City of Lethbridge

100K+ LETHBRIDGE

CITY OF LETHBRIDGE
CYCLING MASTER PLAN

MAY 2017

This page intentionally left blank.

City of Lethbridge
Cycling Master Plan

Prepared for:
City of Lethbridge

Prepared by:
Stantec Consulting Ltd.
Alta Planning + Design

15 May 2017

EXECUTIVE SUMMARY

The City of Lethbridge's Cycling Master Plan builds on goals and objectives developed in the Transportation Master Plan, Integrated Community Sustainability Plan and Municipal Development Plan to provide better design options to facilitate an increase in cycling through safe, well designed and well located cycling infrastructure. Through implementation of the Cycling Master Plan, Lethbridge will become friendlier for people walking and people biking.

A strong cycling network puts the right cycling infrastructure in the right place. This plan was developed through iterative steps; combining extensive data collection and analysis with public and stakeholder engagement to identify routes and infrastructure that will increase access to cycling.

Plan Vision and Goals

The vision for the Cycling Master Plan is ***"Lethbridge commits to make cycling a realistic transportation option for all ages and abilities, contributing to our sustainable future."*** The intent of the implementation of the Cycling Master Plan is that cycling should be a practical option for day-to-day transportation, as well as for recreational trips. The cycling network will help encourage people of all ages and abilities to use a bicycle for travel, which will help reduce auto trips and thereby contribute to making Lethbridge a healthy and sustainable city.

The goals of the Cycling Master Plan support the achievement of the Vision. For this plan, six unique goals were identified based on best practice in bicycle planning and input from project stakeholders and the public. Each of these goals have supporting objectives. The six goals for the Cycling Master Plan are:

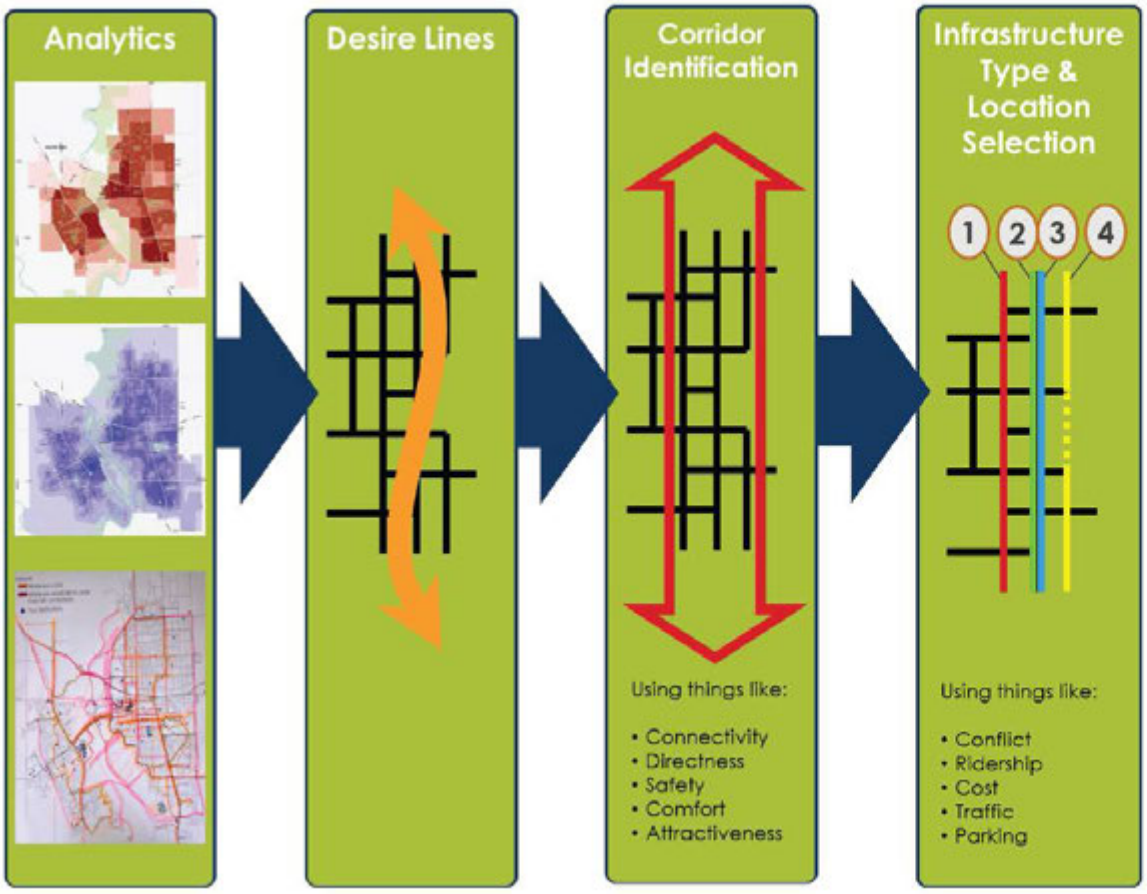
Bicycle Network Development

The recommended cycling network was developed through four phases: analytics, desire line development, corridor identified, and final infrastructure type and locations.

From the public and internal and external engagement, cycling demand analysis, and cycling potential analysis, "desire lines" were derived which represent a high level interpretation of where people want to go. These desire lines are independent of existing street locations.

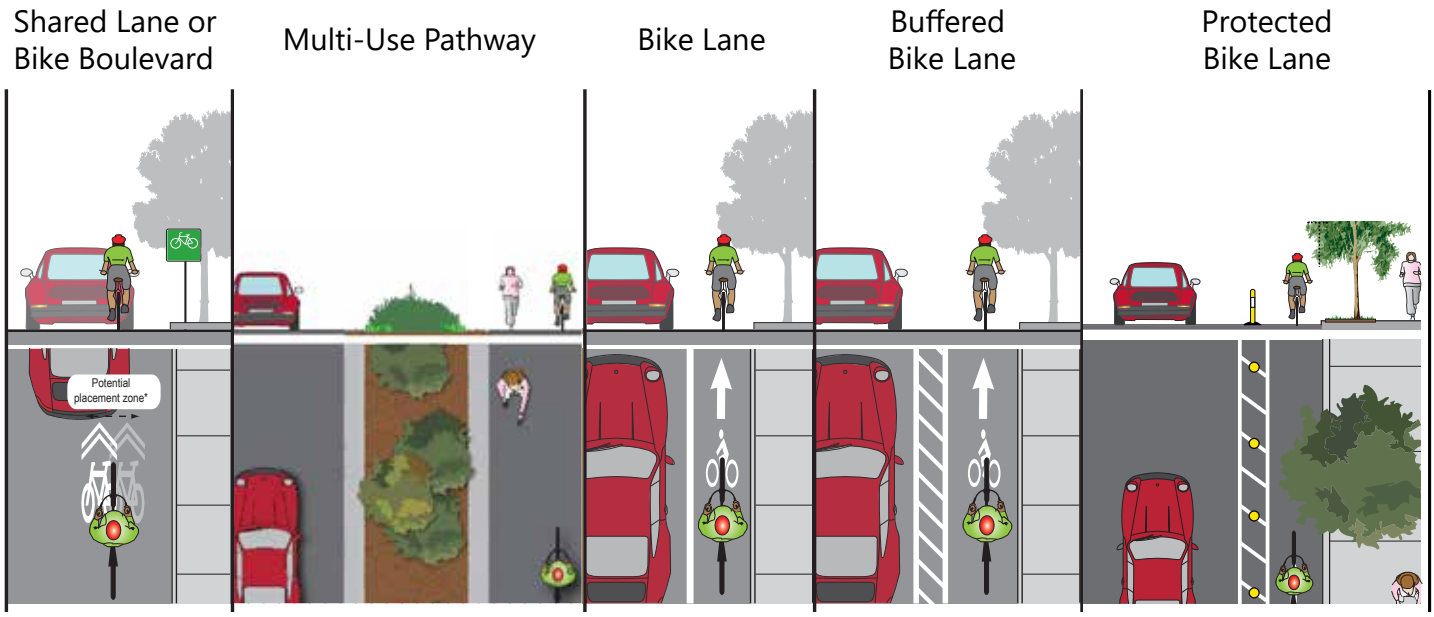
From these desire lines, "opportunity corridors" were then derived. These represent where the desire lines align with two or three existing streets in the city. These corridors show where a cycling route could be located.

From these opportunity corridors, proposed cycling routes were developed based on a preliminary review of the geometry and local context.



Cycling Infrastructure Types

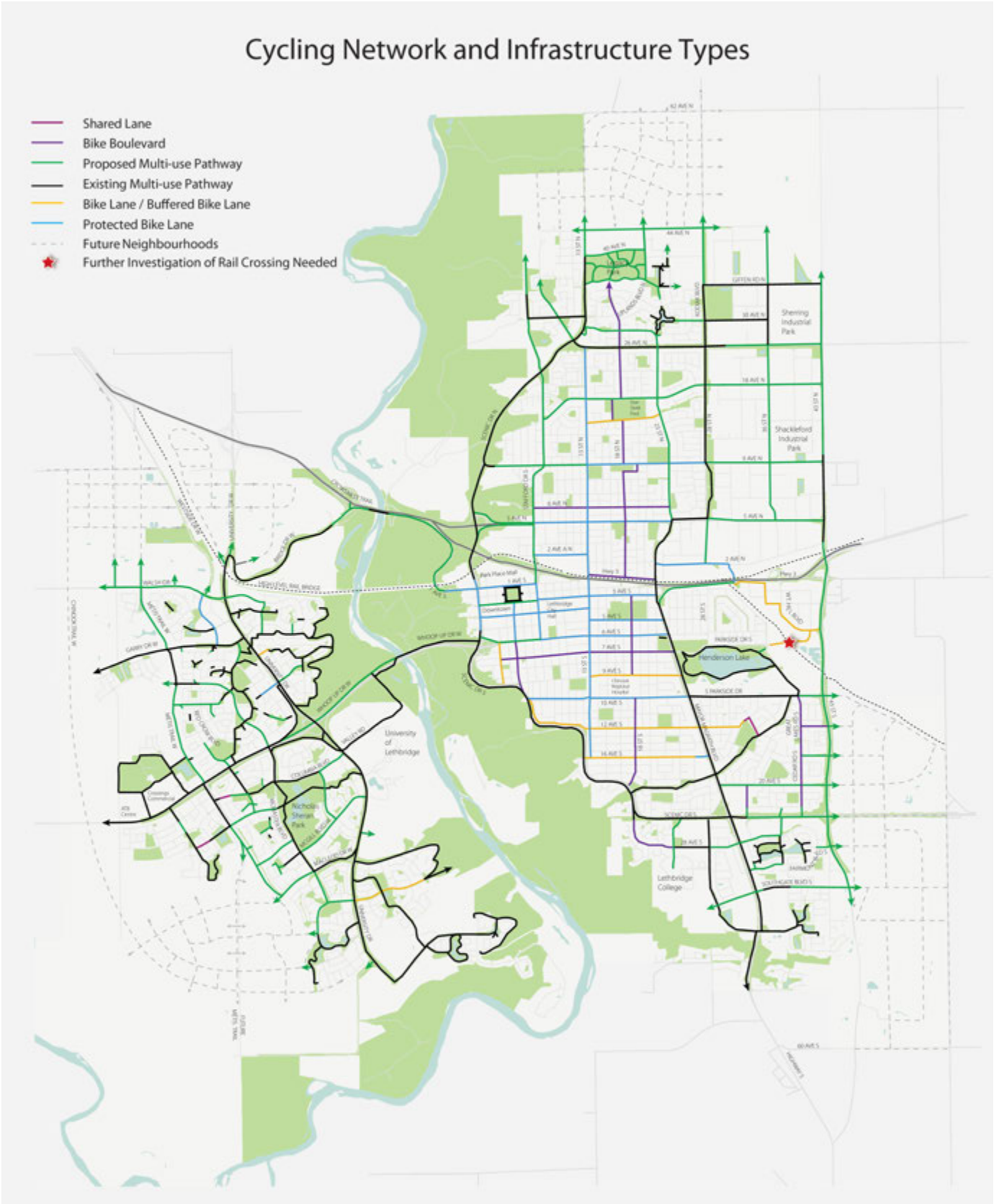
Key aspects of the transportation network (motor vehicle speed, motor vehicle volumes, interactions with pedestrians, and transit operation) have significant impact on the comfort of bicycle riders and, as such, different infrastructure types should be used in varying contexts. Ultimately, having a network that has a consistent level of comfort for all ages and ability of bicycle riders is desired. The various types of infrastructure considered for Lethbridge are illustrated below.



Bicycle Network Map

The bicycle network map for the Cycling Master Plan was created using the analysis and engagement outlined in this document. The recommended bicycle network has many key east-west and north-south routes that will connect people to community facilities, employment areas, schools, recreational areas and shopping destinations. The network is denser in areas with higher cycling potential and/or demand.

In addition to the route locations, the bicycle infrastructure for each route was determined to create a safe and comfortable cycling environment for people of all ages and abilities.


Cycling Network and Infrastructure Types
Shared Lane
Bike Boulevard
Proposed Multi-use Pathway
Existing Multi-use Pathway
Bike Lane / Buffered Bike Lane
Protected Bike Lane
Future Neighbourhoods
Further Investigation of Rail Crossing Needed
Sherring Industrial Park
Shackleford Industrial Park
Henderson Lake
University of Lethbridge
Nicholas Sheran Park
Lethbridge College

Implementation Approach

Funding limitations and coordination with existing and future road projects means that the proposed cycling network plan will be implemented gradually. Through the prioritization of the network, the routes were evaluated so as to provide the most value at earlier stages of implementation.

Phase 1 will focus on the implementation of multi-use paths, bike boulevards and protected bike lanes to create a base network for all ages and abilities that will result in a strong east-west and north-south grid. This grid network will provide good access to downtown activities and destinations in south and north Lethbridge. Some projects have been identified in west Lethbridge that will allow for a strong connection parallel to University Drive and take advantage of the significant existing network of neighbourhood connections available on local paths.

Phase 2 will focus on the completion of the network using multi-use paths as the primary infrastructure type, along with some protected bike lanes.

The Cycling Master Plan has identified routes and infrastructure types within the opportunity corridors. However, at the outset of the functional planning and design phase of implementation, the corridors should be reviewed to confirm that no other alignments are more desirable given the current conditions. The impacts of capital projects not known at the time of creation of this plan, changes in understanding of infrastructure suitability or changes in cycling usage are examples of reasons this review is necessary.

Phase 1 Detailed Cost and Prioritization

To aid in implementation of the first phase of the Cycling Master Plan network, Phase 1 has been broken out into 13 stages, with each stage including multiple projects costing approximately $1 million. The first stage is more capital intensive since many of these projects are being completed in conjunction with other capital projects including arterial street construction in new or expanding neighbourhoods. Likewise, based on estimated timelines, stage four is also more capital intensive to incorporate a number of major multi-use paths that will be built in new or expanding neighbourhoods.

The staging is based on similar criteria that was used to determine the three implementation phases, with more details considered around network connectivity, cost horizons, demand, and constructability. The breakdown is summarized in the following table.

In addition to the projects identified for Phase 1, it is recommended the safety and operation of the existing network of multi-use paths be reviewed and improved with a focus on intersections. This work could be completed in conjunction with other traffic safety, operations, and Vision Zero initiatives.

PHASE 1 DETAILS

Stage	On	From	To	Infrastructure Type	Estimated Cost
1	SCENIC DR S	6 AVE S	1 AVE S	PBL	$490,000
	4 AVE S	SCENIC DR S	STAFFORD DR S	PBL	$640,000
	3 AVE S	SCENIC DR S	STAFFORD DR S	MUP	$300,000***
	7 AVE S	4 ST S	MAYOR MAGRATH DR S	BB	$420,000
	6 ST S	3 AVE S	SCENIC DR S	PBL/BB	$230,000
	HWY 3	MAYOR MAGRATH DR S	31 ST S	MUP	$300,000
	METIS TR W	WALSH DR W	WHOOP UP DR W	MUP	$1,840,000*
	WALSH DR W	UNIVERSITY DR W	30 ST W	MUP	$1,160,000*
	METIS TR W	TEMPLE BLVD W	MACLEOD DR W	MUP	$450,000*
2	STAFFORD DR N/S	5 AVE N	7 AVE S	MUP/PBL	$940,000****
3	2 AVE A N	STAFFORD DR N	13 ST N	PBL	$370,000
	13 ST N	9 AVE N	2 AVE A N	PBL	$810,000
	18 ST N	1 AVE N	9 AVE N	BB	$310,000
4	1 AVE S	SCENIC DR S	STAFFORD DR S	PBL	$510,000
	13 ST N/S	2 AVE A N	3 AVE S	PBL	$140,000
	HWY 3 & 1 AVE S	BRIDGE RD W	SCENIC DR S	MUP	$1,820,000**
	43 ST N	GIFFEN RD N	9 AVE N	MUP	$920,000*
	26 AVE N	31 ST N	43 ST N	MUP	$900,000*
	43 ST N/S	2 AVE N	SOUTHGATE BLVD S	MUP	$1,880,000*
	3 AVE S	STAFFORD DR S	13 ST S	PBL	$360,000
5	28 AVE S	28 ST S	MAYOR MAGRATH DR S	MUP	$150,000
	12 AVE S	10 AVE S	GLACIER DR S	BL	$360,000
6	13 ST S	3 AVE S	16 AVE S	PBL	$900,000
	COLUMBIA BLVD W	LAVAL BLVD W	UNIVERSITY DRIVE W	MUP	$130,000
7	HIGHLANDS BLVD W	WALSH DRIVE W	GARRY DRIVE W	PBL	$200,000
	STAFFORD DR N	SCENIC DR N	5 AVE N	MUP	$760,000
8	9 AVE N	SCENIC DR N	28 ST N	MUP/PBL	$1,660,000
	UPLANDS NHBD	KODIAK GATE N AND LEGACY PARK CONNECTION		MUP	$250,000
9	SOUTHGATE BLVD S	COULEECREEK BLVD S	43 ST S	MUP	$220,000
	MCMASTER BLVD W	MACLEOD DR W	ROCKY MOUNTAIN BLVD W	MUP	$180,000
	SOUTHGATE BLVD S	WEST OF MAYOR MAGRATH DR S	28 ST S	MUP	$210,000
10	28 AVE S	SCENIC DR S	COLLEGE DR S	BB	$150,000
	18 ST S	SCENIC DR S	3 AVE S	BB	$410,000
11	3 AVE S	13 ST S	MAYOR MAGRATH DR S	PBL	$470,000
12	JERRY POTTS BLVD W	RED CROW BLVD W	WHOOP UP DR W	MUP	$550,000
	STONEY CRES W	RED CROW BLVD W	GARRY DR W	MUP	$80,000
	EDGEWOOD BLVD W	SHERWOOD BLVD W	UNIVERSITY DR W	BL	$30,000
13	SCENIC DRIVE S	EAST OF MAYOR MAGRATH DR S	43 ST S	MUP	$420,000

PBL = Protected Bike Lane | MUP = Multi-Use Path | BB = Bike Boulevard | BL = Bike Lane
*Complete with arterial construction | **Includes retaining wall | ***MUP portion only | ****Bridge not included

Total for Phase 1: $21.9 Million

TABLE OF CONTENTS

This page intentionally left blank.

1.0 INTRODUCTION

1.1 PLAN PURPOSE

The Vision for the 2012 Lethbridge Transportation Master Plan (TMP) stated that "We, the TMP Partners, commit to creating an integrated, multi modal plan that encourages a sustainable transportation system that is safe, affordable, effective, and environmentally responsible." Consideration of design for all modes was a key deliverable of the TMP, including goals surrounding better street design for all modes, building awareness to the benefits of cycling and walking, and using planning and development to provide for enhanced cycling and walking.

