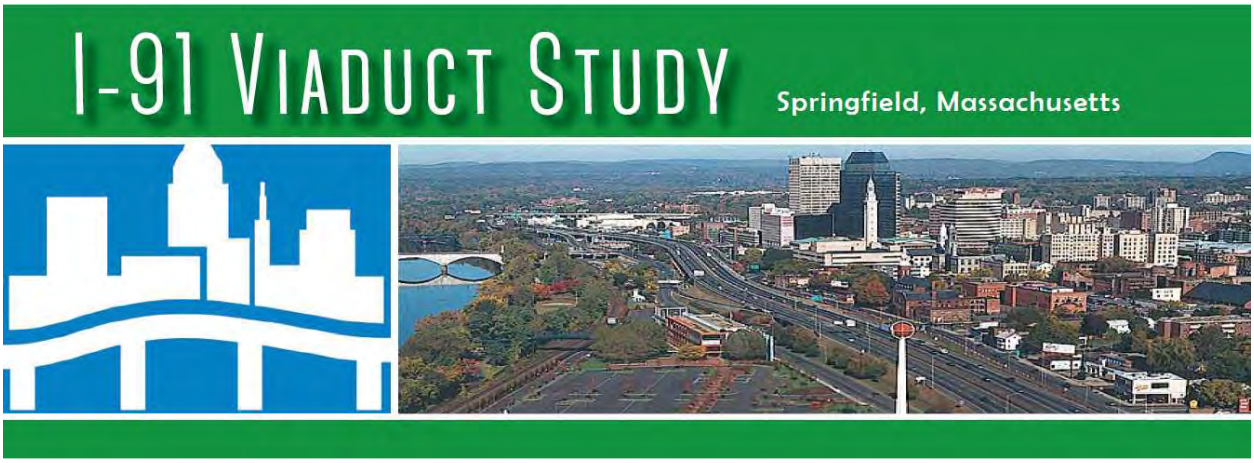


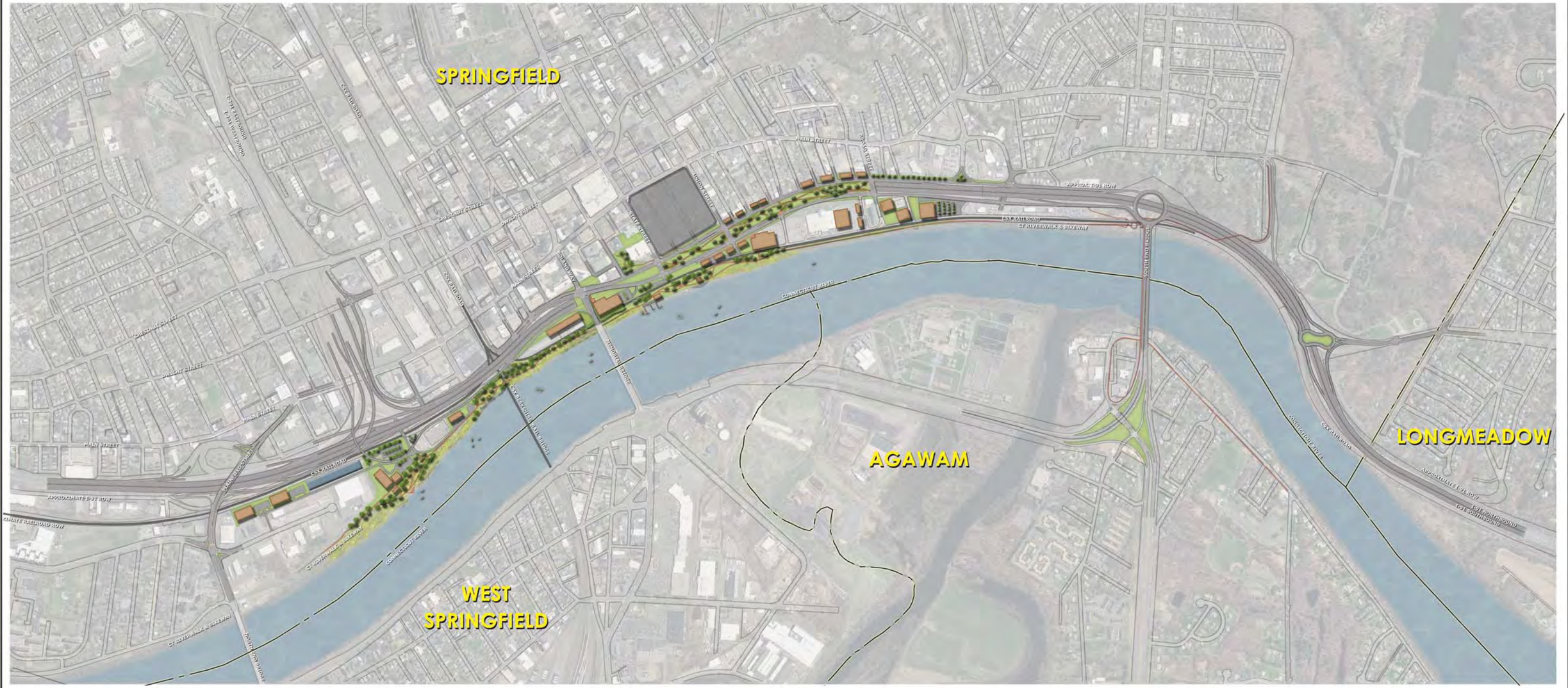
I-91 Viaduct Study – Evaluation Criteria

