

**Benefit-Cost Analysis Supplementary
Documentation**

BUILD Grant Program

**Bangert Island Riverfront
Transformation Project**

City of Saint Charles, Missouri

May 18, 2020

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Benefit-Cost Analysis Supplementary Documentation

1. Executive Summary

Upon the banks of the Missouri River in St. Charles Missouri, William Clark and Meriwether Lewis set forth to discover the western frontier on May 21, 1804. The history and future of St. Charles is tied to the Missouri Riverfront. Historic Main Street in St. Charles served as the State Capitol from 1821 to 1826 and as a center for economic prosperity and growth for the developing nation. As the western development of this great nation occurred, development along the City of St. Charles riverfront remained isolated to approximately one quarter of the City's total riverfront due to impacts from a changing river and poor access to the rapidly developing new modes of transportation. Today St. Charles is prepared to unlock the potential of expanded riverfront development, and by doing so will create a center for economic activity for the St. Louis metropolitan region.

Requested BUILD funds are intended to provide the infrastructure necessary to provide equitable access to middle class jobs, spur economic activity and access to the diverse business community. The improvements will strengthen the urban core of St. Charles County and provide a foundation for the future growth and success of the region.

BUILD funding for the Bangert Island Riverfront Transformation project (Riverpointe) will enable St. Charles to:

- Transform 60 acres into high quality riparian area by building new water quality basins. These basins will also help reduce the downstream head elevation and provide volumetric relief to residents who live upstream of the project area on Crystal Springs Creek who experienced unprecedented flooding in 2011 and 2013 when localized strong storm events occurred in the area.
- Create stormwater control and protection from the Missouri River by directly raising over 100 acres of ground to remove it from flood risk, with an additional 182 acres adjacent to this project area indirectly impacted. Significant storm events in 2011, 2013, 2017, and 2019 caused flooding damage that impacted residents in and adjacent to the Bangert Island project area.
- Directly support the development of 6.7 million square feet of prime development ground located within the urban core of the fastest growing County within the State of Missouri (+10.3% since 2010). The project is expected to contribute to 4,000 new jobs with a \$1.5 billion economic impact. The project is expected to directly increase housing in the area by 840 households, with an additional 420 households expected to be built in the surrounding area.
- Create accessibility to the area by constructing approximately 8 lane miles of new roads, new signals, new street lighting, bicycle and pedestrian infrastructure, transit improvements, green infrastructure, reconstructing the existing inadequate roadway infrastructure located along Arena Parkway which runs the perimeter of the project.

- Build 14 miles of new sidewalks, 1.6 miles of new or improved trails, and 1.6 miles of new transit facilities. This will reduce driving and shift some of the demand to these other transportation modes.

A table summarizing the changes expected from the project (and the associated benefits) is provided below. Total undiscounted benefits are \$419 million.

Table ES-1: Summary of Infrastructure Improvements and Associated Benefits

Current Status, Problems to Be Addressed	Type of Impacts	Populations Affected by Impacts	Undiscounted Benefits (\$2018)	Section #
Stormwater control is a big issue with hundreds of acres in the floodplain and suspended solids impacting the environment. The area is not able to be developed without improvements.	Ecosystem Improvement: Creating High Quality Riparian Area	General Public, Property Owners	\$1.8 Million	7.1
	Property Value Increases from Improvements: Raising Land, Clearing Vegetation and Installing Streets & Sidewalks	Existing Property Owners in Development	\$6.7 Million	7.2
	Property Value Increases from Improvements: Relocating Utilities and Rezoning	Existing Property Owners in Development	Conservatively Excluded from BCA Results	
	Property Value Increases from Raising Land and Reducing Flooding to Residents	Existing Residents Adjacent to Development		
Residents travel relatively long distances in their cars due to the lack of nearby jobs, restaurants and recreation. Lack of quality bicycle and pedestrian facilities discourages multimodal travel. Smart Growth as a solution.	Vehicle Operating Cost Savings- Modal Diversion From Driving	Existing and New Users	\$200 Million	8.1
	Emissions Reduction - Modal Diversion From Driving	General Public	\$1.1 Million	8.2
	Crash Reduction Safety Benefit Savings- Modal Diversion From Driving	Existing and New Users	\$84.7 Million	8.3
	Crash Reduction Safety Benefit Savings- Traffic Circles, new sidewalks and bicycle trails	Existing and New Users	Conservatively Excluded from BCA Results	

Current Status, Problems to Be Addressed	Type of Impacts	Populations Affected by Impacts	Undiscounted Benefits (\$2018)	Section #
	Travel Time Savings- Modal Diversion From Driving	Existing and New Users	\$125 Million	8.4
	Reduced Mortality Benefit – Cyclists and Pedestrians	New Cyclists and Pedestrians		
	Trip Quality Benefits – Cyclists and Pedestrians	Existing and New Cyclists and Pedestrians	Conservatively Excluded from BCA Results	8.5
	Connectivity with Upgraded multimodal transit facilities	Existing and New Users		
	Jobs and Economic Impacts	Existing and New Residents	Conservatively Excluded from BCA Results	8.6

The period of analysis used in the estimation of benefits and costs corresponds to 35 years, including 5 years of construction and 30 years of operation. The total (undiscounted) project costs are \$63 million dollars according to the distribution shown in Table ES-2.

Table ES-2: Summary of Project Costs, Dollars of 2018

Cost Category	Undiscounted Project Cost
Capital Costs	\$65.6 Million
Residual Value	\$0.0 Million
Maintenance Costs	-\$1.1 Million
TOTAL COST	\$64.5 Million

A summary of the relevant data and calculations used to derive the benefits and costs of the project are shown in the Benefit-Cost Analysis (BCA) model (in dollars of 2018) also included with this application. Based on the analysis presented in the rest of this document, the project is expected to generate \$111 million in discounted net benefits and \$53.8 million in discounted

costs, using a 7 percent real discount rate.¹ Therefore, the project is expected to generate a Net Present Value of \$57 million and a Benefit/Cost Ratio of 2.05.

In addition to the monetized benefits, the project would generate benefits that are difficult to quantify. A brief description of those benefits is provided below.

Safety

The addition of traffic circles, modern signals, turning movement changes, widened and continuous sidewalks, and improved bike facilities will improve safety in the corridors.

