and nighttime Weber contrast ratios for both types of billboards are shown in table 3. Both CEVMS and standard billboards had contrast ratios that were close to zero (the surroundings were about equal in brightness to the signs) during the daytime. On the other hand, at night the CEVMS and standard billboards had positive contrast ratios (the signs were brighter than the surrounding), with the CEVMS having higher contrast than the standard billboards.

Table 3. Summary of luminance (cd/m^2) and contrast (Weber ratio) measurements.

	Luminance (cd/m^2)		*Contrast*	
Day	*Mean*	*St. Dev.*	*Mean*	*St .Dev.*
CEVMS	2126	798.81	-0.10	0.54
Standard Billboard	2993	2787.22	-0.27	0.84
Night				
CEVMS	56.00	23.16	73.72	56.92
Standard Billboard	17.80	17.11	36.01	30.93

Visual Complexity

The DCZs were characterized by their overall visual complexity or clutter. For each DCZ, five pictures were taken from the driver's viewpoint at various locations within the DCZ. In Reading, the pictures were taken from 2:00 p.m. to 4:00 p.m. In Richmond, one route was photographed from 11:00 a.m. to noon and the other from 2:30 p.m. to 3:30 p.m. The pictures were taken at the start of the DCZ, quarter of the way through, half of the way through, three quarters of the way through, and at the end of the DCZ. The photographs were analyzed with MATLAB® routines that computed a measure of feature congestion for each image. Figure 10 shows the mean feature congestion measures for each of the DCZ environments. The arterial control condition was shown to have the highest level of clutter as measured by feature congestion. An analysis of variance was performed on the feature congestion measure to determine if the conditions differed significantly from each other. The four conditions with off-premise advertising did not differ significantly with respect to feature congestion; $F(3,36) = 1.25$, $p > 0.05$. Based on the feature congestion measure, the results indicate that the four conditions with off-premise advertising were equated with respect to the overall visual complexity of the driving scenes.

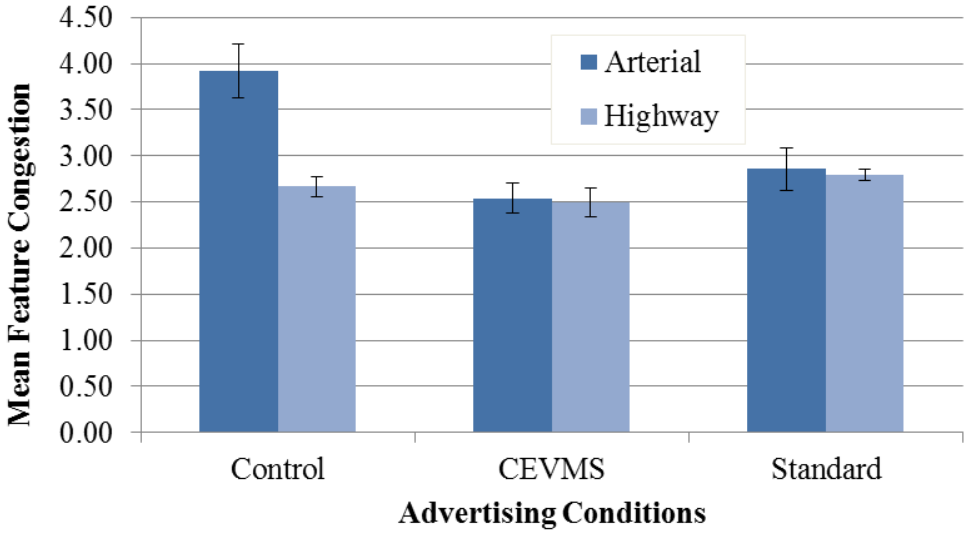

Figure 10. Mean feature congestion as a function of advertising condition and road type (standard errors for the mean are included in the graph).

Effects of Billboards on Gazes to the Road Ahead

For each 60 Hz frame, a determination was made as to the direction of the gaze vector. Previous research has shown that gazes do not need to be separated into saccades and fixations before calculating such measures as percent of time or the probability of looking to the road ahead.[39] This analysis examines the degree to which drivers gaze toward the road ahead across the different advertising conditions as a function of road type and time of day. Gazing toward the road ahead is critical for driving, and so the analysis examines the degree to which gazes toward this area are affected by the independent variables (advertising type, type of road, and time of day) and their interactions.

Generalized estimating equations (GEE) were used to analyze the probability of a participant gazing at driving-related information.[40,41] The data for these analyses were not normally distributed and included repeated measures. The GEE model is appropriate for these types of data and analyses. Note that for all results included in this report, Wald statistics were the chosen alternative to likelihood ratio statistics because GEE uses quasi-likelihood instead of maximum likelihood.[42] For this analysis, road ahead included the following ROIs (as previously described and displayed in figure 9): road ahead, road ahead top, and driving-related risks. A logistic regression model for repeated measures was generated by using a binomial response distribution and Logit (i.e., log odds) link function. Only two possible outcomes are allowed when selecting a binomial response distribution. Thus, a variable (RoadAhead) was created to classify a participant's gaze behavior. If the participant gazed toward the road ahead, road ahead top, or driving-related risks, then the value of RoadAhead was set to one. If the participant gazed at any other object in the panoramic scene, then the value of RoadAhead was set to zero. Logistic regression typically models the probability of a success. In the current analysis, a success would be a gaze to road ahead information (RoadAhead = 1) and a failure would be a gaze toward non-road ahead information (RoadAhead = 0). The resultant value was the probability of a participant gazing at road-ahead information.

Time of day (day or night), road type (freeway or arterial), advertising condition (CEVMS, standard billboard, or control), and all corresponding second-order interactions were explanatory variables in the logistic regression model. The interaction of advertising condition by road type was statistically significant, χ^2 (2) = 6.3, p = 0.043. Table 4 shows the corresponding probabilities for gazing at the road ahead as a function of advertising condition and road type.

Table 4. The probability of gazing at the road ahead as a function of advertising condition and road type.

Advertising Condition	*Arterial*	*Freeway*
Control	0.92	0.86
CEVMS	0.82	0.73
Standard	0.80	0.77

Follow-up analyses for the interaction used Tukey-Kramer adjustments with an alpha level of 0.05. The arterial control condition had the greatest probability of looking at the road ahead (M = 0.92). This probability differed significantly from the remaining five probabilities. On

arterials, the probability of gazing at the road ahead did not differ between the CEVMS (M = 0.82) and the standard billboard (M = 0.80) DCZs. In contrast, there was a significant difference in this probability on freeways, where standard billboard DCZs yielded a higher probability (M = 0.77) than CEVMS DCZs (M = 0.73). The probability of gazing at the road ahead was also significantly higher in the freeway control DCZ (M = 0.86) than in either of the corresponding freeway off-premise advertising DCZs. The probability of gazing at road-ahead information in arterial CEVMS DCZs was not statistically different from the same probability in the freeway control DCZ.

Additional descriptive statistics were computed to determine the probability of gazing at the various ROIs that were defined in the panoramic scene. Some of the ROIs depicted in figure 9 were combined in the following fashion for ease of analysis:

- Road ahead, road ahead top, and driving-related risks combined to form *road ahead*.
- Left side of road bottom and left side of road top combined to form *left side of vehicle*.
- Right side of road bottom and right side of road top combined to form *right side of vehicle*.
- Inside vehicle and top combined to form *participant vehicle*.

Table 5 presents the probability of gazing at the different ROIs.

Table 5. Probability of gazing at ROIs for the three advertising conditions on arterials and freeways.

Road Type	*ROI*	*CEVMS*	*Standard Billboard*	*Control*
Arterial	*CEVMS*	0.07	N/A	N/A
	Left Side of Vehicle	0.06	0.06	0.02
	Road ahead	0.82	0.80	0.92
	Right Side of Vehicle	0.03	0.06	0.04
	Standard Billboard	N/A	0.03	N/A
	Participant Vehicle	0.03	0.05	0.02
Freeway	*CEVMS*	0.05	N/A	N/A
	Left Side of Vehicle	0.08	0.07	0.04
	Road ahead	0.73	0.77	0.86
	Right Side of Vehicle	0.09	0.02	0.05
	Standard Billboard	0.02*	0.09	N/A
	Participant Vehicle	0.04	0.05	0.05

* The CEVMS DCZs on freeways each contained one visible standard billboard.

The probability of gazing away from the forward roadway ranged from 0.08 to 0.27. In particular, the probability of gazing toward a CEVMS was greater on arterials (M = 0.07) than on freeways (M = 0.05). In contrast, the probability of gazing toward a target standard billboard was greater on freeways (M = 0.09) than on arterials (M = 0.03).

Fixations to CEVMS and Standard Billboards

About 2.4 percent of the fixations were to CEVMS. The mean fixation duration to a CEVMS was 388 ms and the maximum duration was 1,251 ms. Figure 11 shows the distribution of fixation durations to CEVMS during the day and night. In the daytime, the mean fixation duration to a CEVMS was 389 ms and at night it was 387 ms. Figure 12 shows the distribution of fixation durations to standard billboards. Approximately 2.4 percent of fixations were to standard billboards. The mean fixation duration to standard billboards was 341 ms during the daytime and 370 ms at night. The maximum fixation duration to standard billboards was 1,284 ms (which occurred at night). For comparison purposes, figure 13 shows the distribution of fixation durations to the road ahead (i.e., top and bottom road ahead ROIs) during the day and night. In the daytime, the mean fixation duration to the road ahead was 365 ms and at night it was 390 ms.

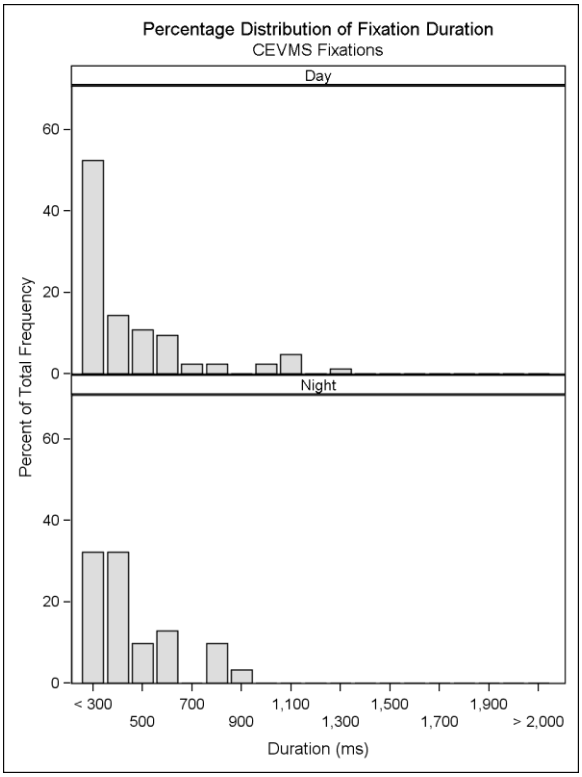

Figure 11. Distribution of fixation duration for CEVMS in the daytime and nighttime.

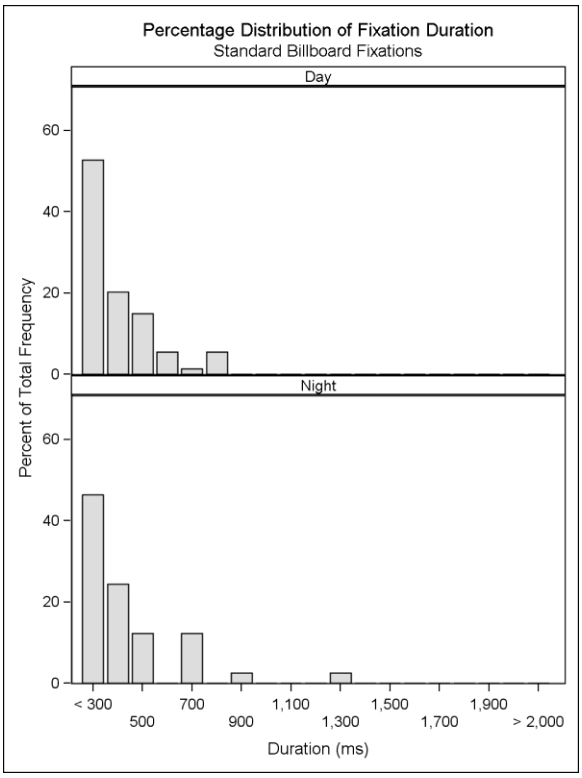

Figure 12. Distribution of fixation duration for standard billboards in the daytime and nighttime.

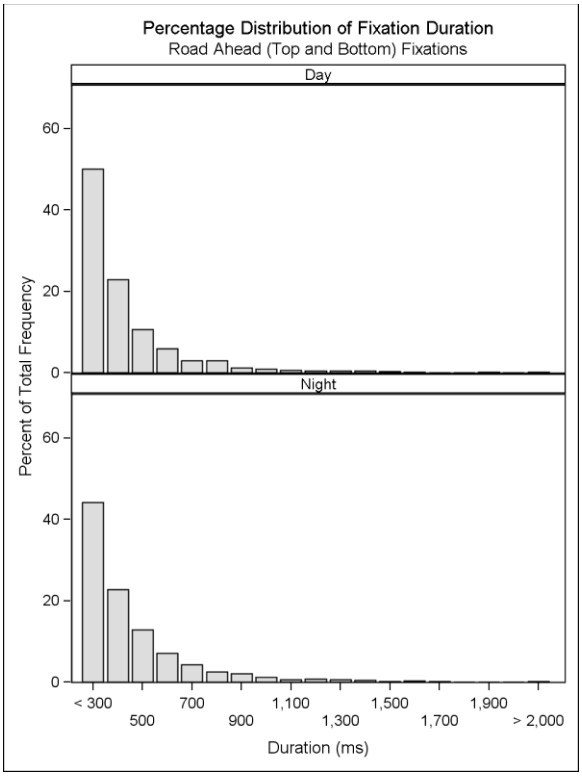

Figure 13. Distribution of fixation duration for road ahead (i.e., top and bottom road ahead ROIs) in the daytime and nighttime.

Dwell times on CEVMS and standard billboards were also examined. Dwell time is the duration of back-to-back fixations to the same ROI.[43,44] The dwell times represent the cumulative time for the back-to-back fixations. Whereas there may be no long, single fixation to a billboard, there might still be multiple fixations that yield long dwell times. There were a total of 25 separate instances of multiple fixations to CEVMS with a mean of 2.4 fixations (minimum of 2 and maximum of 5). The 25 dwell times came from 15 different participants distributed across four different CEVMS. The mean duration of these dwell times was 994 ms (minimum of 418 ms and maximum of 1,467 ms).

For standard billboards, there were a total of 17 separate dwell times with a mean of 3.47 sequential fixations (minimum of 2 fixations and maximum of 8 fixations). The 17 dwell times came from 11 different participants distributed across 4 different standard billboards. The mean duration of these multiple fixations was 1,172 ms (minimum of 418 ms and maximum of 3,319 ms). There were three dwell-time durations that were greater than 2,000 ms. These are described in more detail below.

In some cases several dwell times came from the same participant. In order to compute a statistic on the difference between dwell times for CEVMS and standard billboards, average dwell times were computed per participant for the CEVMS and standard billboard conditions. These average values were used in a t-test assuming unequal variances. The difference in average dwell time between CEVMS (M = 981 ms) and standard billboards (M= 1,386 ms) was not statistically significant, $t(12) = -1.40$, $p > .05$.

Figure 14 through figure 23 show heat maps for the dwell-time durations to the standard billboards that were greater than 2,000 ms. These heat maps are snapshots from the DCZ and attempt to convey in two dimensions the pattern of gazes that took place in a three dimensional world. The heat maps are set to look back approximately one to two seconds and integrate over time where the participant was gazing in the scene camera video. The green color in the heat map indicates the concentration of gaze over the past one to two seconds. The blue line indicates the gaze trail over the past one to two seconds.

Figure 14 through figure 16 are for a DCZ on an arterial at night. The standard billboard was on the right side of the road (indicated by a pink rectangle). There were eight fixations to this billboard, and the single fixations were between 200 to 384 ms in duration. The dwell time for this billboard was 2,019 ms. At the start of the DCZ (see figure 14), the driver was directing his/her gaze to the forward roadway. Approaching the standard billboard, the driver began to fixate on the billboard. However, the billboard was still relatively close to the road ahead ROI.

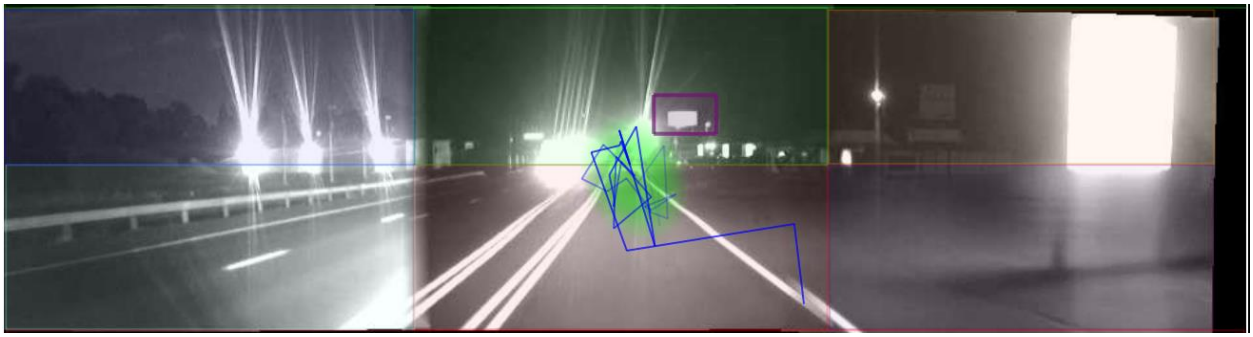

Figure 14. Heat map for the start of a DCZ for a standard billboard at night on an arterial.

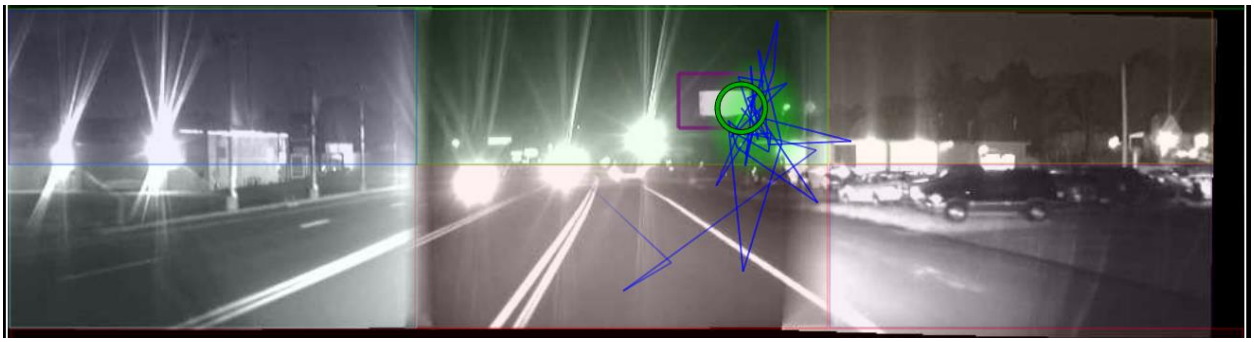

Figure 15. Heat map for the middle of a DCZ for a standard billboard at night on an arterial.

Figure 16. Heat map near the end of a DCZ for a standard billboard at night on an arterial.

Figure 17 through figure 19 are for a DCZ on a freeway at night. The standard billboard was on the right side of the road (indicated by a green rectangle). There were six consecutive fixations to this billboard, and the single fixations were between 200 and 801 ms in duration. The dwell time for this billboard was 2,753 ms. At the start of the DCZ (see figure 17), the driver was directing his/her gaze to a freeway guide sign in the road ahead and the standard billboard was to the left of the freeway guide sign. As the driver approached the standard billboard, his/her gaze was directed toward the billboard. The billboard was relatively close to the top and bottom road ahead ROIs. Near the end of the DCZ (see figure 19), the billboard was accurately portrayed as being on the right side of the road.

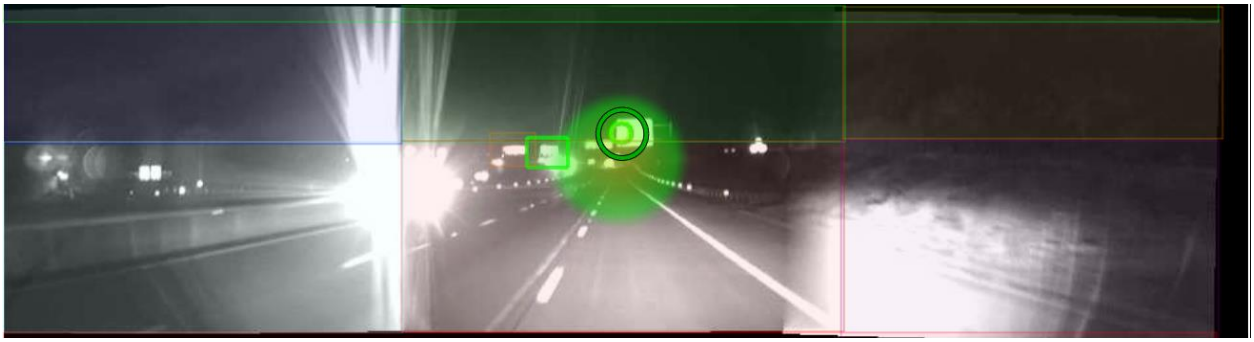

Figure 17. Heat map for start of a DCZ for a standard billboard at night on a freeway.

Figure 18. Heat map for middle of a DCZ for a standard billboard at night on a freeway.

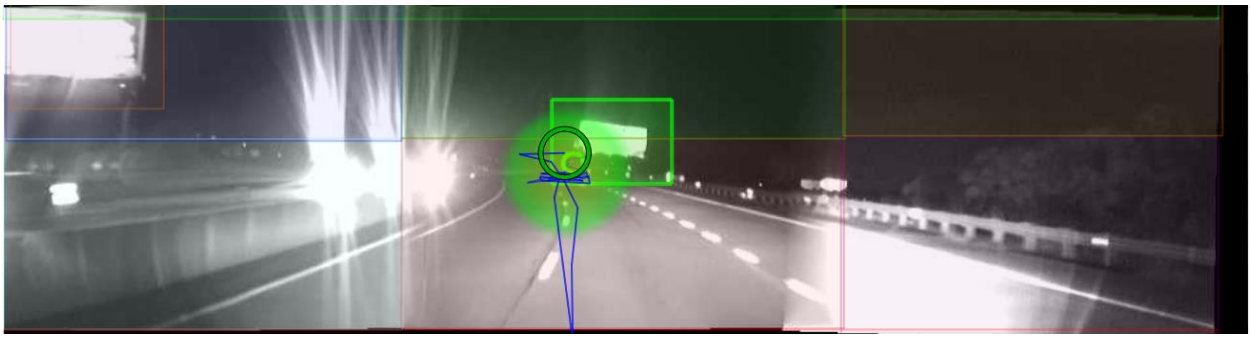

Figure 19. Heat map near the end of a DCZ for a standard billboard at night on a freeway.

Figure 20 through figure 23 are for a DCZ on a freeway during the day. The standard billboard was on the right side of the road (indicated by a pink rectangle). This is the same DCZ that was discussed in figure 17 through figure 19. There were six consecutive fixations to this billboard, and the single fixations were between 217 and 767 ms in duration. The dwell time for this billboard was 3,319 ms. At the start of the DCZ (see figure 20), the driver was principally directing his/her gaze to the road ahead. Figure 21 and figure 22 show the location along the DCZ where gaze was directed toward the standard billboard. The billboard was relatively close to the top and bottom road-ahead ROIs. As the driver passed the standard billboard, his/her gaze returned to the road ahead (see figure 23).

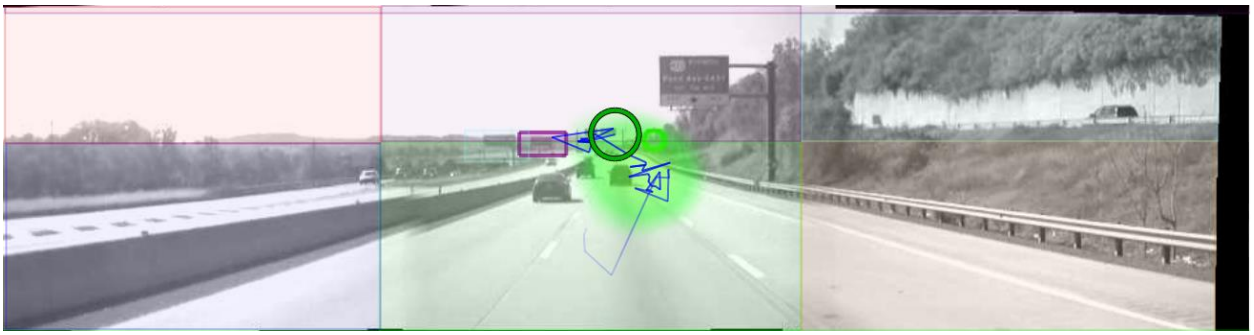

Figure 20. Heat map for the start of a DCZ for a standard billboard in the daytime on a freeway.

Figure 21. Heat map near the middle of a DCZ for a standard billboard in the daytime on a freeway.

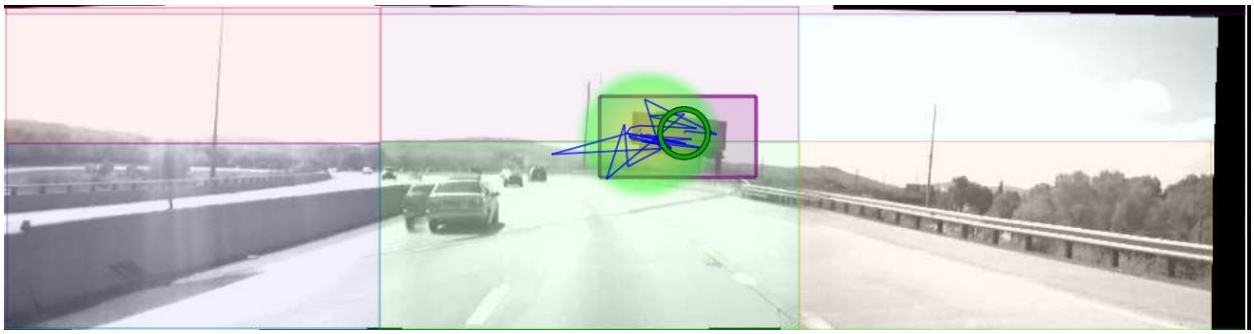

Figure 22. Heat map near the end of DCZ for standard billboard in the daytime on a freeway.

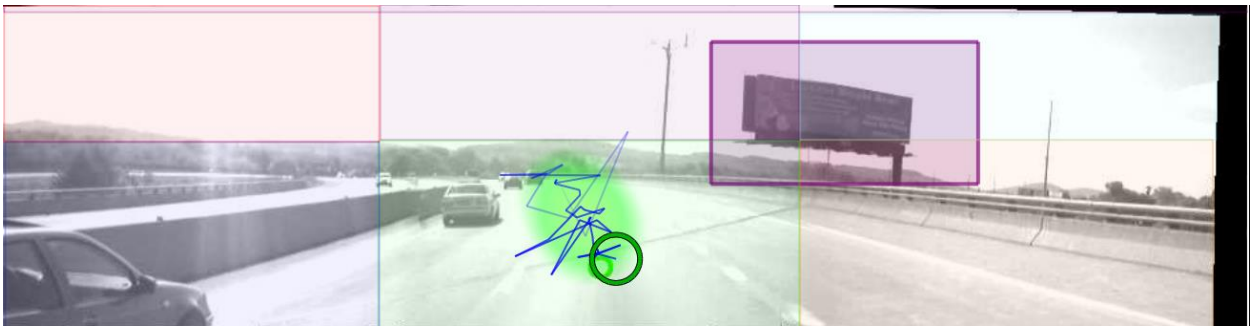

Figure 23. Heat map at the end of DCZ for standard billboard in the daytime on a freeway.

Comparison of Gazes to CEVMS and Standard Billboards

The GEE were used to analyze whether a participant gazed more toward CEVMS than toward standard billboards, given that the participant was gazing at off-premise advertising. With this analysis method, a logistic regression model for repeated measures was generated by using a binomial response distribution and Logit link function. First, the data was partitioned to include only those instances when a participant was gazing toward off-premise advertising (either to a CEVMS or to a standard billboard); all other gaze behavior was excluded from the input data set. Only two possible outcomes are allowed when selecting a binomial response distribution. Thus, a variable (SBB_CEVMS) was created to classify a participant's gaze behavior. If the participant gazed toward a CEVMS, the value of SBB_CEVMS was set to one. If the participant gazed toward a standard billboard, then the value of SBB_CEVMS was set to zero.

Logistic regression typically models the probability of a success. In the current analysis, a success would be a gaze to a CEVMS (SBB_CEVMS = 1) and a failure would be a gaze to a standard billboard (SBB_CEVMS = 0).[2] A success probability greater than 0.5 indicates there were more successes than failures in the sample. Therefore, if the sample probability of the response variable (i.e., SBB_CEVMS) was greater than 0.5, this would show that participants gazed more toward CEVMS than toward standard billboards when the participants gazed at off-premise advertising. In contrast, if the sample probability of the response variable was less than 0.5, then participants showed a preference to gaze more toward standard billboards than toward CEVMS when directing gazes to off-premise advertising.

Time of day (i.e., day or night), road type (i.e., freeway or arterial), and the corresponding interaction were explanatory variables in the logistic regression model. Road type was the only predictor to have a significant effect, $\chi^2(1) = 13.17$, $p < 0.001$. On arterials, participants gazed more toward CEVMS than toward standard billboards (M = 0.63). In contrast, participants gazed more toward standard billboards than toward CEVMS when driving on freeways (M = 0.33).

Observation of Driver Behavior

No near misses or driver errors were observed in Reading.

Level of Service

The mean vehicle densities were converted to level of service as shown in table 6.[(45)] As expected, less congestion occurred at night than in the day. In general, there was traffic during the data collection runs. Review of the scene camera data verified that all eye tracking data within the DCZs were recorded while the vehicle was in motion.

[2] Success and failure are not used to reflect the merits of either type of sign, but only for statistical purposes.

Table 6. Level of service as a function of advertising type, road type, and time of day.

	Arterial		*Freeway*	
	Day	Night	Day	Night
Control	B	A	C	B
CEVMS	C	A	B	A
Standard	A	A	B	A

DISCUSSION OF READING RESULTS

Overall the probability of gazing at the road ahead was high and similar in magnitude to what has been found in other field studies addressing billboards.[11,9,12] For the DCZs on freeways, CEVMS showed a lower proportion of gazes to the road ahead than the standard billboard condition, and both off-premise advertising conditions had lower probability of gazes to the road ahead than the control. On the other hand, on the arterials, the CEVMS and standard billboard conditions did not differ from each other but were significantly different from their respective control condition. Though the CEVMS condition on the freeway had the lowest proportion of gazes to the road ahead, in this condition there was a lower proportion of gazes to CEVMS as compared to the arterials (see table 5 for the trade-off of gazes to the different ROIs). A greater proportion of gazes to other ROIs (left side of the road, right side of the road, and participant vehicle) contributed to the decrease in proportion of gazes to the road ahead. Also, for the CEVMS on freeways, there were a few gazes to a standard billboard located in the same DCZ and there were more gazes distributed to the left and right side of the road than in standard billboard and control conditions. The gazes to ROIs other than CEVMS contributed to the lower probability of gazes to the road ahead in this condition.

The control condition on the arterial had buildings along the sides of the road and generally presented a visually cluttered area. As was presented earlier, the feature congestion measure computed on a series of photographs from each DCZ showed a significantly higher feature congestion score for the control condition on arterials as compared to all of the other DCZs. Nevertheless, the highest probability for gazing at the road ahead was seen in the control condition on the arterial.

The area with the highest feature congestion, especially on the sides of the road, had the highest probability for drivers looking at the road ahead. Bottom-up or stimulus driven measures of salience or visual clutter have been useful in predicting visual search and the effects of visual salience in laboratory tasks.[34,46] These measures of salience basically consider the stimulus characteristics (e.g., size, color, brightness) independent of the requirements of the task or plans that an individual may have. Models of visual salience may predict that buildings and other prominent features on the side of the road may be visually salient objects and thus would attract a driver's attention.[47] Figure 24 shows an example of a roadway photograph that was analyzed with the Salience Toolbox based on the Itti et al. implementation of a saliency based model of bottom-up attention.[48,49] The numbered circles in figure 24 are the first through fifth salient areas selected by the software. Based on this software, the most salient areas in the photographs are the buildings on the sides of the road where the road ahead (and a car) is the fifth selected salient area.

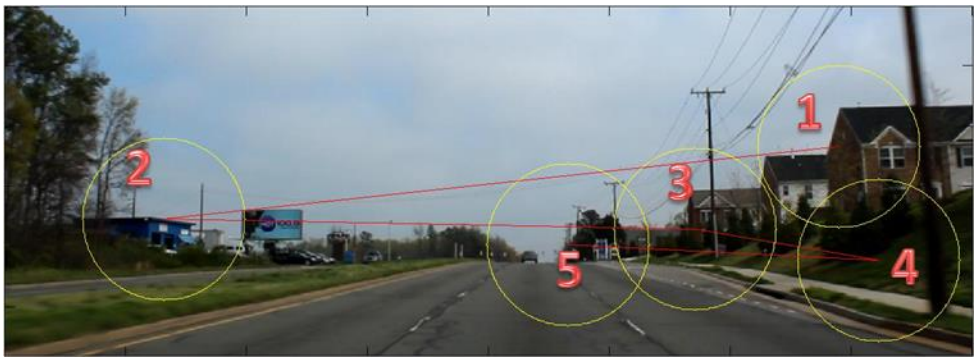

Figure 24. Example of identified salient areas in a road scene based on bottom-up analysis.