The City of Lethbridge's Cycling Master Plan supports the provision of better design options that will safely facilitate an increase in cycling through safe, well designed and well located infrastructure. This master plan will support the goals and directions of the TMP, but also the Integrated Community Sustainability Plan and Municipal Development Plan, specifically the goal that Lethbridge will be a walkable and bicycle friendly city. Along with addressing the goals targeting cycling infrastructure, implementation of this Cycling Master Plan will help the City address a number of other goals identified in the TMP, including transportation demand management and traffic safety.

This Cycling Master Plan presents the opportunity to create a cycling network Lethbridge can be proud of, something that will attract people to the community and create a more active and environmentally friendly city.

The existing cycling network (as outlined in Section 4) consists of a number of multi-use pathways throughout the city and an on-street bike lane on 13 Street N between 9 Ave N and 26 Ave N. Developing more active ways to travel within the city and providing viable alternatives to single occupancy vehicles is identified within the City of Lethbridge's strategic plans.

The Cycling Master Plan builds upon the City of Lethbridge Bikeways and Pathways Master Plan and the recent 6 Ave S Functional Planning Study.

1.2 PLANNING PROCESS

The project planning process is summarized in the following figure.

FIGURE 1. PLANNING PROCESS

As part of the planning process, a clear and agreed upon set of goals and priorities were developed. The team then moved to analysis of the existing network and opportunities, followed by identifying recommended routes, infrastructure types and implementation recommendations. This process allowed the team to identify a network that will achieve the goals and demands of current and potential cyclists in Lethbridge. This process, coupled with extensive public and stakeholder engagement, is summarized in this master plan.

1.3 ENGAGEMENT PROCESS

Three key groups were targeted through the engagement strategy: the public, internal City stakeholders, external stakeholders. An engagement plan was created and implemented at strategic stages of the project to ensure robust information exchange, enhanced understanding and creation of active partnerships with the City. The engagement strategy consisted of three phases of consultation, each involving innovative strategies to solicit meaningful input from internal and external stakeholders and the community as a whole. The tools used throughout the process included surveys, online communication forums, content expert presentations, visual displays and face-to-face conversations. A detailed summary of all of the engagement strategies and tools used in the Cycling Master Plan is included in the Appendix.

1. Banister Telephone Survey: January 18 to 25, 2016
2. Community Engagement Phase 1: January to March, 2016
    a. Internal and External Stakeholder Workshops: March 15, 2016
    b. Community Session: March 15, 2016
    c. Pop Up Engagement: University of Lethbridge (March 9, 2016) and Lethbridge College (March 10, 2016)
3. Community Engagement Phase 2: May to June, 2016
    a. Jane's Ride: May 6, 2016
    b. Internal and External Stakeholder Workshops: May 10, 2016
    c. Community Session (World Café): June 8, 2016
    d. 7th Avenue S Neighbourhood Garage Sale and Festival: June 18, 2016
4. Community Engagement Phase 3: October to December, 2016
    a. Tour of Alberta: September 1, 2016
    b. 100K Day Survey: October 12, 2016
5. MindMixer Online Forum: March to December, 2016

2.0 PLAN VISION AND GOALS

2.1 SETTING THE VISION

The vision for the Cycling Master Plan is "Lethbridge commits to make cycling a realistic transportation option for all ages and abilities, contributing to our sustainable future." The intent of the implementation of the Cycling Master Plan is that cycling should be a practical option for day-to-day transportation, as well as for recreational trips. The cycling network will help encourage people of all ages and abilities to use a bicycle for travel, which will help eliminate auto trips and thereby contribute to making Lethbridge a healthy and sustainable city.

The vision was created with City of Lethbridge staff and then reviewed and approved through the engagement process by the public and internal and external stakeholders.

The vision for this master plan set the direction for all the work completed in order to plan a future network of bicycle infrastructure, and supportive programs in Lethbridge.

VISION

"Lethbridge commits to make cycling a realistic transportation option for all ages and abilities, contributing to our sustainable future."

2.2 GOALS AND OBJECTIVES OF CYCLING MASTER PLAN

The goals of the Cycling Master Plan support the achievement of the Vision. For this plan, six unique goals were identified based on best practice in bicycle planning and input from project stakeholders and the public. Each of these goals have supporting objectives. The six goals for the Cycling Master Plan are:

- More People Cycling
- Cycling is Safe
- Cycling is Desirable
- Cycling is Connected
- Cycling is Understood
- Cycling is Implemented

The supporting objectives of the goals are shown in the table below. The vision, goals and supporting objectives were the foundation of all stages of development of the cycling network.

TABLE 1. CYCLING MASTER PLAN GOALS & OBJECTIVES

Goal	Objective
More People Cycling	• More people cycling to work and school • Events that support cycling as a mode of transportation • Percentages of all trips made by bicycle doubles by 2021
Cycling is Safe	• Reduction in collision rates, year over year • People consider cycling to be safe • The cycling network is designed to be safe
Cycling is Desirable	• Cycling infrastructure is used by people of all ages and abilities • Cycling routes support community activity • Secure and supportive end-of-trip facilities
Cycling is Connected	• Cycling network connected to all major destinations • Branding and wayfinding programs • Connected to transit and walking
Cycling is Understood	• Education programs to support safe cycling • Create a culture of cycling • Awareness programs on the benefits of cycling for individuals and the community including sustainability
Cycling is Implemented	• Staged implementation to optimize value (cost and usage) • Positive public opinion of cycling • Well maintained cycling routes in all seasons

3.0 BICYCLE USER PREFERENCES

To understand the demand for cycling infrastructure and identify who would use that infrastructure, a phone survey was conducted in early 2016. This survey asked 400 citizens of Lethbridge a variety of questions regarding their current level of comfort when cycling and amount and types of cycling trips[1].

The telephone survey identified that 65% of adults living in Lethbridge own bicycles, suggesting that this type of travel mode is accessible to a majority of people. A similar majority (66%) of adults identified that they felt there are destinations within cycling distance of their home.

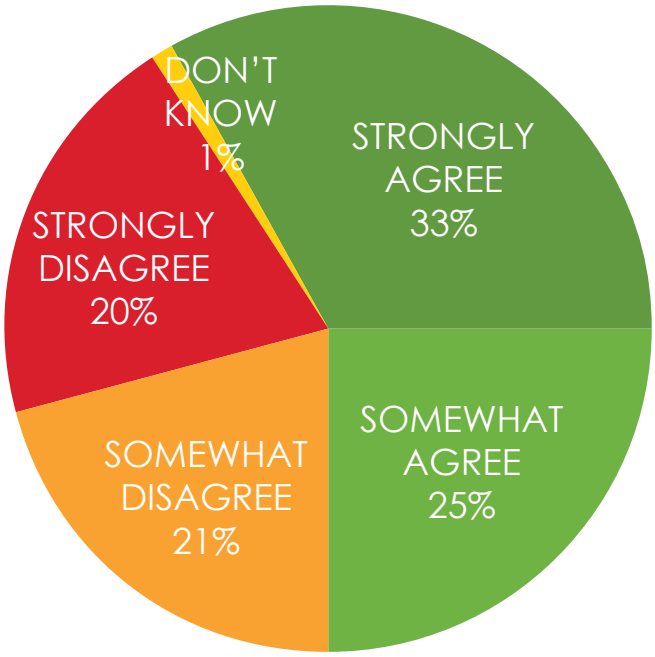


FIGURE 2. WOULD YOU RIDE A BIKE IF YOU FELT SAFER?

Of the 57% of adults that ride a bike, 23% rode it daily or almost daily, 14% rode it 4 to 5 times per week, 31% rode it 2 to 3 times per week, 14% rode it once per week and about 18% rode monthly or less. This breakdown of usage is very encouraging to see, as it suggests a base level of acceptance and appetite for bicycle travel. Reasons people are riding a bicycle already include recreation (97%), transportation not related to work or school (41%) and commuting to work or school (26%) (some users identified more than one reason).

Even with a notable amount of bicycle riding occurring in Lethbridge, 56% of the surveyed adults said that they want to ride a bike more. To support this demand, 58% of adults would ride a bike if they felt safer. The figure to the right shows the level of agreement towards the statement, "I would ride a bike if I felt safer".

To help understand what type of infrastructure is required to meet a person's perceived level of safety, market segmentation of the population was completed using four basic types of cyclists: Strong and Fearless, Enthused and Confident, Interested but Concerned and Reluctant to Cycle. The different types of cyclists are described on the next page.

This segmentation is based on research completed in the United States and has been repeated for many cities across North America. A comparison of the results from Lethbridge to other cities in Canada was completed, as shown in figure 3.

1 400 people provides statistically significant results (+/- 4.9% of error, 19 times out of 20)

Who are the **STRONG AND THE FEARLESS?**

- Riding is a strong part of their identity.
- They are generally undeterred by road conditions.

Who are the **ENTHUSED AND CONFIDENT?**

- Comfortable sharing the road with automobile traffic but prefer to do so operating on their own infrastructure.
- Appreciate bicycle lanes and boulevards.

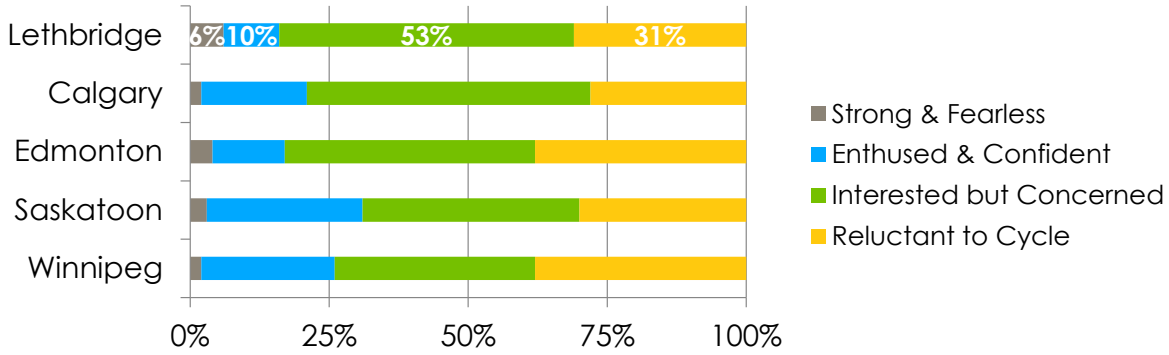
Who are the **INTERESTED BUT CONCERNED?**

- Interested in riding a bike more but afraid to do so because of safety concerns.
- Many are currently cycling for recreation.

Who are the **RELUCTANT TO CYCLE?**

- Currently not interested in cycling at all.
- May be physically unable to ride.

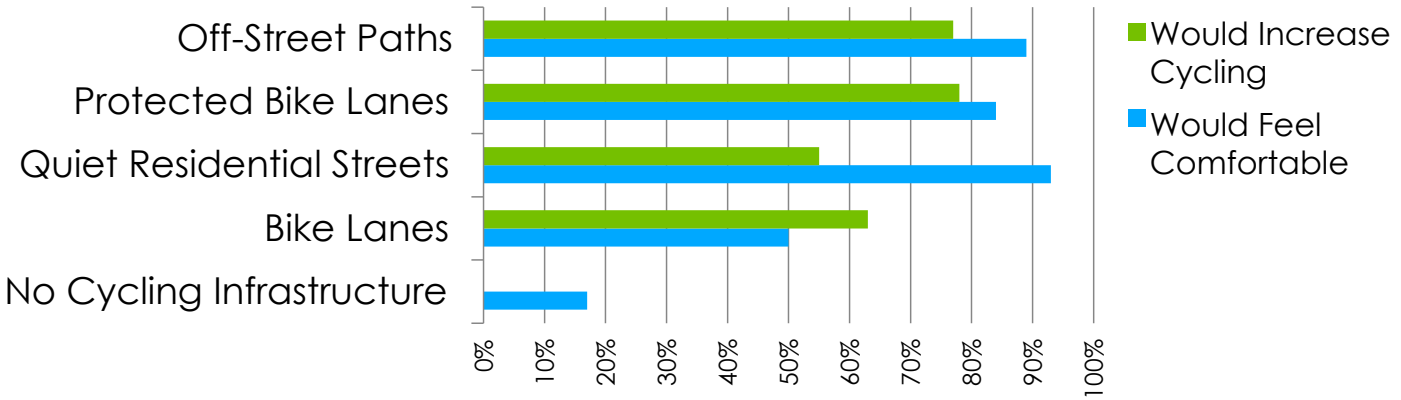
FIGURE 3. TYPES OF CYCLISTS



Lethbridge has a higher number of people that fall in the 'Strong & Fearless' category than most comparable cities, but the 'Enthused and Confident' category is much smaller than other cities. Lethbridge therefore has a significant portion of the population which falls into the 'Interested but Concerned' market segment. This suggests that changes to the types of cycling infrastructure, especially as it relates to higher comfort levels and perceived safety, will be a significant measure to increase cycling activity in Lethbridge.

To help understand the type of infrastructure that should be considered in the development of a bicycle network, questions were asked of the respondents around what type of bicycle infrastructure would increase their levels of cycling and what cycling infrastructure would they feel comfortable on. By focusing on the responses from the 'Interested but Concerned' (see below graph), the infrastructure types that will be important to achieving the Cycling Master Plan's Vision and Goals can be identified.

As shown, cycling infrastructure that would increase cycling are: Off-street Pathways (multi-use paths), Protected Bike Lanes, and Bike Lanes. Interestingly, Quiet Residential Streets ranked the highest in terms of what people would feel comfortable on, but this type of cycling infrastructure ranked lowest of the four infrastructure types in terms of what would increase their cycling activity.



Given the findings from the research completed for Lethbridge, the Cycling Master Plan focuses on a network of multi-use paths and protected bike lanes that connect to quiet residential streets. The research suggests this approach is likely to be successful in getting more people riding a bicycle.

A protected bike lane provides separation from the adjacent roadway and includes treatments that increase cyclists visibility at conflict points.

4.0 EXISTING CONDITIONS

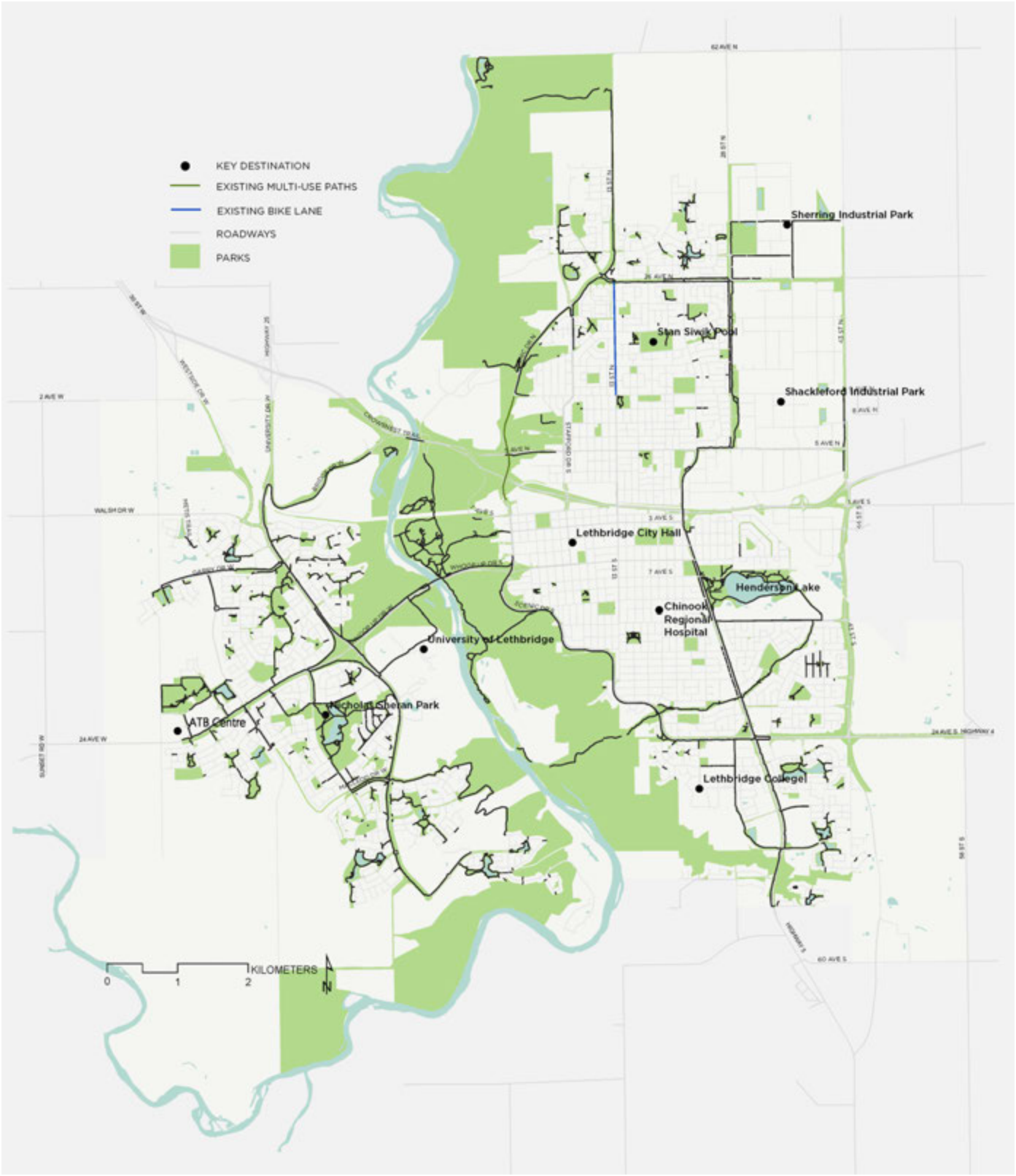
As was seen in the Cycling Survey, Lethbridge's cycling network currently supports primarily recreational uses. There is an extensive network of paved and unpaved multi-use paths and off-street trails, which allow access to parks and the river valley, but the on-street network is currently limited. The network currently lacks the connectivity that allows for direct travel between origins and destinations. Direct connectivity is one of the missing pieces that will make cycling a viable alternative as a true mode of transportation.

The figure on the adjacent page shows the existing bicycle network in Lethbridge. It illustrates that Lethbridge has an extensive network of paved and unpaved paths that provide connections to most parts of the city, particularly in newer neighbourhoods such as those in west Lethbridge. However, the network has significant gaps in north and south Lethbridge, specifically in downtown and the surrounding neighbourhoods as well as connections across Highway 3 and the parallel rail line. The design and alignment of those paths is generally circuitous and they do not serve major destinations. The paths also vary in width and quality, and are often less than three metres wide. Most intersections with paths are generally unmarked, with no signage or pavement to designate path crossings for people riding bicycles, or warn drivers of their presence.

There is currently one on-street piece of cycling infrastructure, a bike lane that runs along 13th St N from 9th Ave N to 26th Ave N. Typical volumes on this segment of road in 2015 were around 11,800 vehicles per day. These volumes exceed the typical upper limit generally accepted for unprotected bike lanes. This lane also lacks a connection to the greater network, including access to downtown or the recreational multi-use paths.

It is noted that there are several streets in Lethbridge that are designated as a 'bike route', identified through green cycling network signs. These routes include, but are not limited to: 13th St between 9th Ave N and 16th Ave S, 10th Ave S between Mayor Magrath Drive and Scenic Drive, 3rd Ave S between 5th St and 13th St, and 5th St S between Scenic Drive and 2nd Ave. While these are marked and signed, they do not contain any infrastructure upgrades to slow traffic, separate modes or protect people riding bicycles. Improvments would be needed to make these routes a functional part of the cycling network.

FIGURE 4. EXISTING CYCLING NETWORK



5.0 CYCLING ANALYTICS

Planning for a cycling network involves understanding an area's built and natural environment, the demographics, and current commuting patterns. People riding bicycles are more sensitive than people driving to various concerns such as changes in elevation and overall trip distance. Careful review and consideration of desire lines is crucial to planning an all ages and abilities cycling network that links people to city destinations.

To help in the development of the cycling network, it was important to understand current conditions as well as key factors of supply and demand that influence people's desire to ride a bicycle. Elements that we reviewed related to supply and demand of cycling include:

- Current and potential supply:
    - An examination of the existing active transportation network;
    - Topography, road density, and permeability of the network by paths or roads;
    - Safety of the network as measured by the number and location of crashes that involve a person riding a bicycle.
- Current and potential demand:
    - Current usage patterns and mode share;
    - Distribution and concentration of residential populations, employment, access to transit and recreation.