Economic Competitiveness

Riverpointe will greatly increase the economic competitiveness by providing greater connectivity along the corridor and into surrounding areas. Improvements to safety, aesthetics (e.g., bike trails and ecosystem changes), and accessibility will open up new opportunities for development and job creation. This project is expected to support \$1.5 billion of economic impact and 4,000 new jobs.

Environmental Sustainability

Riverpointe will provide environmental protection along the corridor by mitigating stormwater runoff, providing parks and green spaces that will minimize the urban heat island, and promoting transit and non-motorized transportation options.

Quality of Life

Riverpointe will improve quality of life in the area by increasing transportation options, improving safety along the corridor, enhancing the existing streetscape, and providing opportunities for new development.

Innovation

Riverpointe will help Saint Charles not only to create a mixed use development from an underutilized area that will protect the surrounding area from flooding, but also reduce the long term demand for roadways with Smart Growth for both existing and future users.

Partnership

The City of Saint Charles has formed partnerships across the City and State to bring this project to fruition. Partnerships on the project include private developers and future tenants, US Army Corps of Engineers, the State of Missouri, St. Charles County, community groups, the regional planning agency, business groups, and a vast amount of political support from our elected officials. Funding includes not only grants and state cost shares, but also local tax initiatives (e.g. Proposition P) as well as private partnerships with national investment grade tenants.

Large and small business alike support the Bangert Island Riverfront Transformation Project including the Missouri Chamber of Commerce, the Missouri State Director of Economic Development Rob Dixon, Ameristar Casino, Cullinan Properties, Bike Stop Cafe, TR Hughes

¹ Maintenance Costs/ State of Good Repair are considered as a benefit and subtracted from net discounted benefits. As the value is negative, this is actually a positive benefit.

Development, Home Builders Association of St. Louis & Eastern Missouri, OPO Startups, Millstone Properties, Cushman Wakefield, and Drury Hotels as it will provide a catalyst for continued economic growth in the region.

2. Introduction

This document provides detailed technical information on the economic analyses conducted in support of the grant application for the Bangert Island Riverfront Transformation project (Riverpointe).

Section 3, Methodological Framework, introduces the conceptual framework used in the BCA. Section 4, Project Overview, provides an overview of Riverpointe, including a brief description of existing conditions and proposed alternatives; a summary of cost estimates and schedule; and a description of the types of effects that the project is expected to generate. Section 5, General Assumptions, discusses the general assumptions used in the estimation of project costs and benefits, while estimates of travel demand and traffic growth can be found in Section 6, Demand Projections. Specific data elements and assumptions pertaining to the long-term outcome selection criteria are presented in Section 7, Benefits Measurement, Data and Assumptions, along with associated benefit estimates. Estimates of the project's Net Present Value (NPV), its Benefit/Cost ratio (BCR) and other project evaluation metrics are introduced in Section 8, Summary of Findings and BCA Outcomes. Next, Section 9, BCA Sensitivity Analysis, provides the outcomes of the sensitivity analysis. Additional data tables are provided within the BCA model including annual estimates of benefits and costs to assist the U.S. Department of Transportation (USDOT) in its review of the application.²

3. Methodological Framework

The BCA conducted for this project includes monetized benefits and costs measured using USDOT guidance, as well as the quantitative and qualitative merits of the project. A BCA provides estimates of the benefits that are expected to accrue from a project over a specified period and compares them to the anticipated costs of the project. Costs include the resources required to develop the project. The costs of maintaining the new or improved asset over time are considered dis-benefits in this analysis. Total estimated benefits are based on the projected impacts of the project on both users and non-users of the facility, valued in monetary terms.³

While BCA is just one of many tools that can be used in making decisions about infrastructure investments, USDOT believes that it provides a useful benchmark from which to evaluate and compare potential transportation investments.⁴

The specific methodology developed for this application was developed using the BCA guidance developed by USDOT and is consistent with the BUILD program guidelines. In particular, the methodology involves:

- Establishing existing and future conditions under the Build and No-Build scenarios;

² The Excel-based BCA model is provided separately as part of the application.

³ USDOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020.

⁴ Ibid.

- Assessing benefits with respect to each of the merit criteria identified in the Notice of Funding Opportunity (NOFO);
- Measuring benefits in dollar terms, whenever possible, and expressing benefits and costs in a common unit of measurement;
- Using USDOT guidance for the valuation of travel time savings, vehicle operating costs, safety benefits, and reductions in air emissions, while relying on industry best practice for the valuation of other effects;
- Discounting future benefits and costs with the real discount rate recommended by USDOT (7 percent); and
- Conducting sensitivity analyses to assess the impacts of changes in key estimating assumptions.