It appears that in the present study participants principally kept their eyes on the road even in the presence of visual clutter on the sides of the road, which supports the hypothesis that drivers tend to look toward information relevant to the task at hand.[50,26,22] In the case of the driving task, visual clutter may be more of an issue with respect to crowding that may affect the driver's ability to detect visual information in the periphery.[51] Crowding is generally defined as the negative effect of nearby objects or features on visual discrimination of a target.[52] Crowding impairs the ability to recognize objects in clutter and principally affects perception in peripheral vision. However, crowing effects were not analyzed in the present study.

Stimulus salience, clutter, and the nature of the task at hand interact in visual perception. For tasks such as driving, the task demands tend to outweigh stimulus salience when it comes to gaze control. Clutter may be more of an issue with the detection and recognition of objects in peripheral vision (e.g., detecting a sign on the side of the road) that are surrounded by other stimuli that result in a crowding effect.

The mean fixation durations to CEVMS, standard billboards, and the road ahead were found to be very similar. Also, there were no long fixations (greater than 2,000 ms) to CEVMS or standard billboards. The examination of multiple sequential fixations to CEVMS yielded average dwell times that were less than 1,000 ms. However, when examining the tails of the distribution, there were three dwell times to standard billboards that were in excess of 2,000 ms (the three dwell times came from three different participants to two different billboards). These three standard billboards were dwelled upon when they were near the road ahead area but drivers quit gazing at the signs as they neared them and the signs were no longer near the forward field of view. Though there were three dwell times for standard billboards greater than 2,000 ms, the difference in average dwell times for CEVMS and standard billboards was not significant.

Using a gaze duration of 2,000 ms away from the road ahead as a criterion indicative of increased risk has been developed principally as it relates to looking inside the vehicle to in-vehicle information systems and other devices (e.g., for texting) where the driver is indeed looking completely away from the road ahead.[14,53,54] The fixations to the standard billboards in the present case showed a long dwell time for a billboard. However, unlike gazing or fixating inside the vehicle, the driver's gaze was within the forward roadway where peripheral vision could be used to monitor for hazards and for vehicle control. Peripheral vision has been shown to be important for lane keeping, visual search orienting, and monitoring of surrounding objects.[55,56]

The results showed that drivers were more likely to gaze at CEVMS on arterials and at standard billboards on freeways. Though every attempt was made to select CEVMS and standard billboard DCZs that were equated on important parameters (e.g., which side of the road the sign was located on, type of road, level of visual clutter), the CEVMS DCZs on freeways had a greater setback from the road (133 ft for both CEVMS) than the standard billboards (10 and 35 ft). Signs with greater setback from the road would in a sense move out of the forward view (road ahead) more quickly than signs that are closer to the road. The CEVMS and standard billboards on the arterials were more closely matched with respect to setback from the road (12 and 43 ft for CEVMS and 20 and 40 ft for standard billboards).

The differences in setback from the road for CEVMS and standard billboards may also account for differences in dwell times to these two types of billboards. However, on arterials where the CEVMS and standard billboards were more closely matched there was only one long dwell time (greater than 2,000 ms) and it was to a standard billboard at night.

RICHMOND

The objectives of the second study were the same as those in the first study, and the design of the Richmond data collection effort was very similar to that employed in Reading. This study was conducted to replicate as closely as possible the design of Reading in a different driving environment. The independent variables included the type of DCZ (CEVMS, standard billboard, or no off-premise advertising), time of day (day or night) and road type (freeway or arterial). As with Reading, the time of day was a between-subjects variable and the other variables were within subjects.

METHOD

Selection of DCZ Limits

Selection of the DCZ limits procedure was the same as that employed in Reading.

Advertising Type

Three DCZ types (similar to those used in Reading) were used in Richmond:

- **CEVMS.** DCZs contained one target CEVMS.
- **Standard billboard.** DCZs contained one target standard billboard.
- **Control conditions.** DCZs did not contain any off-premise advertising.

There were an equal number of CEVMS and standard billboard DCZs on freeways and arterials. Also, there two DCZ that did not contain off-premise advertising with one located on a freeway and the other on an arterial.

Table 7 is an inventory of the target employed in this second study.

Table 7. Inventory of target billboards in Richmond with relevant parameters.

DCZ	*Advertising Type*	*Copy Dimensions (ft)*	*Side of Road*	*Setback from Road (ft)*	*Other Standard Billboards*	*Approach Length (ft)*	*Roadway Type*
5	CONTROL	N/A	N/A	N/A	N/A	710	Arterial
3	CONTROL	N/A	N/A	N/A	N/A	845	Freeway
9	CEVMS	14'0" x 28'0"	L	37	0	696	Arterial
13	CEVMS	14'0" x 28'0"	R	37	0	602	Arterial
2	CEVMS	12'5" x 40'0"	R	91	0	297	Freeway
8	CEVMS	11'0 x 23'0"	L	71	0	321	Freeway
10	Standard	14'0" x 48'0"	L	79	1	857	Arterial
12	Standard	10'6" x 45'3"	R	79	2	651	Arterial
1	Standard	14'0" x 48'0"	L	87	0	997	Freeway
7	Standard	14'0" x 48'0"	R	88	0	816	Freeway

** N/A indicates that there were no off-premise advertising in these areas and these values are undefined.*

Figure 25 through figure 30 below represent various pairings of DCZ type and road type. Target off-premise billboards are indicated by red rectangles.

Figure 25. Example of a CEVMS DCZ on a freeway.

Figure 26. Example of CEVMS DCZ an arterial.

Figure 27. Example of a standard billboard DCZ on a freeway.

Figure 28. Example of a standard billboard DCZ on an arterial.

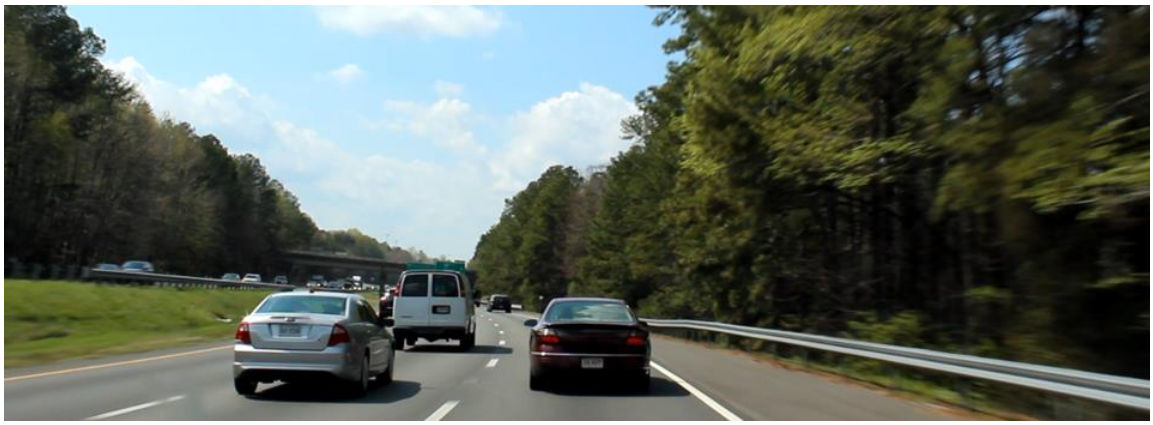

Figure 29. Example of a control DCZ on a freeway.

Figure 30. Example of a control DCZ on an arterial.

Photometric Measurement of Signs

The methods and procedures for the photometric measures were the same as for Reading.

Visual Complexity

The methods and procedures for visual complexity measurement were the same as for Reading.

Participants

A total of 41 participants were recruited for the study. Of these, 6 participants did not complete data collection because of an inability to properly calibrate with the eye tracking system, and 11 were excluded because of equipment failures. A total of 24 participants (13 male, M = 28 years; 11 female, M = 25 years) successfully completed the drive. Fourteen people participated during the day and 10 participated at night.

Procedures

Research participants were recruited locally by means of visits to public libraries, student unions, community centers, etc. A large number of the participants were recruited from a nearby university, resulting in a lower mean participant age than in Reading.

Participant Testing

Two people participated each day. One person participated during the day beginning at approximately 12:45 p.m. The second participated at night beginning at around 7:00 p.m. Data collection ran from November 20, 2009, through April 23, 2010. There were several long gaps in the data collection schedule due to holidays and inclement weather.

Pre-Data Collection Activities

This was the same as in Reading.

Practice Drive

Except for location, this was the same as in Reading.

Data Collection

The procedure was much the same as in Reading. On average, each test route required approximately 30 to 35 minutes to complete. As in Reading, the routes included a variety of freeway and arterial driving segments. One route was 15 miles long and contained two target CEVMS, two target standard billboards, and two DCZs with no off-premise advertising. The second route was 20 miles long and had two target CEVMS and two target standard billboards.

The data collection drives in this second study were longer than those in Reading. The eye tracking system had problems dealing with the large files that resulted. To mitigate this technical difficulty, participants were asked to pull over in a safe location during the middle of each data collection drive so that new data files could be initiated.

Upon completion of the data collection, the participant was instructed to return to the designated meeting location for debriefing.

Debriefing

This was the same as in Reading.

DATA REDUCTION

Eye Tracking Measures

The approach and procedures were the same as used in Reading.

Other Measures

The approach and procedures were the same as used in Reading.

RESULTS

Photometric Measurement of Signs

The photometric measurements were performed using the same equipment and procedures that were employed in Reading with a few minor changes. Photometric measurements were taken during the day and at night. Measurements of the standard billboards were taken at an average distance of 284 ft, with maximum and minimum distances of 570 ft and 43 ft, respectively. The average distance of measurements for the CEVMS was 479 ft, with maximum and minimum distances of 972 ft and 220 ft, respectively. Again, the distances employed were significantly affected by the requirement to find a safe location on the road from which to take the measurements.

Luminance

The mean luminance of CEVMS and standard billboards, during daytime and nighttime are shown below in table 8. The results here are similar to those for Reading.

Contrast

The daytime and nighttime Weber contrast ratios for both types of billboards are shown in table 8. During the day, the contrast ratios of both CEVMS and standard billboards were close to zero (the surroundings were about equal in brightness to the signs). At night, the CEVMS and standard billboards had positive contrast ratios. Similar to Reading, the CEVMS showed a higher contrast ratio than the standard billboards at night.

Table 8. Summary of luminance (cd/m^2) and contrast (Weber ratio) measurements.

	Luminance (cd/m^2)		***Contrast***	
Day	Mean	St. Dev.	Mean	St. Dev.
CEVMS	2134	798.70	-0.20	0.53
Standard Billboard	3063	2730.92	0.03	0.32
Night				
CEVMS	56.44	16.61	69.70	59.18
Standard Billboard	8.00	5.10	6.56	3.99

Visual Complexity

As with Reading, the feature congestion measure was used to estimate the level of visual complexity/clutter in the DCZs. The analysis procedures were the same as for Reading.

Figure 31 shows the mean feature congestion measures for each of the advertising types (standard errors are included in the figure). Unlike the results for Reading, the selected off-premise advertising DCZs for Richmond differed in terms of mean feature congestion; $F(3, 36) = 3.95$, $p = 0.016$. Follow up t-tests with an alpha of 0.05 showed that the CEVMS DCZs on arterials had significantly lower feature congestion than all of the other off-premise advertising conditions. None of the remaining DCZs with off-premise advertising differed from each other. The selection of DCZs for the conditions with off-premise advertising took into account the type of road, the side of the road the target billboard was placed, and the perceived level of visual clutter. Based on the feature congestion measure, these results indicated that the conditions with off-premise advertising were not equated with respect to level of visual clutter.

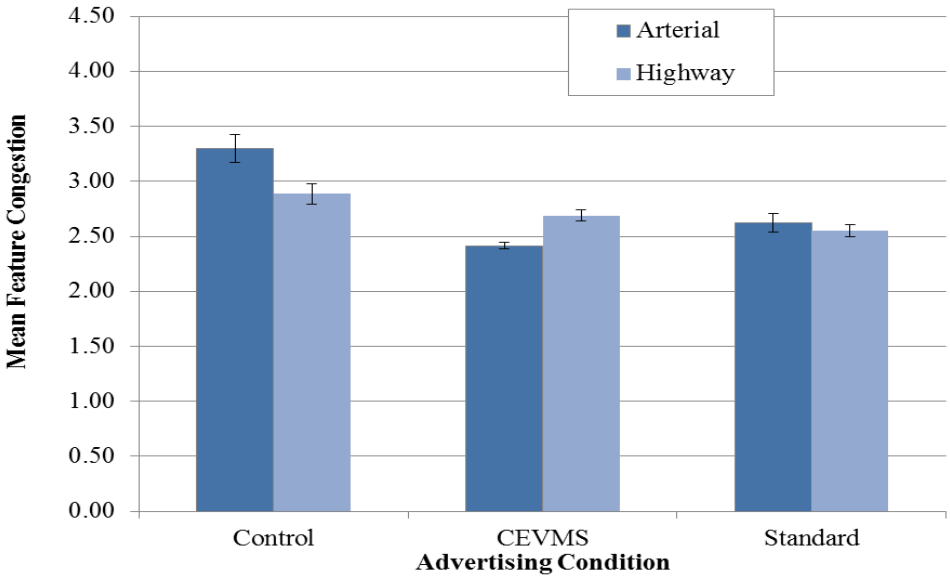

Figure 31. Mean feature congestion as a function of advertising condition and road type.

Effects of Billboards on Gazes to the Road Ahead

As was done for the data from Reading, GEE were used to analyze the probability of a participant gazing at the road ahead. A logistic regression model for repeated measures was generated by using a binomial response distribution and Logit link function. The resultant value was the probability of a participant gazing at the road ahead (as previously defined).

Time of day (day or night), road type (freeway or arterial), advertising type (CEVMS, standard billboard, or control), and all corresponding second-order interactions were explanatory variables in the logistic regression model. The interaction of advertising type by road type was statistically significant, $\chi^2(2) = 14.19$, $p < 0.001$. Table 9 shows the corresponding probability of gazing at the road ahead as a function of advertising condition and road type.

Table 9. The probability of gazing at the road ahead as a function of advertising condition and road type.

Advertising Condition	*Arterial*	*Freeway*
Control	0.78	0.92
CEVMS	0.76	0.82
Standard	0.81	0.85

Follow-up analyses for the interaction used Tukey-Kramer adjustments with an alpha level of 0.05. The freeway control had the greatest probability of gazing at the road ahead (M = 0.92). This probability differed significantly from the remaining five probabilities. On arterials, there were no significant differences among the probabilities of gazing at the road ahead among the three advertising conditions. On freeways, there was no significant difference between the probability associated with CEVMS DCZs and the probability associated with standard billboard DCZs.

Additional descriptive statistics were computed for the three advertising types to determine the probability of gazing at the ROIs that were defined in the panoramic scene. As was done with the data from Reading, some of the ROIs were combined for ease of analysis. Table 10 presents the probability of gazing at the different ROIs.

Table 10. Probability of gazing at ROIs for the three advertising conditions on arterials and freeways.

Road Type	*ROI*	*CEVMS*	*Standard Billboard*	*Control*
Arterial	*CEVMS*	0.06	N/A	N/A
	Left Side of Vehicle	0.03	0.05	0.04
	Road ahead	0.76	0.81	0.78
	Right Side of Vehicle	0.07	0.06	0.09
	Standard Billboard	N/A	0.02	N/A
	Participant Vehicle	0.07	0.06	0.09
Freeway	*CEVMS*	0.05	N/A	N/A
	Left Side of Vehicle	0.03	0.01	0.01
	Road ahead	0.82	0.85	0.92
	Right Side of Vehicle	0.04	0.04	0.03
	Standard Billboard	N/A	0.04	N/A
	Participant Vehicle	0.06	0.06	0.05

The probability of gazing away from the forward roadway ranged from 0.08 to 0.24. In particular, the probability of gazing toward a CEVMS was slightly greater on arterials (M = 0.06) than on freeways (M = 0.05). In contrast, the probability of gazing toward a standard billboard was greater on freeways (M = 0.04) than on arterials (M = 0.02). In both situations, the probability of gazing at the road ahead was greatest on freeways.

Fixations to CEVMS and Standard Billboards

About 2.5 percent of the fixations were to CEVMS. The mean fixation duration to a CEVMS was 371 ms and the maximum fixation duration was 1,335 ms. Figure 32 shows the distribution of fixation durations to CEVMS during the day and at night. In the daytime, the mean fixation duration to a CEVMS was 440 ms and at night it was 333 ms. Approximately 1.5 percent of the fixations were to standard billboards. The mean fixation duration to standard billboards was 318 ms and the maximum fixation duration was 801 ms. Figure 33 shows the distribution of fixation durations for standard billboards. The mean fixation duration to a standard billboard was 313 ms and 325 ms during the day and night, respectively. For comparison purposes, figure 34 shows the distribution of fixation durations to the road ahead during the day and night. In the daytime, the mean fixation duration to the road ahead was 378 ms and at night it was 358 ms.

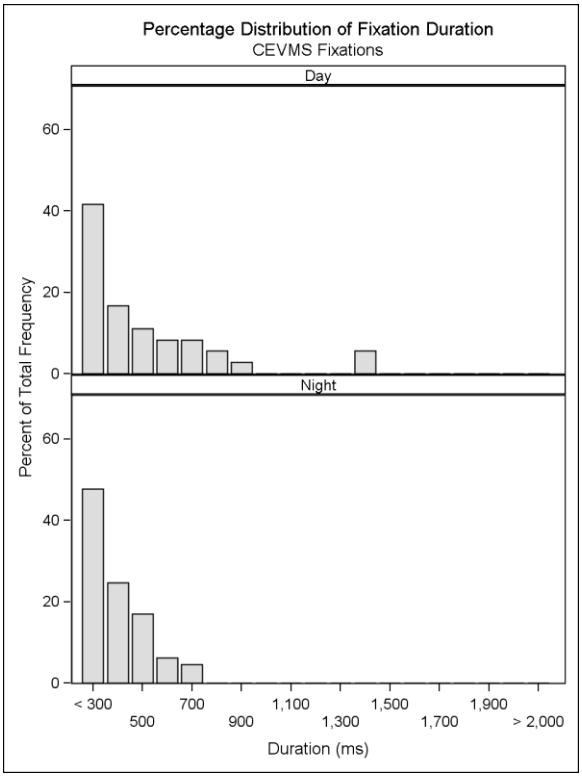

Figure 32. Fixation duration for CEVMS in the day and at night.

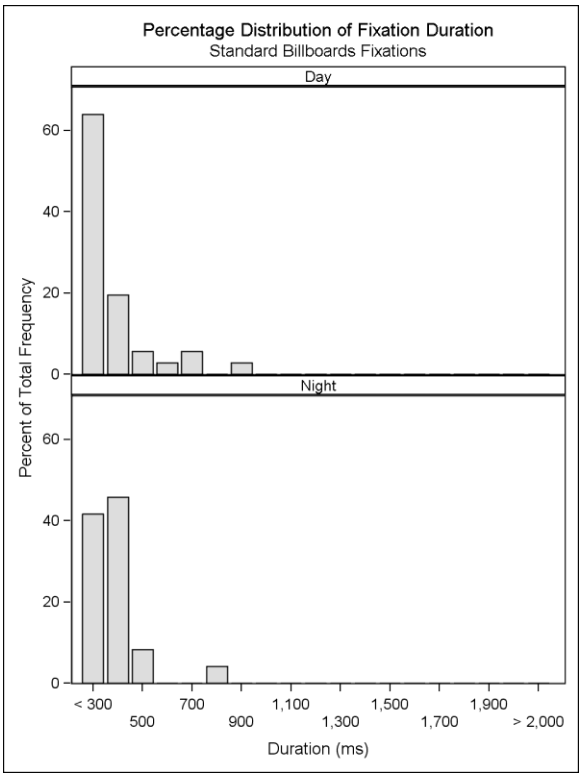

Figure 33. Fixation duration for standard billboards in the day and at night.

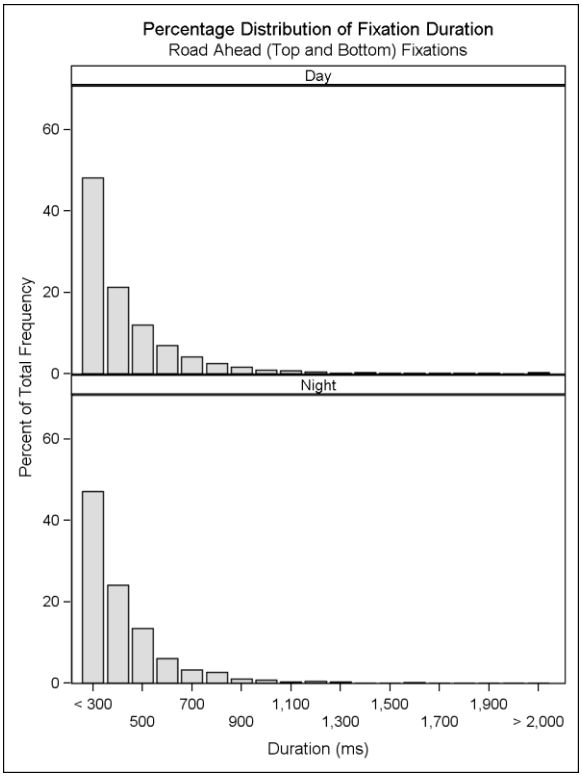

Figure 34. Fixation duration for the road ahead in the day and at night.

As was done with the data for Reading, the record of fixations was examined to determine dwell times to CEVMS and standard billboards. There were a total of 21 separate dwell times to CEVMS with a mean of 2.86 sequential fixations (minimum of 2 fixations and maximum of 6 fixations). The 21 dwell times came from 12 different participants and four different CEVMS. The mean dwell time duration to the CEVMS was 1,039 ms (minimum of 500 ms and maximum of 2,720 ms). There was one dwell time greater than 2,000 ms to CEVMS. To the standard billboards there were 13 separate dwell times with a mean of 2.31 sequential fixations (minimum of 2 fixations and maximum of 3 fixations). The 13 dwell times came from 11 different participants and four different standard billboards. The mean dwell time duration to the standard billboards was 687 ms (minimum of 450 ms and maximum of 1,152 ms). There were no dwell times greater than 2,000 ms to standard billboards.

In some cases several dwell times came from the same participant. To compute a statistic on the difference between dwell times for CEVMS and standard billboards, average dwell times were computed per participant for the CEVMS and standard billboard conditions. These average values were used in a *t*-test assuming unequal variances. The difference in average dwell time between CEVMS (M = 1,096 ms) and standard billboards (M= 674 ms) was statistically significant, $t(14) = 2.23$, $p = .043$.

Figure 35 through figure 37 show heat maps for the dwell-time durations to the CEVMS that were greater than 2,000 ms. The DCZ was on a freeway during the daytime. The CEVMS is located on the left side of the road (indicated by an orange rectangle). There were three fixations to this billboard, and the single fixations were between 651 ms and 1,335 ms. The dwell time for this billboard was 2,270 ms. Figure 35 shows the first fixation toward the CEVMS. There are no vehicles near the participant in his/her respective travel lane or adjacent lanes. In this situation, the billboard is relatively close to the road ahead ROI. Figure 36 shows a heat map later in the DCZ where the driver continues to look at the CEVMS. The heat map does not overlay the CEVMS in the picture since the heat map has integrated over time where the driver was gazing. The CEVMS has moved out of the area because of the vehicle moving down the road. However, visual inspection of the video and eye tracking statistics showed that the driver was fixating on the CEVMS. Figure 37 shows the end of the sequential fixations to the CEVMS. The driver returns to gaze directly in front of the vehicle. Once the CEVMS was out of the forward field of view, the driver quit looking at the billboard.

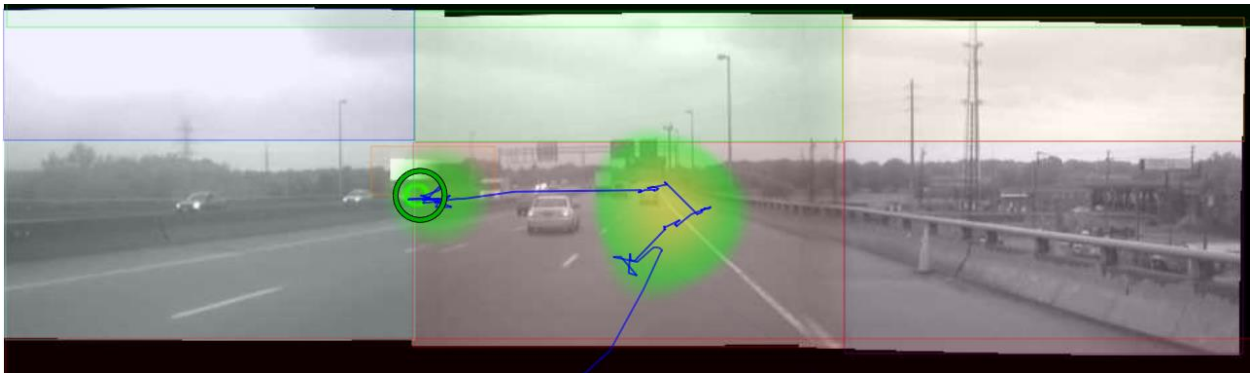

Figure 35. Heat map for first fixation to CEVMS with long dwell time.

Figure 36. Heat map for later fixations to CEVMS with long dwell time.

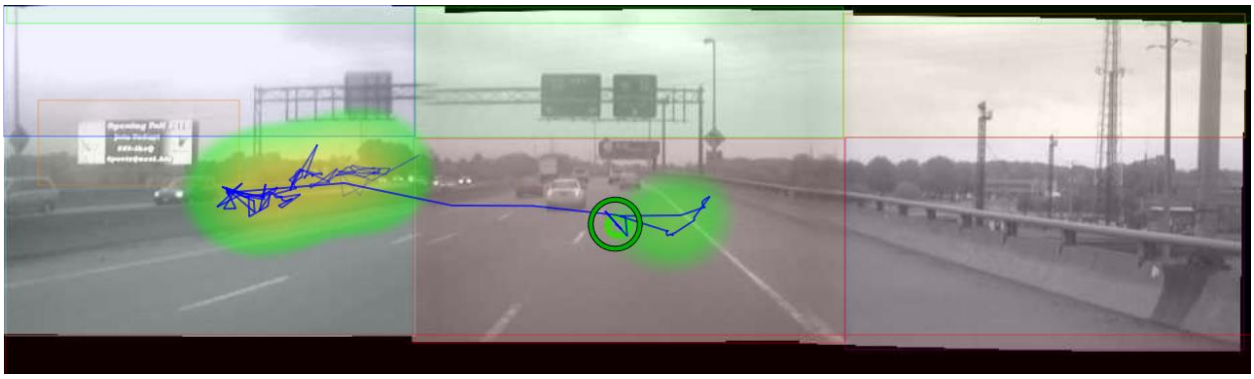

Figure 37. Heat map at end of fixations to CEVMS with long dwell time.

Comparison of Gazes to CEVMS and Standard Billboards

As was done for the data from Reading, GEE were used to analyze whether a participant gazed more toward CEVMS than toward standard billboards, given that the participant was looking at off-premise advertising. Recall that a sample probability greater than 0.5 indicated that participants gazed more toward CEVMS than standard billboards when the participants gazed at off-premise advertising. In contrast, if the sample probability was less than 0.5, participants showed a preference to gaze more toward standard billboards than CEVMS when directing visual attention to off-premise advertising.

Time of day (i.e., day or night), road type (i.e., freeway or arterial), and the corresponding interaction were explanatory variables in the logistic regression model. Time of day had a significant effect on participant gazes toward off-premise advertising, χ^2 (1) = 4.46, p = 0.035. Participants showed a preference to gaze more toward CEVMS than toward standard billboards during both times of day. During the day the preference was only slight (M = 0.52), but at night the preference was more pronounced (M = 0.71). Road type was also a significant predictor of where participants directed their gazes at off-premise advertising, χ^2 (1) = 3.96, p = 0.047. Participants gazed more toward CEVMS than toward standard billboards while driving on both types of roadways. However, driving on freeways yielded a slight preference for CEVMS over standard billboards (M = 0.55), but driving on arterials resulted in a larger preference in favor of CEVMS (M = 0.68).

Observation of Driver Behavior

No near misses or driver errors occurred.

Level of Service

Table 11 shows the level of service as a function of advertising type, type of road, and time of day. As expected, there was less congestion during the nighttime runs than in the daytime. In general, there was traffic during the data collection runs; however, the eye tracking data were recorded while the vehicles were in motion.

Table 11. Estimated level of service as a function of advertising condition, road type, and time of day.

	Arterial		Freeway	
	Day	Night	Day	Night
Control	B	A	C	B
CEVMS	B	A	B	A
Standard	C	A	C	C

DISCUSSION OF RICHMOND RESULTS

Overall the probability of looking at the forward roadway was high across all conditions and consistent with the findings from Reading and previous related research.[11,9,12] In this second study the CEVMS and standard billboard conditions did not differ from each other. For the DCZs on arterials there were no significant differences among the control, CEVMS, and standard billboard conditions. On the other hand, while the CEVMS and standard billboard conditions on the freeways did not differ from each other, they were significantly different from their respective control conditions. The control condition on the freeway principally had trees along the sides of the road and the signs that were present were freeway signs located in the road ahead ROI.

Measures such as feature congestion rated the three DCZs on freeways as not being statistically different from each other. These types of measures have been useful in predicting visual search and the effects of visual salience in laboratory tasks.[34] Models of visual salience may predict that, at least during the daytime, trees on the side of the road may be visually salient objects that would attract a driver's attention.[47] However, it appears that in the present study, participants principally kept their eyes on the road ahead.

The mean fixations to CEVMS, standard billboards, and the road ahead were found to be similar in magnitude with no long fixations. Examination of dwell times showed that there was one long dwell time for a CEVMS greater than 2,000 ms and it occurred in the daytime on a sign located on the left side of the road on a freeway DCZ. Furthermore, when averaging among participants the mean dwell time for CEVMS was significantly longer than to standard billboards, but still under 2,000 ms. For the dwell time greater than 2,000 ms, examination of the scene camera video and eye tracking heat maps showed that the driver was initially looking toward the forward roadway and made a first fixation to the sign. Three fixations were made to the sign and then the

driver started looking back to the road ahead as the sign moved out of the forward field of view. On the video there were no vehicles near the subject driver's own lane or in adjacent lanes.

Only the central 2 degrees of vision, foveal vision, provide resolution sharp enough for reading or recognizing fine detail.[57] However, useful information for reading can be extracted from parafoveal vision, which encompasses the central 10 degrees of vision.[57] More recent research on scene gist recognition[3] has shown that peripheral vision (beyond parafoveal vision) is more useful than central vision for recognizing the gist of a scene.[58] Scene gist recognition is a critically important early stage of scene perception, and influences more complex cognitive processes such as directing attention within a scene and facilitating object recognition, both of which are important in obtaining information while driving.

The results of this study do show one duration of eyes off the forward roadway greater than 2,000 ms, the duration at which Klauer et al. observed near-crash/crash risk at more than twice those of normal, baseline driving.[14,53] When looking at the tails of the fixation distributions, few fixations were greater than 1,000 ms, with the longest fixation being equal to 1,335 ms.[53,54] The one long dwell time on a CEVMS that was observed was a rare event in this study, and review of the video and eye tracking data suggests that the driver was effectively managing acquisition of visual information while driving and fixated on the advertising. However, additional work needs to be done to derive criteria for gazing or fixating away from the forward road view where the road scene is still visible in peripheral vision.

The results showed that drivers are more likely to look at CEVMS than standard billboards during the nighttime across the conditions tested (at night the average probability of gazing at CEVMS was M= 0.71). CEVMS do have greater luminance than standard billboards at night and also have higher contrast. The CEVMS have the capability of being lit up so that they would appear as very bright signs to drivers (for example, up to about10,000 cd/m^2 for a white square on the sign.). However, our measurements of these signs showed an average luminance of about 56 cd/m^2. These signs would be conspicuous in a nighttime driving environment but significantly less so than other light sources such as vehicle headlights. Drivers were also more likely to look at CEVMS than standard billboards on both arterials and freeways, with a higher probability of gazes on arterials.

In this second study, CEVMS and standard billboards were more nearly equated with respect to setback from the road. Gazes to the road ahead were not significantly different between CEVMS and standard billboard DCZs across conditions and the proportion of gazes to the road ahead were consistent with previous research. One long dwell time for a CEVMS was observed in this study; however, it occurred in the daytime where the luminance and contrast (affecting the perceived brightness) of these signs are similar to those for standard billboards.

[3] "Scene gist recognition" refers to the element of human cognition that enables us to determine the meaning of a scene and categorize it by type (e.g., a beach, an office) almost immediately upon seeing it.

GENERAL DISCUSSION

This study was conducted to investigate the effect of CEVMS on driver visual behavior in a roadway driving environment. An instrumented vehicle with an eye tracking system was used. Roads containing CEVMS, standard billboards, and control areas with no off-premise advertising were selected. The CEVMS and standard billboards were measured with respect to luminance, location, size, and other relevant variables to characterize these visual stimuli. Unlike previous studies on digital billboards, the present study examined CEVMS as deployed in two United States cities and did not contain dynamic video or other dynamic elements. The CEVMS changed content approximately every 8 to 10 seconds, consistent within the limits provided by FHWA guidance.[2] In addition, the eye tracking system used had nearly a 2-degree level of resolution that provided significantly more accuracy in determining what objects the drivers were gazing or fixating on as compared to some previous field studies examining CEVMS.

CONCLUSIONS

Do CEVMS attract drivers' attention away from the forward roadway and other driving relevant stimuli?

Overall, the probability of looking at the road ahead was high across all conditions. In Reading, the CEVMS condition had a lower proportion of gazes to the road ahead than the standard billboard condition on the freeways. Both of the off-premise advertising conditions had a lower proportion of gazes to the road ahead than the control condition on the freeway. The lower proportion of gazes to the road ahead can be attributed to the overall distribution of gazes away from the road ahead and not just to the CEVMS. On the other hand, for the arterials the CEVMS and standard billboard conditions did not differ from each other, but both had a lower proportion of gazes to the road ahead compared to the control. In Richmond there were no differences among the three advertising conditions on the arterials. However, for the freeways the CEVMS and standard billboard conditions did not differ from each other but had a lower proportion of gazes to the road ahead than the control.