Using the analytics described, it is possible to identify a network of corridors that can serve as cycling routes and can assist in identifying which routes are priorities for investment.

5.1 CYCLING POTENTIAL ANALYSIS

Assessment of the quality and extent of designated on and off-street cycling infrastructure is an important consideration for any bicycle network analysis. In addition, factors within the built environment such as the land use density and mix, street and path connectivity and topography impact the use of cycling for transportation.

Cycle potential analysis is a supply-based spatial analysis methodology that considers the relationship between the built and natural environment and expected cycling behaviour to identify areas that best support increased cycling. Scores are assigned at the zone (small analysis area) level and represent a gradient of lower to higher potential for cycling. Elements that support higher rates of cycling, from a built environment perspective, include a dense road network in a grid pattern and limited hills. In contrast, networks with sparse road and limited existing cycling infrastructure will score lower.

5.1.1 Cycle Potential Results

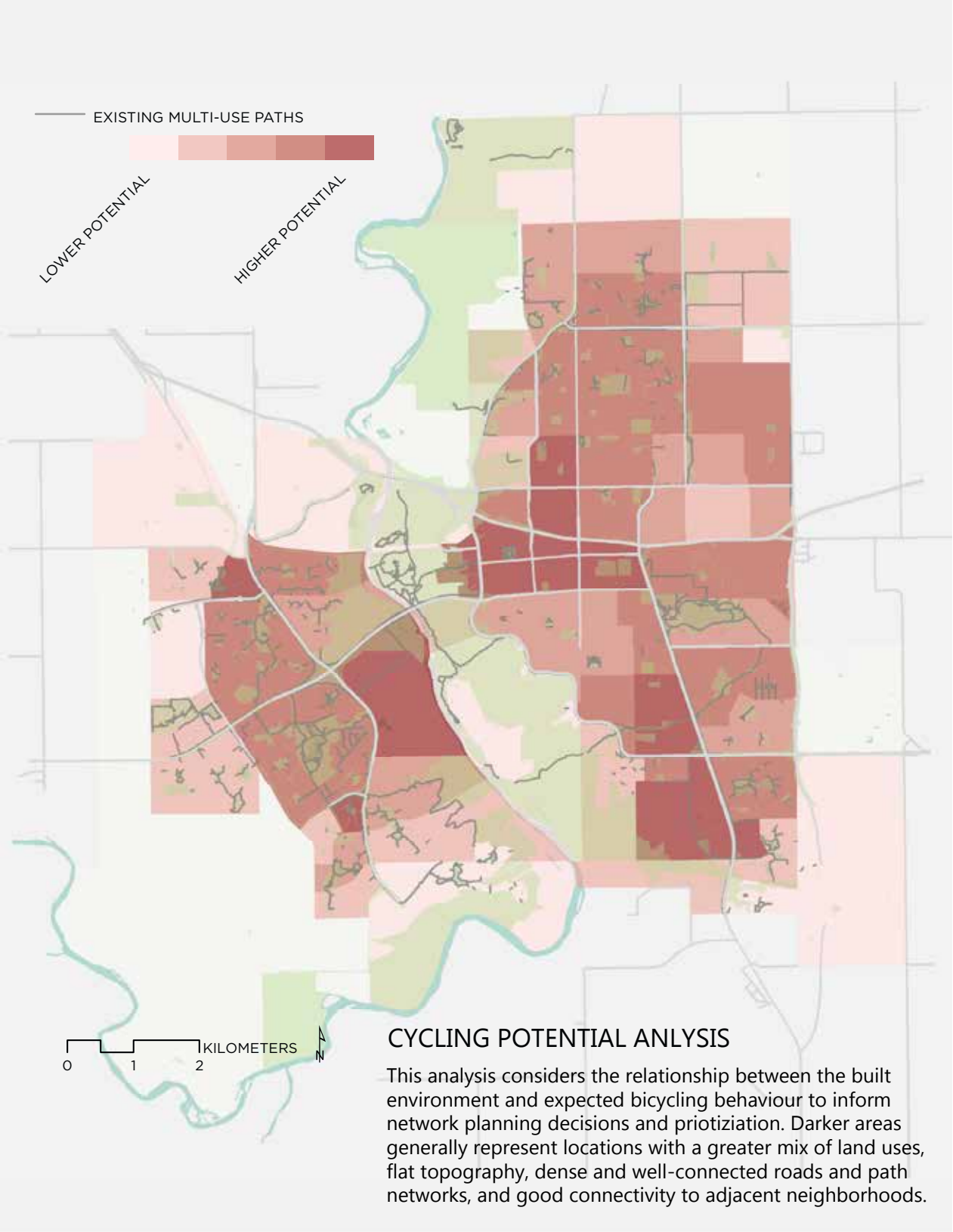
The cycle potential analysis combines the existing cycling network, topography, land use, road density, and permeability to assess the potential for cycling within various parts of the city. Some factors, like the quality of the cycling network are flexible, while other factors, like topography, are fixed. The cycling potential results are summarized in figure 5. The areas in the figure that are darkly shaded have a greater potential to support cycling, while those areas that are lightly shaded have less potential to support cycling.

From the analysis completed, locations that are particularly conducive to cycling include:

- Downtown and adjacent area bounded by Mayor Magrath Drive to the east, Crowsnest Trail to the north, 6th Ave S to the south and the coulee to the west
- The neighborhoods to the north of downtown surrounded by Stafford Drive N, 9th Ave N, 13th St N and Crowsnest Trail to the south.
- The University area bounded by University Drive to the west, Whoop-Up Drive to the north, the coulee to the east, and Parkway Road W to the south.
- The area around Lethbridge College bounded by Mayor Magrath Drive to the east, the coulee to the west, 12 Ave S to the north, and 40th Ave S to the south.

Those areas with darker shading tend to have a greater mix of land uses, flat topography, dense and well-connected roads and paths and good connectivity to adjacent neighborhoods.

FIGURE 5. CYCLING POTENTIAL ANALYSIS



CYCLING POTENTIAL ANLYSIS

This analysis considers the relationship between the built environment and expected bicycling behaviour to inform network planning decisions and priotiziation. Darker areas generally represent locations with a greater mix of land uses, flat topography, dense and well-connected roads and path networks, and good connectivity to adjacent neighborhoods.

5.2 CYCLING DEMAND ANALYSIS

The cycling demand analysis identifies expected bicycle activity by overlaying the locations where people live, work, play, access public transit and go to school. The scoring method is a function of density and proximity[2]. Scores will decrease in low density areas, and if origins and destinations are further apart.

Each demand input is scored on a scale of 1 to 5 based on density and proximity. The inputs included:

- **Where People Live** - These locations represent potential trip origin locations. More trips can be made in areas with higher population density if conditions are right.
- **Where People Work** - This category represents trip ends for people working in Lethbridge regardless of residency. Depending on the type of job, employment can act as a trip attractor (i.e., retail stores or cafes) or trip generator (i.e., office parks and office buildings) or both. Specific employment types, such as retail, are therefore also used in the 'where people play' category. The inclusion of retail employment as an input for where people play allows the analysis to capture both demand generated by employment trips, as well as those generated by shopping trips. Although this employment category is used twice, both work and play, it captures the two types of demand associated with these locations.
- **Where People Learn** - This category shows the locations of all school levels, from elementary schools to post secondary.
- **Where People Play** - This category is a combination of varied land use types and destinations, including retail destinations, parks and recreation facilities.
- **Where People Access Transit** - This category includes bus stops as well as major transit centres.

5.2.1 Cycling Demand Results

Demand for cycling within Lethbridge tends to reflect development patterns in the city. Areas with mixed use development and higher concentrations of employment and residential development tend to have higher unserved demand, while areas with lower density residential and industrial development tend to have less unserved demand. This section examines development patterns in the city as well as other factors that are likely to affect activity levels. This includes concentrations of retail shops and parks within the city. Areas high in a single metric (e.g., population) may be appropriate for local cycling networks such as an Active and Safe Routes to School Program.

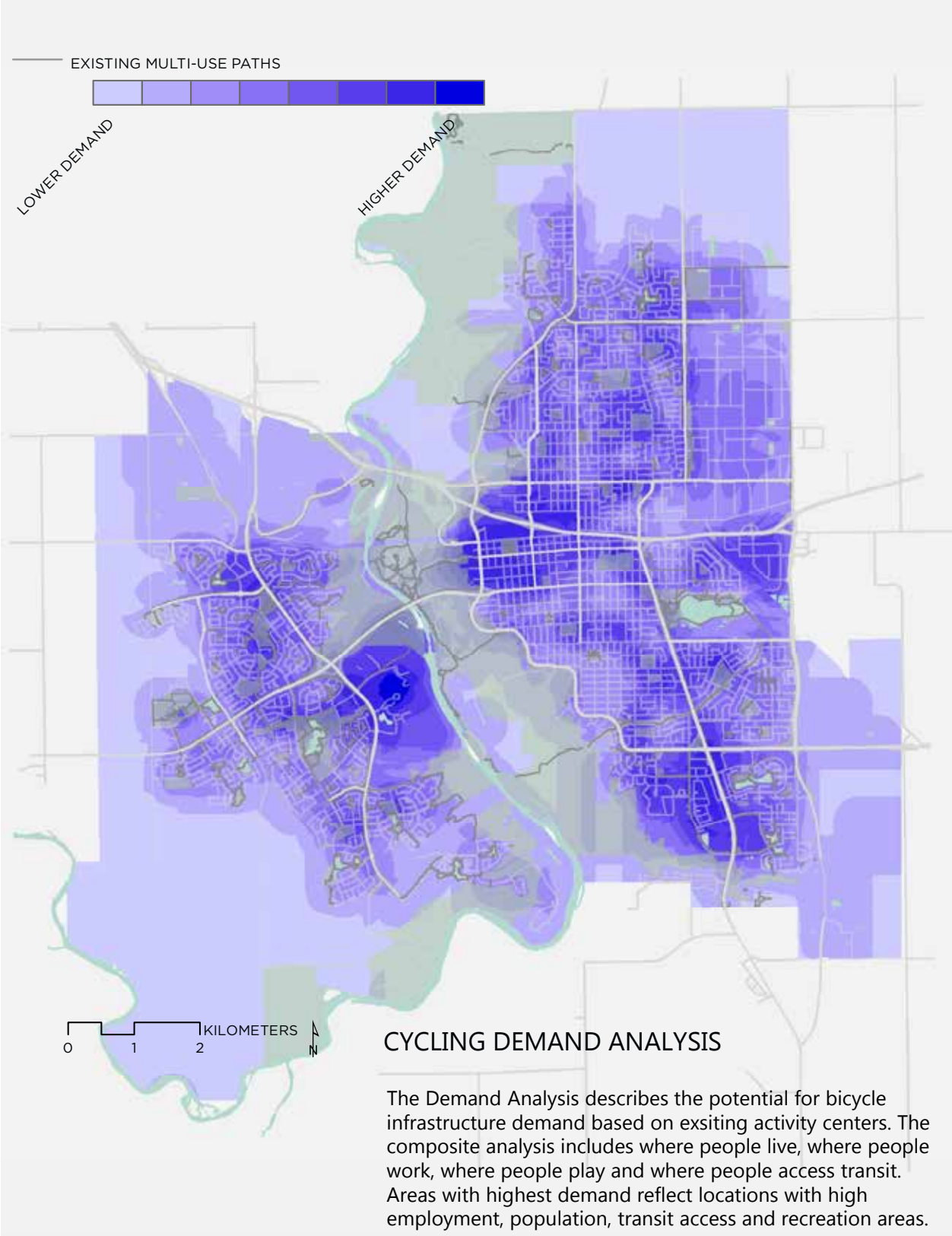
Figure 6 compiles and compares the density and distribution of population, employment, recreational activity and transit stop locations to establish a composite map of potential demand for cycling within Lethbridge. Areas that are shaded darker have greater demand for cycling activity.

2 Scores are a result of two complementing forces: distance decay – the effect of distance on spatial interactions yields lower scores for features farther away from other features; and spatial density – the effect of closely clustered features yields higher scores. Scores will increase in high feature density areas and if those features are close together.

From the analysis completed, the following observations can be made:

- The areas with the greatest demand for cycling include,
    - The area around the University of Lethbridge.
    - Downtown Lethbridge and surrounding neighbourhoods, roughly bounded by 5th Ave N, 6 Ave S, the coulee and Mayor Magrath Drive.
    - The area surrounding Lethbridge College from the coulee to 43rd St S and 40th Ave S to 16th Ave S.
- Areas with lesser demand for cycling activity include outlying areas of the city as well as neighbourhoods that are predominantly lower density residential and auto-oriented low density industrial areas.

FIGURE 6. CYCLING DEMAND ANALYSIS



CYCLING DEMAND ANALYSIS

The Demand Analysis describes the potential for bicycle infrastructure demand based on exsiting activity centers. The composite analysis includes where people live, where people work, where people play and where people access transit. Areas with highest demand reflect locations with high employment, population, transit access and recreation areas.

5.3 CYCLING CRASH ANALYSIS

Crash analysis was based on reviewing the locations of reported collisions involving a person riding a bicyle over a 5 year period. The collision locations were grouped to intersection and mid-block locations. Statistical analysis was not conducted due to bicycle crashes being typically under-reported and rare. Instead, a visual and qualitative analysis of crash locations was conducted. Summary findings described the observed spatial and temporal trends. To address the under-reporting issue, we also collected input from the public and stakeholders about the locations of collisions and near-misses they have experienced in Lethbridge. This additional information corroborated many of the locations identified in the collision data.

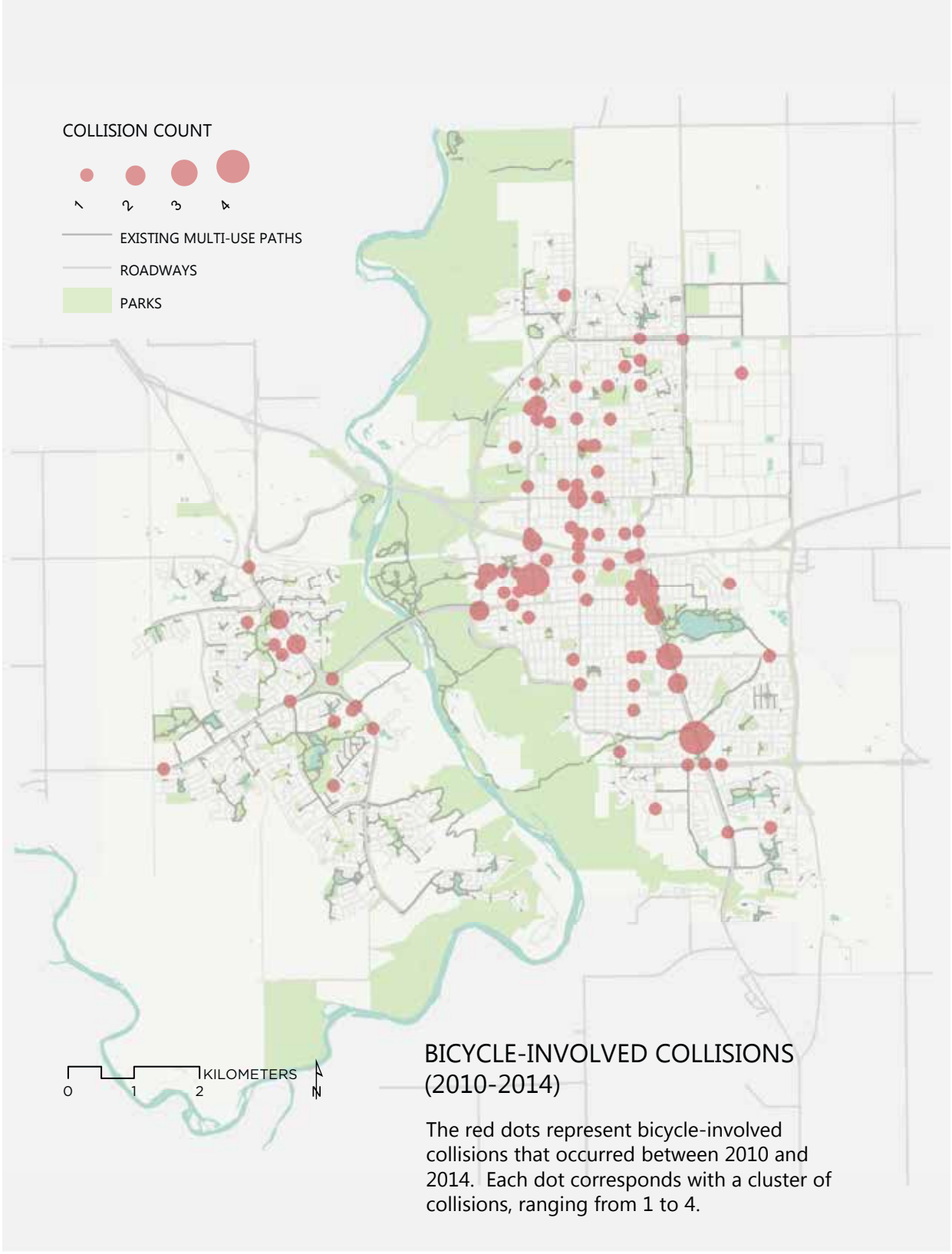
Figure 7 shows the location and number of reported bicycle crashes occurring from 2010 through 2014.

From the analysis, a number of observations were made:

- Higher numbers of crashes occur east of the Oldman River and are especially frequent along Mayor Magrath Drive S.
- Crashes are also common in downtown and along 13th St S. The higher numbers of crashes in this area may be due to greater numbers of people riding bicycles and motor vehicles using these roadways.
- Reported crashes are relatively low around the University of Lethbridge and Lethbridge College.
- From input received from the public and stakeholders, the crossings of Crowsnest Trail and rail lines were locations of near misses and, in general, concerns at intersections were noted. These included Stafford Drive at the Highway crossing as well as at intersections in the London Road area, Downtown, and along University Drive.

From the data received, it was found that injury crashes are reported more commonly than property damage only crashes, which is expected given typical under reporting of property damage only crashes.

FIGURE 7. BICYCLE-INVOLVED COLLISIONS (2010-2014)



6.0 BICYCLE NETWORK

6.1 NETWORK DEVELOPMENT (DESIRE LINES AND OPPORTUNITY CORRIDORS)

From the public, internal and external engagement, cycling demand analysis and cycling potential analysis "desire lines" were derived. This represent a high level interpretation of where people want to go. These desire lines are independent of existing street locations.

From these desire lines, "opportunity corridors" were then derived. Opportunity corridors represent where the desire lines align with two or three existing streets in the city. These corridors show where a cycling route could be located.

From these opportunity corridors, proposed cycling routes were indenti ied based on a preliminary review of the street geometry and local context.