4. Project Overview

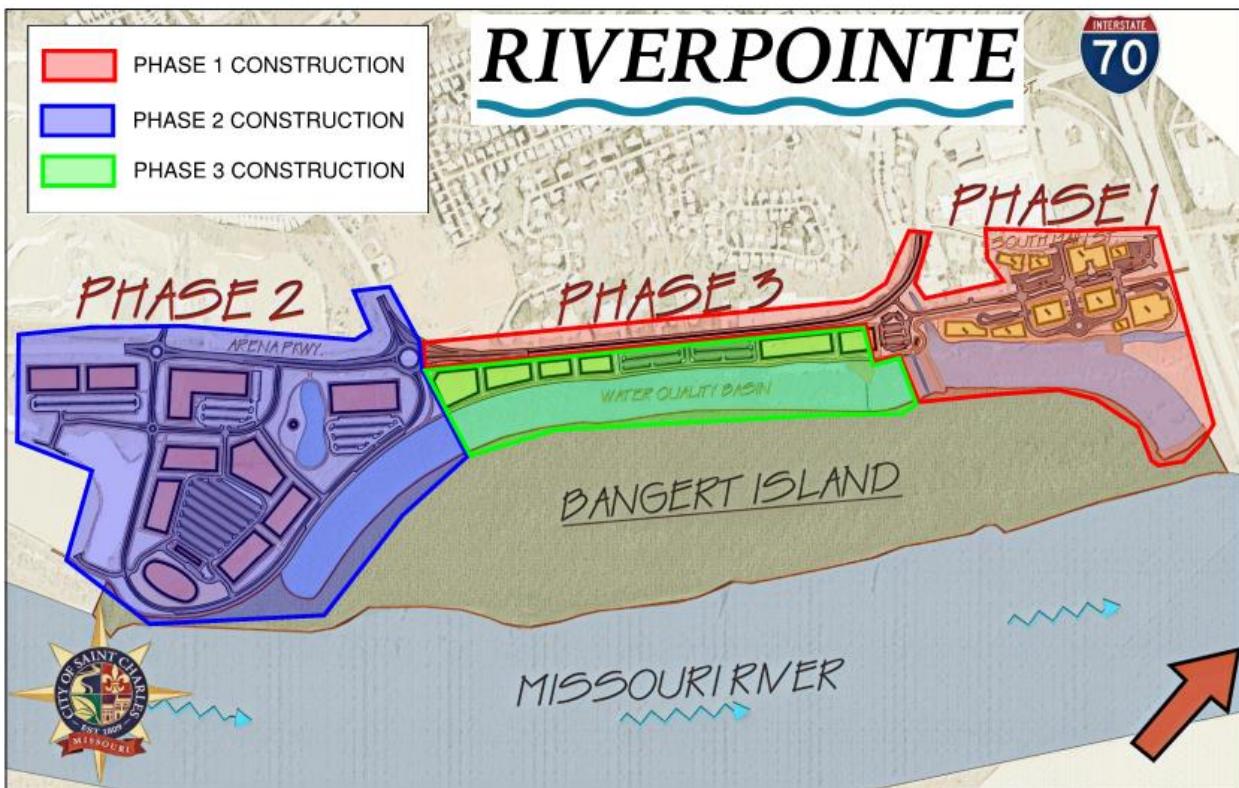
The City of Saint Charles' history and economic vibrancy is forever linked to its river roots. Yet today, approximately a quarter of the City's Riverfront along Bangert Island sits blighted and underutilized. Flooding frequently damages properties that are adjacent to the island. Missouri River control structures, built in the 1930s and 1940s, caused the channel separating the properties from the island to fill with sediment. The Bangert Island Riverfront Transformation Project will recycle the channel spoils to raise the acreage adjacent to the island above the 500-year flood elevation, creating both an aquatic resource and economically viable development sites.

Streets of St. Charles encompass 27-acres of mixed-use development area incorporating retail, entertainment, and residences. It features a town center design with a neighborhood atmosphere. Located in the City of St. Charles in the St. Louis metropolitan area, it has become a destination for dining, shopping, entertainment, and a place to live and work. Streets of St. Charles is bordered by I-70, South 5th Street, South River Road and South Main Street, and has become a magnet that the City hopes to leverage. The Streets of St. Charles project also borders the proposed Project. It will supplement this unique development by bringing additional economic benefits to the community.

This development will occur along Arena Parkway between US 70 (to the North) and Family Area, property owned by the County of Saint Charles. The project will include protecting from stormwater and improving transportation through Smart growth impacts in three phases (Figure 1). While the accompanying excel file includes values for each of the phases, the expectation in this analysis is all phases will be completed at the same time.

If the project were not to move forward, development is not expected. This is supported by various letters received from future tenants, which stated directly that "in the simplest of terms, this investment by USDOT in the transportation infrastructure of the development will [...] result in countless jobs." The City has already garnered commitments for 825,000 square feet of mixed use development and 2,600 jobs in the first 16 acres of development.

Figure 1: Phases of Development



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- Create stormwater control and protection from the Missouri River by directly raising over 100 acres of ground to remove it from flood risk, with an additional 182 acres adjacent to this project area indirectly impacted. Significant storm events in 2011, 2013, 2017, and 2019 caused flooding damage that impacted residents in and adjacent to the Bangert Island project area.
- Directly support the development of 6.7 million square feet of prime development ground located within the urban core of the fastest growing County within the State of Missouri (+10.3% since 2010). The project is expected to contribute to 4,000 new jobs with a \$1.5 billion economic impact. The project is expected to directly increase housing in the area by 840 households, with an additional 420 households expected to be built in the surrounding area.
- Create accessibility to the area by constructing approximately 8 lane miles of new roads, new signals, new street lighting, bicycle and pedestrian infrastructure, transit

improvements, green infrastructure, reconstructing the existing inadequate roadway infrastructure located along Arena Parkway which runs the perimeter of the project.

- Build 14 miles of new sidewalks, 1.6 miles of new or improved trails, and 1.6 miles of new transit facilities. This will reduce driving and shift some of the demand to these other transportation modes.

4.1 Base Case and Alternatives

This BCA measures costs and benefits of the proposed Project against a baseline (also called the “base case” or a “no build” case). The baseline represents an assessment of the way the world would look should this Project not receive the requested BUILD Discretionary Grant funding. The redevelopment area in the baseline, for the most part, will resemble the present state. However, the BCA analysis factors in projected changes (e.g., baseline economic growth, increased traffic volumes, completion of already planned and funded projects) that would occur absent the proposed Project.

Furthermore, the baseline assumes the continuation of reasonable and sound management practices. For example, the baseline scenario assumes continued maintenance on the street network and other public infrastructure systems by the local government. The baseline is also realistic in terms of transportation assumptions. For instance, most drivers, pedestrians, and bicyclists will continue to follow their current routes absent the proposed Project. The proposed Project has independent utility. It has transportation value in the absence of the other components. All of the costs and impacts of the Project form the basis of the estimates of benefits and costs, as it would be incorrect to claim benefits for the entire project but only count the costs associated with the infrastructure improvement project to be funded by the BUILD Discretionary Grant. It is also part of a larger urban renewal and smart growth project. For example, it is adjacent to and will provide synergy with the highly successful Streets of St. Charles project, as well as The Family Arena to the south and west and downtown St. Charles, the Lewis and Clark Boat House and Nature Center, and casino, to the north and east. The City of St. Charles may eventually build this project absent BUILD funding. However, the probability of that occurring and the possible length of delay is unknown. Such a delay would only postpone both benefits and costs. This would result in a similar benefit-cost ratio with fewer net benefits. The lost benefits - added emissions, lost-time, and accident costs - will not be recovered. Moreover, this Project will aid in demonstrating the compelling benefits of this innovative smart growth development. Therefore, this BCA does not include a “now versus later” comparison.

4.2 Types of Impacts

The BCA measured impacts on users in the immediate and surrounding areas, which include existing and new residents as well as property owners. The benefits are two of two primary types: Stormwater Control and Smart Growth.