The control conditions differed across studies. In Reading, the control condition on arterials showed 92 percent for gazing at the road ahead while on the freeway it was 86 percent. On the other hand, in Richmond the control condition for arterials was 78 percent and for the freeway it was 92 percent. The control conditions on the freeway differed across the two studies. In Reading there were businesses off to the side of the road; whereas in Richmond the sides of the road were mostly covered with trees. The control conditions on the arterials also differed across cities in that both contained businesses and on-premise advertising; however, in Reading arterials had four lanes and in Richmond arterials had six lanes. The reason for these differences across cities was that these control conditions were selected to match the other conditions (CEVMS and standard billboards) that the drivers would experience in the two respective cities. Also, the selection of DCZs was obviously constrained by what was available on the ground in these cities.

The results for the off-premise advertising conditions are consistent with Lee et al., who observed that 76 percent of drivers' time was spent looking at the road ahead in the CEVMS scenario and 75 percent in the standard billboard scenario.[9] However, it should be kept in mind

that drivers did gaze away from the road ahead even when no off-premise advertising was present and that the presence of clutter or salient visual stimuli did not necessarily control where drivers gazed.

Do glances to CEVMS occur that would suggest a decrease in safety?

In DCZs containing CEVMS, about 2.5 percent of the fixations were to CEVMS (about 2.4 percent to standard billboards). The results for fixations are similar to those reported in other field data collection efforts that included advertising signs.[12,11,9,13] Fixations greater than 2,000 ms were not observed for CEVMS or standards billboards.

However, an analysis of dwell times to CEVMS showed a mean dwell time of 994 ms (maximum of 1,467 ms) for Reading and a mean of 1,039 ms (maximum of 2,270 ms) for Richmond. Statistical comparisons of average dwell times between CEVMS and standard billboards were not significant in Reading; however, in Richmond the average dwell times to CEVMS were significantly longer than to standard billboards, though below 2,000 ms. There was one dwell time greater than 2,000 ms to a CEVMS across the two cities. On the other hand, for standard billboards there were three long dwell times in Reading; there were no long dwell times to these billboards in Richmond. Review of the video data for these four long dwell times showed that the signs were not far from the forward view when participants were fixating. Therefore, the drivers still had access to information about what was in front of them through peripheral vision.

As the analyses of gazes to the road ahead showed, drivers distributed their gazes away from the road ahead even when there were no off-premise billboards present. Also, drivers gazed and fixated on off-premise signs even though they were generally irrelevant to the driving task. However, the results did not provide evidence indicating that CEVMS were associated with long glances away from the road that may reflect an increase in risk. When long dwell times occurred to CEVMS or standard billboards, the road ahead was still in the driver's field of view.

Do drivers look at CEVMS more than at standard billboards?

The drivers were generally more likely to gaze at CEVMS than at standard billboards. However, there was some variability between the two locations and between type of roadway (arterial or freeway). In Reading, the participants looked more often at CEVMS when on arterials, whereas they looked more often at standard billboards when on freeways. In Richmond, the drivers looked at CEVMS more than standard billboards no matter the type of road they were on, but as in Reading the preference for gazing at CEVMS was greater on arterials (68 percent on arterials and 55 percent on freeways). The slower speed on arterials and sign placement may present drivers with more opportunities to gaze at the signs.

In Richmond, the results showed that drivers gazed more at CEVMS than standard billboards at night; however, for Reading no effect for time of day was found. CEVMS do have higher luminance and contrast than standard billboards at night. The results showed mean luminance of about 56 cd/m^2 in the two cities where testing was conducted. These signs would appear clearly visible but not overly bright.

SUMMARY

The results of these studies are consistent with a wealth of research that has been conducted on vision in natural environments.[26,22,21] In the driving environment, gaze allocation is principally controlled by the requirements of the task. Consistent results were shown for the proportion of gazes to the road ahead for off-premise advertising conditions across the two cities. Average fixations were similar to CEVMS and standard billboards with no long single fixations evident for either condition. Across the two cities, four long dwell times were observed: one to a CEVMS on a freeway in the day, two to the same standard billboard on a freeway (once at night and once in the daytime), and one to a standard billboard on an arterial at night. Examination of the scene video and eye tracking data indicated that these long dwell times occurred when the billboards were close to the forward field of view where peripheral vision could still be used to gather visual information on the forward roadway.

The present data suggest that the drivers in this study directed the majority of their visual attention to areas of the roadway that were relevant to the task at hand (i.e., the driving task). Furthermore, it is possible, and likely, that in the time that the drivers looked away from the forward roadway, they may have elected to glance at other objects in the surrounding environment (in the absence of billboards) that were not relevant to the driving task. When billboards were present, the drivers in this study sometimes looked at them, but not such that overall attention to the forward roadway decreased.

LIMITATIONS OF THE RESEARCH

In this study the participants drove a research vehicle with two experimenters on board. The participants were provided with audio turn-by-turn directions and consequently did not have a taxing navigation task to perform. The participants were instructed to drive as they normally would. However, the presence of researchers in the vehicle and the nature of the driving task do limit the degree to which one may generalize the current results to other driving situations. This is a general limitation of instrumented vehicle research.

The two cities employed in the study appeared to follow common practices with respect to the content change frequency (every 8 to 10 seconds) and the brightness of the CEVMS. The current results would not generalize to situations where these guidelines are not being followed.

Participant recruiting was done through libraries, community centers and at a university. This recruiting procedure resulted in a participant demographic distribution that may not be representative of the general driving population.

The study employed a head-free eye tracking device to increase the realism of the driving situation (no head-mounted gear). However, the eye tracker had a sampling rate of 60 Hz, which made determining saccades problematic. The eye tracker and analyses software employed in this effort represents a significant improvement in technology over previous similar efforts in this area.

The study focused on objects that were 1,000 feet or less from the drivers. This was dictated by the accuracy of the eye tracking system and the ability to resolve objects for data reduction. In addition, the geometry of the roadway precluded the consideration of objects at great distances.

The study was performed on actual roadways, and this limited the control of the visual scenes except via the route selection process. In an ideal case, one would have had roadways with CEVMS, standard billboards, and no off-premise advertising and in which the context surrounding digital and standard billboards did not differ. This was not the case in this study, although such an exclusive environment would be inconsistent with the experience of most drivers. This presents issues with the interpretation of the specific contributions made by billboards and the environment to the driver's behavior.

Sign content was not investigated (or controlled) in the present study, but may be an important factor to consider in future studies that investigate the distraction potential of advertising signs. Investigations about the effect of content could potentially be performed in driving simulators where this variable could be systematically controlled and manipulated.

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City of Mission	Item Number:	4.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Administration	From:	Robyn Fulks

Action items require a vote to recommend the item to the full City Council for further action.

RE: November 1, 2023 Community Development Committee minutes.

RECOMMENDATION: Review and accept the November 1, 2023 minutes of the Community Development Committee.

DETAILS: Minutes of the November 1,2023 Community Development Committee meeting are presented for review and acceptance. At the committee meeting, if there are no objections or recommended corrections, the minutes will be considered accepted as presented.

Draft minutes are linked to the City Council agenda packet so that the public may review the discussion from the committee meeting in advance of the Council action on any particular item.

CFAA CONSIDERATIONS/IMPACTS: N/A

Related Statute/City Ordinance:	NA
Line Item Code/Description:	NA
Available Budget:	NA

MINUTES OF THE MISSION COMMUNITY DEVELOPMENT COMMITTEE
November 1, 2023

The Mission Community Development Committee met at Mission City Hall and virtually via ZOOM on Wednesday, October 4, 2023. The following Committee members were present: Sollie Flora, Lea Loudon, Debbie Kring, Trent Boultinghouse, Mary Ryherd, and Ben Chociej. Councilmember Inman, Councilmember Davis and Councilmember Thomas were absent. Councilmember Loudon called the meeting to order at 6:32 p.m.

The following staff were present: City Administrator Laura Smith, Deputy City Administrator Emily Randel, City Clerk Robyn Fulks, Public Works Superintendent Brent Morton, Parks and Recreation Director Penn Almoney, Chief Dan Madden, and Deputy City Administrator Brian Scott.

Public Comments

Councilmember Loudon reminded the public they can participate via the chat feature on Zoom. All comments would be visible to the group.

There were no public comments.

Public Presentations/Informational Items

There were no public presentations on the agenda.

Planning Commission Items

Preliminary Development Plan for Phase II of Mohawk Park – 6649 Lamar - (PC Case #22-21)

Deputy City Administrator Brian Scott presented a preliminary development plan for Phase II of Mohawk Park. Mr. Scott shared that the Planning Commission met at the end of October and sent this item forward for consideration by the City Council. He reminded the Council that Phase I was completed last year. The plans were presented to the Planning Commission with removal of the small parking lot on Horton and adding parallel parking, removing the existing playground and installing a new playground area along with a pickleball and half basketball court, and extending and realigning the trail around the park. Mr. Scott informed the Committee that there were some residents and neighbors who attended the Planning Commission meeting, with

one resident expressing concern about the noise of the pickleball court. Mr. Scott noted that the pickleball court will be in the middle of the park and is more than 200' from nearby homes. He also noted that a discussion about additional landscaping to help scale down noise can be considered. The Planning Commission accepted all of the Staff conditions and recommended adding conditions surrounding the landscaping at the pickleball court. There was also some discussion about installing a speed hump along Horton Street. Mr. Scott explained that consideration of a traffic calming measure of this type is something that cannot be evaluated until after improvements are completed. Then a multi-step approach to resolve any concerns would be implemented. Mr. Scott noted that the preliminary development plan was approved by the Planning Commission 7-0.

Councilmember Kring asked about the time the park closes. Mr. Scott confirmed it closes at 10 pm.

Action Items

Acceptance of the October 4, 2023 Community Development Committee Minutes

Minutes of the October 4, 2023 Community Development Committee were provided to the Committee.

Councilmember Chociej recommended this item be forwarded to the City Council for approval. All on the committee agreed, and this item will be on the consent agenda.

Extension of On-Call Engineering Contracts

City Administrator Laura Smith presented to the Committee that last year a 12 month extension to the City's on-call engineering contracts was approved due to all of the projects that were in process, and this year Staff is proposing another 12 month extension while a new Public Works Director is in the process of being hired. She noted that the RFQ process for on-call engineering is extensive and very labor intensive. She stated that Staff recommends a second amendment to the master services agreements with GBA and Olsson, who do exceptional work for the City, for an additional 12 months. As a new Public Works Director comes on board, Staff will plan to begin the RFQ process in the fall of 2024.

Councilmember Kring recommended this item be forwarded to the City Council for approval. All on the committee agreed, and this item will be on the consent agenda.

PCC North Kitchen and Hallway Floor

Parks + Recreation Director Penn Almoney presented to the Committee a contract to replace the north kitchen floor at the Powell Community Center, which is original to the 2004 expansion of the facility. The floor has been damaged over the years and has been exposed to normal wear and tear. After the flooring repairs outside of that area, the transition into the kitchen area is now a tripping hazard. A flooring overhaul is planned for 2024, but because of the safety aspect Staff is asking for consideration of this item now. Three bids were received on the project, with the lowest and most responsive from APEX Concrete Coatings. This company recently completed the locker room floor project at the end of 2022. That project has faired well ad Staff is pleased with their work. Some cost savings through various projects this year have allowed for this project to move forward in 2023. Staff proposes utilizing the cost savings to push forward the flooring improvements at the end of 2023 and recommends awarding the contract to APEX Concrete Coatings. Mr. Almoney anticipates these improvements to be completed at the end of December, 2023.

Councilember Boultinghouse asked Mr. Almoney if, considering the long-term plan for the Community Center, that maintaining this space as a kitchen is appropriate going froward. Mr. Almoney confirmed that is correct as Staff sees a lot of in-tandem rentals of the conference room space adjacent to the kitchen and the kitchen itself and anticipates keeping that space a kitchen space going forward.

Councilmember Chociej recommended this item be forwarded to the City Council for approval. All on the committee agreed, and this item will be on the consent agenda.

Contract Award Water Works Park Improvements

Mr. Almoney's final action item of the night was for a contract for the improvements at Water Works park at 53rd Street south of Rushton Elementary School. The land is owned by WaterOne and the City contracts with them through a Joint Use Agreement. The last improvements made at the site was the installation of new playground equipment in 1999. This park has needed improvements for quite some time. Confluence began a master plan for major parks in 2019, and out of that, Water Works Park was identified as one of the quickest from conceptual design to final approval with stakeholders. The Parks, Recreation and Tree Commission consider this as a priority improvement. Due to the proximity to Rushton Elementary School and the stakeholder and resident

feedback, the Council agreed to align the improvements to be completed along with the rebuild of Rushton Elementary School. Mr. Almoney shared that Staff hopes to break ground in December or January and conclude construction in August of 2024. The project improvements include, shelter, restrooms, 10' wide concrete trails consenting to Rushton Elementary School, water fountains, solar lighting, all abilities playground with poured in place rubber and shade sails, benches, bike racks, native plantings and move. Staff is excited to deliver all of that. Staff proposes demolishing the existing parking lot and building a new U-shaped parking lot off of the street for better drop off and pick up, and for safety.

The preliminary development plan was approved earlier in 2023. Mr. Almoney also reviewed that a pre-bid meeting was held on October 12 with nine firms attending to ask questions, resulting in three addendums. Ultimately, four bids were received by the October 19 deadline. Bids were reviewed by Staff and Stantec for completion. Mr. Almoney pointed out that the all abilities playground along with picnic tables, benches and bike racks for a savings of $40,000.00 to avoid middleman markup by adding those purchases into the bid. Staff will purchase those items independently. Early projects of cost from Stantec had the project close to $2 million, but Staff has been able to get the whole project down to around $1.6 million. Mr. Almoney stated that Stantec is doing a final review of bid documents and working to prepare a final contract for later this month.

Councilmember Boultinghouse recommended this item be forwarded to the City Council for approval. All on the committee agreed, and this item will be on the regular agenda.

Discussion Items

2024 Snow Plan

Interim Public Works Director/Public Works Superintendent Brent Morton shared with the Council the department's snow plan for the 2023-2024 winter season. He shared that the snow plan has remained consistent for the last few years. He explained that crews are split into 12-hour shifts that are rotated monthly. Streets are the first priority and employees are on a 2 hour call shift. Conditions will determine the measures taken, whether its pushing snow or salting, or both. The City owns trucks for each employee, plus two back up trucks and a truck that is used at the community center and for city owned parking lots. Roads are broken up between main thoroughfares, which have two dedicated big trucks, and the City is broken into north and south by Johnson Drive. Once hills and heavily traveled main roads are covered, crews will make their way into the residential areas. He also shared that, when fully staffed, an extra crew member

is kept on the north side which is a more difficult residential area. He also shared that the Johson Drive paring spots from Lamar to Nall are plowed at night, and if more than a foot of snow is down crews will discuss moving snow to a city owned parking lot to keep sight lines open. Crews will also plow trails and city-owned sidewalks, although those will come last except at the Community Center and City Hall. He also shared that their goal is to have everything completed in about 24 hours after a snow event.

Mr. Morton also shared that crews are very excited about the new equipment that the Council has approved purchase of. They are also excited to try using a brine solution on roads as they can get it locally. They have been waiting on their next big truck for two years and hope to have it soon.

Councilmember Kring asked if Public Works is fully staffed. Mr. Morton said they have one employee working through the onboarding process, and once that is complete, they will be.

Councilmember Loudon commented that Mr. Morton and his staff do a great job.

OTHER

Department Updates

Mr. Scott shared the second Planning Sustainable Places grant, the city-wide bike ped connection study, is under way. Staff has interviewed a couple of firms and selected RDG out of Omaha, NE. The firm has a principal and associate who are bicycle enthusiasts and do these studies across the Midwest and have worked in Merriam, KS and Leawood, KS. The employees have been in the community doing surveys and taking notes to help build their study. An open house kick-off meeting was held on October 9 which was well attended, and a lot of good input was given. The firm provided interactive maps for notes from residents as well. The past week the steering committee met with a well-rounded group of constituents. The firm will be back at the end of November for an information share out. The steering committee will also meet with them. A website has also been created with an interactive map where visitors can drop pins and add comments as a tool to collect data. They are looking for what issues exist that make traveling on foot or by bike difficult. Mr. Scott shared that the study will carry through December and January and wrap up in February.

Mr. Almoney shared that Spooky Walk brought in 1,350 participants, a new record. That is now the highest attended event. He thanked the Committee for those who volunteered to help. He also shared that concrete is all poured at Broadmoor Park and looks great. Some grading and landscaping, and possible sod laying will need to happen. Sod may have to wait until spring. He also shared that interviews will be held next week for the Powell Community Center Business Manager position. He received 364 resumes for the position and has whittled that down to 15 to interview. He highlighted upcoming events including Thanks for Seniors on November 16; Family Adoption on Monday, November 20; Pearl Harbor Remembrance on December 7 at 11:30 a.m.

Mr. Morton shared that a lot of projects are wrapping up. The residential street program is down to restoration and aesthetics with sod being laid on Riggs and moving through all of the projects. That installation should be completed within two weeks. The Foxridge project is almost complete with sidewalk installation going on right now. Crews will begin to set piers for the traffic signal on Foxridge, and then Johnson County Wastewater is signalizing the bridge of I35 but that has been pushed to probably February while they wait on equipment. He is hopeful they are installed in February. The stormwater project on Beverly is moving along as well and should start in the next 3-4 weeks. WaterOne will do work at Outlook and Martway and some traffic impacts will be felt with Martway closed for a day or two. An overlay will be put on Outlook to repair the damage from the main breaks. 55th Street from Lamar to Nall is the 2024 street project. Utility movement will begin in the next month, including Evergy moving poles. Gas and water will also do a full relocation. Crews will begin the road repairs in the spring. Cres are also moving forward with stormwater projects and will have those out to bid in the next 2-3 weeks. Crews have also done some tree trimming on Johnson Drive and are also buttoning up landscaping to winterize it. TREK is finishing up the stormwater inventory and hope to complete it at the end of 2023 or beginning of 2024.

Councilmember Loudon asked if there was any appetite from Evergy to buy lines when they relocate them. Mr. Morton and Ms. Smith shared that will only happen if the City pays for that. Mr. Morton shared that the cost is extremely high to work around infrastructure and get that done. Councilmember Chociej shared he has read that it is typically not worth the cost to do that work and is very hard to maintain. Mr. Morton shared that a duct bank runs down 55th Street which has required redesign of almost 70% of the stormwater to work around that. He does not see burying lines happening anytime in the future.

Deputy City Administrator Emily Randel shared an update on the energy audit and winterization program, a new program this year. Staff aimed to do 15 energy audits but were able to complete 16. Staff chose homes that represent a variety of housing types and years of build, with the hopes they can be used as demonstration projects and residents can identify similar components in their own homes. She gave accolades to the contractors used and shared that a debrief session was held the prior week while participants and contracts shared their experiences, surprises found, considerations for projects to work on and a general sense of the program. She also shared that there was a lot of room for improvement, and that all participants found the process much less invasive than they expected. Ms. Randel also shared that, in January, Kansas will offer additional rebates for energy efficient projects. She also has photos and reports and will put those on a webpage with a link to the video from the sharing session. She also shared that fuds will now be used for implementation. She also hopes to coordinate contractors and issues to fix between the participants. She is also hopeful to track participants over time.

Councilmember Boultinghouse commented that there was profile in the Shawnee Mission Post that day about Ms. Randel.

Meeting Close

There being no further business to come before the Committee, the meeting of the Community Development Committee adjourned at 7:10 p.m.

Respectfully submitted,

_____

Robyn L. Fulks, City Clerk

City of Mission	Item Number:	5.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Public Works	From:	Brent Morton/Laura Smith

Action items require a vote to recommend the item to full City Council for further action.

RE: Rock Creek Channel Preliminary Project Study – Woodson to Reeds Road

RECOMMENDATION: Approve the submission of Option 3 from the Rock Creek Channel Preliminary Project Study (Woodson to Reeds Road) to the Johnson County Stormwater Management Program for funding in 2025/2026.

DETAILS: Johnson County Stormwater Management Program (SMP) completed a Watershed Master Plan – Phase 1 (WMP) for Watershed 1 (WO1) in March 2022. The portion of Rock Creek Channel located in Mission is within the WO1 boundaries. The WMP used a watershed-based approach to look holistically at watershed characteristics and environmental deficiencies within the watershed. Methodology was also developed to define watershed risk, identification of watershed opportunities and constraints, and concept solutions based on the following factors: flooding, water quality, stream erosion and movement, and watershed hydromodification (i.e., changes in watershed hydrology due to development activities).

The WMP also identified severe risk areas based on the four factors identified above and subsequently identified high concentrations of these risks and grouped them together into “focus areas”. The portion of the Rock Creek Channel located within Mission city limits was identified as Focus Area 2 with a preliminary flood risk score of 4.44 (based on a scale of 1 to 5 with 5 identified as the highest risk) and a preliminary risk score of 2.03 for water quality.

In September 2022, The Council approved a task order with Olsson to conduct a Preliminary Project Study (PPS) of Rock Creek Channel from Woodson to Reeds Rd. A PPS is required by Johnson County SMP to submit a project for matching funds for design and construction at up to a 50% cost share. The City received SMP funding for a portion of the PPS.

The PPS is now complete, and the four proposed options have been reviewed by Staff. The four project alternatives are scored through the County’s ranking system which looks at change in risk score and a cost-efficiency factor. The next step in the3 process is to submit the PPS to Johnson County SMP for review and potential funding of the project in 2025/2026.

Staff is recommending submission of Alternative Three which consists of:

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	Stormwater Utility Fund
Available Budget:	TBD

City of Mission	Item Number:	5.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Public Works	From:	Brent Morton/Laura Smith

Action items require a vote to recommend the item to full City Council for further action.

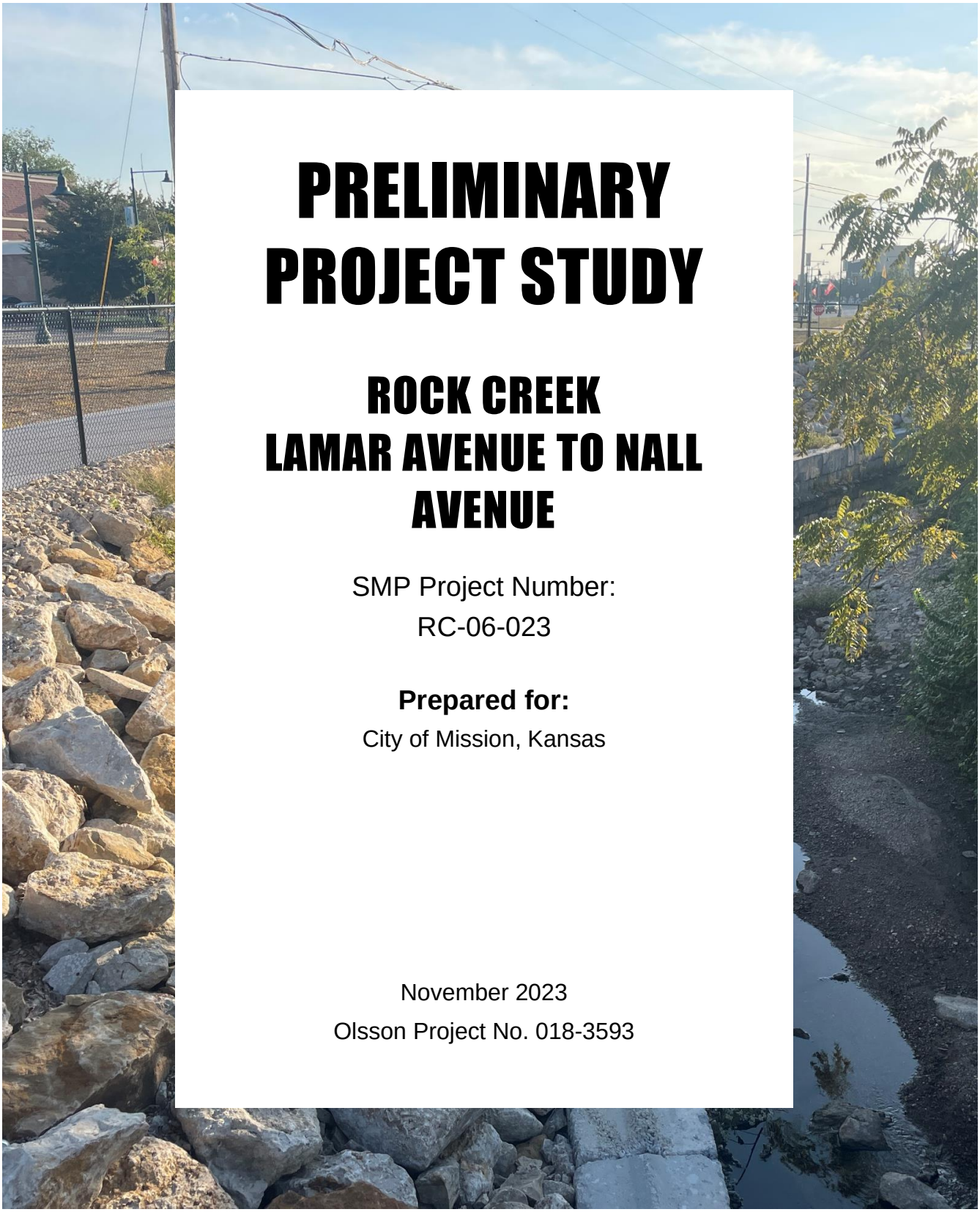
- Lowering the channel from upstream at Woodson to downstream of Reeds Rd
- Upsizing the box culvert at Woodson
- Replacing/up sizing the bridges at Outlook and Reeds Rd.

This is a priority project due to the extensive channel failures that have occurred over the last five years through this section of creek channel. Additionally, it continues the advancing channel improvements from downstream to upstream.

The total estimated project cost is $8,901,596.00, which is estimated to receive 50% matching funding through the SMP Program. The project is currently budgeted in Mission's Stormwater Capital Improvement Program (CIP) for 2025/2026. Securing a place in line for the SMP Program will then allow Staff to focus attention on financing the remaining portion of the project.

CFAA CONSIDERATIONS/IMPACTS: The project includes evaluation of improvements to stormwater and the floodplain to improve safety of stormwater infrastructure that maximizes safety for all users.

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	Stormwater Utility Fund
Available Budget:	TBD



PRELIMINARY PROJECT STUDY

ROCK CREEK
LAMAR AVENUE TO NALL AVENUE

SMP Project Number:
RC-06-023

Prepared for:
City of Mission, Kansas

November 2023
Olsson Project No. 018-3593

olsson®

ACRONYMS AND ABBREVIATIONS

1D ..... one-dimensional
2D ..... two-dimensional
AACE ..... Association for the Advancement of Cost Engineering
AIMS ..... Automated Information Mapping System
APWA ..... American Public Works Association
cfs ..... cubic feet per second
City ..... Mission, Kansas
CLOMR ..... Conditional Letter of Map Revision
CMP ..... corrugated metal pipe
DWR ..... Division of Water Resources
FEMA ..... Federal Emergency Management Agency
FIRM ..... Flood Insurance Rate Map
FIS ..... Flood Insurance Study
HEC-1 ..... Hydrologic Engineering Center 1 model
HEC-HMS ..... Hydrologic Engineering Center Hydrologic Modeling System
HEC-RAS ..... Hydrologic Engineering Center River Analysis System
HGL ..... hydraulic grade line
JCW ..... Johnson County Wastewater
KDHE ..... Kansas Department of Health and Environment
KPI ..... key performance indicators
LoF ..... likelihood of failure
LAG ..... low adjacent grade
LOE ..... low opening elevation
LOMR ..... Letter of Map Revision
NFIP ..... National Flood Insurance Program
NOAA ..... National Oceanic and Atmospheric Administration
NOI ..... notice of intent
NRCS ..... Natural Resources Conservation Service
PPS ..... preliminary project study
RCB ..... reinforced concrete box
RIPP ..... risk integrated project prioritization
SMP ..... Johnson County Stormwater Management Program
USACE ..... U.S. Army Corps of Engineers
WMP ..... watershed master plan
WSE ..... water surface elevation

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APPENDICES

1. PROJECT OVERVIEW

The Project Overview section provides background information on the project location, the flood risk present at this location, challenges to project implementation and constructability, applicable design standards and regulations, and how this study aligns with the goals of the Johnson County Stormwater Management Program (SMP).

1.1 Tie to the Watershed Master Plan

Olsson has completed this preliminary project study (PPS) for the City of Mission, Kansas (City), for a project located in the Rock Creek watershed adjacent to Johnson Drive, between Lamar Avenue and Nall Avenue, following Rock Creek. The City received approval to proceed with the PPS from Watershed Organization 1 on August 25, 2022. Minutes from this meeting are included in Appendix A. The PPS funding request from the city to SMP is included in Appendix B.

The PPS area is within the Phase 1 Watershed Master Plan (WMP) boundary for Watershed 1, as shown in Figure 1. This PPS area is identified in the Watershed 1 WMP as Focus Area 2, which ranks among the highest priority areas in all of Watershed 1. The Phase 1 WMP also identifies several watershed-based actions in Focus Area 2 to reduce risk. A Watershed 1 map, priority flood risk areas map, and a more detailed figure showing recommended solutions in Focus Area 2 are all included in Appendix A. All the recommended solutions identified in Focus Area 2 with the PPS project location were evaluated in this PPS in some form. The discussion of these improvements is presented in Section 4 of this PPS.

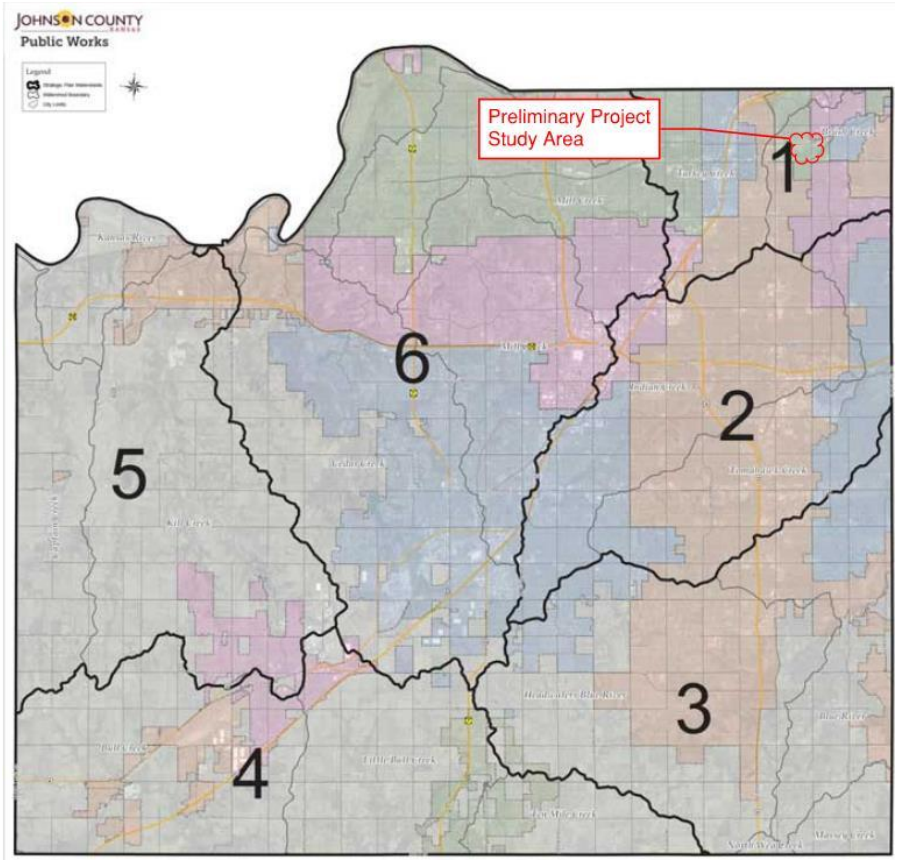

Figure 1. Watershed 1 Location Map.

1.2 Background

The PPS area is focused along a stretch of Rock Creek located between Johnson Drive and 61st Street and between Lamar Avenue to Nall Avenue as shown in Figure 2. Rock Creek flows from southwest to northeast toward the confluence with Brush Creek, approximately 2.5 miles downstream of the PPS area. The PPS location encompasses an area in downtown Mission that has experienced frequent street and building flooding. Though some of the flood risk reduction solutions evaluated in Section 3 and the alternatives discussed in Section 4 extend outside of this PPS area, Figure 2 shows the extents of the flood risk benefit associated with this PPS.