Workbook

6/27/2017

MILONE & MACBROOM

massDOT
Massachusetts Department of Transportation



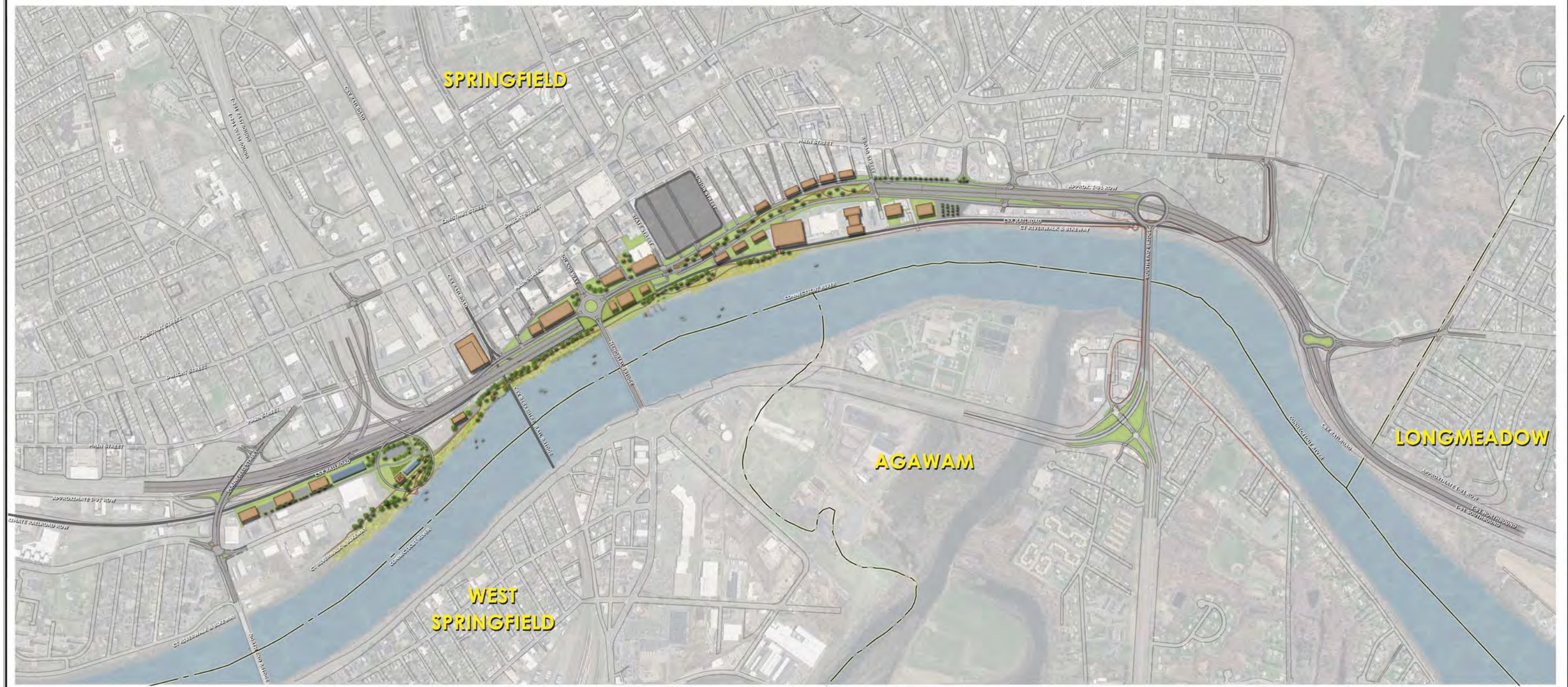
STUDY AREA PLAN - ALT. NO. 1 - SUNKEN SAME ALIGNMENT

I-91 VIADUCT STUDY

MILONE & MACBROOM®
One Financial Plaza
1350 Main Street, Suite 1012
Springfield, Massachusetts 01103
(413) 241-6920 Fax (413) 241-6911
www.miloneandmacbroom.com