The project will generate Stormwater Control benefits by raising land out of the flood plain, reducing flooding and creating high quality riparian area:

Ecosystem Benefits are economic benefits stemming from infrastructure modifications that improve water quality, create riparian lands, and increase recreation and tourism. These

benefits to society are detailed in a FEMA report, cited below in subsections of this report, and discussed in the Ecosystem Benefits section. They include:

- | | |
|--|---------------------------|
| 1. Aesthetic Value | 11. Food Provisioning |
| 2. Air Quality | 12. Habitat |
| 3. Biological Control | 13. Pollination |
| 4. Biodiversity | 14. Recreation/ Tourism |
| 5. Climate Regulation | 15. Storm Water Retention |
| 6. Erosion Control | 16. Nutrient Cycling |
| 7. Flood Hazard Reduction | 17. Water Filtration |
| 8. Hurricane Storm Hazard Risk Reduction | 18. Soil Erosion |
| 9. Water Supply | 19. Carbon Storage |
| 10. Fiber/Raw Materials | 20. Soil Formation |

Property Value Benefits resulting from creating new land value through increasing accessibility to the land while removing it from the floodplain.

The majority of the project's benefits are due to increasing Smart Growth Impacts through development. These are economic benefits resulting from locating workplaces, shopping, dining, and recreation together and closer to underserved populations. The project will provide both new users (households to be built both in the development [direct development] as well as the surrounding areas [indirect development]) and existing users with the opportunity to travel much shorter distances to these opportunities. New pedestrian, bicycle and mass transit facilities will allow users to reduce their dependence on their personal vehicles. Upgraded safety features will reduce the number of accidents. The Development and Smart Growth Impacts Benefits include:

- 1. Operating Cost Savings**
- 2. Environment / Reduced Emissions**
- 3. Safety / Prevented Accidents**
- 4. Travel Time Savings**
- 5. Health Improvements and Connectivity**
- 6. Job and Economic Impacts**

4.3 Project Cost and Schedule

The City of St. Charles engineering staff developed capital costs for the Project. Details are provided separately. The total capital cost of the full project is estimated to be \$64.1 million in 2018 dollars and is expected to be spent between the years 2018 and 2022 (see excel file for breakdown by phase and year). While there are maintenance costs for the project, the costs are less than the No Build condition, as the roadways are in need of major repair. Costs considered include routine resurfacing and maintenance. After subtracting the Build condition maintenance costs, the maintenance benefits \$1.1 million in \$2018 undiscounted (see excel file for breakdown by phase and year). The project team has prepared a schedule of planning, construction and implementation. The project already began in 2018 and requires five years to complete construction.

4.4 Effects on Selection Criteria

The main benefit categories associated with the project are mapped into the seven merit criteria set forth by USDOT in the table below

Table 1: Benefit Categories and Expected Effects on BUILD Merit Criteria

BUILD Merit Criteria	Benefit or Impact Categories	Description	Monetized	Quantified	Qualitative
Safety	Accident Reduction Benefits from Smart Growth	The number of accidents will be reduced by modal transit shifts.	Yes	Yes	Yes
	Improved safety with traffic circles and separation of pedestrians and cyclists	Three intersections will be replaced with traffic circles leading to reduction in accidents. New sidewalks and bike trails will reduce the need for pedestrians and cyclists to walk and ride in or in very close proximity to mixed traffic. The improved walking and cycling environment will generate a level of security in traveling in the study area.	No	No	Yes
Economic Competitiveness	Travel Time Savings for Vehicles from Smart Growth	Travel time savings will be realized from driving less.	Yes	Yes	Yes
	Reduced Auto Use	As some residents shift from driving to using the new and improved active transportation facilities, we will see a reduction in the number of automobile drivers, in turn leading to a reduction in costs to operate and maintain the vehicle.	Yes	Yes	Yes
	Property Values	Removing land from the flood plain and adding transit infrastructure increases property values.	Yes	Yes	Yes
	Economic Development	Rezoning the area and adding utilities will encourage commercial and residential development.	No	Yes	Yes

BUILD Merit Criteria	Benefit or Impact Categories	Description	Monetized	Quantified	Qualitative
Environmental Sustainability	Emissions Reduction – Smart Growth	Reductions in greenhouse gas and air pollutant emissions due to changes in auto use will result as some people opt to walk or bike rather than drive.	Yes	Yes	Yes
	Ecosystem Improvement	Creating high quality riparian land will provide benefits to the environment and general public	Yes	Yes	Yes
State of Good Repair	Pavement maintenance savings	Some people currently walk or cycle to access their jobs, schools, and other destinations. It is expected that the pedestrian and cyclist facility improvements will induce some automobile drivers to utilize the new and improved facilities, reducing pavement wear and tear on existing roadways.	No	No	No
Quality of Life	New Cyclist and Pedestrian Health Benefit	People not currently biking or walking will be induced to do so as a result of the project. Increased physical activity provides a health benefit.	No	No	Yes
	New and Existing Cyclist and Pedestrian Mobility Benefit	Cyclists and pedestrians will benefit from the improved bike trails and sidewalks which will also increase connectivity.	No	No	Yes
Innovation	Benefits of project as they relate to these criteria are described in the application.		No	No	Yes
Partnership					

5. General Assumptions

The BCA measures benefits against costs throughout a period of analysis beginning at the start of construction and including 30 years of operations.

The monetized benefits and costs are estimated in 2018 dollars with future dollars discounted in compliance with BUILD requirements using a 7 percent real rate. A sensitivity testing at 3 percent is also provided in Section 10.

The methodology makes several important assumptions and seeks to avoid overestimation of benefits and underestimation of costs. Specifically:

- Input prices are expressed in 2018 dollars;
- The period of analysis begins in 2018 and ends in 2052. It includes project development and construction years (2018-2022) and 30 years of operations, beginning in 2023;
- A constant 7 percent real discount rate is assumed throughout the period of analysis. A 3 percent real discount rate is used for sensitivity analysis;
- Opening year demand is assumed to be fully realized after construction is complete; and
- The results shown in this document correspond to the effects of the full Build alternative, which includes all three phases with improvements described previously.