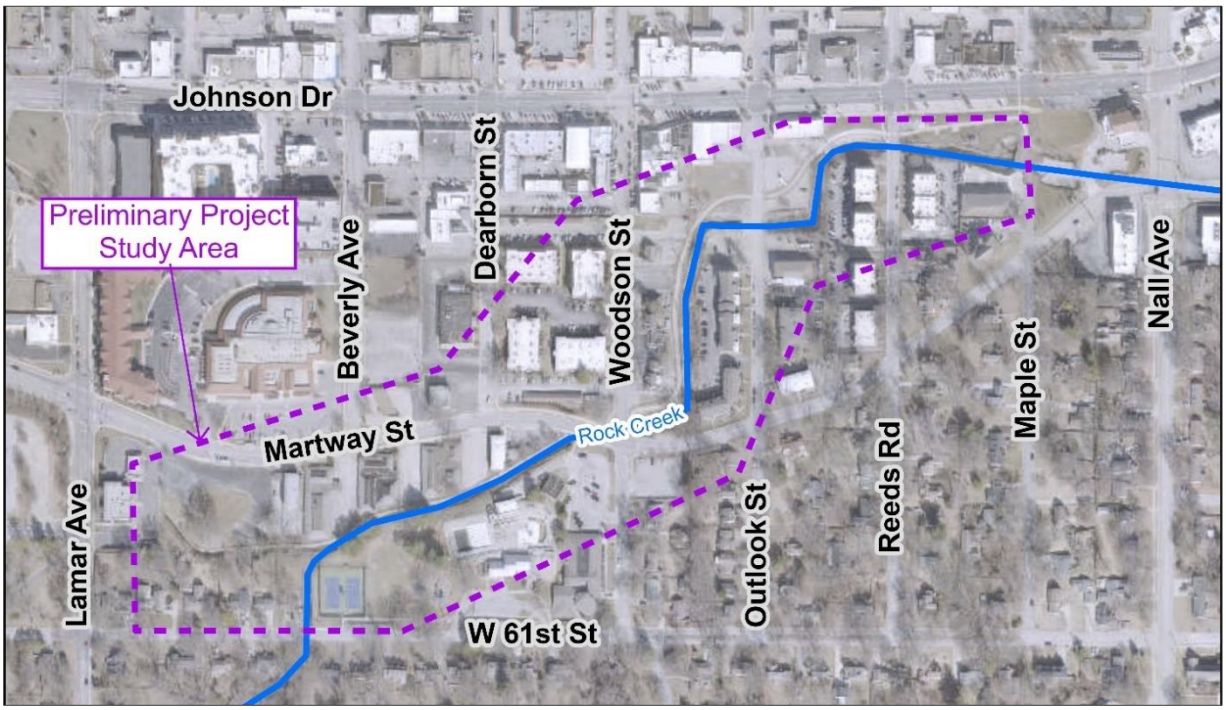

Figure 2. Preliminary Project Study Area.

The goal of the PPS is to identify improvement alternatives that increase system conveyance and reduce the severity and frequency of street and building flooding along Rock Creek in the PPS location identified in Figure 2. Potential improvement options are vetted for feasibility and effectiveness at reducing flood risk, and those that are feasible and effective become proposed alternatives evaluated in this PPS. Preliminary cost estimates and flood risk reduction calculations are completed for the proposed alternatives.

It is anticipated that the Johnson County SMP will provide partial funding for the flood risk reduction improvements identified in this PPS, including both improvement design and construction costs for the project.

The flood risk reduction associated with this PPS will be primarily localized to the PPS location and no negative impacts are anticipated either upstream or downstream of the PPS area.

1.3 Existing Conditions

The Rock Creek watershed is almost entirely developed; with most of the watershed development occurring prior to 1970; redevelopment activities are currently ongoing within the PPS area. The degree of hydromodification within the Rock Creek watershed is high; much of the historical creek and its tributaries are buried in pipes or in heavily modified stream segments. The PPS area is located at the upstream end of Rock Creek, where several storm sewer lines discharge into an open channel.

The City has recorded frequent street and building flooding at different points along Rock Creek within the PPS area; the flooding has caused streets to become impassible, flooded buildings, and restricted emergency access to buildings in the PPS area. In addition to the flooding issues, the Rock Creek channel within the PPS area is hydraulically undersized and has had numerous structural deficiencies to the point of complete failure in some sections. Figure 3 shows one of these failures at the left-bank channel wall just west of Reeds Road that occurred in May 2020 (Shawnee Mission Post 2020).

Figure 3. Rock Creek Channel Wall Failure (Shawnee Mission Post 2020).

Figure 4 shows the existing storm sewer and drainage system in the PPS area, including the existing storm sewer interceptor running in Johnson Drive from Lamar Avenue to east of Reeds Road that was installed in 2013. The concept of using a storm sewer interceptor came from a 2010 preliminary engineering study (Black & Veatch 2010) that evaluated the flood risk reduction benefit of an interceptor solution. Per this 2010 study, the purpose of this interceptor is to capture stormwater from north of Johnson Drive and redirect it to a Rock Creek discharge location at the downstream end of the PPS area with the goal of reducing the upstream flow rates in Rock Creek, which lowers the water surface elevations and reduces flood risk. The hydraulic benefit of the storm sewer interceptor is discussed in more detail in Section 2.1. Constructing the downstream portion of this interceptor in 2013 was the first phase, and the second phase would extend the interceptor farther west toward Metcalf Avenue to redirect all storm sewer flows in Johnson Drive into the interceptor. These flows currently drain south and discharge into Rock Creek at the upstream end of the

PPS area. Note that the 2010 study did not show this storm sewer interceptor as a stand-alone solution to address flood risk along Rock Creek but was part of a full solution that included Rock Creek channel improvements.

The 100-year storm event inundation limits in existing conditions based on the updated hydraulic analysis competed with this PPS (as discussed in Section 2.1) and are shown in Figure 4. The inundation limits indicate that significant street and structure flooding within the PPS area is caused by a combination of channel and culvert flow capacity constrictions. The streets most affected by flooding are Woodson Road, Martway Street, Outlook Street, Johnson Drive, and Reeds Road and the existing channel culverts that appear to be causing the flow constriction are located at Martway Street, Outlook Street, and Reeds Road. The location and size of these features is shown in Figure 4.

Table 1 provides a summary of the most significant flood events along Rock Creek over the past 20 years based on readings from the stream gauge located near the intersection of Martway Street and Roeland Drive, which is the Rock Creek gauge closest to the PPS area. This gauge is named: BR06-Martway @ Rock Creek (5700) and the gauge data comes from Stormwatch.com (Stormwatch 2023). Table 1 also includes the corresponding total 24-hour rainfall depth data according to information from the rain gauge at the same BR06-Martway gauge station (Stormwatch 2023).

Table 1. Rock Creek Flooding.

Date of Event	Rock Creek Peak Water Surface Elevation	Total Rainfall Depth
	(feet)	(inches)
August 26, 2016	924.38	5.56
July 20, 2015	924.24	2.68
July 27, 2017	922.42	4.80
August 5, 2017	922.23	5.44
May 24, 2019	921.87	1.68
May 6, 2012	921.69	2.04
September 3, 2021	921.43	1.76
August 6, 2014	921.42	3.48
September 19, 2013	921.22	2.44
June 14, 2010	920.47	3.24
August 20, 2011	920.41	1.56
May 25, 2018	919.99	1.84

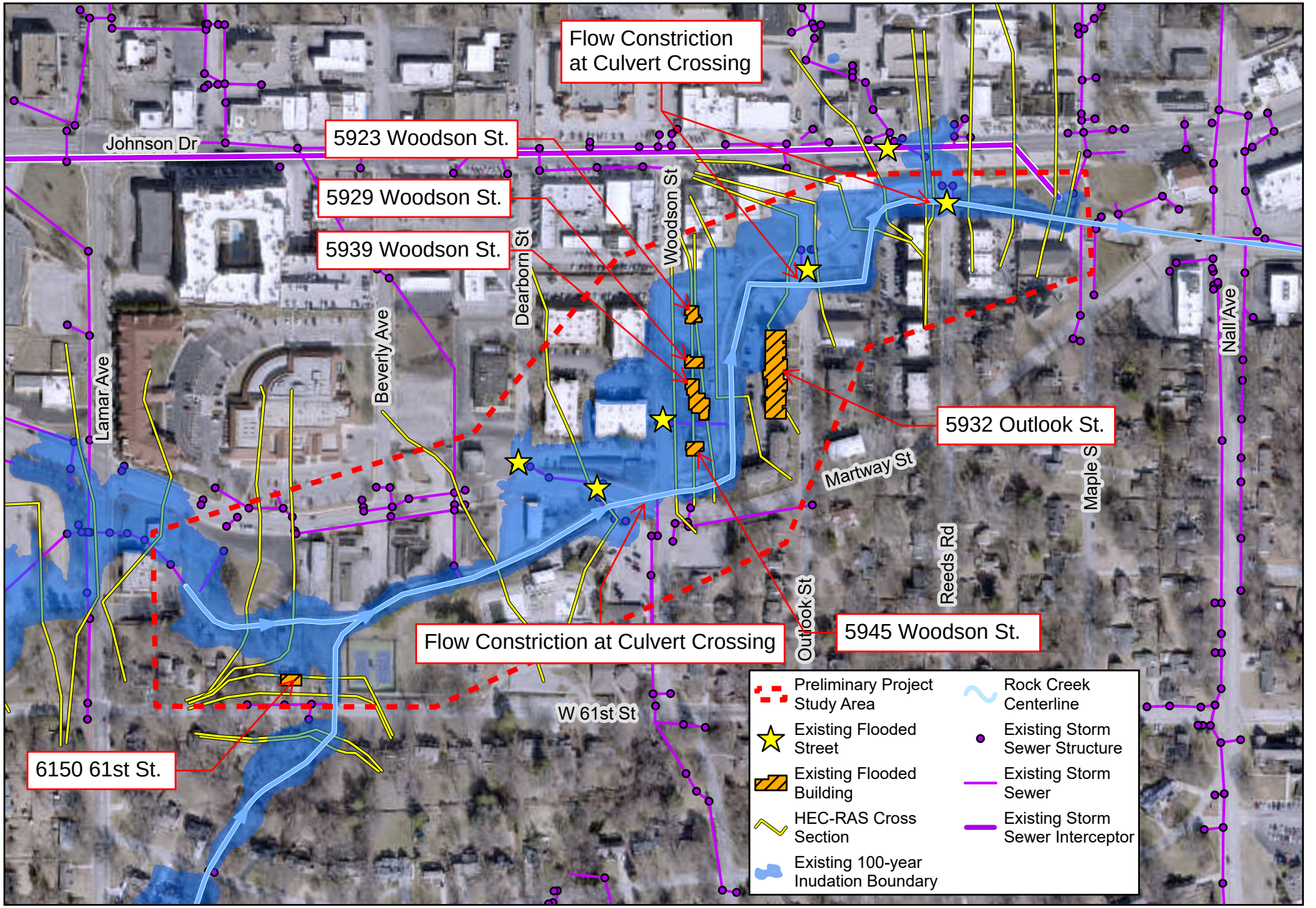

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Figure 4 - Existing Flooding and Flow Constrictions

0 150 300
Feet
1 inch equals 300 feet

Because of some variation in rainfall intensity and rain pattern across the watershed for these events, there is not a perfect correlation between the highest Rock Creek floods and the greatest rainfall depths; however, generally, the greatest rain events have generated the highest peak water surface elevations in Rock Creek. Based on conversations with City staff, these most recent Rock Creek flood events correlate well to known flooding in the PPS area.

In addition to the 100-year inundation limits shown in Figure 4, the Flood Insurance Rate Map (FIRM) and flood profile for Rock Creek from the Johnson County Flood Insurance Study (FIS) (FEMA 2009) is included in Appendix C. A more detailed presentation for flooding depths and locations is included in Section 3.1, Existing Risk.

1.4 Standards and Regulations

The hydrologic and hydraulic analysis for the existing conditions and proposed improvement alternatives were evaluated in accordance with the criteria established in Section 5600, *Storm Drainage System and Facilities* of the *Standard Specifications and Design Criteria* for the Kansas City Metropolitan Chapter, American Public Works Association (APWA) (APWA 2011). It is assumed that materials and workmanship for stormwater management and related improvements will be constructed in accordance with the provisions of the City's technical specifications and standard details.

1.5 Utility Contacts

According to the Johnson County Automated Information Mapping System (AIMS) and utility coordination efforts from projects in the vicinity of the PPS area, the utility companies that have facilities in the PPS area are listed in Table 2 and shown on Figure 5.

Table 2. Utility Contacts in the Preliminary Project Study Area.

Utility	Designated Contact	Phone Number
AT&T	Randy Gaskin	913.383.6948
Charter	Alex Cashman	913.915.0553
Consolidated Communications	Clarence Griffin	816.678.9793
Evergy	Michey Jensen	785.214.9209
Johnson County Wastewater	Mike Pillar	913.715.8537
Google	Doug Folk	816.548.1909
Kansas Gas Service	Melissa Nash	913.216.2580
WaterOne	Ryan Sirridge	913.449.0377

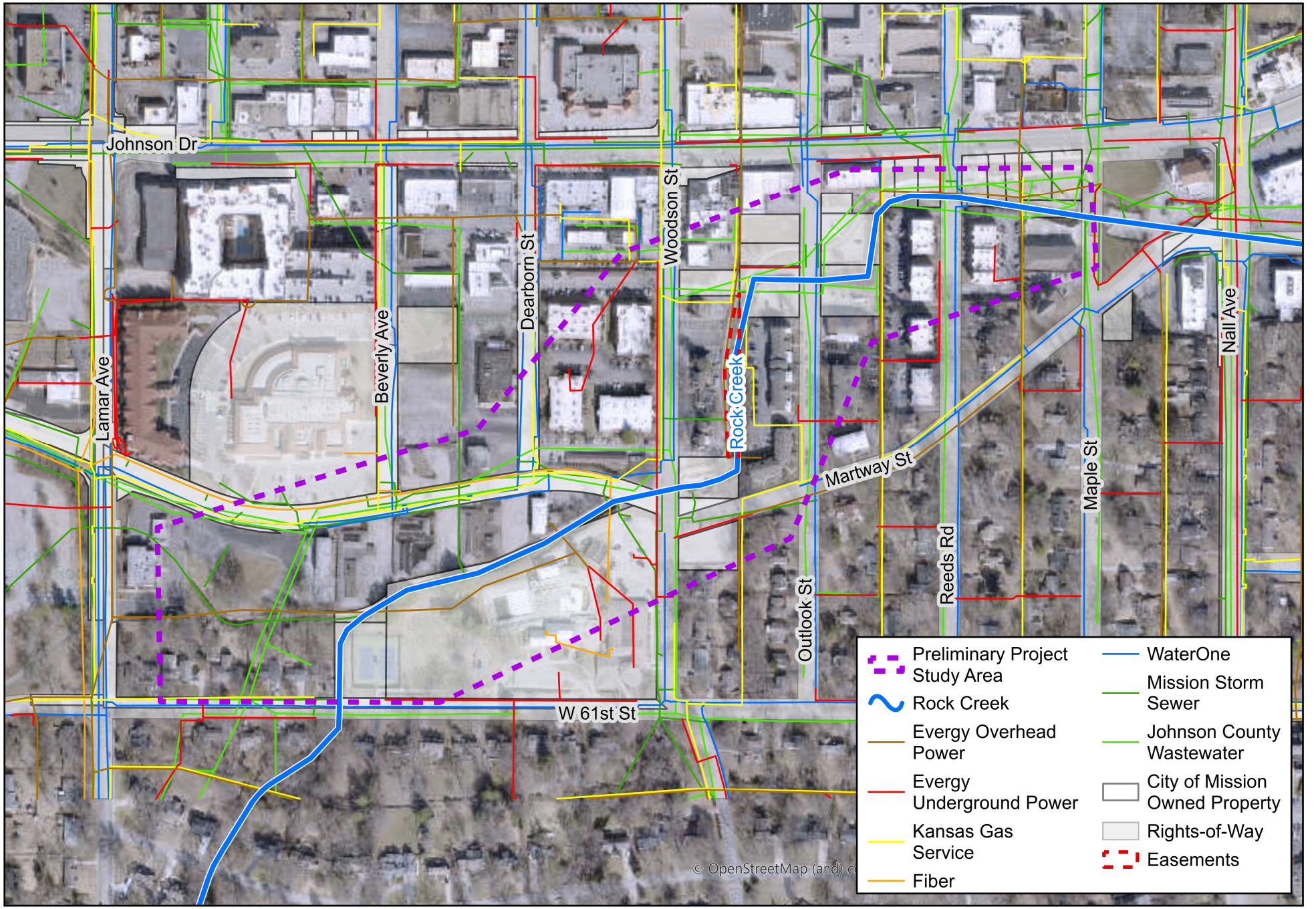

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Figure 5 - Utilities Within the Preliminary Project Study Area

0 150 300
Feet
1 inch equals 300 feet

Utility coordination with these contacts will be performed during project design. Though the proposed improvements will seek to avoid utility conflicts, there will certainly be impacts to utilities within the PPS area. Costs for required utility relocations that fall within existing right-of-way are typically the responsibility of the utility companies. Coordination with utilities to determine locations and relocations will be necessary during the design and construction phases. Specific details about utilities that conflict with the proposed improvement alternatives will be discussed in Section 4.

1.6 Conformance with Federal Emergency Management Agency Regulations

The hydrologic and hydraulic calculations for this PPS are based on the current Federal Emergency Management Agency (FEMA) effective Hydrologic Engineering Center River Analysis System (HEC-RAS) model for Rock Creek. The hydrologic data for the Rock Creek watershed was derived from previous Hydrologic Engineering Center-1 (HEC-1) modeling and updated to reflect current condition storm sewer piping. The hydrological data remains consistent with the HEC-RAS analysis; however, flow rates for additional flood events were interpolated or extrapolated for the purpose of determining a risk score for existing and proposed conditions. The hydrology analysis used for this PPS is discussed further in Section 2.1.1. The current effective HEC-RAS hydraulic model was used as a basis for hydraulic calculations. An existing conditions model was developed to reflect updated HEC-RAS cross-sections cut from 2020 lidar information (Johnson County SMP 2020). The hydraulic analysis used for this PPS is discussed further in Section 2.1.2. The proposed alternatives use the existing conditions model as a base and add proposed alternatives to reduce flood risk by reducing the 100-year flood inundation limits. This hydrologic and hydraulic approach is in conformance with FEMA regulations for this type of analysis. A Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) should be completed with this project to update the FEMA regulatory floodway and floodplain.

1.7 Quality Assurance / Quality Control Procedures

Documentation from Olsson's quality control procedures is included in Appendix E. The PPS checklist is included in Appendix F.

1.8 Key Performance Indicators

The SMP key performance indicators (KPIs) for Watershed Organization 1 have not been identified. Should the KPIs be identified prior to the finalization of this PPS, this section will be updated.

2. METHODOLOGY AND APPROACH

This section documents the methodology and approach to the engineering analyses and field investigations performed with this PPS. The purpose of these analyses and investigations is to characterize the existing risk within the PPS area. This section establishes the baseline method of analysis and the approach to developing proposed alternatives that reduce risk.

2.1 Flood Hydrology and Hydraulics

The goal of this PPS is to reduce flood risk within this PPS area. This section outlines the approach to hydrology and hydraulics used to identify the existing conditions and develop proposed improvement alternatives.

2.1.1 Hydrology Analysis

The Rock Creek watershed is approximately 13 square miles in size and the PPS area is in the upstream end of the watershed with a tributary area of approximately 1.5 square miles. Figure 6 shows the Rock Creek subwatersheds tributary to the PPS area, which is fully developed and covers portions of the cities of Mission, Overland Park, Fairway, Prairie Village, and Mission Hills. Rock Creek is a tributary to Brush Creek; the confluence of these two creeks is located approximately 2.5 miles downstream of the PPS area. There has been very little change in the Rock Creek watershed hydrology since the creation of the current effective modeling.

The effective 2009 Johnson County, Kansas, FIS (FEMA 2009) modeling is the basis for the Rock Creek PPS hydrology. Since the 2009 study, the use of the U.S. Army Corps of Engineers (USACE) HEC-1 program has been superseded by the Hydrologic Engineering Center Hydraulic Modeling System (HEC-HMS). Regarding this hydrologic model change, the HEC-HMS User's Manual (USACE 2023) states the following:

> *"Development of the Hydrologic Modeling System (HEC-HMS) was initiated as part of the Next Generation Software Project to succeed the aging HEC-1 program for simulating the rainfall-runoff process. However, it was not designed to simply add a graphical user interface to the old program. Instead, it was designed to use advances in engineering and computer science wherever possible to improve the quality of simulation results. The modernization process has therefore resulted in some changes in how computations are performed. While these modernizations result in computation differences between the two programs, the HEC-HMS results are preferred because of the modern techniques that have been implemented."*

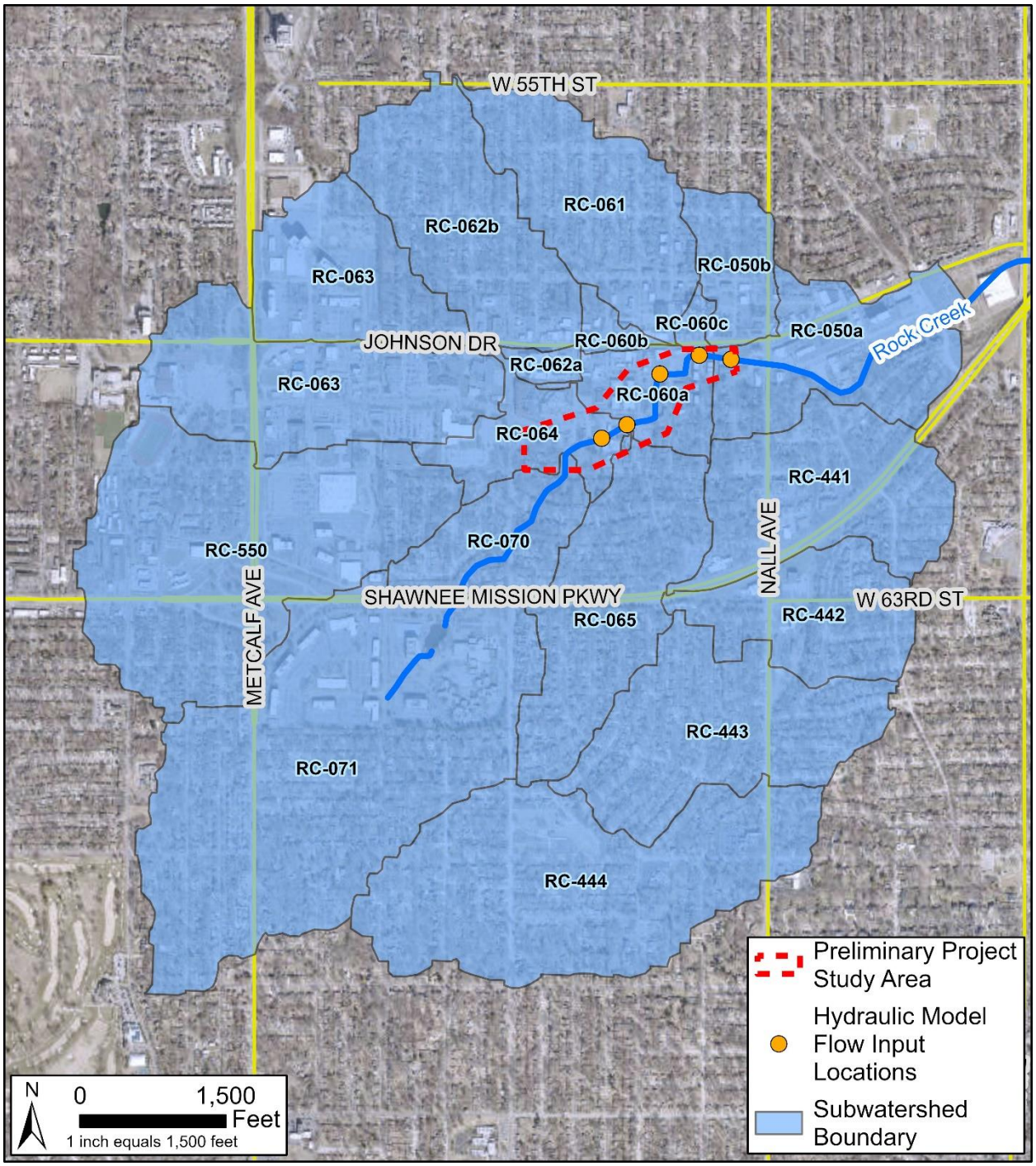

Figure 6. PPS Area Subwatershed Map.

Using the inputs from the effective HEC-1 model, a comparative HEC-HMS model with identical inputs was created. When comparing the flow results for the effective HEC-1 model versus the comparative HEC-HMS model, the HEC-HMS model results for all but one subwatershed were within 5 percent of the HEC-1 model for the 10-, 50- and 100-year, 24-hour storm events. In almost all cases, the modeled HEC-HMS flows were slightly higher

than the effective HEC-1 flows. A complete flow comparison of the effective HEC-1 model versus the comparative HEC-HMS model results for each subwatershed, including the percent of change between the two modeled flow values, are included in Appendix C.

The close alignment of flow values when comparing the HEC-1 model versus the HEC-HMS model, results in a high level of confidence that using the HEC-HMS model to generate hydrology for this PPS would accurately represent the effective FIS hydrology. Once a comparative HEC-HMS model was created, it was necessary to create an updated HEC-HMS model for this PPS which reflects the current flow routing conditions due to the flow routing change caused by the construction of a storm sewer interceptor in 2013 (see Section 1.3 for more information).

The updated HEC-HMS model was created to reflect the existing interceptor by diverting flow from watersheds north of Johnson Drive along reaches which eventually discharge back into Rock Creek, south of Johnson Drive and west of Nall Avenue. The amount of flow to be diverted along Johnson Drive from each watershed was determined through hydraulic capacity calculations performed in StormCAD. The maximum diversion capacity at specific flow input locations is based on the capacity of the interceptor and other existing storm sewer pipes that tie-into the interceptor. Flows up to the available diversion capacity for each storm event are routed into the interceptor and excess flow is bypassed to multiple junctions south of Johnson Drive.

Table 3 compares the hydrologic peak flow rates at the five input locations that affect the hydraulics in the PPS area from the effective HEC-1 FIS model, the comparative HEC-HMS model (FIS model routing), and the updated HEC-HMS model that reflects the storm sewer interceptor model routing. Flow rates for the 10-, 50- and 100-year, 24-hour storm events are included in Table 3. Additional details from the HEC-HMS model created for this PPS can be found in Appendix C.

Note that though the flow rates presented in Table 3 are slightly different, which reflects different modeling calculation approaches and routing, the same input values (subwatershed size, land cover characteristics, and flow timing) and rainfall depths used in the effective HEC-1 model were used in the updated HEC-HMS model. For these reasons, the flow hydrology for this PPS should be considered consistent with the effective FIS hydrology.

2.1.2 Hydraulic Analysis

Early in the preparation of this PPS, several different requests were made to FEMA, the Kansas Division of Water Resources (DWR), and Johnson County to obtain the current effective HEC-RAS hydraulic model for Rock Creek. From these requests, no definitive effective model was found that incorporates all effective LOMRs. The most current effective

Table 3. Hydrology Model Comparison.

Storm Event Recurrence Interval	Hydraulic Model Flow Input Cross-section	Flow Rate Inputs (cubic feet per second)		
		Effective HEC-1	Comparative HEC-HMS	Updated HEC-HMS
10-year, 24-hour (5.29 inches)	3.014	1,318	1,331	1,364
	2.958	1,404	1,413	1,379
	2.815	1,622	1,634	1,567
	2.711	1,700	1,750	1,865
	2.588	1,911	1,967	2,099
50-year, 24-hour (7.04 inches)	3.014	1,970	1,893	1,940
	2.958	2,092	2,022	1,971
	2.815	2,434	2,360	2,266
	2.711	2,601	2,524	2,710
	2.588	2,922	2,835	3,025
100-year, 24-hour (7.80 inches)	3.014	2,094	2,141	2,195
	2.958	2,224	2,299	2,242
	2.815	2,591	2,685	2,593
	2.711	2,773	2,870	3,099
	2.588	3,116	3,223	3,430

model that was provided from FEMA was a truncated model that incorporated changes from a LOMR that was completed in 2022, but only included the area of focus for the LOMR, which was along Rock Creek from Maple Street to Roeland Drive; downstream of the PPS area. The 2022 LOMR documentation FEMA is included in Appendix C. Unfortunately, no record of an update to the original effective model to reflect this LOMR could be found. As a result, it was necessary to create an updated current effective model for the purpose of this PPS.

The basis for the updated current effective model is the HEC-RAS hydraulic model for the 2009 Johnson County FIS. The truncated 2022 LOMR model was then incorporated to create a single updated current effective model. An existing conditions HEC-RAS model was then produced from the updated current effective model to accurately reflect the present-day hydraulic conditions. Cross-sections outside of the 2022 LOMR area were modified to reflect the more current and accurate 2020 Johnson County (1-meter) lidar topography. Further adjustments to improve the PPS model within the 2022 LOMR area were completed by updating the cross-section geometry outside of the Rock Creek channel to reflect the 2020

lidar, while maintaining the channel geometry shape. This lidar dataset is more consistent with observed site conditions.

The steady flow inputs for the existing conditions HEC-RAS model were derived from the updated HEC-HMS model, as described in Section 2.1.1. The 10-, 50-, and 100-year flow rates at each flow change location were pulled directly from the respective elements in the updated HEC-HMS model. The 2-, 5-, and 25-year flow rates were calculated through logarithmic interpolation and extrapolation. Additional details from the HEC-RAS models created for this PPS to evaluate the project hydraulics can be found in Appendix C.

2.1.3 Storm Events

Because this PPS is located within the regulatory floodplain of Rock Creek, the hydrology from the effective FEMA modeling (with the minor adjustments to the project hydrology as discussed in Section 2.1.1) was used for the existing conditions analysis and proposed alternatives analysis. The 10-, 50-, and 100-year, 24-hour storm events listed in Table 3, as well as flows from the 2-, 5-, and 25-year, were all included in the hydraulic modeling effort to accurately portray the full range of flood risk within the PPS area. Updated hydrology using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 rainfall is not incorporated into this PPS.

2.1.4 Future Anticipated Flooding Condition

SMP has not yet defined the future anticipated conditions scenario. Should the future anticipated conditions scenario be identified prior to the finalization of this PPS, this section will be updated.

Note that the Rock Creek watershed is essentially fully developed. There is an ongoing two-dimensional (2D) modeling effort through SMP that will update the Rock Creek watershed hydrology to better reflect the current watershed development characteristics; this effort will represent a fully developed watershed. In addition, the 2D modeling effort will update the watershed hydrology using Atlas 14 rainfall depths and it is anticipated that with the rainfall depth update, peak flows and corresponding flood depths and widths will increase. Though it is outside of the scope of this PPS, at the conclusion of the 2D modeling effort, the proposed PPS selected alternative could be reevaluated to determine if any adjustments to this alternative would provide a greater degree of flood risk reduction.

There is certainly redevelopment potential within the watershed; however, it is not anticipated that this redevelopment activity will be significant enough to alter runoff volumes carried in the downstream end of Rock Creek. In addition, the focus of this PPS is reducing flood risk, which has minimal correlation to minor changes in runoff volume because of upstream redevelopment activities.

2.2 Water Quality

The focus of this PPS is flood risk reduction within the PPS area. Although water quality benefits may be associated with the proposed improvement alternatives, water quality was not a primary consideration for this PPS; therefore, this section is not applicable to this PPS.

2.3 Field Investigations

Several field investigations were performed during this PPS, including a topographic survey, a geotechnical investigation, and a field visit, as described in the sections below.

2.3.1 Survey

Olsson performed a limited topographic survey along Rock Creek within the PPS area to capture key culvert elevations, low structure opening elevations, and soil boring locations within the PPS area. This survey was completed during the weeks of February 13, 2023, and April 10, 2023. This survey information and survey data from several Olsson-designed projects in the vicinity of the PPS area provided a solid survey base map for the proposed alternatives within the PPS area. Potential utility impacts are included with each improvement alternative in Section 4 of this PPS.

2.3.2 Field Visits

Several field visits were completed during the preparation of this PPS. A variety of channel section geometries and bank materials exist within the PPS area. The Rock Creek channel section between Woodson Street and Outlook Street is an approximately 20-foot-wide cast-in-place concrete channel with vertical walls. Downstream of Outlook Street, the channel shape shifts to a trapezoidal channel section with various bottom widths, and side slopes covered with riprap, gabion baskets, or vegetation.

Several channel wall repair areas were identified during these site visits, specifically the east channel bank, east of Outlook Street (see Figure 7) and the west channel bank, east of Reeds Road. Figure 3 shows the channel wall failure at this location. In both locations, a combination of a large block retaining wall in the channel bottom and riprap along the channel slope is the bank stabilization measure.

Figure 7. Existing Channel at Outlook Street.

Near the downstream end of the PPS area, weathered shale is present in the channel bottom. It is anticipated that potential channel lowering would encounter weathered shale and/or limestone in the downstream end of the PPS area.

2.3.3 Geotechnical Investigation

Olsson completed soil borings adjacent to Rock Creek within the PPS area in April 2023 to provide existing soils information and determine the top-of-bedrock elevation along the Rock Creek channel.

Because the proposed PPS improvement alternatives all include lowering the existing channel flowline, the top of rock bed elevations collected indicate where rock excavation will be required to construct the improvements. Figure 8 shows the soil boring locations for this PPS. The boring logs from the geotechnical investigation are included in Appendix C.

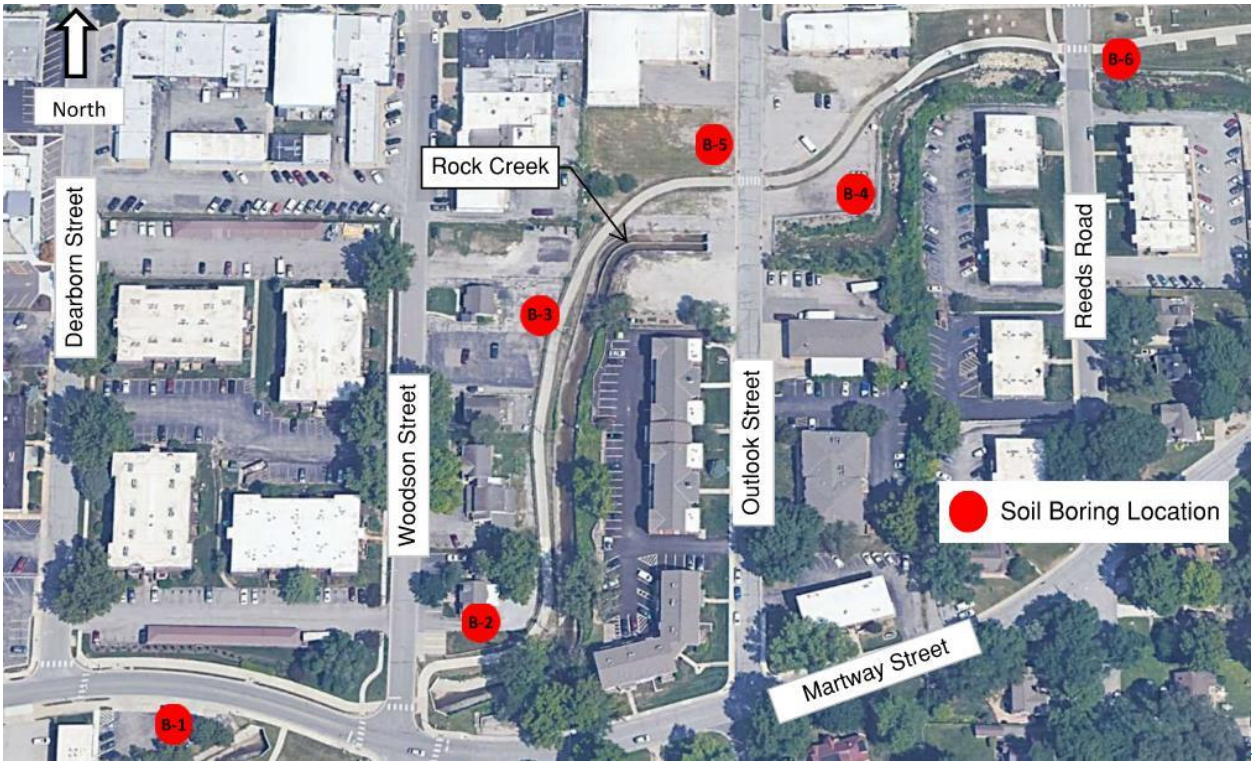

Figure 8. Soil Boring Locations.