0 600' 1200' 1800' 2400'

NORTH



STUDY AREA PLAN - ALT NO.2 - SUNKEN, NEW ALIGNMENT

I-91 VIADUCT STUDY

MILONE & MACBROOM®
One Financial Plaza
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Springfield, Massachusetts 01103
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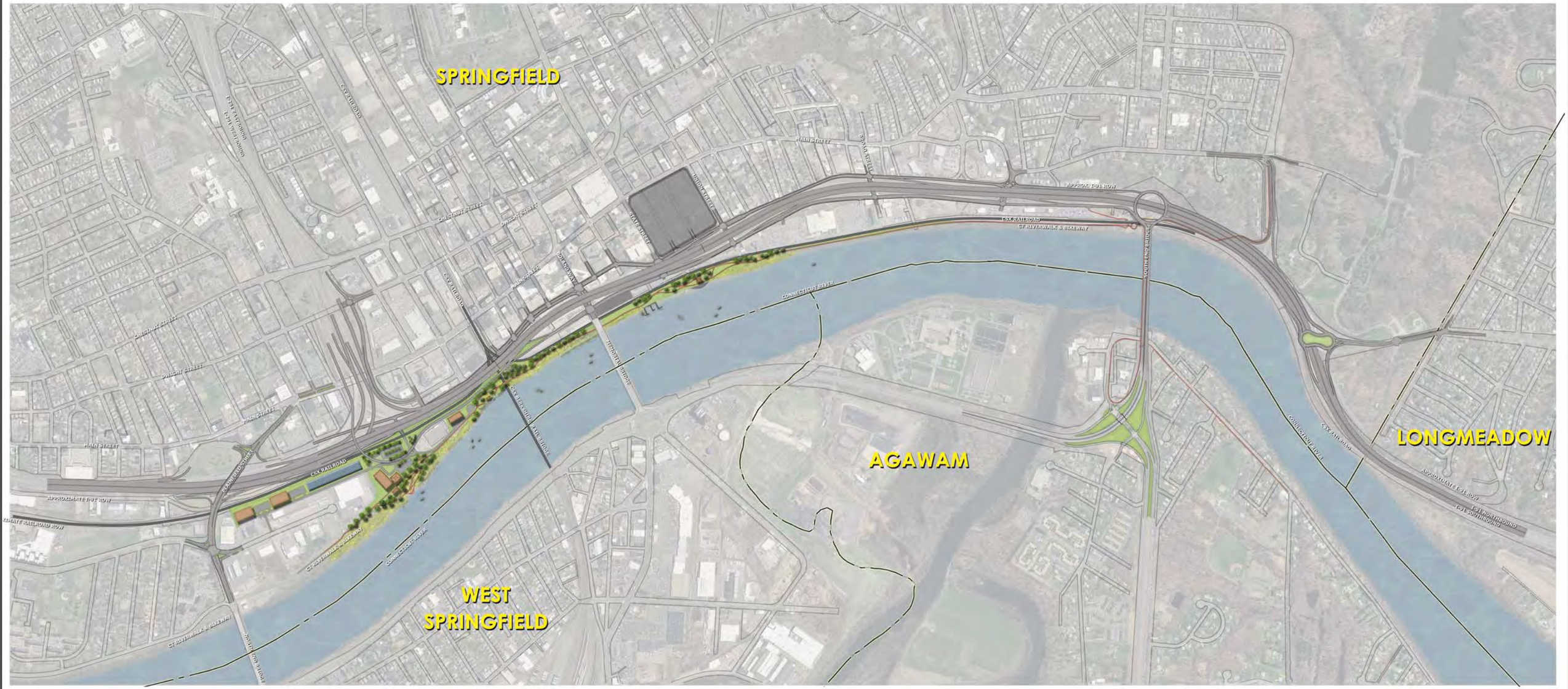
0 600' 1200' 1800' 2400'

