Local Road Safety Plan

City of Redmond, WA

Prepared for City of Redmond
Prepared by Transpo Group

Redmond
WASHINGTON

Risk Factors

Pedestrians in Marked Crossings

A majority of crashes involving pedestrians have occurred in marked crossings. Crossings are the primary location where different modes have potential conflicts. Improvements to increase the visibility of crossings, users in and entering the crossing are a high priority to address a significant risk factor to vulnerable users.

Bikes in Existing Facilities

Redmond has a well-developed bike network, but improvements to incorporate current best practices and guidance on separation and crossing improvements can address a risk factor for crashes with bikes in existing facilities. Risk factors based on crash history are present in both linear and crossing bike facilities.

Crashes at Signalized Intersections

Signalized intersections are complex environments with many demands on the attention of all users. Redmond's signalized intersections represent a risk factor for vehicle and active mode crashes. Improvements to visibility, operations and predictability of signalized intersections can reduce risks and improve overall system safety.

Crashes on 30 mph+ Roadways

Roadways in Redmond with a posted speed limit of 30 mph or greater experience a higher percentage of crashes than similar cities. Faster vehicle speeds can mean less time to react to changing roadway conditions or grant right of way to active mode users. Addressing the risk factors for higher speed roadways could include a study of appro-

Crashes on 2-way Divided Roadways

Median-divided roadways in Redmond are typically associated with higher speeds and are another common risk factor for crashes involving all modes. Identification of countermeasure projects on divided roadways works together with other risk factors to reduce the overall crash risk in the City.

Improper Speed for Conditions

Speed involvement affects not only the risk for a crash occurring, but the severity and outcomes of the crash on people. While Redmond's rate of speed compliance with posted limits in crash data is a positive, there is a common risk factor of improper speed for conditions, indicating a need to address speeds and roadway conditions in inclement weather or in heavy traffic conditions.

High Visibility Crosswalk Markings

Risk Factors

Countermeasures

Expand use of Continental style crossings

Mark crossings at slip lanes and ped islands

Green/white combined crossings for multimodal

The use of Continental style crosswalk markings for improved visibility is now the City of Redmond's standard. The larger bars improves the visibility of crossings for drivers and can create contrast with crossing pedestrians compared to thinner crosswalk marking styles. Using green and white combined colors highlights the increased presence of bicycles and widens the crossing for the comfort of all modes. Marking crossings at slip lanes improves driver yielding and visibility of pedestrians.

Updated markings are prioritized at;

- Signalized intersections with existing crosswalks
- Arterial and higher volume collector roadway intersections
- On transit routes (bus and light rail)
- Near schools, parks and other high volume pedestrian generators

The City has been upgrading crossings, but the following intersections have been identified as a priority for the next round of grant-funded or maintenance upgrades to the current City Standard 311B.

Multimodal continental crossing

Continental, high visibility markings

Estimated Project Construction Cost:

$15,000–30,000

per intersection

Costs would include marking removal, and new pavement markings at selected intersections

Time to Construct:

3-6

months from design kickoff

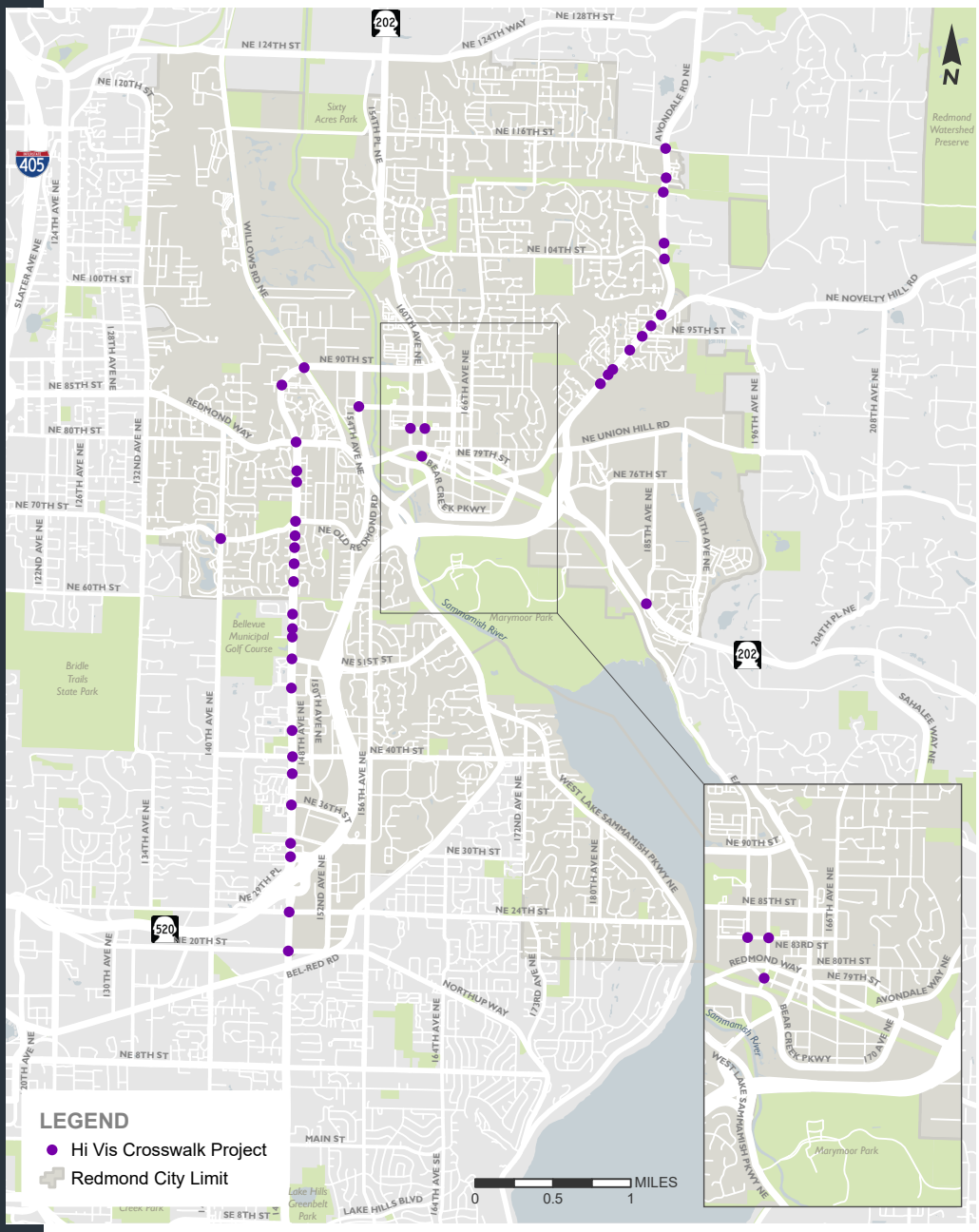
High Visibility Crosswalk Markings

Candidate locations for upgraded markings include:

- Avondale Road (90th to 116th)
- 148th Avenue NE (Willows Rd to 20th)
- 161st/83rd
- 160th/83rd
- 85th/154th
- Willows/90th
- Redmond Way/185th
- Old Redmond Road/148th, 140th

Multimodal continental crossing:

- Bear Creek/161st, Leary



Signalized Crosswalk Improvements & Signage

Risk Factors

Countermeasures

- **Lighted and actuated warning and blankout turn restriction signage**
- **PM peak turn restrictions**
- **Lead pedestrian interval**
- **Pedestrian "scrambles"**
- **ADA pushbutton and ramp upgrades**

Pedestrian and cyclist risk factors in marked crossings varies by time of day. Starting in the evening peak hours, a greater concentration of pedestrian and cyclist-involved crashes occurs in marked crossings. Pedestrians are more often involved in left turn crashes with vehicles, while cyclists are involved in right turn crashes. Lead pedestrian interval, lead cyclist intervals with bike boxes, or turn restrictions limited by time of day, controlled by electronic blank-out signage that can be actuated to pedestrian push buttons or bicycle presence detectors can remove some of the conflicts contributing to historical crashes, while balancing impacts to traffic operations.

Based on the results of traffic studies, restrictions on turns, all-way pedestrian crossing signal phases or "scrambles" where all traffic is held, and lead pedestrian intervals can all assist in increasing pedestrian visibility, considering a range of pedestrian abilities and crossing speeds and improve comfort for users.

Some existing crossings, because of intersection geometry, make visibility of pedestrians in marked crossings difficult from some approaches. Installation of lighted signage actuated to pedestrian push-buttons, combined with leading pedestrian intervals can improve visibility of pedestrians in crossings prior to the permitted movement of traffic.

Estimated Project Construction Cost:

$15,000–100,000
per intersection

Costs could vary widely depending on the need to upgrade signal control equipment, cost of static and electronic signage, pushbutton upgrades and associated curb ramps, and traffic studies.

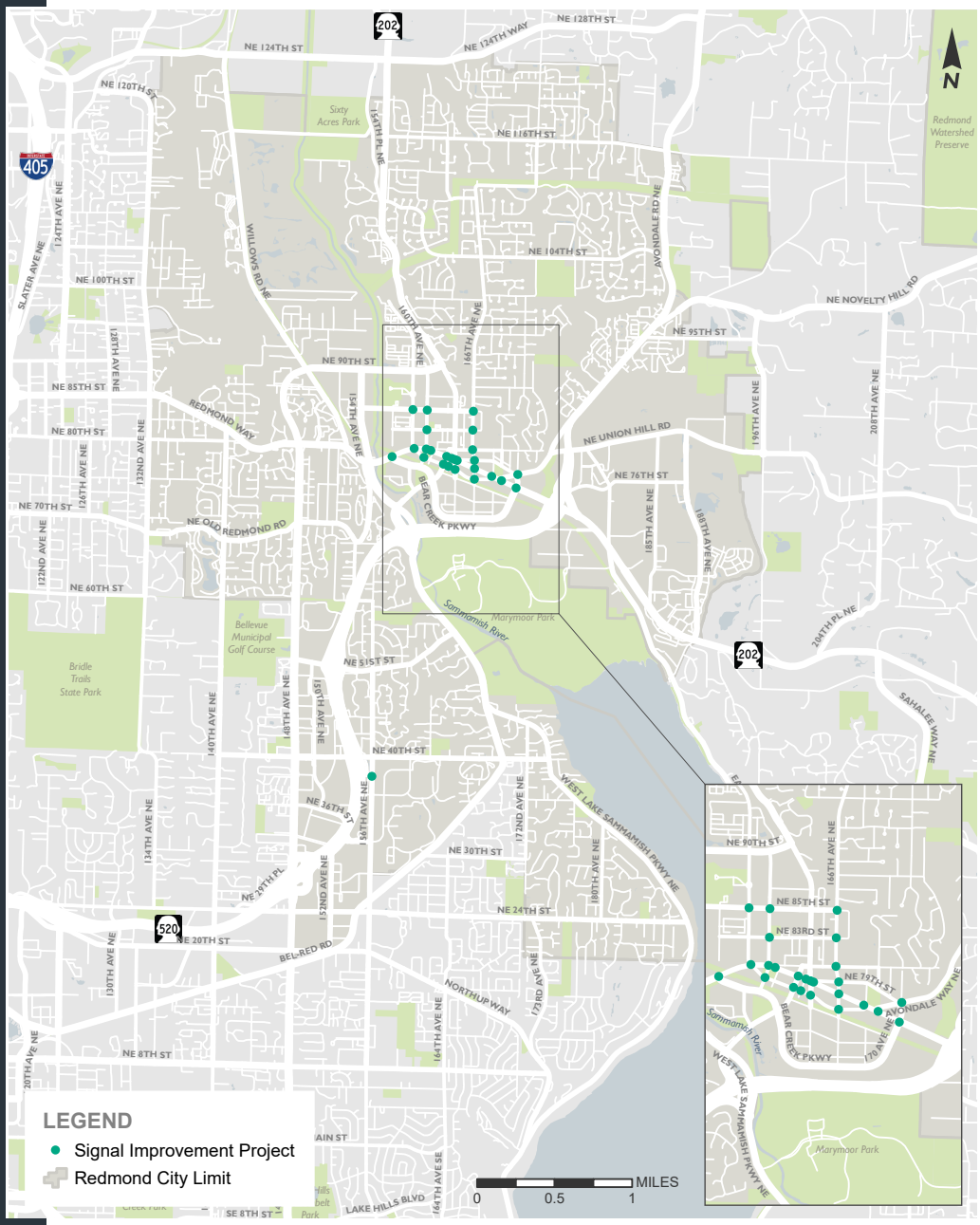
Time to Construct:

12–15
months from design and traffic study kickoff

Signalized Crosswalk Improvements & Signage

Candidate locations for signalized operational and signing improvements include:

- Redmond Way (all downtown intersections)
- Cleveland Street (all downtown intersections)
- 160th, 161st and 166th, Redmond Way to 85th
- EB Avondale Road at 170th
- EB Redmond Way at Cleveland



High Friction Surface Treatment Program

Risk Factors

Countermeasures

High Friction Surface Treatment

High friction surface treatments (HFST) are a method of applying higher quality aggregate and binder to an existing roadway to improve vehicle grip in wet conditions as well as dry. The crash history at signalized intersections and higher volume and speed roadways in the City is correlated with wet surface conditions. HFST is a relatively inexpensive method of reducing crash rates, especially in the vicinity of horizontal curves and high-volume intersection approaches.

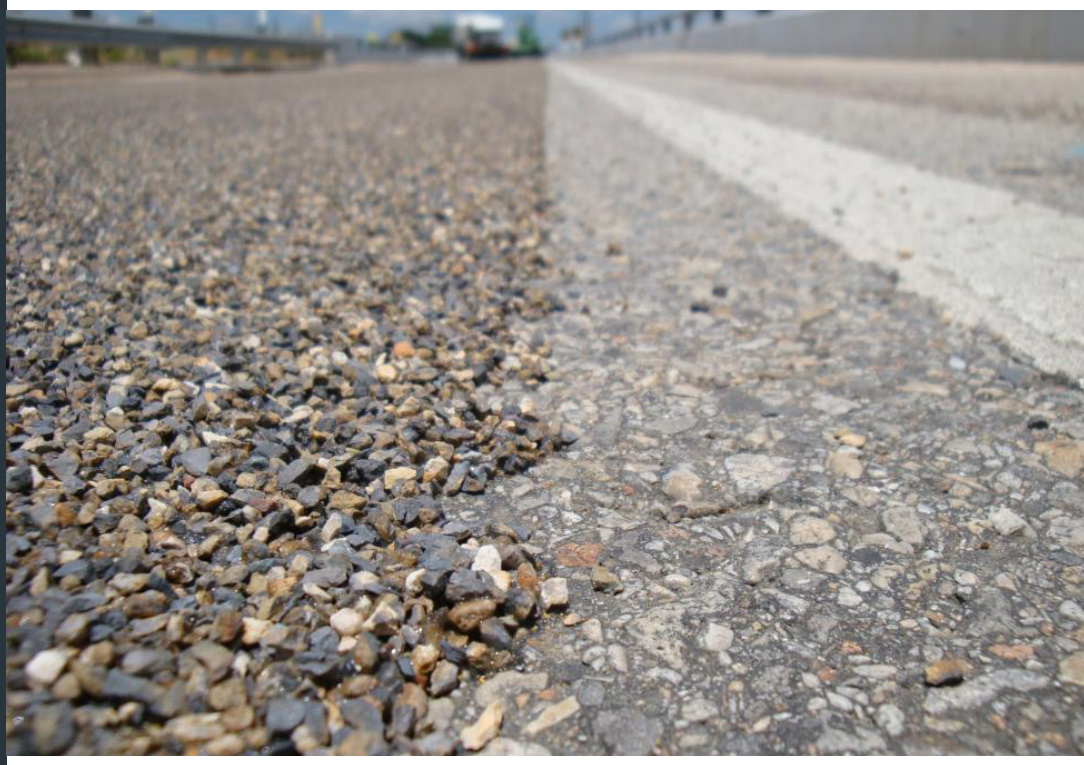
HSFT does not involve the overlay of long sections of roadway but is a spot treatment applied in critical areas. HFST does require some long-term maintenance in excess of that for a traditional asphalt roadway, but there is a tangible benefit in reduced crash rates that has been demonstrated by pilot and research projects using the treatment.

A HFST program should also include a field assessment of existing pavement conditions to determine the appropriate extents of HSFT to be applied to the candidate roadways identified in the list below.

Estimated Project Construction Cost:

$35,000–50,000

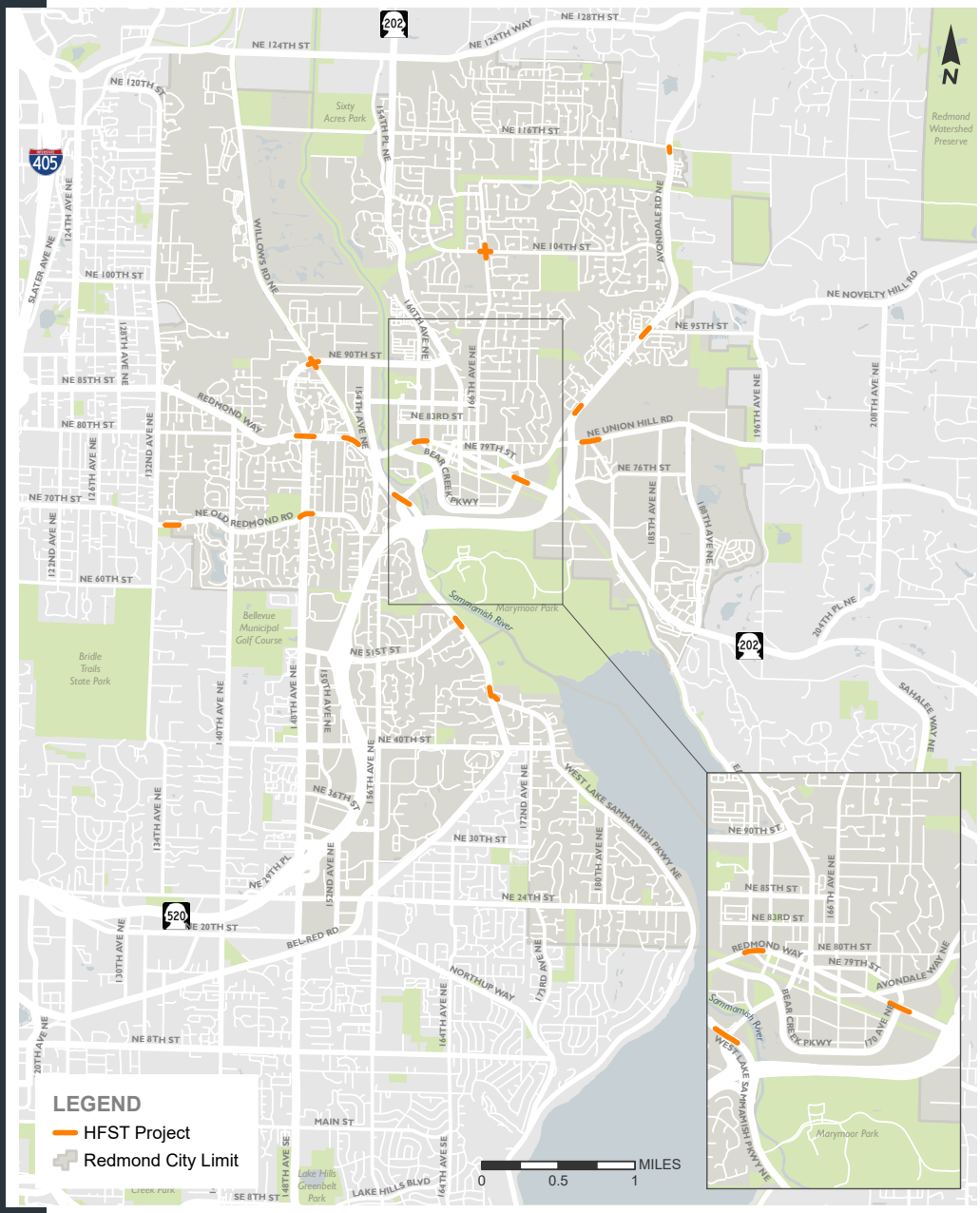
per 100 LF depending on roadway curb-to-curb width



High Friction Surface Treatment Program

Candidate locations for spot location installation of HFST include:

- Avondale Road – 85th to Avondale Way, NE 95th, south of NE 116th
- 148th and Willows Road
- Union Hill Road – 178th Place
- Redmond Way – 148th, Willows, Cleveland, Cleveland through 170th,
- West Sammamish Lake Parkway – Leary Way, NE 51st, Bel-Red Road
- NE 104th Street and 166th Ave
- Old Redmond Road – 148th, 154th, east of Snyder's Corner Park



Enhanced Bike Lane Protection

Risk Factors

Countermeasures

Physical barriers at bike lane buffers

Physical protection of bike lanes can help to avoid incursion by vehicles, improve the comfort of bike lanes for a wider range of users, address conflicts with vehicles approaching intersections, and improve the visibility of bikes and awareness of drivers of the presence of bike lanes. Linear crashes with cyclists in marked bike lanes could be significantly reduced by the increased physical protection.

The use of single unit curbing from vendors, equipped with a vertical reflective marker, significantly increase the visibility of bike lanes, and also provide a physical separation from traffic. The units do require long-term maintenance and potential replacement, but allow for increased protection of existing bike lanes without modification of curbs, hardscape or other more expensive capital improvements. Acquisition of specialized bike lane width cleaning equipment by the City would help to maintain the safety and utility of physically separated bike lanes.

Other low-cost modifications to improve the physical barriers to existing bike lanes, which could be piloted as a demonstration project, would be to flip the location of on-street parking adjacent to bike lanes. Bike lanes would be placed at the curb line, and on-street parking would occur separated from the curb. On-street parking can be accessed without crossing the bike lanes, drivers' doors do not open into bike lanes, and bikes are protected from moving vehicle traffic by the space of the parking lane and any parked vehicles. There is an educational requirement for drivers to avoid parking occurring in the bike lane.

Estimated Project Construction Cost:

$1,000

per 100 LF of bike lane stripe

Spaced at 50 foot intervals, curbs could be installed directly overtop of existing bike lane striping.

Time to Construct:

3–6

months from design kickoff

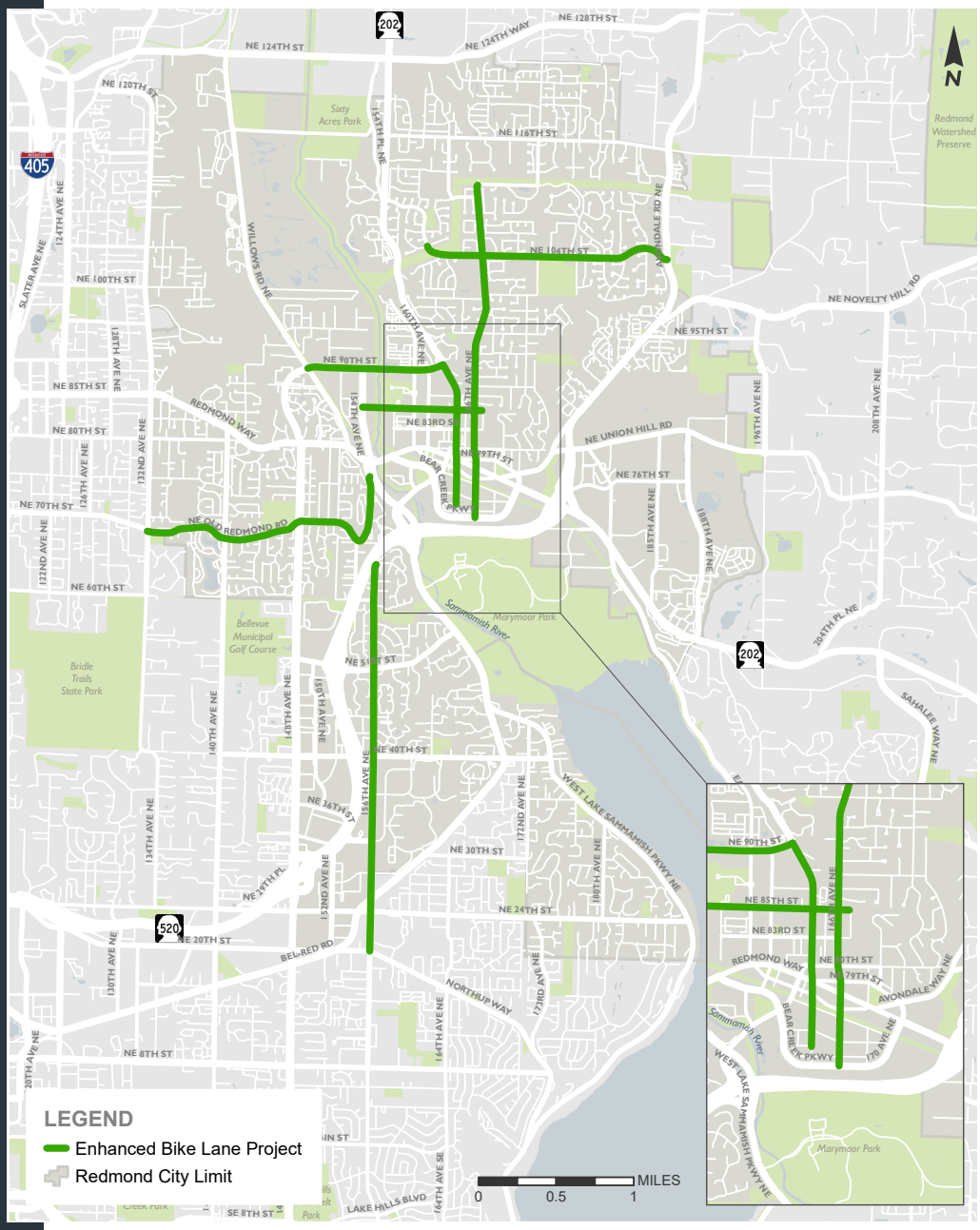
Enhanced Bike Lane Protection

Candidate locations for physical buffers include:

- NE 85th Street
- NE 90th Street
- 164th Avenue NE
- 166th Avenue NE
- 156th Avenue NE
- NE 104th Street
- Old Redmond Road

Candidate locations for flipping on-street parking and bike lanes include:

- NE 85th Street (pilot project potential)
- 156th Avenue NE (pilot project potential)
- NE 104th Street



Bike Lane Relocation

Risk Factors

Countermeasures

Separated bike facilities

Redmond Way has experienced a history of bike crashes at intersections and linearly along the roadway. The existing bike facilities on the roadway consist of marked bike lanes. Current best practices for bike facilities would not recommend the use of striped bike lanes on Redmond Way due to the posted speed limit and traffic volume. To improve the comfort and safety of biking on Redmond Way, a project to relocate the existing curb line would provide for a separated bike facility, and could have a calming effect on vehicle traffic by increasing side friction with a narrower roadway curb-to-curb width.

The relocation of the curb would allow, with some reconstruction of the existing vegetated buffer strip, for either a side-by-side bike and pedestrian facility, a shared use path on both sides of the roadway , or a raised bike lane with the existing sidewalk and vegetated buffer retained in place.

The limits of the raised bike facility would ultimately be between the SR 520 ramps and 187th Avenue. Phasing of the relocated bike facility at logical termini with significant intersections, such as at East Lake Sammamish Parkway and 185th Avenue would allow the City to pursue multiple grant funding sources to implement the project while also making incremental safety and comfort improvements for cyclists.

Estimated Project Construction Cost:

$3,000,000+

Costs would include curb relocation, stormwater and utility modifications, new buffer strips and bike lane pavements.

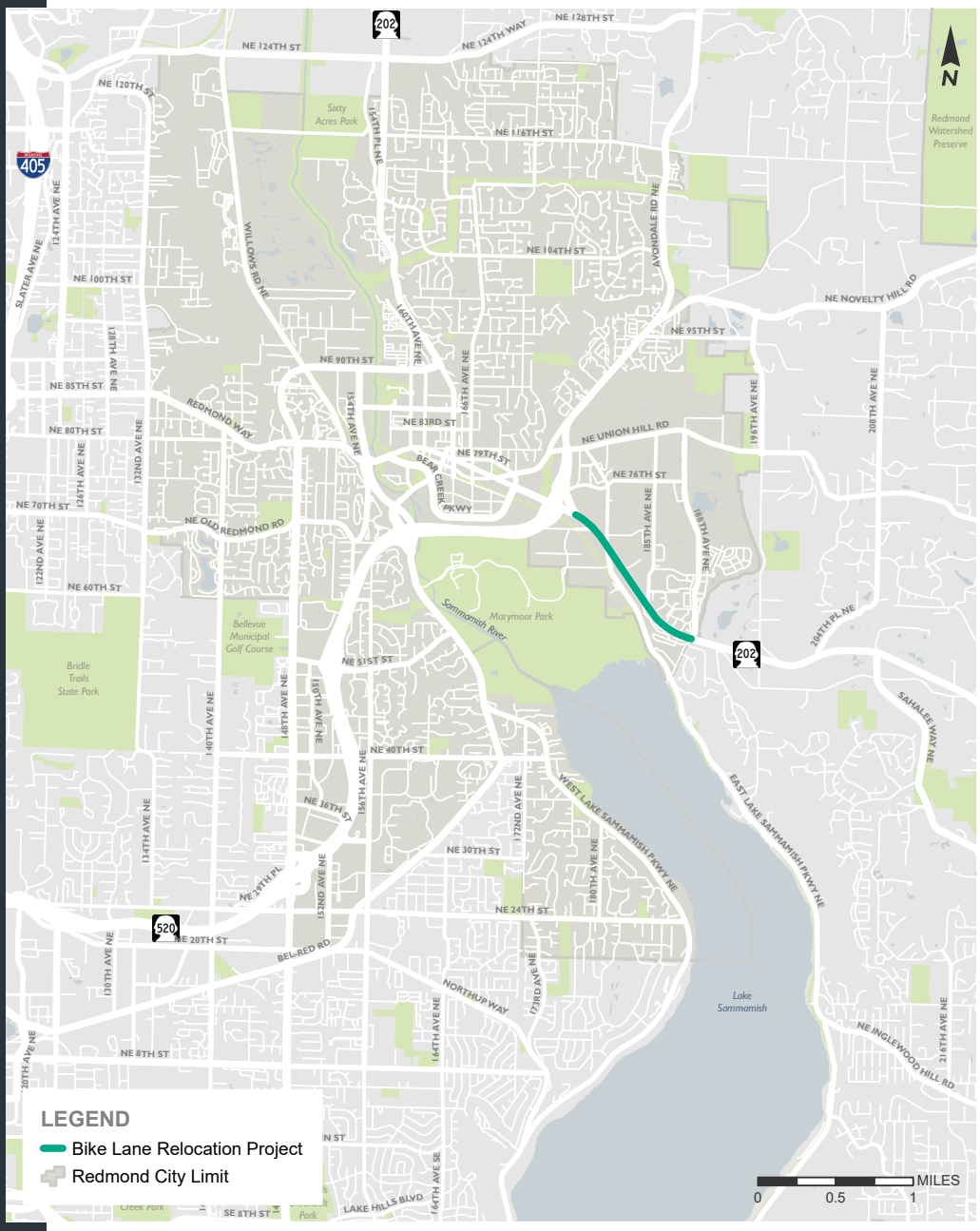
Time to Construct:

18–24+

months from design kickoff

Bike Lane Relocation

Avondale Road would also be a strong candidate for a bike lane relocation behind a new curb line to remove the bikes from the higher volume roadway lanes. The historical crash rate for cyclists on Avondale Road is lower than for Redmond Way, but this could be a result of uncomfortable existing conditions that limit the number of cyclists in the corridor. Avondale Road meets the criteria for the risk factors and should be considered as a bike lane relocation project location as well.



Divided Highway, 35 mph+ Limit Intersection Program

Risk Factors

Countermeasures

Corridor-wide improvements to;

High visibility crosswalk markings	**Signal timing**	**Crosswalk length**

The City of Redmond's highest priority risk factors come together in two corridors that meet all of the risk factors and could be upgraded throughout the City to improve comfort and reduce risk of crashes for not only users of the crossings, but vehicle traffic as well.

The recommended program of improvement in each corridor would seek to implement at all existing signalized intersections, one or all of the following projects;

- High visibility crosswalk markings
- Curb extensions using either full height curbs or 2" "truck apron" style curb extensions to avoid impacts to bike facilities and low frequency truck turning movements, to shorten the crossing distance of vehicle lanes.
- Reduce lane widths to shorten the crossing distance.
- Widen sidewalks, add vegetated buffers, and reduce driveway lengths along high volume, higher speed arterials in the vicinity of transit stops.
- Increase pedestrian phase times and/or introduce lead pedestrian interval, especially near transit stops. Update pedestrian pushbuttons and curb ramps for ADA/PROWAG compliance.
- Conduct corridor-wide signal timing or interconnect signals to improve traffic flow at peak hours and reduce congestion that can lead to crashes and risky behaviors to reduce travel times.

Estimated Project Construction Cost:

$100,000–$2,000,000+

Costs will vary depending on the amount of hardscape changes, sidewalk extensions and need for signal equipment replacement

Time to Construct:

12–24

months from design kickoff

Divided Highway, 35 mph+ Limit Intersection Program

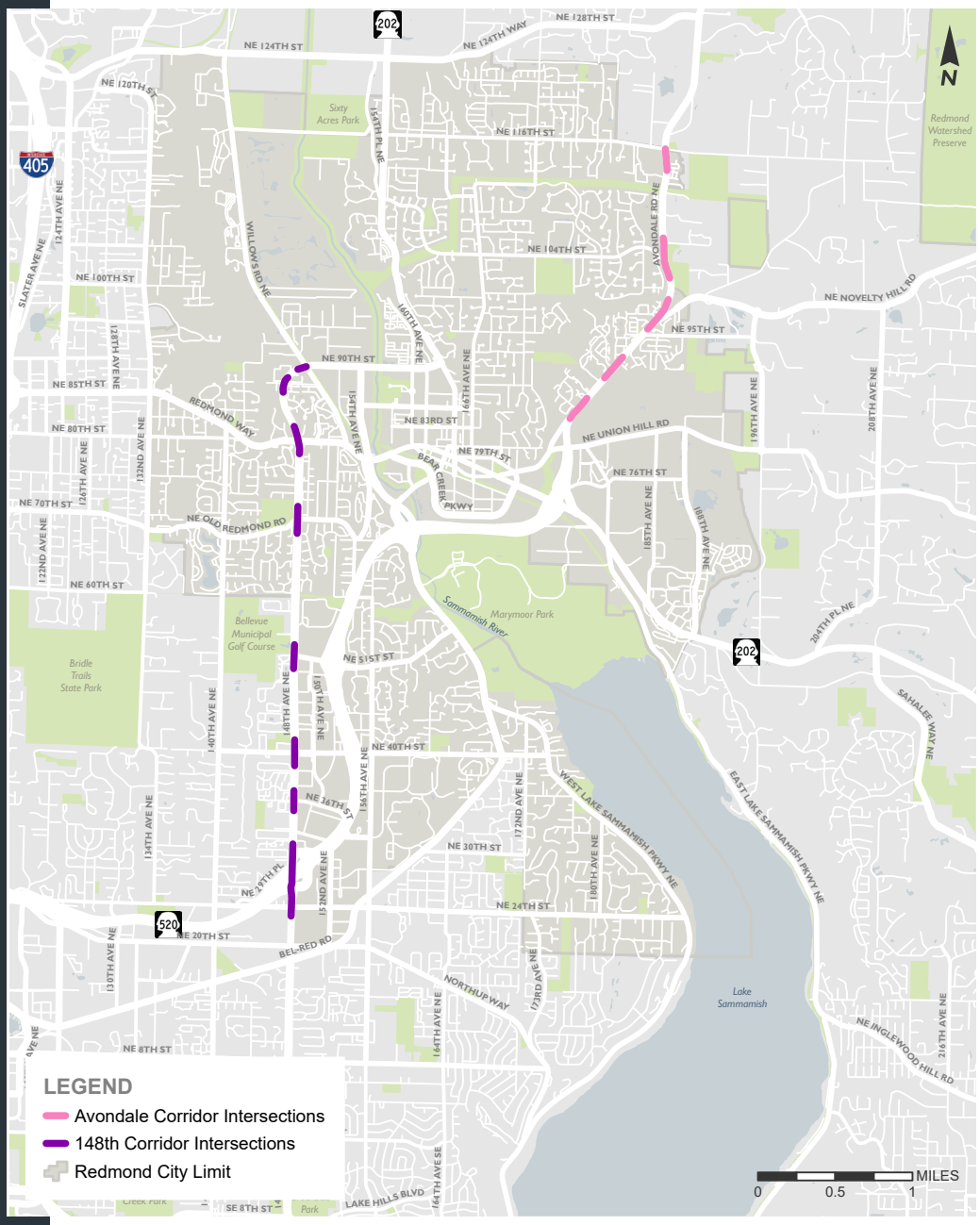
Two corridors are recommended for a full-length program of improvements at signalized intersections:

Avondale Road, including the intersections with

- 116th Street
- 104th Street
- Novelty Hill Road
- 180th Street
- 85th Avenue (new pedestrian signal)

148th Avenue

- All intersections within the City limits



Add Pedestrian Crossings at High Demand Locations

Risk Factors

Countermeasures

Pedestrian crossings with high visibility markings and pedestrian-actuated beacons or signals

Locations at cross streets where there are no existing markings are legal crossings under Washington state law. But, without markings, signage and pedestrian-actuated beacons or signals, unmarked crossings of higher volume or higher speed roadways can be an elevated risk for crashes. The City of Redmond has experienced crashes at unmarked crossings, indicating a demand for crossings that could warrant new enhanced crossings.

Estimated Project Construction Cost (RRFB):

$100,000

Costs include solar powered RRFBs, new curb ramps, markings and signage.

Time to Construct:

6–9

months from design kickoff

Estimated Project Construction Cost (Pedestrian Signal):

$300,000

Costs include a new pedestrian signal, new curb ramps, markings and signage.

Time to Construct:

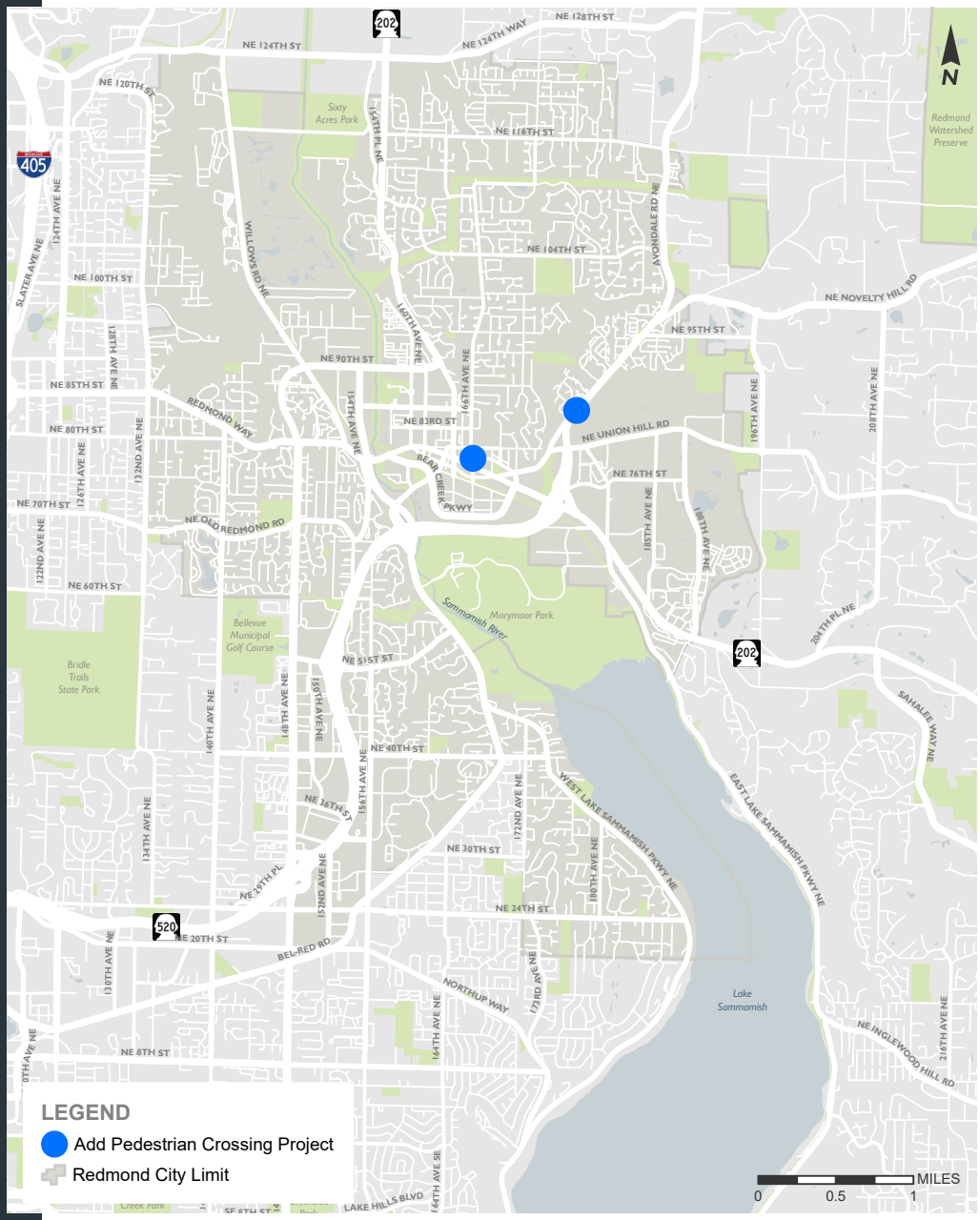
12–15

months from design kickoff

Add Pedestrian Crossings at High Demand Locations

Candidate locations for new location crossings include:

- Avondale and 85th Street (pedestrian signal)
- 166th Street and 79th Avenue (rectangular rapid flashing beacon) – planned City project
- Other locations on transit routes to be identified



Reducing Vehicle Speeds Through Automated Enforcement

Risk Factors

Countermeasures

Automated speed enforcement (compliant with RCW 46.63.170)

The state of Washington recently passed RCW 46.63.170 which grants Cities the authority to install speed cameras where both of the following conditions are met;

- Warranted by a Local Road Safety Plan
- In proximity to certain land uses, including parks and schools.