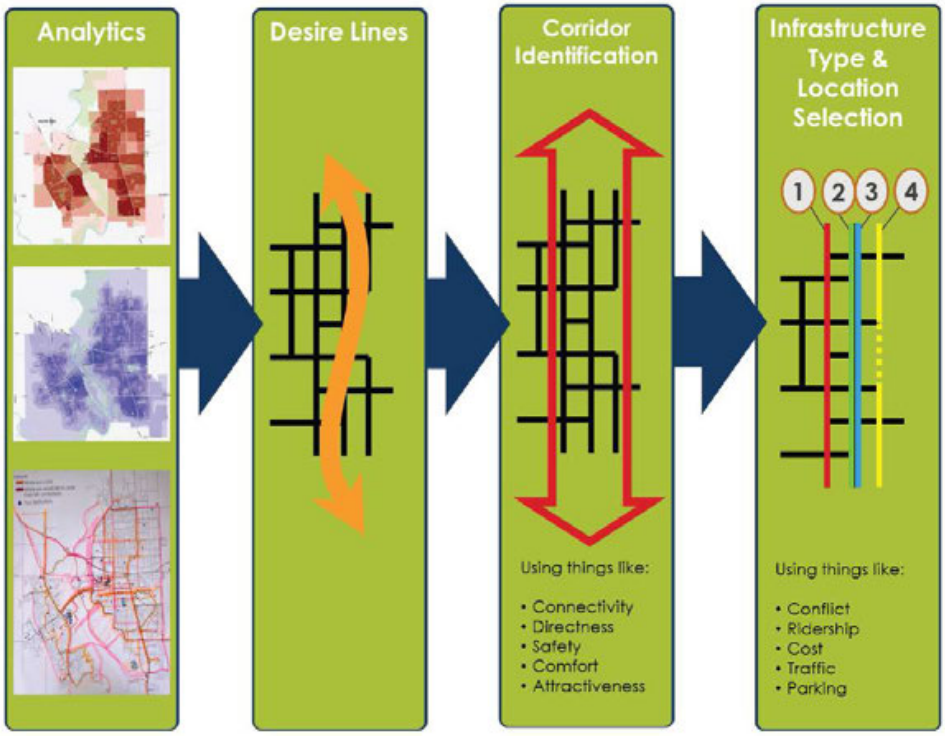


FIGURE 8. NETWORK DEVELOPMENT PROCESS

6.2 CREATING DESIRE LINES FROM ANALYTICS AND ENGAGEMENT

Desire lines were developed using the analytics described in the previous sections along with public and stakeholder input on desirable bicycle routes within the city. Figure 9 shows the desire lines overlaid on the analytics and input maps. These graphics demonstrate the general alignment with high intensity areas of both cycling potential and cycling demands and a desire for a network of bicycle infrastructure to function both in north-south and east-west alignments. It is also clear that the coulee is a barrier to cycling, which was confirmed through the public engagement.

FIGURE 9. DESIRE LINE DEVELOPMENT

6.3 IDENTIFYING OPPORTUNITY CORRIDORS

Using the desire lines, opportunity corridors were then identified. These opportunity corridors are a number of possible streets and corridors where designated bicycle routes could be constructed.

Figure 10 shows the opportunity corridors overlaid on the desire lines and demonstrates the overall effectiveness of using an east-west and north-south grid of streets in order to meet the travel desire lines.

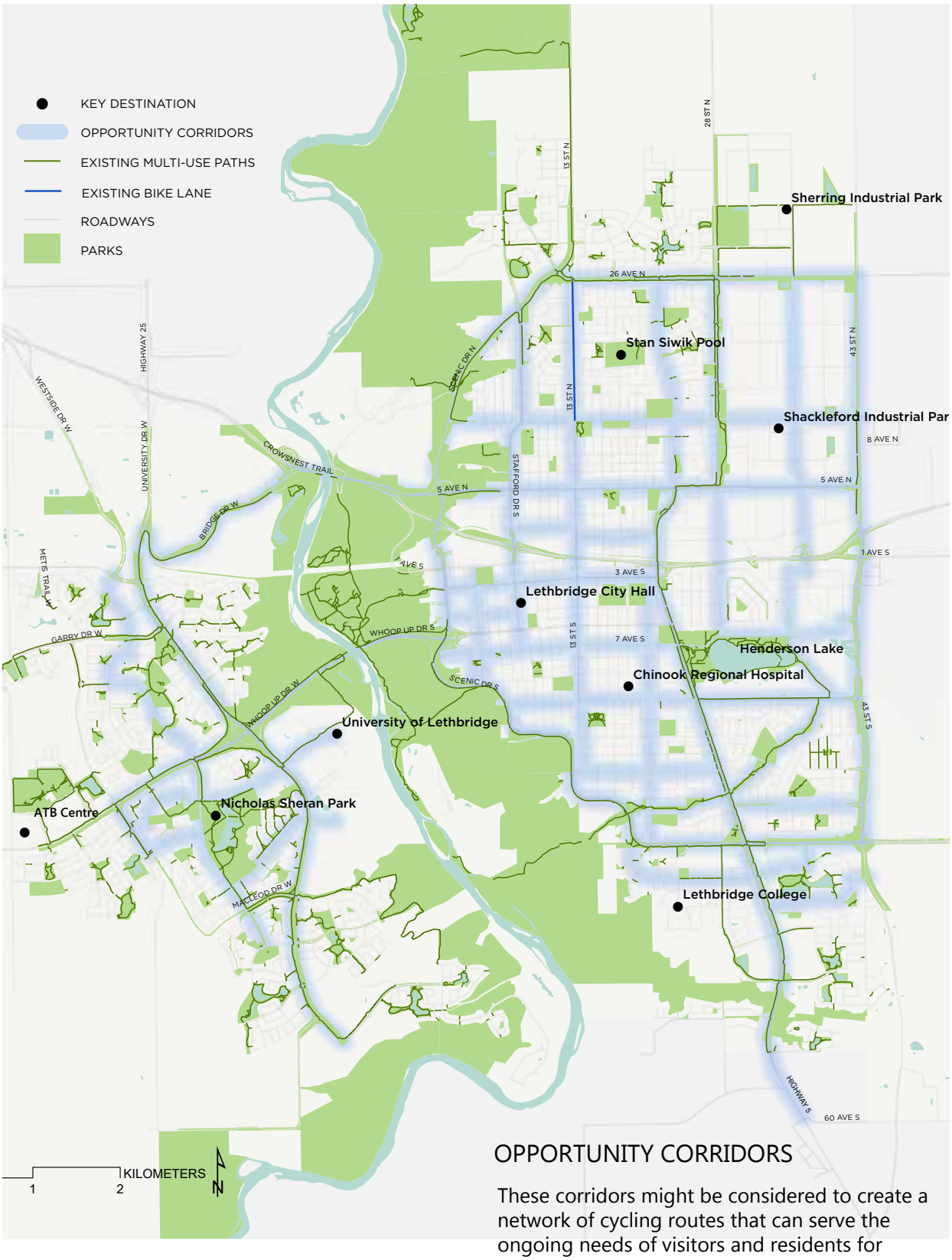
This concept is refined in Figure 10, and finalized in Figure 11. These corridors might be considered to create a network of cycling routes that can serve the ongoing needs of visitors and residents for travel throughout the community.

FIGURE 10. OPPORTUNITY CORRIDORS DEVELOPMENT

The network builds on routes that are already commonly used by people riding bicycles. It recommends a higher density of routes in areas of high activity like downtown and surrounding neighbourhoods as well as near the University of Lethbridge and Lethbridge College.

With the opportunity corridors identified, the routes and cycling infrastructure types were then assigned to each corridor.

FIGURE 11. OPPORTUNITY CORRIDORS



OPPORTUNITY CORRIDORS

These corridors might be considered to create a network of cycling routes that can serve the ongoing needs of visitors and residents for travel throughout the community.

6.4 BICYCLE NETWORK MAP

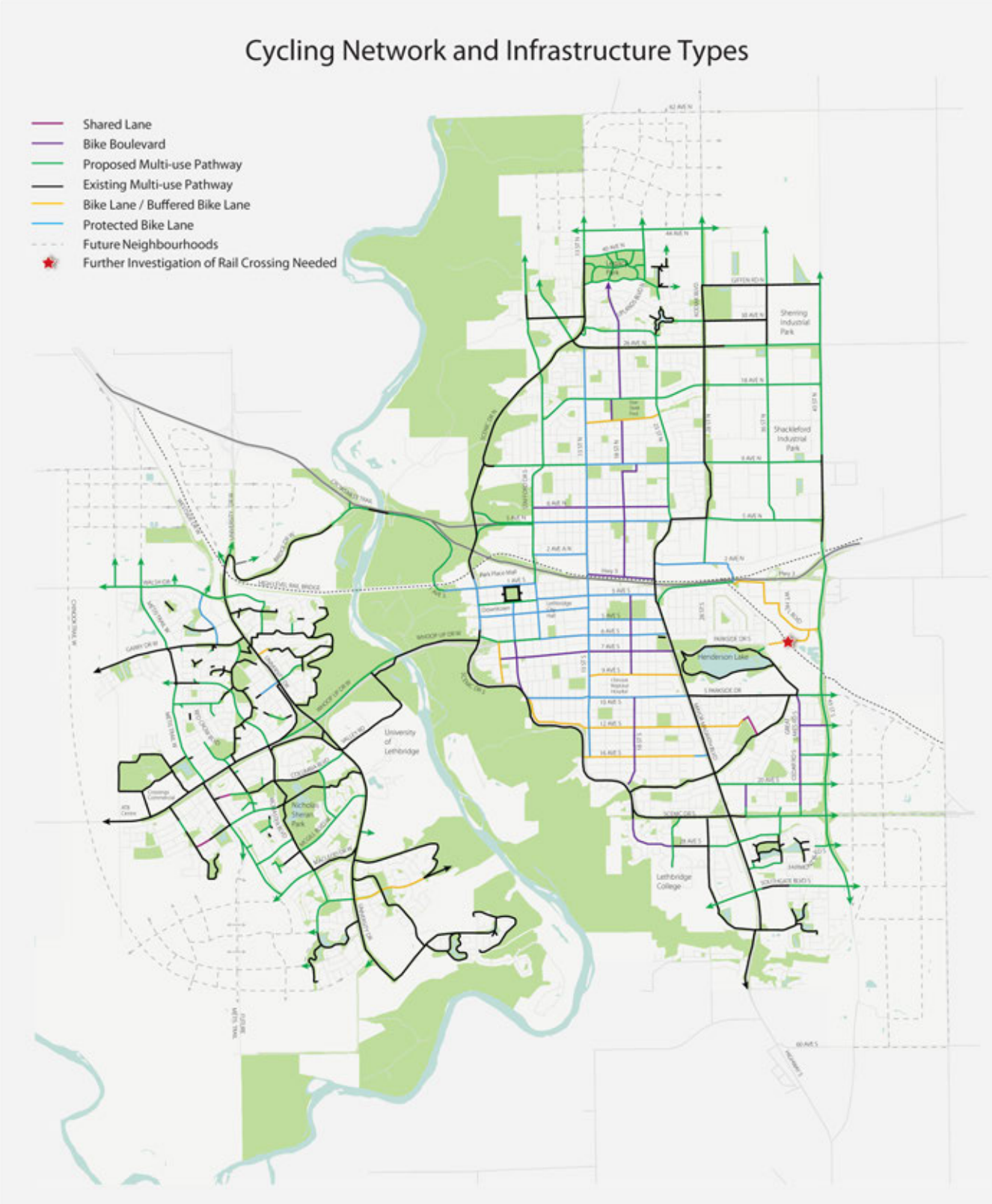
The bicycle network map for the Cycling Master Plan was created using the analysis to create desire lines, opportunity corridors and evaluating possible routes within the opportunity corridors. The recommended bicycle network has many key east-west and north-south routes that will connect people to community facilities, employment areas, schools, recreational areas and shopping destinations. The network is denser in areas with higher cycling potential and/or demand.

In addition to the route locations, the bicycle infrastructure for each route was determined to create a safe and comfortable cycling environment for people of all ages and abilities.

The assessment of infrastructure-type suitability is discussed in the subsequent sections of this chapter. The analysis is based on current conditions and characteristics of the streets. It is recommended to review and reconfirm the suitable bicycle infrastructure for each route during the design stage of implementation.

The design and construction of bicycle infrastructure may include a number of changes. In some cases, curbs may need to be relocated, new asphalt laid, pavement markings added to the street or intersections, parking consolidated to one side of the street to manage sightlines and operations, platforms built at bus stops, traffic calming installed at intersections, and installation of new signals. These have been considered at a very high level for this study but the implementation of each route will require more detailed consideration.

FIGURE 12. PROPOSED BICYCLE NETWORK



6.5 CYCLING INFRASTRUCTURE TYPES

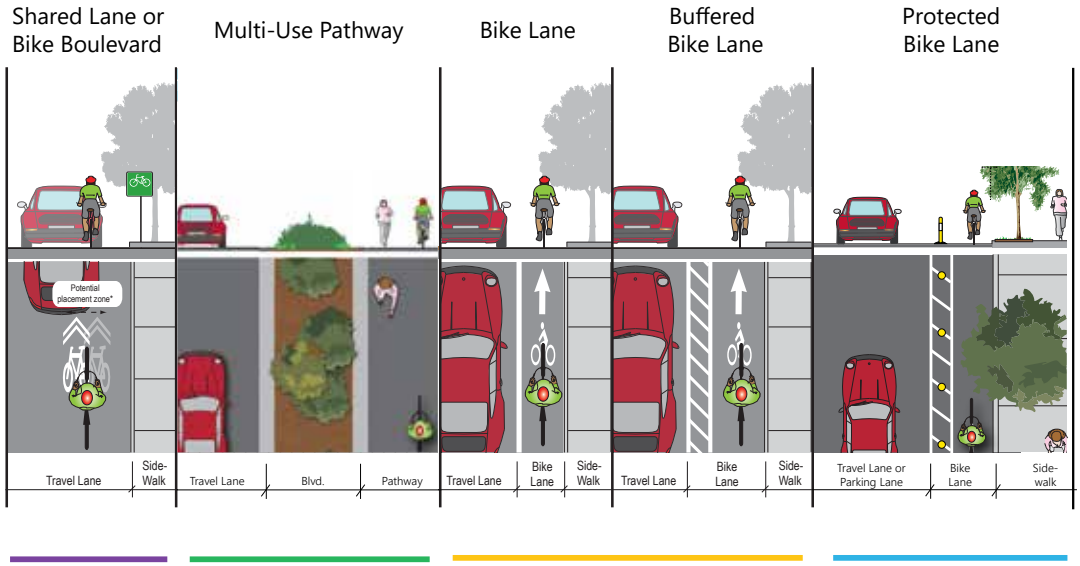


FIGURE 13. CYCLING INFRASTRUCTURE TYPES

Key aspects of the transportation network (motor vehicle speed, motor vehicle volumes, interactions with pedestrians, and transit operation) have significant impact on the comfort of bicycle riders and, as such, different infrastructure types should be used in varying contexts. Ultimately, having a network that has a consistent level of comfort for all ages and ability of bicycle riders is desired. The various types of infrastructure considered for Lethbridge are shown above in Figure 13.

The cycling infrastructure types that were chosen for the plan meet the following objectives which have been shown to reduce collision frequency and severity[3,4]:

- Separate people riding bicycles from vehicles when the road environment is designed for higher vehicle traffic speeds and/or traffic volumes.
- Use interventions to create a road environment with low vehicle speeds and volumes where people riding bicycles are intended to share the travelled way with moving vehicles but where the speed differential is 10 km/hr or less (i.e., vehicle operating speeds of 30 km/hr maximum).
- Separate people riding bicycles from people walking in areas where high volumes of either or both activities are anticipated.

3 CROW. Design manual for bicycle traffic. The Netherlands: CROW, 2007.
4 Teschke K, Harris A, Reynolds C, Winters M, et al. Route Infrastructure and the Risk of Injuries to Bicyclists: A Case-Crossover Study. American Journal of Public Health 2012;102(12):2336-2343.

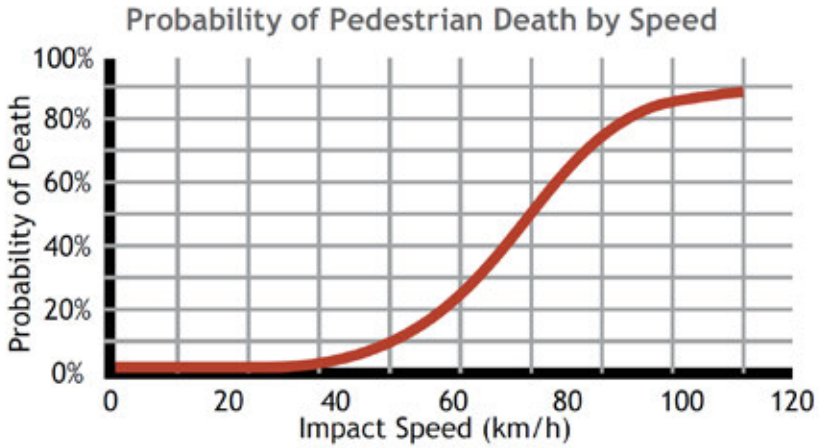
Suitability of the bicycle infrastructure in the network plan is based on industry standards. Table 1 outlines a matrix indicating the road environment conditions that would be suitable for each type of bicycle infrastructure.

TABLE 1: BICYCLE INFRASTRUCTURE SUITABILITY MATRIX

Bicycle Infrastructure Type	Suitable Conditions			
	Posted Speed Limit	Vehicle Volumes	Walking and/or Cycling Volumes	Transit Operations
Bike Lane or Buffered Bike Lane	30 kilometres per hour (km/hr) or less	2,500 vehicles per day (vpd) or more	N/A	N/A
	30 km/hr to 50 km/hr	Less than 4,000 vpd-	N/A	N/A
Protected Bike Lane	50 km/hr or less	Any volume	Any volume and particularly with higher volumes (greater than 33 persons per hour per metre of path width) and in downtown environments	N/A
	Over 50 km/hr to 80 km/hr	Any volume but more rigid barriers required at higher speeds (e.g., over 60 km/hr) or a bike path or MUP may be more suitable		N/A
Multi-Use Path	80 km/hr or less	Any volume	Consider segregating walking and bike paths when greater than 33 persons per hour per metre of path width	N/A
	Over 80 km/hr	Any volume with greater separation (i.e., outside the clear zone)		
Bicycle Boulevard	30 km/hr or less	Less than 2,500 vpd	N/A	No transit service or limited, small bus community service (less than 8 buses per peak hour)
	Up to 40 km/hr	Less than 1,000 vpd		
Shared Lane Typically for shorter sections or on streets that exhibit low traffic volumes and speeds	30 km/hr or less	Less than 2,500 vpd	N/A	No transit service or limited, small bus community service (less than 8 buses per peak hour)
	Up to 40 km/hr	Less than 1,000 vpd		

6.6 INTERSECTION INFRASTRUCTURE

Intersections, driveways and accesses are the locations of most conflicts between people riding bicycles and people driving. With the difference in mass and operating speeds, this can lead to injuries and deaths if the design of intersections does not manage these aspects. The key is to separate people riding bicycles and people driving vehicles in time and/or space. If this is not possible, the locations should be designed so that cyclists and motorists cross each other at low speeds. The graph below is a summary of three collision studies, all of which show that above a speed of 50 km/h, the probability of death increases significantly.[1]



1 Richards, D. (2010) Relationship between speed and risk of fatal injury: pedestrians and car occupants. Road Safety Web Publications, No 16, Transport Research Laboratory

Research has been completed internationally, in Canada and the United States about the safety of intersection designs for bicycle infrastructure. Intersection designs that have been shown to improve safety include:[5, 6, 7, 8, 9, 10,11,12,13,1415]

- Use of signal phases to separate conflicting movements such as right turning vehicle traffic and through bicycle traffic (i.e., protected phase for cyclists) or turn restrictions for vehicle traffic;
- Use of green pavement markings to indicate conflict zones at driveways and intersections;
- Bending the bicycle infrastructure out (i.e., away from the vehicle lanes) a distance of 2m to 5m; and
- Raising the bicycle crossing (and pedestrian crossing) at intersections (signalized and unsignalized) and driveways.

During more detailed design, these types of approaches should be included in the design of bike routes. In addition, the approaches to improve safety and efficiency of existing intersections, particularly multi-use path crossings of streets, should be completed as part of the City's traffic safety and operational review processes.

An early signal phase for bicyclists reduces conflict with turning vehicles, while use of green defines the infrastructure and increases awareness of conflict zones.

The cycle track remains level at driveway crossings, requiring turning vehicles to cross a steep apron to access parking.