3. EXISTING / FUTURE ANTICIPATED RISK AND POTENTIAL SOLUTIONS

This section summarizes existing flood risk within the PPS area and lists potential improvement solutions that were analyzed for their ability to reduce flood risk. As the Rock Creek watershed is entirely developed, increased flood risk in the future is not anticipated. The focus of this PPS is flood risk reduction along Rock Creek. Potential solutions target flood risk reduction, and though there may be some water quality risk reduction associated with these solutions, water quality risk reduction is not actively incorporated into the potential solutions.

3.1 Existing Risk

The existing flood risk for the PPS area is characterized by the combination of roadway and building flooding. As previously discussed, the Rock Creek corridor through the City experiences frequent street flooding and periodic building flooding during larger rain events.

The Johnson County SMP has developed the Risk Integrated Project Prioritization (RIPP) methodology for identifying and quantifying flood risks. A RIPP spreadsheet created by SMP allows for a consistent application of this methodology for quantifying risks in all PPSs. The RIPP methodology subdivides risk scores into three asset groupings: buildings, streets, and waterways. The risk scores from each asset grouping are then combined using the weighted averages shown in Table 4 to obtain a total risk score. The default weighting values in Table 4 for each asset grouping were used in this PPS.

Table 4. Project Weighting Values.

Asset Grouping	Weight (Percent)
Buildings	20
Streets	50
Waterways	30

Based on the hydrology and hydraulic analysis performed for this PPS as described in Section 2.1, existing flood risk was determined. Figure 4 shows the streets and buildings identified as flooding within the PPS area and tables 5 and 6 identify the street and building flood risk scores based on the RIPP methodology, respectively. Note that the RIPP methodology for building flooding calculates a likelihood of failure (LoF) risk score for all storm event frequencies when flooding occurs, but only the greatest LoF risk score is used to calculate the total building flood risk score. The greatest LoF risk score for each flooded building is shown in Table 6. The full RIPP scoring spreadsheet showing all existing flood risks within the PPS area is included in Appendix D.

Table 5. Existing Street Flood Risk Summary.

Flooded Street	Street Classification	Storm Event Frequency Before Overtopping	Likelihood of Failure Risk Score	Consequence of Failure Risk Score	Street Risk Score
Martway Street	Collector	5-year	5.0	5.0	5.0
Woodson Road	Residential	10-year	1.5	5.0	2.7
Outlook Street	Residential	< 2-year	5.0	5.0	5.0
Johnson Drive	Arterial	25-year	2.0	5.0	3.1
Reeds Road	Residential	5-year	2.0	5.0	3.1
Dearborn Street	Residential	25-year	1.0	5.0	2.4
				Total Existing Street Risk Score	**4.4**

Table 6. Existing Building Flood Risk Summary.

Building Address	Storm Event Frequency for Risk Scoring	Likelihood of Failure Risk Score	Consequence of Failure Risk Score	Building Risk Score
5923 Woodson Street	50-year	4.0	4.0	4.0
5929 Woodson Street	25-year	4.3	4.0	4.2
5932 Outlook Street	25-year	3.8	4.0	3.8
5939 Woodson Street	50-year	4.0	4.0	4.0
6150 W. 61st Street	100-year	4.0	4.0	4.0
			Total Existing Building Risk Score	**4.0**

Using the project weighting values presented in Table 4 and the existing street and building risk score values in tables 5 and 6, the total calculated existing risk score for this PPS is 3.3. This total existing risk score accounts for a waterway (i.e., water quality) risk score of 1.0. The full RIPP spreadsheet that calculates existing project risks is included in Appendix D for reference.

Regarding the existing risk associated with water quality in the PPS area, from the Phase 1 WMP for Watershed Organization 1, project RC19 is in subbasin RC2 and has a medium water quality priority ranking. No water quality enhancements are being considered with this PPS. Therefore, water quality priority in subbasin RC2 would remain medium.

3.2 Future Anticipated Risk

The Rock Creek watershed is fully developed and there is a low probability that redevelopment activities within the watershed will result in measurable increases in flood risk. For this reason, future risk scores were not calculated for this PPS. As discussed in Section 2.1.1, a new hydrology model was created to replicate the effective flows from the 2009 Johnson County FIS (FEMA 2009) and the effective hydrology was updated to reflect the function of the existing storm sewer interceptor in Johnson Drive. There is an ongoing 2D modeling effort that will update the Rock Creek watershed hydrology using a different hydrologic calculation method and new rainfall data. At the conclusion of the 2D modeling effort, it is recommended that the existing flood risk be reevaluated to reflect the updated hydrology that represents a full development condition within the watershed.

3.3 Flood Risk Reduction Solutions

A range of potential solutions were evaluated for overall hydraulic performance to determine the risk reduction effectiveness and feasibility of each solution. Hydraulic models in HEC-RAS were created for each potential solution to evaluate the potential impact on water surface elevation and flooding depth in the PPS area. The potential risk reduction solutions that were effective at reducing flood risk, constructable, and amenable to the City were carried forward into the PPS project alternatives. In all PPS project alternatives, several potential solutions are combined to create a project alternative. A summary of the flood risk reduction solutions evaluated in this PPS, the feasibility of each solution, and the City's interest in each solution is presented in Table 7.

Table 7. Flood Risk Reduction Solutions.

Solution Name	Solution Description	Carried Forward as Project Alternative
Storm Sewer Interceptor Extension	As presented in sections 1.3 and 2.1, a storm sewer interceptor solution provides some flood risk reduction benefit, but not a completely stand-alone solution. This solution would extend the existing interceptor farther west in Johnson Drive to redirect all storm sewer flows draining to Johnson Drive into the interceptor. There is a flood risk reduction benefit associated with this interceptor extension, but it must be combined with Rock Creek channel improvements to provide sufficient flood risk reduction.	Yes, in combination with Rock Creek channel improvements

Solution Name	Solution Description	Carried Forward as Project Alternative
Upstream Detention	An evaluation of open space areas (undeveloped/vacant property, park space, green space, etc.) that are tributary to the Rock Creek PPS area were evaluated for potential upstream reginal detention locations. Based on this evaluation, there are not enough available parcels in proximity to each other within the Rock Creek watershed to provide sufficient stormwater detention to reduce downstream flood risk. This solution is not considered a viable potential solution.	No
Rock Creek Channel Widening	This solution maintains the existing channel flowline but widens the existing Rock Creek channel from Woodson Street to Reeds Road by an additional 10 feet. Though there was reduction in the Rock Creek water surface elevation, the culvert restrictions remained and widening the channel would also have a major impact on the private properties along the Rock Creek corridor. Because of the lack of flood risk reduction and private property impacts, this solution is not considered a viable potential solution.	No
Rock Creek Natural Channel Section	This solution maintains the existing channel flowline but replaces the existing vertical walled channel from Woodson Street to Outlook Street with a trapezoidal channel with 3:1 (horizontal: vertical) side slopes restored with native vegetation. Like the channel widening solution, while there was some reduction in the Rock Creek water surface elevation, the reduction was not enough to sufficiently reduce flood risk and would also have a major impact on the private properties along this stretch of Rock Creek. Because of the lack of flood risk reduction and private property impacts, this solution is not considered a viable potential solution.	No
Rock Creek Channel Realignment	This solution maintains the existing channel flowline and shape but realigns the channel from west of Outlook Street to west of Reeds Road to provide a single smooth bend to replace the existing S-curve in the channel. Though this solution provides a more efficient channel shape by eliminating two sharp bends in the channel, the realignment would negatively impact the City's plans to redevelop the City-owned property in this corridor. For this reason, this solution is not considered a viable potential solution.	No
Rock Creek Channel Lowering	This solution maintains the existing Rock Creek channel section shape but lowers the channel flow line by 2-3 feet from Woodson Drive to Reeds Road, and ties back into the existing channel flow line east of Reeds Road. The existing culvert flowlines at Outlook Drive and Reeds Road were also lowered with this solution. Channel lowering has a significant impact on lowering the Rock Creek water surface elevation and reducing flood risk and doesn't require additional easements along the channel corridor. This solution is a viable potential solution, when combined with culvert improvements.	Yes, in combination with culvert widening

Solution Name	Solution Description	Carried Forward as Project Alternative
Rock Creek Culvert Widening	As a stand-alone solution, this widening will not sufficiently reduce flood risk; however, when combined with the channel-lowering solution, this culvert-widening solution further lowers the channel water surface elevation by removing the existing culvert restrictions. The culverts at Woodson Street, Outlook Street, and Reeds Road were all widened with this solution. This solution is a viable potential solution, when combined with channel improvements.	Yes, in combination with channel lowering
Structure Buyout	Though this solution would eliminate the structure flood risk, the street flood risk would remain. In addition, the upfront cost to buy out four commercial businesses, a multifamily housing building, and a single-family home is high, and the loss in tax revenue from removing these structures would be significant, therefore this solution is not financially feasible. This solution is not considered a viable potential solution.	No, although this solution could be considered in the detailed design phase should structure buy-out funding become available.

3.4 Water Quality Degradation Risk Reduction Solutions

As mentioned in Section 2.2, the focus of this PPS is flood risk reduction within the Rock Creek corridor, and water quality was not a primary consideration. Though temporary erosion control practices will be incorporated into the construction of improvements, no permanent water quality improvement features are considered with the PPS improvement alternatives.

4. PROJECT ALTERNATIVES AND SELECTED ALTERNATIVE

From the viable project solutions identified in Table 7, a total of four project alternatives were developed and presented in this PPS. Each of these project alternatives are described in detail in this section.

4.1 Project Alternative 1

The improvements associated with Project Alternative 1 are described in detail in this section. In addition, a conceptual opinion of probable cost and the flood risk reduction associated with Project Alternative 1 are provided.

4.1.1 Project Alternative Limits

Project Alternative 1 is focused on lowering the Rock Creek channel with street culvert improvements to reduce the channel WSEs. The limits of Project Alternative 1 are contained within the PPS area shown in Figure 2 extending from east of Woodson Road to east of Reeds Road along Rock Creek. The Project Alternative 1 improvements are shown in Figure 9 and described as follows:

- Replacing the existing varied channel section with a more standard channel section through the entire PPS area, specifically using large block walls for the channel sides and either a concrete or bedrock channel bottom.
- Lowering the Rock Creek channel bottom approximately 1-2 feet from downstream of Woodson Street to downstream of Outlook Street.
- Widening and lowering the culverts at Outlook Street and Reeds Road. The existing culvert at Woodson Road will remain in place for Project Alternative 1.

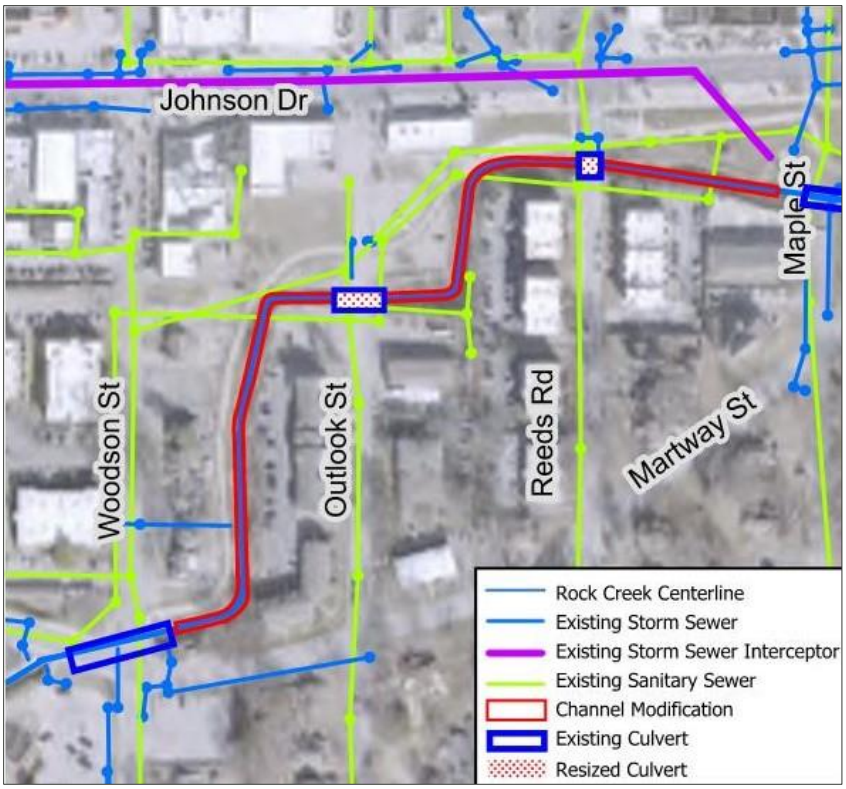

Figure 9. Alternative 1 Rock Creek Improvements.

4.1.2 Flood Reduction Improvements

The flood risk reduction benefit of the Project Alternative 1 improvements was evaluated using the updated HEC-RAS model created for this PPS. Figure 9 shows the Rock Creek channel improvements associated with Project Alternative 1, Figure 10 shows the location of the Rock Creek 100-year inundation limits along Rock Creek for each alternative, and Figure 11 compares the HEC-RAS modeled Rock Creek 100-year water surface elevation (WSE) profiles for each of the alternatives with the existing conditions profile.

Figures 10 and 11 compare the hydraulic performance of Project Alternative 1 with the existing condition. As shown in these figures, Project Alternative 1 reduces flood elevations within the PPS area, which lessens the building and street flood risk in this area. Table 8 shows a detailed comparison of flood elevations for existing conditions and Project Alternative 1 at each HEC-RAS-modeled cross-section for a 100-year storm event. A full HEC-RAS model output for all storm events analyzed is included in Appendix C.

Regarding the upstream and downstream limits of Project Alternative 1, the 100-year flood profile for Project Alternative 1 (see Figure 11) shows that the WSE matches the existing conditions profile at cross-section 3.014 (upstream of the project) and ties back into the existing conditions profile at cross-section 2.588, which is downstream of the PPS area. No floodplain impacts are anticipated either upstream or downstream of these tie-in locations. Because of the reduction in the 100-year flood footprint within the PPS area, a FEMA CLOMR and LOMR are anticipated for this project.

4.1.3 Water Quality Improvements

No permanent water quality improvement features are considered with Project Alternative 1.

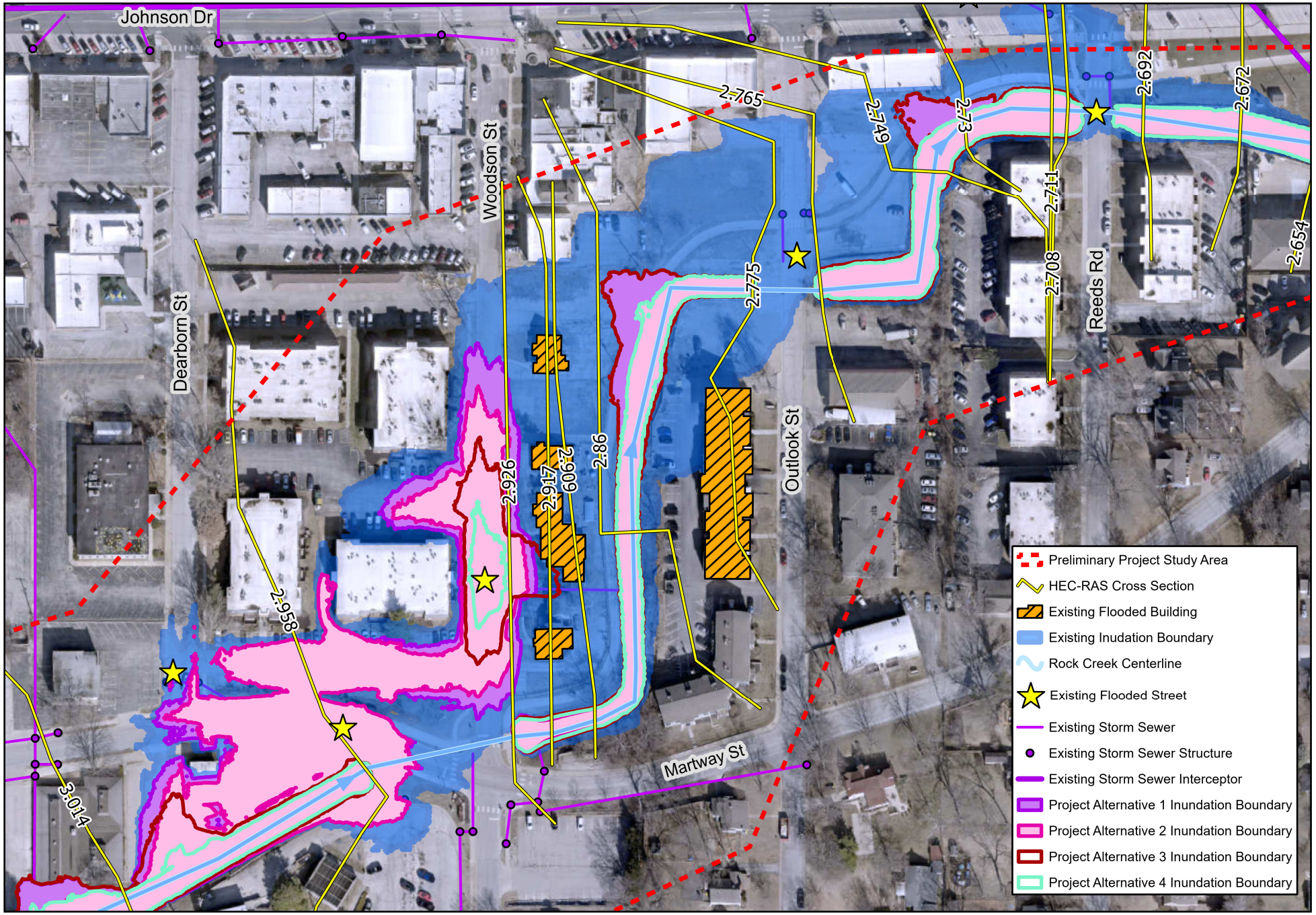

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Figure 10 - Proposed Flood Inundation Limits

0 140 280
Feet
1 inch equals 140 feet

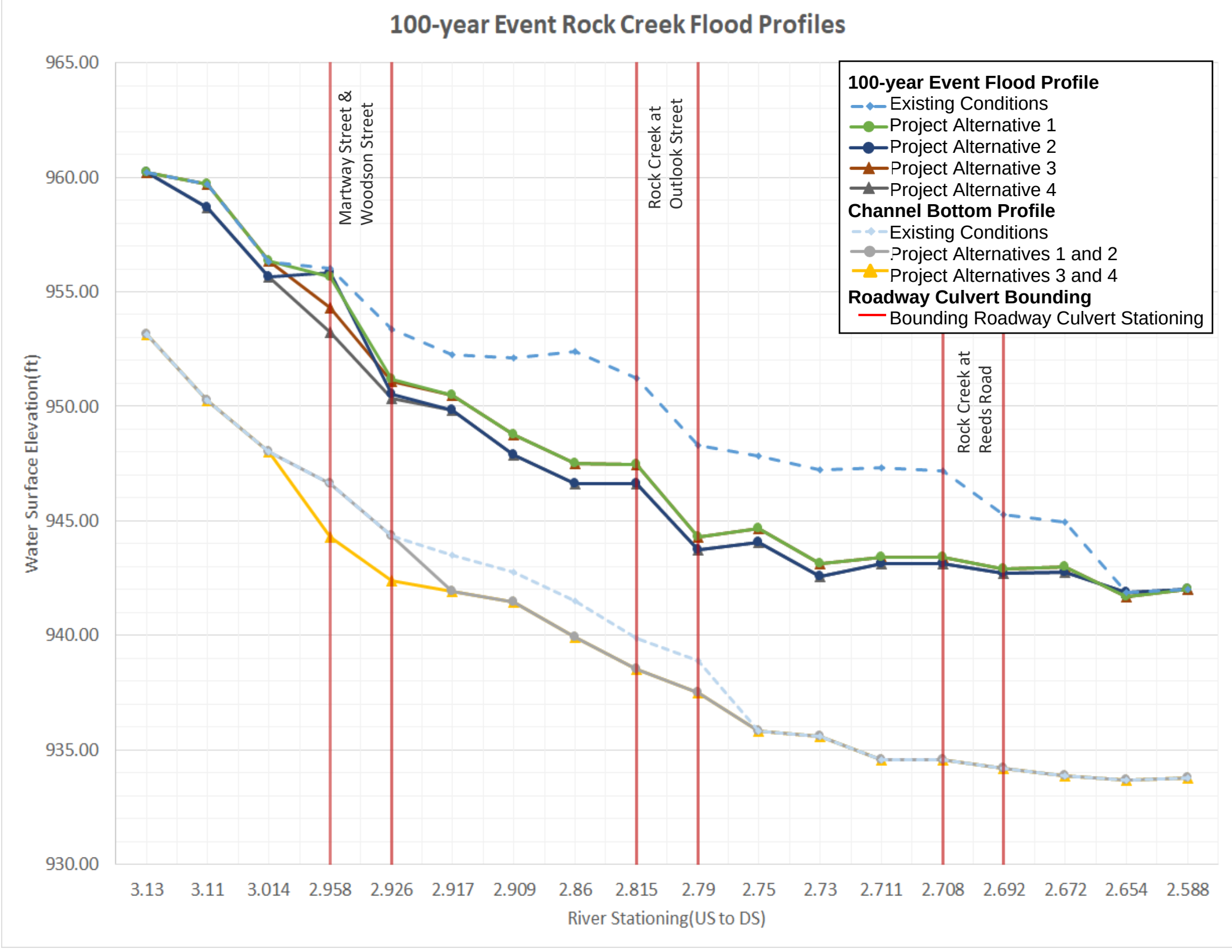
100-year Event Rock Creek Flood Profiles
965.00
960.00
955.00
950.00
945.00
940.00
935.00
930.00
Water Surface Elevation(ft)
Martway Street & Woodson Street
Rock Creek at Outlook Street
Rock Creek at Reeds Road
3.13
3.11
3.014
2.958
2.926
2.917
2.909
2.86
2.815
2.79
2.75
2.73
2.711
2.708
2.692
2.672
2.654
2.588
River Stationing(US to DS)
100-year Event Flood Profile
Existing Conditions
Project Alternative 1
Project Alternative 2
Project Alternative 3
Project Alternative 4
Channel Bottom Profile
Existing Conditions
Project Alternatives 1 and 2
Project Alternatives 3 and 4
Roadway Culvert Bounding
Bounding Roadway Culvert Stationing

Table 8. Existing Conditions and Project Alternative 1 Hydraulic Comparison.

Cross-section Number	100-year Storm Event		
	Existing Water Surface Elevation (feet)	Project Alternative 1 Water Surface Elevation (feet)	Change in Water Surface Elevation from Existing Conditions (feet)
3.130	960.20	960.20	0.00
3.110	959.72	959.71	-0.01
3.014	956.32	956.34	0.02
2.958	956.03	955.64	-0.39
2.926	953.37	951.18	-2.19
2.917	952.24	950.48	-1.76
2.909	952.10	948.74	-3.36
2.860	952.41	947.52	-4.89
2.815	951.24	947.47	-3.77
2.790	948.30	944.30	-4.00
2.750	947.85	944.66	-3.19
2.730	947.22	943.11	-4.11
2.711	947.33	943.43	-3.90
2.708	947.18	943.43	-3.75
2.692	945.27	942.88	-2.39
2.672	944.95	942.98	-1.97
2.654	941.88	941.68	-0.20
2.588	942.03	942.03	0.00

4.1.4 Project Details

This section summarizes pertinent design-related information to describe the proposed improvements associated with Project Alternative 1.

4.1.4.1 Stormwater System

The existing stormwater system within the PPS area that will be affected by Project Alternative 1 improvements includes the existing Rock Creek channel and the two channel culverts at Outlook Street and Reeds Road. The existing Rock Creek channel varies in shape and width through the PPS area. The channel section from east of Woodson Street to Outlook Street is a 20-foot-wide cast-in-place concrete channel with vertical walls that average 8 feet tall. Downstream of Outlook Street, the channel section shifts to a trapezoidal channel section with the channel bottom on bedrock and various

bottom widths ranging from 16 feet to 30 feet. The side slopes of this channel range from 2.5:1 (horizontal: vertical) to near vertical and are covered with riprap, gabion baskets, or vegetation. The Project Alternative 1 improvements will revise the channel to a more uniform 20-foot-wide channel with large block wall side slopes that are near vertical and a height that varies from 9 feet to 11 feet.

The existing box culverts at Outlook Street and Reeds Road are a double 10-foot-by-8-foot reinforced concrete box (RCB) and a double 10-foot-by-9-foot RCB, respectively. Project Alternative 1 proposes the replacement of these two box culverts with a double 12-foot-by-10-foot RCB and a triple 12-foot-by-9-foot RCB, respectively. It may be more hydraulically efficient at a similar cost to change the triple-cell RCB to a short span bridge at Reeds Road and this alternative solution should be evaluated in the detailed design phase of this project. All existing storm sewer discharges into the Rock Creek channel will be reconnected to the lowered channel at the existing discharge flowline with no pipe size increase.

4.1.4.2 Road/Traffic

The existing roadway profiles for Outlook Street and Reeds Road will be maintained with the installation of new wider culverts at these two locations. A traffic control plan for the full closure and detour during the construction of the new culverts at Outlook Street and Reeds Road at the Rock Creek channel will be necessary to complete this project. This traffic control plan, showing closures and detour routes, will apply to both vehicles and pedestrians using these two streets.

4.1.4.3 Utilities

Several utilities identified in Figure 5 will be affected by the Project Alternative 1 improvements, including water, sewer, gas, and overhead electric. The most significant impacts will be to Johnson County Wastewater (JCW) facilities, specifically 15-inch and 24-inch sewer mains that parallel the existing Rock Creek channel and cross the channel in multiple locations. Based on evaluation of the proposed Project Alternative 1 channel profile, several sewer crossings will be encased and one of these sanitary sewer crossings must be lowered. The concept cost estimate for Project Alternative 1 includes costs to encase and lower the JCW sewer in these locations. Another significant impact is to the overhead power lines that run parallel to the rock Creek channel between Woodson Street and Outlook Street. Coordination with Evergy to relocate these overhead power lines prior to construction of the channel improvements will be necessary. Initial contact with utilities in the PPS area was performed, but more detailed utility coordination during future design efforts will be required to confirm utility relocation areas and time frames. Additional relocations to WaterOne watermains and Kansas Gas Service gas lines may be necessary depending on their depths.

4.1.4.4 Permits

Project Alternative 1 includes the reconstruction and lowering of the existing Rock Creek channel from east of Woodson Street to east of Reeds Road. This channel will include placement of fill, channel excavation, and grading within the FEMA-regulated floodplain of Rock Creek. These activities will require federal, state, and local permits prior to beginning construction. A summary of permitting activities to be initiated during the final design includes the following:

- **USACE Section 404** – Although Rock Creek has a highly modified channel section, the fill, excavation, and grading activities in Rock Creek will affect the creek and any wetlands that may be present in the defined PPS area and will therefore require permitting from USACE. Because of the impacts, it is likely that Project Alternative 1 would meet the criteria for a Section 404 Individual Permit. The modification of the channel section downstream of Outlook Street could also require stream mitigation based on a loss of biological function. Coordination with USACE during the initial design phase of a project is recommended.
- **FEMA** – The Project Alternative 1 improvements are located within a FEMA-regulated floodway and they target revisions to floodplain elevations and limits; therefore, a CLOMR during the design phase of the project and a post-construction LOMR must be completed. As shown in Figure 10, there is a reduction in the 100-year flood footprint; therefore, a FEMA CLOMR and LOMR are anticipated for this project.
- **Kansas Department of Agriculture, Division of Water Resources** – DWR has jurisdiction over designated streams with drainage areas greater than 1 square mile. The PPS area has a drainage area of approximately 13 square miles, requiring a DWR permit. A floodplain fill, channel change, and/or a stream obstruction permit from DWR will be required for this alternative.
- **Kansas Department of Health and Environment (KDHE)** – Land disturbance activities greater than 1 acre require filing a notice of intent (NOI) with the KDHE under the National Pollutant Discharge Elimination System. The proposed project will require submitting an NOI.
- **City of Mission** – The City participates in the National Flood Insurance Program (NFIP) and requires a floodplain development permit for construction within the FEMA floodplain. A land disturbance permit from the City is also required for construction sites larger than 1 acre and/or a right-of-way permit is required for work in City right-of-way.

4.1.4.5 Rights-of-way/Easements

The improvements for Project Alternative 1 will be primarily within either the existing drainage easement that follows Rock Creek or City-owned property/City right-of-way through the PPS Area. Figure 5 shows the limits of this drainage easement, City-owned parcels, and City right-of-way. Additional permanent drainage easement may be necessary along the north-south stretch of the Rock Creek channel between Woodson Street and Outlook Street. Temporary construction easements may be necessary in areas where construction is close to the existing easement limits and where construction activity would extend onto private property.

4.1.4.6 Conceptual or Preliminary Design Drawings

A conceptual plan and profile figure for the lowering of the Rock Creek channel and culvert reconstruction associated with Project Alternative 1 is shown on Exhibit 1 in Appendix C. This conceptual plan provided sufficient detail to identify the quantities that went into the concept opinion of probable cost for Project Alternative 1.

4.1.4.7 Escalated Class 3 Opinion of Probable Cost

Table 9 is the concept opinion of probable cost for Project Alternative 1 and this cost is consistent with the level of detail for a Class 3 estimate as defined by the Association for the Advancement of Cost Engineering (AACE 2005).

The preliminary opinion of probable cost for Project Alternative 1 in current dollars is $7,299,219, and the probable cost escalated to the midpoint of construction (estimated to be September 2026) is $8,601,297.

4.1.4.8 Schedule and Cost Estimate for Establishment and Maintenance for Water Quality Solutions

As discussed, water quality solutions are not a primary consideration for this PPS. No permanent water quality improvement features are considered with Project Alternative 1.

PROJECT ALTERNATIVE 1 PRELIMINARY OPINION OF PROBABLE COST.

olsson

Client: City of Mission, Kansas
Project: Rock Creek PPS
Project Number: 018-3593
Date: 11/27/2023

	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization	1	LS	$ 125,000.00	$ 125,000.00
2	Clearing & Grubbing	1	LS	$ 10,000.00	$ 10,000.00
3	Removal of Existing Structures	1	LS	$ 50,000.00	$ 50,000.00
4	Shed Relocation	1	LS	$ 8,000.00	$ 8,000.00
5	Tree Removal	20	EA	$ 500.00	$ 10,000.00
6	Unclassified Excavation (Channel)	3,594	CY	$ 50.00	$ 179,682.26
7	Excavation (Rock)(Channel)	1,231	CY	$ 75.00	$ 92,322.84
8	2" Asphaltic Concrete Surface	120	Ton	$ 85.00	$ 10,200.00
9	9" Intermediate Asphaltic Concrete	530	Ton	$ 80.00	$ 42,400.00
10	5" Aggregate Base Course (AB-1)	1,040	SY	$ 9.00	$ 9,360.00
11	Curb & Gutter, Combined (Type B)	256	LF	$ 25.00	$ 6,400.00
12	Curb & Gutter, Combined (Type C-1)	218	LF	$ 25.00	$ 5,450.00
13	Sanitary Sewer Reinforced Concrete Encasement (RCE)	255	LF	$ 225.00	$ 57,375.00
14	24" Sanitary Sewer (PS 115 PVC)	96	LF	$ 300.00	$ 28,800.00
15	8" Sanitary Sewer (SDR 26 PVC)	231	LF	$ 220.00	$ 50,820.00
16	4' Diameter Sanitary Sewer Structure	2	EA	$ 6,500.00	$ 13,000.00
17	Sidewalk Construction (4")	8,892	SF	$ 12.00	$ 106,704.00
18	Concrete Paved Channel (6")	1,052	SY	$ 100.00	$ 105,177.78
19	Salvage Riprap	150	CY	$ 50.00	$ 7,500.00
20	Large Block Retaining Wall	22,380	SFF	$ 90.00	$ 2,014,200.00
21	Soldier Pile Wall	2,500	SFF	$ 225.00	$ 562,500.00
22	Double 12'x10' RCB & Wingwalls	70	LF	$ 4,000.00	$ 280,000.00
23	Triple 12'x9' RCB & Wingwalls	38	LF	$ 4,800.00	$ 182,400.00
24	Inlet (2'x4')(Grate)	5	EA	$ 2,500.00	$ 12,500.00
25	Connect to Existing Structure	4	EA	$ 1,000.00	$ 4,000.00
26	Metal Handrail (42")	206	LF	$ 250.00	$ 51,500.00
27	Fence (4' Chain Link)	2,813	LF	$ 55.00	$ 154,715.00
28	Sod (Fescue)	2,653	SY	$ 7.00	$ 18,568.67
29	Traffic Control	1	LS	$ 50,000.00	$ 50,000.00
30	Erosion Control	1	LS	$ 25,000.00	$ 25,000.00
31	Construction Staking	1	LS	$ 15,000.00	$ 15,000.00
32	Preconstruction Survey	1	LS	$ 15,000.00	$ 15,000.00
				SUBTOTAL =	**$ 4,866,075.54**
				CONSTRUCTION CONTINGENCY (20%) =	$ 973,300.00
				TOTAL CONSTRUCTION COST	**$ 5,839,375.54**
				ENGINEERING, SURVEY, PERMITTING, CONSTRUCTION OBSERVATION (25%)	$ 1,459,843.89
				TOTAL PROJECT COST (2023 Dollars) =	**$ 7,299,219.43**
				COST ESCALATION TO MIDPOINT OF CONSTRUCTION =	**$ 8,601,297.00**

Engineering News Record Construction Cost Index (May 2023) =	13,288.27
Engineering News Record Construction Cost Index (May 2020) =	11,418.00
Percent Change Over 3 Years ((2023 ECI - 2020 ECI)/2019 ECI) x 100 / 3 =	5.5%
Cost Date =	August 2023
Construction Start =	February 2026
Construction End =	April 2027
Construction Midpoint =	September 2026
Time to Midpoint of Construction (Years) =	3.1
Escalation Cost [(Current Cost x (1 + Percent Change/100) ^ Time to Midpoint) - Current Cost] =	$ 1,302,076.96

4.1.4.9 Relationship to Other Stormwater Facilities

The Project Alternative 1 improvements will tie-in to the existing Rock Creek channel on the upstream end of the project, which is immediately east of Woodson Street, and on the downstream end of the project, which is east of Reeds Road. The Project Alternative 1 improvements lower water surface elevations within Rock Creek to reduce flood risk, so there will be no negative impacts to other stormwater facilities hydraulically connected to Rock Creek.