NORTH



STUDY AREA PLAN - ALT. NO. 3 - ELEVATED SECTION

I-91 VIADUCT STUDY

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NORTH

1. **Mobility and Accessibility –** This set of criteria was developed to evaluate each alternatives ability to maintain or improve the conveyance of regional traffic through the corridor, while enhancing the connectivity of all modes of transportation into and around the City and its waterfront.

1.1 Roadway Operational Functionality

1.1.1 Intersection Level of Service

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section, the Level of service is for signalized intersections. Typically, LOS that performs at a LOS D or better is considered acceptable. In this criterion, only those intersections that scored a LOS E or worse for either or the morning (AM) and afternoon (PM) Peak periods were used for analysis.

1.1.2 Volume to Capacity Ratio

Volume to capacity ratio is in which the volume (V) is the total number of vehicles passing a point in one hour and the capacity (C) for the maximum number of cars that can pass a certain point for a reasonable traffic condition. In other words, this measurement of effectiveness deals with ability of the roadways to handle the number of vehicles expected to be on those roads in 2040. A higher ratio value will be a more negative result.

1.1.3 Queue Length

Queue length is a line of vehicles waiting to proceed through an intersection. Slowly moving vehicles joining the back of the queue are usually considered part of the queue. The internal queue dynamics can involve starts and stops. A faster-moving line of vehicles is often referred to as a moving queue or a platoon. For this criterion, the queues were added for all approaches at all the studied intersections. Any reductions in queue lengths would be a positive result.

1.1.4 Level of Service Merge, Diverge and Weave Locations

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section the Level of service is for weaving, where one movement must cross the path of another along a length of facility without any aid of traffic control devices. Merging is when two separate traffic streams form a single lane and diverge is when one flow of traffic separates to form two separate lanes. Typically, LOS that performs at a LOS D or better is considered acceptable. In this criterion, only those intersections that scored a LOS E or worse for either the morning (AM) and afternoon (PM) Peak periods were used for analysis. A smaller number of LOS E's or worse would be a positive result.

1.1.5 Level of Service Ramps and Highway Segments

Level of service (LOS) is a term used to qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, maneuverability, delay, and safety. The level of service of a facility is designated with a letter, A to F, with A representing the best operating conditions and F the worst. For this section the Level of service is for interstate on and off ramps and also interstate segments. Typically LOS that performs at a LOS D or better is considered acceptable. Locations were listed when their LOS was E or worse for either or the AM and PM Peak periods. A smaller number of LOS E's or worse would be a positive result

1.2 Travel Time

1.2.1 Travel time along I-91 corridor

Travel time is the length in time it will take to get to one point from another. The travel time is typically in minutes and seconds. Travel time is equal to the running time plus delay, which can be along a pathway or at a signalized and/or unsignalized intersection. Speed limit is a factor. For this case, the distance or path considered is along I-91 from the Connecticut state line to just north of the Plainfield Street overpass. A distance of 6.68 miles for both directions.

1.2.2 Travel time through Primary Study Area

Travel time is the length in time it will take to get to one point from another. The travel time is typically in minutes and seconds. Travel time is equal to the running time plus delay, which can be along a pathway or at a signalized and/or unsignalized intersection. Speed limit is a factor. For this case, the distance or path considered was from the intersection of Union Street at East Columbus Avenue to the intersection of Springfield Street and Chestnut Street. A distance of 2.37 miles from the intersection of Union Street and East Columbus Avenue and Springfield Street and Chestnut Street and 2.68 miles in the opposite direction.

1.3 Pedestrian and Bicycle Functionality and Connectivity

1.3.1 Improve access to the Riverfront from Downtown core

This section is presented to evaluate proposed changes and enhancements (including sidewalk, shared use paths, crossing improvements, etc.) in connections between downtown urban core and riverfront for bicyclists and pedestrians. Areas that are gauged are the crossings of I-91 and also the rail lines.