5 CROW. Design manual for bicycle traffic. The Netherlands: CROW, 2007.
6 Furth P, Koonce P, Yu M, Peng F, Littman M. Mitigating the Right Turn Conflict Using Protected-Yet-Concurrent Phasing for Cycle Track and Pedestrian Crossings. Transportation Research Board Annual Meeting, Washington, D.C., 2014.
7 Garder P, Leden L, Pulkkinen U. Measuring the Safety Effect of Raised Bicycle Crossings Using a New Research Methodology. Transportation Research Record: Journal of the Transportation Research Board 1998;1636:64-70.
8 Harris A, et al. Comparing the effects of infrastructure on bicycling injury at intersections and non-intersections using a case-crossover design. Injury Prevention 2013;0:1-8.
9 Monsere C et al. Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S. NITC-RR-583. Portland, Oregon: National Institute for Transportation and Communities, 2014.
10 Schepers J, Kroeze P, Sweers W, Wüst J. Road factors and bicycle-motor vehicle crashes at unsignalized priority intersections. Accident Analysis and Prevention 2011;43:853-861.
11 Schepers J, Voorham J. Oversteekongevallen met fietsers: Het effect van infrastructuurkenmerken op voorrangskruispunten. The Netherlands: Rijkswaterstaat Dienst Verkeer en Scheepvaart, 2010.
12 SWOV. Bicycle facilities on distributor roads. SWOV Fact Sheet. Leidschendam, the Netherlands: SWOV, 2010.
13 Transportation Association of Canada (TAC). Geometric Design Guide for Canadian Roads (Update). Ottawa, Ontario: Transportation Association of Canada, 2016 (draft).
14 Wijlhuizen G, Dijkstra A, van Petegem J. Safe Cycling Network: Developing a system for assessing the safety of cycling infrastructure. R-2014-14E. The Hague, the Netherlands: SWOV Institute for Road Safety Research, 2014.
15 Zangenehpour S, Strauss J, Miranda-Moreno L, Saunier N. Are signalized intersections with cycle tracks safer? A case-control study based on automated surrogate safety analysis using video data. Accident Analysis and Prevention 2016;86:161-172.

7.0 IMPLEMENTATION APPROACH

Funding limitations and coordination with existing and future road projects mean that the proposed cycling network plan will be implemented gradually. Those routes that provide the most value, as measured by existing and latent cycling demand, communnity acceptance, project cost and network connectivity should be proritized for early implementations.

Implementation of the identified network is only a piece of the long-term elements required to facilitate cycling as a viable transportation option in Lethbridge. To that end, we have identified a four part implementation strategy: implementing the identified master plan infrastructure, developing infrastructure within new areas, supporting infrastructure and programs, and ongoing monitoring.

7.1 IMPLEMENTING THE CYCLING MASTER PLAN NETWORK

The recommended cycling network was identified in **Section 6.4**. To support a phased implementation strategy, the overall network is broken out into two phases. Each phase represent an approximate 15 year plan.

7.1.1 Proposed Implementation Criteria

Implementation criteria were developed using best practices from North American bicycle planning together with the local Lethbridge context based on values and interests of the public, internal and external stakeholders. The criteria are linked to the goals and objectives of the Cycling Master Plan and are used as a means of scoring the individual projects to inform prioritization for implementation.

The implementation criteria used in the development of the phasing of the bicycle network are described below:

- **Cycling Demand.** This criterion measures the existing and future ridership anticipated for the bicycle route by using population and employment information provided by the City and the degree to which the proposed project will serve key destinations within Lethbridge. This criterion was assessed using the Cycling Demand Map previously developed as part of this project.

- **Cycling Potential**. This criterion identifies if the project is likely to support high levels of cycling based on characteristics of the natural and built environment (such as intersection density and road grades). This criterion was assessed using the Cycling Potential Map previously developed as part of this project.

- **Community Acceptance**. This criterion considers the anticipated level of impact required for the implementation of the project such as parking consolidation and potential motor vehicle traffic impacts, as well as input from the public, internal and external stakeholders for route preferences.

All identified projects were ranked on a score that combined those three elements. Final ranking was then evaluated based on criteria of project cost and network connectivity.

- **Project Cost**. This criterion assesses the high level anticipated capital cost and associated constructability. These are used to prioritize projects that can be constructed quickly at lower costs and those projects that are in

existing/future plans or development opportunities. Project costs were used to create the breakdown in phases and in detailed ranking of projects in Phase 1, to create clusters of projects.

- **Network Connectivity**. This criterion considers the degree to which the proposed route fills an existing gap within the city's cycling network. The primary existing cycling routes are provided through multi-use paths. Therefore, it is advantageous to first invest in routes that do not have access to existing multi-use pathways. This criterion also allows for consideration of grouping projects to ensure new segments of the cycling network connect to existing cycling routes, which was particularly important in the detailed ranking of Phase 1 projects.

Phase 1 will focus on the implementation of multi-use paths, bike boulevards and protected bike lanes to create a base network that will result in a strong east-west and north-south grid. This grid network will provide good access to downtown activities and destinations in south and north Lethbridge. Some projects have been identified in west Lethbridge that will allow for a strong connection parallel to University Drive and take advantage of the significant existing network of neighbourhood connections available on local paths. Focusing on multi-use paths, protected bike lanes, and bike boulevards is consistent with the research conducted in Lethbridge on the types of bicycle infrastructure that people would feel most comfortable on and that would increase cycling.

Phase 2 will focus on the completion of the network using multi-use paths as the primary infrastructure type along with some protected bike lanes.

The two phases are shown in Figures 14 and 15.

FIGURE 14. PHASE 1 IMPLEMENTATION

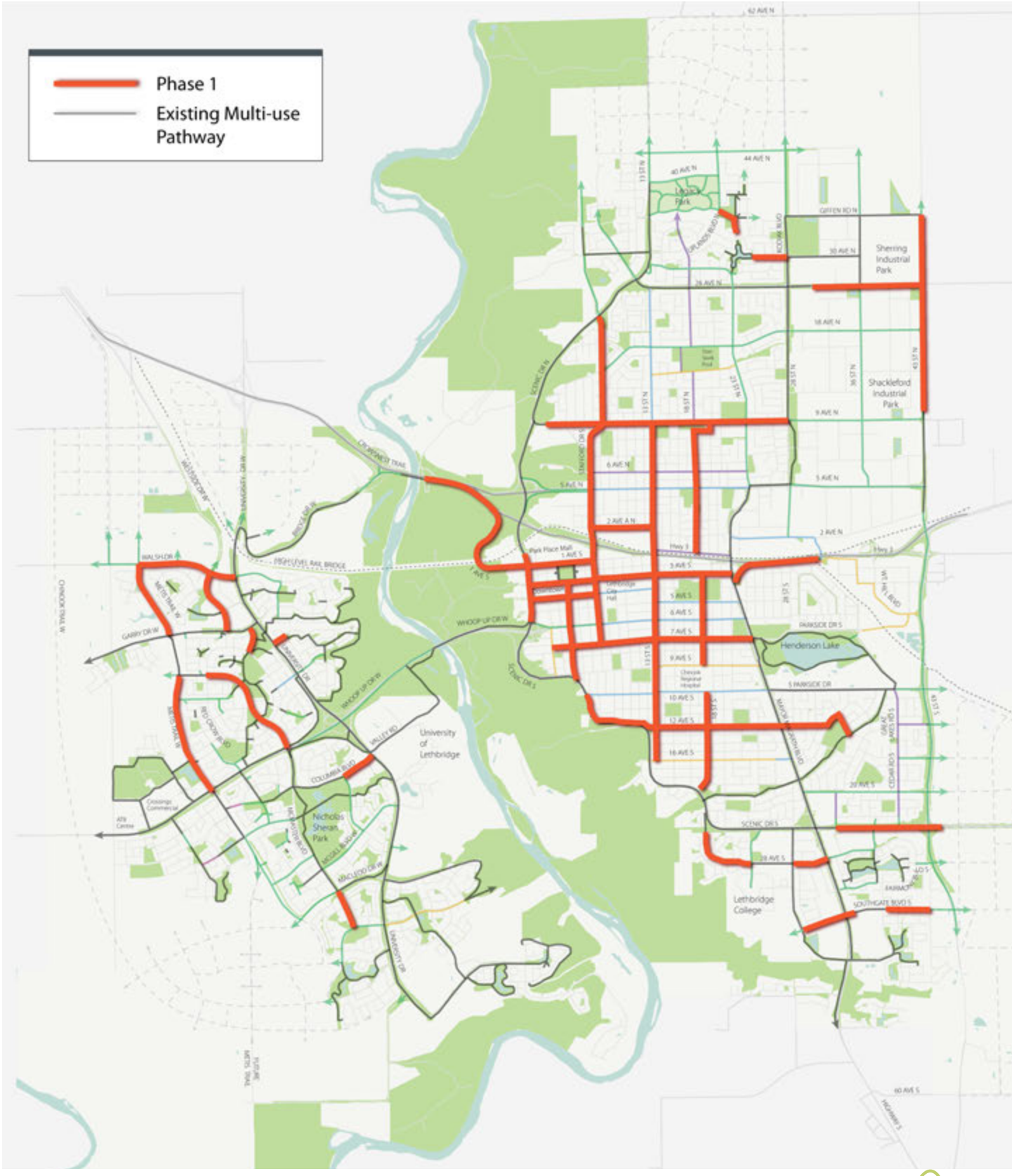
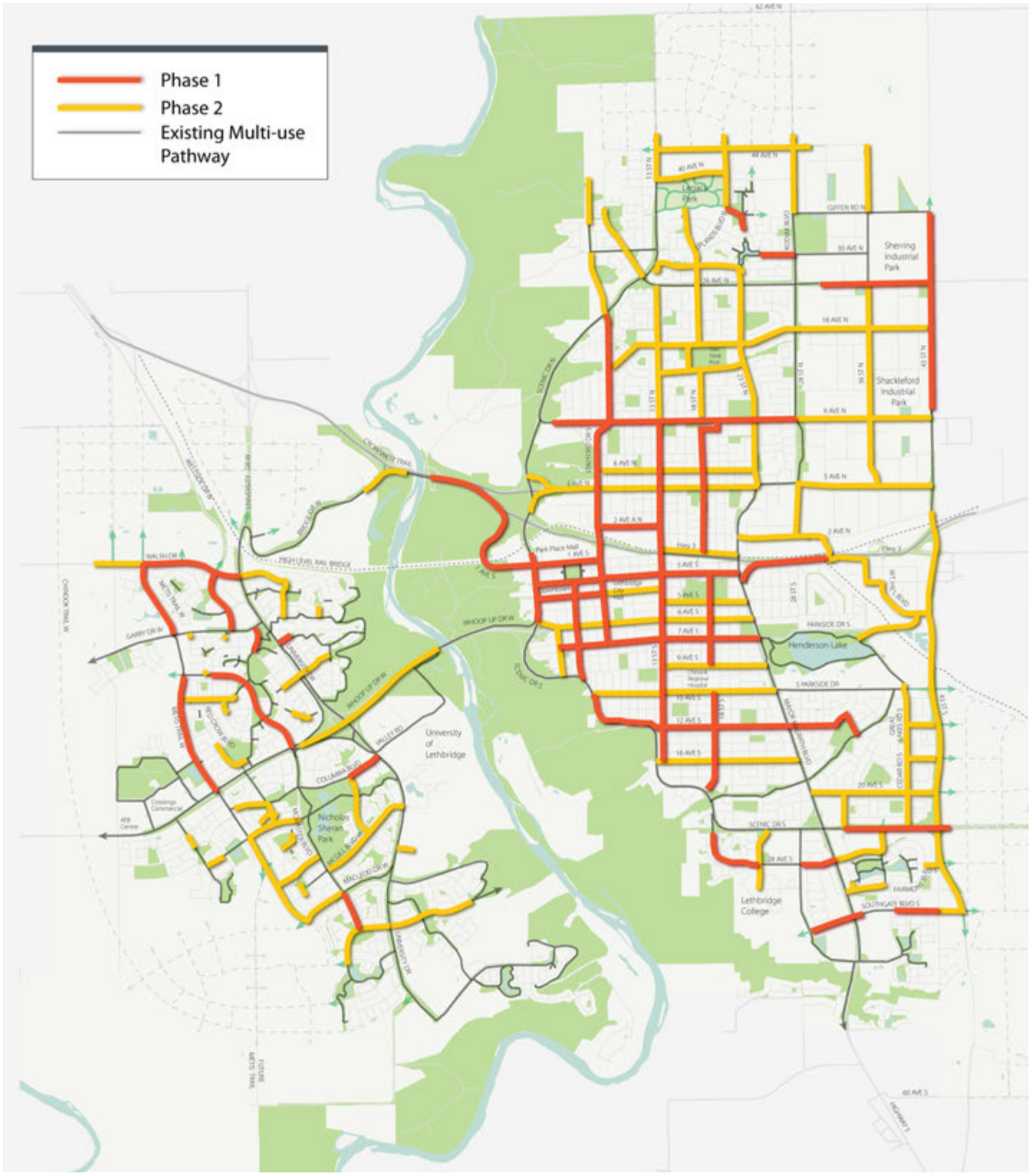


FIGURE 15. PHASE 2 IMPLEMENTATION



7.1.2 Cost Estimate

A conceptual cost estimate, in 2016 dollars, was completed for the bicycle routes in the network plan. Depending on the type of cycling infrastructure recommended, infrastructure requirements could include paving new facilities, pavement markings, medians, traffic calming and signal upgrades. Costs were identified for four different infrastructure types on a centre-line basis (i.e., accommodating two-way bicycle traffic for each infrastructure type).

1. **Multi Use Paths** – Costs include construction of an approximately 3 m wide asphalt path. The cost estimate is mostly reflective of new infrastructure, though, for this study, certain retrofit projects are also included under this typology. **$375 PER LINEAL METRE**

2. **Bike Lane** – Bike lanes are identified through pavement markings on existing road structures; they are delineated by lines, bike symbols, and signage. For this type of infrastructure, costs for conflict zone marking markings are included but no signal upgrades. Approximately **$108 PER LINEAL METRE OF ROADWAY**

3. **Protected Bike Lane** - A protected bike lane has the same base as a bike lane, but additional costs to implement this type of infrastructure include protective delineators and low profile parking curb. Approximately **$230 PER LINEAL METRE OF ROADWAY.** Additional costs for protected bike lanes include intersection upgrades, which are identified as $65,000 per intersection. This includes replacing traffic controllers and cabinets and installing bicycle signal heads. Not all signals will require upgrades. This estimate will allow for consideration of new signals in locations where signals do not current exist but may be required.

4. **Bike Boulevard** – Bike boulevards share the right of way with vehicle traffic. Bike boulevards are identified through on-pavement marking and signage but not separate lanes. Because bike boulevards require low volume and low speed streets, the cost of bike boulevards includes an estimate to provide mini-roundabouts or other traffic calming at intersections. Approximately **$180 PER LINEAL METRE**

Other general assumptions for the cost estimates include the following:

- Costs do not include engineering design;
- All costs are for two-way infrastructure;
- Costs include approximately 25% contingency; and
- Costs do not include purchase of land or installation of lighting.

The entire Network is estimated to cost a total of $43.8 million, which has been split evenly between Phase 1 and 2.

7.1.3 Phase 1 Detailed Cost and Prioritization

To aid in implementation of the first phase of the Cycling Master Plan Network, Phase 1 has been broken out into 13 stages, with each stage including multiple projects costing approximately $1 million. The first stage appears more capital intensive, but many of these projects are being completed in conjunction with other capital projects including arterial street construction in new or expanding neighbourhoods. Likewise, based on estimated timelines, stage four also appears capital intensive to incorporate a number of major multi-use paths that will be built in new or expanding neighbourhoods.

The staging is based on similar criteria used to determine the three implementation phases, with more details considered around network connectivity, cost horizons, demand and constructability. The breakdown is summarized in the Table 2.

The projects in Phase 2 were not broken down in as much details as those in Phase 1. Development priorities may change over the next 10-15 years; growth may be higher in some areas than others, and identifying opportunities for efficiencies in construction will be more effective closer to construction dates.

In addition to the projects identified for Phase 1, it is recommended the safety and operation of the existing network of multi-use paths be reviewed and improved with a focus on intersections. This work could be completed in conjunction with other traffic safety, operations and Vision Zero Safety initiatives.

TABLE 2: PROPOSED PHASE 1 PROJECTS

Stage	On	From	To	Infrastructure Type	Estimated Cost
1	SCENIC DR S	6 AVE S	1 AVE S	PBL	$490,000
	4 AVE S	SCENIC DR S	STAFFORD DR S	PBL	$640,000
	3 AVE S	SCENIC DR S	STAFFORD DR S	MUP	$300,000***
	7 AVE S	4 ST S	MAYOR MAGRATH DR S	BB	$420,000
	6 ST S	3 AVE S	SCENIC DR S	PBL/BB	$230,000
	HWY 3	MAYOR MAGRATH DR S	31 ST S	MUP	$300,000
	METIS TR W	WALSH DR W	WHOOP UP DR W	MUP	$1,840,000*
	WALSH DR W	UNIVERSITY DR W	30 ST W	MUP	$1,160,000*
	METIS TR W	TEMPLE BLVD W	MACLEOD DR W	MUP	$450,000*
2	STAFFORD DR N/S	5 AVE N	7 AVE S	MUP/PBL	$940,000****
3	2 AVE A N	STAFFORD DR N	13 ST N	PBL	$370,000
	13 ST N	9 AVE N	2 AVE A N	PBL	$810,000
	18 ST N	1 AVE N	9 AVE N	BB	$310,000
4	1 AVE S	SCENIC DR S	STAFFORD DR S	PBL	$510,000
	13 ST N/S	2 AVE A N	3 AVE S	PBL	$140,000
	HWY 3 & 1 AVE S	BRIDGE RD W	SCENIC DR S	MUP	$1,820,000**
	43 ST N	GIFFEN RD N	9 AVE N	MUP	$920,000*
	26 AVE N	31 ST N	43 ST N	MUP	$900,000*
	43 ST N/S	2 AVE N	SOUTHGATE BLVD S	MUP	$1,880,000*
	3 AVE S	STAFFORD DR S	13 ST S	PBL	$360,000
5	28 AVE S	28 ST S	MAYOR MAGRATH DR S	MUP	$150,000
	12 AVE S	10 AVE S	GLACIER DR S	BL	$360,000
6	13 ST S	3 AVE S	16 AVE S	PBL	$900,000
	COLUMBIA BLVD W	LAVAL BLVD W	UNIVERSITY DRIVE W	MUP	$130,000
7	HIGHLANDS BLVD W	WALSH DRIVE W	GARRY DRIVE W	PBL	$200,000
	STAFFORD DR N	SCENIC DR N	5 AVE N	MUP	$760,000
8	9 AVE N	SCENIC DR N	28 ST N	MUP/PBL	$1,660,000
	UPLANDS NHBD	KODIAK GATE N AND LEGACY PARK CONNECTION		MUP	$250,000
9	SOUTHGATE BLVD S	COULEECREEK BLVD S	43 ST S	MUP	$220,000
	MCMASTER BLVD W	MACLEOD DR W	ROCKY MOUNTAIN BLVD W	MUP	$180,000
	SOUTHGATE BLVD S	WEST OF MAYOR MAGRATH DR S	28 ST S	MUP	$210,000
10	28 AVE S	SCENIC DR S	COLLEGE DR S	BB	$150,000
	18 ST S	SCENIC DR S	3 AVE S	BB	$410,000
11	3 AVE S	13 ST S	MAYOR MAGRATH DR S	PBL	$470,000
12	JERRY POTTS BLVD W	RED CROW BLVD W	WHOOP UP DR W	MUP	$550,000
	STONEY CRES W	RED CROW BLVD W	GARRY DR W	MUP	$80,000
	EDGEWOOD BLVD W	SHERWOOD BLVD W	UNIVERSITY DR W	BL	$30,000
13	SCENIC DRIVE S	EAST OF MAYOR MAGRATH DR S	43 ST S	MUP	$420,000

PBL = Protected Bike Lane | MUP = Multi-Use Path | BB = Bike Boulevard | BL = Bike Lane
*Complete with arterial construction | **Includes retaining wall | ***MUP portion only | ****Bridge not included

Total for Phase 1: $21.9 Million

7.1.4 Recommended Network Implementation Process

The Cycling Master Plan has identified routes and infrastructure types within the opportunity corridors. However, at the outset of the functional planning and design phase of implementation, the corridors should be reviewed to confirm that no other alignments are more desirable given the current conditions. The impacts of capital projects not known at the time of creation of this plan, changes in understanding of infrastructure suitability or changes in cycling usage are examples of reasons this review is necessary.