4.1.4.10 Upstream and Downstream Effects

The improvements proposed with this alternative are contained within the City. The hydraulic modeling confirmed that no negative effects occurred upstream or downstream outside the PPS area.

4.1.5 Risk Reduction

The change in flood risk between the existing condition and the Project Alternative 1 improvements for buildings and streets is summarized in tables 10 and 11, respectively. The complete RIPP spreadsheet for Project Alternative 1 is included in Appendix D. The asset class weightings for all risk reduction remains as approved in the Johnson County, Kansas Administrative Procedures for the SMP, adopted July 2022 (Johnson County SMP 2022).

Table 10. Project Alternative 1 Building Flood Risk Reduction.

Building Address	Existing Flood Risk	Project Alternative 1 Flood Risk	Change in Flood Risk
5923 Woodson Street	4.0	2.4	1.6
5929 Woodson Street	4.2	2.4	1.8
5932 Outlook Street	3.8	1.7	2.1
5939 Woodson Street	4.0	2.4	1.6
6150 W 61st Street	4.0	3.7	0.3
		Total Change in Building Flood Risk =	**1.2**

Table 11. Project Alternative 1 Street Flood Risk Reduction.

Street Location	Existing Flood Risk	Project Alternative 1 Flood Risk	Change in Flood Risk
Martway Street	5.0	4.7	0.3
Woodson Road	2.7	2.7	0.0
Outlook Street	5.0	2.1	2.9
Johnson Drive	3.1	2.1	1.0
Reeds Road	3.1	2.1	1.0
Dearborn Street	2.4	2.1	0.3
		Total Change in Street Flood Risk =	**1.1**

Based on the change in building and street flood risk and using the asset weighting values presented in Table 4, assuming there is no change in water quality risk, the total change in risk for Project Alternative 1 is 0.8. The conceptual opinion of probable cost for Project Alternative 1 escalated to the midpoint of construction is $8,601,297, and the cost efficiency factor for this alternative is $10,597,971.

4.2 Project Alternative 2

The improvements associated with Project Alternative 2 are described in detail in this section. In addition, a conceptual opinion of probable cost and the flood risk reduction associated with Project Alternative 2 are provided.

4.2.1 Project Alternative Limits

Project Alternative 2 includes the identical Rock Creek channel improvements to Project Alternative 1 (see Figure 9 for these improvements) but adds the extension of the storm sewer interceptor in Johnson Drive from Lamar Avenue to approximately 160 feet west of Barkley Street. In addition to the PPS area identified in Figure 4, the Project Alternative 2 limits include the extension of the existing interceptor as shown in Figure 12, which identifies the improvement limits for the interceptor extension.

4.2.2 Flood Reduction Improvements

The flood risk reduction benefit of the Project Alternative 2 improvements was evaluated using the updated HEC-RAS model created for this PPS. Figures 10 and 11 compare the hydraulic performance of Project Alternative 2 with the existing condition. As shown in these figures, Project Alternative 2 reduces flood elevations within the PPS area, which lessens the building and street flood risk in this area.

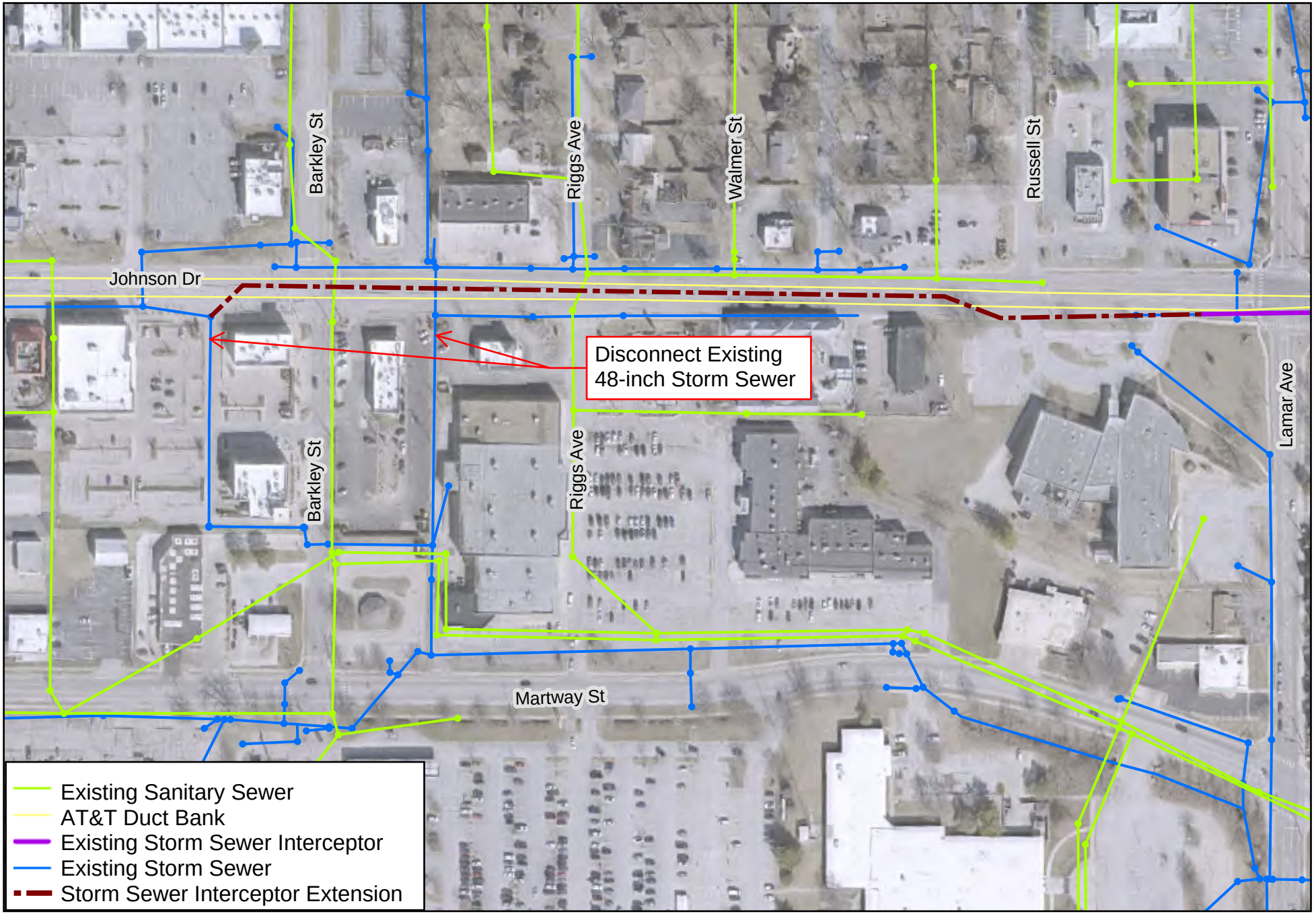

Figure 12 - Johnson Drive Storm Sewer Interceptor Extension

Note that the Rock Creek flood elevations in the PPS area for Project Alternative 2 are lower than the elevations for Project Alternative 1 by as much as 1 foot at some locations. This flood elevation reduction is attributable to the redirection of upstream flows (approximately 300 cubic feet per second [cfs] in the 100-year storm event) from north of Johnson Drive into the extended 5-foot-by-6-foot (horizontal: vertical) RCB storm sewer interceptor. The flow redirection calculations from StormCAD and HEC-HMS for the storm sewer interceptor extension are included in Appendix C. Table 12 shows a detailed comparison of flood elevations for existing conditions and Project Alternative 2 at each HEC-RAS-modeled cross-section for a 100-year storm event. A full HEC-RAS model output for all storm events analyzed is included in Appendix C.

Table 12. Existing Conditions and Project Alternative 2 Hydraulic Comparison.

Cross Section Number	100-Year Storm Event		
	Existing Water Surface Elevation (feet)	Project Alternative 2 Water Surface Elevation (feet)	Change in Water Surface Elevation from Existing Conditions (feet)
3.130	960.20	960.20	0.00
3.110	959.72	958.66	-1.06
3.014	956.32	955.66	-0.66
2.958	956.03	955.82	-0.21
2.926	953.37	950.54	-2.83
2.917	952.24	949.81	-2.43
2.909	952.10	947.88	-4.22
2.860	952.41	946.60	-5.81
2.815	951.24	946.60	-4.64
2.790	948.30	943.75	-4.55
2.750	947.85	944.04	-3.81
2.730	947.22	942.58	-4.64
2.711	947.33	943.13	-4.20
2.708	947.18	943.14	-4.04
2.692	945.27	942.70	-2.57
2.672	944.95	942.78	-2.17
2.654	941.88	941.87	-0.01
2.588	942.03	941.99	-0.04
2.502	936.66	936.64	-0.02
2.474	936.14	936.13	-0.01
2.470	935.89	935.88	-0.01
2.452	934.32	934.33	0.01
2.427	934.90	934.90	0.00

Regarding the upstream and downstream limits of Project Alternative 1, the 100-year flood profile for Project Alternative 1 (see Figure 11) shows that the WSE matches the existing conditions profile at cross-section 3.130 (upstream of the project) and ties back into the existing conditions profile at cross-section 2.427, which is downstream of the PPS area. No floodplain impacts are anticipated either upstream or downstream of these tie-in locations. Because of the reduction in the 100-year flood footprint within the PPS area, a FEMA CLOMR and LOMR are anticipated for this project.

4.2.3 Water Quality Improvements

No permanent water quality improvement features are considered with Project Alternative 2.

4.2.4 Project Details

This section summarizes pertinent design-related information to describe the proposed improvements associated with Project Alternative 2.

4.2.4.1 Stormwater System

The stormwater system for Project Alternative 2 is identical to the Project Alternative 1 stormwater system but with the addition of the storm sewer interceptor extension in Johnson Drive. The interceptor extension will connect to the existing storm sewer system in Johnson Drive at two locations, as shown in Figure 12. By connecting these two existing 48-inch pipes to the storm sewer interceptor, the downstream side of these two pipes can be abandoned, which will reduce long-term system management costs for these pipes. This effort will also benefit the City's storm sewer system south of Johnson Drive by providing additional capacity in the existing system and greater flexibility in the pipe rehabilitation options available, including slip-lining, which would reduce the pipe conveyance capacity.

4.2.4.2 Road/Traffic

The existing roadway profiles for Outlook Street and Reeds Road will be maintained with the installation of new wider culverts at these two locations. A traffic control plan for the full closure and detour during the construction of the new culverts at Outlook Street and Reeds Road at the Rock Creek channel will be necessary to complete this project. This traffic control plan showing closures and detour routes will apply to both vehicles and pedestrians using these two streets.

The interceptor extension will follow an alignment under the eastbound lanes of Johnson Drive, avoiding known utilities in Johnson Drive and the streetscape elements, utilities, and traffic signals at Barkley Street to the south. Figure 12 shows some of the streetscape elements in Johnson Drive that will be avoided. Construction of this interceptor would require lane closures during construction, limiting through traffic to one

lane in either direction. The streets connecting to Johnson Drive would require a traffic detour during construction, and coordination with all the businesses along Johnson Drive would be critical to maintain business access during construction.

4.2.4.3 Utilities

Project Alternative 2 has the same potential utility conflicts in the PPS area as identified in Section 4.1.4.2 for Project Alternative 1; the most significant conflicts are two JCW sewer mains and an overhead Evergy power line. Additional utility conflicts are present along Johnson Drive; the most significant potential utility conflict is the two existing AT&T communication duct banks that run in Johnson Drive. These duct banks are major fiber networks of several bundled conduits that provide communications to a wide service area in northeast Johnson County. Previous experience shows the relocation of these duct banks is costly and would extend the project schedule by at least two years. Though there is some opportunity to reconfigure the shape of a duct bank to squeeze new facilities over or under the duct bank, relocation is not feasible while still maintaining the project schedule.

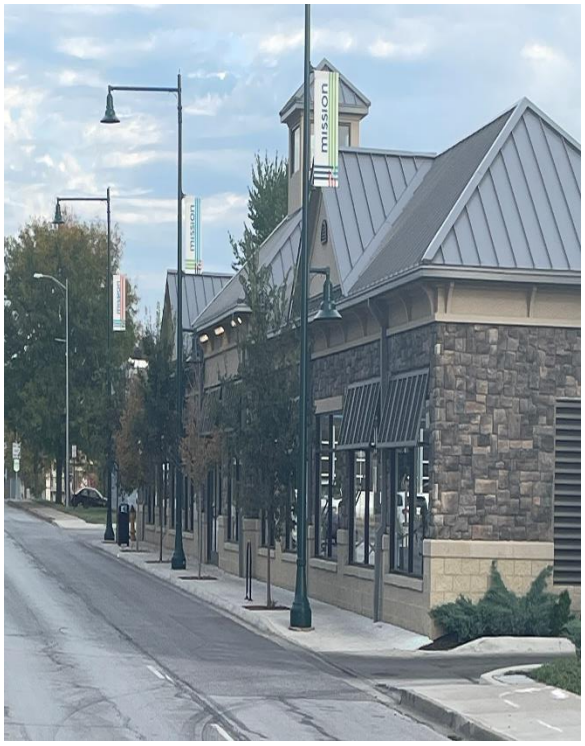

Figure 13. Johnson Drive Streetscape Elements.

The AT&T duct bank location is based on pothole information from earlier projects in Johnson Drive and utility locates. Figure 14 shows one of the access lids for this duct bank in Johnson Drive. The location of the existing storm sewer interceptor followed an alignment south of the southerly duct bank. The proposed interceptor extension for Project Alternative 2 will cross under the southerly AT&T duct bank along an alignment between the two duct banks to avoid other utilities, traffic signals, and recently constructed streetscape elements located along the southern side of Johnson Drive. Figure 12 shows the alignment of the storm

sewer interceptor extension. More detailed concept plan and profile sheets showing the interceptor extension, utilities in the corridor, and improvement quantities within the corridor are included in Appendix C.

4.2.4.4 Permits

Project Alternative 2 has the same type of stream, floodplain, and grading impacts as Project Alternative 1. The same permits identified in Section 4.1.4.4 apply to this project alternative.

4.2.4.5 Rights-of-way/Easements

The Rock Creek channel improvements for Project Alternative 2 will be primarily within either the existing drainage easement that follows Rock Creek or City-owned property/City right-of-way through the PPS area. Figure 5 shows the limits of this drainage easement, City-owned parcels, and City right-of-way. Additional permanent drainage easement may be necessary along the north-south stretch of the Rock Creek channel between Woodson Street and Outlook Street. Temporary construction easements may be necessary in areas where construction is close to the existing easement limits and where construction activity would extend onto private property.

The storm sewer interceptor extension improvements in Johnson Drive are in City right-of-way. Additional temporary construction easements may be necessary to construct this extension in certain areas.

4.2.4.6 Conceptual or Preliminary Design Drawings

A conceptual plan and profile figure for the lowering of the Rock Creek channel and culvert reconstruction associated with Project Alternative 2 is shown on Exhibit 1 in Appendix C. Exhibit 2 in Appendix C shows the storm sewer interceptor extension improvements in Johnson Drive. These concept plans provided sufficient detail to identify the quantities that went into the concept opinion of probable cost for Project Alternative 2.

4.2.4.7 Escalated Class 3 Opinion of Probable Cost

Table 13 is the concept opinion of probable cost for Project Alternative 2 and this cost is consistent with the level of detail for a Class 3 estimate as defined by the AACE (AACE 2005).

The preliminary opinion of probable cost for Project Alternative 2 in current dollars is $9,794,724, and the probable cost escalated to the midpoint of construction (estimated to be September 2026) is $11,541,964.

PROJECT ALTERNATIVE 2 PRELIMINARY OPINION OF PROBABLE COST.

olsson

Client: City of Mission, Kansas
Project: Rock Creek PPS
Project Number: 018-3593
Date: 11/27/2023

	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization	1	LS	$ 225,000.00	$ 225,000.00
2	Clearing & Grubbing	1	LS	$ 22,000.00	$ 22,000.00
3	Removal of Existing Structures	1	LS	$ 175,000.00	$ 175,000.00
4	Shed Relocation	1	LS	$ 8,000.00	$ 8,000.00
5	Tree Removal	20	EA	$ 500.00	$ 10,000.00
6	Unclassified Excavation (Channel)	3,594	CY	$ 50.00	$ 179,682.26
7	Excavation (Rock)(Channel)	1,231	CY	$ 75.00	$ 92,322.84
8	2" Asphaltic Concrete Surface	580	Ton	$ 85.00	$ 49,300.00
9	9" Intermediate Asphaltic Concrete	2,540	Ton	$ 80.00	$ 203,200.00
10	5" Aggregate Base Course (AB-1)	5,010	SY	$ 9.00	$ 45,090.00
11	Curb & Gutter, Combined (Type B)	2,657	LF	$ 25.00	$ 66,425.00
12	Curb & Gutter, Combined (Type C-1)	218	LF	$ 25.00	$ 5,450.00
13	Brick Pavers	4,997	SF	$ 20.00	$ 99,947.07
14	Sanitary Sewer Reinforced Concrete Encasement (RCE)	315	LF	$ 225.00	$ 70,875.00
15	24" Sanitary Sewer (PS 115 PVC)	96	LF	$ 300.00	$ 28,800.00
16	8" Sanitary Sewer (SDR 26 PVC)	231	LF	$ 220.00	$ 50,820.00
17	4' Diameter Sanitary Sewer Structure	2	EA	$ 6,500.00	$ 13,000.00
18	Sidewalk Construction (4")	10,908	SF	$ 12.00	$ 130,896.74
19	Sidewalk Ramp (6")	240	SF	$ 40.00	$ 9,600.00
20	Detectable Warning Surface	45	SF	$ 65.00	$ 2,925.00
21	Commercial Concrete Apron (8")	70	SY	$ 130.00	$ 9,100.00
22	Concrete Paved Channel (6")	1,052	SY	$ 100.00	$ 105,177.78
23	Salvage Riprap	150	CY	$ 50.00	$ 7,500.00
24	Large Block Retaining Wall	22,380	SFF	$ 90.00	$ 2,014,200.00
25	Soldier Pile Wall	2,500	SFF	$ 225.00	$ 562,500.00
26	Double 12'x10' RCB & Wingwalls	70	LF	$ 4,000.00	$ 280,000.00
27	Triple 12'x9' RCB & Wingwalls	38	LF	$ 4,800.00	$ 182,400.00
28	6'x5' RCB	1,640	LF	$ 810.00	$ 1,328,400.00
29	18" Storm Sewer (RCP Class III)	64	LF	$ 140.00	$ 8,960.00
30	Inlet (2'x4')(Grate)	5	EA	$ 2,500.00	$ 12,500.00
31	Inlet (6'x4') (Curb)	8	EA	$ 8,000.00	$ 64,000.00
32	Connect to Existing Structure	6	EA	$ 1,000.00	$ 6,000.00
33	Metal Handrail (42")	206	LF	$ 250.00	$ 51,500.00
34	Fence (4' Chain Link)	2,978	LF	$ 55.00	$ 163,790.00
35	Sod (Fescue)	2,917	SY	$ 7.00	$ 20,417.37
36	Traffic Control	1	LS	$ 150,000.00	$ 150,000.00
37	Erosion Control	1	LS	$ 35,000.00	$ 35,000.00
38	Construction Staking	1	LS	$ 25,000.00	$ 25,000.00
39	Preconstruction Survey	1	LS	$ 15,000.00	$ 15,000.00
				SUBTOTAL =	**$ 6,529,779.06**
				CONSTRUCTION CONTINGENCY (20%) =	$ 1,306,000.00
				TOTAL CONSTRUCTION COST	**$ 7,835,779.06**
				ENGINEERING, SURVEY, PERMITTING, CONSTRUCTION OBSERVATION (25%)	$ 1,958,944.76
				TOTAL PROJECT COST (2023 Dollars) =	**$ 9,794,723.82**
				COST ESCALATION TO MIDPOINT OF CONSTRUCTION =	**$ 11,541,964.00**

Engineering News Record Construction Cost Index (May 2023) =	13,288.27
Engineering News Record Construction Cost Index (May 2020) =	11,418.00
Percent Change Over 3 Years ((2023 ECI - 2020 ECI)/2019 ECI) x 100 / 3 =	5.5%
Cost Date =	August 2023
Construction Start =	February 2026
Construction End =	April 2027
Construction Midpoint =	September 2026
Time to Midpoint of Construction (Years) =	3.1
Escalation Cost [(Current Cost x (1 + Percent Change/100) ^ Time to Midpoint) - Current Cost] =	$ 1,747,239.46

4.2.4.8 Schedule and Cost Estimate for Establishment and Maintenance for Water Quality Solutions

As discussed, water quality solutions are not a primary consideration for this PPS. No permanent water quality improvement features are considered with Project Alternative 2.

4.2.4.9 Relationship to Other Stormwater Facilities

The Project Alternative 2 improvements will tie-in to the existing Rock Creek channel on the upstream end of the project, which is immediately east of Woodson Street, and on the downstream end of the project, which is east of Reeds Road. Project Alternative 2 improvements lower water surface elevations within Rock Creek to reduce flood risk, so there will be no negative impacts to other stormwater facilities hydraulically connected to Rock Creek.

The storm sewer interceptor extension included with Project Alternative 2 will connect to the existing storm sewer system in Johnson Drive at two locations, as shown on Figure 12. These two connections to existing 48-inch storm sewer pipes will redirect all the storm sewer flows from Johnson Drive, and areas draining to Johnson Drive from the north, into the interceptor. The benefit to the PPS area is the reduction of flow discharging into Rock Creek at the upstream end of the PPS area. This flow reduction yields a reduction in flood elevations as shown in Figures 10 and 11.

4.2.4.10 Upstream and Downstream Effects

The improvements proposed with this alternative are contained within the City. The hydraulic modeling confirmed that no negative effects occurred upstream or downstream outside the PPS area.

4.2.5 Risk Reduction

The change in flood risk between the existing condition and the Project Alternative 2 improvements for buildings and streets is summarized in tables 14 and 15, respectively. The complete RIPP spreadsheet for Project Alternative 2 is included in Appendix D. The asset class weightings for all risk reduction remains as approved in the Johnson County, Kansas Administrative Procedures for the SMP, adopted July 2022 (Johnson County SMP 2022).

Table 14. Project Alternative 2 Building Flood Risk Reduction.

Building Address	Existing Flood Risk	Project Alternative 2 Flood Risk	Change in Flood Risk
5923 Woodson Street	4.0	1.0	3.0
5929 Woodson Street	4.2	1.7	2.5
5932 Outlook Street	3.8	1.0	2.8
5939 Woodson Street	4.0	1.0	3.0
6150 W 61st Street	4.0	1.7	2.3
Total Change in Building Flood Risk =			**2.8**

Table 15. Project Alternative 2 Street Flood Risk Reduction.

Street Location	Existing Flood Risk	Project Alternative 2 Flood Risk	Change in Flood Risk
Martway Street	5.0	2.7	2.3
Woodson Road	2.7	2.7	0.0
Outlook Street	5.0	2.1	2.9
Johnson Drive	3.1	2.1	1.0
Reeds Road	3.1	2.1	1.0
Dearborn Street	2.4	2.1	0.3
Total Change in Street Flood Risk =			**2.2**

Based on the change in building and street flood risk and using the asset weighting values presented in Table 4, assuming there is no change in water quality risk, the total change in risk for Project Alternative 2 is 1.6. The conceptual opinion of probable cost for Project Alternative 2 is $11,541,964, and the cost efficiency factor for this alternative is $7,089,109.

4.3 Project Alternative 3

The improvements associated with Project Alternative 3 are described in detail in this section. In addition, a conceptual opinion of probable cost and the flood risk reduction associated with Project Alternative 3 are provided.

4.3.1 Project Alternative Limits

Project Alternative 3 is focused on lowering the Rock Creek channel with street culvert improvements to reduce the channel WSEs to a greater extent when compared to Project Alternative 1 considering the additional culvert expansion at Woodson Street. The limits of Project Alternative 3 are contained within the PPS area shown in Figure 2 extending from west of Woodson Road to east of Reeds Road along Rock Creek. The Project Alternative 3 improvements are shown in Figure 15 and described as follows:

- Replacing the existing varied channel section with a more standard channel section through the entire PPS area, specifically using large block walls for the channel sides and either a concrete or bedrock channel bottom.
- Lowering the Rock Creek channel bottom approximately 1-2 feet from upstream of Woodson Street to downstream of Outlook Street
- Widening and lowering the culverts at Woodson Street, Outlook Street, and Reeds Road.

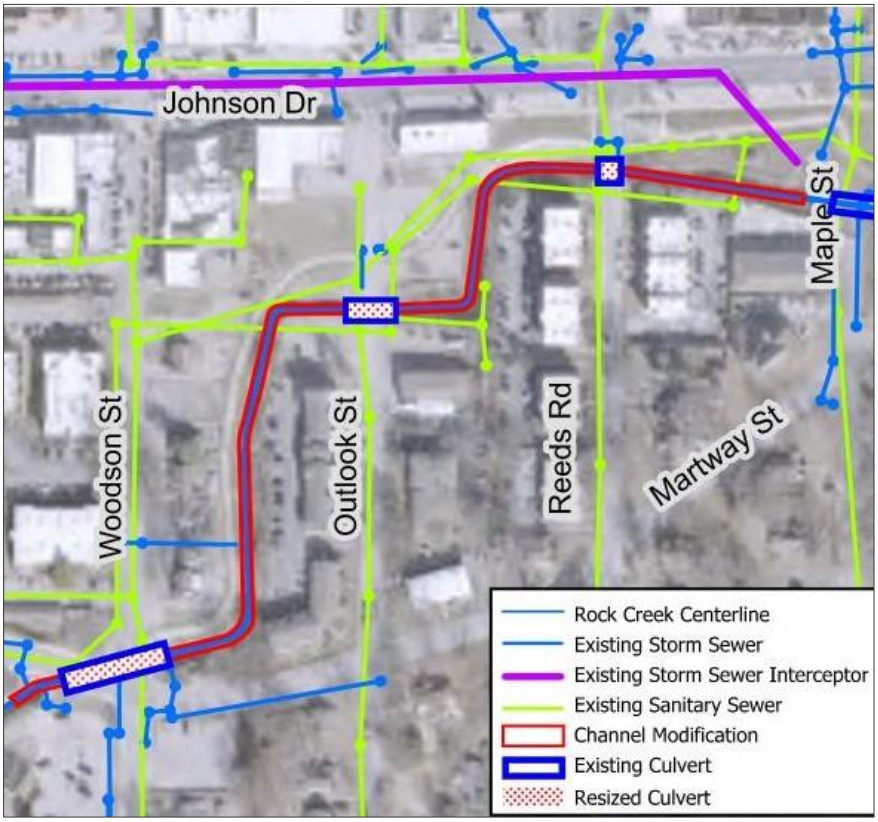

Figure 15. Project Alternative 3 Improvements.

4.3.2 Flood Reduction Improvements

The flood risk reduction benefit of the Project Alternative 3 improvements was evaluated using the updated HEC-RAS model created for this PPS. Figures 9 and 10 compare the hydraulic performance of Project Alternative 3 with the existing condition. As shown in these figures, Project Alternative 3 reduces flood elevations within the PPS area, which lessens the building and street flood risk in this area. Table 16 shows a detailed comparison of flood elevations for existing conditions and Project Alternative 3 at each HEC-RAS-modeled

cross-section for a 100-year storm event. A full HEC-RAS model output for all storm events analyzed is included in Appendix C.

Table 16. Existing Conditions and Project Alternative 3 Hydraulic Comparison.

Cross Section Number	100-Year Storm Event		
	Existing Water Surface Elevation (feet)	Project Alternative 3 Water Surface Elevation (feet)	Change in Water Surface Elevation from Existing Conditions (feet)
3.130	960.20	960.20	0.00
3.110	959.72	959.71	-0.01
3.014	956.32	956.34	0.02
2.958	956.03	954.28	-1.75
2.926	953.37	951.08	-2.29
2.917	952.24	950.48	-1.76
2.909	952.10	948.74	-3.36
2.860	952.41	947.52	-4.89
2.815	951.24	947.47	-3.77
2.790	948.30	944.30	-4.00
2.750	947.85	944.66	-3.19
2.730	947.22	943.11	-4.11
2.711	947.33	943.43	-3.90
2.708	947.18	943.43	-3.75
2.692	945.27	942.88	-2.39
2.672	944.95	942.98	-1.97
2.654	941.88	941.68	-0.20
2.588	942.03	942.03	0.00

Regarding the upstream and downstream limits of Project Alternative 3, the 100-year flood profile for Project Alternative 3 (see Figure 11) shows that the WSE matches the existing conditions profile at cross-section 3.130 (upstream of the project) and ties back into the existing conditions profile at cross-section 2.588, which is downstream of the PPS area. No floodplain impacts are anticipated either upstream or downstream of these tie-in locations. Because of the reduction in the 100-year flood footprint within the PPS area, a FEMA CLOMR and LOMR are anticipated for this project.

4.3.3 Water Quality Improvements

No permanent water quality improvement features are considered with Project Alternative 3.

4.3.4 Project Details

This section summarizes pertinent design-related information to describe the proposed improvements associated with Project Alternative 3.

4.3.4.1 Stormwater System

The existing stormwater system within the PPS area that will be affected by Project Alternative 3 improvements includes the existing Rock Creek channel and the three channel culverts at Woodson Street, Outlook Street, and Reeds Road. The existing Rock Creek channel varies in shape and width through the PPS area. The channel section from east of Woodson Street to Outlook Street is a 20-foot-wide cast-in-place concrete channel with vertical walls that average 8 feet tall. Downstream of Outlook Street, the channel section shifts to a trapezoidal channel section with the channel bottom on bedrock and various bottom widths ranging from 16 feet to 30 feet. The side slopes of this channel range from 2.5:1 (horizontal: vertical) to near vertical and are covered with riprap, gabion baskets, or vegetation. The Project Alternative 3 improvements will revise the channel to a more uniform 20-foot-wide channel with large block wall side slopes that are near vertical and a height that varies from 9 feet to 11 feet.

The existing box culverts at Woodson Street, Outlook Street, and Reeds Road are a double 10-foot-by-7-foot RCB, a double 10-foot-by-8-foot RCB, and a double 10-foot-by-9-foot RCB, respectively. Project Alternative 3 proposes the replacement of these three box culverts with a double 12-foot-by-9-foot RCB, a double 12-foot-by-10-foot RCB, and a triple 12-foot-by-9-foot RCB, respectively. It may be more hydraulically efficient at a similar cost to change the triple-cell RCB to a short span bridge at Reeds Road and this alternative solution should be evaluated in the detailed design phase of this project. All existing storm sewer discharges into the Rock Creek channel will be reconnected to the lowered channel at the existing discharge flowline with no pipe size increase.

4.3.4.2 Road/Traffic

The existing roadway profiles for Woodson Street, Outlook Street, and Reeds Road will be maintained with the installation of new wider culverts at these three locations. A traffic control plan for the full closure and detour during the construction of the new culverts at the Woodson Street and Martway Street intersection, Outlook Street, and Reeds Road at the Rock Creek channel will be necessary to complete this project. This traffic control plan showing closures and detour routes will apply to both vehicles and pedestrians using these streets.

4.3.4.3 Utilities

Several utilities identified in Figure 5 will be affected by the Project Alternative 3 improvements, including water, sewer, gas, and overhead electric. The most significant impacts will be to JCW facilities, specifically 15-inch and 24-inch sewer mains that parallel the existing Rock Creek channel and cross the channel in multiple locations. In addition, Project Alternative 3 includes an 8-inch sewer crossing that is currently above the existing RCB at the Woodson Street and Martway Street intersection. Based on evaluation of the proposed Project Alternative 3 channel profile, several sewer crossings will be encased and one of these sanitary sewer crossings must be lowered. The concept cost estimate for Project Alternative 3 includes costs to encase and lower the JCW sewer in these locations. Another significant impact is to the overhead powerlines that run parallel to the Rock Creek channel between Woodson Street and Outlook Street. Coordination with Evergy to relocate these overhead power lines prior to the construction of channel improvements will be necessary. Initial contact with utilities in the PPS area was performed, but more detailed utility coordination during future design efforts will be required to confirm utility relocation areas and time frames. Additional relocations to WaterOne watermain and Kansas Gas Service gas lines may be necessary depending on their depths.