6. Schedule of Benefit Impacts and Population

This section of the technical documentation discusses who is impacted by the project under the two primary benefits: stormwater control (e.g. acreage owned property owners and the general public) and transportation infrastructure improvement benefits/Smart Growth (e.g. population projections in the development and surrounding areas).

The stormwater control benefits will occur as soon as the project is complete as the stormwater controls measures will all be in place. However, transportation infrastructure benefits are not only dependent on the transportation infrastructure, but also people who will come and their destinations.

There is already a sizable population ready to be served by this project, with approximately 100,000 people, 10,000 students, and more than 40,000 employees within walking (1/4 mile) and biking (3 miles) distance. It is also located adjacent to Interstate 70 which carries approximately 1 million vehicles per week.

To be conservative, this analysis only considered households that were within a census tract where the majority of the census tract was within 2 miles of the project and focused on the area directly around the US70 (Figure 2). These households were divided into Census Tract (CT) Group 1 and CT Group 2, CT Group 1 consists of census tracts with part of Riverpoint (Table 2).

Table 2: Census Tract Groups

US Census Tract	Households	Type
Census Tract 3110.01	1,683	CT Group 1
Census Tract 3110.03	1,522	CT Group 1
Census Tract 3110.04	2,343	CT Group 1
Census Tract 3105.01	1,615	CT Group 2
Census Tract 3105.02	1,196	CT Group 2
Census Tract 3104	963	CT Group 2
Census Tract 3103.02	1,524	CT Group 2

Figure 2: Census Tracts



In addition, this project will be creating additional housing, through direct and indirect project development. Conservatively, Riverpointe will include 850 new households of direct project development, with an additional 420 households developed in the surrounding area.

Regardless of the close by population, transportation infrastructure must link to destinations for its use. The Smart Growth benefits will only occur once development is finished. Table 3 provides the development schedule, with 10 percent of the development expected to occur in the first year. Thus, transportation and development related benefits are phased in over time. To be conservative, the analysis does not consider commercial trucks.

Table 3: Development Schedule and Households by Phase

Year	Phase 1	Phase 2	Phase 3
2023	10%	10%	10%
2024	44%	0%	0%
2025	0%	0%	0%
2026	7%	0%	0%
2027	0%	44%	0%
2028	25%	7%	0%
2029	0%	0%	0%
2030	14%	25%	0%
2031	0%	0%	0%
2032	0%	14%	10%
2033	0%	0%	0%
2034	0%	0%	46%
2035	0%	0%	0%
2036	0%	0%	34%
Households - Direct Project Development	300	540	0
Households - Indirect Project Development	150	270	0
Households - CT Group 1	2,051	1,446	2,051
Households - CT Group 2	1,854	1,589	1,854

7. Stormwater Control Improvement Benefits

This section describes the measurement approach used for each benefit associated with stormwater control improvements and provides an overview of the associated methodology, assumptions, and estimates.

7.1 Ecosystem Improvement

Ecosystem benefits are those that arise due to infrastructure modifications that improve water quality, create riparian lands, and increase recreation and tourism. Stormwater control and an improved ecosystem enhance environmental sustainability in the area. One of USDOT's goals is to advance more sustainable methods of transportation to reduce adverse impacts and guarantee that future generations will be able to experience the same or better standards of living and mobility.⁵ According to USDOT, sustainable transportation focuses on environmental impacts to decrease emissions of greenhouse gases and other pollutants, advance the national interest in increasing energy efficiency, reduce our dependence on fossil fuels, and build livable communities. These goals seek to enhance Quality of Life as described in the BUILD NOFO. In addition, the Federal Emergency Management Agency (FEMA) allows consideration of Environmental Benefits in its infrastructure improvement projects.⁶ As the Riverpointe Project seeks to reduce flooding issues in St. Charles, these benefits have been included in this analysis. The project will create additional riparian land that will allow for and result in increased tourism and recreation while also enhancing biodiversity and creating value for the public.

7.1.1 METHODOLOGY

The Riverpointe Project includes the conversion of existing lands among various use types. The conversion of this land from wetlands to usable riparian lands provides benefits to the local ecosystem and to residents and visitors. The methodology to estimate benefits associated with the ecosystem improvement relies upon the environmental values of different land use classes and an understanding of the vision of the project. The analysis utilizes these land values and anticipated acreage conversions to estimate the value of the land converted from one use type to another.

While FEMA provides environmental values for five types of land, only two different types are relevant for this project. They are:

- **Wetlands** - a wetland is an area of land whose soil is either permanently or seasonally saturated with moisture. This is the existing condition for much of the land under evaluation in this project.

⁵ <https://www.fhwa.dot.gov/policy/2010cpr/chap11.cfm#body>

⁶ US Department of Homeland Security, "Consideration of Environmental Benefits in the Evaluation of Acquisition Projects under the Hazard Mitigation Assistance (HMA) Programs," FEMA Mitigation Policy – FP-108-024091, June 18, 2013.

- **Riparian Areas** – land located along a water feature such as a stream, creek, or river that is allowed to revert to a natural state or be converted into park-like settings. These areas provide a buffer to improve water quality entering the stream and reducing erosion potential.

The Riverpointe Project will convert 60 acres of existing wetland to riparian areas. To avoid double counting of land values, only the portion of the converted acreage that is not going to be developed for other uses is considered in this calculation.

7.1.2 ASSUMPTIONS

The assumptions used in the estimation of economic competitiveness benefits are summarized in the table below.

Table 4: Monetary Benefit per Acre per Year, 2018 Dollars

Environmental Benefit	Monetary Benefit per Acre per Year (\$, 2018)				
	Agricultural Lands	Riparian Area	Wetland	Green Space	Forests
Aesthetic Value	\$58	\$654	\$1,937	\$1,827	\$0
Air Quality	\$0	\$242	\$0	\$230	\$254
Biological Control	\$16	\$184	\$0	\$0	\$0
Biodiversity	\$0	\$0	\$127	\$0	\$0
Climate Regulation	\$0	\$230	\$241	\$15	\$445
Erosion Control	\$0	\$12,883	\$0	\$73	\$70
Flood Hazard Reduction	\$0	\$4,509	\$0	\$0	\$0
Hurricane Storm Hazard Risk Reduction*	\$0	\$0	\$0	\$0	\$0
Water Supply	\$0	\$0	\$246	\$0	\$0
Fiber/Raw Materials	\$0	\$0	\$631	\$0	\$0
Food Provisioning	\$0	\$686	\$1,507	\$0	\$0
Habitat	\$0	\$940	\$185	\$0	\$0
Pollination	\$1,014	\$0	\$0	\$326	\$0
Recreation/ Tourism	\$0	\$17,081	\$544	\$6,038	\$0
Storm Water Retention	\$0	\$0	\$6,004	\$330	\$0
Nutrient Cycling	\$0	\$0	\$594	\$0	\$0
Water Filtration	\$0	\$4,785	\$823	\$0	\$0
Soil Erosion	\$143	\$0	\$0	\$0	\$0
Carbon Storage	\$58	\$0	\$0	\$0	\$0
Soil Formation	\$123	\$0	\$0	\$0	\$0
Total	\$1,412	\$42,195	\$12,839	\$8,839	\$769