The following outlines the recommended implementation process for the projects identified in the Cycling Master Plan.

TABLE 3: IMPLEMENTATION PLANNING & DESIGN RECOMMENDED PROCESS

Cycling Master Plan Implementation Planning & Design Recommended Process		
Step 1	**Route Validation**	• Review the location of the route within the identified opportunity corridor using Multiple Accounts Evaluation (MAE). MAE is a process where multiple factors are evaluated (e.g., safety, travel time, parking) to measure the performance for multiple users.
Step 2	**Infrastructure Type Selection**	• Confirm the type of cycling infrastructure for the route based on MAE
Step 3	**Functional Planning and Detailed Design**	• Complete functional planning and detailed design for the cycling infrastructure. • Design consideration for mid-block design, intersections and connections to other infrastructure on the network.
Step 4	**Construction**	• Complete construction of the cycling infrastructure.
Step 5	**Monitoring and Adjustments**	• Monitor the use of the new infrastructure and make adjustments as necessary.

7.2 NEW AREAS

The Cycling Master Plan focuses on infill cycling infrastructure to retrofit existing roads and areas to improve cycling access and safety. These improvements are crucial to creating opportunities for people to feel comfortable cycling and to consider cycling a viable option for transportation. To create a complete and connected network, cycling infrastructure in developing areas of Lethbridge is also needed.

7.2.1 Principles

Cycling infrastructure in new developments should align with the following principles:

- Direct access to destinations (schools, shopping, jobs, recreation);
- Network spacing should allow users to be within a 2 to 4 block distance of infrastructure;
- Arterial roadways must offer cycling infrastructure; and
- Intersections must be designed to accommodate the type of cycling infrastructure provided.

7.2.2 Infrastructure Identification Approach

There are two general approaches that can be considered for implementing cycling infrastructure in new areas. Either approach allows for a well-connected cycling network that provides safe cycling routes in new areas that link to existing routes to other parts of Lethbridge.

The first approach is to create a grid or network of infrastructure that aligns with the road network, where cycling infrastructure type is selected based on the suitability matrix identified in Section 6.5. This would result in a network with a mixture of bike boulevards that allow cycling on lower volume roads and separated infrastructure such as protected bike lanes and multi-use paths along higher volume and speed roads. Newer areas will align with the infill infrastructure currently recommended in Lethbridge's existing neighbourhoods, but alternative cross-sections would be needed for new roads.

The alternative approach is to focus on separated infrastructure through off-street and on-street multi-use paths. With this approach, a network of off-street, multi-use paths can be used to connect to multi-use paths along arterials roads. This method is similar to the approach currently employed in west Lethbridge, but with an increased focus on ensuring that all off-street infrastructure are connected and provide access to the destinations within the community. This method can sometimes result in less direct connections, but aligns better with the existing design paradigm.

7.3 SUPPORTING INFRASTRUCTURE AND PROGRAMS

In addition to the cycling infrastructure for the cycling network, improving access to cycling requires support through land use, education and advocacy initiatives. Examples of supporting programs that the City should develop include:

A wayfinding kiosk in Calgary helps orient people to the area, providing travel times to nearby destinations. Accompanying signage along the route provides further guidance to bicyclists.

- Updating the City of Lethbridge Design Standards to include cycling infrastructure design;
- Updating the Land Use Bylaw to require bicycle parking in all new developments that is not tied to the total number of vehicle parking requirements;
- Developing a strategy to encourage new bicycle parking infrastructure in developed areas;
- Introducing a wayfinding program including on street signage and print/digital maps to support use of the network;
- Partnering with organizations like the Alberta Motor Association to include drivers training on interaction with people riding bicycles and associated infrastructure; and
- Improving cycling education in schools through programs like "bike to school day" and cycling educations programs such as Can-Bike. Can-Bike is an accredited cyclist training program coordinated through Cycling Canada.

7.4 ONGOING PROGRAM MONITORING

Ongoing monitoring of the new cycling infrastructure will allow the City of Lethbridge to make changes and updates as required, and continue to make informed decisions about future infrastructure. Elements to consider as part of ongoing monitoring include:

- Permanent count stations on key routes to monitor ridership and growth in ridership;
- Citizen satisfaction surveys including reporting of locations requiring review/upgrades; and
- Monitoring and assessment of collision data to identify areas where safety improvements are needed.

Intercept surveys along popular bicycle routes are one method for gauging citizen satisfaction with current bicycle infrastructure.

Permanent count stations on key routes can help gauge infrastructure use and growth in ridership over time.

8.0 APPENDIX

8.1 CYCLE POTENTIAL ANALYSIS

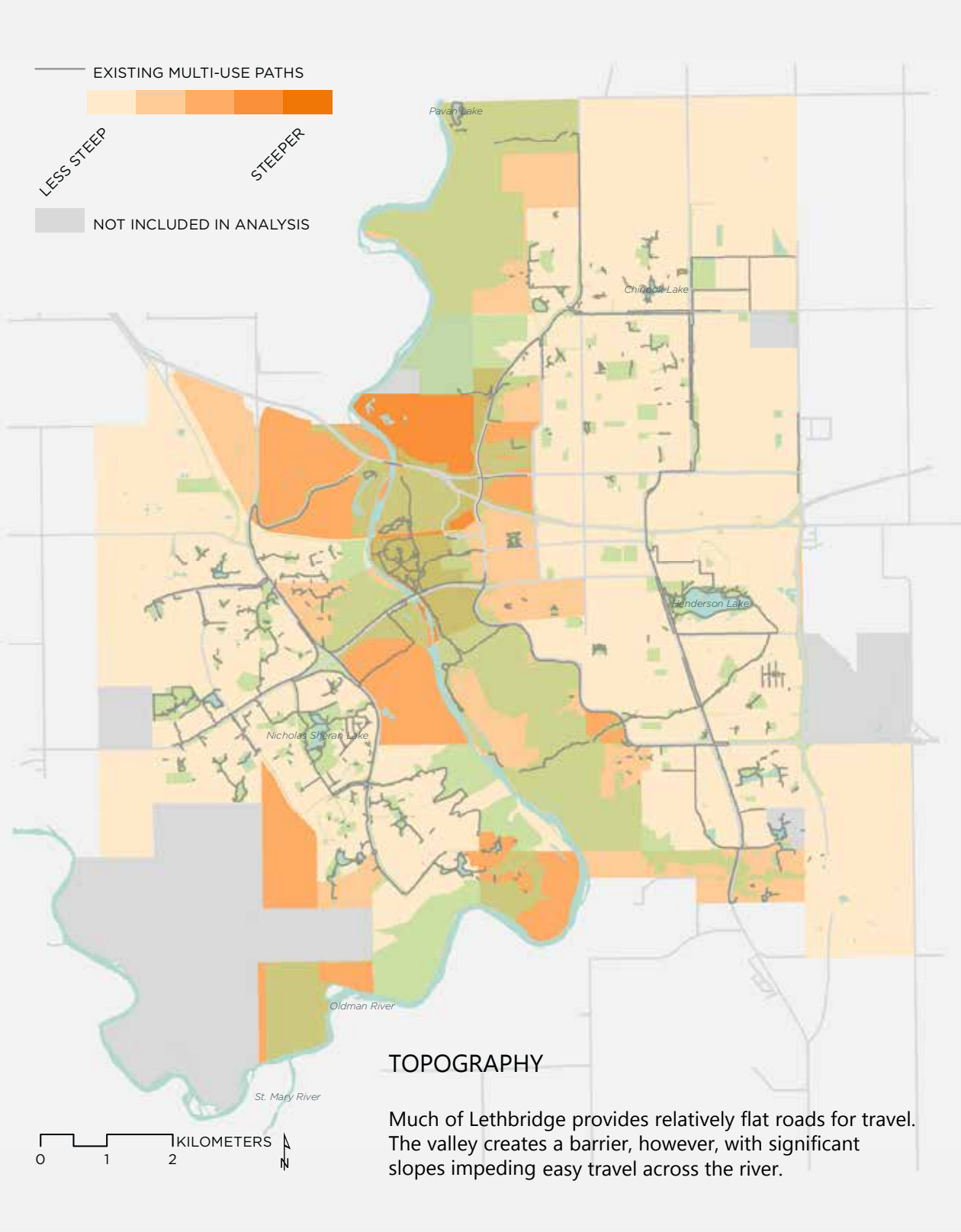
The following series of maps break Lethbridge down into a number of zones to assess and compare physical conditions in these zones that are likely to have a strong influence on people's ability and propensity to cycle.

8.1.1 Topography

Figure 16 shows the topography of Lethbridge. Zones were assessed based on the average slopes of roadways within the zone.

- There are steep hills down into the coulees that border the Oldman River forming an impediment to travel across the river.
- Elsewhere the topography is relatively flat, allowing for ease of movement north and south as well as east and west.

FIGURE 16. TOPOGRAPHY

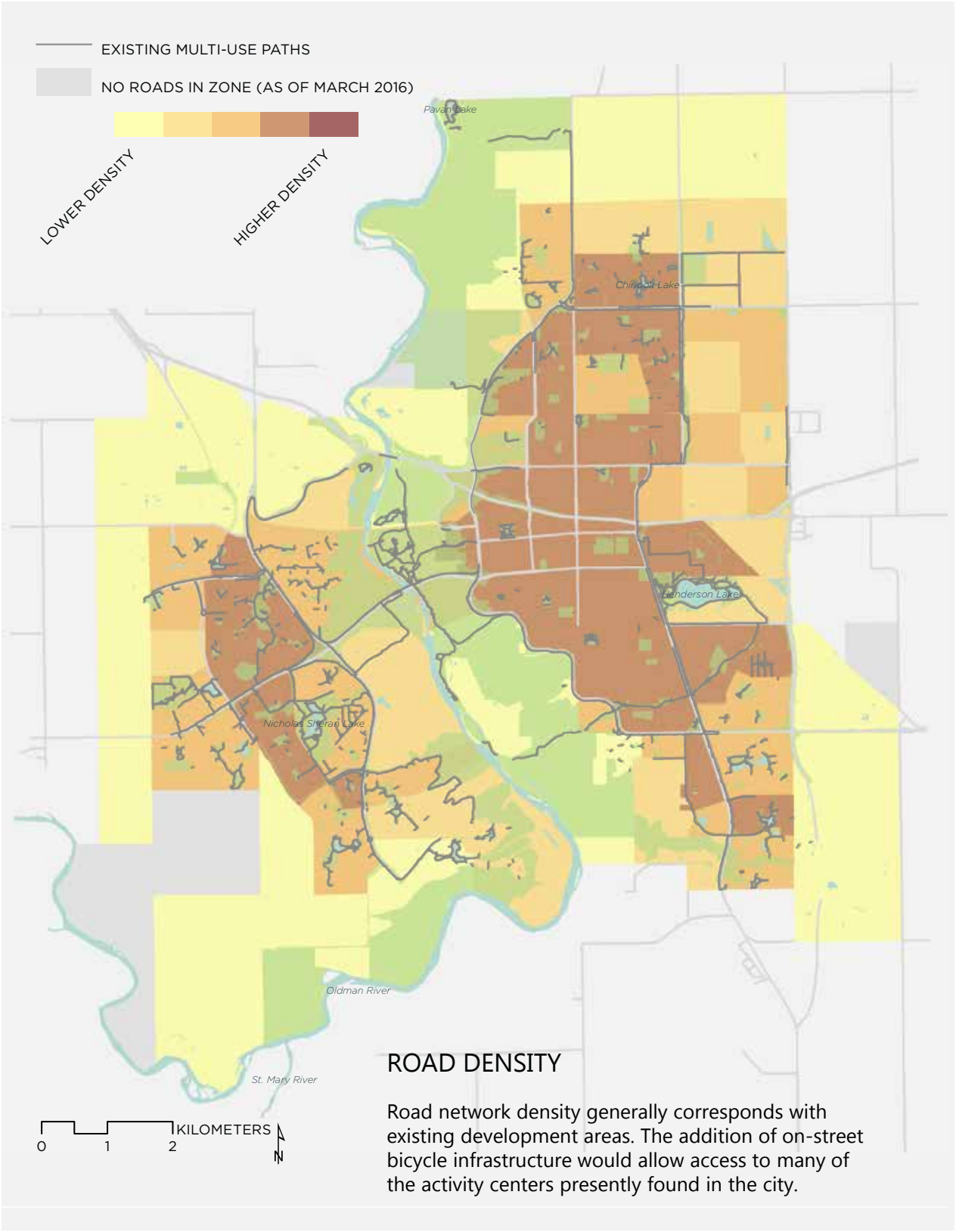


8.1.2 ROAD DENSITY

Figure 17 shows the density of roads in zones throughout the City. Density was detemined by considering the ratio of total road length within the zone to the total area of the zone.

- The map is shaded dark in areas of the city that have an extensive network of roads relative to the zone in which they fall.
- The density of roads corresponds generally with the built-up areas within the city.
- There tends to be a higher concentration of roads in downtown Lethbridge and in surrounding neighbourhoods to the north and south.
- There is also a higher concentration of roadways in neighbourhoods to the west and southwest of the University of Lethbridge.

FIGURE 17. ROADWAY DENSITY

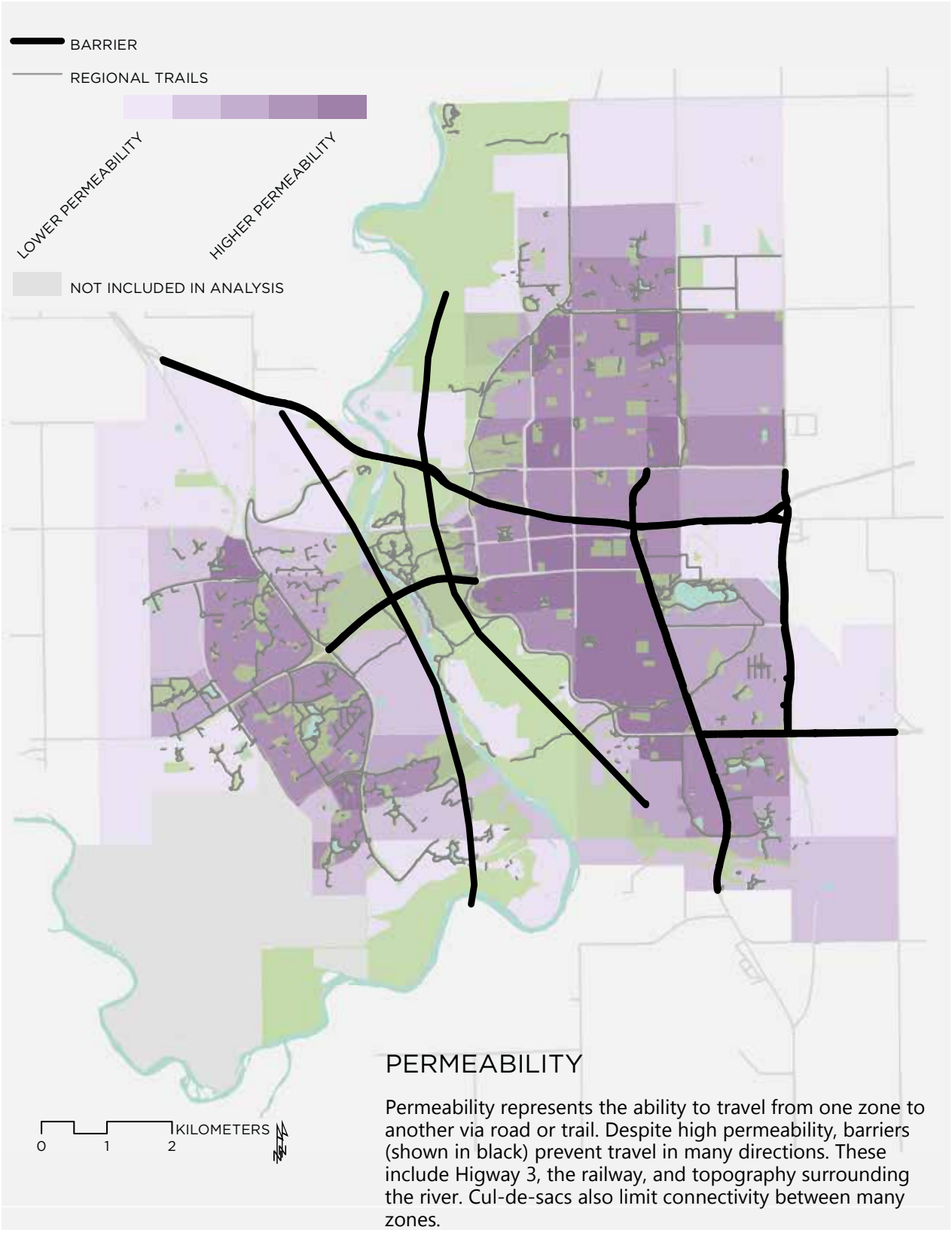


8.1.3 Permeability

Figure 18 shows how easy it is to travel from one zone to another via road or trail within Lethbridge. Permeability considers the number of access points into and out of the zone. If a roadway or path crosses the boundary of a zone, it was considered to provide access into the zone.

- While many zones have high permeability, there are a number of roadways and geographic features that form a barrier to cycling movement.
- Those zones that are lightly coloured tend to have poor permeability and significant barriers are accentuated by black lines.
    - Barriers to north south travel include:
        - Crowsnest Trail and the rail line that roughly borders this Highway running east west between north and south Lethbridge,
        - Whoop-Up Drive, particularly McMaster Boulevard and 5th St S, and
        - 24th Ave S, particularly between 43rd St S and Mayor Magrath Drive.
    - Barriers to east west travel include:
        - 43rd St S between 24th Ave S and Crowsnest Trail where it forms part of Highway 4,
        - Mayor Magrath Drive between the southern edge of town and 5th Ave N, and
        - The entire length of the coulee.
- Additionally, culs-de-sac limit connectivity between many zones.
- Within Lethbridge, very few neighbourhoods have a well-connected road system, even though the density of roads within each zone is relatively high. Similarly, most zones have access to the trail network; however, improved connections between the road and path networks could enhance the overall quality of the existing network.