1.3.2 Improve access to community services and social services

This section is presented to evaluate the number and quality of connections to schools, health care, social services, etc. for bicyclists and pedestrians in the Primary Study Area. Areas that are gauged include roadways within the primary study area, immediately surrounding the downtown core, Interstate 91, and I-291.

1.3.3 Improve access to Retail and Commerce

This section is presented to evaluate the number of commercial businesses, goods, employment centers, and public and institutional properties for which bicyclists and pedestrians are likely to benefit from enhanced access in the Primary Study Area. Any property within ¼ mile of an enhanced bicycle or pedestrian connection is defined as experiencing an improvement in access. No differentiation between levels of pedestrian or bicycle connection quality is provided (as changes in levels of quality are contingent on design decisions not addressed in this conceptual-level study). Areas that are gauged include roadways within the primary study area, immediately surrounding the downtown core, Interstate 91, and I-291.

1.3.4 Improve connections to Union Station

This section is dedicated to realizing the change in vehicular, bicycle, pedestrian and transit networks to stimulate connectivity to the renovated Union Station. Each alternative will be examined to determine the extent of new bicycle facilities and additional sidewalks that are or are not being added to improve the connection to the transportation hub at Union Station.

1.3.5 Regional bicycle and pedestrian connectivity

This section is dedicated to providing comparisons of each alternatives ability to promote longer distance commuting and recreational trips, as well as improved access to regional bicycle and pedestrian facilities such as the Connecticut Riverwalk and Bikeway in Springfield, the Connecticut Riverwalk and Bikeway in Agawam, and Forest Park in Springfield. The map series "Bicycle, Pedestrian, and Transit Connectivity and Employment" illustrates proposed connections under each alternative.

1.4 Mode Shift

1.4.1 Increase transit mode share

This section will evaluate the number of improved connections to transit stops within 0.25 miles of each alternative, providing a better means of access to existing transit stops in the area.

1.4.2 Increase bicycle and pedestrian mode share

In order to evaluate, the increase of bicycle and pedestrian mode share, this section will tabulate the change in linear feet of both sidewalk and linear feet of designated bicycle facilities.

2. **Safety** - This set of criteria was developed to evaluate each alternatives ability to create a safer and more user friendly, pedestrian and bicycle system through and across the transportation corridor.

2.1 Pedestrian and Bicycle Safety

2.1.1 Improve bicycle and pedestrian safety – minimize conflicts

This section will evaluate if the alternatives improve bicycle and pedestrian safety by minimizing conflict points based on the number of intersections that are potentially being mitigated and will improve the overall safety for users other than vehicles.

2.1.2 Improve bicycle and pedestrian safety – ADA compliance

This section will evaluate if the alternatives improve pedestrian safety by incorporating the latest ADA/AAB standards at signalized intersections within the primary study area of each alternative. Items that would be included are compliant wheel chair ramps, detectable warning strips, APS push buttons, etc.

2.1.3 Improve bicycle and pedestrian safety – safe crossing accommodations

This section will evaluate if the alternatives improve bicycle and pedestrian safety where they may come in contact with interstate on and off ramps. A quantitative number of actual crossings for each alternative will be compared.

2.1.4 Improve bicycle and pedestrian safety – improve crossing times

This section will evaluate if the alternatives improve crossing times for the pedestrians at signalized intersections based on modifications that will take place at existing intersections that will be modified or implementing the latest ADA/AAB standards at newly designed standards.

2.1.5 Improve bicycle and pedestrian safety – provision of separated facilities

This section will evaluate if the alternatives improve bicycle and pedestrian safety by reviewing the total number of shared-use paths that are separated from the roadways, such as a typical on-street situation.

2.2 Vehicular Safety

2.2.1 Improve interaction and roadway safety – conflict points

This section identifies the number of weaving sections along the I-91 corridor within the primary study area. Within these areas there are numerous high crash locations due to the fact that the weaving sections distances are relatively short and there numerous on and off ramps within the Primary Study Area. A reduction of weaving sections and/or lengthen the distance between on and off ramps will mitigate the number of conflict points along the I-91 corridor. Also a standard four-legged signalized intersection typically consists of 80 conflict points with the inclusion of bicycles and pedestrians. If there are less signalized intersections from one alternative to another, generally there would be less conflict points. A tally of the number of signalized intersections is included in this criteria.