*Not Included

7.1.3 BENEFIT ESTIMATES

The Ecosystem Improvement benefits amount to \$1.3 million, when discounted according to a 7 percent discount rate.

Table 5: Estimates of Ecosystem Improvement Benefits, 2018 Dollars

Variable Name	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Ecosystem Benefits	\$1,761,000	\$1,256,000	\$1,519,000

7.2 Property Value Increases

Property value benefits are those that arise due to infrastructure modifications that directly improve the land value due to making them more attractive or accessible. It is important to avoid double counting benefits associated with both the ecosystem improvement and impacts on transportation. This section focuses on the Project's impact from raising the land above the flood plain and not any additional value due to future development.

7.2.1 METHODOLOGY

The research team projected changes in real estate value based on expert opinion and comparable projects. The proposed project will redevelop existing underdeveloped land in the floodplain raising it out of the floodplain so it is suitable for development. The project will provide developable land in an area with employment opportunities, dining, recreation, and shopping. It features biking and hiking trails including the Katy Trail and Bangert Island's trail system. It will be very close to, and have excellent access to, downtown Saint Charles.

The methodology the analysis employed was to develop an inventory of parcels along with their acreage, to assign a value per acreage after development of the properties, and to assign to each property an assumed timeframe for development.

To be conservative, the analysis only considers the impact of lifting the acreage out of the floodplain and does not include impacts from rezoning or relocating utilities along the road, although the capital costs for this work are included. In addition, the impacts on surrounding areas that are indirectly impacted are not included. **The sensitivity analysis does consider these factors as this is the anticipated future outcome.**

7.2.2 ASSUMPTIONS

The assumptions used in the estimation of property value benefits are summarized in the table below.

Table 6: Assumptions Used in the Estimation of Property Value Benefits

Variable Name	Unit	Value	Source/Notes
Removed from Floodplain	Acres	120	Development Plan
Indirectly Impacted	Acres	182	Development Plan
Pre Land Improvement, East of Katy Trail	\$/Sf	\$0.29	Pg 48 of 12/4/19 appraisal of 2000 S. River Road assuming existing conditions
Pre Land Improvement, West of Katy Trail	\$/Sf	\$1.18	Pg 47 of 12/4/19 appraisal of 2000 S. River Road assuming existing conditions
Post Land Improvement w/o Utilities	\$/Sf	\$1.97	pg 3 of 5/12/20 appraisal of 2000 S. River Road assuming filled to street grade, raised out of 500-year flood plain, streets & sidewalks in place, and all vegetation cleared.
Post Land Improvement w/ Utilities	\$/Sf	\$1.97	No additional appraisal provided
Post Land Improvement w/ Utilities & Rezoning	\$/Sf	\$12.77	Page 1 of 7/6/18 appraisal of South Main St at Lombard St. assuming filled to street grade, raised out of 500-year flood plain, streets & sidewalks in place, and all vegetation cleared. Utility, zoning, and other development improvements are also included.

7.2.3 BENEFIT ESTIMATES

Property value benefits amount to \$4.8 million, when discounted according to a 7 percent discount rate.

Table 7: Estimates of Property Value Benefits, 2018 Dollars

	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Property Values	\$6,730,000	\$4,798,000	\$5,805,000

8. Smart Growth Benefit Impacts

Smart Growth, as described by the US Environmental Protection Agency (EPA), includes a range of development and conservation strategies designed to protect health and the natural environment.⁷ The policies are designed to make communities stronger, more attractive, and more socially diverse. For this project, smart growth covers the economic benefits resulting from locating workplaces, shopping, dining, and recreation together and closer to underserved populations. This section describes the smart growth economic benefits envisioned from the project. They include:

- Operating Cost Savings
- Environment/Reduced Emissions
- Safety/Prevented Accidents
- Travel Time Savings
- Health Improvements & Connectivity
- Job and Economic Impacts

⁷ About Smart Growth. US Environmental Protection Agency. <https://www.epa.gov/smartgrowth/about-smartgrowth#smartgrowth>. Accessed 5/14/2020

The general assumptions used in the estimation of smart growth impacts are described below:

The analysis derived a general estimate of Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) reduction based on a Strategic Highway Research Program report entitled the "Effect of Smart Growth Policies on Travel Demand"⁸ with 50% modal shift of Pedestrian Hours Traveled (PHT) and calculated 6% modal shift of Pedestrian Miles Traveled (PMT) to pedestrians, cyclists and mass transit. This conservative approach lead to generally 30% VMT reduction, 30% VHT reduction, 1.8% PMT increase and 15% PHT increase. New households from indirect development and located in CT Group 1 are expected to have half of these changes. CT Group 2 has 25% of these changes, except for the modal shift to PHT (50% of the direct development).

Table 8 includes the VMT, PMT, VHT and PHT for both No Build and Build. The average No Build household is assumed to have 42.2 VMT and 1.1 VHT per day (see spreadsheet for sources) and 1 PMT and 0.1 PHT per day.

Table 8: Values per Household

Variables	Direct	Indirect	CT Group 1	CT Group 2
No Build VMT (Vehicle)	42.2	42.2	42.2	42.2
No Build PMT (Other Modes)	0.4	0.4	0.4	0.4
Build VMT (Vehicle)	29.8	36.0	36.0	39.1
Build PMT (Other Modes)	1.7	1.0	1.0	1.0
No Build PHT (Vehicle)	1.8	1.8	1.8	1.8
No Build PHT (Other Modes)	0.1	0.1	0.1	0.1
Build PHT (Vehicle)	1.2	1.5	1.5	1.6
Build PHT (Other Modes)	0.3	0.2	0.2	0.2

8.1 Vehicle Operating Cost Savings

The proposed project will contribute to enhancing economic competitiveness through multi-modal cost savings across the study area. The planned development is expected to lead to a reduction in automobile usage, which will in turn result in reduced operating costs.