FIGURE 18. PERMEABILITY



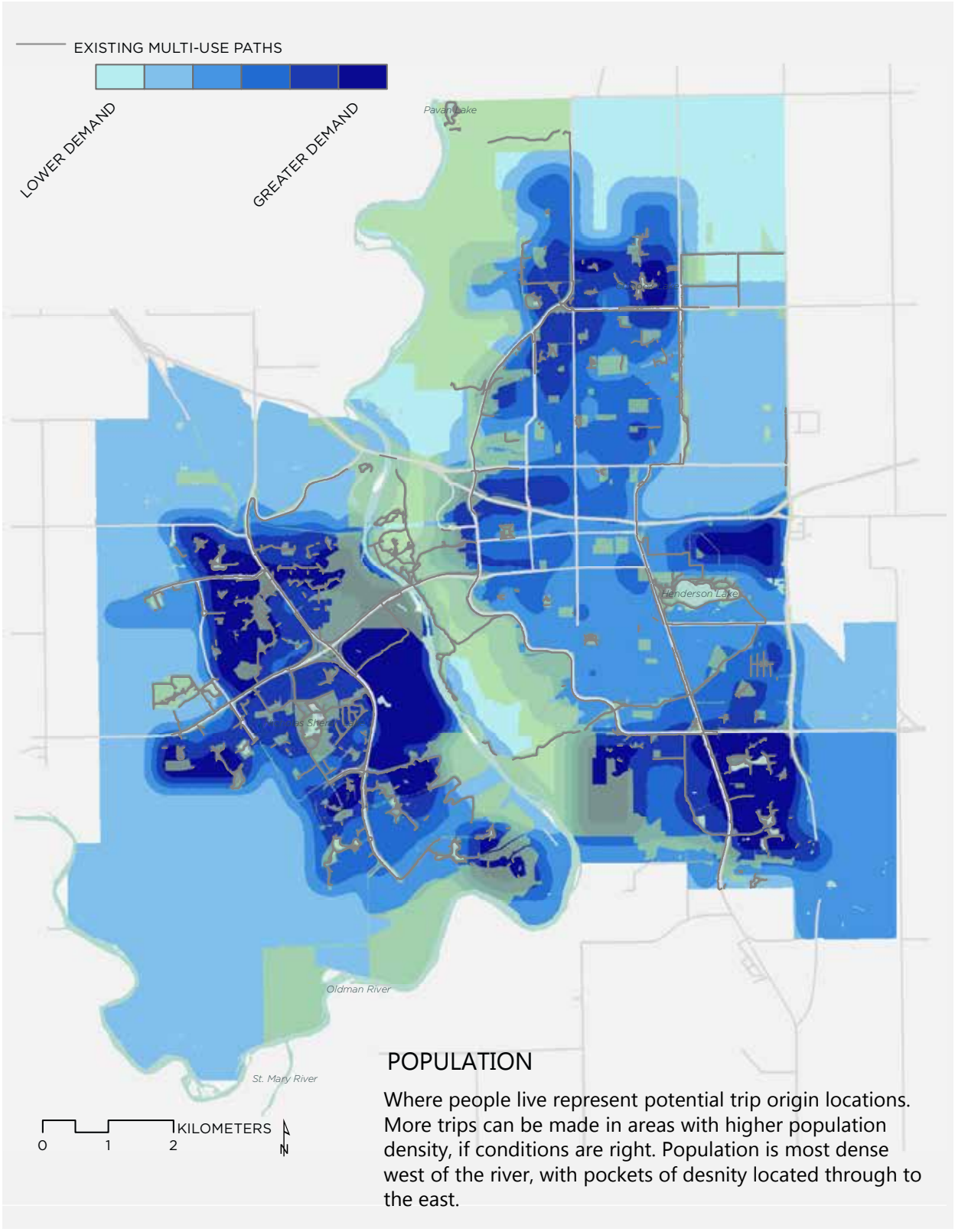
8.2 CYCLING DEMAND ANALYSIS

8.2.1 Population

Figure 19 shows the distribution of residential population throughout Lethbridge. Those areas that have darker shading have generally higher concentrations of residential population. These locations represent potential trip origin locations. More trips can be made in areas with higher population density if conditions are right.

- Areas with higher concentration of residential population include:
    - The neighbourhood to the east of Lethbridge College,
    - The area around University of Lethbridge,
    - The neighbourhood to the north and east of Henderson Lake,
    - The neighbourhoods to the north of Crowsnest Trail and bounded by 5th Ave N, 13th St N, and Scenic Drive N, and
    - The area immediately to the north of 26th Ave N and west of 28th St N.
- A key strategy to increase cycling for transportation is to connect residential areas to activity nodes with direct and safe connections.

FIGURE 19. POPULATION



POPULATION

Where people live represent potential trip origin locations. More trips can be made in areas with higher population density, if conditions are right. Population is most dense west of the river, with pockets of desnity located through to the east.

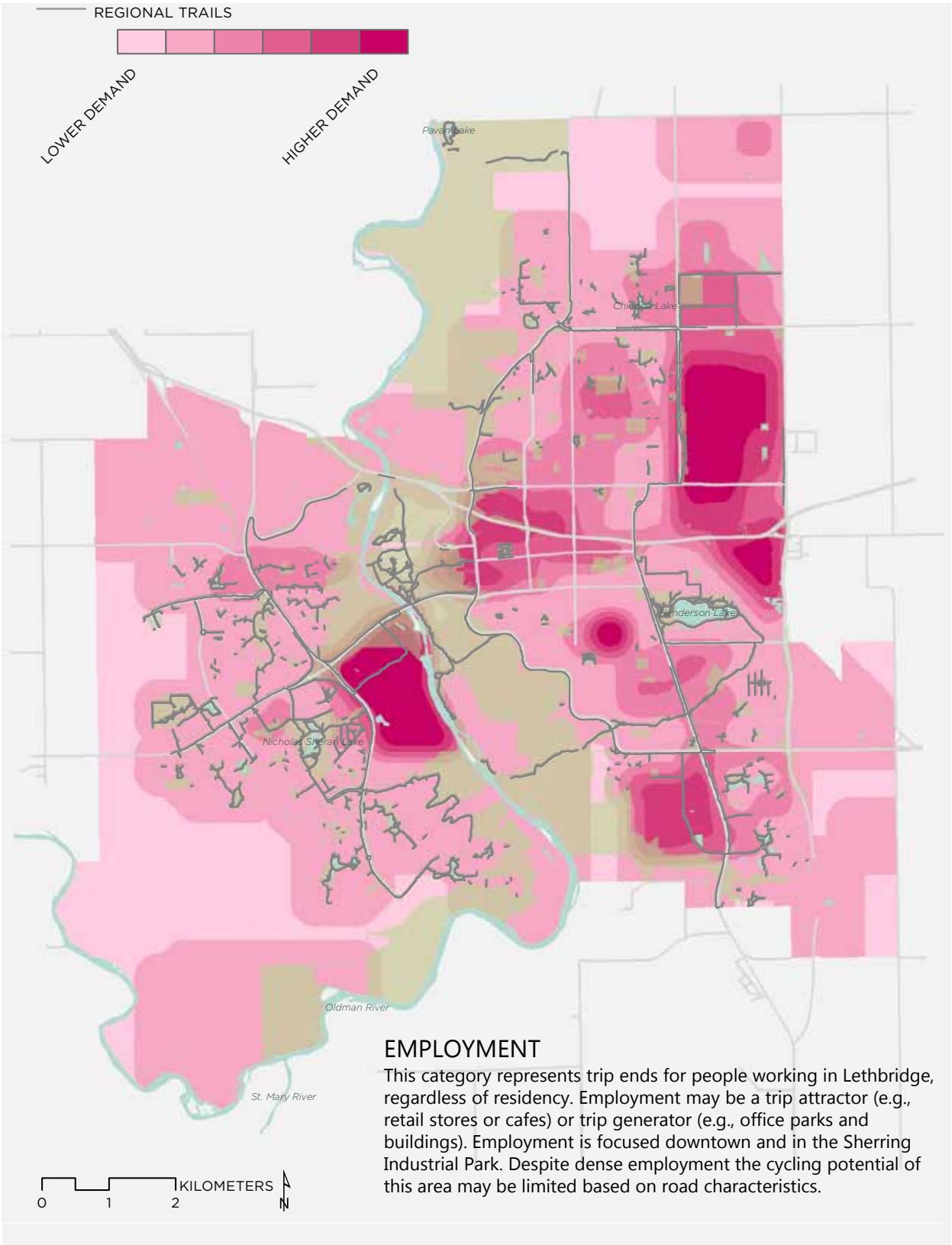
8.2.2 Employment

Figure 20 shows the distribution of employment. Those areas that have darker shading have generally higher concentrations of employment.

This category represents trip ends for people working in Lethbridge regardless of residency. Depending on the type of job, employment can act as a trip attractor (i.e., retail stores or cafes) or trip generator (i.e., office parks and office buildings) or both. Specific employment types, such as retail, are therefore also used in the **where people play** category. The inclusion of retail employment as an input for **where people play** allows the analysis to capture both demand generated by employment trips as well as those generated by shopping trips. Although this employment category is used twice, both work and play, it captures the two types of demand associated with these locations.

- Areas with higher concentration of employment include:
    - Downtown,
    - University of Lethbridge,
    - The employment district east of 28th St N, west of 43th St N, north of Henderson Lake and south of 26th Ave N,
    - Lethbridge College, and
    - Chinook Regional Hospital.
- Areas with high densities of employment should be connected to areas with higher concentrations of residential development in order to facilitate bicycle commute trips.

FIGURE 20. PROPOSED BICYCLE NETWORK



EMPLOYMENT

This category represents trip ends for people working in Lethbridge, regardless of residency. Employment may be a trip attractor (e.g., retail stores or cafes) or trip generator (e.g., office parks and buildings). Employment is focused downtown and in the Sherring Industrial Park. Despite dense employment the cycling potential of this area may be limited based on road characteristics.

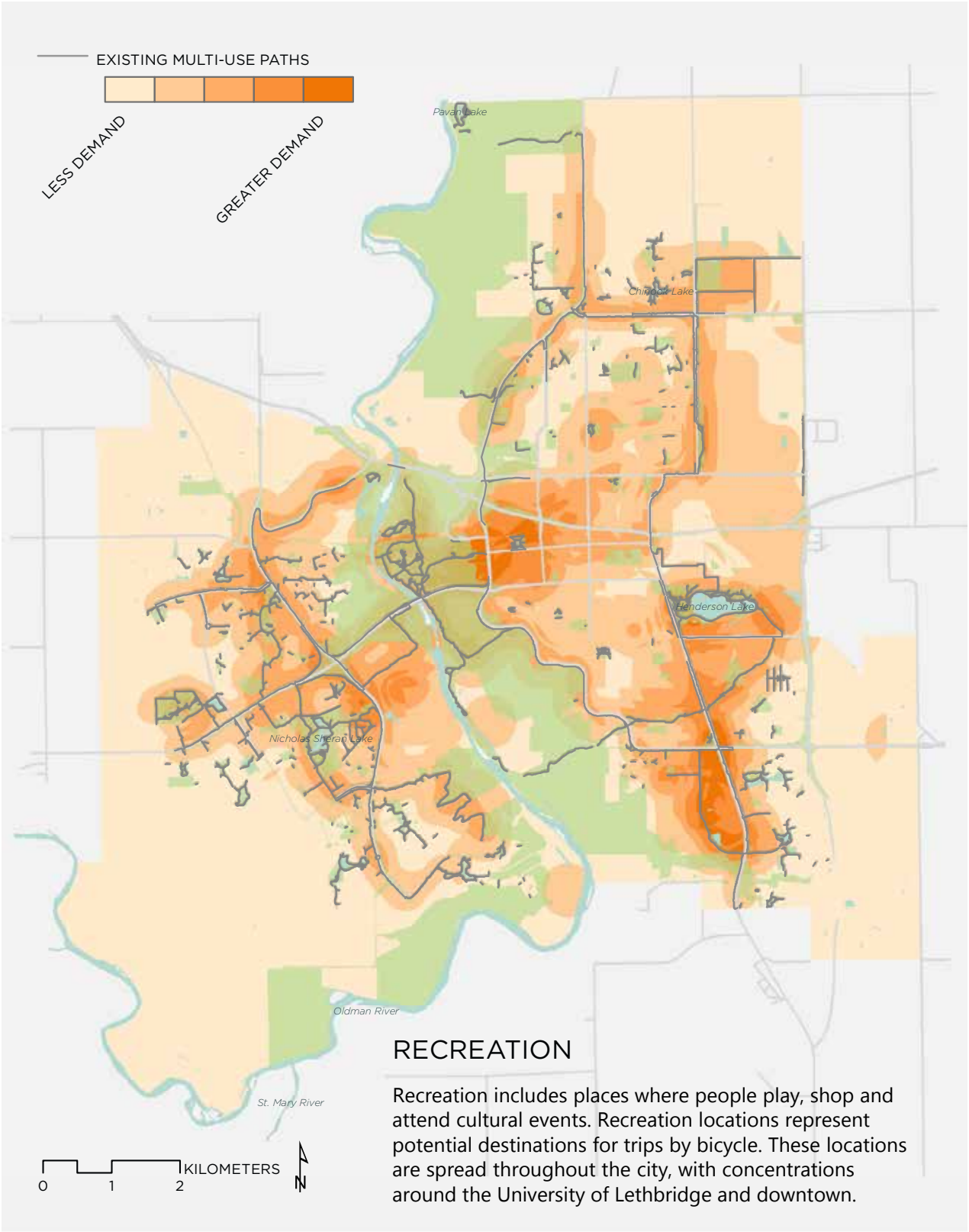
8.2.3 Recreation

Figure 21 shows the relative levels of recreational activity throughout Lethbridge. Those areas with higher concentrations of recreational activity include parks and recreation facilities. Those areas that have darker shading have generally higher concentrations of recreational activity.

Parks, trails, retail locations and recreation sites were used in this analysis with areas having a high density of locations in close proximity to each other receiving the highest score. The results were scored on a scale of 1 to 5 with 5 representing the highest density and proximity.

- Areas with higher concentration of recreational activity include:
    - Downtown,
    - Around Henderson Lake, and
    - Bordering Mayor Magrath Drive south of 16th Ave S.
- Making connections to areas with recreation facilities encourages cycling among a broader segment of the population including children, families and people interested in riding for fun.

FIGURE 21. RECREATION

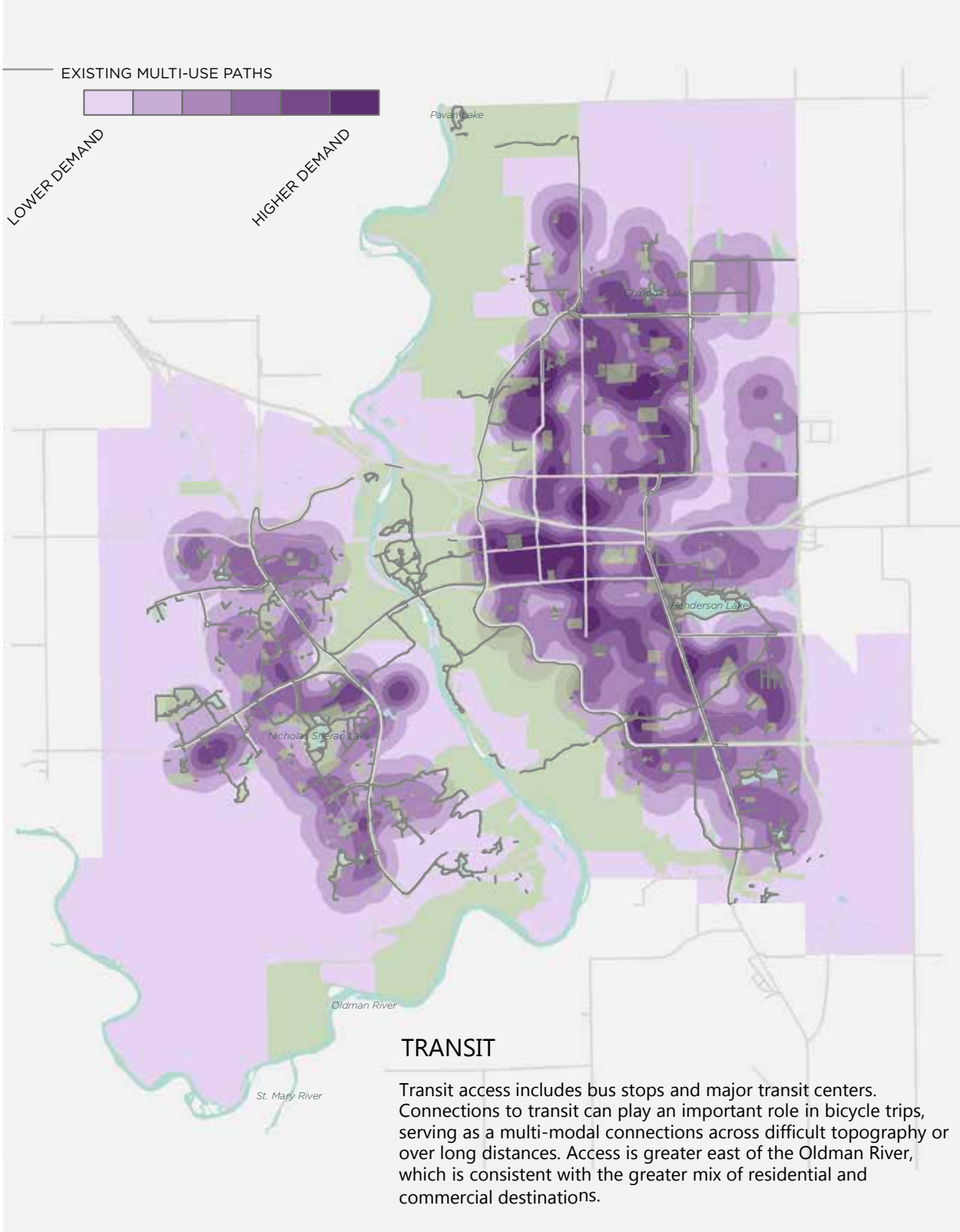


8.2.4 Transit

Figure 22 shows the distribution of transit stops within Lethbridge, highlighting those areas where there tends to be a higher number of people getting on and off the bus. Existing bus stops and major transit centers were used in this analysis with areas having a high density of locations in close proximity to each other receiving the highest score. The results were scored on a scale of 1 to 5, with 5 representing the highest density and proximity.

- Those areas that have dark shading have generally higher concentrations of transit activity.
- Areas with higher concentration of transit activity include:
    - Downtown,
    - University of Lethbridge, and
    - Throughout the built up areas in the city.
- Making strong cycling connections to areas with significant transit activity may facilitate the first and last mile of trip by bicycle.

FIGURE 22. TRANSIT



TRANSIT

Transit access includes bus stops and major transit centers. Connections to transit can play an important role in bicycle trips, serving as a multi-modal connections across difficult topography or over long distances. Access is greater east of the Oldman River, which is consistent with the greater mix of residential and commercial destinations.

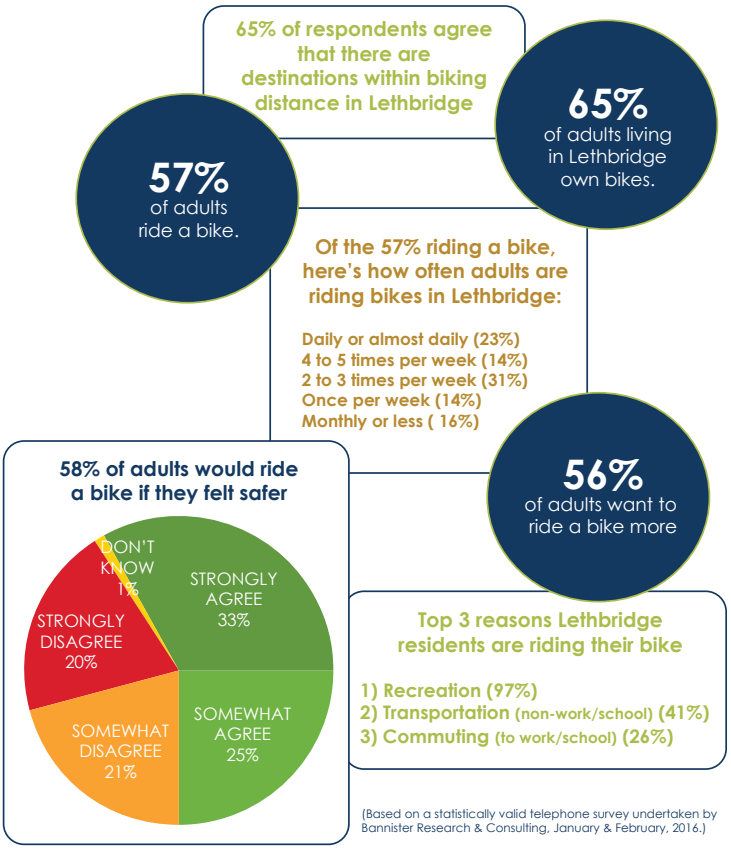
8.3 PUBLIC ENGAGEMENT PROCESS

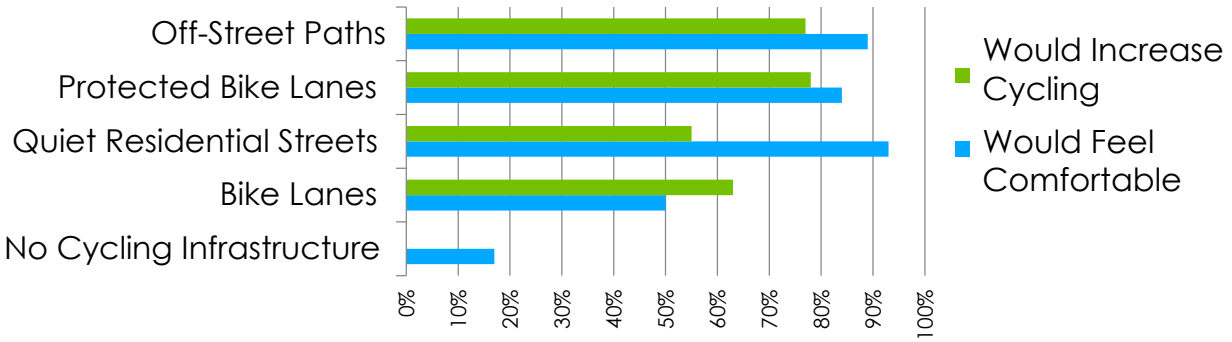
A public consultation and stakeholder engagement plan was created and implemented at strategic stages of the project to ensure robust information exchange, enhanced understanding and creation of active partnerships with the City. The engagement strategy consisted of three phases of consultation, each implementing innovative strategies to solicit meaningful input from internal and external stakeholders and the community as a whole. The tools used throughout the process included surveys, online communication forums, content expert presentations, visual displays and face-to-face conversations.