2.2.2 Improve interaction and roadway safety – mitigate high crash locations

This section identifies the number of high crash locations or clusters within the primary study area that are adjacent to Interstate 91 and 291. Each alternative will list if any of the high crash cluster intersections will be mitigated, which will include design changes, in order to improve intersection and roadway safety.

2.3 Public Safety

2.3.1 Improve Public Safety

This section compares the levels of how each alternative will improve public safety or the perception thereof. Each alternative may minimize factors that would contribute increased crime or the fear of crime. Poor lit areas, confined spaces, isolated areas and types of land use typically create an unsafe feeling to pedestrians, bicyclists and even motorists. This section will prepare of qualitative review of improvements to site lines, lighting, open spaces, etc.

3. **Environmental Effects (TBD)** - This set of criteria was developed to evaluate each alternatives ability to improve the overall environmental quality of the transportation corridor

3.1 Sustainability

3.1.1 Impacts on environmental resources

This section compares impacts of each alternative on relevant natural resources, including the 100 foot and 500 foot FEMA floodways, NHESP priority habitat areas, and DEP wetlands.

3.1.2 Inclusion of Low Impact Development standards

This section depicts total gain in pervious surface as a result of inclusion of LID standards and improvements as well as creation of additional open space for recreation on or adjacent to the existing viaduct footprint.

3.1.3 Reduction of pavement footprint

This section compares the differences in total pervious area within the I-91 corridor between East and West Columbus Avenues within the Primary Study Area.

3.2 Air Quality

3.2.1 Health impacts to vehicle occupants, bicyclists and pedestrians

This section presents estimates of criteria pollutant emissions as modeled by CTPS. Differences in VMT and associated estimates of NOx, VOC, and CO emissions during AM and PM peaks from the 2040 No-Build scenario are presented for each alternative.

3.2.2 Reduction of greenhouse gas emissions

This section compares estimated greenhouse gas emissions (specifically CO2) between each alternative. Differences in VMT and associated estimates of CO2 emissions during AM and PM peaks from the 2040 No-Build scenario are presented for each alternative.

3.3 Noise

3.3.1 Noise impacts – decibel levels

Noise impacts of each alternative are measured in terms of the modeled distances from the highway alignment experiencing decibel levels above Noise Abatement Criteria levels (66dB for residential uses, 71 dB for commercial uses). Distances are expressed as a range, as the distance at which given levels of noise are experienced varies based on terrain. Distance estimates are from the I-91 Springfield Conceptual Level Noise Assessment prepared by VHB.

3.3.2 Noise impacts – impacted receptors

This section provides estimates of the number of receptors (residences or commercial properties) experiencing noise levels above those specified by Noise Abatement Criteria (66dB for residential uses, 71dB for commercial uses) under each alternative. Estimates of impacted receptors are from the I-91 Springfield Conceptual Noise Assessment prepared by VHB.

4. **Land Use and Economic Development** - This set of criteria was developed to evaluate each alternatives ability to include transportation based improvements that create beneficial land use opportunities for the City and the region that promote both access to open space and new opportunities for economic development

4.1 Economic Development Potential

4.1.1 Parcel Growth

This section quantifies the estimated area of lands that will be made available for new development or green space. This space includes both lands made available through enhanced access to currently constrained waterfront parcels, and through the creation of new greenspace and/or developable areas within the existing I-91 right of way under the sunken alignments presented in Alternatives 1 and 2.

4.1.2 Improve accessibility to potential and existing development parcels

This section identifies the number and quality of connections to the waterfront and development areas. High-quality connections are assessed as those with complete streets elements that provide for safe accommodations for pedestrians and bicyclists as well as vehicular traffic.

4.1.3 Improve bicycle and pedestrian infrastructure

This section will evaluate if the alternatives improve bicycle and pedestrian facilities, specifically with the evaluation of complete streets elements within the primary study area that include improved bike and pedestrian accommodation

4.1.4 Increase density

This section quantifies the estimated impacts to population, households, and jobs within the study area based on the development scenarios associated with each of Alternatives 1-3. Potential increases in population and households are derived from the number of housing units proposed for each scenario at full buildout, average occupancy rates, and average household sizes of comparable units. The potential increase in jobs is based on the size of commercial and industrial developments and average ratios of building size to employment across sectors. As the study area geography remains static across Alternatives and through time, any increase in population, households, or jobs results in an increase in residential/employment density.