8.1.1 METHODOLOGY

Vehicle operating cost savings are quantified as the reduction in vehicle miles traveled projected as a result of project improvements compared to the increase in miles traveled on other modes (e.g. bicycles). This measure of miles averted is monetized according to parameters recommended in USDOT BCA Guidance.

8.1.2 ASSUMPTIONS

The assumptions used in the estimation of economic competitiveness benefits are summarized in the table below.

⁸ Maren Outwater, Colin Smith, Jerry Walters, Brian Welch, Robert Cervero, Kara Kockelman, J. Richard Kuzmyak, *Effect of Smart Growth Policies on Travel Demand*, Strategic Highway Research Program, Transportation Research Board, Washington, D.C., 2014

Table 9: Assumptions Used in the Estimation of Vehicle Operating Cost Savings Benefits

Variable Name	Unit	Value	Source
Vehicle Operating Cost – Light Duty Vehicles	\$/VMT	\$0.41	USDOT, <i>BCA Guidance for Discretionary Grant Programs</i> , January 2020.
Operating Costs – non-vehicular	\$/PMT	\$0.10	http://bikearlingtonforum.com/showthread.php?123-Cost-per-Mile-of-Biking

8.1.3 BENEFIT ESTIMATES

Vehicle operating cost savings benefits amount to \$51 million, when discounted according to a 7 percent discount rate.

Table 10: Estimates of Vehicle Operating Cost Savings Benefits, 2018 Dollars

	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Vehicle Operating Cost Savings	\$199,968,000	\$51,110,000	\$106,648,000

8.2 Environmental Sustainability

Reducing the number of vehicles on the road will contribute to environmental sustainability by reducing vehicle emissions. Emissions reductions benefits are expected to be realized as a portion of current drivers switch to active transportation modes, including biking, as a result of the project improvements.

8.2.1 METHODOLOGY

Emissions rates for motor vehicles, in grams per mile, were estimated using the EPA MOVES model. These per-mile emissions rates for five distinct pollutants—CO₂, VOC, NO_x, SO₂, and PM—were multiplied by change in Vehicle Miles Traveled (VMT) to calculate total change in emissions volumes. Reduced emissions were then monetized according to USDOT BCA Guidance.

8.2.2 ASSUMPTIONS

The assumptions and parameters used in the estimation of environmental sustainability benefits are summarized in the table below.

Table 11: Assumptions Use in the Estimation of Environmental Sustainability Benefits

Variable Name	Unit	Value	Source
Value of Reduced Emissions: CO ₂	\$ per metric ton	\$1.00 - \$2.00	USDOT, <i>BCA Guidance for Discretionary Grant Programs</i> , January 2020.
Value of Reduced Emissions: VOCs		\$2,313	
Value of Reduced Emissions: NOx		\$9,473	

Variable Name	Unit	Value	Source
Value of Reduced Emissions: PM2.5		\$426,611	
Value of Reduced Emissions: SO ₂		\$55,185	
Emissions Factor: CO ₂	grams per mile	316.4	EPA MOVES Database
Emissions Factor: VOCs		0.289	
Emissions Factor: NOx		0.610	
Emissions Factor: PM		0.064	
Emissions Factor: SO ₂		0.033	
Annual Days	days per year	365	

8.2.3 BENEFIT ESTIMATES

The project improvements are estimated to decrease air contaminant emissions over the study period, as drivers divert to biking and vehicle trips are made more efficient with the improvements on the roadway. This benefit is estimated to be approximately \$0.3 million when discounted by seven percent.

Table 12: Estimates of Environmental Sustainability Benefits, 2018 Dollars

	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Emissions Reduction Benefit	\$1,119,000	\$279,000	\$591,000

8.3 Safety

Investment in the corridor as a result of the Riverpointe project will enhance safety through the implementation of new roundabouts along the corridor. The modal shift and anticipated reduction in vehicle miles traveled is also expected to have an impact on the overall number of crashes in the corridor. Relocating the Katy Trail to avoid a roadway crossing, enhancing sidewalks and wider on-street bike lanes along the corridor will improve safety for all users.

8.3.1 METHODOLOGY

Accident reduction benefits generated by the improved corridor are estimated for this project based on the reduction in vehicle miles traveled and USDOT-recommended values for monetizing safety benefits. To estimate safety benefits, avoided crashes are multiplied by estimates of the economic cost of crashes per USDOT's Guidance.

Five years of crash data for the safety analysis was obtained for Missouri and St. Charles County. Data were extracted from the Missouri State Highway Patrol Statistical Analysis Center and the Missouri Statewide Traffic Accident Record System (STARS) from January 2016 through December 2019.

The No-Build crash predictions were based on the historic crash data and vehicular traffic in the area. The Build scenario includes a reduction in overall vehicle miles traveled and a modal shift to bike and pedestrian uses. This reduction in vehicle miles traveled leads to a reduction in overall crashes on a per VMT basis. While it is anticipated that the new road infrastructure will further reduce crash rates, specific crash modification factors were not applied and the resulting improvement in safety is likely a conservative estimate.

8.3.2 ASSUMPTIONS

The assumptions used in the estimation of safety benefits are summarized in the table below and is consistent with USDOT BCA Guidance.

Table 13: Assumptions Used in the Estimation of Safety Benefits

Variable Name	Unit	Value	Source
Fatalities – auto	Per million VMT	0.009	Missouri Statewide Traffic Accident Records System
Injuries– auto		0.672	
Property damage only – auto		1.914	
Fatalities– non-vehicular	\$ per fatality or injury	0.027	https://bicycleuniverse.com/bicycle-safety-almanac/; https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/810968
Injuries– non-vehicular		0.250	
Property damage only – non-vehicular		1.914	
Value of Averted Fatality (K)		\$9,600,000	
Value of Averted Incapacitating Injury (A)		\$459,100	
Value of Averted Non-Incapacitating Injury (B)		\$125,000	
Value of Averted Possible Injury (C)		\$63,900	
Value of Averted No Injury (O)	\$ per vehicle	\$3,200	USDOT, <i>BCA Guidance for Discretionary Grant Programs</i> , January 2020.
Value of Averted Property Damage		\$4,300	

8.3.1 BENEFIT ESTIMATES

Safety benefits are generated by the improved infrastructure in the Riverpointe Project area. Crash reduction benefits generated by improved intersections, signaling, and other improvements are significant, estimated at \$21.7 million over the 30-year period, when discounted at seven percent.