1. Banister Telephone Survey – January 18-25, 2016

In November 2015, Banister Research and Consulting Inc. was contracted to conduct a telephone survey to gather perceptions and opinions of cycling in Lethbridge. A total of 400 surveys were completed with residents in the City of Lethbridge; results provide a margin of error no greater than ±4.9% at the 95% confidence level or 19 times out of 20.

Key findings from the 2016 Lethbridge Cycling Survey are demonstrated in the accompanying visuals.

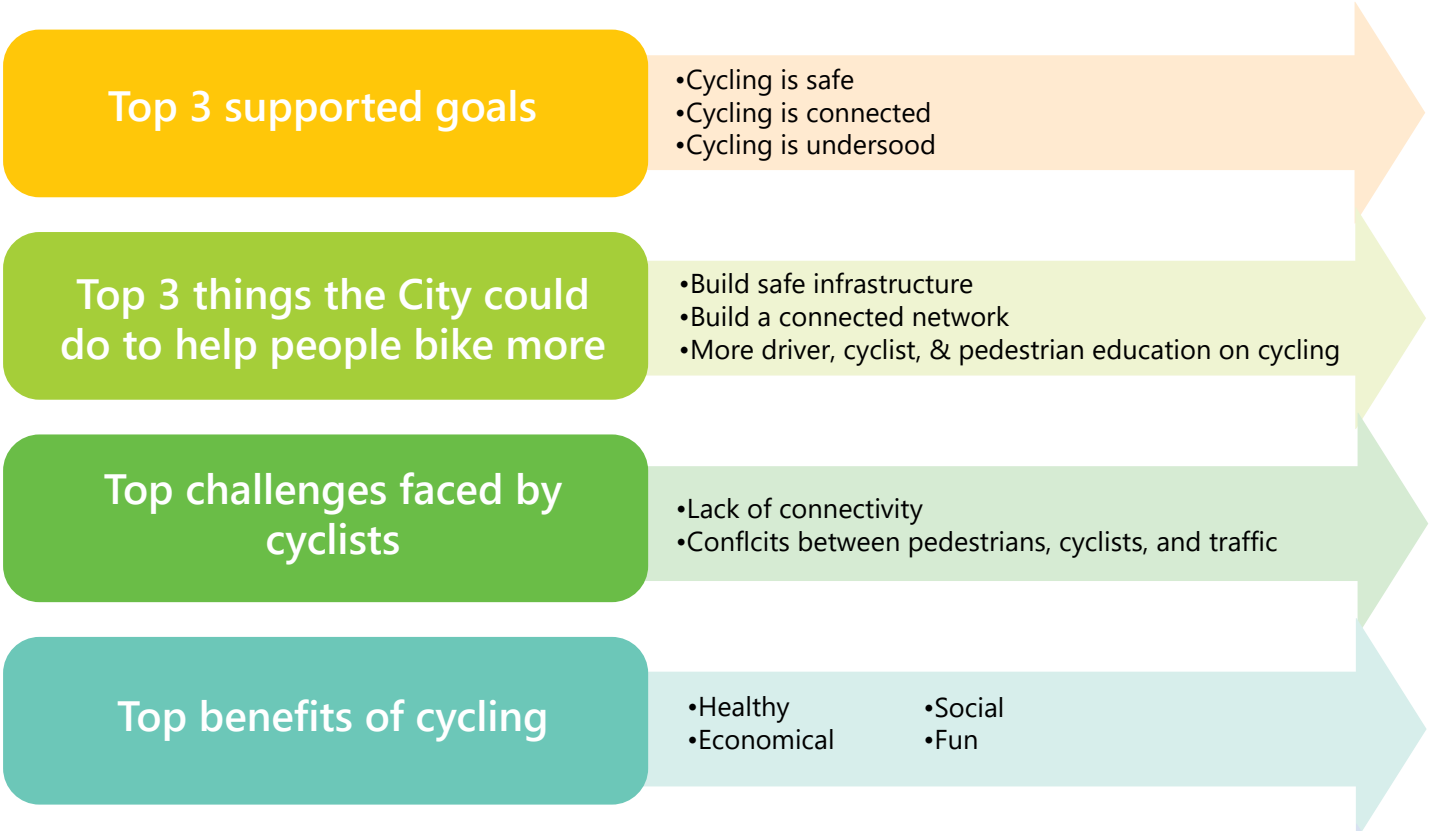




2. Community Engagement Phase 1 – January-March, 2016

Phase 1 of the community engagement provided an opportunity for stakeholders to review and comment on background information, comment on vision and goals, highlight local challenges and express their preferences for bicycle options. The tools used in this phase included a stakeholder workshop, community open house, sounding boards, pop-up engagements at the University and College, student surveys and MindMixer online forum.

WHAT WE HEARD:



3. Community Engagement Phase 2 – May-June, 2016

The second engagement phase provided an opportunity for stakeholders to share their perspective on potential design options, route selection and evaluation criteria and corridor concepts. Visual displays, depicting the alternative routes and infrastructure, were discussed at a stakeholder workshop, community open house and MindMixer online forum.

Based on the feedback during community engagement phase 2 and best practices, proposed cycling network and infrastructure plans were produced as well as proposed implementation strategies.

4. Community Engagement Phase 3 – October-December, 2016

Community engagement phase #3 was hosted as part of a multi-project City "trade show" style Open House (100K Day) that drew 318 attendees. The Cycling Master Plan, as a key highlighted project, presented the final draft route map with opportunities for input on implementation and phasing. A survey completed by 194 attendees, answered Cycling Master Plan project specific questions. Refer to the survey information below for survey highlights.

Feedback regarding the cycling network and implementation strategy within each quadrant of the city included:

North Lethbridge

- Consider "green" cross-walks on multi-use path-ways
- Allow gradient ramps to Hwy 3 overpass
- Stafford Drive & St. James Blvd. is treacherous
- Better access for Research Station employees to reach Jail Road and cross 43 St N.

West Lethbridge

- Sharing the road education needed for cyclists and pedestrians
- Divider between traffic and pedestrian and cycle traffic on Whoop-Up Hill
- Safer crossings at Whoop-Up Drive and University Drive
- Need safe cycle route from west side to Hwy 3
- Implement a bike rental plan

South Lethbridge

- Cycle activated street lights
- 7th Ave. is great for a bike lane
- Link research station
- Bike lane along Mayor Magrath Dr. without start and stop at each intersection
- Improve signage for multi-use pathway locations
- Increase secure cycle parking

Of the 194 attendees that completed the survey at the 100K Day event, 108 completed all the questions. Their responses indicate:

- 72% are in support of the proposed Cycling Master Plan
- Of those respondents, 77% felt the proposed routes and infrastructure met their cycling needs for the future
- 86% agreed with the Cycling Master Plan implementation phases
- Other feedback from the survey included the following:
    - The Cycling Master Plan demonstrates environmental wisdom
    - Improve and support cycling safety and education
    - Link the entire city with cycling connections
    - Need more north/south connections
    - Improve connections between west side and downtown

- Provide improved cycling route maps
- Improve intersections for people riding bicycles
- Very positive support for 7th Ave S cycle route
- Many felt the implementation of the plan was too slow

5. MindMixer Online Forum – March-December, 2016

The MindMixer site facilitated an online conversation forum for interested participants by posting cycling information, background, probing questions and surveys through a link hosted by the City of Lethbridge website. Throughout the project the following information was gleaned:

- 130 individuals participated
- Visits to the site were as high as 188 per day
- The site hosted a total of 1383 visitors
- A total of 7299 pages were viewed
- 134 ideas were introduced by participants
- The highest participation centered around cycling challenges, ways to increase cycling in Lethbridge and benefits of cycling.

8.4 EXISTING CYCLIST TRAVEL PATTERNS

At public consultation events in Spring 2016, the consulting team asked the general public and Lethbridge College and University students to identify bicycle routes that they commonly use and those routes which they would like to use. Figure 14 and 15 show the results of those mapping exercises and are called 'iMaps'. Those routes that are marked with lighter shades of orange and red are currently used by people riding bicycles, while those marked with darker shades of orange and red are those routes that students and the general public would like to use. The orange lines were marked by members of the general public while the red lines were marked by students.

- These maps show that there are a number of routes that are currently used by people riding bicycles, despite the fact that many of the routes identified do not contain designated cycling infrastructure.
- The results show that there are a significant number of informal cycling routes that are commonly used by students and the general public.
- There are also a number of routes that are commonly desired by students and the general public. Some of the conclusions that can be drawn from these maps are as follows:
- There is clearly a common desire for a dense network of cycling routes within Downtown Lethbridge

- There are a number of north-south routes that are popular with people riding bicycles including:
  - 28th St
  - 13th St
  - University Drive West
  - Mayor Magrath Drive
  - Stafford Drive
  - Westside Drive West
  - 20th St S
  - Portions of Scenic Drive
  - Portions of the coulee
- There are also a number of north-south routes that many people who ride bicycles would like to use, including:
  - 43rd St
  - Mayor Magrath Drive and 23rd St
  - Scenic Drive
  - 36th St N
  - 13th St
  - The coulee
  - 20th St South
  - Stafford Drive
  - University Drive West
- There are a number of east-west routes that are popular with people riding bicycles including:
  - 26th Ave N
  - Portions of 2nd Ave N
  - Portions of 10th Ave S and S Parkside Drive
  - On the west side of the coulee it is apparent that the curvilinear roadway network causes people on bicycles to select a variety of routes. Those that are most common include MacLeod Drive West, Whoop-Up Drive West, Walsh Drive West and Bridge Drive West
  - 9th Ave N
  - 9th Ave S
  - 16th Ave S
  - Scenic Drive S
  - Portions of 5th Ave N
  - Various routes between 1st Ave S and 7th Ave S, particularly between Mayor Magrath Drive and Scenic Drive
  - The paved path from Scenic Drive S at 20 Ave S.
  - The paved path from South Parkside Drive at Great Lakes Road.
- There are also a number of east-west routes that many people on bicycles would like to use, including:
  - 26th Ave N
  - 1st Ave S alignment
  - 16th Ave S alignment
  - 9th Ave N
  - Whoop-up Drive
  - Scenic Drive S
  - Crowsnest Highway
  - 10th Ave S alignment
  - 40th Ave S Alignment
- There is significant overlap between those routes that are commonly used by people on bicycles and those that the cyclists would like to use. This overlap tends to occur on routes that have higher volumes of motor vehicle traffic and constrained circumstances, which force people to ride in close proximity to motor vehicle traffic. Those who are interested in cycling but who are uncomfortable riding in close proximity to motor vehicle traffic, tend to identify such routes as desired. Overlap can also be seen in the coulee where some desire a route but are discouraged by circuitous, poor quality paths.

FIGURE 23. PUBLIC ENGAGEMENT RESULTS: EXISTING AND DESIRED TRAVEL ROUTES (STUDENTS)

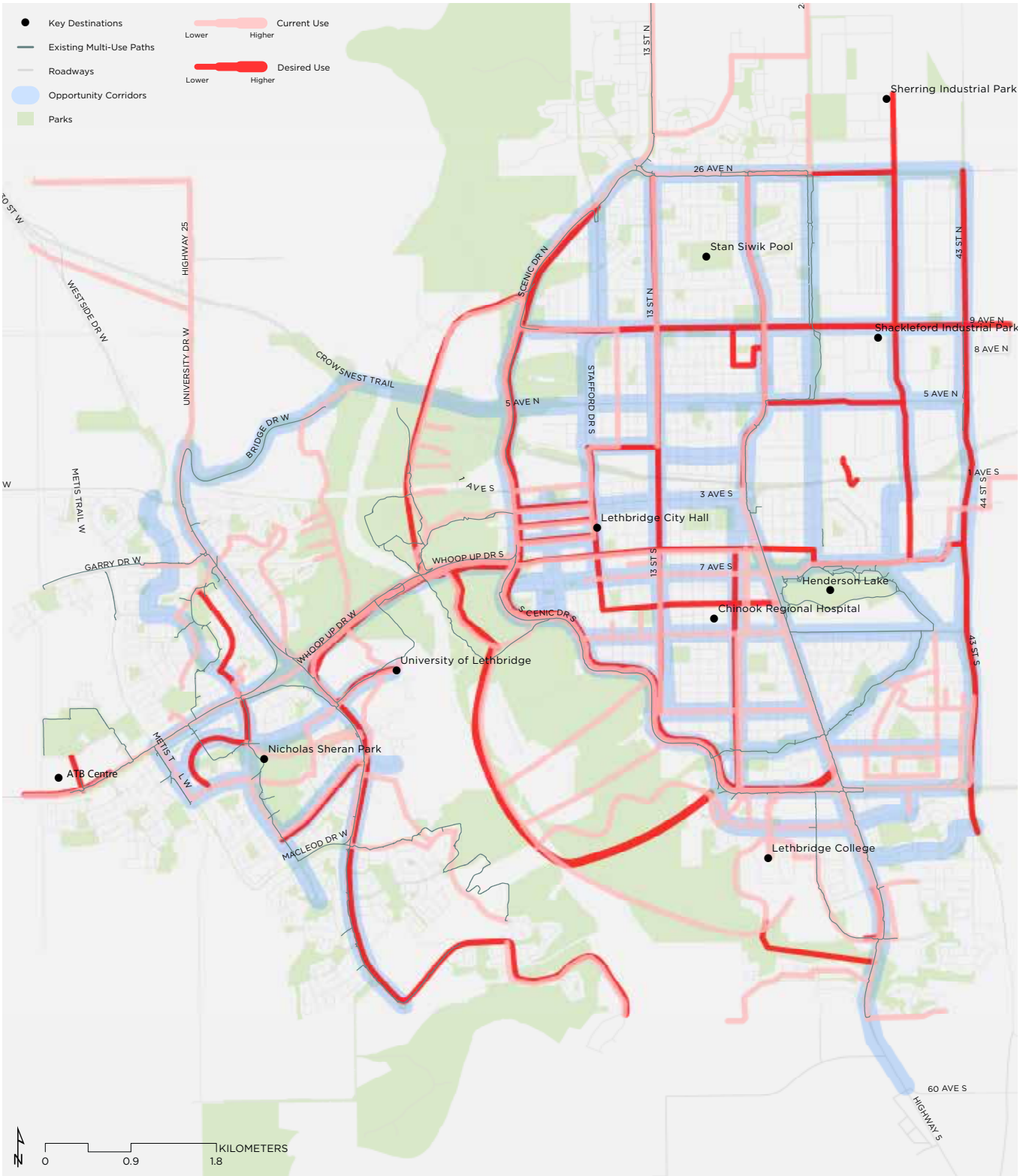
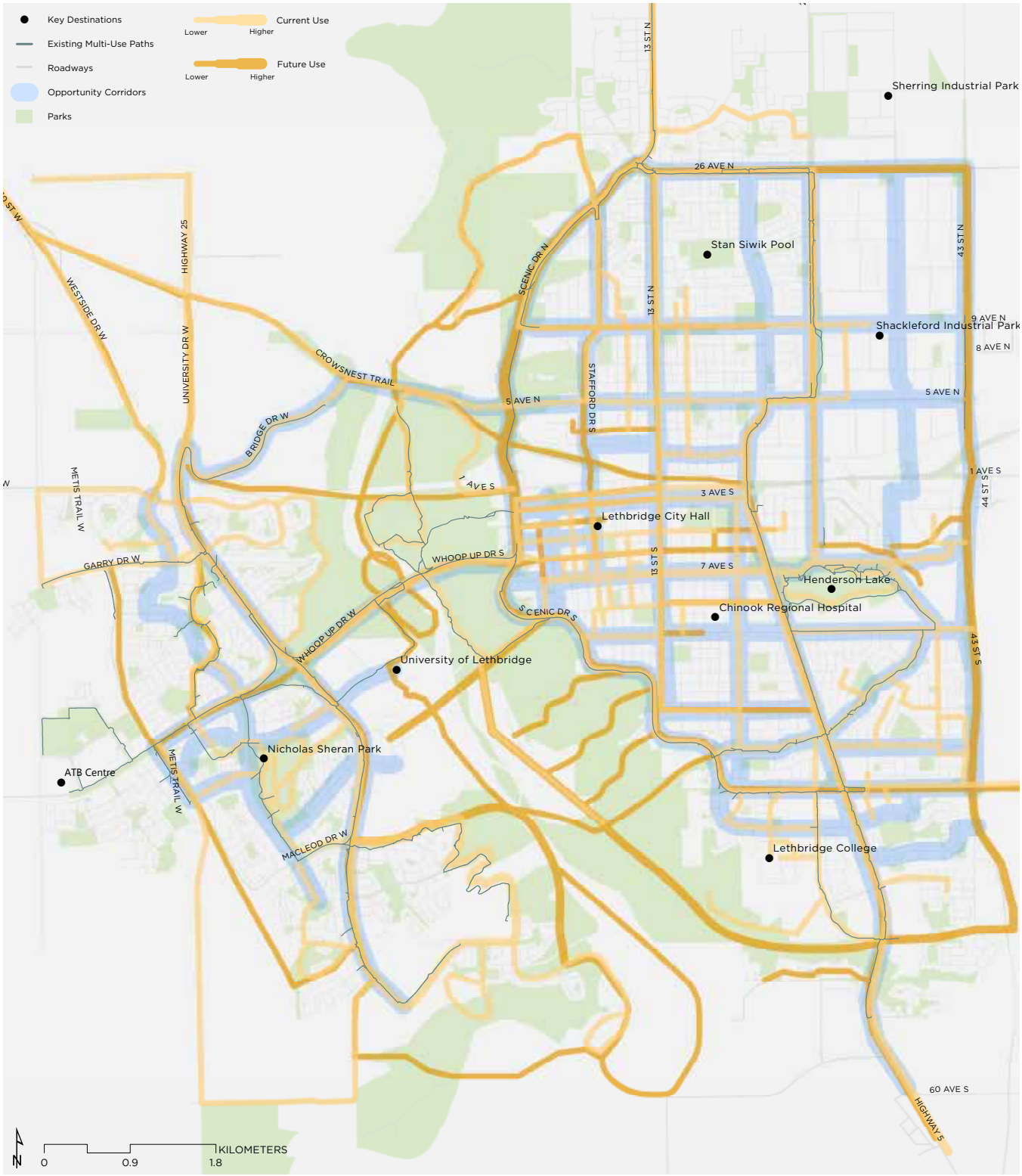


FIGURE 24. PUBLIC ENGAGEMENT RESULTS: EXISTING AND DESIRED TRAVEL ROUTES (GENERAL PUBLIC)



This page intentionally left blank.

City of Lethbridge

100K+ LETHBRIDGE

www.lethbridge.ca