The City of Redmond's crash history does cite speed in excess of that which would be appropriate for the given conditions in nearly 10% of all crashes. Crashes that cite speed as a contributing factor cite speeds in excess of the posted limits at a significantly lower rate than other cities. The City would be able to pilot an automated speed enforcement system and monitor the impact on nearby crash rates for crashes of all types. Implementation of automated enforcement would likely require policy discussions and a public outreach program prior to implementation.

An automated speed enforcement program would not be intended to replace existing traffic calming programs, such as the Traffic and Pedestrian Safety Program or existing enforcement focuses on local streets.

Estimated Project Construction Cost:

TBD

Costs will be dependent on vendor contracts and scale of public outreach program

Time to Construct:

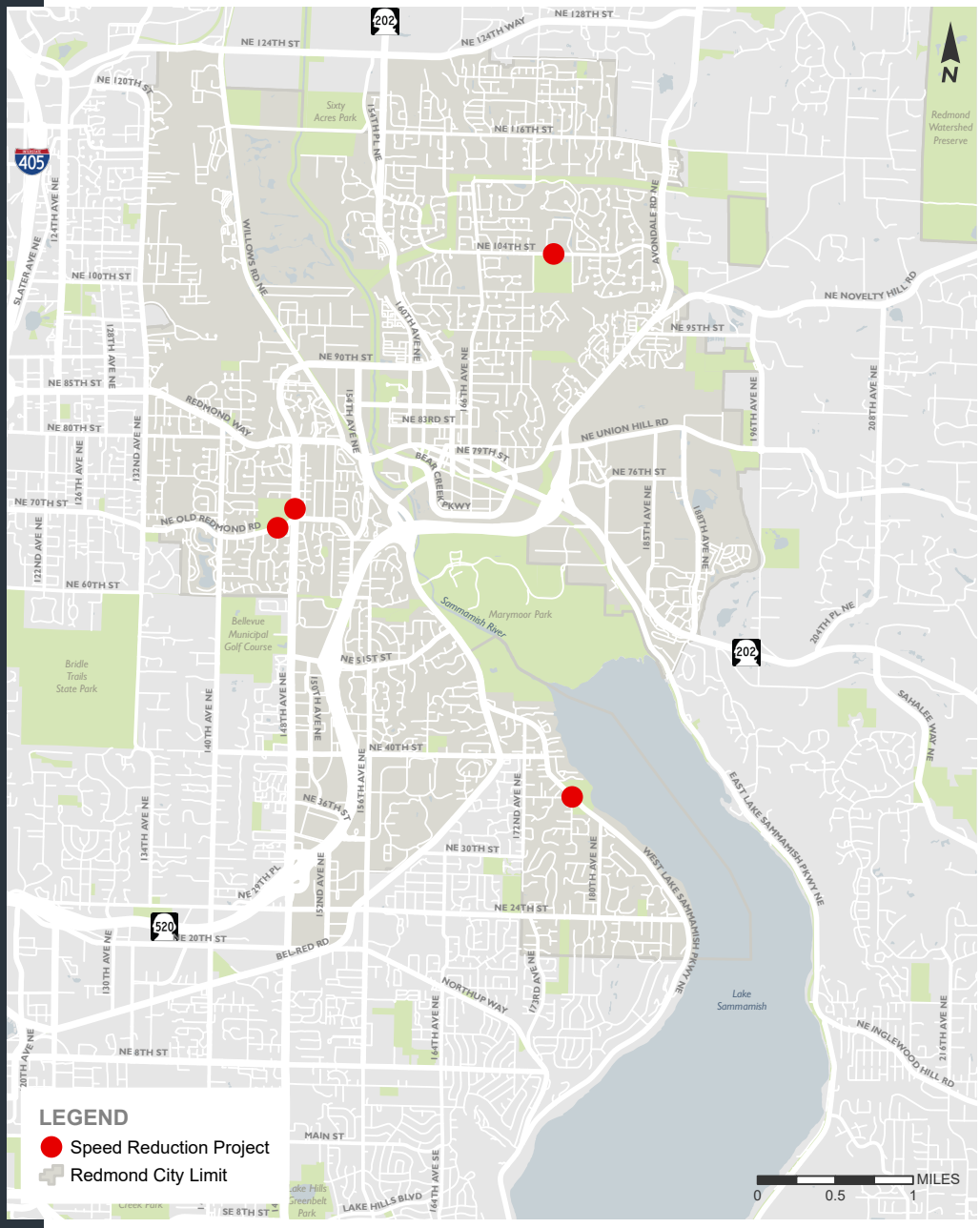
TBD

Reducing Vehicle Speeds Through Automated Enforcement

Candidate locations for automated speed enforcement include:

- Old Redmond Road or 148th Avenue NE at Grass Lawn Park
- West Lake Sammamish Parkway at Marymoor Park
- NE 104th Street at Hartman Park

In addition to the locations adjacent to parks, a school zone automated enforcement program can help to reduce speeds in proximity to vulnerable users. School zone enforcement is typically more acceptable to the public, and can help to change the local culture around speeding.



Citywide Speed Limit Study

Risk Factors

Countermeasures

Identify feasibility of reducing speed limits

Reducing speed limits can help reduce a number of risk factors for crashes, but the determination of speed limits is a complex task that balances the roadway physical environment, operating conditions, and passive and active enforcement measures. A comprehensive citywide speed limit study would help the City to identify where existing speed limits may be able to be reduced based on existing conditions without significant investment in physical modification to the roadway, or enforcement.

A citywide study of speed limits could also identify locations where physical modifications of higher volume arterial roadways, which are not candidates for traditional physical traffic calming devices, would be warranted in order to provide passive enforcement of a lower speed limit. The speed limit study could help to identify other high priority safety capital projects related to speed reduction for addressing crash risk factors.

Estimated Project Cost:

$150,000

Costs include acquisition of current speed data, field study of existing conditions, an analysis of potential changes in speed limits that are warranted by existing conditions, and identification of conceptual projects to modify the roadway environment of arterials that are identified for lower speed limits.