Table 14: Estimates of Safety Benefits, 2018 Dollars

	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Crash Reduction Benefit	\$84,691,000	\$21,652,000	\$45,173,000

8.4 Time Savings

The proposed project will contribute to enhancing economic competitiveness through multi-modal time savings across the study area.

8.4.1 METHODOLOGY

Travel time savings are quantified as the reduction in aggregate vehicle delay projected as a result of project improvements. This measure of delay hours averted is monetized according to parameters recommended in USDOT BCA Guidance.

8.4.2 ASSUMPTIONS

The assumptions used in the estimation of economic competitiveness benefits are summarized in the table below.

Table 15: Assumptions Used in the Estimation of Time Savings Benefits

Variable Name	Unit	Value	Source
Average Vehicle Occupancy – All Travel	passengers per vehicle	1.67	USDOT, BCA Guidance for Discretionary Grant Programs, January 2020.
Value of Time – Automobiles (“All Purposes”)	\$ / hour	\$16.60	
Value of Time – Trucks (“Truck Drivers”)		\$29.50	

8.4.3 BENEFIT ESTIMATES

Motor vehicle travel time savings benefits amount to \$32 million, when discounted according to a 7 percent discount rate.

Table 16: Estimates of Time Savings Benefits, 2018 Dollars

	In Constant Dollars	Discounted at 7 Percent	Discounted at 3 Percent
Travel Time Savings	\$125,069,000	\$32,034,000	\$66,761,000

8.5 Quality of Life

In terms of monetized quality of life benefits, the proposed project is expected to generate health benefits for new cyclists and pedestrians. Another quality of life benefit is improved mobility for existing cyclists, whose journey quality is improved by project enhancements.

USDOT Guidance on the valuation of active transportation quality of life benefits is not as established as for other benefit categories. Accordingly, quality of life benefits arising from increased active transportation utilization have conservatively been excluded from the benefit-cost analysis.

8.6 Innovation and Partnership

Qualitative information related to these BUILD merit criteria are provided in the application narrative.

9. Summary of Findings and BCA Outcomes

The tables below summarize the BCA findings. Annual costs and benefits are computed over the lifecycle of the project and, as stated earlier, construction is expected to be completed in 2025. Benefits accrue during the full operation of the project, which begins after construction.

Table 17: Overall Results of the Benefit Cost Analysis, 2018 Dollars*

Project Evaluation Metric	7% Discount Rate	3% Discount Rate
Total Discounted Net Benefits	\$111 million	\$226 million
Total Discounted Costs	\$53.9 million	\$59.7 million
Net Present Value	\$57.2 million	\$166.9 million
Benefit / Cost Ratio	2.05	3.76
Internal Rate of Return (%)	13.1%	
Payback Period (from 2018)	17 years	15 years

Considering all monetized benefits and costs, the estimated internal rate of return of the project is 13.0 percent. With a 7 percent real discount rate, the investment would result in \$111 million in total net benefits⁹ and a Benefit/Cost ratio of approximately 2.05.

With a 3 percent real discount rate, the Net Present Value of the project would increase to \$226 million, for a Benefit/Cost ratio of 3.76.

⁹ Total Net Benefits include negative O&M cost dis-benefits per USDOT Guidance.

10. BCA Sensitivity Analysis

The BCA outcomes presented in the previous sections rely on a large number of assumptions and long-term projections, both of which are subject to considerable uncertainty. The primary purpose of the sensitivity analysis is to help identify the variables and model parameters whose variations have the greatest impact on the BCA outcomes: the “critical variables.”

The sensitivity analysis can also be used to:

- Evaluate the impact of changes in individual critical variables – how much the final results would vary with reasonable departures from the “preferred” or most likely value for the variable; and
- Assess the robustness of the BCA and evaluate, in particular, whether the conclusions reached under the “preferred” set of input values are significantly altered by reasonable departures from those values.

One key sensitivity to note is the addition of rezoning to property values. This scenario represents the actual expected outcome of this proposed investment, generating further benefits over the base case that was conservatively utilized for this analysis. With the rezoning of the newly improved land, the project is expected to generate a net present value of \$104.8 million and a benefit-cost ratio of 2.92.

The outcomes of the quantitative analysis for the project using a 7 percent discount rate are summarized in the table below. The table provides the percentage changes in project NPV associated with variations in variables or parameters or calculations (listed in row), as indicated in the column headers.

The BCA model that is provided as part of this application and technical appendix also allows additional sensitivity analyses.

Table 18: Quantitative Assessment of Sensitivity, Summary

Parameters	Change in Parameter Value	New NPV	% Change in NPV	New B/C Ratio
No Additional Changes		\$57,268,000		2.05
Benefits Period	Benefits Period of 20 Years	\$37,989,000	-34%	1.70
Development	Reduce Direct Project Development to 50%	\$51,224,000	-11%	1.94
	Reduce Indirect Project Development to 50%	\$55,757,000	-3%	2.02
	Reduce Census Tract Group 1 to 50%	\$22,056,000	-61%	1.40
	Reduce Census Tract Group 2 to 50%	\$47,496,000	-17%	1.87
Property Values	Remove Property Values	\$52,470,000	-8%	1.96
	Add in Indirect Acreage	\$64,596,000	13%	2.18
	Remove Utilities Relocation Costs	\$60,737,000	6%	2.19
	Add in Rezoning	\$104,849,000	83%	2.92
Total Project Cost	20% Reduction in Project Costs	\$68,176,000	19%	2.56
	20% Increase in Project Costs	\$46,360,000	-19%	1.71
SMART Growth	Add Trolley (Benefits and Costs)	\$70,279,000	23%	2.13
	Increase SMART Ratio by 25%	\$83,536,000	46%	2.53
	Decrease SMART Ratio by 25%	\$30,999,000	-46%	1.57