4.3.4.4 Permits

Project Alternative 3 has the same type of stream, floodplain, and grading impacts as Project Alternative 1. The same permits identified in Section 4.1.4.4 apply to this project alternative.

4.3.4.5 Rights-of-way/Easements

The improvements for Project Alternative 3 will be primarily within either the existing drainage easement that follows Rock Creek or City-owned property/City right-of-way through the PPS area. Figure 5 shows the limits of this drainage easement, City-owned parcels, and City right-of-way. Additional permanent drainage easement may be necessary along the north-south stretch of the Rock Creek channel between Woodson Street and Outlook Street. Temporary construction easements may be necessary in areas where construction is close to the existing easement limits and where construction activity would extend onto private property.

4.3.4.6 Conceptual or Preliminary Design Drawings

A conceptual plan and profile figure for the lowering of the Rock Creek channel and culvert reconstruction associated with Project Alternative 3 is shown on Exhibit 1 in Appendix C. This concept plan provided sufficient detail to identify the qualities that went into the concept opinion of probable cost for Project Alternative 3.

4.3.4.7 Escalated Class 3 Opinion of Probable Cost

Table 17 is the concept opinion of probable cost for Project Alternative 3, and this cost is consistent with the level of detail for a Class 3 estimate as defined by the AACE (AACE 2005).

The preliminary opinion of probable cost for Project Alternative 3 in current dollars is $7,897,196, and the probable cost escalated to the midpoint of construction (estimated to be September 2026) is $9,305,944.

4.3.4.8 Schedule and Cost Estimate for Establishment and Maintenance for Water Quality Solutions

As discussed, water quality solutions are not a primary consideration for this PPS. No permanent water quality improvement features are considered with Project Alternative 3.

4.3.4.9 Relationship to Other Stormwater Facilities

The Project Alternative 3 improvements will tie-in to the existing Rock Creek channel on the upstream end of the project, which is immediately west of Woodson Street, and on the downstream end of the project, which is east of Reeds Road. The Project Alternative 3 improvements lower water surface elevations within Rock Creek to reduce flood risk, so there will be no negative impacts to other stormwater facilities hydraulically connected to Rock Creek.

4.3.4.10 Upstream and Downstream Effects

The improvements proposed with this alternative are contained within the City. The hydraulic modeling confirmed that no negative effects occurred upstream or downstream outside the PPS area.

PROJECT ALTERNATIVE 3 PRELIMINARY OPINION OF PROBABLE COST.

olsson

Client: City of Mission, Kansas
Project: Rock Creek PPS
Project Number: 018-3593
Date: 11/27/2023

	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization	1	LS	$ 125,000.00	$ 125,000.00
2	Clearing & Grubbing	1	LS	$ 10,000.00	$ 10,000.00
3	Removal of Existing Structures	1	LS	$ 150,000.00	$ 150,000.00
4	Shed Relocation	1	LS	$ 8,000.00	$ 8,000.00
5	Tree Removal	20	EA	$ 500.00	$ 10,000.00
6	Unclassified Excavation (Channel)	4,777	CY	$ 50.00	$ 238,831.78
7	Excavation (Rock)(Channel)	1,231	CY	$ 75.00	$ 92,322.84
8	2" Asphaltic Concrete Surface	190	Ton	$ 85.00	$ 16,150.00
9	9" Intermediate Asphaltic Concrete	830	Ton	$ 80.00	$ 66,400.00
10	5" Aggregate Base Course (AB-1)	1,630	SY	$ 9.00	$ 14,670.00
11	Curb & Gutter, Combined (Type B)	734	LF	$ 25.00	$ 18,350.00
12	Curb & Gutter, Combined (Type C-1)	218	LF	$ 25.00	$ 5,450.00
13	Sanitary Sewer Reinforced Concrete Encasement (RCE)	330	LF	$ 225.00	$ 74,250.00
14	24" Sanitary Sewer (PS 115 PVC)	96	LF	$ 300.00	$ 28,800.00
15	8" Sanitary Sewer (SDR 26 PVC)	297	LF	$ 220.00	$ 65,340.00
16	4' Diameter Sanitary Sewer Structure	3	EA	$ 6,500.00	$ 19,500.00
17	Sidewalk Construction (4")	10,978	SF	$ 12.00	$ 131,736.00
18	Sidewalk Ramp (6")	320	SF	$ 40.00	$ 12,800.00
19	Detectable Warning Surface	60	SF	$ 65.00	$ 3,900.00
20	Concrete Paved Channel (6")	1,052	SY	$ 100.00	$ 105,177.78
21	Salvage Riprap	150	CY	$ 50.00	$ 7,500.00
22	Large Block Retaining Wall	22,380	SFF	$ 90.00	$ 2,014,200.00
23	Soldier Pile Wall	2,500	SFF	$ 225.00	$ 562,500.00
24	Double 12'x9' RCB & Wingwalls	160	LF	$ 3,800.00	$ 608,000.00
25	Double 12'x10' RCB & Wingwalls	70	LF	$ 4,000.00	$ 280,000.00
26	Triple 12'x9' RCB & Wingwalls	38	LF	$ 4,800.00	$ 182,400.00
27	Inlet (2'x4')(Grate)	5	EA	$ 2,500.00	$ 12,500.00
28	Connect to Existing Structure	4	EA	$ 1,000.00	$ 4,000.00
29	Metal Handrail (42")	322	LF	$ 250.00	$ 80,500.00
30	Fence (4' Chain Link)	2,848	LF	$ 55.00	$ 156,640.00
21	Sod (Fescue)	3,120	SY	$ 7.00	$ 21,838.44
32	Traffic Control	1	LS	$ 75,000.00	$ 75,000.00
33	Erosion Control	1	LS	$ 30,000.00	$ 30,000.00
34	Construction Staking	1	LS	$ 18,000.00	$ 18,000.00
35	Preconstruction Survey	1	LS	$ 15,000.00	$ 15,000.00

SUBTOTAL =	**$ 5,264,756.84**
CONSTRUCTION CONTINGENCY (20%) =	$ 1,053,000.00
TOTAL CONSTRUCTION COST	**$ 6,317,756.84**
ENGINEERING, SURVEY, PERMITTING, CONSTRUCTION OBSERVATION (25%)	$ 1,579,439.21
TOTAL PROJECT COST (2023 Dollars) =	**$ 7,897,196.05**
COST ESCALATION TO MIDPOINT OF CONSTRUCTION =	**$ 9,305,944.00**

Engineering News Record Construction Cost Index (May 2023) =	13,288.27
Engineering News Record Construction Cost Index (May 2020) =	11,418.00
Percent Change Over 3 Years ((2023 ECI - 2020 ECI)/2019 ECI) x 100 / 3 =	5.5%
Cost Date =	August 2023
Construction Start =	February 2026
Construction End =	April 2027
Construction Midpoint =	September 2026
Time to Midpoint of Construction (Years) =	3.1
Escalation Cost [(Current Cost x (1 + Percent Change/100) ^ Time to Midpoint) - Current Cost] =	$ 1,408,747.48

4.3.5 Risk Reduction

The change in flood risk between the existing condition and the Project Alternative 3 improvements for buildings and streets is summarized in tables 18 and 19, respectively. The complete RIPP spreadsheet for Project Alternative 3 is included in Appendix D. The asset class weightings for all risk reduction remain as approved in the Johnson County, Kansas, Administrative Procedures for the SMP, adopted July 2022 (Johnson County SMP 2022).

Table 18. Project Alternative 3 Building Flood Risk Reduction.

Building Address	Existing Flood Risk	Project Alternative 3 Flood Risk	Change in Flood Risk
5923 Woodson Street	4.0	1.0	3.0
5929 Woodson Street	4.2	1.0	3.2
5932 Outlook Street	3.8	1.0	2.8
5939 Woodson Street	4.0	1.0	3.0
6150 W 61st Street	4.0	3.7	0.3
		Total Change in Building Flood Risk =	**1.5**

Table 19. Project Alternative 3 Street Flood Risk Reduction.

Street Location	Existing Flood Risk	Project Alternative 3 Flood Risk	Change in Flood Risk
Martway Street	5.0	1.0	4.0
Woodson Road	2.7	1.0	1.7
Outlook Street	5.0	1.0	4.0
Johnson Drive	3.1	1.0	2.1
Reeds Road	3.1	1.0	2.1
Dearborn Street	2.4	1.0	1.4
		Total Change in Street Flood Risk =	**3.4**

Based on the change in building and street flood risk and using the asset weighting values presented in Table 4, assuming there is no change in water quality risk, the total change in risk for Project Alternative 3 is 2.0. The conceptual opinion of probable cost for Project Alternative 3 is $9,305,944, and the cost efficiency factor for this alternative is $4,604,399.

4.4 Project Alternative 4

The improvements associated with Project Alternative 4 are described in detail in this section. In addition, a conceptual opinion of probable cost and the flood risk reduction associated with Project Alternative 4 are provided.

4.4.1 Project Alternative Limits

Project Alternative 4 includes the identical Rock Creek channel improvements to Project Alternative 3 but adds the extension of the storm sewer interceptor in Johnson Drive from Lamar Avenue to approximately 160 feet west of Barkley Street. In addition to the PPS area identified in Figure 4, the Project Alternative 4 limits include the extension of the existing interceptor as shown in Figure 11, which identifies the improvement limits for the interceptor extension.

4.4.2 Flood Reduction Improvements

The flood risk reduction benefit of the Project Alternative 4 improvements was evaluated using the updated HEC-RAS model created for this PPS. Figures 9 and 10 compare the hydraulic performance of Project Alternative 4 with the existing condition. As shown in these figures, Project Alternative 4 reduces flood elevations within the PPS area, which lessens the building and street flood risk in this area. Note that the Rock Creek flood elevations in the PPS area for Project Alternative 4 are lower than the elevations for Project Alternative 3 by as much as 1 foot at some locations. This flood elevation reduction is attributed to the redirection of upstream flows (approximately 300 cfs in the 100-year storm event) from north of Johnson Drive into the extended storm sewer interceptor. The flow redirection calculations from StormCAD and HEC-HMS for the storm sewer interceptor extension are included in Appendix C. Table 20 shows a detailed comparison of flood elevations for existing conditions and Project Alternative 4 at each HEC-RAS-modeled cross-section for a 100-year storm event. A full HEC-RAS model output for all storm events analyzed is included in Appendix C.

Regarding the upstream and downstream limits of Project Alternative 4, the 100-year flood profile for Project Alternative 4 (see Figure 10) shows that the WSE matches the existing conditions profile at cross-section 3.130 (upstream of the project) and ties back into the existing conditions profile at cross-section 2.452, which is downstream of the PPS area. No floodplain impacts are anticipated either upstream or downstream of these tie-in locations. Because of the reduction in the 100-year flood footprint within the PPS area, a FEMA CLOMR and LOMR are anticipated for this project.

Table 20. Existing Conditions and Project Alternative 4 Hydraulic Comparison.

Cross Section Number	100-Year Storm Event		
	Existing Water Surface Elevation (feet)	Project Alternative 4 Water Surface Elevation (feet)	Change in Water Surface Elevation from Existing Conditions (feet)
3.130	960.20	960.20	0.00
3.110	959.72	958.66	-1.06
3.014	956.32	955.66	-0.66
2.958	956.03	953.24	-2.79
2.926	953.37	950.36	-3.01
2.917	952.24	949.81	-2.43
2.909	952.10	947.88	-4.22
2.860	952.41	946.60	-5.81
2.815	951.24	946.60	-4.64
2.790	948.30	943.75	-4.55
2.750	947.85	944.04	-3.81
2.730	947.22	942.58	-4.64
2.711	947.33	943.13	-4.20
2.708	947.18	943.14	-4.04
2.692	945.27	942.70	-2.57
2.672	944.95	942.78	-2.17
2.654	941.88	941.87	-0.01
2.588	942.03	941.99	-0.04
2.502	936.66	936.64	-0.02
2.474	936.14	936.13	-0.01
2.470	935.89	935.88	-0.01
2.452	934.32	934.33	0.01
2.427	934.90	934.90	0.00

4.4.3 Water Quality Improvements

No permanent water quality improvement features are considered with Project Alternative 4.

4.4.4 Project Details

This section summarizes pertinent design-related information to describe the proposed improvements associated with Project Alternative 4.

4.4.4.1 Stormwater System

The stormwater system for Project Alternative 4 is identical to the Project Alternative 3 stormwater system with the addition of the storm sewer interceptor extension in Johnson Drive. The interceptor extension will connect to the existing storm sewer system in Johnson Drive at two locations, as shown in Figure 11. By connecting these two existing 48-inch pipes to the storm sewer interceptor, the downstream side of these two pipes can be abandoned, reducing long-term system management costs for these pipes. This effort will also benefit the City's storm sewer system south of Johnson Drive by providing additional capacity in the existing system and greater flexibility in the pipe rehabilitation options available, including slip-lining, which would reduce the pipe conveyance capacity.

4.4.4.2 Road/Traffic

The existing roadway profiles for Woodson Street, Outlook Street, and Reeds Road will be maintained with the installation of new wider culverts at these three locations. A traffic control plan for the full closure and detour during the construction of new culverts at the Woodson Street and Martway Street intersection, Outlook Street, and Reeds Road at the Rock Creek channel will be necessary to complete this project. This traffic control plan showing closures and detour routes will apply to both vehicles and pedestrians using these streets.

The interceptor extension will follow an alignment under the eastbound lanes of Johnson Drive, avoiding known utilities in Johnson Drive and the streetscape elements, utilities, and traffic signals at Barkley Street to the south. Figure 12 shows some of the streetscape elements in Johnson Drive that will be avoided. Construction of this interceptor would require lane closures during construction, limiting through traffic to one lane in either direction. The streets connecting to Johnson Drive would require a traffic detour during construction; coordination with all the businesses along Johnson Drive would be critical to maintain business access during construction.

4.4.4.3 Utilities

Several utilities identified in Figure 5 will be affected by the Project Alternative 4 improvements, including water, sewer, gas, and overhead electric. The most significant impacts will be to JCW facilities, specifically 15-inch and 24-inch sewer mains that parallel the existing Rock Creek channel and cross the channel in multiple locations. In addition, Project Alternative 4 includes an 8-inch sewer crossing that is currently above the existing RCB at the Woodson Street and Martway Street intersection. Based on evaluation of the proposed Project Alternative 4 channel profile, several sewer crossings will be encased and one of these sanitary sewer crossings must be lowered. The concept cost estimate for Project Alternative 4 includes costs to encase and lower the

JCW sewer in these locations. Project Alternative 4 will also have a significant impact on the overhead power lines that run parallel to the Rock Creek channel between Woodson Street and Outlook Street. Coordination with Evergy to relocate these overhead power lines prior to the construction of the channel improvements will be necessary. Initial contact with utilities in the PPS area was performed, but more detailed utility coordination during future design efforts will be required to confirm utility relocation areas and time frames. Additional relocations to WaterOne watermain and Kansas Gas Service gas lines may be necessary, depending on their depths.

The proposed interceptor extension for Project Alternative 4 will cross under the southerly AT&T duct bank along an alignment between the two duct banks to avoid other utilities, traffic signals, and recently constructed streetscape elements located along the southern side of Johnson Drive. Figure 12 shows the alignment of the storm sewer interceptor extension. More detailed concept plan and profile sheets showing the interceptor extension, utilities in the corridor, and improvement quantities within the corridor are included in Appendix C.

4.4.4.4 Permits

Project Alternative 4 has the same type of stream, floodplain, and grading impacts as Project Alternative 1. The same permits identified in Section 4.1.4.4 apply to this project alternative.

4.4.4.5 Rights-of-way/Easements

The Rock Creek channel improvements for Project Alternative 4 will be primarily within either the existing drainage easement that follows Rock Creek or City-owned property/City right-of-way through the PPS Area. Figure 5 shows the limits of this drainage easement, City-owned parcels, and City right-of-way. Additional permanent drainage easement may be necessary along the north-south stretch of the Rock Creek Channel between Woodson Street and Outlook Street. To allow the project to be constructed, temporary construction easements may be necessary in areas where construction is close to the existing easement limits and where construction activity would extend onto private property.

The storm sewer interceptor extension improvements are in City right-of-way. Additional temporary construction easements may be necessary to construct this extension in certain areas.

4.4.4.6 Conceptual or Preliminary Design Drawings

A conceptual plan and profile figure for the lowering of the Rock Creek channel and culvert reconstruction associated with Project Alternative 4 is shown on Exhibit 1 in Appendix C. Exhibit 2 in Appendix C shows the storm sewer interceptor extension

improvements in Johnson Drive. These concept plans provided sufficient detail to identify the quantities that went into the concept opinion of probable cost for Project Alternative 4.

4.4.4.7 Escalated Class 3 Opinion of Probable Cost

Table 21 is the concept opinion of probable cost for Project Alternative 4 and this cost is consistent with the level of detail for a Class 3 estimate as defined by the AACE (AACE 2005).

The preliminary opinion of probable cost for Project Alternative 4 in current dollars is $11,254,450, and the probably cost escalated to the midpoint of construction (estimated to be September 2026) is $13,262,085.

4.4.4.8 Schedule and Cost Estimate for Establishment and Maintenance for Water Quality Solutions

As discussed, water quality solutions are not a primary consideration for this PPS. No permanent water quality improvement features are considered with Project Alternative 4.

4.4.4.9 Relationship to Other Stormwater Facilities

The Project Alternative 4 improvements will tie-in to the existing Rock Creek channel on the upstream end of the project, which is immediately west of Woodson Street, and on the downstream end of the project, which is east of Reeds Road. Project Alternative 4 improvements lower water surface elevations within Rock Creek to reduce flood risk, so there will be no negative impacts to other stormwater facilities hydraulically connected to Rock Creek.

The storm sewer interceptor extension included with Project Alternative 4 will connect to the existing storm sewer system in Johnson Drive at two locations, as shown on Figure 11. These two connections to existing 48-inch storm sewer pipes will redirect all the storm sewer flows from Johnson Drive and areas draining to Johnson Drive from the north into the interceptor. The benefit to the PPS area is the reduction of flow discharging into Rock Creek at the upstream end of the PPS area. This flow reduction yields a reduction in flood elevations as shown in Figure 11.

PROJECT ALTERNATIVE 4 PRELIMINARY OPINION OF PROBABLE COST.

olsson

Client: City of Mission, Kansas
Project: Rock Creek PPS
Project Number: 018-3593
Date: 11/27/2023

	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST
1	Mobilization	1	LS	$ 225,000.00	$ 225,000.00
2	Clearing & Grubbing	1	LS	$ 22,000.00	$ 22,000.00
3	Removal of Existing Structures	1	LS	$ 275,000.00	$ 275,000.00
4	Shed Relocation	1	LS	$ 8,000.00	$ 8,000.00
5	Tree Removal	20	EA	$ 500.00	$ 10,000.00
6	Unclassified Excavation (Channel)	4,777	CY	$ 50.00	$ 238,831.78
7	Excavation (Rock)(Channel)	1,231	CY	$ 75.00	$ 92,322.84
8	2" Asphaltic Concrete Surface	650	Ton	$ 85.00	$ 55,250.00
9	9" Intermediate Asphaltic Concrete	2,840	Ton	$ 80.00	$ 227,200.00
10	5" Aggregate Base Course (AB-1)	5,600	SY	$ 9.00	$ 50,400.00
11	Curb & Gutter, Combined (Type B)	3,135	LF	$ 25.00	$ 78,375.00
12	Curb & Gutter, Combined (Type C-1)	218	LF	$ 25.00	$ 5,450.00
13	Brick Pavers	4,997	SF	$ 20.00	$ 99,947.07
14	Sanitary Sewer Reinforced Concrete Encasement (RCE)	390	LF	$ 225.00	$ 87,750.00
15	24" Sanitary Sewer (PS 115 PVC)	96	LF	$ 300.00	$ 28,800.00
16	8" Sanitary Sewer (SDR 26 PVC)	297	LF	$ 220.00	$ 65,340.00
17	4' Diameter Sanitary Sewer Structure	3	EA	$ 6,500.00	$ 19,500.00
18	Sidewalk Construction (4")	12,994	SF	$ 12.00	$ 155,928.74
20	Sidewalk Ramp (6")	560	SF	$ 40.00	$ 22,400.00
19	Detectable Warning Surface	105	SF	$ 65.00	$ 6,825.00
21	Commercial Concrete Apron (8")	70	SY	$ 130.00	$ 9,100.00
22	Concrete Paved Channel (6")	1,052	SY	$ 100.00	$ 105,177.78
23	Salvage Riprap	150	CY	$ 50.00	$ 7,500.00
24	Large Block Retaining Wall	22,380	SFF	$ 90.00	$ 2,014,200.00
25	Soldier Pile Wall	2,500	SFF	$ 225.00	$ 562,500.00
26	Double 12'x9' RCB & Wingwalls	160	LF	$ 3,800.00	$ 608,000.00
27	Double 12'x10' RCB & Wingwalls	70	LF	$ 4,000.00	$ 280,000.00
28	Triple 12'x9' RCB & Wingwalls	38	LF	$ 4,800.00	$ 182,400.00
29	6'x5' RCB	1,640	LF	$ 810.00	$ 1,328,400.00
30	18" Storm Sewer (RCP Class III)	64	LF	$ 140.00	$ 8,960.00
31	Inlet (2'x4')(Grate)	5	EA	$ 2,500.00	$ 12,500.00
32	Inlet (6'x4') (Curb)	8	EA	$ 8,000.00	$ 64,000.00
33	Connect to Existing Structure	6	EA	$ 1,000.00	$ 6,000.00
34	Metal Handrail (42")	322	LF	$ 250.00	$ 80,500.00
35	Fence (4' Chain Link)	3,013	LF	$ 55.00	$ 165,715.00
36	Sod (Fescue)	3,384	SY	$ 7.00	$ 23,687.15
37	Traffic Control	1	LS	$ 175,000.00	$ 175,000.00
38	Erosion Control	1	LS	$ 40,000.00	$ 40,000.00
39	Construction Staking	1	LS	$ 40,000.00	$ 40,000.00
40	Preconstruction Survey	1	LS	$ 15,000.00	$ 15,000.00

SUBTOTAL =	**$ 7,502,960.36**
CONSTRUCTION CONTINGENCY (20%) =	$ 1,500,600.00
TOTAL CONSTRUCTION COST	**$ 9,003,560.36**
ENGINEERING, SURVEY, PERMITTING, CONSTRUCTION OBSERVATION (25%)	$ 2,250,890.09
TOTAL PROJECT COST (2023 Dollars) =	**$ 11,254,450.44**
COST ESCALATION TO MIDPOINT OF CONSTRUCTION =	**$ 13,262,085.00**

Engineering News Record Construction Cost Index (May 2023) =	13,288.27
Engineering News Record Construction Cost Index (May 2020) =	11,418.00
Percent Change Over 3 Years ((2023 ECI - 2020 ECI)/2019 ECI) x 100 / 3 =	5.5%
Cost Date =	August 2023
Construction Start =	February 2026
Construction End =	April 2027
Construction Midpoint =	September 2026
Time to Midpoint of Construction (Years) =	3.1
Escalation Cost [(Current Cost x (1 + Percent Change/100) ^ Time to Midpoint) - Current Cost] =	$ 2,007,633.93

4.4.4.10 Upstream and Downstream Effects

The improvements proposed with this alternative are contained within the City. The hydraulic modeling confirmed that no negative effects occurred upstream or downstream outside the PPS area.

4.4.5 Risk Reduction

The change in flood risk between the existing condition and the Project Alternative 4 improvements for buildings and streets is summarized in tables 22 and 23, respectively. The complete RIPP spreadsheet for Project Alternative 4 is included in Appendix D. The asset class weightings for all risk reduction remains as approved in the Johnson County, Kansas, Administrative Procedures for the SMP, adopted July 2022 (Johnson County SMP 2022).

Table 22. Project Alternative 4 Building Flood Risk Reduction.

Building Address	Existing Flood Risk	Project Alternative 4 Flood Risk	Change in Flood Risk
5923 Woodson Street	4.0	1.0	3.0
5929 Woodson Street	4.2	1.0	3.2
5932 Outlook Street	3.8	1.0	2.8
5939 Woodson Street	4.0	1.0	3.0
6150 W 61st Street	4.0	1.7	2.4
Total Change in Building Flood Risk =			**2.9**

Table 23. Project Alternative 4 Street Flood Risk Reduction.

Street Location	Existing Flood Risk	Project Alternative 4 Flood Risk	Change in Flood Risk
Martway Street	5.0	1.0	4.0
Woodson Road	2.7	1.0	1.7
Outlook Street	5.0	1.0	4.0
Johnson Drive	3.1	1.0	2.1
Reeds Road	3.1	1.0	2.1
Dearborn Street	2.4	1.0	1.4
Total Change in Street Flood Risk =			**3.4**

Based on the change in building and street flood risk and using the asset weighting values presented in Table 4, assuming there is no change in water quality risk, the total change in risk for Project Alternative 4 is 2.3. The conceptual opinion of probable cost for Project Alternative 4 is $13,262,085, and the cost efficiency factor for this alternative is $5,792,460.

4.5 Selected Alternative

Table 24 presents the total conceptual opinion of probable cost escalated to the midpoint of construction, total change in risk score, and the cost-efficiency factor (cost per change in risk score) for each of the four proposed project alternatives.

Table 24. Project Alternative Risk Reduction Summary.

Project Alternative	Project Cost (Escalated to Midpoint of Construction)	Change in Risk Score	Cost-Efficiency Factor
1	$8,601,297	0.8	$10,597,971
2	$11,541,964	1.6	$7,089,109
3	$9,305,944	2.0	$4,604,399
4	$13,262,085	2.3	$5,792,460

Based on these cost-efficiency factors, Project Alternative 3 has the lowest value. Alternatives 1 and 2 costs are comparable to Alternative 3; however, both alternatives 1 and 2 have a change in total risk score of less than Alternative 3, which makes their cost-efficiency factors higher than Alternative 3. Project Alternative 4 has both the highest cost, but also the highest change in risk score, and the cost-efficiency factor for Project Alternative 4 is higher than Project Alternative 3. With the cost-efficiency factor for Project Alternative 3 being the lowest for the alternatives, Project Alternative 3 is the selected alternative for the Rock Creek PPS.

5. REFERENCES

AACE. 2005. "Cost Estimate Classification System - As Applied in Engineering, Procurement, and Construction for the Process Industries." (The Association for the Advancement of Cost Engineering International).

APWA. 2011. "Section 5600 Storm Drainage Systems & Facilities." (Kansas City Metropolitan Chapter American Public Works Association).

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FEMA. 2009. "Flood Insurance Study - Johnson County, Kansas, and Incorporated Areas."

Johnson County SMP. 2020. "2020 lidar."

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Shawnee Mission Post. 2020. *Rock Creek retaining wall collapses causing electricity pole to tilt, public advised to stay clear of the area.* Juliana Garcia. May 28. Accessed 2023. https://shawneemissionpost.com/2020/05/28/rock-creek-retaining-wall-collapses-causing-electricity-pole-to-tilt-public-advised-to-stay-clear-of-the-area-93790/.

Stormwatch. 2023. *Gauge site data.* https://www.stormwatch.com/site/?site_id=106&site=df8e2b91-db3c-4fec-8fda-5b70977b82c1.

USACE. 2023. *HEC-HMS and HEC-1 Differences.* https://www.hec.usace.army.mil/confluence/hmsdocs/hmsum/4.9/hec-hms-and-hec-1-differences.

APPENDIX A:
COORDINATION WITH WATERSHED ORGANIZATION

APPENDIX B:
PRELIMINARY PROJECT STUDY FUNDING REQUEST

APPENDIX C:
DIGITAL FILES AND PROJECT FIGURES

APPENDIX D:
RISK INTEGRATED PROJECT PRIORITIZATION SCORING BACKUP DOCUMENTATION

APPENDIX E:
QUALITY ASSURANCE/QUALITY CONTROL

APPENDIX F:
PRELIMINARY PROJECT STUDY CHECKLIST

ROCK CREEK LAMAR AVENUE TO NALL AVENUE

PRELIMINARY PROJECT STUDY

SMP Project Number: RC-06-023

Mission, Kansas

November 2023

Olsson Project No. 018-3593

Project Alternative 1
(Lower Channel from DS of Woodson St to DS of Reeds Rd)

Risk Score Improvement

Asset	Weighting	Existing	Proposed	Change in Risk
Building	20%	4.0	2.8	1.2
Street	50%	4.4	3.3	1.1
Waterway	30%	1.0	1.0	0.0
	100%		Existing Risk Score:	3.3
			Proposed Risk Score:	2.5
			Change in Risk Score:	0.8
			Estimated Total Project Cost:	$8,601,297
			Cost-Efficicency Factor:	$10,597,971
			Project Estimated BCA Competitiveness	Low

Project Alternative 2
(Lower Channel from DS of Woodson St to DS of Reeds Rd + Interceptor Extension)

Risk Score Improvement

Asset	Weighting	Existing	Proposed	Change in Risk
Building	20%	4.0	1.3	2.8
Street	50%	4.4	2.3	2.2
Waterway	30%	1.0	1.0	0.0
	100%		Existing Risk Score:	3.3
			Proposed Risk Score:	1.7
			Change in Risk Score:	1.6
			Estimated Total Project Cost:	$11,541,964
			Cost-Efficicency Factor:	$7,089,109
			Project Estimated BCA Competitiveness	Low

Project Alternative 3
(Lower Channel from US of Woodson St to DS of Reeds Rd)

Risk Score Improvement

Asset	Weighting	Existing	Proposed	Change in Risk
Building	20%	4.0	2.5	1.5
Street	50%	4.4	1.0	3.4
Waterway	30%	1.0	1.0	0.0
	100%		Existing Risk Score:	3.3
			Proposed Risk Score:	1.3
			Change in Risk Score:	2.0
			Estimated Total Project Cost:	$9,305,944
			Cost-Efficicency Factor:	$4,604,399
			Project Estimated BCA Competitiveness	Low

Project Alternative 4
(Lower Channel from US of Woodson St to DS of Reeds Rd + Interceptor Extension)

Risk Score Improvement

Asset	Weighting	Existing	Proposed	Change in Risk
Building	20%	4.0	1.1	2.9
Street	50%	4.4	1.0	3.4
Waterway	30%	1.0	1.0	0.0
	100%		Existing Risk Score:	3.3
			Proposed Risk Score:	1.0
			Change in Risk Score:	2.3
			Estimated Total Project Cost:	$13,262,085
			Cost-Efficicency Factor:	$5,792,460
			Project Estimated BCA Competitiveness	Low

City of Mission	Item Number:	5.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Public Works	From:	Brent Morton/Laura Smith

Action items require a vote to recommend the item to full City Council for further action.

RE: Rock Creek Channel Preliminary Project Study – Woodson to Reeds Road

RECOMMENDATION: Approve the submission of Option 3 from the Rock Creek Channel Preliminary Project Study (Woodson to Reeds Road) to the Johnson County Stormwater Management Program for funding in 2025/2026.

DETAILS: Johnson County Stormwater Management Program (SMP) completed a Watershed Master Plan – Phase 1 (WMP) for Watershed 1 (WO1) in March 2022. The portion of Rock Creek Channel located in Mission is within the WO1 boundaries. The WMP used a watershed-based approach to look holistically at watershed characteristics and environmental deficiencies within the watershed. Methodology was also developed to define watershed risk, identification of watershed opportunities and constraints, and concept solutions based on the following factors: flooding, water quality, stream erosion and movement, and watershed hydromodification (i.e., changes in watershed hydrology due to development activities).

The WMP also identified severe risk areas based on the four factors identified above and subsequently identified high concentrations of these risks and grouped them together into “focus areas”. The portion of the Rock Creek Channel located within Mission city limits was identified as Focus Area 2 with a preliminary flood risk score of 4.44 (based on a scale of 1 to 5 with 5 identified as the highest risk) and a preliminary risk score of 2.03 for water quality.

In September 2022, The Council approved a task order with Olsson to conduct a Preliminary Project Study (PPS) of Rock Creek Channel from Woodson to Reeds Rd. A PPS is required by Johnson County SMP to submit a project for matching funds for design and construction at up to a 50% cost share. The City received SMP funding for a portion of the PPS.

The PPS is now complete, and the four proposed options have been reviewed by Staff. The four project alternatives are scored through the County’s ranking system which looks at change in risk score and a cost-efficiency factor. The next step in the3 process is to submit the PPS to Johnson County SMP for review and potential funding of the project in 2025/2026.

Staff is recommending submission of Alternative Three which consists of:

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	Stormwater Utility Fund
Available Budget:	TBD

City of Mission	Item Number:	6.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Parks + Recreation	From:	Penn Almoney

Action items require a vote to recommend the item to full City Council for further action.

RE: Powell Community Center North Bathrooms Remodel

RECOMMENDATION: Approve a contract with MAC General Contracting for the demolition and remodeling of the two north the Powell Community Center bathrooms in an amount not to exceed $35,026.

DETAILS: The Powell Community Center's (PCC) two north bathrooms were originally installed in the 2004 community center expansion. A myriad of rental groups ranging from business conferences to basketball teams and high use associated with summer camp and programming have deteriorated the amenities over the last 19 years. The floors, counters, stall dividers and wall tile need replaced with fixtures that are more durable, aesthetically pleasing, easier to maintain and invite visitors to see the value in their patronage to our facility.

Restroom remodels are widely recognized as adding value to any facility. Users have commented that the PCC north restrooms look "tired and well-used". Recent remodeling investments for the south restrooms and locker rooms have yielded positive feedback from patrons and maintenance staff and have helped save time and resources.