4.1.5 Incur new tax generation

This section provides estimates of the potential property tax generation that would accrue to the City of Springfield under each of the development scenarios associated with each of Alternatives 1-3. Estimates of tax generation are derived separately for residential units and commercial/industrial development. Residential tax revenues are based on local comps for condo sales with an upwards adjustment to account for the likely price premium for new waterfront units, and are calculated on a per-unit basis. Commercial/industrial tax revenues are based on local comps for office/retail and industrial properties in the waterfront area, with upwards adjustment for building age and condition; these revenues are calculated on a square footage basis. All values are based on 2016 property values and tax rates in the City of Springfield, and are expressed in 2016 dollars.

4.2 Socio-Economic Impacts

4.2.1 Increase employment

This section quantifies the estimated impacts to jobs within the primary study area based on the development scenarios associated with each of Alternatives 1-3. The potential increase in jobs in the PSA/City of Springfield is based on the size of commercial and industrial developments and average ratios of building size to employment across sectors.

4.2.2 Increase population

This section quantifies the estimated impacts to population within the primary study area based on the development scenarios associated with each of Alternatives 1-3. Potential increases in population in the PSA/City of Springfield are derived from the number of housing units proposed for each scenario at full buildout, average occupancy rates, and average household sizes of comparable units.

4.2.3 Increase housing

This section quantifies the estimated number of housing units within the primary study area based on the development scenarios associated with each of Alternatives 1-3. The number of housing units added to the PSA/City of Springfield associated with each development scenario is based on developable land available under the design Alternatives as well as potential market demand.

4.2.4 Improve affordability – housing in proximity to transit

This section compares the quantity of housing generated within ¼ mile of Union Station, a major transportation hub for downtown Springfield. Expansion of housing stock near Union Station can provide an increase in housing options that allows households to meaningfully decrease costs, e.g. by reducing vehicle ownership and reducing combined housing and transportation costs.

4.2.5 Improve public service provision

This section quantifies the extent to which additional public services may be enabled by incremental tax revenue generated within the primary study area and accruing to the City of Springfield by the development scenarios associated with Alternatives 1-3. Estimates of tax generation are derived separately for residential units and commercial/industrial development. Residential tax revenues are based on local comps for condo sales with an upwards adjustment to account for the likely price premium for new waterfront units, and are calculated on a per-unit basis. Commercial/industrial tax revenues are based on local comps for office/retail and industrial properties in the waterfront area, with upwards adjustment for building age and condition; these revenues are calculated on a square footage basis. All values are based on 2016 property values and tax rates in the City of Springfield, and are expressed in 2016 dollars.

4.2.6 Promote reduced travel costs

This section provides a qualitative assessment of design, environmental, and population-based factors that may act to reduce travel costs (including time and safety) for travel via modes other than single-occupancy vehicles. Because no changes in transit service are contemplated under Alternatives 1-3 vs. the no-build option, potential improvements in first/last mile connections based on enhancements to bicycle and pedestrian infrastructure that may benefit transit users and transit ridership.

4.2.7 Improve social cohesion

This section inventories the transportation and open space impacts of each of the alternatives with respect to factors that may increase opportunities for social and recreational travel between neighborhoods, and improve connections to open space areas suited for recreation, community events, and socialization between residents of different neighborhoods and backgrounds.

4.3 Freight Rail Impacts

4.3.1 Operational Impacts

This section identifies whether there will be any operational impacts to freight rail based on the mitigation measures in each alternative. Each alternative assumes that if any direct impacts may occur, mitigation measures will be made to the rail in order not to impact any freight rail operations.

4.3.2 Implementation Costs

This section identifies whether there will be any operational impacts to freight rail based on the mitigation measures in each alternative. Each alternative assumes that if any direct impacts may occur, mitigation measures will be made to the rail in order not to impact any freight rail operations. For example, temporary tracks, etc. This section identifies if the mitigation measure measures required to the rail will be categorized as no-impacts to severe impacts. Actual implementation costs are not depicted with a monetary value.