As staff progresses through this final phase of deferred maintenance, it is important for the PCC to choose inputs that are pleasing and add value to the patron experience. Renovating the PCC space provides an opportunity to enhance our amenities and also create a refreshed space that could also attract attention from potential customers and through word-of-mouth sharing. These changes, coupled with the revised and strong brand identity the PCC currently has, can significantly boost future interest and ultimately revenue and lift the Community Center to new heights.

The 2023 Parks + Recreation Capital Improvement Plan includes $35,000 for remodeling the two north bathrooms. In preparing for this capital project, staff considered various replacement objectives including: aesthetics, durability, ease of maintenance, and impact to patrons (time to replace). With those objectives in mind, staff reviewed vendor solutions along with industry best practices and concluded that the most cost-effective, safe, visually appealing and maintenance-friendly options were metallic epoxy flooring, stone counters, high density polymer dividers and industrial hinges. To save on costs, staff is planning to reuse the toilets, sinks and fixtures, which are touchless and were replaced during the COVID-19 pandemic.

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	45-90-805-09
Available Budget:	$35,000

City of Mission	Item Number:	6.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Parks + Recreation	From:	Penn Almoney

Action items require a vote to recommend the item to full City Council for further action.

Quotes were solicited from ten (10) bathroom remodeling contractors, two of whom responded. Bid amounts are included in the table below.

Contractor	**Total**
Kings Collective	$61,200
MAC General Contracting	$35,026

MAC General Contracting submitted the lowest and most responsive bid, which included details on each phase of the project, reusing the existing fixtures where possible, installing all drywall, flooring, wall and stall dividers to manufacturer specifications. MAC General Contracting has extensive experience working both small and large-scale projects and completed a project similar in scope at the Matt Ross Community Center several years ago.

MAC General Contracting have staff available to complete the project within a 3-week window. Staff recommends the project be awarded to MAC General Contracting for the demolition and remodel of the two PCC north bathrooms in an amount not to exceed $35,026.00 with anticipated installation to occur during 2024 spring break. This project was approved in the 2023 Parks + Recreation CIP and will be paid from Parks + Recreation Sales Tax funds.

CFAA CONSIDERATIONS/IMPACTS: This work will help ensure the Powell Community Center patrons of all ages and abilities will be able to enjoy the conference space and its support facilities for many years to come.

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	45-90-805-09
Available Budget:	$35,000

MAC GENERAL CONTRACTING LLC

ESTIMATE #	DATE	EXPIRES
92	11/17/2023	12/16/2023

Title: Community center bathrooms

CUSTOMER

Jenna Dickman
6200 Martway Street Mission KS
Mission, KS 66202

PROJECT

Community center bathrooms
PROJECT #: Comm. center
6200 Martway Street Mission KS
Mission, KS 66202

SERVICE ADDRESS

6200 Martway Street Mission KS
Mission, KS 66202

SUMMARY

Men's restroom: Demo partitions only, demo wall and floor tile, demo countertops only we are leaving sinks and mirrors and dispensers. We are installing new partitions and tiling up the wall 48" subway tile 4x8 white, epoxy swirl on the floor, installing new countertops, patch and repair walls where needed, paint color tbd by customer.

Women's restroom: Demo partitions only, demo wall and floor tile, demo countertops only we are leaving sinks and mirrors and dispensers. We are installing new partitions and tiling up the wall 48" subway tile 4x8 white, epoxy swirl on the floor, installing new countertops, patch and repair walls where needed, paint color tbd by customer.

	Total
Item	$35,026.00
Total	$35,026.00

SCOPE OF WORK

MAC GENERAL CONTRACTING LLC

ESTIMATE #	DATE	EXPIRES
92	11/17/2023	12/16/2023

- Demo partitions/stalls
- Demo tile flooring
- Demo wall tile
- Demo countertops
- Prep floors for epoxy
- Install tile on walls 48”
- Reinstall partitions
- Repair walls where needed
- Paint walls color tbd by customer
- Install countertops
- Epoxy floor swirl

MAC GENERAL CONTRACTING LLC

ESTIMATE #	DATE	EXPIRES
92	11/17/2023	12/16/2023

TERMS & CONDITIONS

MAC General Contracting LLC

5435 Merriam Dr

913-529-1055 Office

Merriam, Kansas

Email: macgeneralcontractingllc@gmail.com

66203

Work Authorization & Direction to Pay _____,

("Owner") hereby authorizes MAC General Contracting LLC and/or its assignees to mobilize and complete the necessary work to remodel ,restore, rebuild, clean, and/or deodorize the building structure and/or contents and/or to provide emergency services as authorized by owner and/or insurance representative relating to the loss or work. The person signing below represents that they have the authority to do so on owner's behalf. Owner agrees to pay MAC General Contracting LLC and/or its' assignees for all labor, materials, and equipment utilized to mobilize, demobilize, and perform the work with pricing as outlined below:

Phone Number: _____ Email:_____

Address_____

City/State_____Zip Code_____ Date: _____

Lump Sum Amount of: $_____ per Estimate or Proposal Emailed or texted to Owner.

Down Payment 25% _____

25% draw upon agreed upon completion of _____25% upon CERTIFICATE OF COMPLETION SIGNED BY OWNER of $_____

All CHANGE ORDERS ARE DUE UPON COMPLETION OF CHANGE ORDER.

If a Lump Sum amount is not inserted above, Owner understands and agrees that a Price will be determined later and will be determined by MAC General Contracting LLC and/or its' assignees Labor time, Equipment, & Materials and/or independent pricing set for insurance restoration purposes by Xactimate. Project X T.E.M. provided by Insurance company. Owner agrees to make payment directly to MAC General Contracting LLC and/or its' assignees for the work and for any deductible, depreciation, or amounts not covered by insurance for this work. Owner agrees to remove cash, jewelry, firearms, collectibles, or any valuable items prior to work start. Owner acknowledges the understanding and agreement to all terms and conditions. Owner Requests that all payments pertaining to MAC General Contracting LLC and/or its' assignees work be paid directly to MAC General Contracting LLC and/or its' assignees by Owner's insurance provider, and to add MAC General Contracting LLC and/or its' assignees as additional payee on all claim payments. To the extent this does not occur, Owner assigns the insurance proceeds, to the extent they are on account of MAC General Contracting LLC and/or its' assignees work, to MAC General Contracting LLC and/or its' assignees.

MAC GENERAL CONTRACTING LLC

ESTIMATE #	DATE	EXPIRES
92	11/17/2023	12/16/2023

PAYMENT TERMS: 50% Down Payment at time of contract unless otherwise agreed upon, with progress invoices submitted per work complete, all payments due per Invoice & Payment Method of above. (Down payment covers mobilization, overhead, supervision, scheduling, materials, permits, and other initial costs)

Signed: _____ Date_____ Home Authorized agent

Signed:_____Date_____ MAC General Contracting LLC Agent

Company contacts information

MAC General Contracting LLC

5435 Merriam Dr, KS 66203

Office number 913-529-1055

2 email addresses of macgeneralcontractingllc@gmail.com or f3glazing@gmail.com

TERMS & CONDITIONS:

Scope of Work & Additional Work: MAC General Contracting LLC and/or its' assignees agrees to perform the scope of work referenced on page 1. Owner agrees that any supplements or additions to work may be accomplished verbally or with a written change order. Supplemental work includes betterment; owner selected changes, and/ or enforcement of code or ordinances by municipality or building department.

Lump Sum Contract & Pricing: The estimate included or a Quickbooks invoice will be written to define the scope and pricing, if not based on time, equipment & materials. A copy of the same is available upon request. The estimated value for each line item multiplied by 40% for the replacement will equal the material cost of that item. If owner reduces the overall scope of work, overhead and profit originally calculated will still apply to the overall price MAC General Contracting LLC and/or its' assignees at its option may utilize value engineering to complete the same work in a more efficient manner or in order to achieve a savings to MAC General Contracting LLC and/or its' assignees

Work Quality: All work involving remodeling, restoration and/or repairs is for the damaged work only and for like kind & quality craftsmanship and does not cover unaffected areas and does not cover restoring existing deficiencies. Estimate presumes original walls, floors and framing are plumb, square, and straight. Construction does not result in "Perfect Finishes" such as is found in manufacturing under a controlled environment. Our work will conform to existing qualities and will be governed by references published by the National Association of Home Builders, "Residential Construction Performance Guidelines". All construction debris will be removed from project and areas left in a swept and/or shop vacuumed quality cleaned condition.

Contract Time: Time is of the essence to this agreement and contractor will diligently pursue substantial completion of the work but will not be held liable for delays due to deliveries, weather, owner or insurance carrier, scheduling of trade issues or any other conditions beyond contractor's control. Owner agrees to hold harmless contractor for any additional delays to work. Owner further agrees not to cause delays to project for any reason and to provide clear and continuous access to the work site from

9:00am to 5:00pm. MAC General Contracting LLC and/or its' assignees may at their option, place a 'LOCK BOX" at the property and assumes no responsibility for unauthorized entry. Owner agrees to provide electricity, heat, water, local telephone, and sanitary facilities. Substantial completion is the date when the property can be occupied for its intended use, not when the work is 100% satisfactory. Customer agrees to sign Certificate of Completion upon project completion.

Invoice & Payment Method: If the insurance company does not pay MAC General Contracting LLC and/or its' assignees directly, Owner agrees to make payment to MAC General Contracting LLC and/or its' assignees for the Work, whether such Work is covered by insurance. MAC General Contracting LLC and/or its' assignees may invoice work for parts of work complete. Owner shall pay MAC General Contracting LLC and/or its' assignees the amount of each invoice no later than ten (10) days following Owner's receipt of the invoice. Interest shall accrue on payments not received within such time at the lesser of (i) the maximum lawful interest rate or (ii) one and one-half percent (1 ½ %) per month. Any remaining balance of the Contract Price after the above payments are made shall be paid no later than ten (10) days following completion of the work. At the completion of Final Walk Through, owner must pay MAC General Contracting LLC and/or its' assignees for all sums less correction items on list. Items addressed after Final Walk Through will be placed on a warranty list and will not be subject to subtractions from final payments subject to limited warranty below.

Limited Warranty: Conditioned upon payment in full of all amounts due MAC General Contracting LLC and/or its' assignees, MAC General Contracting LLC and/or its' assignees warrants that the Work will be free from defects for a period of one year from the first day the Work is occupied or is ready to be occupied (whichever occurs first) by Owner and shall assign to Owner all applicable warranties of manufactures, supplies or others. MAC General Contracting LLC and/or its' assignees warranty is limited to repair or replacement, at MAC General Contracting LLC and/or its' assignees option, of the defective work and specifically excludes any equipment or materials covered by manufacturer's, supplier's, or others' warranties, and specifically excludes incidental or consequential damages. This warranty specifically excludes cracking, etc. of any concrete, drywall, plaster, caulking, sealant, tile, or any other product subject to movement of any kind. This warranty also excludes any loss caused by or consisting of any mold or microbial growth whether caused by or their subcontractors or suppliers. Owner further agrees to hold MAC General Contracting LLC and/or its' assignees harmless from all claims for personal, profile MAC General Contracting LLC and/or its' assignees professional, or property damage related to mold, microbial growth, fungi, mildew. Except as provided herein, there are no other expressed or implied warranties.

Certain Owner Obligations: Owner shall make customer selections within MAC General Contracting LLC and/or its' assignees or pay additional overhead fees to MAC General Contracting LLC and/or its' assignees and agrees to utilize the design center of contractor's choice to do so. If owner fails to make timely selections, MAC General Contracting LLC and/or its' assignees can make selections on behalf of owner with standard items. Owner agrees to allow Project X to communicate with insurance company to facilitate the processing and payment of the claim. Owner agrees to quickly facilitate the signing of any proof of loss and/or mortgage company inspections and/or endorsements to claim payments. Owner waives any right of recovery or subrogation against MAC General Contracting LLC and/or its' assignees to the extent of Owner's insurance coverage. Owner shall provide and maintain Property, Building, Personal Property, Builders Risk, "All Risk" and Premises Liability Insurance covering the Work, including all materials and supplies on site but not yet installed. Owner agrees to make claim for defects in construction pursuant to the Kansas Construction Defect Claims Act.

Hazardous or Other Conditions: MAC General Contracting LLC and/or its' assignees may halt the work upon any finding of hazardous substances or unsafe conditions. MAC General Contracting LLC and/or its'

assignees will notify owner upon the discovery of any such items. Owner must notify MAC General Contracting LLC and/or its' assignees of any known hazardous items at the site including asbestos, chemicals, lead, or other and owner shall indemnify and hold harmless MAC General Contracting LLC and/or its' assignees from and against any and all claims arising from or related to the Conditions, and MAC General Contracting LLC and/or its' assignees shall be entitled to payment from Owner for all costs, expenses and damages, including reasonable attorneys' fees and expenses, it incurs as a result of the Conditions. If conditions cause delay to project for more than 1 week, MAC General Contracting LLC and/or its' assignees may terminate this agreement. While MAC General Contracting LLC and/or its' assignees performs work related to and including the removal of mold and mold spores, owner agrees to hold MAC General Contracting LLC and/or its' assignees harmless from any and all claims for physical, personal, and/or mental damages related to or consisting of mold or microbial growth of any sort or manner.

Default: If Owner defaults in any of its obligations hereunder, MAC General Contracting LLC and/or its' assignees may, at its option, in addition to other remedies provided in this Contact or pursuant to applicable law or principles of equity, pursue one or more of the following remedies; suspend some or all of the Work until all defaults have been cured, upon three (3) days written notice to Owner, terminate some or all of MAC General Contracting LLC and/or its' assignees 's obligations under this Contract, and/or recover all amounts due under this Contract plus all expenses and reasonable attorneys' fees and expenses incurred by MAC General Contracting LLC and/or its' assignees as a result of Owner's breach or MAC General Contracting LLC and/or its' assignees enforcement of this Contract. In the event this Contract or MAC General Contracting LLC and/or its' assignee's obligations are terminated by MAC General Contracting LLC and/or its' assignees pursuant to the terms of this Contract, MAC General Contracting LLC and/or its' assignees shall be paid for all Work performed through the date of termination in an amount that will compensate MAC General Contracting LLC and/or its' assignees for all costs incurred, plus thirty percent of those costs. MAC General Contracting LLC and/or its' assignees retains the right to file a Mechanics Lien for services rendered and hereby notifies owner that MAC General Contracting LLC and/or its' assignees will file said liens to protect MAC General Contracting LLC and/or its' assignees' interest in the subject property. In such event, owner shall pay all interest charges and filing fees for the lien. Owner shall also pay MAC General Contracting LLC and/or its' assignees liquidated damages of $100.00 for each owner delay.

Dispute Resolution: Any Controversy or claim arising out of or relating to this Contract or work performed pursuant thereto shall be resolved by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award may be entered in any court having jurisdiction. MAC General Contracting LLC and/or its' assignees shall be entitled to all reasonable attorneys' fees and other legal associated costs.

Limitation, Waiver, and Venue: Owner and MAC General Contracting LLC and/or its' assignees agree that venue for any legal proceedings shall be in Leavenworth County court and that Kansas law shall govern all disputes relating to this agreement. The Arbitration shall be conducted by the American Arbitration Association. Owner agrees not to libel or slander contractor for any reason whatsoever and that in doing so to any source, agrees to indemnify contractor an amount equal to $10,000.00 unless it can be proven that such libel & slander did not cause any damages. Owner and contractor further waive their right to trial by jury and any claims for consequential or punitive damages against each other.

Entire Agreement: This Contract, including the Attachments hereto, comprises the complete agreement of the parties and no representations or agreements have been made by either party except as expressly stated in this Contract. All modifications to this Contract shall be in writing and signed by both parties hereto. If any provision of this Contract becomes or is determined to be illegal or unenforceable

MAC GENERAL CONTRACTING LLC

ESTIMATE #	DATE	EXPIRES
92	11/17/2023	12/16/2023

for any reason, the remainder of the Contract shall remain in full force and effect.

Initials: _____ Date: _____ MAC General Contracting LLC

Initials:_____Date_____ Home owner or Authorized Agent

APPROVAL

This Estimate has been accepted on _____ by _____

Signature: _____

City of Mission	Item Number:	7.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Parks + Recreation	From:	Penn Almoney

Action items require a vote to recommend the item to full City Council for further action.

RE: Powell Community Center Steam Sauna Retiling

RECOMMENDATION: Approve a contract with Alex Tile and Floor for retiling the Powell Community Center steam sauna in an amount not to exceed $12,960.00.

DETAILS: The Powell Community Center's (PCC) steam sauna is tile and grout which is original to the facility construction in 1999. Staff pressure washes and reseals the grout as a continuous standard of care. Some tiles are cracking and grout lines are replaced periodically depending on need. The 1 x 1-inch tiles have endured daily impacts well, but their useful life has ended.

Staff have received feedback from patrons on condition and appearance of the current tile and grout lines in addition to it being a focus of maintenance efforts. New grout lines were added in March 2023 to protect and enclose sharp tile edges which could result in injury to patrons. Although it was a significant safety enhancement, there was nominal aesthetic improvement. Tile and grout maintenance on such small tiles is not only time-consuming for maintenance staff, but it creates the perception that the facility is old and not in good working condition.

The 2023 Parks Capital Improvement Plan included $15,000 for replacement of the steam sauna tile floors and walls. In preparing for this capital project, Staff considered various replacement objectives including: aesthetics, durability, ease of maintenance, patron impact (time to replace).replace

With those objectives in mind, staff reviewed vendor solutions along with industry best practices and concluded that the most cost-effective, safe, visually appealing and maintenance-friendly option was large tile along the walls and seating and medium tiles on the floor. The tiles being utilized will require very little if any grout to seal. Tighter tile seams will help maintain the space and prevent grout discoloration.

Quotes were solicited from seven qualified vendors with four responding. of whom have the capacity to install for the bid amounts listed in the table below.

Contractor	Total
Alex Tile and Floor	$8,960 + ($4,000 unknown framing + concrete if needed)

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	45-90-805-09
Available Budget:	$15,000

City of Mission	Item Number:	7.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Parks + Recreation	From:	Penn Almoney

Action items require a vote to recommend the item to full City Council for further action.

Elite Tile Co	$27,380
Footprints Floors	$14,936
Tilemasters	$38,954.61

Alex Tile and Floor has extensive experience in both residential and commercial tiling projects. They have staff available to complete the project in six business days with relatively open availability beginning in January 2024. Alex Tile and Floor does not foresee any issues with the existing space but did caution that there are sometimes unknown issues once demolition begins. Based on what is known, Alex Tile and Floor bid $8,960 and recommended that if there is concrete and/or framing damage behind the existing tile $4,000 will cover those repairs, which would only be utilized if needed. There is a warranty on their installation for one year with the added coverage of tile warranty for 15 years.

Staff recommends the project be awarded to Alex Tile and Floor for steam sauna demolition and tile installation for a total not to exceed $12,960 with installation to occur in January 2024. Funds are available from the Parks + Recreation Sales Tax Fund for this project.

CFAA CONSIDERATIONS/IMPACTS: This work will help ensure the Powell Community Center patrons of all ages and abilities will be able to enjoy the indoor pool and its related amenities for many years to come.

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	45-90-805-09
Available Budget:	$15,000

TILE FLOOR

ALEX TILE AND FLOOR LLC

ESTIMATE

Jenna Dickman
913-722-8207
6200 Martway St.
Mission, KS 66202
jdickman@missionks.org

Project Title:
Tile

Date:
11/7/2023

Pay To the Order: **Alex Tile & Floor LLC**

Mail Check To: **14105 Broadmoor St APT S405, Overland Park, KS 66223**

*This price is for payment with cash or check only.
*Furniture moving is not included in this Quote.
*Any additional work that is not in this estimate that is needed to complete installation, will have to be added to the total amount.
*By accepting our services, ordering material, making payment, signing or by verbal acceptance, customer agrees to the terms of paying the full amount of this estimate within five (5) days of job completion before additional interest occurs. Restocking fees will be applied to returned orders. Other charges will be applied for any extra work/material not specified in the quote.

Thank you for your business

Erick Bautista
913-405-1070
Alexstilefloorllc@gmail.com
Alex Tile & Floor LLC

ALEX TILE AND FLOOR LLC

Labor	Qt / sqft	Unit. Price	Cost
Demolition and Trash	1	$ 2,000.00	$ 2,000.00
Tile Installation	300	$ 15.00	$ 4,500.00
Thinset	20	$ 40.00	$ 800.00
			$ -
			$ 7,300.00

Tile	Qt / sqft	Unit. Price	Cost
Tile in ceramic or porcelain	300	$ 5.00	$ 1,500.00
Grout	4	$ 40.00	$ 160.00
			$ -
			$ 1,660.00

NOTES:
- The place should be free and ready before begin the work.
- All the materials should be available before begin the work.
- WonderBoard, Thinset included

Erick Bautista
913-405-1070
Alexstilefloorllc@gmail.com

City of Mission	Item Number:	8.
ACTION ITEM SUMMARY	Date:	December 13, 2023
Public Works	From:	Brent Morton

Action items require a vote to recommend the item to the full City Council for further action.

RE: Johnson County CARS 2024 Interlocal Agreement for Funding of Public Improvements for Roe Avenue (Johnson Drive to 63rd Street)

RECOMMENDATION: Approve the Interlocal Agreement with Johnson County for the public improvement of Roe Avenue (Johnson Drive to 63rd Street) (CARS Project No. 320001399) using 2024 CARS Program funding in an amount not to exceed $870,000.

DETAILS: The City of Mission's proposed CARS project for 2024 is the Roe Avenue (Johnson Drive to 63rd Street) Street Rehabilitation Project. The improvements include an Ultra-then Bonded Asphalt Surface (UBAS) surface treatment, spot curb/cutter, stormwater improvements, traffic signal buyout and replacement, new sidewalk, and permanent pavement markings. The stormwater improvements include replacing aging corrugated metal pipe (CMP) that is rated 3.5 or higher.

The Interlocal Agreement specifies the County's participation in the project for a total cost not to exceed $870,000 and commits the City's funds to the project. Approval of the interlocal agreement is the final step with the County to accept CARS funds for this project. The total conceptual project costs submitted to CARS in 2023 totaled $1,815,000 with estimated CARS funding of $870,000. This project is funded at a 50% cost share due to participation by multiple cities including Fairway, Roeland Park, and Prairie Village.

The plans are currently being finalized and will be bid in mid-January 2024 contingent upon KDOT's review since a portion of this road is in their right-of-way. The current Engineer's Estimate is based on design at 80%.

CFAA CONSIDERATIONS/IMPACTS: This project supports a number of CFAA considerations, including sidewalk improvements to promote walkability and provide pedestrian modes of transportation for residents and visitors of all ages and abilities.

Related Statute/City Ordinance:	N/A
Line Item Code/Description:	25-90-805-60 CARS Projects - Capital Improvement Fund
Available Budget:	$1,815,000

Agreement among Johnson County, Kansas, the City of Mission, Kansas, the City of Fairway, Kansas, and the City of Roeland Park, Kansas, for the Public Improvement of Roe Avenue from Johnson Drive to 63rd Street (320001399)

THIS AGREEMENT, made and entered into this _____ day of _____, 202_, by and among the Board of County Commissioners of Johnson County, Kansas ("Board"), the City of Mission, Kansas ("Mission"), the City of Fairway, Kansas ("Fairway"), and the City of Roeland Park, Kansas ("Roeland Park"). Mission, Fairway and Roeland Park are collectively referred to as the "Cities".

WITNESSETH:

WHEREAS, the parties have determined that it is in the best interests of the general public in making certain public improvements to Roe Avenue from Johnson Drive to 63rd Street (the "Project"); and

WHEREAS, the laws of the State of Kansas authorize the parties to this Agreement to cooperate in undertaking the Project; and

WHEREAS, the governing bodies of each of the parties have determined to enter into this Agreement for the purpose of undertaking the Project, pursuant to K.S.A. 12-2908 and K.S.A. 68-169, and amendments thereto; and

WHEREAS, the Project has been approved, authorized, and budgeted by the Board as an eligible project under the County Assistance Road System ("CARS") Program; and

WHEREAS, the Board has, by County Resolution No. 106-90, authorized its Chairman to execute any and all Agreements for County participation in any CARS Program project which has been approved and authorized pursuant to the Policies and Guidelines adopted by the Board and for which funding has been authorized and budgeted therefore; and

WHEREAS, the governing body of Mission did approve and authorize its Mayor to execute this Agreement by official vote of said body on the _____ day of _____, 202_.

WHEREAS, the governing body of Fairway did approve and authorize its Mayor to execute this Agreement by official vote of said body on the _____ day of _____, 202_.

WHEREAS, the governing body of Roeland Park did approve and authorize its Mayor to execute this Agreement by official vote of said body on the ____ day of _____, 202_.

NOW, THEREFORE, in consideration of the mutual covenants and agreements hereinafter contained, and for other good and valuable consideration, the parties agree as follows:

1. **Purpose of Agreement**. The parties enter into this Agreement for the purpose of undertaking the Project to assure a more adequate, safe, and integrated roadway network in the developing and incorporated areas of Johnson County, Kansas.

2. **Estimated Cost and Funding of Project**

    a. The estimated cost of the Project ("Project Costs"), a portion of which is reimbursable under this Agreement is One Million Eight Hundred Fifteen Thousand Dollars ($1,815,000).

    b. Project Costs include necessary costs and expenses of labor and material used in the construction of the Project and construction inspection and staking for the Project.

    c. The Project Costs shall be allocated between the parties as follows:

        i. The Board shall provide financial assistance for the Project in an amount up to but not exceeding Fifty Percent (50%) of the Project Costs. However, the Board's financial obligation under this Agreement shall be limited to an amount not to exceed Eight Hundred Seventy Thousand Dollars ($870,000). For purposes of this Agreement, Project Costs shall not include any portion of costs which are to be paid by or on behalf of any state or federal governmental entity or for which the Cities may be reimbursed through any source other than the general residents or taxpayers of the Cities. Further, it is understood and agreed by the parties hereto that the Board shall not participate in, nor pay any portion of, the Costs incurred for or related to the following:

            1. Land acquisition, right-of-way acquisition, or utility relocation;
            2. Legal fees and expenses, design engineering services, Project administration, or financing costs;

3. Taxes, licensing or permit fees, title reports, insurance premiums, exactions, recording fees, or similar charges;
4. Project overruns;
5. Project scope modifications or major change orders which are not separately and specifically approved and authorized by the Board; and
6. Minor change orders which are not separately and specifically approved and authorized by the Director of Public Works & Infrastructure of Johnson County, Kansas ("Public Works Director"). Minor change orders are those which do not significantly alter the scope of the Project and which are consistent with the CARS Program Policies and Guidelines and administrative procedures thereto adopted by the Board.

It is further understood and agreed that notwithstanding the designated amount of any expenditure authorization or fund appropriation, the Board shall only be obligated to pay for the authorized percentage of actual construction costs incurred or expended for the Project under appropriate, publicly bid, construction contracts. The Board will not be assessed for any improvement district created pursuant to K.S.A. 12-6a01 et seq., and amendments thereto, or any other improvement district created under the laws of the State of Kansas.

ii. The Cities shall pay One Hundred Percent (100%) of all Project Costs not expressly the Board's obligation to pay as provided in this Agreement.

3. **Financing**

a. The Board shall provide financial assistance, as provided in Paragraph 2.c. above, towards the cost of the Project with funds budgeted, authorized, and appropriated by the Board and which are unencumbered revenues that are on-hand in deposits of Johnson County, Kansas. This paragraph shall not be

construed as limiting the ability of the Board to finance its portion of the costs and expenses of the Project through the issuance of bonds or any other legally authorized method.

b. The Cities shall pay their portion of the Project Costs with funds budgeted, authorized, and appropriated by the governing bodies of the Cities.

4. **Administration of Project**. The Project shall be administered by Mission acting by and through its designated representative who shall be the Cities' public official designated as Project Administrator. The Project Administrator shall assume and perform the following duties:

a. Cause the making of all contracts, duly authorized and approved, for retaining consulting engineers to design and estimate the necessary costs and expenses of the Project Costs.

b. Submit a copy of the plans and specifications for the Project to the Public Works Director for review prior to any advertisement for construction bidding, together with a statement of estimated Project Costs which reflects the Board's financial obligation under the terms of this Agreement. The Public Works Director or his designee shall review the plans and specifications for the Project and may, but shall not be obligated to, suggest changes or revisions to the plans and specifications.

c. If required by applicable state or federal statutes, solicit bids for the construction of the Project by publication in the official newspaper of the City of Mission. If the Project is located in more than one city, then the Project Administrator shall be responsible for determining proper publication. In the solicitation of bids, the appropriate combination of best bids shall be determined by the Project Administrator.

d. Cause the making of all contracts and appropriate change orders, duly authorized and approved, for the construction of the Project.

e. Submit to the Public Works Director a statement of actual costs and expenses, in the form of a payment request, with attached copies of all invoices and supporting materials, on or before the tenth day of each month following the month in which costs and expenses have been paid. The Public Works Director shall review the statement or payment request to determine whether

the statement or payment request is properly submitted and documented and, upon concurrence with the Finance Director of Johnson County, Kansas ("Finance Director"), cause payment to be made to the Project Administrator of the Board's portion of the Project Costs within thirty (30) days after receipt of such statement or payment request. In the event federal or state agencies require, as a condition to state or federal participation in the Project, that the Board make payment prior to construction or at times other than set forth in this subsection, the Public Works Director and Finance Director may authorize such payment.

f. Except when doing so would violate a state or federal rule or regulation, cause a sign to be erected in the immediate vicinity of the Project upon commencement of construction identifying the Project as part of the CARS Program. The form and location of the sign shall be subject to the review and approval of the Public Works Director.

Upon completion of the construction of the Project, the Project Administrator shall submit to each of the parties a final accounting of all costs and expenses incurred in the Project for the purpose of apportioning the same among the parties as provided in this Agreement. It is expressly understood and agreed that in no event shall the final accounting obligate the parties for a greater proportion of financial participation than that set out in Paragraph 2.c. of this Agreement. The final accounting of Project Costs shall be submitted by the Project Administrator no later than sixty (60) days following the completion of the Project construction.

It is further understood and agreed by the City that to the extent permitted by law and subject to the provisions of the Kansas Tort Claims Act including but not limited to maximum liability and immunity provisions, the City agrees to indemnify and hold the County, its officials, and agents harmless from any cost, expense, or liability not expressly agreed to by the County which result from the negligent acts or omissions of the City or its employees or which result from the City's compliance with the Policy and Procedures.

This agreement to indemnify shall not run in favor of or benefit any liability insurer or third party.

In addition, the Cities shall, and hereby agree to, insert as a special provision of its contract with the general contractor ("Project Contractor") chosen to undertake the Project construction as contemplated by this Agreement the following paragraphs:

> The Project Contractor shall defend, indemnify and save the Board of County Commissioners of Johnson County, Kansas and the City harmless from and against all liability for damages, costs, and expenses arising out of any claim, suit, action or otherwise for injuries and/or damages sustained to persons or property by reason of the negligence or other actionable fault of the Project Contractor, his or her sub-contractors, agents or employees in the performance of this contract.
>
> The Board of County Commissioners of Johnson County, Kansas shall be named as an additional insured on all policies of insurance issued to the Project Contractor and required by the terms of his/her agreement with the City.

5. **Acquisition of Real Property for the Project**

   a. The Board shall not pay any costs for acquisition of real property in connection with the Project.

   b. Each City shall be responsible for the acquisition of any real property, together with improvements thereon, located within such City's corporate boundaries, which is required in connection with the Project; such real property acquisition may occur by gift, purchase, or by condemnation as authorized and provided by the Eminent Domain Procedure Act, K.S.A. 26-201 et seq. and K.S.A. 26-501 et seq., and any such acquisition shall comply with all federal and state law requirements.

6. **Duration and Termination of Agreement**

   a. The parties agree that this Agreement shall remain in full force and effect until the completion of the Project, unless otherwise terminated as provided for in Paragraph 6.b. hereinbelow. The Project shall be deemed completed and this Agreement shall be deemed terminated upon written certification to each of the parties by the Project Administrator that the Project has been accepted as

constructed. The Project Administrator shall provide a copy of the Project Administrator's certification to both the Public Works Director and the Finance Director within thirty (30) days of the Project Administrator's determination that the Project is complete.

b. It is understood and agreed that the Public Works Director shall review the status of the Project annually on the first day of March following the execution of this Agreement to determine whether satisfactory progress is being made on the Project. In the event that the Public Works Director determines that satisfactory progress is not being made on the Project due to one or both of the Cities' breach of this Agreement by not meeting the agreed upon project deadlines or otherwise not complying with the terms of this Agreement, the Public Works Director is authorized to notify the City that has breached the Agreement that it shall have thirty (30) days from receipt of such notification to take steps to cure the breach (the "Cure Period"). It is further understood and agreed that the Board shall have the option and right to revoke funding approval for the Project and terminate this Agreement should the Board find, based upon the determination of the Public Works Director, that satisfactory progress is not being made on the Project and that the Cities have not taken sufficient steps to cure the breach during the Cure Period. Should the Board exercise its option as provided herein, it shall send written notice of the same to the Cities and the Board shall have no further liability or obligation under this Agreement.

7. **Placing Agreement in Force**. The attorney for the Cities shall cause sufficient copies of this Agreement to be executed to provide each party hereto with a duly executed copy of this Agreement for its official records.

IN WITNESS WHEREOF, the above and foregoing Agreement has been executed by each of the parties hereto and made effective on the day and year first above written.

Board of County Commissioners of Johnson County, Kansas

Mike Kelly, Chairman

Attest:

Lynda Sader
Deputy County Clerk

Approved as to form:

Robert A. Ford
Assistant County Counselor

City of Mission, Kansas

Solana Flora, Mayor

Attest:

City Clerk

Approved as to form:

City Attorney

City of Fairway, Kansas

Melanie Hepperly, Mayor

Attest:

City Clerk

Approved as to form:

City Attorney

City of Roeland Park, Kansas

Michael Poppa, Mayor

Attest:

City Clerk

Approved as to form:

City Attorney