4.4 Parking Impacts

4.4.1 Impacts to parking underI-91

Currently there are two parking garages controlled by the Springfield Parking Authority, the North and South garages underneath the Interstate 91 viaduct between State Street and . Hampden Street. There approximately 1760 parking spaces available underneath I-91 in these two garages, approximately 1100 in the North garage and 660 in the South Garage. This section is being looked at to understand the impacts each alternative will have on these garages, whether or not they will be removed and/or maintained as many individuals in the downtown core area utilize these garages.

5. **Community Effects** - This set of criteria was developed to evaluate each alternatives ability to minimize temporary impacts to all stakeholders, while understanding and maximizing the future benefits of a completed project

5.1 Visual Impacts

5.1.1 Visual perception of I—91 Viaduct

The visual perception of the I-91 viaduct is being reviewed in this section to assess the vertical location and horizontal alignment in number of feet relative to activity center proxies. This is important to understand and evaluate, each alternative will influence a person's opinion on safety, connection to the Riverfront, aesthetics, etc. based on the location of the interstate, vertically and horizontally.

5.2 Construction Impacts

5.2.1 Construction Duration

The time estimated for the completion of construction of each alternative, typically the value/time frame will be in years for a potential project of this magnitude. This is primarily evaluated to understand what hardships or burdens, effects that will be placed on commuters and directly impacted business owners who utilize these facilities on a daily basis.

5.2.2 Lane closures and detours

In order to complete the construction of a project, certain mitigation measures are typically required, in this case lane closures and/or detours. Lane closure and detours maybe required to be implemented prior to construction depending on construction staging. Thus, closures and detours are intended to possibly start prior to construction and also for the duration of the project depending on construction stages and the means and methods of construction.

5.2.3 Maintenance of access to abutters

Many businesses, residents and visitors will be impacted by the construction of each of the alternatives. This section will assume the length (in years) of anticipated closures, temporary and/or permanent for each alternative. The length is determined by anticipated construction stages for different locals and also considers the all the impacts that are required for the construction of each alternative, for example mitigation measures needed prior to the start of the actual construction to the viaduct and other features in the overall alternative design. Access to a potential business and/ or residence maybe reduced and/or detoured for certain periods of time.

5.2.4 Disruption of local businesses

Many businesses and their visitors will be impacted by the construction of each of the alternatives. This section will assume the length (in years) of anticipated closures, temporary and/or permanent for each alternative. The length is determined by anticipated construction stages for different locals and also considers the all the impacts that are required for the construction of each alternative, for example mitigation measures needed prior to the start of the actual construction to the viaduct and other features in the overall alternative design. Access to a potential business maybe reduced and/or detoured for certain periods of time. This may have an effect on both vehicles and/or foot traffic.

5.3 Compatibility

5.3.1 Compatibility with local and regional transportation plans, strategies, conservation and development

The section takes into consideration regional and local transportation plans, strategies, conservation and development. Alternatives where reviewed to see if in fact that they

support or differentiate with plans and developments that the City of Springfield and surrounding communities.

5.3.2 Consistency with MassDOT goals, policies and directives

MassDOT currently was certain goals, policies and directives in which designs follow, particularly for transportation projects. An example would be to provide pedestrian and bicycle accommodations for all roadway projects. Each alternative will be reviewed on this section to determine if the conceptual design meets and follows the latest goals, policies and directives.

5.4 Environmental Justice Impacts

5.4.1 Availability of Jobs in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, the increase in availability of jobs within EJ areas is identical to the increase in jobs discussed in 4.2.1.

5.4.2 Availability of education and health services in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, the increase in availability of education and health services within EJ areas is identical to the increase in availability of those services discussed in 1.3.2.

5.4.3 Mobility impacts in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, mobility impacts within EJ areas are identical to the impacts discussed in 4.1.3.

5.4.4 Improve local access from urban core to riverfront in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, enhanced access from the urban core to riverfront in EJ areas is identical to the impacts discussed in 4.1.2.

5.4.5 Improve access to community resources and social services in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, improved access to community resources and social services in EJ areas is identical to the increase in availability of those services discussed in 1.3.2.

5.4.6 Improve access to retail and commerce in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, improved access to retail and commerce in EJ areas is identical to the impacts discussed in 1.3.3.

5.4.7 Environmental Impacts in EJ areas

Because the entirety of the Primary Study Area geography is classified as environmental justice areas, environmental impacts in EJ areas will be identical to the impacts identified in Section 3.2 (pending CTPS analysis results).